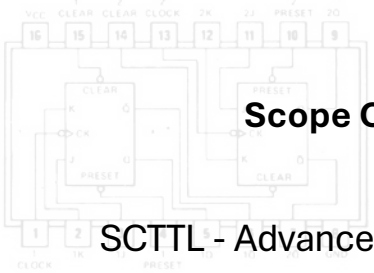
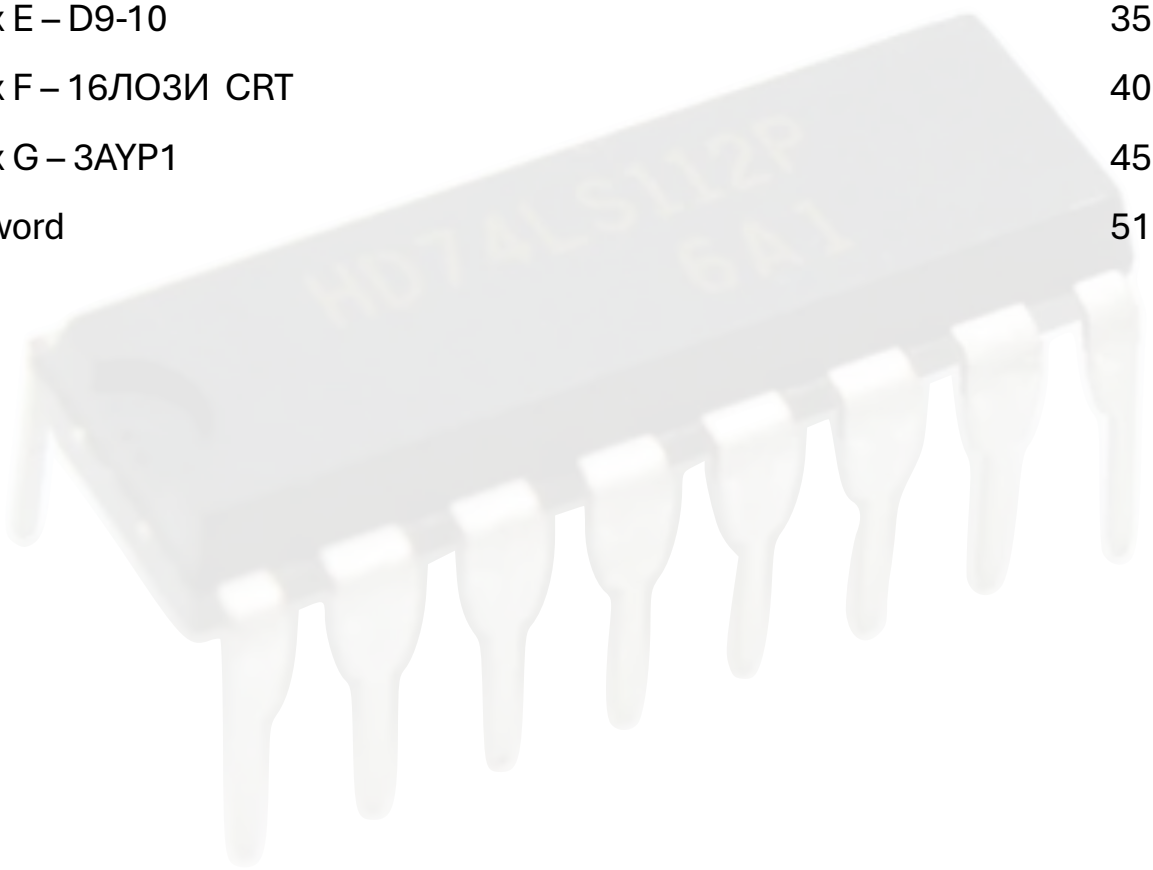
SCTTL - Advanced Customisation

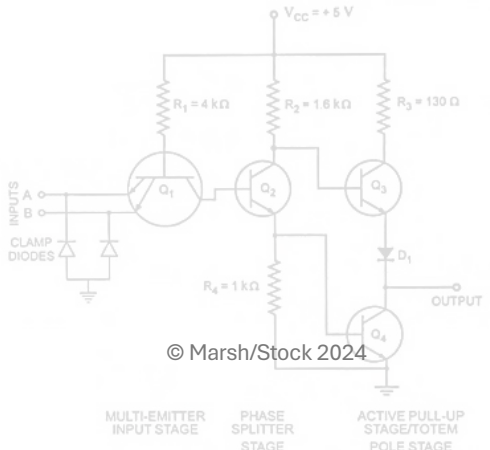
How to change SCTTL to suit your taste and use different CRTs

Version 1.1.3



Scope Clock TTL - Advanced Customization - Table of Contents





SCTTL - Advanced Customisation

Introduction

You've built your SCTTL and things aren't *entirely* the way you'd prefer them. If so, then this short manual is for you..

- Want to make changes to the display?
- What if you want to use a CRT different to the reference 3SP1 CRT?

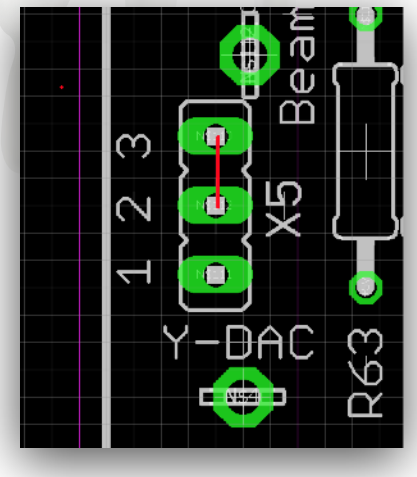
Here's how.

Customisations that require component values to be changed[1]

- Beam On / Blanking Polarity
- The available characters and colon shapes in the font EEPROM (IC32)
- The drawn character positions (X direction)
- The drawn lines in each character (X, Y and slope)
- Screen Saver – Step distance
- Screen Saver – Sleep timer
- CRTs other than the 3SP1

All customisations are made to the Digital & Analogue Board except when another CRT is desired, where the customisation is made to the PSU and CRT Board.

Beam on / Blanking Polarity



Jumper X5 sets the polarity of the blanking signal. It is provided in case this board is to be used with another CRT board that has a different blanking amplifier.

- Linking 1 – 2 the signal will be low to turn the beam on
- Linking 2 – 3 (default) the signal will be high to turn the beam on.

Fit as required by the beam on / blanking amplifier in use.

Customising the Character Font and Colon Shapes

Each font entry in the EEPROM (IC32) consists of 16 bytes of data. The first 10 are for character positions 0 to 9 and the remaining 6 are pairs of colon shapes. To aid with the conversion of a font line arrangement into the hexadecimal number required to programme the EEPROM there is a spreadsheet in the project Dropbox document folder.

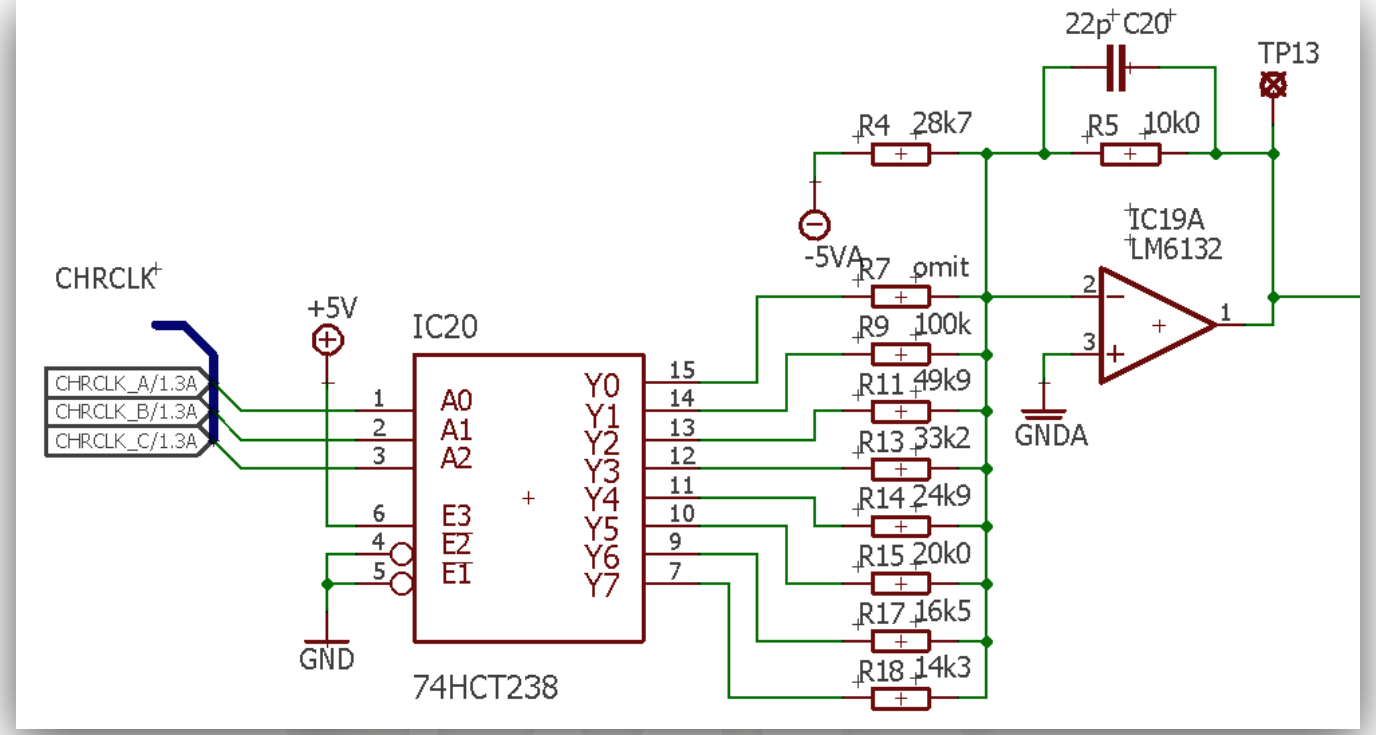
If you do develop another font or have just an idea then please let us have it![2]

[1] Including the EEPROM contents.
[2] Granted that the options aren't exactly *enormous*...

Finally, to transfer a new or modified font into the EEPROM you need a programmer. A simple manual programmer is described in the / Common Stuff / 28CXX EPROM Programmer folder on the Sgitheach public Dropbox. A PCB (but not a kit) is available. I built my first programmer on perfboard and a prototyping board would also work well.

Drawn Character X Positions

The X position of the left hand corner of each of the 8 displayed characters (6 numbers and 2 colons) are set by resistors in a simple DAC implemented by IC20 and IC19A:



The character clock (CHRCLK) counts 0 to 7 (binary 000 to 111) and turns each of the outputs from IC20 high (5V) in turn. Output Y0 corresponds to the leftmost character (10s of hours) and output Y7 corresponds to the rightmost character (units of seconds).

The X position of the 8 characters can be adjusted. The default arrangement with the resistor values shown (and in the kit) produces equispaced characters. However, you might want to put in more space either side of the colon characters as an example. The resistor values are arranged to produce linear steps at 0.5V intervals: 0, 0.5V, 1.0V ... 3.5V. This produces the equispaced characters. R7 sets the position of the leftmost character, where X = 0 and so is omitted.

The other resistors are calculated by:

$$Resistor(\Omega) = \frac{50000}{Position(V)}$$

For example, for binary 100, the Y4 output needs to generate 2.0V from the DAC, this gives:

$$\frac{50000}{2} = 25000\Omega$$

The nearest E96 1% resistor is 24.9 kΩ and is used for R14.

Finally, rather than have the OPAMP output deliver 0 to a positive voltage, R4 provides a negative bias so the OPAMP output is ±1.75V. This resistor value is calculated in the same way:

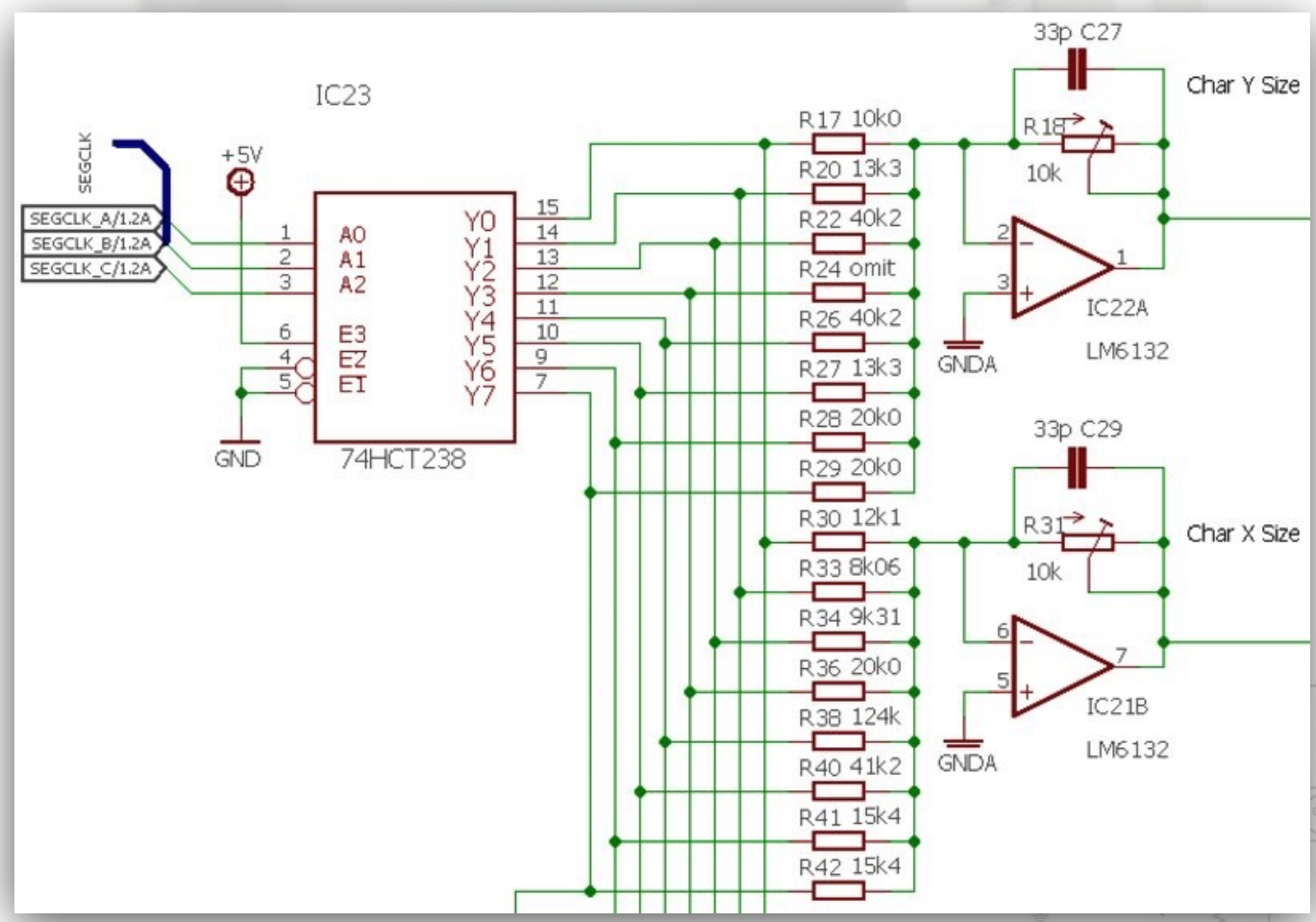
$$\frac{50000}{1.75} = 28571\Omega$$

The nearest E96 1% resistor is 28.7 kΩ and is used for R4.

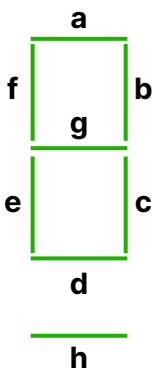
On the project Dropbox in the manual folder there is a DAC resistor spreadsheet to help with these calculations.

X, Y and Slope of the Drawn Character Lines

The X and Y of the centre point of each of the 8 lines that make up a single character are set by a simple DAC implemented by IC23, IC21B and IC22A.

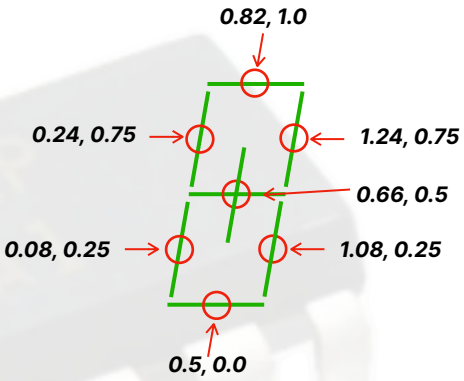


The line segment clock (SEGCLK) counts 0 to 7 (binary 000 to 111) and turns on each output of IC23 in turn. Output Y0 corresponds the line 'a' which is the topmost line in the common method of labelling:



Output Y7 corresponds to line 'h'. In the default arrangement this is placed in the centre of the 7 segment character in a vertical position (we will come to how you set lines to be vertical or horizontal later).

In this default arrangement characters lean slightly to the right.[3] The coordinates shown here are the voltage outputs required from the X and Y DACs. I worked out these values by drawing the 7 + 1 segments on graph paper first and measuring the centre point coordinates.



The resistors are calculated using:

$$Resistor(\Omega) = \frac{10000}{Position(V)}$$

For example the centre line, 'g' has centre coordinates 0.66, 0.5

The corresponding output is Y6, the X DAC resistor has a value of:

$$\frac{10000}{0.66} = 15152\Omega$$

The nearest E96 1% resistor is 15.4 kΩ and is used for R41.

The Y DAC resistor has a value of:

$$\frac{10000}{0.5} = 20000\Omega$$

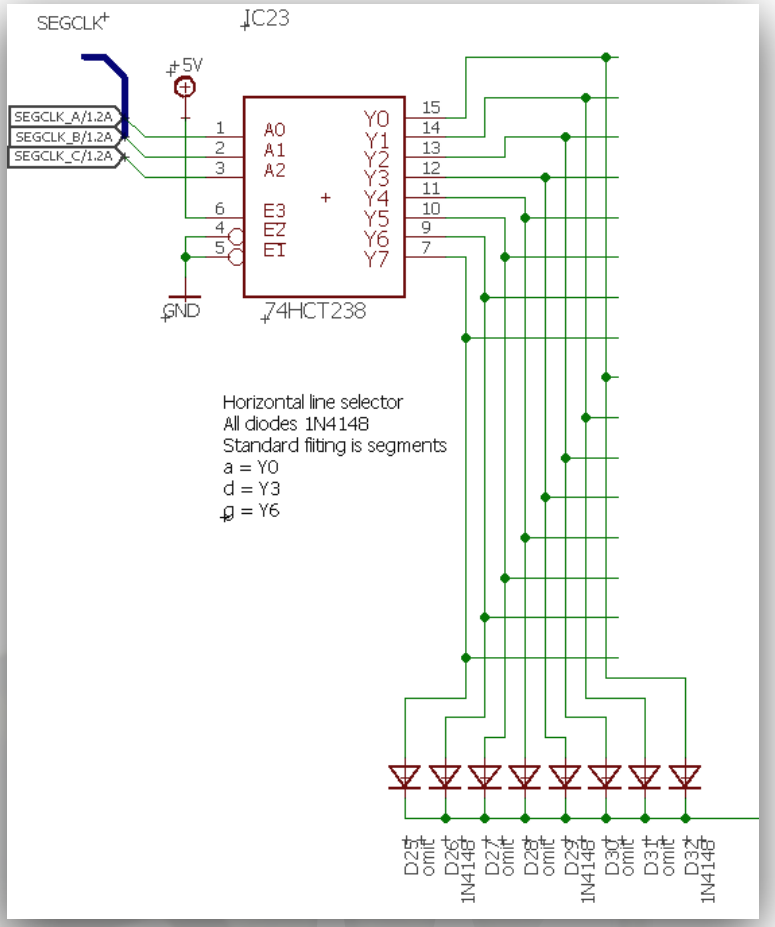
The nearest E96 1% resistor is 20.0 kΩ[4] and is used for R28.

A X or Y coordinate of 0 will produce a calculated result of infinite resistance – so the resistor is just omitted.[5] On the project Dropbox in the manual folder there is a DAC resistor spreadsheet to help you with these calculations.

Since the line coordinates are the centre point of the line, we also need to say if the line should be drawn horizontally or vertically (even if leaning slightly). This is carried out with a simple linear diode matrix: The

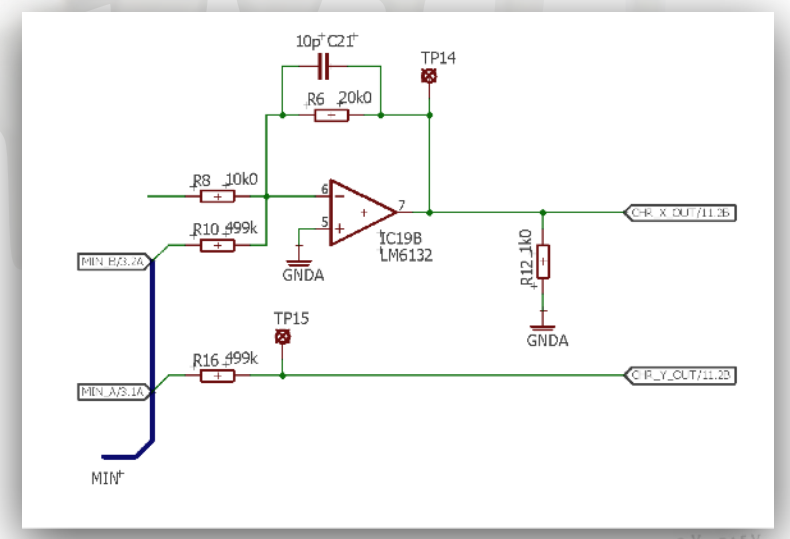
[3] One limitation of the hardware is that a character cannot *lean* to the left…
[4] Spot on!
[5] Infinite I say!

diode is fitted if the line is to be horizontal and omitted for a vertical line. The common 7 segment character has lines ‘a’, ‘d’ and ‘g’ horizontal so the corresponding diode is fitted: D32 for ‘a’ on output Y0, D29 for ‘d’ on Y3 and D26 for ‘g’ on Y6.



Screen Saver – Step Distance

The screen image is moved slightly every minute to try to avoid burning the phosphor. Signals from the minute counter (MIN_A and MIN_B) are fed to the analogue outputs (Y and X respectively). High value resistors R10 and R16 (499kΩ in the standard kit) are used to make the step distance small. You can increase the resistor values to decrease the step distance or decrease their values to increase the step distance. They do not have to be the same value.



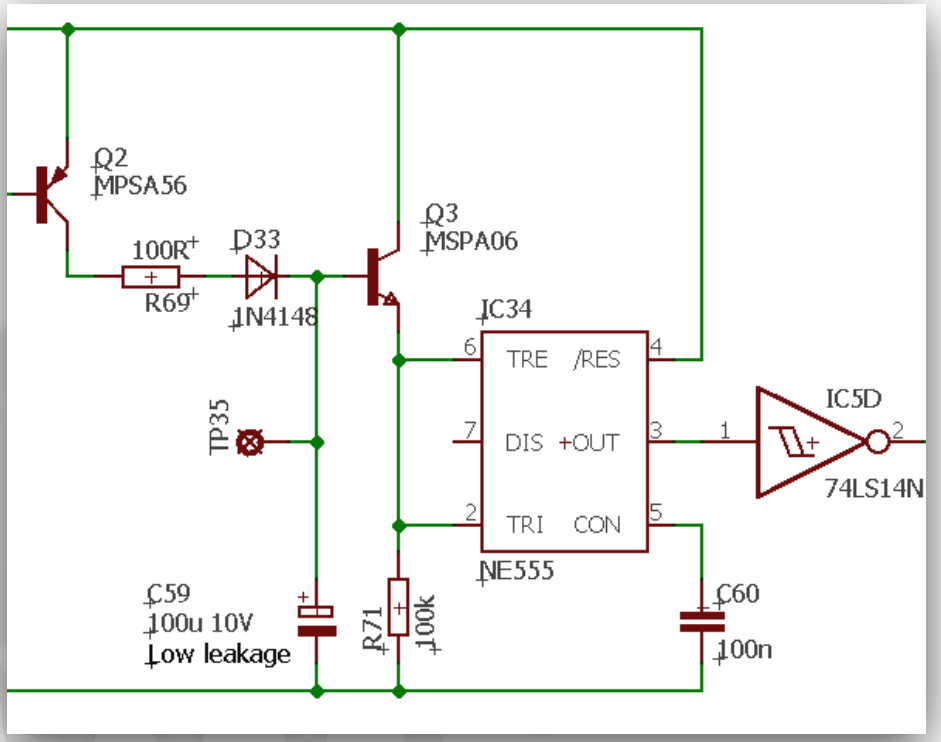
Screen Saver – Sleep timer

The clock has a PIR detector that senses room occupancy. Each time the PIR sensor is triggered a timer is reset but eventually, when the room has been unoccupied for long enough the timer will fire and this will shut down the heater Royer power supply and the HT/EHT flyback convertor. The clock then goes to

"sleep" with the CRT display off and power demand minimised. When the PIR is again triggered the clock "wakes up"[6] and the cycle repeats.

The time it takes the timer to fire and put the clock to sleep can be customised. The time is dependent upon the product of resistor R71 and capacitor C59. The default kit values are 100kΩ and 100µF respectively. With these values the time is about 25 minutes. Therefore, doubling the R7 * C59 value will double the time period and so on. How soon the clock should be put to sleep is a matter of debate. A fairly fast period will reduce CRT use and should prolong screen phosphor life. However, it can also be argued that restarting the CRT heater strains it and this puts the tube at risk from heater failure.[7]

To be honest, we don't know which of these competing factors – prolonging phosphor life or prolonging heater life is the most important. Personally, I have always used about 20 to 30 minutes as being a reasonable time but without any scientific proof.



The value of R71 can go up to several megaΩ and the value of C59 to 1000 µF. This will give the timer a period of longer than 24 hours.

The choice is yours...

N.B. If you want to watch the timer decay on an oscilloscope then you can monitor TP35 which is marked as Time on the silkscreen. You must use a high resistance probe or else you will disturb the timing as the oscilloscope will also discharge C59. I use a 100MΩ divide by 100 probe to achieve this.

[6] Wake up takes about 10 seconds.

[7] The heater has a relatively low cold resistance and therefore draws more current when it is started so if you keep the heater running it is not subject to the start up surge current.

Alternatives to the 3SP1 CRT

The Power Supply & CRT Board sets the basic limitations for the specification of a suitable CRT:

- 6.3V heater up to 600mA.
- [1.65kV] acceleration voltage.
- up to [-100V] blanking voltage.
- Electrostatic deflection and focus.
- Symmetrical deflection.
- X and Y sensitives such that 250V will deflect the spot to the tube edge.
- No PDA.

Whilst described as *limitations* they are not all entirely absolute. For example a CRT with a 4V heater could be used but the heater Royer transformer would need to be modified. A tube with asymmetrical deflection could work but the results would probably be disappointing.

"Low voltage" CRTs such as the DG7-32 are not suitable[8] as they operate with an acceleration voltage of < 1kV.

Due to the nature of the eight 7 segment character display it is most likely that a rectangular tube will look the best. However, there is no reason why a circular CRT could not be used other than the aesthetic appearance of the clock. CRTs with a high X/Y ratio look particularly good:

The 3ASP1 does not have a PDA (despite appearances). The side connector is for the electron gun's acceleration anodes.

A 3ASP1 CRT as an example of a rectangular display with a high X/Y ratio

[8] But see later in the manual...

Rectangular CRTs that have been identified as likely candidates are (this is not an exhaustive list):

50mm tubes:

- D6-100GH

75mm tubes:

- 3SP1 (reference CRT in the standard kit)
- 3AHP1
- 3ASP1
- 3AYP1
- 3BDP1
- 3BEP1
- 3BGP1
- 3BQP1
- 3UP1
- 3XP1
- 3YP1
- D7-220
- D7-221
- D8-11

100mm tubes:

- D9-10

160mm tubes:

- 16ЛО3И[9]

Tubes unlikely to work (too high voltage, have PDA, insensitive etc.)

- 4MP1
- 4NP1
- 4QP1
- 4VP1
- D10-19
- D14-11 … and many, many more[10]

The phosphor colour and glow persistence must be considered when selecting a CRT. Unlike the display on many scope clocks, this clock is not *very dynamic* i.e. with lots of moving lines. It is unlikely that a long-persistence phosphor such as P2 or P7 will produce results more interesting than a common medium (P1, P31) phosphor. It is not that these phosphors won't work but the results will be perhaps disappointing. The short blue P11 phosphor is a very nice colour but tends to produce a dim image.

[9] A real monster..

[10] Probably. It's not easy to search for rectangular CRT designations on the interwebs….

Annexes to this manual give information, data sheets and how to customise the clock to use the range of CRTs that have been tested. If you wish, contact us if you are considering using another CRT.

This is not the end of the story:

The tube I want to use has a PDA. Can I still use it?

You can certainly try if it does not have a problem with any another limitation. Firstly, I would try and connect the tube to the +300V test point (near to the flyback transformer). Many tubes will light up with sufficient brightness to be useable. However, the electrostatic lens inside the tube will likely not be correct and the image could be distorted. Secondly, I have available a small PDA PSU that will deliver up to +2.1kV for the PDA. This is often sufficient.

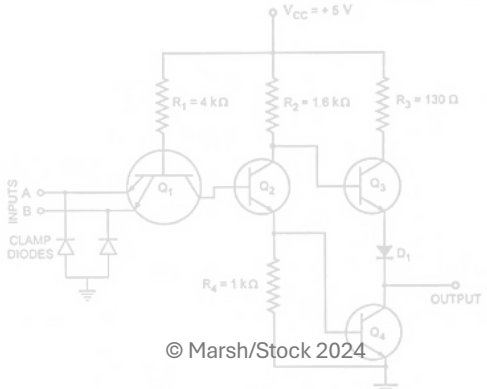
I want to use a DG7/32 CRT as I already have one.

This is a low voltage CRT requiring < 1kV to operate. The problem now is the PSU & CRT Board needs to be modified to reduce the HT and -EHT voltages.

Here is a suggestion on how to modify the board accordingly, just "thinking out loud" you understand:

- Reduce the value of R46 and R47 to 120k (1% MF). This will reduce the HT from +300V to +240V and the EHT multiplier steps to 240V per stage.
- Omit the last two EHT multiplier stages, C12, C13, C17, C18, D28 to D31 and R42 to R45.
- Link the -900V tap to the -1.5kV tap to bridge over the omitted stages

With just 3 stages the -EHT voltage will now be about 3x(-240) = -720V. With about +120V on the acceleration anodes it means the tube will be operating with about 840V in total. This should be OK. You will still need to check the grid voltage, unblanking and focus. This is an untested modification, I am just trying to show how you can play with component values to rearrange the available voltages.



Annex A – 3SP1[11] – Reference Design CRT

The main text covers the component values and wiring for this CRT. This is the reference CRT.

- Oscilloscope tube
- 38mm x 76mm Direct viewed rectangular glass type
- Pressed faceplate
- Electrostatic deflection and focus
- Clear, cylindrical faceplate
- P1, P2, P4, P5, P7 and P11 phosphors available[12]

Tested in a Scope Clock TTL

[11] Thank you Frank - https://frank.pocnet.net/sheets/168/3/3SP1.pdf

[12] If you can find them....

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3SP*

CHARACTERISTICS

GENERAL DATA

Focusing Method	Electrostatic
Deflecting Method	Electrostatic

Types*	Fluorescence	Phosphorescence	Persistence
3SP1	Green	———	Medium
3SP2	Blue-Green	Green	Long
3SP4	White	———	Short to Medium
3SP5	Blue	———	Very Short
3SP7	Blue-White	Yellow	Long
3SP11	Blue	———	Short

Faceplate . . . . . Clear, Cylindrical

* In addition to the types shown, the 3SP- can be supplied with several other screen phosphors.

ELECTRICAL DATA

Heater Voltage	6.3 Volts
Heater Current	0.6 ± 10% Ampere
Direct Interelectrode Capacitances (approx.)	
Cathode to All Other Electrodes	5 pf
Grid No. 1 to All Other Electrodes	6.5 pf
Between Deflecting Plates 1-2	2 pf
Between Deflecting Plates 3-4	2 pf
Deflecting Plate 1 to All Other Electrodes	7.5 pf
Deflecting Plate 2 to All Other Electrodes	6.0 pf
Deflecting Plate 3 to All Other Electrodes	5.5 pf
Deflecting Plate 4 to All Other Electrodes	6.5 pf

MECHANICAL DATA

Minimum Useful Screen Dimensions	
Horizontal	2¾ Inches
Vertical	1⅛ Inches
Diagonal	3 Inches
Base (Small Shell Duodecal 12-Pin)	B12-43
Basing	12E
Base Alignment	
The Plane through the Base Key and the Tube Axis aligns with Long Axis of Tube Face	± 10 Degrees
Trace Alignment[1]	
Angle Between D1-D2 trace and D3-D4 trace	90 ± 1 Degrees
D1-D2 trace Aligns with Long Axis of Tube Face[2]	± 1.5 Degrees
Positive Voltage on D1 deflects Beam approx. Toward Key	
Positive Voltage on D3 deflects Beam approx. Toward Pin. No. 4	
Bulb	C26 Exp 6 or equivalent
Weight (approx.)	¾ Pound

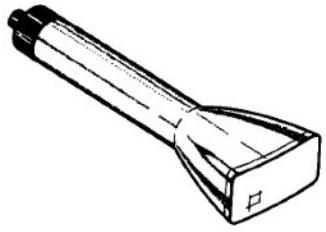
RATINGS

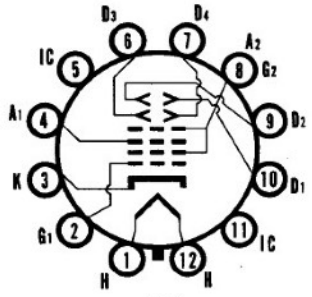
MAXIMUM RATINGS (Absolute Maximum Values)

Anode No. 2 Voltage	3000 Volts dc
Anode No. 1 Voltage (Focusing Electrode)	1200 Volts dc
Anode No. 2 Input	6 Watts Max.

QUICK REFERENCE DATA

Oscilloscope Tube
1½" x 3" Direct Viewed
Rectangular Glass Type
Electrostatic Deflection
Electrostatic Focus
Clear, Cylindrical
Faceplate





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Electronic Components Group
ELECTRONIC TUBE DIVISION
SENECA FALLS, NEW YORK

A Technical Publication

APRIL, 1964

PAGE 1 OF 3

File Under

SPECIAL AND GENERAL PURPOSE CATHODE RAY TUBES

MAXIMUM RATINGS (Absolute Maximum Values) (con'td)

Grid No. 1 Voltage		
Negative Bias Value	200 Volts	dc
Positive Bias Value	0 Volts	dc
Positive Peak Value	2 Volts	
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	140 Volts	
Heater Positive with Respect to Cathode	140 Volts	
Peak Voltage between A2 and any Deflecting Plate	550 Volts	

TYPICAL OPERATING CONDITIONS

Anode No. 2 Voltage	2000 Volts	dc
Anode No. 1 Voltage for Focus	330 to 620 Volts	dc
Grid No. 1 Voltage Required for Cutoff[2]	−58 to −135 Volts	dc
Deflection Factors		
Deflecting Plates 1-2	146 to 198 Volts	dc/Inch
Deflecting Plates 3-4	104 to 140 Volts	dc/Inch
Spot Position (Focused, Undeflected)[4]	Within a 12 mm Square	

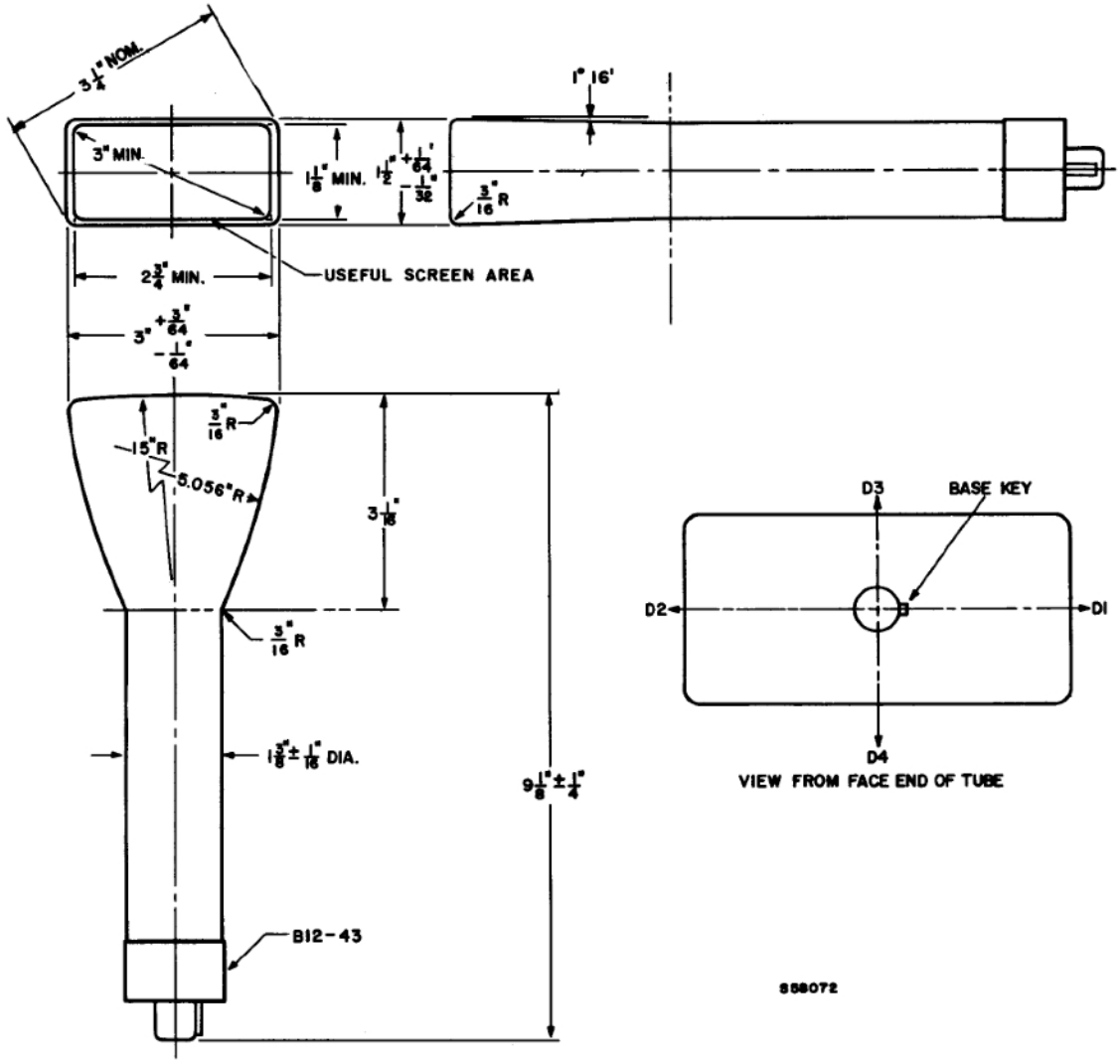
CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5 Megohms Max.
Resistance in Any Deflecting Plate Circuit[5]	1.0 Megohms Max.

NOTES:

1. *Deflecting plates 1 & 2 are nearer the screen, and scan the major dimension of the screen. Plates 3 & 4 are nearer the base, and scan the minor dimension of the screen.*
2. *The D1-D2 trace scanning through the geometric center of the tube face will be parallel to the long axis of the tube face, within the limits specified.*
3. *Visual extinction of undeflected focused spot.*
4. *With deflecting plates connected to Anode No. 2 and with tube shielded. The sides of the limit square will be parellel to the deflection axes.*
5. *It is recommended that the deflecting plate circuit resistances be approximately equal.*

OUTLINE



3SP1 Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	100k 5% CF
R77	22k 5% CF
R70	1M trim pot
R72, R76, R79	470k 5% CF
R80	500k trim pot
X8	2 way screw connector

3SP1 CRT Socket B12-43 Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire Rating	Wire Colour
1	Heater	H1 on X11	EHT	
2	Grid	Grid on X10	EHT	
3	Cathode	Cathode on X10	EHT	
4	Focus Anode	Focus on X10	EHT	
5	N/C			
6	D3	Y2 on X7	HT	
7	D4	Y1 on X7	HT	
8	Acceleration Anodes	A3 on X7	HT	
9	D2	X1 on X8	HT	
10	D1	X2 on X8	HT	
11	N/C			
12	Heater	H2 on X11	EHT	

Notes

1. When using the vertical case the Y connections need to be reversed.
2. Wire colours are depicted as supplied in the standard kit.

3SP1 Trace Rotation Coil

Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

3SP1 Additional Electrodes

None - Omit R55, R61 and X8 is a 2 way screw connector with the S connection unused.

B12-43 Socket

These are commonly available on ebay. If a kit is bought with a 3SP1 CRT then a new socket will be included.

Annex B – 3ASP1[13] CRT

- 38mm x 76mm Direct viewed rectangular glass type.
- Clear, flat, pressed faceplate.
- Electrostatic deflection and focus.
- High deflection sensitivity.
- P1, P2 and P11 phosphors.

Note that the tube does not have a PDA, the side connector connects to the acceleration anodes.

Tested in a Scope Clock TTL

[13] Thank you Frank - https://frank.pocnet.net/sheets/168/3/3ASP1.pdf

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CHARACTERISTICS

GENERAL DATA

Focusing Method			Electrostatic
Deflection Method			Electrostatic
Types*	Fluorescence	Phosphorescence	Persistence
3ASP1	Green	.....	Medium
3ASP2	Blue-Green	Green	Long
3ASP11	Blue	.....	Short
Faceplate			Flat, Clear

**In addition to the types shown, the 3ASP- can be supplied with several other screen phosphors.*

ELECTRICAL DATA

Heater Voltage	6.3 Volts
Heater Current	0.6 ± 10% Ampere
Direct Interelectrode Capacitances (approx.)	
Grid No. 1 to All Other Electrodes	4.5 μμf
Between Deflection Plates 1-2	2.0 μμf
Between Deflection Plates 3-4	2.5 μμf
Deflection Plate 1 to All Other Electrodes	6.5 μμf
Deflection Plate 2 to All Other Electrodes	6.0 μμf
Deflection Plate 3 to All Other Electrodes	5.5 μμf
Deflection Plate 4 to All Other Electrodes	5.5 μμf

MECHANICAL DATA

Minimum Useful Screen Dimensions	
Horizontal	2¾ Inches
Vertical	1⅛ Inches
Bulb	LEA 448 or Equiv.
Base	B8-218
Basing	8KF
Anode No. 2 Contact	J1-22

Base Alignment

Pin #3 aligns with major axis of tube face within 10°, and is on same side as anode contact (J1-22)

Trace Alignment

Positive Voltage on D1 (Pin #2) with respect to D2, (Pin #1) deflects spot approximately toward Pin #3.

Positive Voltage on D3 (Pin #6) with respect to D4, (Pin #7) deflects spot approximately toward Pin #5.

Angle between D1-D2 and D3-D4 traces	90 ± 1 Degree
Angle between D1-D2 and major axis of tube face	0 ± 1½ Degrees

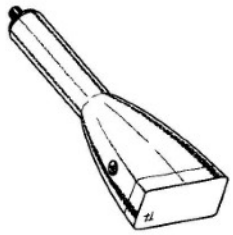
Deflection Plates

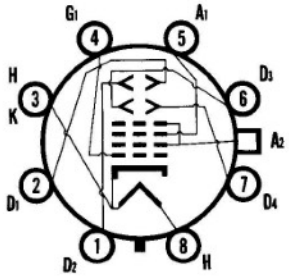
D1 and D2 are nearer to the tube face

D3 and D4 are nearer the base

QUICK REFERENCE DATA

1½" x 3" Direct Viewed
Rectangular Glass Type
Clear, Pressed Faceplate
Electrostatic Deflection
Electrostatic Focus
High Deflection Sensitivity





8 K F

SYLVANIA
ELECTRONIC TUBES

A Division of
Sylvania Electric Products Inc.

PICTURE TUBE OPERATIONS
SENECA FALLS, NEW YORK

Prepared and Released By The
TECHNICAL PUBLICATIONS SECTION
EMPORIUM, PENNSYLVANIA

MARCH, 1960

PAGE 1 OF 3

File Under
SPECIAL AND GENERAL PURPOSE
CATHODE RAY TUBES

RATINGS

MAXIMUM RATINGS (Absolute Maximum Values)

Anode No. 2 Voltage	3000	Volts	dc
Anode No. 2 Input	6.0	Watts	
Anode No. 1 Voltage (Focusing Electrode)	1200	Volts	dc
Grid No. 1 Voltage			
Negative Bias Value	140	Volts	dc
Positive Bias Value	0	Volts	dc
Positive Peak Value	2	Volts	
Peak Voltage between Anode No. 2 and Any Deflection Plate	600	Volts	
Altitude	35,000	Feet	

TYPICAL OPERATING CONDITIONS

Anode No. 2 Voltage	2000	Volts	dc
Anode No. 1 Voltage for Focus	400 to 700	Volts	dc
Grid No. 1 Voltage Required for Cutoff[1]	–40 to –70	Volts	dc
Deflection Factors			
Deflection Plates 1-2	68 to 92	Volts	dc/Inch
Deflection Plates 3-4	28 to 38	Volts	dc/Inch
Spot Position (Undeflected, Focused)[2]	Within a 15	mm Square	
P1 Light Output[4]	20	Ft. L.	Min.
Modulation[5]	38	Volts	dc Max.
Line Width A[6]	0.65	mm Max.	

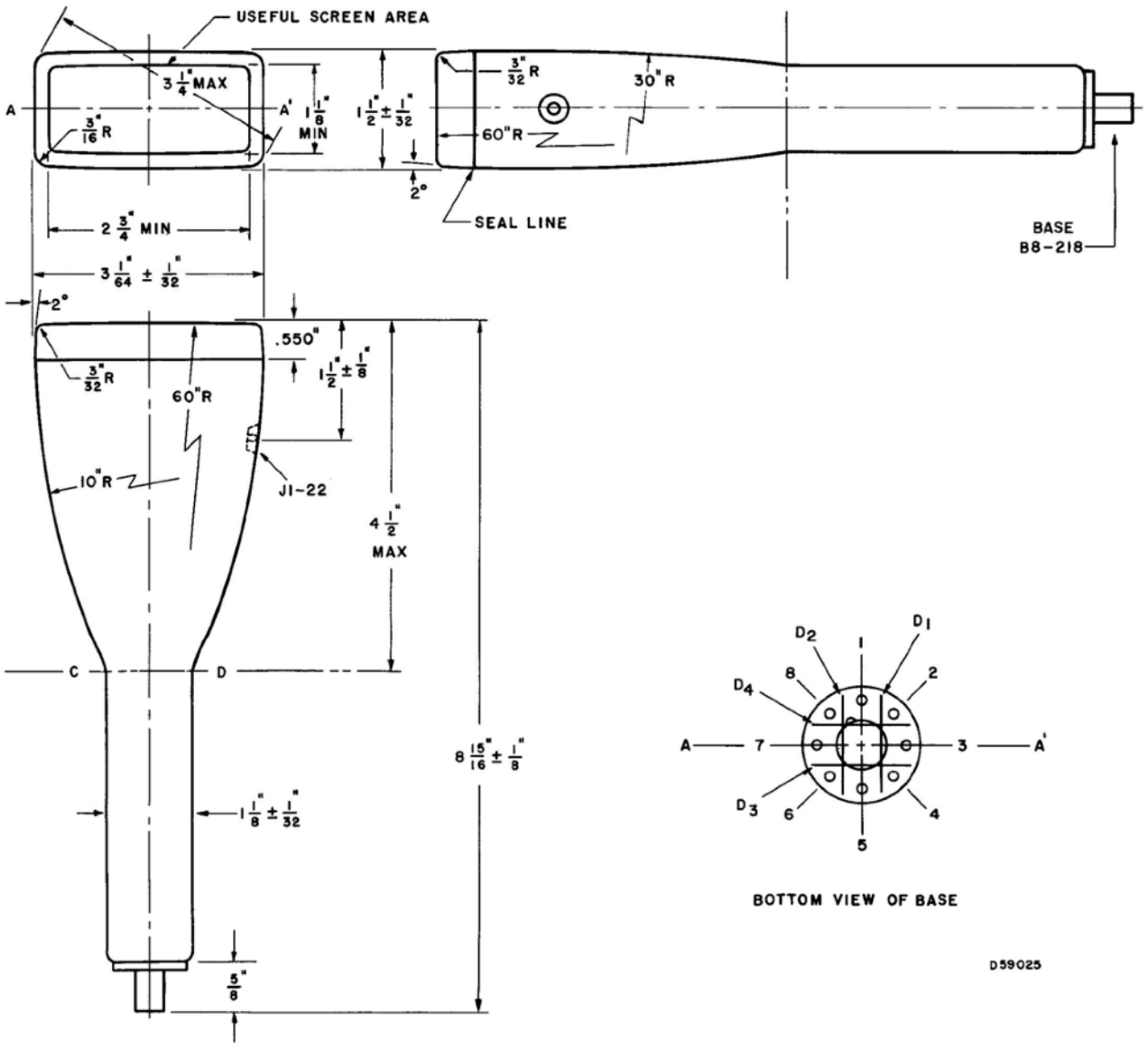
CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Megohms	Max.
Deflection Circuit Resistance[3]	1.0	Megohms	Max.

NOTES:

1. *Visual extinction of undeflected focused spot.*
2. *With the tube shielded and with the deflection plates connected to Anode No. 2, the square shall be centered on the tube face with its sides parallel to the deflection axis.*
3. *It is recommended that the deflecting electrode circuit resistances be approximately equal.*
4. *Raster size 1⅛" x 1 9/16".*
5. *Measured at 20 Ft. L. on a raster 1⅛" x 1 9/16".*
6. *Measured by compressed raster method starting with conditions of Note 5.*

OUTLINE



BOTTOM VIEW OF BASE

D59025

3ASP1 Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64, R72, R76	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	100k 5% CF
R77	22k 5% CF
R70	1M trim pot
R79	470k 5% CF
R80	500k trim pot
X8	2 way screw connector

3ASP1 CRT Socket B12-43 Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire	Wire Colour
1	D2	X1 on X8	HT	
2	D1	X2 on X8	HT	
3	Cathode	Cathode on X10	EHT	
	Heater	H2 on X11		
4	Grid	Grid on X10	EHT	
5	Focus Anode	Focus on X10	EHT	
6	D3	Y2 on X7	HT	
7	D4	Y1 on X7	HT	
8	Heater	H1 on X11	EHT	
Side contact J1-22	Acceleration Anodes	A3 on X7	HT	

Notes

1. When using the vertical case the Y connections need to be reversed.
2. Wire colours are depicted as recommended but not essential.

3ASP1 Trace Rotation Coil

Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

3ASP1 Additional Electrodes

None - Omit R55, R61 and X8 is a 2 way screw connector with the S connection unused.

J1-22 Side Connector

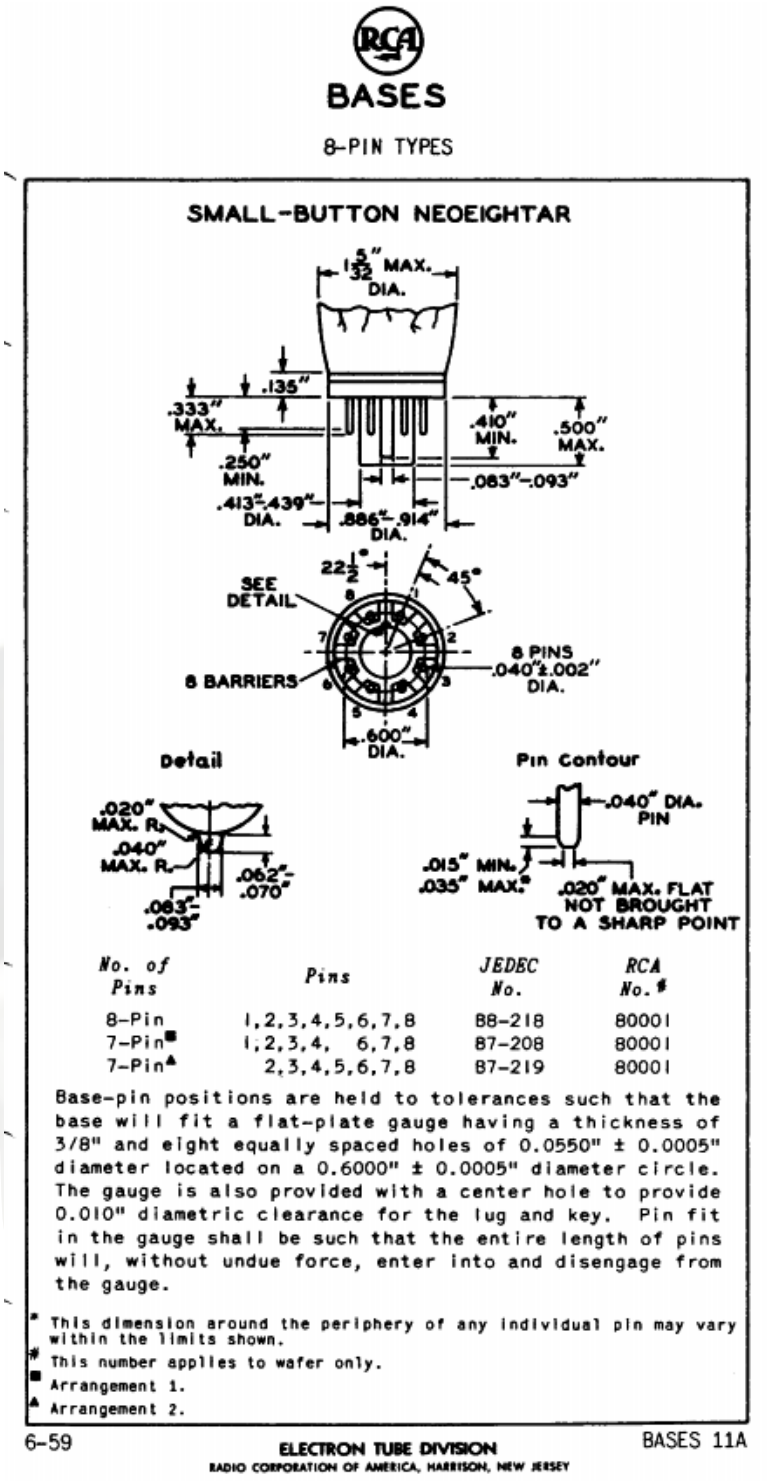
The Sgitheach shop[14] has these for sale for this type of socket with a lip.

[14] http://www.sgitheach.org.uk/shop.html#j1-22

B8-218 Socket

These sockets are as rare as hen's teeth.[15] They're known as *small-button neoeightar 8 pin arrangement*.[16] See right for further information.

A couple of 3D printed shell designs are available from the project Dropbox that can be used with "nixie pins" from ebay to form a reasonable looking connector for the CRT base.



BASES

8-PIN TYPES

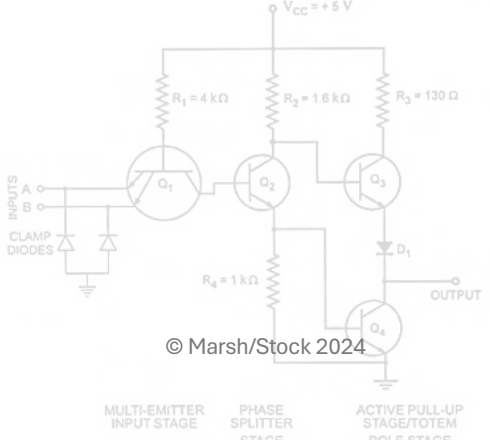
SMALL-BUTTON NEOEIGHTAR

No. of Pins	Pins	JEDEC No.	RCA No.#
8-Pin	1,2,3,4,5,6,7,8	88-218	80001
7-Pin■	1,2,3,4, 6,7,8	87-208	80001
7-Pin▲	2,3,4,5,6,7,8	87-219	80001

Base-pin positions are held to tolerances such that the base will fit a flat-plate gauge having a thickness of 3/8" and eight equally spaced holes of 0.0550" ± 0.0005" diameter located on a 0.6000" ± 0.0005" diameter circle. The gauge is also provided with a center hole to provide 0.010" diametric clearance for the lug and key. Pin fit in the gauge shall be such that the entire length of pins will, without undue force, enter into and disengage from the gauge.

* This dimension around the periphery of any individual pin may vary within the limits shown.
# This number applies to wafer only.
■ Arrangement 1.
▲ Arrangement 2.

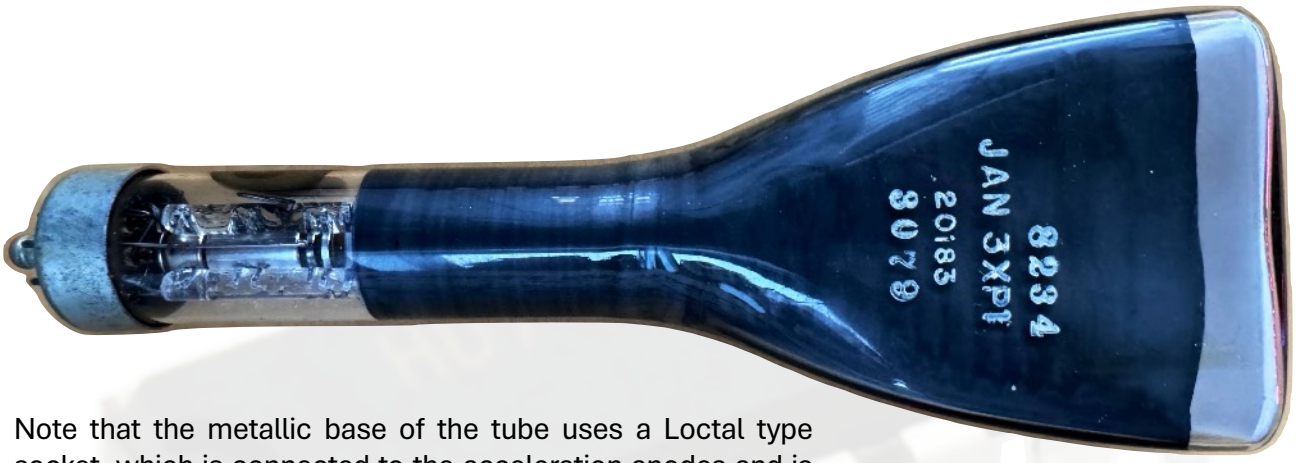
6-59 ELECTRON TUBE DIVISION BASES 11A
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



[15] https://en.wiktionary.org/wiki/rare_as_hen's_teeth
[16] http://www.tubebooks.org/tubedata/hb-3/General/Bases_8-9%20Pins.pdf

Annex C – 3XP1[17] CRT

- Oscilloscope tube.
- 38mm x 76mm.
- High deflection sensitivity.
- Short length.
- Mono-accelerator.
- Clear, cylindrical faceplate.
- Electrostatic deflection and focus.
- P1, P2, P7 and P11 phosphors.



Note that the metallic base of the tube uses a Loctal type socket, which is connected to the acceleration anodes and is therefore 150V above ground when in use.

[17] Thank you Frank - https://frank.pocnet.net/sheets/201/3/3XP1.pdf

ENGINEERING DATA

RAYONIC
3XP1
3XP2
3XP7
3XP11

RAYONIC® 3XP1 CATHODE RAY TUBE

GENERAL DATA

Focusing Method	Electrostatic
Deflecting Method	Electrostatic
Phosphor Number	P1
Fluorescent Color	Green
Phosphorescent Color	None
Persistence	Medium
Mounting Position	Any

ELECTRICAL DATA

Heater Voltage	6.3 Volts
Heater Current	0.6 ±10% Amperes
Direct Interelectrode Capacitances (approx.)	
Cathode to all other electrodes	5.2 $\mu\mu$f
Grid #1 to all other electrodes	5.7 $\mu\mu$f
D1 to D2	6.9 $\mu\mu$f
D3 to D4	5.4 $\mu\mu$f
D1 to all other electrodes	7.0 $\mu\mu$f
D2 to all other electrodes	7.4 $\mu\mu$f
D3 to all other electrodes	8.0 $\mu\mu$f
D4 to all other electrodes	7.3 $\mu\mu$f

MECHANICAL DATA

Overall Length ..... 8⅞ ±⅛ Inches

Bulb Dimensions	Greatest Dim.	Min. Useful Screen	
Diagonal	$3\frac{11}{32} \pm \frac{1}{32}$	3	Inches
Width	$3 \pm \frac{3}{64}$	2¾	Inches
Height	$1\frac{15}{32} \pm \frac{3}{64}$	1⅛	Inches

Base-Loctal ..... JETEC D8-1

Basing ..... See basing diagram

Base Alignment
- D1D2 trace aligns with pin #3 and tube axis 0 ±10 Degrees
- Positive voltage on D1 deflects beam approximately toward pin #3
- Positive voltage on D3 deflects beam approximately toward pin #5
- Angle between D3D4 and D1D2 traces;90 ±1 Degrees

Trace Alignment
- Angle between trace and bulb wall ±1½ Degrees

Deflection Plates
- D1-D2 are nearest to the screen (3" Dimension)
- D3-D4 are nearest to the base ($1\frac{15}{32}$" Dimension)

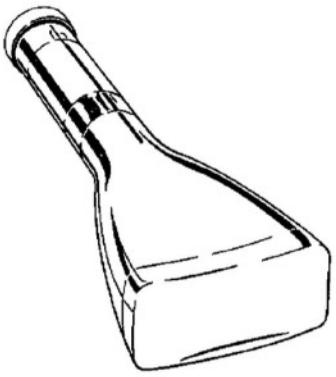
MAXIMUM RATINGS (Design Center Values)

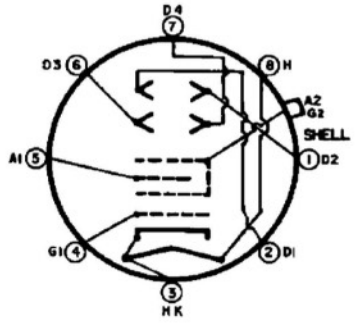
Anode Voltage (A2)	2750 Volts DC
Anode (A2) Input	6 Watts
Anode #1 (Focusing Electrode) Voltage	1100 Volts
Grid #1 (G1) Voltage	
Negative-Bias Value	125 Volts DC
Positive-Bias Value	0 Volts DC
Positive-Peak Value	2 Volts
Peak voltage between Anode #2 and any deflecting plate	550 Volts

"REVISED NOVEMBER, 1958" from JEDEC release #1133A, Dec. 15, 1958

QUICK REFERENCE DATA

OSCILLOSCOPE TUBE
FACE—1½" x 3"
DEFLECTION SENSITIVITY—HIGH
LENGTH—SHORT
MONOACCELERATOR
FACE PLATE—CLEAR, CYLINDRICAL
DEFLECTION—ELECTROSTATIC
FOCUSING—ELECTROSTATIC
JAN APPROVED





3XP1

TUBE RATINGS

Focusing Electrode (A1) current for any operating condition ..... −15 to +10 μAmps
Spot Position, Undeflected (Note 1) ..... 7.0 Max. mm
Useful Scan
D1D2 ..... 2¾ Inches
D3D4 ..... 1⅛ Inches
A1 Voltage 20% to 35% of A2 Voltage
G1 Voltage 3.375 max% of A2 Voltage (Note 2)
Deflection factors
D1 and D2 (3" Dimension) ..... 34 to 46 Volts DC/inch/A2 Kilovolts
D3 and D4 ($1\frac{15}{32}$" Dimension) ..... 14 to 19 Volts DC/inch/A2 Kilovolts

OPERATING CONDITIONS

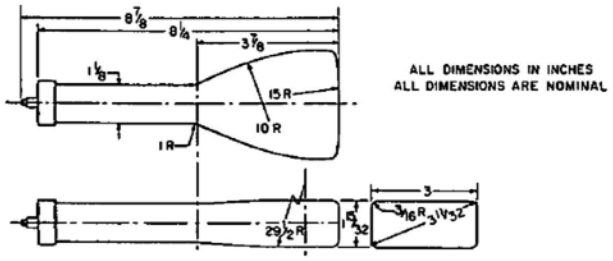
	Minimum	Typical	Typical	
Anode Voltage (A2)	1000	1500	2000	Volts
Focusing Electrode Voltage (A1)	200 to 350	300 to 525	400 to 700	Volts
Grid #1 Voltage (Note 2)	−34 max.	−51 max.	−67.5 max.	Volts
Deflection Factor D1-D2	34 to 46	51 to 69	68 to 92	Volts DC/Inch
Deflection Factor D3-D4	14 to 19	21 to 28.5	28 to 38	Volts DC/Inch

MAXIMUM CIRCUIT VALUES

Grid #1 Circuit Resistance ..... 1.5 Megohms
Resistance in any Deflecting Electrode Circuit (Note 3) ..... 1.0 Megohms

NOTES

1. *With deflecting electrodes connected to Anode (A2).*
2. *For visual extinction of undeflected focused spot.*
3. *The resistance in each deflecting electrode circuit should be approximately equal.*



3XP2

The Waterman Rayonic Type 3XP2 is identical to the type 3XP1 except that it has a green fluorescent, green phosphorescent, long persistence phosphor.

3XP7

The Waterman Rayonic Type 3XP7 is identical to the Type 3XP1 except that it has a blue fluorescent, yellow phosphorescent, long persistence phosphor.

3XP11

The Waterman Rayonic Type 3XP11 is identical to the Type 3XP1 except that it has a blue fluorescent, short persistence phosphor.

WATERMAN PRODUCTS CO., INC.

Phone: GArfield 6-8600 Philadelphia 25, Penna., USA Cable Address, Poketscope, Phila.

Manufacturers of POCKETSCOPE®, CRAFTSCOPE®, PULSESCOPE®, PANELSCOPE®, PANELPACK®, RAKSCOPE®, SYSTEMAT®, RAYONIC® TUBES

PRINTED IN U.S.A

3XP1 Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	270k 5% CF
R77	22k 5% CF
R70	1M trim pot
R72, R76	560k 5% CF
R79	470k 5% CF
R80	500k trim pot

3XP1 CRT Socket B12-43 Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire	Wire Colour
1	D2	X1 on X8	HT	
2	D1	X2 on X8	HT	
3	Cathode	Cathode on X10	EHT	
	Heater	H2 on X11		
4	Grid	Grid on X10	EHT	
5	Focus Anode	Focus on X10	EHT	
6	D3	Y2 on X7	HT	
7	D4	Y1 on X7	HT	
8	Heater	H1 on X11	EHT	
Base Shell	Acceleration Anodes	A3 on X7	HT	

Notes

1. The loctal base shell connects to the acceleration anodes which under normal operation have a voltage of about 150V above ground. Depending on the construction of the loctal socket it may be necessary to insulate any exposed metal.
2. Wire colours are depicted as recommended but not essential.

3XP1 Trace Rotation Coil

Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

3XP1 Additional Electrodes

None - Omit R55, R61 and X8 is a 2 way screw connector with the S connection unused.

Loctal B8-1 Socket

These are commonly available on ebay. If a kit is supplied with a 3XP1 CRT then a new socket will be included.

Annex D – D8-11[18]

- This is a Telefunken single beam CRT with flat screen for small oscilloscopes and indicator applications.
- The screen dimension is 40 x 75 mm.
- P1, P7 and P35 phosphors.

Tested in a Scope Clock TTL

[18] Thank you Åke and Frank - https://www.sm5cbw.se/tubes/htm/d8-11bg.htm

Einstrahl-
Oszillographen-Röhre

Vorläufige technische Daten

Aufbau Rechteckiger Planschirm, Kathode mit geringer Heizleistung

Verwendung Für kleine Universal-Ozillographen und als Anzeigeröhre

	D 8–11 BG	D 8–11 GJ	D 8–11 GM
Fluoreszenz	blau	gelblichgrün	blau
Phosphoreszenz	blauweiß	gelblichgrün	gelblichgrün
Nachleuchten [1]	mittelkurz	mittel	lang

Heizung	indirekt, Parallelspeisung		
Heizspannung	U_f	**6,3**	V
Heizstrom	I_f	ca. 100	mA

Betriebswerte

Anodenspannung	U_a	**1000**	**2000**	V
Korrekturspannung	ΔU_a	±20	±20	V
Fokussierungsspannung	U_{g3}	150	300	V
Gittersperrspannung (unabgelenkter fokussierter Leuchtfleck verschwindet)	$-U_{g1sperr}$	35	70	V
Helltastspannung	ΔU_{g1} [2]	20	20	V
Ablenkkoeffizient				
Kathodennahe Ablenkplatten	D3 D4	11	22	V/cm
Schirmnahe Ablenkplatten	D1 D2	11	22	V/cm
Linienbreite bei $I_S = 10\ \mu A$		0,45	0,3	mm

Meßbedingungen siehe Datenblatt „Linienbreitenmessung bei Oszillographenröhren".

Ausnutzbare Ablenkung			
in Richtung D3 D4		min. 69,4	mm
in Richtung D1 D2		min. 27,4	mm

[1] Bezogen auf einen Abfall der Helligkeit auf 10% des Anfangswertes.

[2] Bei gerade gesperrter Röhre wird die angegebene Helltastspannung benötigt, um einen Strahlstrom von 25 µA bei fokussiertem Strahl zu erreichen.

TELEFUNKEN

Absolute Grenzwerte

Anodenspannung	U_a	**2750**	V
Fokussierungsspannung	U_{g3}	**800**	V
Gitterspannung	$-U_{g1}$	**125**	V
	$+U_{g1}$	**0**	V
	$+U_{g1sp}$	**0**	V
Spitzenspannung zwischen Anode und jeder Ablenkplatte	$U_{a/D\,sp}$	**550**	V
Produkt $I_k \cdot U_a$		**0,6**	
Gitterableitwiderstand	R_{g1}	**1,5**	MΩ
Plattenableitwiderstand	R_D [3])	**1**	MΩ
Spannung zwischen Faden und Kathode	$U_{f/k}$	**±125**	V

[3]) Die Plattenableitwiderstände sollten untereinander möglichst gleich sein.

Bezugspunkt für alle Spannungswerte ist die Kathode.

Kapazitäten

Kathode gegen Rest	ca.	4	pF
Gitter 1 gegen Rest	ca.	9,5	pF
D3 gegen D4 (Rest geerdet)	ca.	1,4	pF
D1 gegen D2 (Rest geerdet)	ca.	3,2	pF
D3 gegen Rest (D4 geerdet)	ca.	3,5	pF
D4 gegen Rest (D3 geerdet)	ca.	3,5	pF
D1 gegen Rest (D2 geerdet)	ca.	4,2	pF
D2 gegen Rest (D1 geerdet)	ca.	4,2	pF
D3 D4 gegen D1 D2	ca.	0,5	pF
Gitter 1 gegen D1 D2 D3 D4	ca.	4	pF
Kathode gegen D1 D2 D3 D4	ca.	0,06	pF

Allgemeine Daten

Achsenabweichung

Der Winkel zwischen der Ablenkebene D1 D2 und der Ablenkebene D3 D4 beträgt 90°, max. Abweichung ±1°.

Der Winkel zwischen der Ablenkebene D3 D4 und der Mittellinie beträgt maximal ±1°.

Mittenabweichung

Der unabgelenkte fokussierte Leuchtfleck befindet sich innerhalb eines Kreises vom Radius 3,5 mm um den Schirmmittelpunkt.

Beim Messen muß die Röhre sorgfältig gegen Störfelder abgeschirmt sein.

Ausnutzbare Schirmfläche

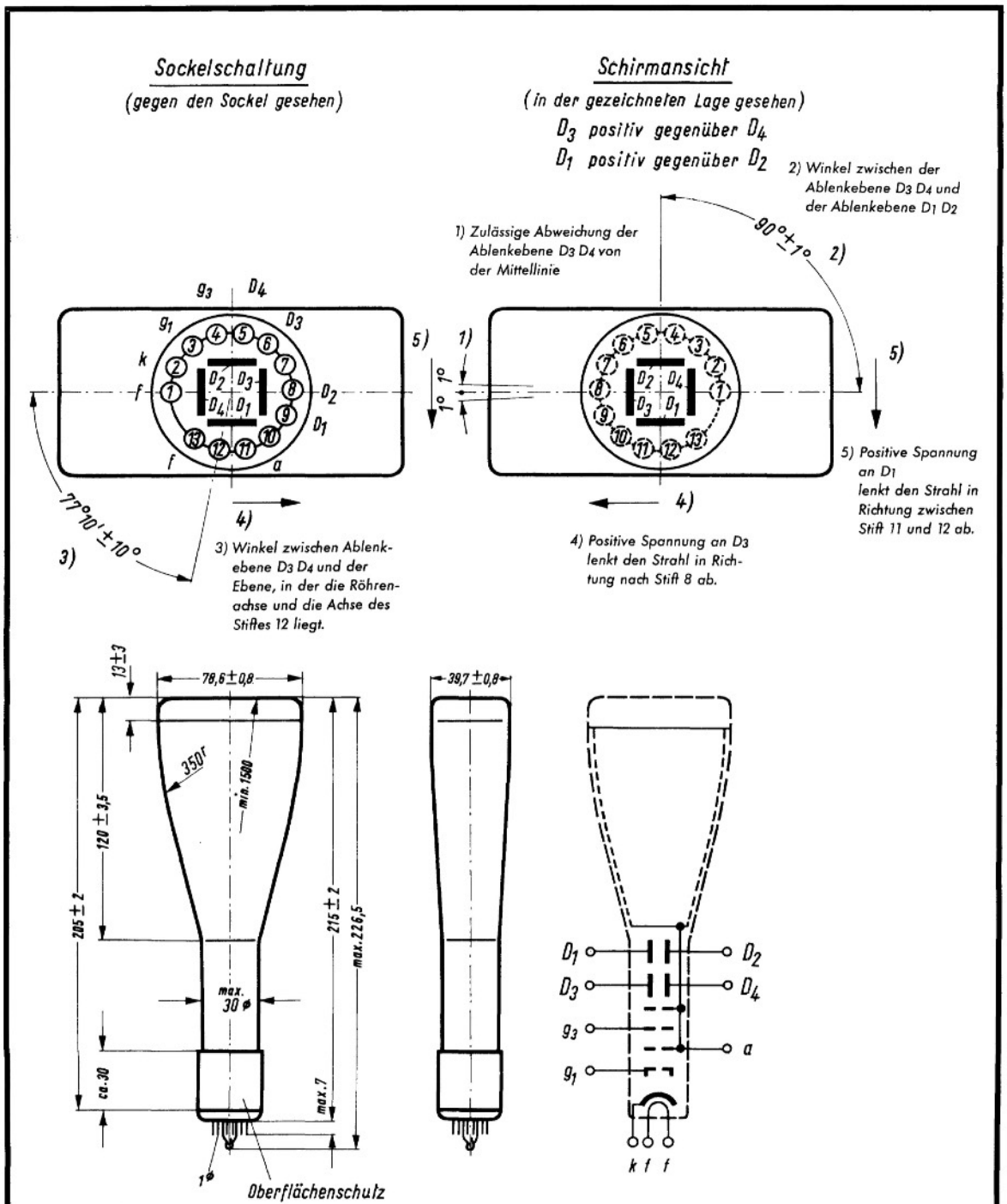
in Richtung D3 D4	min. 28,5	mm
in Richtung D1 D2	min. 70	mm

Ablenkung	doppelelektrostatisch, symmetrisch
Fokussierung	elektrostatisch
Betriebslage	beliebig
Sockel	Spezial, 13 Stifte
Gewicht	ca. 300 g

Zubehör

Fassung	Lager-Nr. 30249
Abschirmzylinder	Lager-Nr. 30702
Gummitüllen	Lager-Nr. 30591

TELEFUNKEN



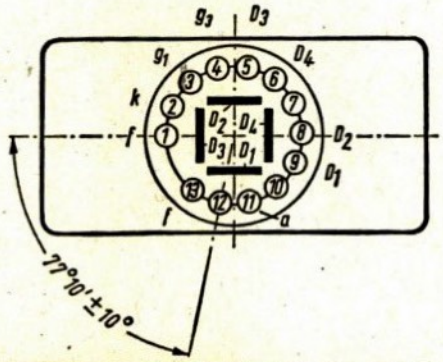
Beim Aufsetzen und Abziehen der Fassung darf der Pumpstutzen nicht mechanisch beansprucht werden.

Freie Stifte bzw. freie Fassungskontakte dürfen nicht als Stützpunkte für Schaltmittel benutzt werden.

Type	Heizung Heating	Betriebswerte Typical operation	Grenzwerte Maximum ratings
D 8-11 BG **D 8-11 GM** **D 8-11 GJ**	U_f = 6,3 V I_f ca. 80 mA indirekt geheizt indir. heated	U_a = 1000 2000 V ΔU_a = ±20 ±20 V U_{g3} = 150 300 V $U_{g1\,sperr.}$ = −35 −70 V ΔU_{g1} = 20 20 V $D_3\,D_4$ = 11 22 V/cm $D_1\,D_2$ = 11 22 V/cm	Absolute Grenzdaten Absolute maximum ratings U_a = 2750 V U_{g3} = 800 V U_{g1} = -125...0 V $U_{a/D\,sp}$ = 550 V R_D = 1 MΩ R_{g1} = 1,5 MΩ $U_{f/k}$ = ±125 V

Oszillographen-Röhre mit rechteckigem Planschirm, Kathode mit geringer Heizleistung für kleine Universal-Oszillographen und für Anzeigezwecke

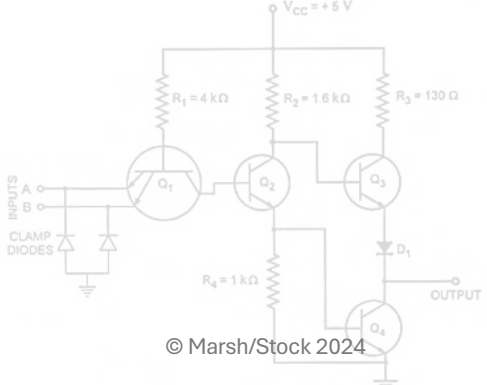
Flat-rectangular-faced 3" CRT for small universal oscilloscopes and indicator applications, cathode with low heater power



Ausnutzbare Schirmfläche		Useful screen area
$D_3\,D_4$	min. 70 mm	
$D_1\,D_2$	min. 28,5 mm	
Länge über alles	226,5 mm	Overall length
Gewicht	ca. 300 g	Weight

Zubehör (Lagernummer)		Accessories (stock no.)
Fassung	30 249	Socket
Abschirmzylinder	30 702	Shielding
Gummitüllen	30 591	Rubber plugs

Note that the prior Telefunken data sheet included previously contains errors in the socket connections. This second smaller data sheet shows the correct connections. Please ensure you use the connections given in the table on the next page.



D8-11 Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	390k 5% CF
R77	22k 5% CF
R70	1M trim pot
R72, R76	270k 5% CF
R79	470k 5% CF
R80	500k trim pot

D8-11 CRT Socket B12-43 Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire	Wire Colour
1	Heater	H1 on X11	EHT	
2	Cathode	Cathode on X10	EHT	
3	Grid	Grid on X10	EHT	
4	Focus Anode	Focus on X10	EHT	
5	D3	X2 on X8	HT	
6	D4	X1 on X8	HT	
7	N/C			
8	D2	Y1 on X7	HT	
9	D1	Y2 on X7	HT	
10	N/C			
11	Acceleration Anodes	A3 on X7	HT	
12	N/C			
13	Heater	H2 on X11	EHT	

Notes

1. As before, if using the vertical case then the Y connections will need reversing

D8-11 Trace Rotation Coil

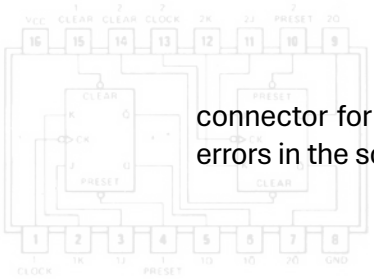
Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

D8-11 Additional Electrodes

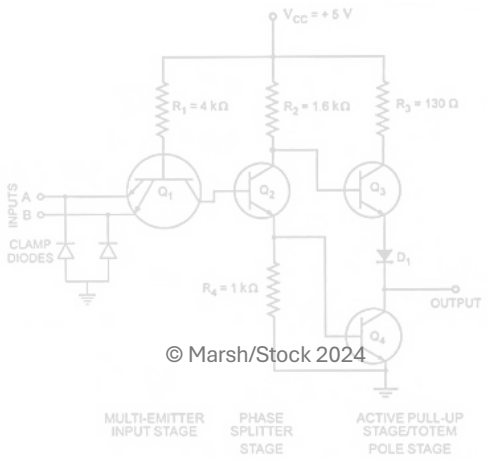
None - Omit R55, R61 and X8 is a 2 way screw connector with the S connection unused.

CRT Socket

The tube has a special 13 pin base. A couple of 3D printed shell designs are available from the project Dropbox that can be used with “nixie pins” from ebay to form a reasonable looking



connector for the CRT base. **N.B**. Note that the Telefunken data sheet included above contains errors in the socket connections. Please ensure you use the connections given in the table.



Annex E – D9-10[19]

- Flat screen for small universal oscilloscopes and indicator applications.
- The screen dimension is 50 x 80 mm.
- P31, P7 phosphors.

Tested in a Scope Clock TTL

[19] Thank you Åke and Frank - https://www.sm5cbw.se/tubes/htm/d9-10gh.htm; https://upload.wikimedia.org/wikipedia/commons/5/58/D9-10GH.jpg; This was the tube used in the original AEG 16x4 character design.

Vorläufige technische Daten

Aufbau Einstrahl-Oszillographen-Röhre, rechteckiger Planschirm, Kathode mit geringer Heizleistung

Verwendung Für kleine Universal-Oszillographen und als Anzeigeröhre

Schirmart	D 9-10 GH	D 9-10 GM
EIA	D 9-10 P 31	D 9-10 P 7
Fluoreszenz	grün	blau
Phosphoreszenz	grün	gelblichgrün
Nachleuchten [1]	mittelkurz	lang

Heizung		indirekt, Parallelspeisung	
Heizspannung	U_f	**6,3**	V
Heizstrom	I_f	ca. 80	mA

Betriebswerte

Anodenspannung	U_{a1a}	**1000**	**2000**	V
Astigmatismuskorrekturspannung	ΔU_{a1a}	±20	±40	V
Hilfsspannung	U_{a1b} [2]	**1000**	**2000**	V
Fokussierungsspannung	U_{g3}	120 ... 155	250 ... 320	V
Gittersperrspannung (unabgelenkter fokussierter Leuchtfleck verschwindet)	$U_{grsperr}$	23 ... 47	45 ... 90	V
Helltastspannung [3]	ΔU_{g1}	ca. 25	ca. 25	V
Ablenkkoeffizient				
Kathodennahe Ablenkplatten	$X \triangleright$ D3 D4	13,5 ... 16	27 ... 32	
Schirmnahe Ablenkplatten	$Y \triangleright$ D1 D2	13,7 ... 17	27,5 ... 34	
Linienbreite bei $I_S = 10\ \mu A$		0,5	0,35	mm

Meßbedingungen siehe Datenblatt „Linienbreitenmessung bei Oszillographenröhren".

[1] Bezogen auf einen Abfall der Helligkeit auf 10% des Anfangswertes.

[2] Bei hohen Anforderungen an die Verzeichnungsfreiheit kann diese durch Verändern der Hilfsspannung U_{a1b} um ±2% verbessert werden.

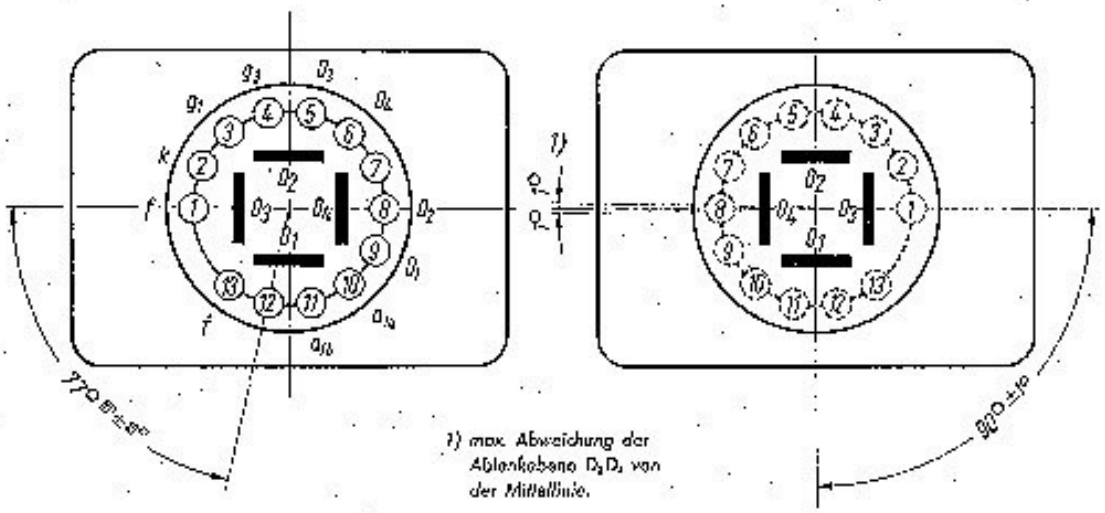
[3] Bei gerade gesperrter Röhre wird die angegebene Helltastspannung benötigt, um einen Strahlstrom von 25 µA bei fokussiertem Strahl zu erreichen.

TELEFUNKEN

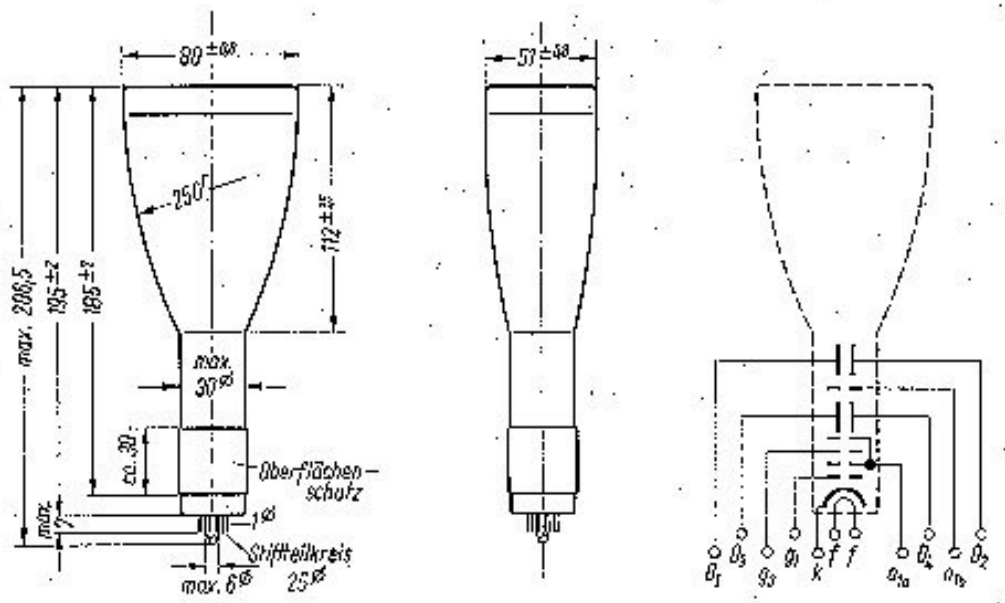
Sockelschaltung
(gegen den Sockel gesehen)

Schirmansicht

Positive Spannung an D_4 lenkt den Strahl in Richtung Stift 8 ab.



1) max. Abweichung der Ablenkebene D_3D_4 von der Mittellinie.



Beim Aufsetzen und Abziehen der Fassung darf der Pumpstutzen nicht mechanisch beansprucht werden.

Freie Stifte bzw. freie Fassungskontakte dürfen nicht als Stützpunkte für Schaltmittel benutzt werden.

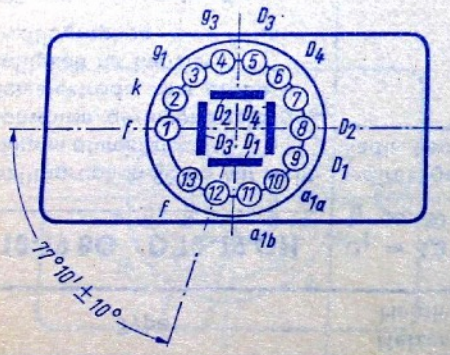
D 9–10 GH D 9–10 GM

U_f = 6,3 V
I_f ca. 80 mA

indirekt geheizt
indir. heated

Oszillographen-Röhre mit rechteckigem Planschirm, Kathode mit geringer Heizleistung für kleine Universal-Oszillographen und für Anzeigezwecke

CRT wiht rectangular flat-faced screen for small universal oscilloscopes and indicator applications, cathode with low heater power

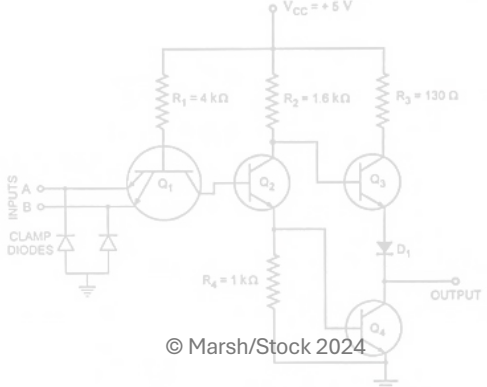


U_{a1a}	=	1000	2000 V
ΔU_{a1a}	=	±20	±40 V
U_{a1b}	=	1000	2000 V
$U_{g1sperr}$	ca.	−34	−65 V
U_{g3}	ca.	130	290 V
ΔU_{g1}	ca.	25	25 V
$D_3\ D_4$	ca.	16	32 V/cm
$D_1\ D_2$	ca.	14	28 V/cm
$D_3\ D_4$	ca.	40,7	81 V/inch
$D_1\ D_2$	ca.	35,6	71 V/inch

U_{a1a}	=	2750 V
U_{a1b}	=	2750 V
U_{g3}	=	800 V
U_{g1}	=	−125...0 V
U_{g1sp}	=	0 V
$U_{a/Dsp}$	=	550 V
$I_k \cdot U_{a1k}$	=	0,6
R_{g1}	=	1,5 MΩ
R_D	=	1 MΩ
$U_{f/k}$	=	±125 V

Ausnutzbare Schirmfläche			Useful screen area
$D_3\ D_4$	min.	70 mm	
$D_1\ D_2$	min.	40 mm	
Länge über alles		206,5 mm	Overall length
Gewicht	ca.	300 g	Weight

Zubehör (Lagernummer)		Accessories (stock no.)
Fassung	30 249	Socket
Abschirmzylinder	30 777	Shielding



D9-10 Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	390k 5% CF
R77	22k 5% CF
R70	1M trim pot
R72, R76	270k 5% CF
R79	470k 5% CF
R80	500k trim pot

D9-10 CRT Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire	Wire Colour
1	Heater	H1 on X11	EHT	
2	Cathode	Cathode on X10	EHT	
3	Grid	Grid on X10	EHT	
4	Focus Anode	Focus on X10	EHT	
5	D3	X2 on X8	HT	
6	D4	X1 on X8	HT	
7	N/C			
8	D2	Y1 on X7	HT	
9	D1	Y2 on X7	HT	
10	Screen	S on X8	HT	
11	Acceleration Anodes	A3 on X7	HT	
12	N/C			
13	Heater	H2 on X11	EHT	

Notes

1. Wire colours are depicted as recommended but not essential.
2. As before, if using the vertical case then the Y connections will need reversing

D9-10 Trace Rotation Coil

Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

D9-10 Additional Electrodes

Screen between X and Y deflection plates

Part Number	Value
R55, R61	330k 5% CF
X8	3 way screw connector

CRT Socket

The tube has a special 13 pin base. A couple of 3D printed shell designs are available from the project drop box that can be used with “nixie pins” from ebay to form a reasonable looking connector for the CRT base.

Annex F – 16ЛОЗИ[20] CRT

Осциллографическая трубка. Предназначена для визуальной регистрации электрических процессов. Фокусировка луча—электростатическая. Отклонение луча — электростатическое. Экран — зеленого свечения. Послесвечение экрана — среднее. Оформление — стеклянное, с цоколем (РШ10). Долговечность не менее 500 ч. Масса не более 1,35 кг.

Google translates says:

Oscillographic tube. Designed for visual registration of electrical processes. Beam focusing is electrostatic. Beam deflection is electrostatic. The screen is a green glow. The afterglow of the screen is average. The decoration is glass, with a socket (РШ10). Durability not less than 500 h.[21] Weight not more than 1.35 kg.

Tested in a Scope Clock TTL - A Monster!

[20] http://www.radiolamp.ru/sprav/elt/16lo3.html; http://www.gstube.com/data/125/

[21] Doesn't fill you with enthusiasm does it?

25

Трубка электроннолучевая 16ЛОЗИ

3.350.096 ТУ1

Электроннолучевая трубка 16ЛОЗИ с электростатическими фокусировкой и отклонением электронного луча, с зеленым цветом свечения экрана, со средним послесвечением, предназначена для регистрации электрических процессов путем визуальных наблюдений в различных радиоэлектротехнических устройствах специального назначения.

1. Основные технические данные

Напряжение накала, В	6,3
Ток накала, А	0,54—0,66
Напряжение на 1-м аноде, В	290—450
Напряжение на 2-м аноде, В	1500
Напряжение запирающее (отрицательное), В	67,5—22,5
Напряжение модуляции при яркости свечения экрана 10 кд/м², В, не более	35
Ширина сфокусированной линии при яркости свечения экрана 10 кд/м², мм, не более	0,6
Чувствительность к отклонению временных пластин, мм/В	0,35—0,48
Чувствительность к отклонению сигнальных пластин, мм/В	0,50—0,70
Размер экрана, мм, не более	100,5×158,5
Длина ЭЛТ, мм, не более	350
Минимальная наработка, ч	1000
Критерии годности:	
а) ширина линии в центре экрана, мм, не более	0,7
б) напряжение модуляции, В, не более	45
в) яркость паразитного свечения, кд/м², не более	0,05

Срок сохраняемости 12 лет при хранении в отапливаемом хранилище или в хранилище с кондиционированием воздуха, а также вмонтированных в защищенную аппаратуру или в комплекте ЗИП.

Для других условий хранения срок сохраняемости должен быть:

Место хранения по ГОСТ В 9. 003—72	Срок сохраняемости, лет	
	в упаковке предприятия-изготовителя	вмонтированных в аппаратуру
Неотапливаемое хранилище	6	6
Под навесом	6	4
На открытой площадке	Хранение не допускается	4

Условия хранения должны соответствовать ГОСТ В 18348—73.

Предприятие-изготовитель гарантирует соответствие каждой поставляемой ЭЛТ всем требованиям ОТУ и ЧТУ в течение срока сохраняемости или минимальной наработки в пределах срока сохраняемости при соблюдении потребителем режимов и условий эксплуатации, правил хранения и транспортирования, а также указаний по применению, монтажу и эксплуатации.

2. Предельно допустимые значения электрических параметров

Напряжение накала, В	5,7—6,9
Напряжение на 1-м аноде, В	0—1100
Напряжение на 2-м аноде, В	1000—2200
Напряжение на модуляторе, В	от минус 125 до 0
Напряжение катод — подогреватель, В	от минус 135 до 0
Сопротивление в цепи модулятора, МОм, не более	1,5
Полное сопротивление в цепи любой из отклоняющих пластин при частоте 50 Гц, МОм, не более	2,0
Напряжение между любой из отклоняющих пластин и 2-м анодом, В	от минус 450 до 450

3. Рекомендации и указания по эксплуатации

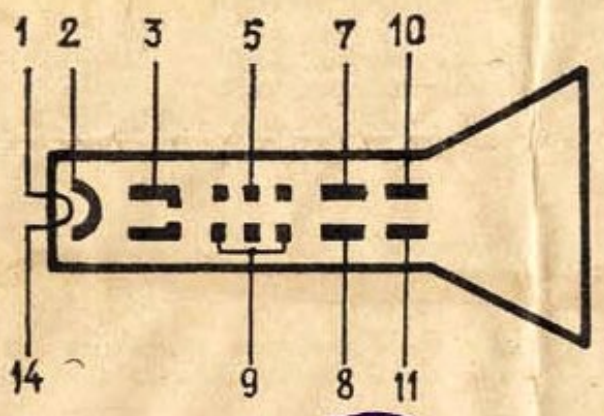
3.1. Эксплуатация ЭЛТ разрешается в соответствии с указаниями и рекомендациями, изложенными в ОСТ 11 335.015—75.

3.2. Эксплуатация ЭЛТ при двух и более предельно допустимых значениях величин, определяющих режим эксплуатации, не допускается.

3.3. Запрещается использовать свободные лепестки ламповых панелей и свободные выводы ЭЛТ в качестве опорных точек для монтажа.

3.4. В процессе эксплуатации должны быть приняты меры для предотвращения повреждения рабочей части экрана ЭЛТ в случае выключения разверток.

4. Схема соединения электродов со штырьками



Расположение штырьков
РШ 10 ГОСТ 7842—71

Номер штырька	Наименование электрода
1	Подогреватель
2	Катод
3	Модулятор
4	Не подключен
5	Анод первый
6	Отсутствует
7	Сигнальная пластина $У_1$
8	Сигнальная пластина $У_2$
9	Анод второй
10	Временная пластина $Х_2$
11	Временная пластина $Х_1$
12	Не подключен
13	Отсутствует
14	Подогреватель

Штамп ОТК

Штамп представителя заказчика

Просим по окончании эксплуатации ЭЛТ возвратить этикетку предприятию-изготовителю, сообщив следующие сведения:

Число фактических часов работы_____

Причина выхода из строя_____

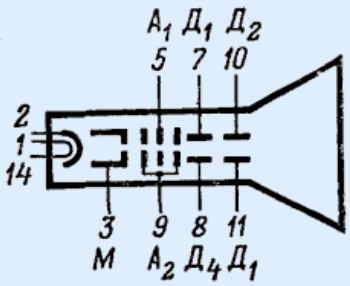
_____

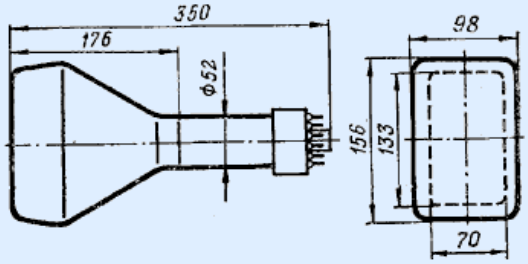
Сведения дал_____

_____

Зак. 3356—88

Осциллографическая трубка. Предназначена для визуальной регистрации электрических процессов. Фокусировка луча— электростатическая. Отклонение луча — электростатическое. Экран — зеленого свечения. Послесвечение экрана — среднее. Оформление — стеклянное, с цоколем (РШ10). Долговечность не менее 500 ч. Масса не более 1,35 кг.





ОСНОВНЫЕ ПАРАМЕТРЫ

Номинальные

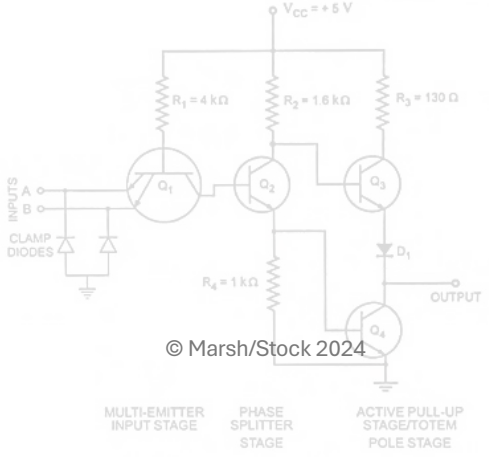
$d_{цэ}$, мм	B, кд/м²	$S_{1,2}$, мм/В	$S_{3,4}$, мм/В	U_{a1}, В	$U_{к2}$, кВ	$U_{м\ зап}$, В
⩽0,6	⩾10	0,35... ...0,48	0,5...0,7	290... ...450	1,5	−45±22,5

$\Delta U_м$, В	$I_{ум}$, мкА	$I_{уки}$, мкА	I_{a1}, мкА	I_{a2}, мкА	$U_н$, В	$I_н$, мА
⩽35	⩽5	⩽30	−50... ...300	⩽500	6,3	600±60

Предельно допустимые

Пределы	$U_и$, В	$U_м$, В	$U_{ки}$, В	U_{a1}, В	U_{a2}, кВ	$R_м$, МОм
мин.	5,7	−125	−135	—	1	—
макс.	6,9	0	0	1100	2,2	1,5

Междуэлектродные емкости, пФ:
$C_{мΣ} ⩽ 8$; $C_{кΣ} < 6$; $C_{д1,д2} ⩽ 4$; $C_{д1Σ} ⩽ 13$ (кроме Д2); $C_{д2Σ} ⩽ 10$ (кроме Д1); $C_{д3,д4} ⩽ 3$; $C_{д3Σ} ⩽ 8$; (кроме Д4); $C_{д4Σ} ⩽ 10$ (кроме Д3).



16ЛОЗИ Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	33k 5% CF
R72, R76, R79	470k 5% CF
R77	22k 5% CF
R70	1M trim pot
R80	500k trim pot
X8	2 way

16ЛОЗИ CRT Socket B12-43 Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire	Wire Colour
1	Heater	H1 on X11	EHT	
2	Cathode	Cathode on X10	EHT	
3	Grid	Grid on X10	EHT	
4	N/C			
5	Focus Anode	Focus on X10	EHT	
6	N/C			
7	D3	Y2 on X7	HT	
8	D4	Y1 on X7	HT	
9	Acceleration Anodes	A3 on X7	HT	
10	D2	X1 on X8	HT	
11	D1	X2 on X8	HT	
12	N/C			
13	N/C			
14	Heater	H2 on X11	EHT	

Notes

1. Wire colours are depicted as recommended but not essential.
2. As before, if using the vertical case then the Y connections will need reversing

16ЛОЗИ Trace Rotation Coil

Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

16ЛОЗИ Additional Electrodes

None - Omit R55, R61 and X8 is a 2 way screw connector with the S connection unused.

Socket - Diheptal 12 pin (B12-37)/РШ10 / B14A

These sockets are commonly available on ebay.

Annex G – 3AYP1[22]

- Oscilloscope tube.
- 38mm x 76mm.
- Designed for small, light weight oscillograph applications.
- Pressed faceplate with uniform glass surface to reduce errors from parallax.
- Electrostatic deflection and focus.
- P1, P2, P7 and P11 phosphors.

New! It still has the face protection film in place for both these photos - Tested in a Scope Clock TTL

[22] Thank you Frank - https://frank.pocnet.net/sheets/201/3/3AYP1.pdf

DUMONT

CATHODE-RAY TUBE

TYPE 3AYP-

TENTATIVE

The DuMont 3AYP- is a 3 x 1 1/2-inch rectangular face electrostatic deflection and focus cathode-ray tube, designed for small, light weight oscillograph applications. It features a pressed faceplate with uniform glass surface to reduce errors from parallax. A newly-designed gun structure is used for greater rigidity and improved electrical stability.
The 3AYP- is designed as a replacement for the 3XP-.

GENERAL CHARACTERISTICS

Electrical Data

Focusing Method	Electorstatic	
Deflection Method	Electrostatic	
Direct Interelectrode Capacitance (Approx.)		
Grid No. 1 to all other electrodes	5.7	µµf
Cathode to all other electrodes	5.2	µµf
D1 to D2	6.9	µµf
D3 to D4	5.4	µµf
D1 to all other electrodes	7.0	µµf
D2 to all other electrodes	7.4	µµf
D3 to all other electrodes	8.0	µµf
D4 to all other electrodes	7.3	µµf

Optical Data

Phosphor	1	2	7	11
Fluorescent Color	Green	Blue-Green	Blue-White	Blue
Phosphorescent Color	------	Green	Yellow	---
Persistence	Medium	Long	Long	Short
Faceplate			Clear	

Mechanical Data

Overall Length	8.875 ± .125	Inches
Greatest Dimensions:		
Width	3.016 ± .031	Inches
Height	1.516	Max. Inches
Minimum Useful Screen Dimensions:		
Horizontal	2.750	Inches
Vertical	1.125	Inches
Base	D8-1	

DE-5770 -2
8/24/59

Allen B. Du Mont Laboratories, Inc.
Clifton, New Jersey

from JEDEC release #2585, Sept. 14, 1959

FORM 809 M1 3 59 BH

DUMONT

CATHODE-RAY TUBE

TYPE 3AYP-

Mechanical Data (Cont'd)

Trace Alignment		
D1D2 trace aligns with bulb wall	± 1	Degree
Angle between D1D2 and D3D4 traces	90 ± 1	Degrees
Base Alignment:		
D1D2 trace aligns with tube axis and Pin No. 3	± 10	Degrees
Positive voltage on D1 deflects beam approximately toward Pin No. 3		
Positive voltage on D3 deflects beam approximately toward Pin No. 5		

MAXIMUM RATINGS (DESIGN CENTER VALUES)

Heater Voltage	6.3	Volts
Heater Current	0.6 ± 10%	Ampere
Accelerator Voltage	2750	Max. Volts DC
Accelerator Input	6	Max. Watts
Focusing Electrode Voltage	1100	Max. Volts DC
Grid No. 1 Voltage:		
Negative Bias Value	125	Max. Volts DC
Positive Bias Value	0	Max. Volts DC
Positive Peak Value	2	Max. Volts
Peak Voltage between accelerator and any deflection electrode	550	Max. Volts

TYPICAL OPERATING CONDITIONS

Accelerator Voltage	1000	2000	Volts DC
Focusing Electrode Voltage	200 to 350	400 to 700	Volts DC
Grid No. 1 Voltage [1]	-14.5 to -33.5	-28.5 to -67.5	Volts DC
Deflection Factors:			
D1D2	34 to 46	68 to 92	VDC/Inch
D3D4	14 to 19	28 to 38	VDC/Inch
Focusing Electrode Current for any operating conditions		-15 to +10	μADC
Spot Position [2]		Within a 7	MM Radius Circle

Allen B. Du Mont Laboratories, Inc.
Clifton, New Jersey

FORM 809-M1-8-55-GH

DUMONT
CATHODE-RAY TUBE

TYPE 3AYP-

MAXIMUM CIRCUIT VALUES

Grid No. 1 Circuit Resistance	1.5	Max. Megohms
Resistance in any Deflection Electrode Circuit [3]	1.0	Max. Megohms

NOTES

1. Visual extinction of the undeflected, focused spot.

2. When the tube is operated at typical operating conditions, with Ec1 adjusted to avoid damage to the screen, and with each of the deflection electrodes connected to the accelerator, and the tube shielded against external influences, the spot will fall within a 7 mm radius circle, centered with respect to the tube center.

3. It is recommended that the deflection electrode circuit resistances be approximately equal.

DE-5770 -2

Allen B. Du Mont Laboratories, Inc.
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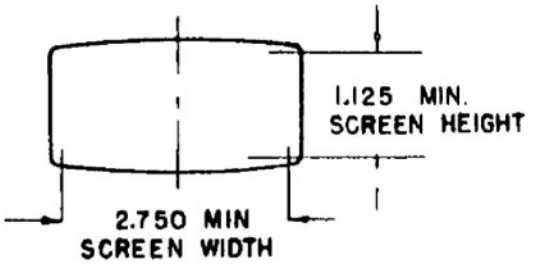
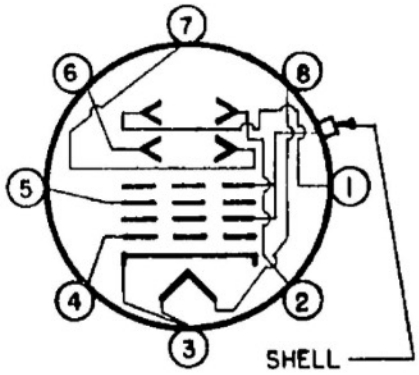
FORM 808-M1-3-58-DH

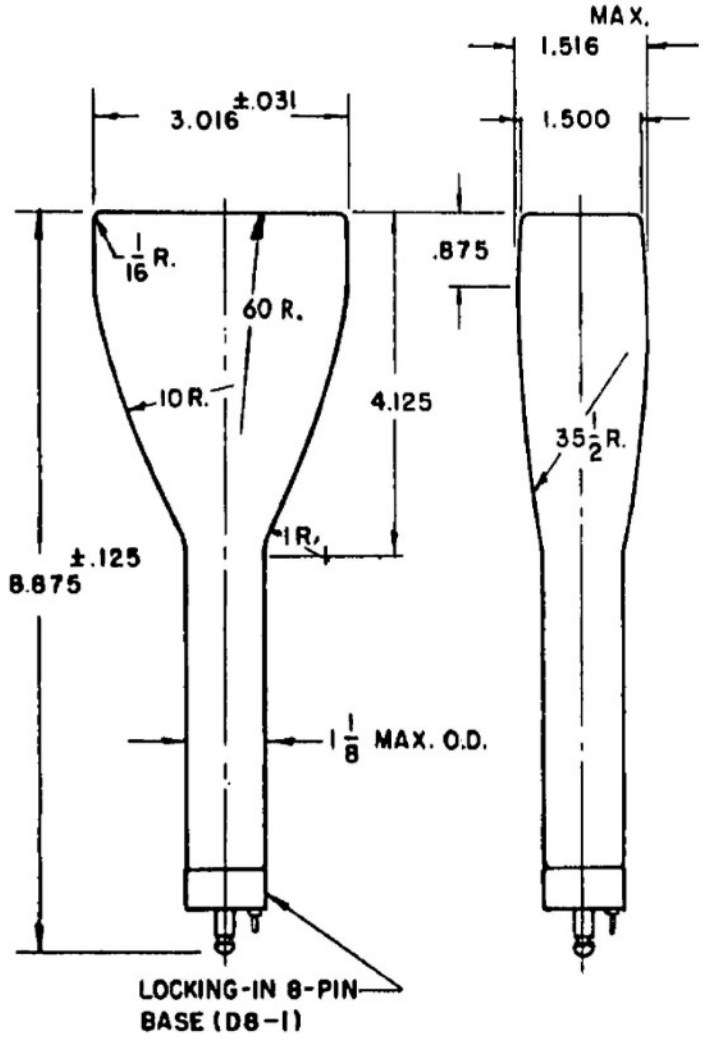
DUMONT

CATHODE-RAY TUBE
3 AYP-





BOTTOM VIEW OF BASE



PIN NO.	ELEMENT
1	— DEFLECTING ELECTRODE D_2
2	— DEFLECTING ELECTRODE D_1
3	— HEATER & CATHODE
4	— GRID NO.1
5	— FOCUSING ELECTRODE
6	— DEFLECTING ELECTRODE D_3
7	— DEFLECTING ELECTRODE D_4
8	— HEATER
SHELL	— ACCELERATOR

Allen B. Du Mont Laboratories, Inc.
Passaic, New Jersey

DE-5770-2
8-24-59

FORM 6057 MS 8-57-5M

3AYP1 Focus Divider Chain Resistors

Part Number	Value
R54, R58, R60, R64	560k 5% CF
R65, R71, R75, R78	4M7 5% CF
R66, R67	270k 5% CF
R77	22k 5% CF
R70	1M trim pot
R72, R76	560k 5% CF
R79	470k 5% CF
R80	500k trim pot

3AYP1 CRT Socket Loctal B8-1 Board to Socket Wiring

Socket Pin	Function	Board Connection	Wire	Wire Colour
1	D2	X1 on X8	HT	
2	D1	X2 on X8	HT	
3	Cathode, Heater	Cathode on X10 H2 on X11	EHT	
4	Grid	Grid on X10	EHT	
5	Focus Anode	Focus on X10	EHT	
6	D3	Y2 on X7	HT	
7	D4	Y1 on X7	HT	
8	Heater	H1 on X11	EHT	
Base Shell	Acceleration Anodes	A3 on X7	HT	

Notes

1. Wire colours are depicted as recommended but not essential.
2. The vertical case requires the Y connections reversed.
3. The loctal base shell connects to the acceleration anodes which under normal operation have a voltage of about 150V above ground. Depending on the construction of the loctal socket it may be necessary to insulate any exposed metal.

3AYP1 Trace Rotation Coil

Not used - Omit Q20, Q24, R85, R89, R90, R91 and X12.

3AYP1 Additional Electrodes

None - Omit R55, R61 and X8 is a 2 way screw connector with the S connection unused.

Loctal B8-1 Socket

These sockets are commonly available on ebay. If a kit is supplied with a 3AYP1 CRT then a new socket will be included.

Afterword

All the CRTs featured here have been rectangular CRTs with a high aspect ratio.

Circular CRTs can be used. As an example, a 3ACP1 CRT with the PDA connected to 300V works well:

However, it is not perhaps an efficient use of the CRT face area?