SECTION 3
CIRCUIT DESCRIPTION

3.0 ATTENUATOR AND VERTICAL INPUT AMPLIFIER Figures 1A & 1B.

CH1 and CH2 are identical and the following description covers both channels.

The input to the attenuator is connected via C901 to the input socket SK901 on AC, directly to the input socket on DC or to ground on GND. The capacity compensated attenuator is switched by S902 wafer 1 in steps of 100, 10 and 1 and the output is fed to the gate of TR601 via C601 and R602 which, together with D601, protect the input against overloads up to ±400 V. TR601 is a F.E.T. source follower whose output DC level is adjusted to zero by R604 and R608. The output is then attenuated in steps of 5, 2 and 1 selected by S902 wafer 2 F and fed to the base of TR603 which together with TR604 forms a longtailed pair. The diodes D602 and D603 in the emitters increase the signal handling capacity without affecting the change in gain which remains directly proportional to current and, therefore, to supply voltage. This compensates for the CRT sensitivity which is inversely proportional to supply voltage and hence the overall vertical sensitivity remains independent of supply voltage. Vertical shift is fed to the base of TR604. The gain of the channel is set up by R613 which controls the total stage emitter current. The collector currents of TR603 and TR604 pass through thermal compensating networks R611, C602 and R614, C603 and also through grounded base stage TR602 to the output stages. TR602 isolates the channel switching waveforms from the input circuit.

3.1 VERTICAL OUTPUT AMPLIFIER
Figure 2

The collector currents of the selected channel pass through diodes D637 and D638 for Channel 1, or D642 and D643 for Channel 2, to the bases of shunt feedback stages TR633 and TR636. The output of TR633 and TR636 are fed to the bases of TR634 and TR635, a longtailed pair whose collectors feed the Y plates of the CRT. C641 and R671 in the emitter circuit are adjusted for the best pulse response and TH631 compensates for the temperature coefficient of the input stages. The appropriate channel is selected either manually by S631 and S632 which are ganged to the vertical shift controls, or automatically by the Chop/Alternate circuit TR631 and TR632. On EXT X and Time/Div speeds of 2 ms/div and slower, TR631 and TR632 operate as a free-running multivibrator at a frequency of approx. 100 kHz. When TR632 conducts D635 and D636 conduct and turn off D637 and D638 thus disconnecting Channel 1. Conversely when TR631 conducts D639 and D641 conduct and turn off D642 and D643 thus disconnecting Channel 2. C632 and C634 feed pulses to the unblanking amplifier to blank out the trace during the transitions. On Time/Div speeds above 2 ms/div, TR631 and TR632 operate as a bistable whose state is changed at the end of each time base sweep by an edge from the emitter of TR34. The network L631, C640, R640 in CH1 and L632, C649, R669 in CH2 delay the transitions until the trace is blanked. The vertical output amplifier current supplies the +13 V line which is decoupled by C645 and also the +7.5 V line which is stabilized by zener diode D644. The +7.5 V is used as a reference for the −7.5 V line which is a shunt stabilizer circuit consisting of TR637, R659, R666, R667 and R668. R658 compensates for variations in the −13 V line and reduces the effect of supply voltage variations on the −7.5 V line.

3.2 TRIGGER CIRCUIT Figures 3 & 4

This consists of a longtailed pair TR23 and TR25 similar to the Vertical Amplifier input stage but with temperature compensation in its emitter circuit. On the CH2 position the input is connected to CH2 and EXT X position via C20, C21 and R23 to the TRIG/EXT X socket. On all other positions of the Time/Div switch the input is connected to S20 which selects either the EXT TRIG socket, CH1 or CH2 signal. The output from the appropriate collector, selected either by the Polarity switch S21 or the Time/Div switch S1, is connected via diode D27 or D31 to the emitter of common base stage TR26. The collector of TR26 is connected via D54, D33 and D34 to the input of the Horizontal Amplifier on CH2 and EXT X positions of the Time/Div switch S1. On other positions of the Time/Div switch the collector of TR26 is AC coupled via D32 to the base of TR21, a shunt feedback stage.

On the AC position of S22 the output of TR21 is connected via diodes D58 and D59, which limit the voltage swing, to the input of the Schmitt trigger circuit TR22 and TR24. The Level control R21 allows the mean DC level of the output of TR21 to be varied so that any portion of the trigger signal can be set at the triggering level of the Schmitt. When the Level control is in the Auto position the range of the Level control is restricted by the addition of R20 in series with R22. This reduces the Level control range from more than 10 divisions to approximately 2.5 divisions. On the TV position of S22 the output of TR21 is connected via diode D57 to the sync separator TR38 which conducts only during the sync pulses and is cut off during the video signal. On Time/Div speeds of 100 µs and slower the output of TR23 is integrated by R129 and C63. This gives a waveform where the field pulses are of greater amplitude than the line pulses and are fed via TR25 to the input of the Schmitt trigger circuit. On Time/Div speeds of 50 µs and faster C63 is disconnected from ground by cutting off diode D56. The line and field pulses are then of equal amplitude and are fed via TR39 to the input of the Schmitt trigger circuit. On TV diodes D58 and D59 are cut off and the Level control is disconnected by switching R22 to −13V. The Schmitt trigger circuit TR22 and TR24 provides a constand amplitude trigger signal at the collector of TR24 to the timebase and bright-line auto circuit.

TR30 provides a positive going gating pulse to the base of TR24 to inhibit the Schmitt trigger circuit during the timebase sweep. This prevents trigger pulses being produced during the sweep and breaking through into the Vertical Amplifier. To prevent the triggering pulses which are produced by the gating waveform being fed to the bright-line AUTO circuit a negative differentiated pulse is fed from the collector of TR30 to the anode of D43 cutting it off before the arrival of the positive trigger pulse. The trigger pulse is thus prevented from reaching the bright-line circuit, triggering it and interupting the free running of the timebase. The gating is removed on timebase speeds below 1 ms/div by removing the HT supply to TR30 by means of S1 − 2F.

3.3. TIMEBASE, UNBLANKING AND BRIGHT LINE AUTO CIRCUIT Figure 4

3.3.1 The differentiated positive pulse from the trigger circuit is fed via D36 to the base of TR27 which together with TR29 forms a bistable. The positive pulse turns on TR27 which in turn cuts off the clamping transistor TR34. The timebase, a F.E.T. Miller circuit, then runs up linearly charging up the hold-off capacitor via D47 and resetting the bistable via R114. When TR27 cuts off, TR34 conducts and discharges the timing capacitor until D45 conducts and reduces the current in TR34 to the value required by the timing resistor. At this point the flyback stops. During the flyback the hold-off capacitor discharges through R114 until D48 conducts. At this point the action is complete and the timebase can be triggered by the next triggering pulse.

3.3.2 If the Trig level control is in the Auto position and no trigger pulses are present, TR34 and D49 conduct and reduce the potential at the anode of D48. This allows the hold-off capacitor to discharge further and re-trigger the bistable. The timebase then free-runs. If trigger pulses are present at the anode of D43 the positive pulses trigger the monostable TR32 and TR35. When triggered at frequencies above about 10 Hz the average collector current of TR35 is low and D49 is cut off returning the timebase to the normal triggered condition.

3.3.3 The collector current of TR29 which is cut off during the sweep is fed to the input of TR28. The collector of TR28 goes negative at the beginning of the sweep until diode D38 conducts and clamps the collector potential at about 3 V, thus unblanking the sweep. When TR29 conducts at the end of the sweep TR28 collector goes positive blanking the trace. On chop positions of the sweep negative edges from the chop circuit are fed to the base of TR28 to blank the trace during the transitions.

3.4 HORIZONTAL AMPLIFIER Figure 3

This consists of a shunt feedback stage TR31 with switched feedback resistors to give X5 expansion. The sweep and horizontal shift currents are mixed at the input of the shunt feedback stage and the output is fed to a longtailed pair, TR33 and TR37, which feeds the horizontal deflection plates of the CRT. D44 clamps the collector of TR33 and prevents it from bottoming.

On the EXT X and CH2 positions of the Time/Div switch the input of TR31 is switched to the collector of TR26 via D33, D34 and D54 and the X5 feedback resistor is shorted out by diodes D33, D34, D35 and D37. The trace is then deflected horizontally via the EXT X socket or from Channel 2. On these positions the gate of TR36 is connected to the cathode of D47 which clamps the output of the timebase at about +1 V and turns off TR29 thus unblanking the trace.

3.5 CRT CIRCUIT AND POWER SUPPLY

Figure 5

The supply voltage is fed via the power ON/OFF switch S401, the fuse FS401 and the voltage selector SK401 to the appropriate primary tapping on T401.

3.5.1 The −13 V line is obtained from a full wave rectifier circuit consisting of D405, D406, C402 and R403.

3.5.2 The +117 V line is obtained from a bridge rectifier D401, D402, D403 and D404 with reservoir capacitor C403 and smoothed by R406 and C408 to provide the +110 V line and by R407 and C406 to provide the +80 V line.

3.5.3 The −1050 V line is obtained from a half wave rectifier circuit consisting of D407, D409, C411 and C412.

3.5.4 The +2500 V line is obtained from a voltage doubler circuit consisting of D408, D409, C401 and C404.

3.5.5 The calibrator circuit provides a 0.5 V squarewave at supply frequency. It is produced by a diode switching circuit in which a current derived from the stabilized −7.5 V line is passed through D413 and R408 during negative half cycles of the AC voltage from the 13 V transformer winding. On positive half cycles D413 is cut off and the current passes through D412 and R402. The output voltage is set by R405. The temperature coefficient of the diode D413 is compensated for by the negative coefficient of the output resistor R408 giving an output voltage which is nominally independent of temperature.

3.5.6 The grid voltage of the CRT is derived from a zener diode connected between the CRT cathode and the −1050 V supply. The voltage is varied by the intensity control R301. The intensity of the trace may be varied by signals fed via the Z Mod socket SK301 and C301 to the grid of the CRT.

SECTION 4

MAINTENANCE AND RE-CALIBRATION

Care must be taken not to touch high voltage tags. The instrument MUST BE UNPLUGGED when removing the case, removing or replacing the tube, or other components and where possible during other servicing.

4.1 INTRODUCTION

4.1.1 GENERAL

The solid state design of the instrument makes frequent adjustment of the internal preset components unnecessary. The appropriate part of the re-calibration procedure should be carried out, whenever the instrument fails to meet its specification, or whenever a defective component is replaced. Section 3 should be helpful in deciding which part of the circuit requires adjustment.

4.1.2 CALIBRATOR

The internal 0.5 V calibration signal allows the accuracy of the vertical amplifier system to be checked. The calibration signal which is at supply frequency can also be used to check the sweep speed to the accuracy of the supply frequency.

4.1.3 TOOLS AND EQUIPMENT

To carry out the whole calibration procedure, the following tools and equipment are required:—

Low-capacitance trimming tool (for preset capacitors).

Small screwdriver (for preset potentiometers).

Amplitude Calibrator, providing 1 kHz squarewave, amplitude 50 mV, amplitude accuracy within 0.25%.

Time-mark Generator, providing markers of 1 ms, 1 µs and preferably, 0.5 µs. Accuracy within 0.1%.

Squarewave Generator, providing outputs of 1 kHz and 10 kHz, 50 mV to 50 V.

Squarewave Generator, providing outputs of 10 kHz, 100 kHz and 1 MHz with rise-time less than 10 ns.

Coaxial cable and terminating resistor for the above.

Monitor Oscilloscope, complete with X10 passive probe, and having a sweep output socket.

Passive Probe, X10 attenuation, suitable for input capacities of 25 to 35 pF.

Test Meter, 20,000 Ω/volt or higher, accuracy within 2% 2.5 V DC to 2500 V DC.

Composite TV video signal source.

Sinewave Generator, 1 kHz, 10 kHz and 50 kHz.

Co-axial leads allowing the same signal to be connected to Channel 1, Channel 2 and the EXT socket.

4.2 MECHANICAL

4.2.1 ACCESS TO INTERIOR

NOTE: UNPLUG INSTRUMENT FROM SUPPLY BEFORE REMOVING COVERS.

The cabinet covers are removed as follows:—

1. The back cover is removed by undoing and removing the three fixing screws and pulling the cover off.
2. The lower side panels can then be slid backwards out of position.
   To re-fit the covers it is necessary to slide the lower covers into position taking care that the slot on the lower edge engages with the raised portion of the lower panel bezel, and that the lug at the top is engaged. The rear cover should be slid into position and the three screws inserted.

4.2.2 CRT REMOVAL

1. Disconnect the instrument from the ac supply.
2. Remove the covers as shown in 4.2.1 above.
3. Short point k on the Printed Circuit board to chassis via a 1 MΩ resistor and keep the short in place for about 1 minute to discharge any residual high voltage.
4. Remove the INTENSITY and FOCUS knobs.
5. Remove the felt washers and the panel bearing the name TELEQUIPMENT.
6. Remove the 4 screws fixing the plastic bezel surrounding the tube face and pull off the bezel and graticule.
7. Slide off the black section of the upper case by moving forward.
8. Spring down the ends of the springy copper strip above the tube and slide the strip out.
9. Pull off the tube base (at the rear of the tube) using the loop provided.
10. Loosen the screws holding the clamps which fix the rear tube screen to the plastic moulding and slide these clamps off.
11. Slide the tube gently forward easing the mumetal past the lower support and chassis edge until the PDA cap is clear of the chassis.
12. Remove the PDA cap by pulling out and then slide the tube right out of the instrument.

4.2.3 RE-FITTING CRT

The procedure for re-fitting is the reverse of 4.2.2 above. Care must be taken in easing the front of the mumetal screen past the chassis edge, and in keeping the PDA cap clear of the chassis front.

4.2.4 REPLACING INTENSITY OR FOCUS CONTROLS

If it is required to replace either of these controls it is necessary to remove the C.R.T. as above to allow enough room to get to the extension spindles and fixing nuts.

4.3 CALIBRATION PROCEDURE

4.3.1 INITIAL SETTING

1. Remove side covers, reference Para 4.2.1. Connect to a suitable A.C. power source and switch the instrument on.
2. Set the front panel controls as follows:—

AC-DC-GND) CH1 &	GND
VOLTS/DIV) CH1 &	0.01
POSITION) CH2	Mid-position
TIME/DIV)	1 ms
Horizontal POSITION	Mid-position, push in
TRIG LEVEL	Mid-position, out (AUTO)
±	+
EXT-CH1-CH2	EXT
AC-TV	AC
FOCUS)	Adjust for well defined
INTENSITY)	low brilliance trace

4.3.2 SUPPLY LINE VOLTAGES (R668)

D.C. supply line voltages should normally lie within the prescribed limits when A.C. power source voltage coincides with the setting of the line voltage selector on the rear of the instrument.

The −7.5 V line is adjustable by means of R668. It should normally only require re-setting when TR637 has been replaced. If the movement of the trace is greater than 1 div when the mains voltage is adjusted to ± 10% of nominal, use the following procedure:—

1. Set the Test Meter to a range suitable for measuring 10 V d.c.
2. Connect the negative test lead to test point 67 and the positive test lead to chassis.
3. Set CH1 & CH2 AC-DC-GND to GND.
4. Adjust R668 for a meter reading of 7.5 V approximately.
5. Re-check the trace movement for ± 10% variation.
6. If the specification cannot be met, raise or lower the voltage setting which must remain within the limits of 7 V to 7.7 V.
7. If R668 is altered, the Vertical Amplifier Balance procedures in 4.3.4 must be re-checked.

Supply Line	Test Point	Limits
– 7.5V	CH1 POSITION potentiometer violet-blue wire	–7.3V to –7.7V
+ 7.5V	CH1 POSITION potentiometer orange-white wire	+7.1V to +7.9V
– 13V	Horizontal POSITION potentiometer mauve-white wire	–12.4V to –13.6V
+ 13V	Test Point 3	+11.9V to +12.1V
+ 80V	Test Point 22	+75V to +85V
+ 110V	Test Point 29	+107V to +117V
–1050V	Test Point 156/7	–1060V to –1160V
+2500V	Test Point 156/K	+2400V to +2500V

4.3.3 ASTIGMATISM AND GEOMETRY (R305 and R307)
1. Set TIME/DIV to 100 µs and display a 10 kHz sinewave signal on one channel only at 6 divisions vertical amplitude.
2. Adjust FOCUS and R305 (Astigmatism) for best definition of display. Leave 10 kHz signal connected.
3. Set TIME/DIV to 1 ms.
4. Select AUTO and ensure that no signal is connected to EXT.
5. Set EXT-CH1-CH2 switch to EXT so that display becomes an unsynchronised raster.
6. Adjust R307 so that the raster becomes as nearly as possible rectangular.
7. Disconnect 10 kHz signal.

4.3.4 VERTICAL AMPLIFIER

4.3.4.1 CHANNEL 1 VOLTS/DIV BALANCE (R604 and R608)
1. Check that Channel 1 input switch is set to GND and VOLTS/DIV to 0.01.
2. Turn Channel 1 on, Channel 2 off.
3. Connect test meter between test point C3 and chassis.
4. Adjust R604 for zero reading. It should normally be necessary to adjust R604 only when TR601 has been replaced. After adjustment of R604, R613 must be checked and re-adjusted if necessary. See para 4.3.4.5. Disconnect test meter.
5. Switch Channel 1 VOLTS/DIV between 0.01, 0.02 and 0.05 positions. Adjust R608 to eliminate vertical movement of the trace.

4.3.4.2 CHANNEL 1 POSITION BALANCE (R618)
1. Connect test meter between Channel 1 POSITION potentiometer moving contact (red-blue wire) and chassis.
2. Adjust POSITION for zero reading.
3. Adjust R618 to bring the trace to the centre of the screen.
4. Disconnect test meter.

4.3.4.3 CHANNEL 2 VOLTS/DIV BALANCE (R704 and R708)
1. Check that Channel 2 input switch is set to GND and VOLTS/DIV to 0.01.
2. Turn Channel 2 on and Channel 1 off.
3. Connect test meter between test point C33 and the chassis.
4. Adjust R704 for zero reading.
   It should normally be necessary to adjust R704 only when TR701 has been replaced. After adjustment of R704, R713 must be checked and re-adjusted if necessary. See para 4.3.4.6.
5. Disconnect test meter.
6. Switch Channel 2 VOLTS/DIV between 0.01, 0.02 and 0.05 positions. Adjust R708 to eliminate vertical movement of the trace.

4.3.4.4. CHANNEL 2 POSITION BALANCE (R718)
1. Connect test meter between Channel 2 POSITION potentiometer moving contact (red-blue wire) and chassis.
2. Adjust POSITION for zero meter reading.
3. Adjust R718 to bring the trace to the center of the screen.
4. Disconnect test meter.

4.3.4.5 CHANNEL 1 GAIN (R613)
1. Set Channel 1 VOLTS/DIV to 0.01 and Amplitude Calibrator output to 50 mV.
2. Display Amplitude Calibrator output on Channel 1.
3. Adjust the amplitude of the display to exactly 5 divisions with R613.
4. Disconnect Amplitude Calibrator.

4.3.4.6 CHANNEL 2 GAIN (R713)
1. Set Channel 2 VOLTS/DIV to 0.01 and Amplitude Calibrator output to 50 mV.
2. Display Amplitude Calibrator output on Channel 2.
3. Adjust the amplitude of the display to exactly 5 divisions with R713.
4. Disconnect Amplitude Calibrator.

4.3.4.7 PULSE RESPONSE (C641, R671 and R653)
1. Set both VOLTS/DIV to 0.01.
2. Display a 1 MHz squarewave signal simultaneously on both channels. (Ensure that the co-axial cable connecting the signal to the instrument is correctly terminated).
3. Adjust C641 and R671 to optimise squarewave response on both channels. If the response of the channels is not exactly the same, adjust for best compromise.
4. Adjust R653 to minimize the change in squarewave response occurring when either POSITION control is adjusted.
5. Disconnect squarewave signal.

4.3.4.8 ATTENUATORS (C902, C903, C904 and C905)
Channel 1 and Channel 2 attenuators and input selector circuits are electrically identical. Corresponding components in these parts of the two channels carry the same component references.
1. Set Channel 1 input switch to D.C.
2. Display a 10 kHz squarewave of 0.5 V amplitude on Channel 1, using the 0.1 VOLTS/DIV position of the attenuator.
3. Adjust C905 for the best response (square corner without overshoot or undershoot.
4. Set Channel 1 attenuator to 1 VOLTS/DIV and increase the amplitude of the squarewave to 5V.
5. Adjust C904 for the best response.
6. Disconnect squarewave signal.
7. Connect a X10 passive probe to the input of Channel 1.
8. Set the Channel 1 VOLTS/DIV to 0.01.
9. Display a 1 kHz squarewave of 0.5 V amplitude via the probe.
10. Adjust the probe compensation for the best squarewave response.
11. Set VOLTS/DIV to 0.1 and increase the amplitude of the squarewave to 5 V.
12. Without altering the probe compensation, adjust C903 for the best squarewave response.
13. Set VOLTS/DIV to 1 and increase the amplitude of the squarewave to 50 V.
14. Adjust C902 for the best squarewave response.

15. Disconnect signal and probe.
16. Repeat Ops 1 to 15 for Channel 2.

4.3.5 HORIZONTAL AMPLIFIER

4.3.5.1 OUTPUT STAGE BALANCE (R108 and R113)

1. With TIME/DIV set to 2 ms display a 1 kHz signal (sinewave or squarewave) on Channel 1.
2. Adjust the horizontal POSITION control to the point where the lefthand end of the trace does not move when the X5 switch is operated.
3. Without re-adjusting the POSITION control, bring the lefthand end of the trace to the centre vertical graticule line by adjustment of R113.
4. Position the trace centrally on the screen with the horizontal POSITION control.
5. Adjust R108 for the best horizontal linearity at the right and lefthand extremities of the CRT screen.

4.3.5.2 PRE-AMPLIFIER BALANCE (R37, R49 and R80)

1. Set TIME/DIV to 2 ms.
2. Short tag C2 or the top lead of C20 to ground.
3. Set EXT-CH1-CH2 switch to EXT.
4. Connect test meter between test point (H–) and Chassis (+).
5. Adjust R49 so that the test meter reading is independent of the position of the ± switch.
6. Disconnect the test meter.
7. Set TIME/DIV to 1 ms.
8. Adjust the lefthand end of the trace to the left-hand edge of the graticule by means of the POSITION control.
9. Turn TIME/DIV to CH2 and bring the spot to the centre vertical graticule line by adjusting R80.
10. Set TIME/DIV to EXT X.
11. Bring the spot to the central graticule line by adjusting R37.

4.3.5.3 CHANNEL 2 HORIZONTAL GAIN (R104)

1. Set TIME/DIV to CH2.
2. Set the output of the Amplitude Calibrator to 50 mV and connect to the input of Channel 2.
3. Set Channel 1 input switch to GND and channel 2 input switch to A.C.
4. Set Channel 2 VOLTS/DIV to 0.01.
5. Set horizontal deflection to exactly 5 division with R104.
6. Disconnect Calibrator.

4.3.6 TRIGGER SWEEP

4.3.6.1 TRIGGER SENSITIVITY (R31)

1. Set CH1 and CH2 VOLTS/DIV to 1 V and both channels on.
2. Feed 0.5 V 50 Hz squarewave to both INPUTS.
3. Set both AC-DC-GND switches to DC.
4. Set TIME/DIV to 2 ms.
5. Push TRIG LEVEL in with TRIG switches set to CH1 and +.
6. Adjust LEVEL for a triggered trace.
7. Turn R31 anti-clockwise until multi-triggering takes place. Note setting of R31.
8. Remove the 50 Hz input signal.
9. Feed 0.25 V 10 kHz signal to both INPUTS.
10. Set TIME/DIV to 100 µs.
11. Turn R31 clockwise adjusting the LEVEL control if necessary to maintain triggering until a position is reached at which triggering can not be obtained or, the pot is fully clockwise. Note setting of R31.
12. Adjust R31 to halfway between the two positions previously noted.
13. Remove the 10 kHz input signal.
14. Feed a 1 div amplitude to 10 MHz sinewave to CH1 and check that a locked trace can be obtained by adjustment of the LEVEL control on both +ve and –ve. If not turn R31 anticlockwise sufficient to obtain a locked trace but not as far as in 7 above.
15. Repeat 14 on CH2 both +ve and –ve.

4.3.6.2 SWEEP STABILITY (R74)

1. Remove CAL signal.
2. Apply a 1 kHz signal.
3. Set TIME/DIV to 1 ms.
4. Bring the RH end of the trace on to the screen using the X POSITION control.
5. Adjust R74 anticlockwise until the trace disappears noting the position of the end of the trace at that instant.
6. Turn R74 clockwise until the timebase starts to free run again noting the position of the end of the trace.
7. Re-adjust R74 to bring the RH end of the trace halfway between the two positions previously noted.

4.3.6.3 1ms/DIV SWEEP ACCURACY (R89)

This adjustment should not be performed until any necessary adjustments have been made to R104. See para. 4.3.5.3.

1. Set TIME/DIV to 1 ms.
2. Display .1 ms markers from the Time Marker Generator on Channel 1.
3. Adjust R89 so that markers are exactly one major division apart over the centre 7 divisions. Leave Time Marker Generator connected.

4.3.6.4 SWEEP LENGTH (R77)

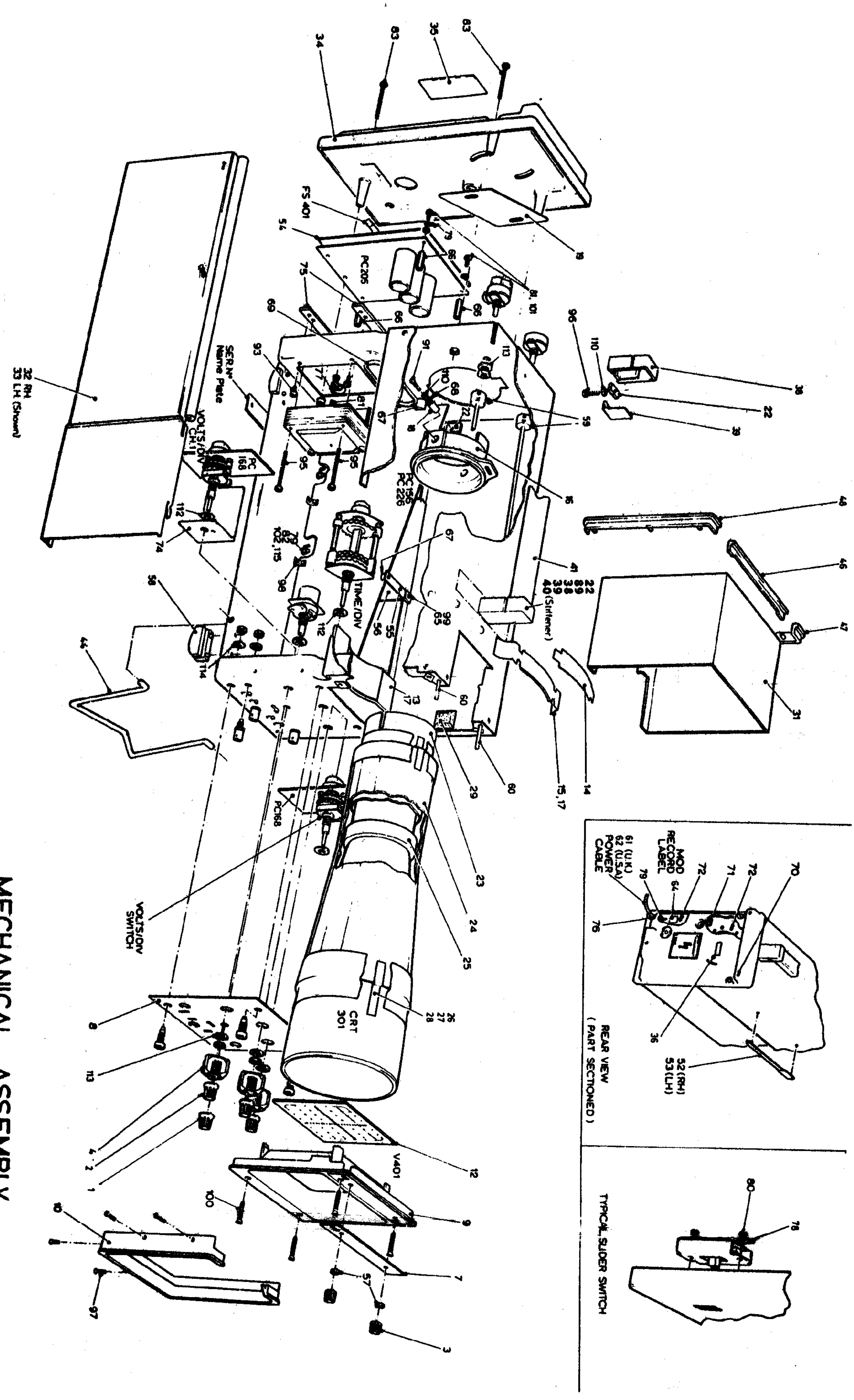
Adjust sweep length to 10.5 divisions with R77. Leave Time Marker Generator connected.

4.3.6.5 0.5µs/DIV SWEEP ACCURACY (C2)

1. Set Time Marker Generator to 0.5µs.
2. Set TIME/DIV to 0.5 µs.
3. Adjust C2 (mounted on TIME/DIV switch) so that one marker occurs for each major division over the centre 8 divisions. (Alternatively, set Time Marker Generator to 1 µs and adjust for one marker every 2 divisions).
4. Disconnect Time Marker Generator.

4.3.7 INTERNAL CALIBRATOR (R405)

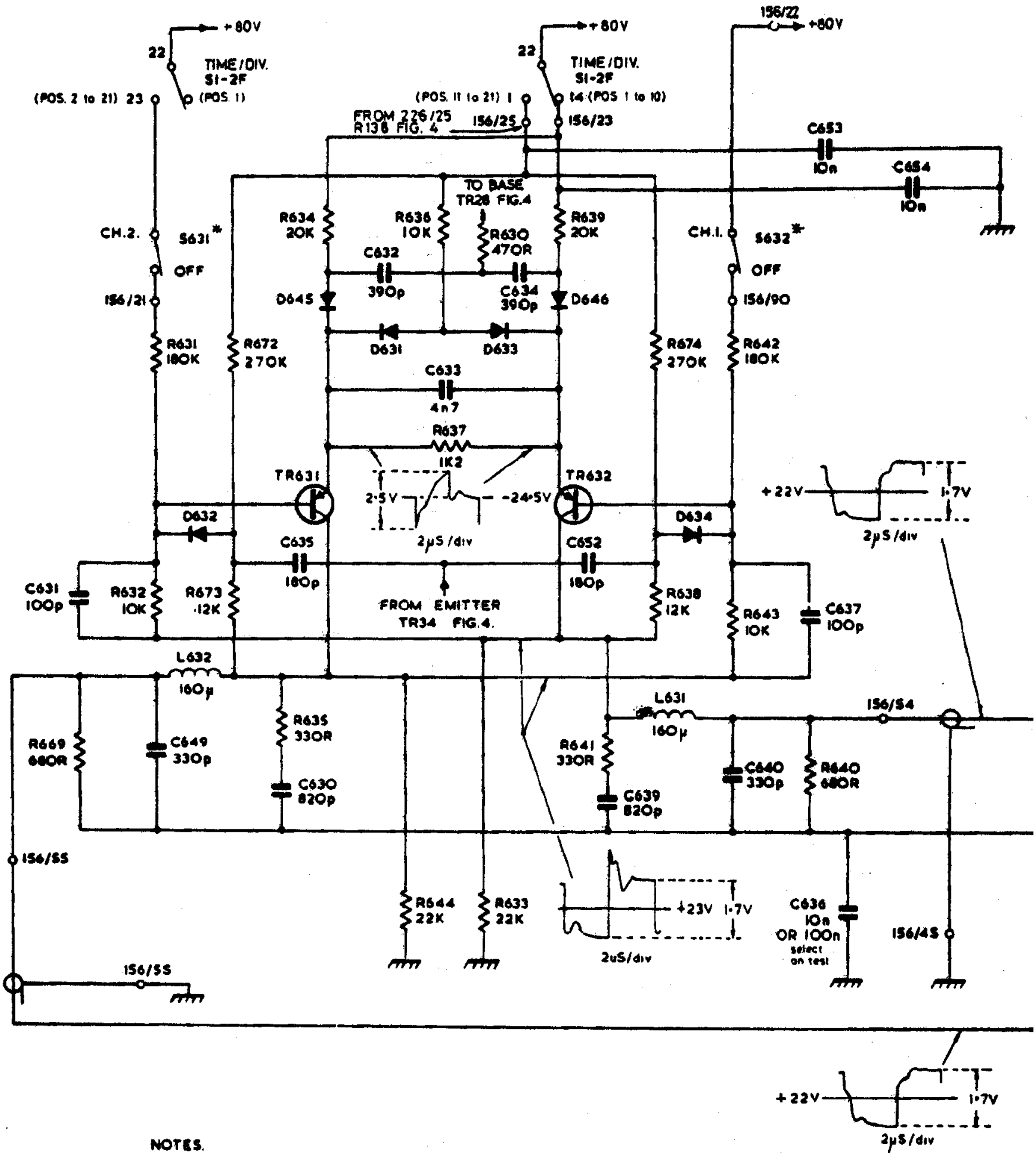
1. Set Channel 1 input switch to DC.
2. Set VOLTS/DIV switch to 0.1 V.
3. Display a 0.5 1 kHz signal from the Amplitude Calibrator and adjust R613 for exactly 5 divisions vertical deflection.
4. Remove Amplitude Calibrator signal and connect the internal calibrator signal to Channel 1.
5. Adjust the amplitude of the displayed signal to exactly 5 divisions with R405.


MECHANICAL ASSEMBLY
D61A
REAR VIEW
(PART SECTIONED)
TYPICAL SLIDER SWITCH
CRT
301
VOLTS/DIV
SWITCH
TIME/DIV
MOD
RECORD
LABEL
61 (U.K.)
62 (U.S.A.)
POWER
CABLE
52 (RH)
53 (LH)
32 RH
33 LH (Shown)
SER No
Name Plate

RESISTORS: 669, 631, 632, 672, 673, 635, 634, 644, 636, 637, 633, 630, 639, 641, 674, 638, 642, 643, 640

CAPACITORS: 631, 649, 630, 635, 632, 633, 634, 652, 639, 640, 637, 653, 636, 654

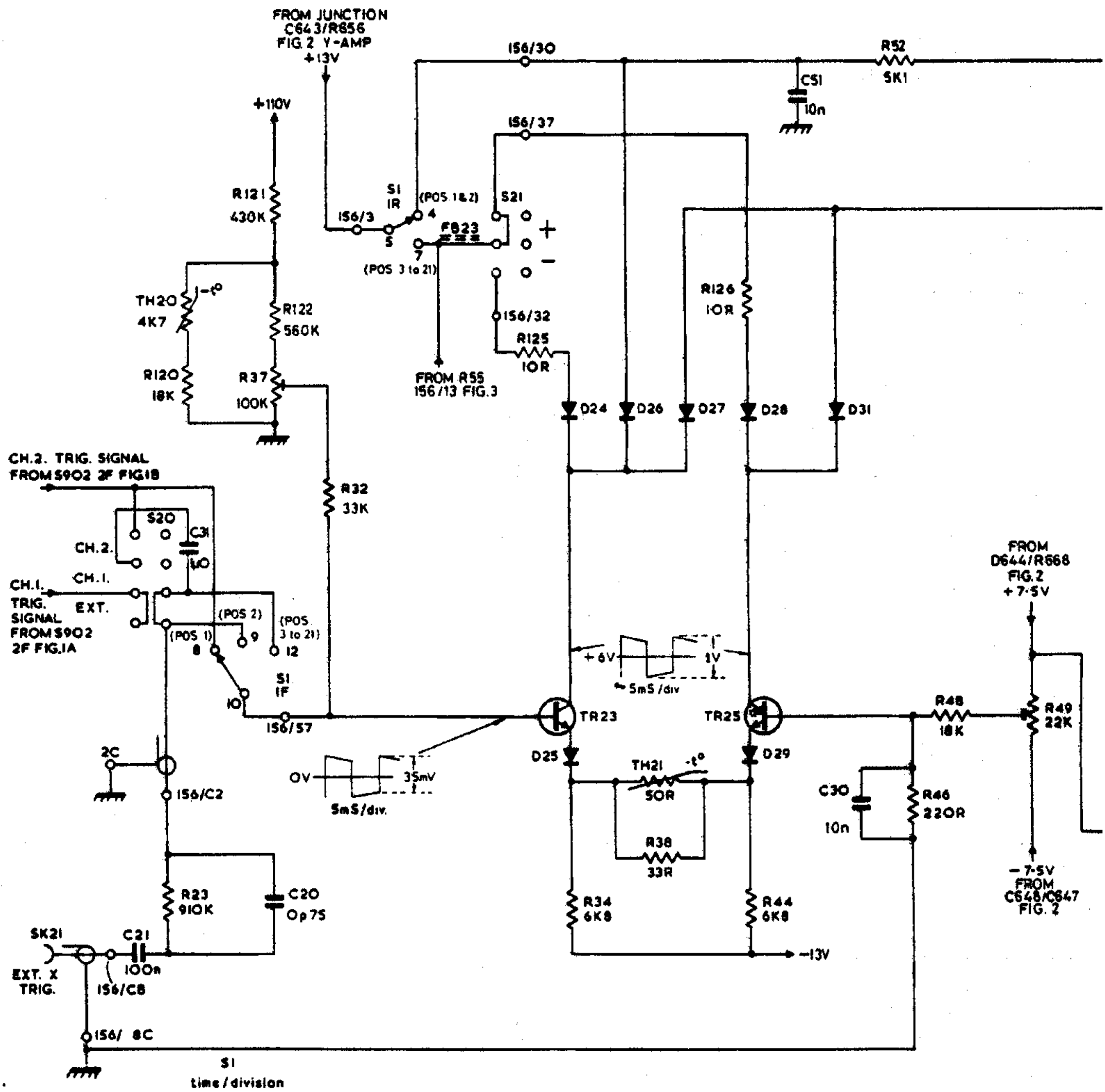
MISC.: L632, S1-2F, S631, D632, TR631, D645, D631, D633, TR632, S1-2F, D646, L631, D634, S632



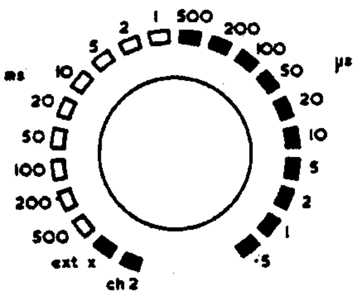
NOTES.

1. * DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.
2. 156/55 DENOTES P.C. BOARD/EYELET OR TERMINAL No. CONNECTION.
3. ALL WAVEFORMS MEASURED WITH CAL WAVEFORM FED TO BOTH CHANNELS VOLTS/DIV SET TO 0·1 TRIG SELECTOR TO CH.1 AND TIME/DIV TO 2mS.

RESISTORS	23 37 32 34 38 44 46 48 49
	120 121 122 135 126 52
CAPACITORS	20 51
	21 31 30
MISC.	TH20 FB23 TR23 D24 D25 TH21 D26 D27 TR25 D28 D29 D31
SK21	S20 S1-IF S1-IR S21



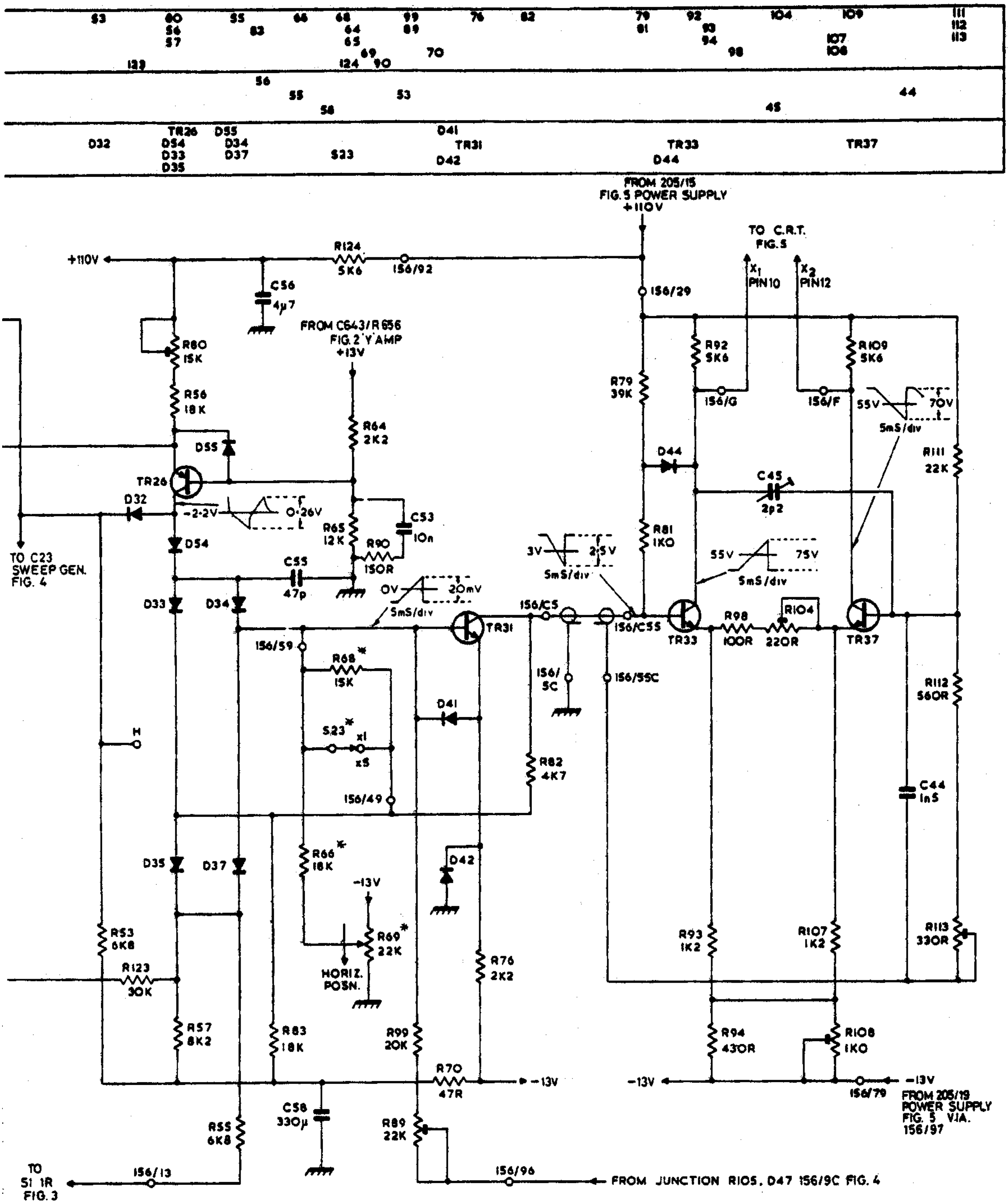
S1 time/division



FRONT PANEL MARKING

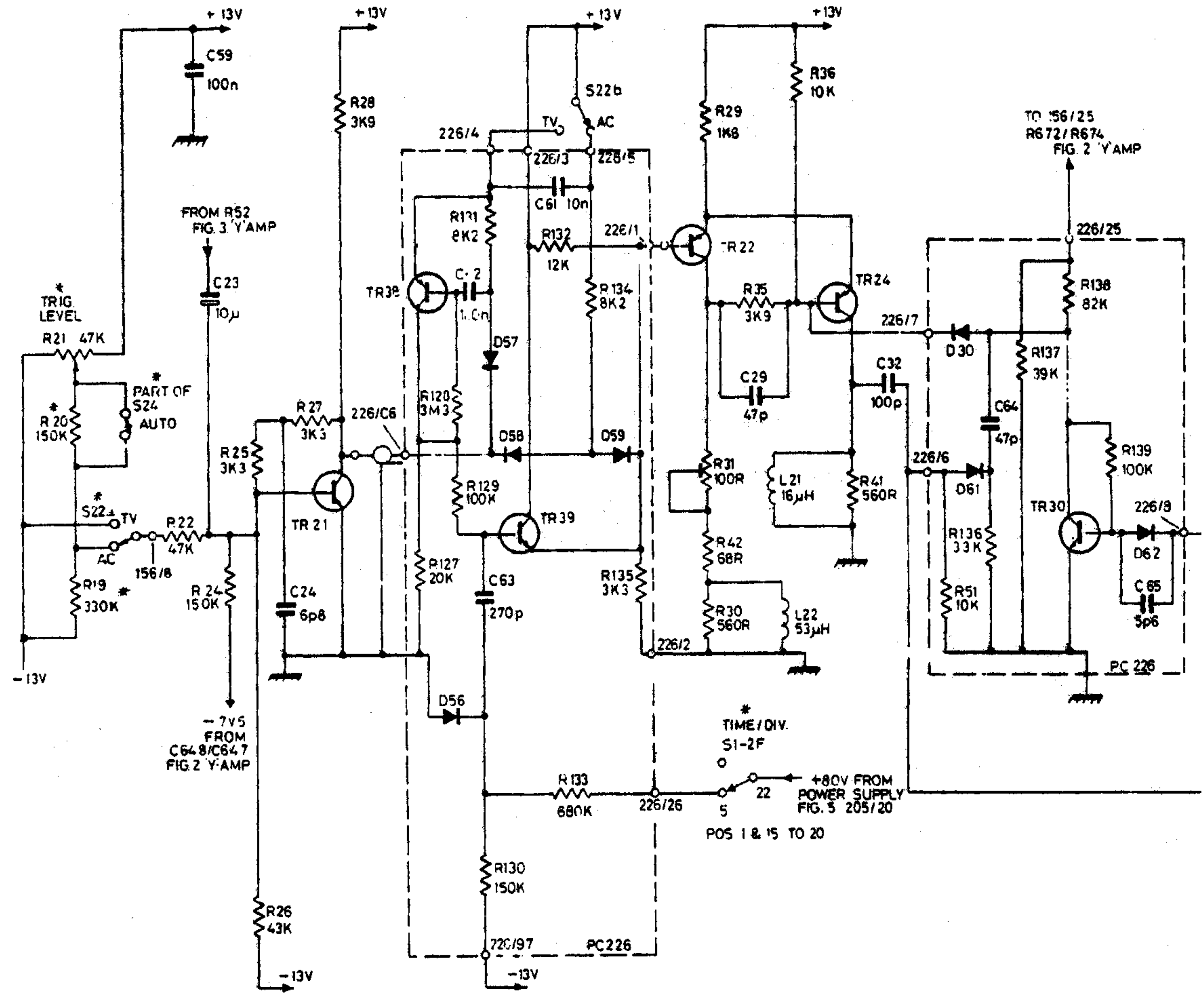
NOTES.

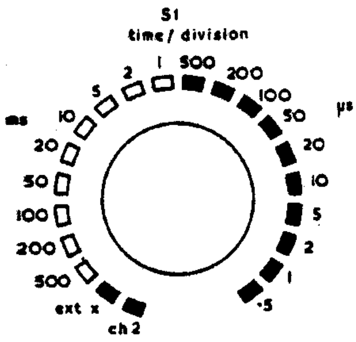
1. * DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.
2. 156/C8 DENOTES P.C. BOARD/EYELET OR TERMINAL No. CONNECTION
3. SWITCH SHOWN IN FULLY ANTI-CLOCKWISE POSITION.
4. FOR S1 SWITCH WAFERS SEE FIG.6.
5. ALL WAVEFORMS MEASURED WITH CAL WAVEFORM FED TO BOTH CHANNELS VOLTS/DIV. TO 0·1 TRIG SELECTOR TO CH.1 AND TIME/DIV TO 2mS.



TRIG INPUT & HORIZONTAL AMP D61A
FIG. 3.

RESISTORS	21 19 20	22	24	25 26	27	28	127	128 129	130 131	132 133	134	135	29 31 42 30	35	36	41	51	136	137	138	139
CAPACITORS	59 23	24	62	63	61	29	32	64	65												
MISC.	S24 S22a	TR21	TR 38 D56	D57	TR39 D58	S22b	D59	TR22	S1-2F	L21 L22	TR24	D30 D61	TR30	D62							

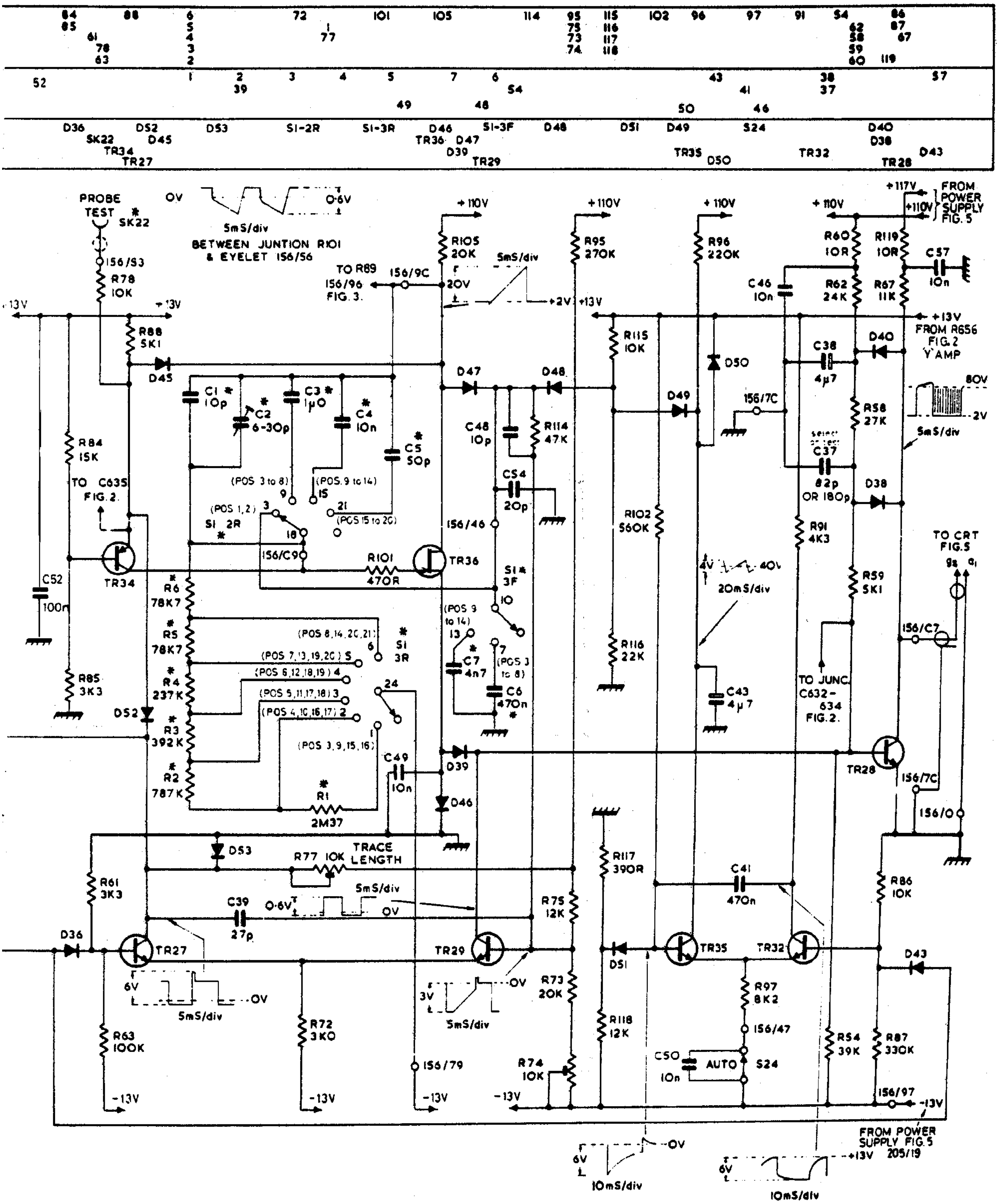




FRONT PANEL MARKING

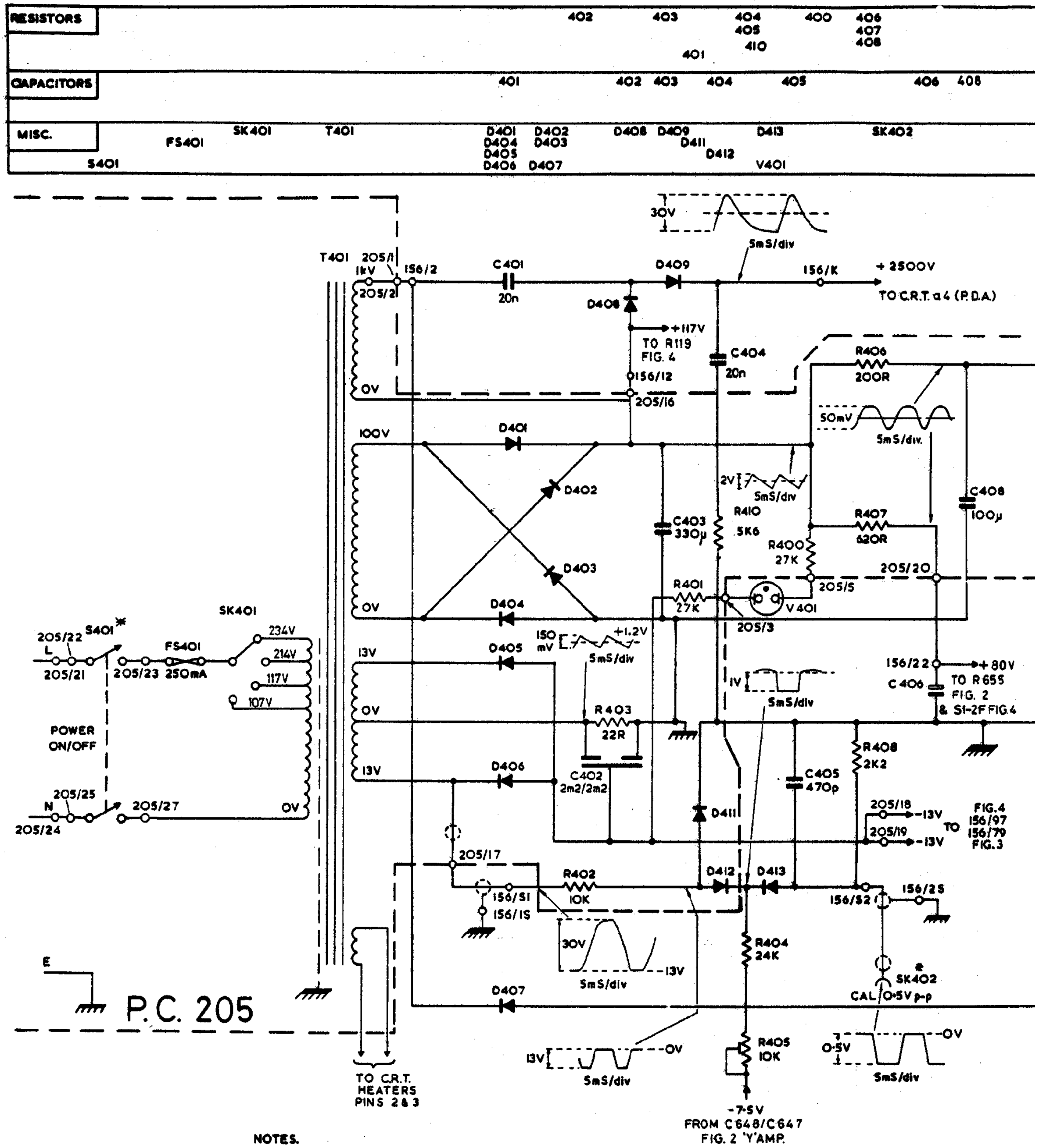
NOTES

1. * DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.
2. 156/6C DENOTES P.C. BOARD/EYELET OR TERMINAL No. CONN.
3. SWITCH SHOWN IN FULLY ANTI-CLOCKWISE POSITION.
4. FOR S1 SWITCH WAFERS SEE FIG. 6.
5. ALL WAVEFORMS MEASURED WITH CAL. WAVEFORM FED TO BOTH CHANNELS, VOLTS/DIV. SET TO 0·1, AND TRIG. SELECTOR TO CH.1. AND TIME/DIV. TO 2mS.
6. PUSH PULL SWITCH S24 IS SHOWN IN THE OUT POSITION



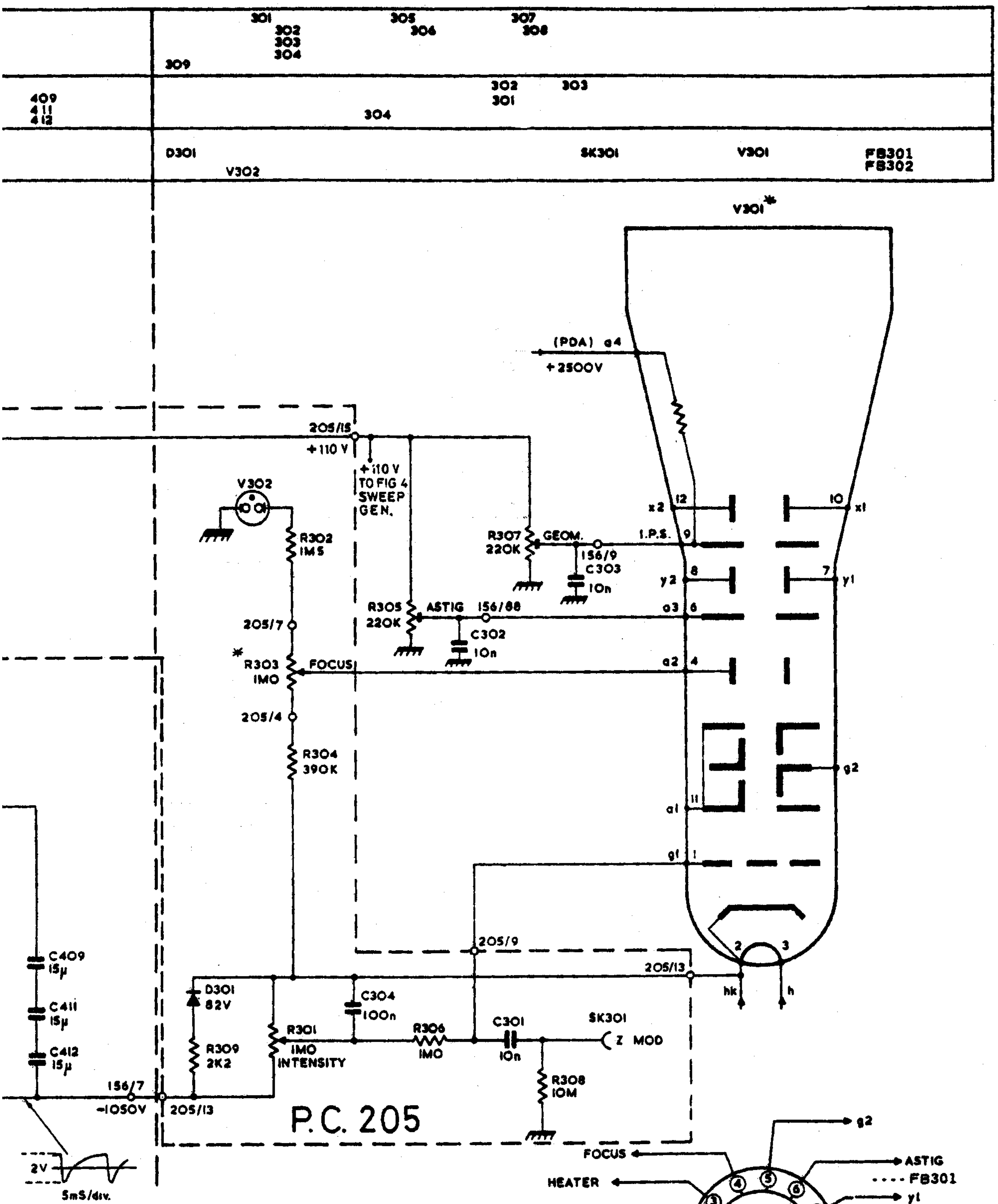
SWEEP GENERATOR D61A

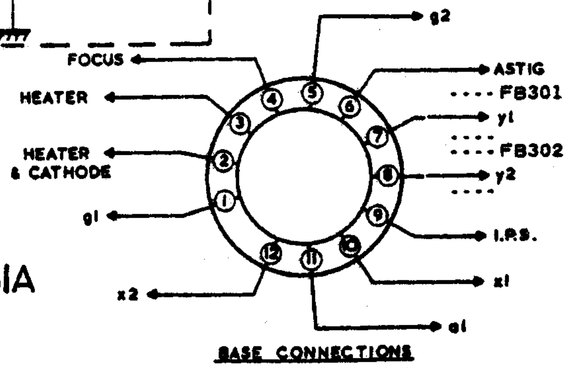
FIG. 4.



NOTES.

1. ✻ DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.
2. 156/2 DENOTES P.C. BOARD/EYELET OR TERMINAL No. CONNECTION
3. ALL WAVEFORMS MEASURED WITH CAL. WAVEFORM FED TO BOTH CHANNELS. VOLTS/DIV. SET TO 0·1, AND TRIG. SELECTOR TO CH.I. AND TIME/DIV. TO 2mS.

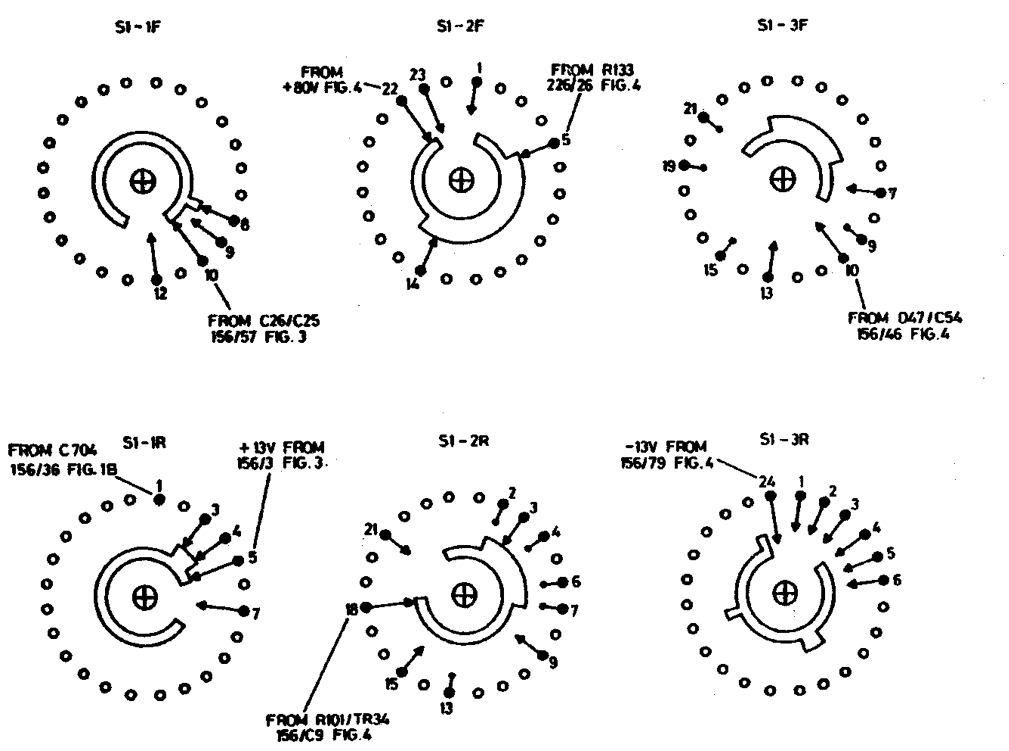




POWER SUPPLY & C.R.T. — D61A

FIG. 5

FOR RELATED CIRCUITS SEE FIG.'S 3& 4

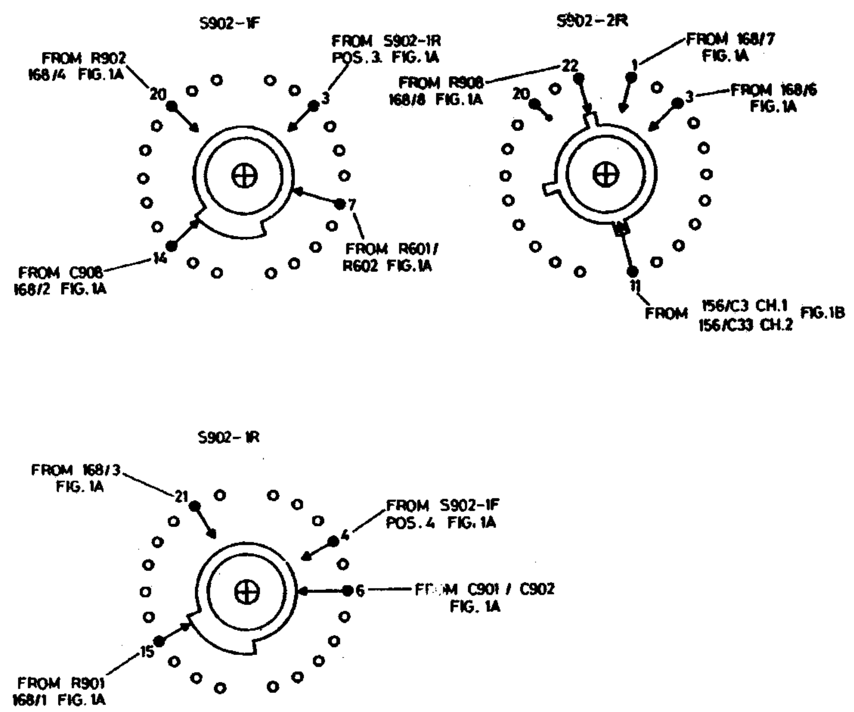


NOTES.
1. SWITCH IS SHOWN IN FULLY ANTICLOCKWISE POSITION.
2. No. OF POSITIONS 21.

TIME/DIV. SWITCH D61A

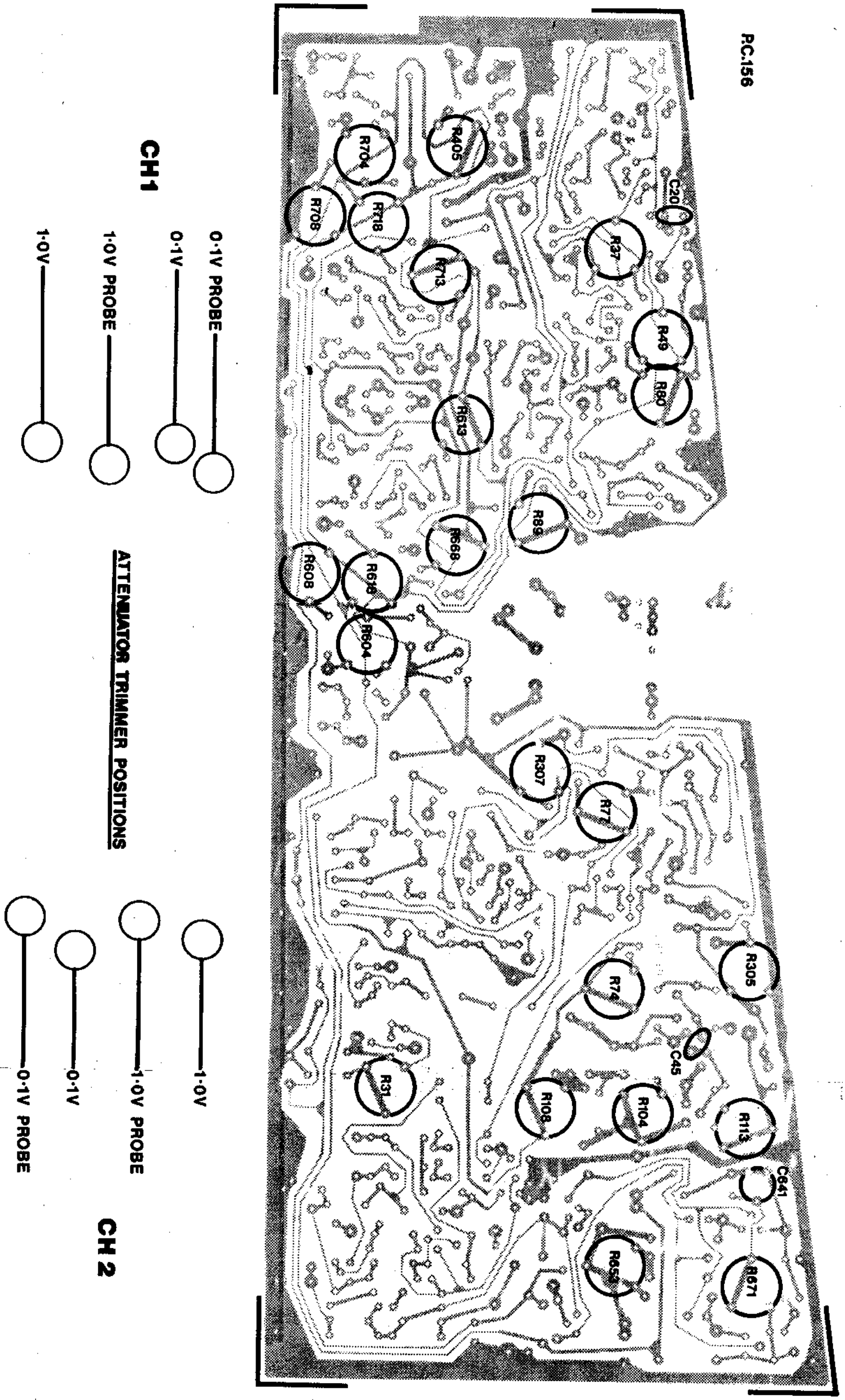
FIG.6

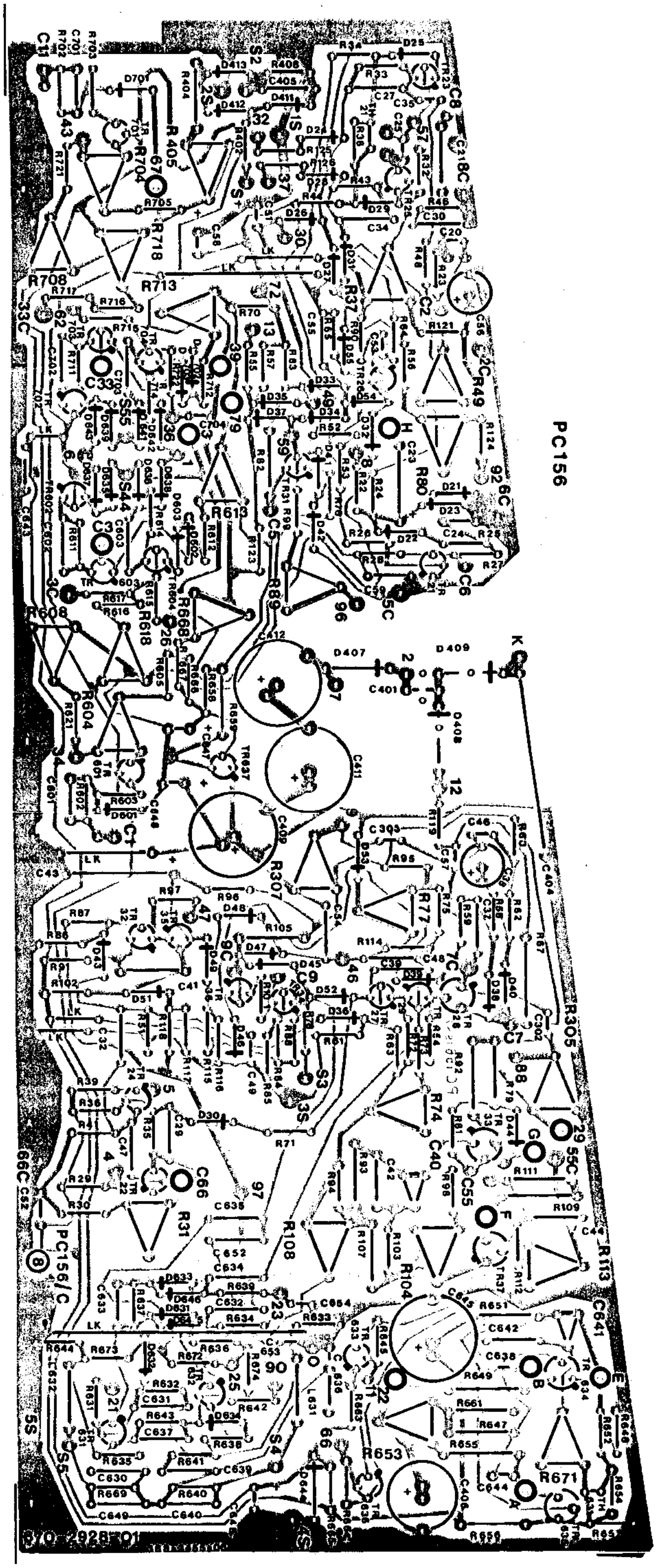
FOR RELATED CIRCUITS SEE FIG.'S 1A & 1B



NOTES.
1. SWITCH IS SHOWN IN FULLY ANTICLOCKWISE POSITION.
2. No. OF POSITIONS 9.

VOLTS/DIV. SWITCH-MK 2


P.C.156
CH1
0·1V PROBE
0·1V
1·0V PROBE
1·0V
ATTENUATOR TRIMMER POSITIONS
CH 2
1·0V
1·0V PROBE
0·1V
0·1V PROBE
R704
R405
R708
R718
R713
C20
R37
R49
R80
R613
R89
R668
R608
R618
R604
R307
R77
R305
R74
C45
R31
R108
R104
R113
C641
R653
R671



PC156

PC 226