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009266



®

## OSCILLOSCOPE

### TYPE DM63

FOR SERVICING AND SPARES ENQUIRIES  
SEE THE INFORMATION AT START OF SECTION 5.

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For Service Manuals Contact  
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# INTRODUCTION

The DM63, with two vertical plug-ins, is an all solid state direct-view storage oscilloscope with a single sweep horizontal system. An 8 x 10 divs, split beam, CRT provides a bright and clear dual beam display. The features of the vertical system depend on the type of plug-in used and are given in the appropriate manuals.

The manual covers the mainframe, which houses the following:

- Calibrator
- Storage Circuit
- Sweep Generator and Horizontal Amplifier
- Power Supplies
- Un-blanking Amplifier
- Vertical Amplifier, Output Stage

The design of this instrument is subject to continuous development and improvement, consequently this instrument may incorporate minor changes in detail from the information contained herein, which would, in the main, affect the Components List and Circuit Diagrams. The reader should pay particular attention to the notes at the beginning of Chapter 5.

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## NOTICE TO OWNER

To obviate the risk of damage during transit and facilitate packaging, the owner is requested to remove the power supply plug and NOT send the following items unless they are suspect, should this instrument be returned to TELEQUIPMENT for servicing:—

- Manual
- Probes
- Power Supply Lead
- Plug Assemblies



# CHAPTER 1

## SPECIFICATIONS

### 1.0 VERTICAL AMPLIFIER

X - Y Mode  
 Operation  
 'Y'  
 'X'  
 Phase response

provided by two of the following:-  
 V1 Single trace  
 V3 High gain differential  
 V4 Dual trace  
 V5 Single trace with signal delay

Reference should be made to the appropriate manual for details.

Two identical plug-ins  
 L.H. plug-in  
 R.H. plug-in  
 $< 1^\circ$  up to 100 kHz

### 2.0 HORIZONTAL AMPLIFIER

#### 2.1 SWEEP OPERATING MODE

Repetitive  
 Single shot

#### 2.2 TRIGGER

Mode  
 Auto  
 DC  
 AC  
 Sensitivity  
 Internal

Bright line 10 Hz - 15 MHz  
 DC - 15 MHz  
 10 Hz - 15 MHz

External

$< 0.3$  division at 1 MHz  
 $< 0.7$  division at 15 MHz

Polarity

+  
 -

From positive signal edge } By Rotation of  
 From negative signal edge } LEVEL CONTROL

Source

Internal  
 L.H. Vert  
 R.H. Vert

From L.H. Amplifier  
 From R.H. Amplifier

External

From external source, DC or AC coupled

Line

From supply frequency

#### 2.3 SWEEP

Range  
 X1  
 X5  
 Variable (time) range

1s - 200 ns/div  
 0.2 s - 40 ns/div max.  
 $> 2.5$  to 1

Accuracy

X1  
 X5

$\pm 3\%$   
 $\pm 5\%$

#### 2.4 EXT X input

Sensitivity  
 X1  
 X5  
 Bandwidth

1 V/div  $\pm 25\%$   
 0.2 V/div  $\pm 25\%$   
 $> 1$  MHz, a.c. or d.c. coupled depending on trigger mode selection

### 3.0 CATHODE RAY TUBE (CRT)

Display area  
Phosphor standard  
Overall accelerating potential

Split beam storage CRT with internal graticule  
8 x 10 div (each div 0.9 cm approx)  
P31  
8 kV approx.

#### Operating modes

Stored condition  
Variable persistence  
Max. enhancement

Min. writing speed	Approx. storage time	
	Store	Hold
0.05 div/ $\mu$ s	4 minutes 0.2s to 1 minute coverage	50 minutes
1.0 div/ $\mu$ s	0.5 minute	5 minutes

### 4.0 FRONT PANEL OUTPUTS

#### 4.1 CALIBRATOR

Amplitude Pk to Pk

30 mV, 300 mV or  
3 mA at 1 kHz when shorted together

Accuracy

Voltage  
Frequency  
Current

$\pm 1\%$   
 $\pm 20\%$   
 $\pm 1\%$

#### 4.2 GATE OUT

Impedance

Positive pulse at sweep width  
3 k $\Omega$  approx.

#### 4.3 SWEEP OUT

Amplitude  
Impedance

10 V  
5 k $\Omega$  approx.

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#### 5.0 Z MOD

Full blanking sensitivity  
Input impedance  
Frequency

+ 20 V approx.  
10 k $\Omega$  and 20 pF approx.  
DC - 3 MHz approx.

### 6.0 GENERAL

#### 6.1 POWER REQUIREMENTS

Voltage  
Frequency  
Consumption

100 - 125 V in 5 V steps  
200 - 250 V in 10 V steps  
48 - 400 Hz  
80VA to 95VA depending on the vertical plug-in configurations

#### 6.2 SIZE

Height  
Width  
Depth

290 mm  
215 mm  
520 mm

#### 6.3 WEIGHT

Complete  
Less plug-ins

14 kg  
12.25 kg

#### 6.4 COOLING

Convection

#### 6.5 TEMPERATURE LIMITS, ambient

Operating  
Non-operating

+ 5 to 40°C approx.  
-25 to 70°C approx.

# CHAPTER 2

## OPERATING INSTRUCTIONS

### 2.1 FUNCTION OF CONTROLS AND CONNECTORS

These are situated on the front panel except where otherwise specified. For those controls not covered below, reference should be made to Chapter 2 of the manual for "V" plug-in.

#### 2.1.1 CRT

- POWER**
- PULL ON** power supply ON-OFF switch.
- INTENSITY** varies the intensity of the display.
- ASTIG** a preset used in conjunction with FOCUS for achieving the best overall definition.
- FOCUS** controls the definition of the display.
- TRACE LOCATE** when pressed brings the trace onto the screen and free runs the timebase.
- NON STORE** permits conventional operation of the CRT. In this mode, the only CRT controls affecting display are INTENSITY, ASTIG and FOCUS.
- STORE** when pushed in, the written trace can be stored, all controls being operative.
- VIEW** in conjunction with STORE mode, provides storage time up to 5 minutes.
- HOLD** the storage time is increased and the information is retained at reduced intensity. All controls in this setting are inoperative unless switched to NON STORE.
- PERSIST** in association with the VARIABLE alters the persistence of the CRT. In this setting, all CRT controls function but INTENSITY must be adjusted for the best display.
- ENHANCE** when pushed in, and with the clockwise rotation of the VARIABLE, the writing capability of the CRT is improved but the time for which the trace could be stored in the STORE and HOLD modes is reduced.
- ERASE** when depressed, clears the stored trace. This control is inoperative in the HOLD mode.
- SET POS** while depressed, enables the trace start point to be set using POSITION control so that more than one trace can be stored without overlapping.
- TRACE ROTATION** preset situated on the rear panel; used to align the trace in the horizontal axis.

#### 2.1.2 SWEEP

- TIME/DIV** controls the speed of the sweep. The sweep rates indicated are only valid if VARIABLE is fully clockwise and X5 is not selected. If X5 is selected and VARIABLE at CAL, the calibrations should be divided by 5 to ascertain the sweep speed.
- VARIABLE** provides continuous coverage of sweep speeds in between those selected by TIME/DIV switch.
- POSITION** varies the position of the trace in the horizontal axis.
- FINE** is a fine horizontal position control.

- X5** when pulled magnifies trace 5 times in the horizontal axis; sweep calibrations must be divided by 5.
- REP SINGLE** pressed, selects repetitive triggering. assists in viewing or photographing a non-recurrent signal. Upon application of a trigger pulse a single sweep only takes place. Sweep circuit is then disabled until the RESET button is pressed.
- X - Y** connects R.H. VERT to 'X' and L.H. VERT to 'Y'.

#### 2.1.3 TRIGGER

- TRIG LEVEL** selects the point on the waveform at which the sweep starts.
- TRIG MODE AUTO** provides a horizontal trace in the absence of signal by permitting the timebase to free run until signal is applied. LEVEL range is reduced to approximately 1 division.
- AC or DC** relates to the coupling of the trigger circuit. For very low input frequency signals, DC should be selected.
- POLARITY ±** selects triggering from the positive or negative-going slope of a waveform.
- L.H. VERT )**  
**R.H. VERT )** selects the respective vertical trigger signal.
- LINE** provides trigger signal at the power supply frequency.
- EXT** enables the sweep to be triggered from an external source.

#### 2.1.4 VERTICAL

refer to respective 'V' Manuals.

#### 2.1.5 CONNECTORS

- INPUT**
- EXT TRIG**
- EXT X** share a common input BNC socket located on the front panel. Signals are then applied to the required circuit by selection of either the EXT TRIG button or EXT X on T/B switch.
- Z MOD** input socket situated on the rear panel is DC coupled via Z mod amp. to the CRT grid. A negative-going signal is necessary to intensify the trace while a positive-going signal will blank it.

#### OUTPUTS

CAL

output sockets provide a 1 kHz waveform for checking the calibrations of the vertical channels and setting up probes. The two outputs provide 300 mV and 30 mV 1 kHz (approx.) squarewave, when linked a 3 mA peak to peak current passes.

#### SAWTOOTH



provides a positive-going ramp waveform when the sweep is running. A recurring sawtooth is produced when AUTO is selected. The resistance of an applied load should exceed 10 kΩ.

#### GATE OUT



provides a fast-edged positive-going rectangular pulse lasting for the duration of the sweep. The resistance of an applied load should exceed 4.7 kΩ.

## 2.2 FIRST TIME OPERATION

### 2.2.1 CHECKS

- 1 Correct plug-ins are plugged in.
- 2 Rear voltage-selector plug is indicating the local supply voltage or nearest value.
- 3 Fuse fitted is a 2 A for 100–125 V operation or 1A for 220–250 V.

NOTE: The 3-core supply lead is colour coded as follows:

Line	Neutral	Earth (Chassis)
or Brown Black	Blue White	Green/Yellow Green

- 4 The power supply cord is secured to the instrument with the nuts and screws provided.

### 2.2.2 OPERATION


Set controls as follows:

#### 1 CRT

INTENSITY	Central
FOCUS	Central
ASTIG	As set
Mode	NON STORE
VIEW-HOLD	VIEW
PERSIST-ENHANCE	PERSIST
VARIABLE	OFF

#### TIME BASE

POSITION	Central and depressed
SWEEP	REP
TIME/DIV	5 ms
VARIABLE	Fully clockwise

TRIG MODE	AUTO
POLARITY	Rotate to + 
SOURCE	INT
VERTICAL	As given in appropriate 'V' manuals.

- 2 Plug into the supply; pull POWER ON.
- 3 Allow a few minutes for warm up then press TRACE LOCATE and adjust POSITION controls for a display.
- 4 Adjust TRACE ROTATION, if necessary, to align trace horizontally.
- 5 Connect the CAL 30 mV to one INPUT via co-axial lead.
- 6 Set DC-GND-AC to DC; adjust INTENSITY and FOCUS as required.
- 7 Check amplitude is 6 divisions.

### 2.2.3 STORAGE OPERATION

- 1 Repeat 1 through 7 Para. 2.2.2.
- 2 Release VIEW-HOLD and PERSIST-ENHANCE buttons to select VIEW and PERSIST. Select SINGLE sweep and STORE mode. Depress ERASE and then RESET button and check that the trace is stored.  
NOTE: Adjust INTENSITY if required.
- 3 Depress VIEW-HOLD button to select HOLD and notice the change in degree of brightness.
- 4 Select VIEW and set TIME/DIV to 5  $\mu$ s. Depress ERASE button. Turn INTENSITY fully clockwise. Select ENHANCE, depress RESET and turn VARIABLE clockwise till the trace is visible. Depress ERASE and check that the trace can be restored with the RESET button.
- 5 Disconnect CAL input. Set VOLTS/DIV to 5 mV and TIME/DIV to 0.1 s. Display sinewave of amplitude 20 mV and Frequency 20 Hz. Select PERSIST and turn VARIABLE to select the required level of persistence.

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# CHAPTER 3

## CIRCUIT DESCRIPTION

### 3.1 VERTICAL AMPLIFIER

- 3.1.1 As both channels of the main amplifier are similar in design, only the left hand (LH) channel will be described in detail, the differences in the right hand (RH) channel will be described separately.
- 3.1.2 The interface, reference Figure 1, with the vertical plug-ins is via two 16 way sockets mounted on the mother board PC175. The sockets are designated SK802 (LH) channel and SK803 (RH) channel. The signal is carried via pins 5 and 13 to the shunt feedback amplifier TR801, TR802. To ensure that the main amplifier always has the same sensitivity, the gain is set by the series elements, R809, R812 and the shunt elements R805, R806. The total gain adjustment is approximately 18%.
- 3.1.3 The output of the shunt feedback amplifier drives directly into the output stage amplifier TR812, TR813. The collectors are connected to the CRT 'Y' plates. Adjustment of R869 sets the mean plate potential to 50 V. Emitter resistors, R845, R846, are normally earthed in the timebase via SK804/13. H.F. peaking is achieved by the network between the emitters formed by R849, C812.
- 3.1.4 TR805, TR806 are driven from the output of the shunt feedback stage and form the trigger amplifier. The output from TR805 collector is controlled via the switching diode D805, by the potential existing on SK802 pin 6. D803 is the path by which the trigger signal is fed to the timebase via SK804 pin 11. A second source of trigger signal is also applied to SK804 pin 11, and is derived from SK802 pin 7. If a V1 plug-in is plugged into SK802 the only trigger source available is from TR805, therefore a +24 V control voltage is applied to SK802/6 reverse biasing D805, the signal is therefore allowed to pass via D803 to the timebase socket SK804/11. If, however, the V1 plug-in is exchanged for a V5 plug-in, (this plug-in contains the delay cable), a pre-delay line trigger signal is required via SK802 pin 7. Therefore in this case SK802 pin 6 is connected to potential of -24 V, thereby forward biasing D805 and reverse biasing D803, thus switching off the source of trigger signal from TR805 collector.
- 3.1.5 SK804/13 and SK804/14 are joined together inside the timebase, via switch S4a/5, S4a/4 (X-Y switch) and then to earth via S3 (TRACE LOCATE). When the TRACE LOCATE button is pressed, the total current of both output stages is limited by R843 thus restricting the available collector swing of both output stages to within the confines of the tube, regardless of the POSITION. The POSITION control may then be set to centre the trace.
- 3.1.6 When the DM63 is switched to X - Y mode, the LH vertical plug-in is used in the 'Y' axis but the RH plug-in is now used to drive the 'X' axis. However, as the DM63 uses a split beam tube it becomes necessary to shift the RH channel beam off the screen. This is achieved in the following manner. When the X - Y switch S4 is pressed, the emitter resistors R847, R848 become disconnected from earth via SK804/14, hence the collectors of TR814 and TR815 rise to HT. However at the same time, S4 switches SK804/12 to earth, D811 (normally reverse biased by R868) becomes forward biased and the collector voltage of TR815 is lowered due to the potential divider formed by R865, collector load, and R861. Sufficient voltage differential now exists between the 'Y' plates to position the trace off the screen.
- 3.1.7 Whilst in X - Y mode, the timebase uses the RH trigger signal to drive the 'X' axis. As already explained, it is possible to obtain a trigger signal from two sources, i.e. direct from SK803/7

or from the collector of TR807 via D804, depending upon the type of 'V' plug-in used. Therefore to ensure the same amplitude of signal regardless of 'V' plug-in used, it is very desirable to use one trigger source only i.e. that from TR807. This is achieved in the following manner. The trigger source from TR807 is connected permanently to SK804/10. SK803/7 is connected to SK804/10 via diode D809. SK803/6, the trigger amplifier controlling voltage, is connected to diode D808. TR809 and TR811 form a bistable circuit. Now consider a V1 plug-in plugged into the RH channel, and the oscilloscope working normally, SK803/6 is at +24 V, therefore diode D808 is conducting, and TR811 is 'on' its collector is therefore at approximately -24 V, diode D807 is therefore conducting, D809 being reverse biased. No signal is therefore able to pass D809 to SK804/10. However TR809 is 'off', its collector being at approximately +24 V reverse biases D806, allowing D804 to pass the signal onto SK804/10. Now switching to X - Y mode, the junction of R847 and R848 rises in potential to approximately +17 V and thereby aiding TR811 to stay 'on'. The signal source remains as before i.e. via D804. However, consider a V5 plug-in in the RH channel and working normally. SK803/6 is now at -24 V, reverse biasing diode D808. SK804/14 is at earth therefore TR811 is 'off' its collector being at approx. +24 V reverse biasing D807. However, TR809 is now 'on' its collector being at approx. -24 V forward biasing D806 and switching off this signal source. But SK803/7 can now feed its signal via D809 to SK804/10. Now switching to X - Y, R847 R848 junction rises to +17 V and this is sufficient to turn TR811 'on' and once again D807 is forward biased, shunting the signal from SK803/7 to -24 V and also TR809 is once again 'off', reverse biasing D806 and permitting the signal to pass on to SK804/10 via D804. So, whichever amplifier is in situ, when X - Y is pressed the signal source is via TR807.

- 3.1.8 The RH channel trigger amplifier contains in its emitter circuit a DC TRIG BAL potentiometer. It is used to ensure that the start of a dc triggered trace is the same for RH channel as for LH channel.

### 3.2 TRIGGER AMPLIFIER

#### 3.2.1 INTERNAL TRIGGER

Part of the signal to be displayed is "picked-off" from the appropriate vertical amplifier and fed via the 16 way socket, SK804, to diode D11 or D12, reference Figure 2. Selecting S4a or S4b causes the correct diode to conduct and passes the trigger signal on to the trigger pre-amplifier stage TR2. Switches S1b and S1c select DC and AC TRIG, respectively, while S4c allows triggering at supply frequency. Level and polarity controls are achieved with a centre-tapped dual ganged potentiometer, R38 and R61. Operating the pot between its fully anti-clockwise end and the centre tap selects the positive slope region of the displayed waveform while the range between the centre tap and the clockwise end selects the negative slope. The AUTO mode is selected with S1a, part of whose action is to reduce the triggerable range of the display to within 1 division on the screen.

The output of the trigger pre-amplifier TR2 is DC coupled via current limiting circuitry and a frequency compensation network, which improves the H.F. response at 5 MHz, to provide an analogue signal at pin 4 of I.C.1 the Sweep Control I.C. TR7 functions as a slope selector switch converting the positive or negative voltage at the wiper of R61 into corresponding logic levels for application to pin 5 of I.C.1.

### 3.2.2 EXTERNAL TRIGGER

The signal from an external triggering source is connected to the BNC socket on the timebase unit front panel. This is then coupled via emitter follower, TR1, to the base of TR2 through diodes D3, D7, which are turned on when S4d is selected.

When DC Trig Mode switch is selected the trigger signal is DC coupled all the way to the base of TR2 as both C1 and C11 are by-passed.

The circuit has an input impedance of approximately 100 k and is protected from voltage overloads by C2, R4.

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### 3.3 SWEEP GENERATOR

3.3.1 The sweep generator, reference Figure 2, is basically a very high gain Miller integrator and a voltage comparator contained within a 10 pin integrated circuit in a T05 package, I.C.2. Interlinked with this unit is the "control" integrated circuit, I.C.1, in a 16 pin D.I.L. package.

The "control" I.C. is driven with positive logic, the convention used being, positive = logic '1', ground = logic '0'.

The operation of the two interlinked integrated circuits is best understood by referring to Tables 1, 2 and 3.

3.3.2 The 10 V sawtooth output produced at pin 8 of I.C.2 is converted into a current via R74 and fed to the base of TR101 in the X amplifier. Trimmer C22 in parallel with R74 is a sweep linearity control, while trimmer C19 is an adjustment for setting the timing on the fastest settings of the Time/Div switch. A measure of variable Hold-off is incorporated, when the trig level control is operated, by feeding back a portion of the volts via R37 to pin 11 of I.C.1 TR4 supplies a regulated +5 V to supply I.C.1.

### 3.4 HORIZONTAL AMPLIFIER

The input to the horizontal amplifier, reference Figure 4 is at the base of TR101 where the sweep is mixed with fine and coarse shift levels. The junction of R12/C5 and C7/R25, where the signal currents from External X and X - Y respectively are taken, is also connected to the base of TR101. The differential output from the collectors of TR102, TR103, drives the 'X' plates of the C.R.T. The amplifier incorporates a catching network D101/R104, to prevent TR102 from saturating. The X5 gain switch is incorporated in the emitters of the output pair.

R110, across the collectors of TR102 and TR103 is fitted for the DM63, storage version. This effectively reduces the gain of the stage by approximately 10% as the storage C.R.T. is that much more sensitive.

### 3.5 EXTERNAL X

When switched to this mode, (with the Time/Div switch) all functions of the timebase unit are overridden except the X - Y facility and Trace Locate button. The external driving voltage is applied to the BNC socket on the T.B. unit front panel and after passing through emitter follower TR1 passes to the horizontal amplifier via D1 and D4 reference Figure 2.

'Bright-up' is achieved by holding pin 15 of I.C.1 at about + 0.8V when R14 is connected to the -24 V line. At the same time pin 10 of I.C.1 rises to logic '1' to "lockout" the sweep.

### 3.6 X-Y MODE

In this mode all functions of the timebase unit are overridden except Trace Locate. Its function is such that a calibrated 'Y' co-ordinate (in the vertical direction) is available using the LH channel of the oscilloscope and also a calibrated 'X' co-ordinate (in the horizontal direction) via the RH channel. The 'Y' signal passes through the LH plug-in via the vertical amplifier on the mother board to the 'Y' plates of the CRT. The 'X' signal passes through the RH plug-in via SK804 on the mother board to D12 in the timebase unit. When S4e is selected, D12 conducts and the 'X' signal is passed to the base of TR101 in the horizontal amplifier via R29/R25/C7. S4e also disables the coarse shift control and unbalances the RH channel output amplifier. Bright-up is accomplished by taking pin 15 of I.C.1 to logic '1' when R6 is connected to the -24 V line. Pin 10 of I.C.1 also rises to logic '1' and the sweep is locked out.

### 3.7 TRACE LOCATE

When S3 is depressed and held, the currents of the horizontal amplifier and both vertical output amplifiers are reduced by about 50% restricting the display to within the screen area of the CRT. Also pin 2 of I.C.1 rises to logic '1' enabling the timebase to "free run". Trace Locate functions for all modes of operation of the oscilloscope.

### 3.8 CALIBRATOR

This (reference Figure 4) is a simple multivibrator running at about 1 kHz. Accuracy depends on resistors R124, R125, R128 and the -24 V line. Potentiometer R127 takes up the tolerance of R128. When SK101 and SK102 are shorted, 3 mA passes through the short circuit.

### 3.9 STORAGE CIRCUIT - Fig.7

3.9.1 The storage circuit is mounted on a printed circuit board, PC176, and situated underneath the CRT. All connections to it are achieved via a connector situated at the rear of PC176.

#### 3.9.2 PRINCIPLES OF STORAGE OPERATION

The essential components of a typical storage tube are shown in Plate 1. The writing beam is the same as the electron beam of a conventional cathode ray tube, but in addition to exciting the screen phosphor directly, it deposits a charge pattern on the storage surface. Low velocity flood beam electrons continuously approach the entire surface area of the storage mesh but are transmitted only where a charge has been deposited by the writing beam. Flood electrons which are transmitted are then accelerated by the screen voltage, and produce a visible, continuous image corresponding to the trace of the writing beam.

#### 3.9.3 THE STORAGE MESH

The storage tube relies for its operation on the characteristics of the storage mesh, particularly the high leakage resistance and secondary emission characteristics of the storage surface. The backing electrode is a fine metal mesh. On one side of this mesh, facing the electron guns, is a thin layer of a high quality dielectric material. The resistivity of this dielectric is very high, so that adjacent positive and negative charges on the storage surface are effectively isolated.

The storage mesh behaves as a control grid to the flood beam. The maximum brightness of any area on the screen depends on the screen and flood gun voltages but intermediate brightness values result from modulation of the flood beam by local storage

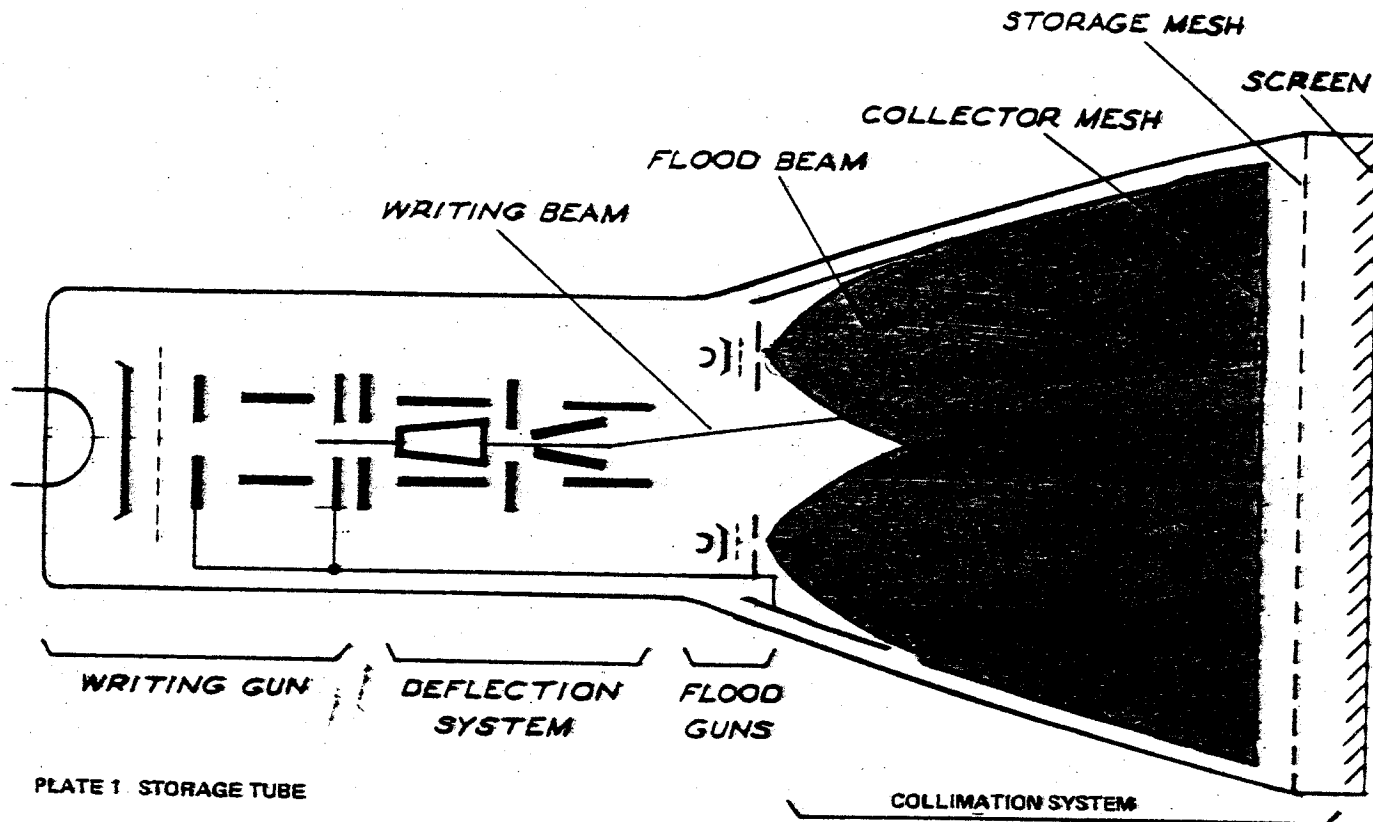


PLATE 1 STORAGE TUBE

surface potentials. Electrons which land with energies between the first and second cross-over potentials as shown in Plate 2 result in the emission of secondary electrons in greater numbers than those arriving. The secondary electrons are attracted to the

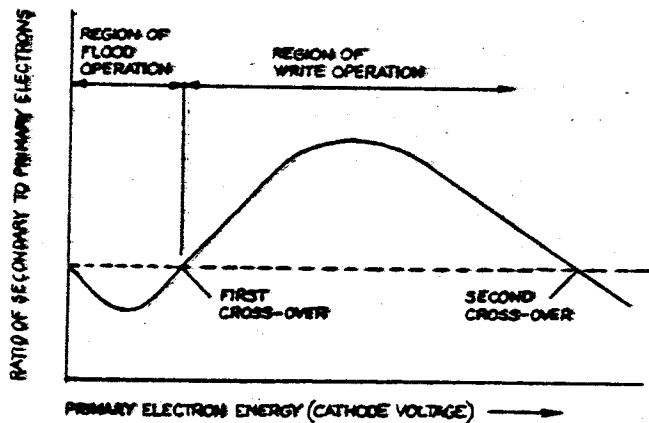


PLATE 2 SECONDARY EMISSION CHARACTERISTIC

collector mesh, leaving a net positive charge on the storage surface. Electrons landing with energies below the first cross-over potential (i.e. the flood beam) generate less secondary electrons and produce a net negative charge.

During operation, the potential on any part of the storage surface is determined by the following four factors.

a) Flood beam charging

An area which becomes positive with respect to the flood gun cathode will attract flood beam electrons; provided the initial positive voltage is below the first cross-over potential the flood beam will charge it negatively, back to zero (cathode potential).

b) Writing beam operation

The cathode of the writing gun is typically 1350 V negative, so that an area scanned by the writing beam is bombarded by

electrons with an energy above the first cross-over potential and driven positive. The amount of positive charge deposited depends on the current density of the writing beam and the speed with which it scans the storage surface (writing speed). The charge increments from successive low-current scans of the same point are integrated until the surface potential is limited by flood beam charging.

c) Backing electrode voltage

The storage surface, dielectric layer and backing electrode form a capacitance, so that changes in the backing electrode voltage are capacitively coupled to the whole of the storage surface. The steady-state operating voltage of the backing electrode is typically 0.5 to 3 V.

d) Positive ion charging

Since the storage mesh is negative with respect to its surroundings, it will attract positive ions produced by collision of electrons with residual gas molecules within the tube. Only those ions produced between the collector mesh and the screen can reach the storage surface, the collector mesh repelling ions formed in the gun end of the tube.

This positive ion current is present whenever the electron beams are operating and tends to drive the whole storage surface slowly positive.

When studying the action of the storage mesh, it is important to remember that the ion and electron currents described above are not landing on a conducting electrode, as in most types of electron tube, but on an insulator surface where the local potential depends on the relative magnitudes and energies of the currents landing. The backing electrode, in addition to providing structural support for the dielectric layer, is used to shift the range of storage surface potential by capacitive coupling.

3.9.4 BACKING ELECTRODE DC

*via PC175/66*

For non store operation, the backing electrode (BE) of the CRT is held at -50 V. This is achieved via CON13 and S1004. For store operation BE potential is retained between 0 and approximately 4 volts, TR1012 and TR1014 form a summing amplifier, and TR1014 collector voltage is adjusted to the required d.c. potential by setting, SET BE-DC, R1019.

### 3.9.5 ERASE SEQUENCE

To erase the stored information from the CRT a pulse of shape and duration shown in Fig. 8—F is required at the BE. This erase pulse is made up from the following time periods.

- a) For a period of approximately 100 ms the potential of the backing electrode is raised from its initial value to 105 volts.  
then
- b) For a period of approximately 200 ms the backing electrode is returned to its original value.  
then
- c) For a period of approximately 300 ms the backing electrode is raised from its initial value to a maximum of 12 volts.

Condition (a) is provided by the 100 ms monostable TR1001 and TR1002, whose time constant is controlled by C1003 and R1003. TR1001 is normally on and TR1002 is off. At initiation of the erase sequence S1001 is pressed, this allows C1001 to charge up. Release of S1001 shorts C1001 and provides a -ve going pulse at TR1001 base. Usual monostable action takes place and provides the pulse shown in Fig. 8—A, at the collector of TR1002. This pulse is fed to the summing amplifier, TR1012, TR1014, whose gain is determined by the feedback resistor R1038 and the series summing resistor, in this case being R1025. Hence the input (-24 V) to the summing amplifier is amplified by a factor of 5.5 giving approximately 138 V inverted output. As the HT line is only +105 V, this provides the upper limit of the pulse amplitude.

Condition (b) is provided by TR1003 and its associated timing elements C1004 and R1009, these produce the 200 ms time period. At rest TR1003 is normally on hence its base sits at approximately -22.8 volts. C1004 is therefore discharged. At the initiation of erase sequence, TR1001 turns off, its collector rising to earth, C1004 is therefore charged up to approximately 24 volts. At the termination of the 100 ms period, TR1001 turns on again and its collector is pulled down to -23 volts. The base of TR1003 is also pulled down by 20 volts and now sits at approximately -44 volts (see Fig. 8—C). Instantly C1004 starts to discharge towards +105 volts via R1009. The collector of TR1003 provides a +ve going pulse of 200 ms duration shown in Fig. 8—D.

Condition (c) is achieved by TR1004 and TR1005 the 300 ms monostable, its time constant being controlled by C1006 and R1014. TR1004 is normally on and TR1005 is normally off and initiation of the monostable is controlled by the -ve going edge of the waveform at TR1003. R1017 is the collector load and is used to adjust the amplitude of the 300 ms pulse before it is applied to the summing amplifier. Once again the gain at the summing amplifier is determined by the feedback resistor R1038 and the series resistor, in this case being R1033. The resulting gain is approximately 0.5. Therefore the pulse at TR1005 collector, as shown in Fig. 8—E is inverted at TR1014 collector and is adjusted by R1017 from BE-DC to approximately +12 volts. Therefore the complete waveform as shown in Fig. 8—F is produced at TR1014 collector.

### 3.9.6 VARIABLE PERSISTENCE

TR1011 and TR1013 form a multivibrator operating at a frequency of approximately 500 Hz, the frequency determining elements being C1015, R1037 and C1017, R1039. The waveform at both collectors is shown in Fig. 8—G. The -ve going edge of the waveform is differentiated by C1014 R1035, and coupled via C1012 to the base of TR1009.

TR1006 and TR1009 form the variable persistence monostable. TR1009 collector is returned to earth via TR1008 and S1006, therefore TR1008 and TR1009 are conducting and TR1006 is off. With S1002 in persist mode, R1028 is connected as a variable resistance, with one side earthed and is in series with R1031, R1028, R1031 and C1008 form the timing elements of the monostable. Negative pulses from C1012 keep the monostable running at approximately 500 Hz and the pulse width is then made to vary between 2  $\mu$ s and 220  $\mu$ s by use of the variable control. The waveform at TR1006 collector, Fig. 8—H, is fed via the same path as the 300 ms generator, R1017 being a common load resistor. So that the setting of R1017 is the same for the erase pulse as for the variable persistence pulse. If during the variable persistence mode it is required to erase the

information on the CRT (for instance variable persistence is set to a very long period) this may still be done manually by pressing the erase button. However, it is desirable that during the 200 ms period of the erase sequence, the variable persistence pulses should be eliminated. This is achieved in the following way. The base of TR1008 is returned to the collector of TR1003, which is normally on and the collector is at -23 volts. TR1008 is thus on. During the 200 ms period TR1003 is turned off, its collector is returned to earth for the 200 ms period thereby turning TR1008 off during the same period. The waveform of Fig. 8—J is therefore seen at the output of the summing amplifier.

### 3.9.7 HOLD

For all storage operations the flood beam current is set to 700  $\mu$ A by the adjustment of R1056. As flood gun cathode FK is at earth the negative voltage derived by R1056 is applied to flood gun grid Fg1 via diodes D1021, D1022 and Con 5. To achieve the hold condition, the mean flood beam current must be reduced. This is achieved by pulsing the flood gun grid Fg1 negative with respect to the d.c. potential normally on the grid. TR1015, TR1016 form a monostable, the time constant being derived from C1021 and R1044. When switched to hold condition, TR1015 collector is connected to +24 V and negative pulses, differentiated from TR1013 collector, are coupled via C1019 and trigger the monostable at approximately 500 Hz. A portion of the collector waveform is used to switch TR1017 which acts as an inverter and buffer amplifier. The collector waveform of TR1017 shown in Fig. 8—K is a.c. coupled via C1023 and then d.c. restored by D1022, to the d.c. potential originally set on R1056 (see Fig. 8—L). The ratio of pulse width to repetition pulse duration i.e. 2 ms to 170  $\mu$ s is approximately 12 : 1. Therefore the mean flood beam current is approximately  $700/12 = 65 \mu$ A.

### 3.9.8 ENHANCE

Enhance mode is a condition in which the storage writing rate be increased at the expense of storage time. This condition is simply acquired by raising the potential at backing electrode. When S1002 is depressed R1028 becomes a potentiometer, connected between R1019 wiper and R1027, in the collector circuit of TR1007. The base of TR1007 is returned to the +105 volt line via R1024, and is therefore turned on. The wiper of the variable is now taken to the series summing resistor R1034. The output of the summing amplifier can now be set to a potential greater than the original BE-DC by turning the variable clockwise. When it is required to erase the enhance stored information, it is desirable to first remove the enhanced voltage. This is achieved in the following manner. As the erase switch is depressed, the base of TR1007 is connected to -24 volts so that C1007 is charged to -24 volts via R1022, thus turning TR1007 off, and allowing the variable wiper to rise to the potential set by R1019 i.e. backing electrode original potential. On releasing S1001, the erase sequence is initiated and also allows, TR1007 base to rise towards +105 volts, however at approximately +1.2 volts, TR1007 turns on again and pulls the variable wiper down to the enhanced condition. The time constant C1007, R1024 is arranged to be longer than the total erase sequence.

### 3.9.9 SET POSITION

When in store mode and set pos is depressed the intensity of the beam is set by R1012, such that there is minimal flooding of the storage surface. For non store and normal store conditions the intensity functions normally. When in hold the intensity is turned off completely so that no information can be written on to the CRT thus over writing on any stored information.

## 3.10 POWER SUPPLY

The -105 V, +24 V and -24 V lines, reference Figure 6, are all self regulating and protected from short circuits, they are connected to the remainder of the instrument via two plugs and sockets.

### 3.10.1 +24 V,

Diodes D405, D406, D407 and D408 form a full wave bridge rectifying circuit whose reservoir capacitor is C405. The output of this line is dependent on -24 V line setting, the sampling chain resistors R424 and R426 provide bias to the control loop of TR408, TR406 and TR405. TR402, R407 R425 and R413 form a current limiting and foldback network to protect the output under overload conditions.

### 3.10.2 -24 V.

This is used as a reference voltage for the other two lines and when set accurately will bias the +105 V and +24 V lines to their correct output voltages. Diodes D409, D411 and D413 form a full wave bridge rectifying circuit. TR411 and TR407 are a long tailed pair and in conjunction with TR409 and TR413 stabilise the circuit.

Current foldback and limiting is provided by TR403, R433, R420 and R405.

### 3.10.3 +105 V.

Diodes D401, D402, D403 and D404 provide full wave bridge rectification. If a short circuit occurs on this line the instrument must be switched off and on again before the line returns to its normal voltage. Transistors TR414, TR412, TR415 and TR416 stabilise the output and TR401 and TR404 provide short circuit protection in the form of a bistable.

### 3.11 E.H.T.

The E.H.T. (reference Figure 5) is derived from a class-C oscillator operating at approximately 28 kHz. The oscillator amplifying transistor TR303 uses transformer T301 as its load and main frequency determining component. R301 sets the cathode potential which is regulated by a feedback loop including a high gain amplifier formed by TR301 and TR302. The grid is set to the correct tube cut-off potential by adjusting R315. The output voltage is limited at switch on by thermistor TH301 whilst C304 inhibits E.H.T. feedback into the unregulated +30 V line. Diodes D303 and D304 provide half wave rectification from T301 for the cathode and grid supplies. The PDA is derived from a five stage multiplier (quintupler) whose input is taken from the same tapping on T301 as that used for the cathode supply. Tube focusing is achieved by adjusting R327 which is on the front panel.

### 3.12 UNBLANKING AMPLIFIER

This amplifier is a current in voltage out stage. A 2 mA change of input current produces an anti-phase 30 V output. The internal unblanking and external Z MOD signals are fed into TR351 emitter in current form at each potential. This current is transferred to the base of TR352 where it is mixed with the intensity control current. TR352 and TR353 form a stage whose gain is determined by R358.

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TABLE 1

## I.C.1. Sweep Control I.C.

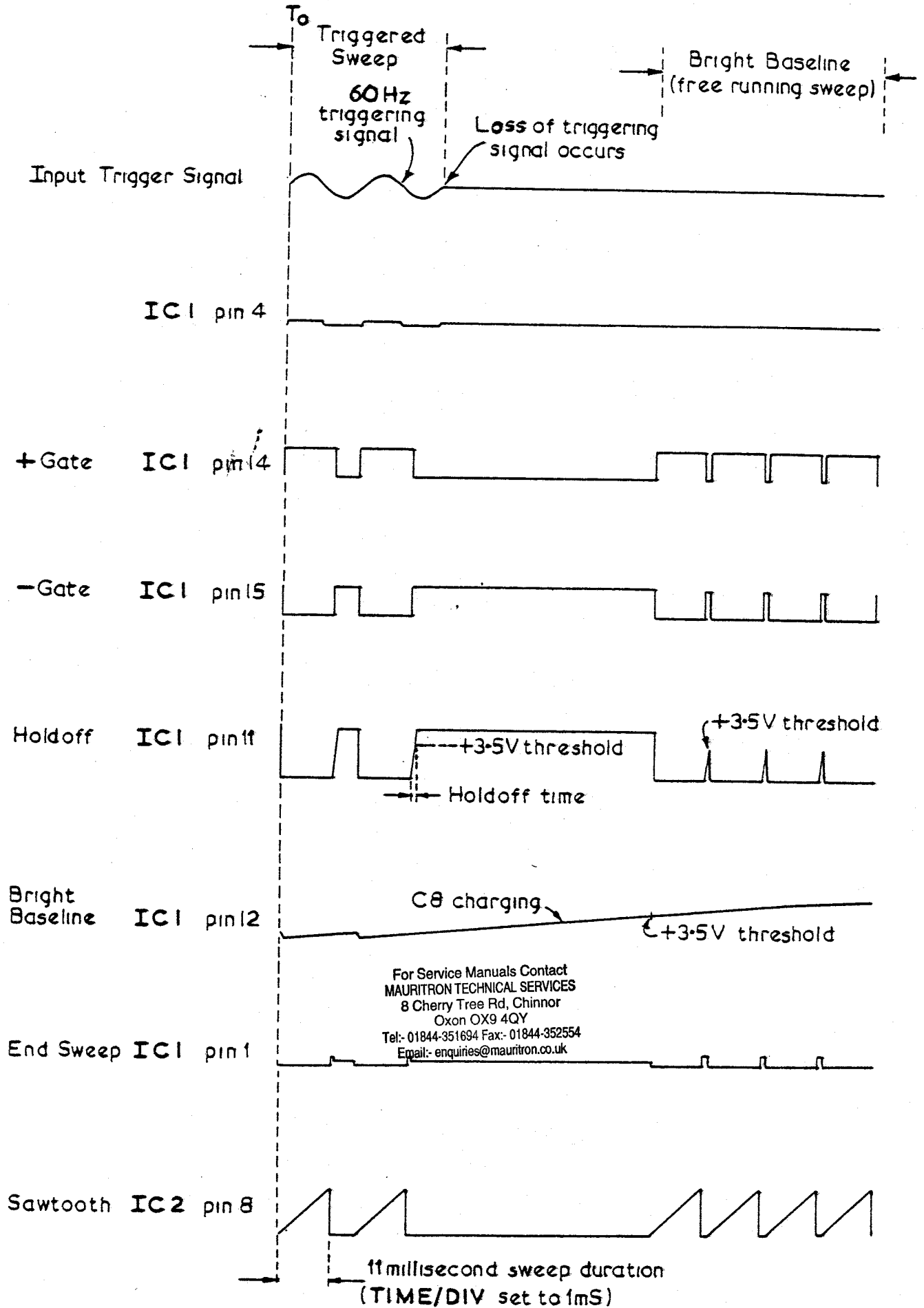
Pin No.	Function	Operation
1	END SWEEP	A logic '1' input causes logic '0' at pin 14 to end sweep (see pin 14).
2	FREE RUN	A logic '1' input causes logic '1' at pin 14 which if maintained, enables the sweep to free run at its "natural" selected frequency. Used to free run timebase when "Trace Locate" button is pushed.
3	INDEPENDENT GROUND	Connected to pin 8.
4	TRIGGER INPUT	Analogue input current from trigger pre-amp produces a train of "internal" pulses, in conjunction with a logic level at pin 5.
5	SLOPE SELECTOR	A logic '1' input allows a positive analogue signal at pin 4 to produce "internal" pulses. Logic '0' allows negative going analogue at pin 4 to produce "internal" pulses.
6	SINGLE SHOT CONTROL	A logic '1' input enables a repetitive sweep to continue. Logic '0' input allows a single sweep to be produced.
7	RESET	A logic '1' arms the timebase to receive a trigger signal and produces a single sweep. When Reset button is released pin returns to logic '0'.
8	SUBSTRATE	Connected to ground.
9	READY LAMP OUTPUT	A logic '0' output is produced when Single Shot button is pushed. This state allows ready state indicator, light emitting diode, to come on.
10	LOCKOUT	A logic '1' input disables the sweep, i.e., it cannot be started. A logic '0' allows normal operation.
11	HOLD-OFF TIMING	On receipt of an internal pulse, (generated at the end of the sweep), the timing components are connected allowing the pin to rise to threshold voltage of 3.5 V. A new sweep can commence upon receipt of next trigger pulse or if pin 12 is above its upper threshold voltage (see pin 12).
12	BRIGHT BASE LINE TIMING	Pin is allowed to rise to its threshold of 3.5 V when AUTO switch is selected. This then produces a logic '1' at pin 14 to start sweep and free run at "natural" selected frequency. If trigger signal is present or has a repetition rate >15 Hz, threshold voltage is never reached, pin goes to logic '0' and timebase is "triggered" in normal manner.
13	BRIGHT BASE LINE CONTROL	A logic '1' input keeps pin 12 at ground and disables B.B.L. operation. A logic '0' allows B.B.L. to function.
14	+ GATE OUTPUT	A logic '1' output is applied to pin 1 of I.C.2 to start the sweep and is maintained for duration of sweep. Logic '0' output to pin 1 of I.C.2 ends ramp and is maintained for whole of retrace period.
15	- GATE OUTPUT	Logic output is exactly 180° out of phase with pin 14. Output used as the bright up pulse.
16	POWER SUPPLY	Taken to +5 V line.

TABLE 2

## I.C.2. Sweep Generator

Pin No.	Function	Operation
1	SWEEP GATE IN	Logic '1' input starts sweep and results in sawtooth output at pin 8.
2	OSCILLATION SUPPRESSOR	C17 and R65 connected to ground reduce gain of integrator and prevent internal oscillation.
3	GROUND	Connected to ground.
4	END SWEEP PULSE	Logic '1' output produced when ramp reaches its allowed maximum amplitude. Applied to pin 1 of I.C.1.
5	DELAYED GATE	Not used.
6	DELAY CONTROL IN	Maintained at +9.8 V and applied to one side of a voltage comparator inside i.e. the amplitude of the ramp is established at the other side.
7	POWER SUPPLY	Held at approximately +15.8 V by Zener diode, D24.
8	SAWTOOTH OUTPUT	Ramp output of approximately 10 V amplitude starting from 0 V, when logic '1' applied to pin 1.
9	TIMING CURRENT IN	Junction of timing capacitors and resistors taken to pin.
10	SUBSTRATE	Taken to -24 V line via R69, sits at approximately -6.7 V.

TABLE 3. RELATIONSHIP OF EVENTS IN AUTO MODE



For Service Manuals Contact  
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# CHAPTER 4

## MAINTENANCE AND CALIBRATION

### 4.1 INTRODUCTION

4.1.1 The solid-state design of the instrument makes frequent adjustment of the internal components unnecessary. The appropriate part of the calibration procedure should be performed whenever the instrument fails to meet its specification or whenever a defective component is replaced. However, if R428 is adjusted to set the  $-24$  V line, the full calibration procedure should be carried out.

4.1.2 For calibration procedure of VERTICAL plug-ins, see appropriate Vertical plug-in MANUAL.

4.1.3 For calibration, the tools and equipment required are:

- Low-capacitance trimming tool (for preset controls)
- Small screwdriver (for preset potentiometers)
- Two Vertical plug-ins
- Vertical Calibration Unit 067-0672-00
- D.C. Voltmeter  $\pm 0.5\%$  accurate for measuring power supply voltages
- D.C. Voltmeter of input impedance greater than  $25\text{ M}\Omega$  and  $\pm 0.5\%$  accuracy for measuring cathode potential ( $-1.35$  kV)
- Squarewave Generator providing outputs of  $25\text{ mV}$  and  $250\text{ mV}$  at  $1\text{ kHz}$  accuracy  $\pm 1\%$
- Squarewave Generator providing  $1\text{ MHz}$  rise time  $\leq 3\text{ ns}$
- Sinewave Generator providing  $500\text{ Hz}$  to  $50\text{ kHz}$
- Constant Amplitude Sinewave Generator providing  $50\text{ kHz}$  to  $20\text{ MHz}$  for measuring bandwidth
- Time-mark Generator providing markers of  $1\text{ ms}$  and  $1\text{ }\mu\text{s}$ .

### 4.2 MECHANICAL

#### 4.2.1 ACCESS TO INTERIOR

The instrument has two vertical plug-ins, a timebase unit, a power supply unit and a EHT unit. The two cabinet covers of the instrument are removed as follows:

- 1 Disconnect the power lead.
- 2 Turn four buttons, two on each side cover, to release.
- 3 Lift the two side covers.

To remove the vertical plug-in(s):

Depress the plug-in retaining clip on the front and withdraw the plug-in(s).

To remove the sweep unit:

- 1 Unplug the two output leads from the CRT top pins.
- 2 Loosen one screw at the rear securing the unit.
- 3 Withdraw the unit.

To gain access to the preset controls inside the EHT box:

Remove the L-cover (one screw).

Power supply unit can be withdrawn from the rear of the instrument by removing the two retaining screws.

#### 4.2.2 CRT REMOVAL

- 1 Remove the side covers as detailed above.
- 2 Remove the bush from the moulding to expose the PDA plug and socket. Earth plug and socket with a screwdriver and remove plug from the socket.
- 3 Remove the rear cover (two screws).
- 4 Disconnect the CRT base connector.
- 5 Unplug the neck pin connectors.
- 6 Unsolder the trace rotation coil connections.
- 7 Remove the vertical plug-in units and sweep unit as detailed in para 4.2.1.

- 8 Disconnect the CRT flying leads (three) from PC175 noting position of the connections.
- 9 Disconnect the VARIABLE coupling.
- 10 Remove INTENSITY, FOCUS and PULL-ON knobs.
- 11 Remove CRT front panel and sub panel (two screws).
- 12 Remove two screws holding PC176 assembly to the main frame.
- 13 Disengage PC176 from SK805 and remove the PC176 assembly.
- 14 Remove CRT front clamp screws (two) on the top.
- 15 Slacken the top screw of the clamp holding the mumetal screen.
- 16 Remove bezel (four screws) and the filter.
- 17 Remove two screws holding CRT clamp to the main frame.
- 18 Remove the CRT, screen and clamp from the instrument by moving these toward the rear to clear the front panel, then lowering the front end of CRT towards the centre of the instrument allows the CRT rear to be moved outwards. Withdraw the CRT assembly.
- 19 Remove location moulding (two screws).
- 20 Withdraw the CRT from the screen.

#### 4.2.3 CRT FITTING

Reverse the order detailed above in 4.2.2. When fitting location moulding, it must be ascertained that the CRT front end is held against the front casting.

### 4.3 CALIBRATION PROCEDURE

#### 4.3.1 POWER SUPPLY

Adjustment of  $-24$  V line or replacement of any of the transistors TR407, TR409, TR411 and TR413 would necessitate carrying out the entire calibration procedure as detailed in this chapter.

A voltmeter of better than  $0.5\%$  accuracy should be used for measuring the power supply voltages.

- 1.0 Check line voltages.
- 1.1 Remove cabinet covers.
- 1.2 Set meter range to cover  $-24$  V DC.
- 1.3 Connect meter between earth and  $-24$  V output (junction of R429 and C415).
- 1.4 Adjust R428 PC162 for  $-24$  V.
- 1.5 Set meter range to cover  $+105$  V DC.
- 1.6 Connect meter between earth and  $+105$  V output (junction of R432 and C416).
- 1.7 Check voltage is within  $\pm 2\%$  of  $+105$  V i.e.  $+107.1$  V,  $+102.9$  V.
- 1.8 Set meter range to cover  $+24$  V DC.
- 1.9 Connect meter between earth and  $+24$  V output (junction of R424 and C414).
- 1.10 Check voltage is within  $\pm 2\%$  of  $+24$  V i.e.  $+24.48$  V,  $+23.52$  V.

#### 4.3.2 E.H.T. and DISPLAY ADJUSTMENTS

A voltmeter of input impedance greater than  $25\text{ M}\Omega$  and accuracy better than  $0.5\%$  should be used for measuring the cathode potential.

CAUTION: HIGH VOLTAGE

- 1.0 Check cathode potential (R301 PC163).
- 1.1 Remove cabinet covers, EHT cover and rear cover plate.
- 1.2 Set meter range to cover  $-1.35$  kV DC.
- 1.3 Connect meter between earth and pin on tube base.
- 1.4 Adjust R301 for  $-1.35$  kV.



- 2.0 Check grid cut-off (R317 PC163).
- 2.1 Remove cabinet covers and EHT cover.
- 2.2 Check INTENSITY range.
- 2.3 Set TIME/DIV to EXT X.
- 2.4 Turn INTENSITY fully anti-clockwise.
- 2.5 Adjust R317 for extinction of spot.
- 2.6 Set TIME/DIV to 10 ms.
- 2.7 Check INTENSITY range.
- 3.0 Set differential intensity (R332 PC163).
- 3.1 Display two traces and position these 2 to 3 mm apart about the central graticule line.
- 3.2 Turn INTENSITY such that one of the two traces is just visible.
- 3.3 Adjust R332 to equalise intensity of the two traces.
- 3.4 Turn INTENSITY control anticlockwise and check that both the traces disappear at the same time. Repeat 3.2 and 3.3 if necessary.
- 4.0 Set geometry (R1055 PC176).
- 4.1 Obtain a trace and bring it onto the graticule centre using POSITION.
- 4.2 Adjust TRACE ROTATE so that the trace is exactly parallel to the graticule horizontal line.
- 4.3 Reposition the trace on the top graticule line and adjust R1055 to correct the trace distortion.
- 4.4 Bring the trace, using POSITION, onto the bottom graticule line. Examine the trace. If any distortion is visible, correct it by resetting R1055. Re-check 4.3.

#### 4.3.3 VERTICAL AMPLIFIER PC175 (Final Stage)

Switch off the instrument. Remove left-hand V plug-in and replace with vertical calibration unit 067-0672-00. Switch on the instrument.

- 1.0 Set LH Y plate potential (R869).
- 1.1 Switch calibration unit to CALIBRATE.
- 1.2 Connect voltmeter of at least 1% accuracy between TR812 and TR813 collectors.
- 1.3 Adjust POSITION to achieve 0 V between collectors.
- 1.4 Connect voltmeter from one collector to earth.
- 1.5 Adjust R869 to obtain a reading of 51 V.
- 1.6 Repeat Ops 1.2 to 1.5.
- 1.7 Disconnect voltmeter.
- 2.0 Set LH channel gain (R805).
- 2.1 Connect 1 kHz squarewave of 250 mV amplitude to INPUT.
- 2.2 Set TIME/DIV to 1 ms.
- 2.3 Adjust R805 for precisely 5 divisions.
- 3.0 Set LH channel pulse response (R849 and C812).
- 3.1 Connect 200 mV 1 MHz  $\leq$  3 ns rise time squarewave to INPUT.
- 3.2 Set TIME/DIV to 0.2  $\mu$ s.
- 3.3 Adjust R849 and C812 for best pulse response.
- 4.0 Check LH channel bandwidth.
- 4.1 Connect 50 kHz sinewave to INPUT.
- 4.2 Adjust generator to give 5 div trace.
- 4.3 Set TIME/DIV to 1 ms.
- 4.4 Switch generator to 18 MHz.
- 4.5 Check amplitude  $>$  3.5 divisions.
- 5.0 Set RH Y plate potential (R871).
- Note: Place vertical calibration unit 067-0672-00 into right-hand channel.
- 5.1 Switch vertical calibration unit to CALIBRATE.
- 5.2 Connect voltmeter of at least 1% accuracy between TR814 and TR815 collectors.
- 5.3 Adjust POSITION to achieve 0 V between collectors.
- 5.4 Connect voltmeter from one collector to earth.
- 5.5 Adjust R871 to obtain a reading of 51 V.
- 5.6 Repeat Ops. 5.2 to 5.5.
- 5.7 Disconnect voltmeter.
- 6.0 Set RH channel gain (R807).
- 6.1 Connect 250 mV 1 kHz squarewave to INPUT.
- 6.2 Set TIME/DIV to 1 ms.
- 6.3 Adjust R807 for precisely 5 divisions.
- 7.0 Set RH channel pulse response (R851 and C813).
- 7.1 Connect 200 mV 1 MHz  $\leq$  3 ns rise time squarewave to INPUT.

- 7.2 Set TIME/DIV to 0.2  $\mu$ s.
- 7.3 Adjust R851 and C813 for best pulse response.
- 8.0 Check RH channel bandwidth.
- 8.1 Connect 50 kHz sinewave to INPUT.
- 8.2 Adjust generator to give 5 div trace.
- 8.3 Set TIME/DIV to 1 ms.
- 8.4 Switch generator to 18 MHz.
- 8.5 Check amplitude  $>$  3.5 divisions.
- Note: Replace vertical calibration unit with normal 'V' plug-in.

#### 4.3.4 VERTICAL PLUG-IN

See appropriate MANUAL.

#### 4.3.5 TIME BASE PC158

- 1.0 Set trigger.
- 1.1 Select AUTO Trigger Mode and LH VERT Source buttons.
- 1.2 Set TIME/DIV switch to 1 ms.
- 1.3 Ensure that the main frame contains two calibrated V1, vertical plug-ins. Centralise traces of both channels.
- 1.4 Apply a 500 Hz sinewave to LH channel input socket and adjust its amplitude to display 0.5 division on the screen.
- 1.5 Adjust R57 so that the display "free runs" when the TRIG LEVEL control is at either extremity of its front panel + and - slope regions.
- 1.6 Select AC Trigger Mode button.
- 1.7 Increase amplitude of display to 8 divisions on the screen.
- 1.8 Check that by operating the TRIG LEVEL control the displayed waveform can be made to start at any point on its + or - slope.
- 1.9 Set start point of display on centre graticule line.
- 1.10 Select DC Trigger Mode button.
- 1.11 Adjust R32 for  $<$  0.4 division change in position of the start point of the display when the Trigger Mode is switched between AC and DC on both + and - slopes.
- 1.12 Select DC Trigger Mode button. Apply the same signal also to RH channel input socket and ensure that both displayed waveforms are superimposed.
- 1.13 Adjust R841 on rear of Mother Board PC175 for no change in start point of display when switching between LH VERT and RH VERT Source buttons.
- 1.14 Disconnect the signal from both input sockets.
- 2.0 Set timing.
- 2.1 Set TIME/DIV switch to 1 ms, VARIABLE to CAL and horizontal gain to x1. Select LH VERT Source button. Apply 1 ms markers to LH channel input socket and adjust to a suitable amplitude on the screen.
- 2.2 Adjust R114 for 1 marker per division.
- 2.3 Pull gain switch for x5 and adjust R108 for 1 marker per 5 divisions.
- 2.4 Alter input signal to 1  $\mu$ s markers.
- 2.5 Set TIME/DIV switch to 1  $\mu$ s.
- 2.6 Push gain switch for x1.
- 2.7 Adjust C19 for 1 marker per division.
- 2.8 Set TIME/DIV switch to 0.2  $\mu$ s.
- 2.9 Pull gain switch for x5.
- 2.10 Remove marker input signal and apply a 15 MHz sinewave.
- 2.11 Adjust C22 for best linearity at the start of the trace.
- 3.0 Set external trig.
- 3.1 Remove signal from inputs and connect LH channel input socket to Ext X socket on timebase front panel.
- 3.2 Push AUTO and DC Trigger buttons together and select EXT Source button.
- 3.3 Set LH channel VOLTS/DIV switch to 0.1 V and select x1 gain.
- 3.4 Set LH channel DC-GND-AC switch to GND, and centre the trace.
- 3.5 Set DC-GND-AC to DC and adjust R2 to return trace to centre of screen.
- 3.6 Repeat 3.4 and 3.5 until there is no more movement of trace.
- 3.7 Disconnect LH channel input and EXT X sockets op. 3.1.
- 4.0 Set X-Y gain.
- 4.1 Select RH VERT Source button on time base front panel.
- 4.2 Set RH channel DC-GND-AC switch to DC and LH channel DC-GND-AC switch to GND.
- 4.3 Set RH channel VOLTS/DIV switch to 5 mV.

- 4.4 Apply a 25 mV 1 kHz squarewave to RH channel input socket and ensure that the squarewave is 5 divisions high on the screen.
- 4.5 Select X-Y Source button.
- 4.6 Adjust R25 for 2 spots, 5 divisions apart in the horizontal direction on the screen.

#### 4.3.6 STORAGE CIRCUIT PC176

- 1.0 Set Fg 1 (R1056).
- 1.1 Ensure NON STORE-STORE, VIEW-HOLD and PERSIST-ENHANCE buttons are OUT and VARIABLE is OFF.
- 1.2 Switch off the instrument; remove left-hand vertical plug-in and set all the presets on PC176 to midrange excepting R1055.
- 1.3 Unsolder the wire connected to CRT base pin 9. †
- 1.4 Connect meter, set to 1 mA d.c., positive to CRT base pin 9 and negative to earth.
- 1.5 Switch on the instrument and allow 5 minute warm up time.
- 1.6 Adjust R1056 to give a meter reading of 700  $\mu$ A.
- 1.7 Switch off the instrument, disconnect the meter, reconnect the wire to pin 9 and switch the instrument on.
- 2.0 Set collimation (R1047).
- 2.1 Select STORE, AUTO, REP, RH VERT and set TIME/DIV to 1 ms.
- 2.2 Turn INTENSITY to maximum and slowly cover the whole screen with the trace using vertical POSITION control.
- 2.3 Depress SINGLE sweep button and adjust R1047 to obtain the most uniform background illumination.
- 2.4 Depress ERASE to clear the screen.
- 3.0 Set backing electrode BE-DC (R1019).  
In order to determine the backing electrode potential to which it should be set, proceed as follows:
- 3.1 Set TIME/DIV to 20  $\mu$ s, VARIABLE to CAL, INTENSITY fully clockwise and FOCUS as required.
- 3.2 Switch off the instrument; connect voltmeter to SK805/13. Switch on and allow 5 minute warm up time.
- 3.3 Connect 300 mV CAL output to EXT X/EXT socket; select REP, EXT TRIG SOURCE and AC TRIG MODE. Adjust TRIG LEVEL to obtain a trace and position it about 0.4 div of the screen centre.

- 3.4 Select SINGLE sweep and STORE and, depress ERASE to clear the screen.
- 3.5 Set backing electrode d.c. voltage to 3 V using R1019.
- 3.6 Set collimation as detailed in ops. 2.1 to 2.4 above.
- 3.7 Set erase amplitude as detailed in ops 4.1 to 4.4 below.
- 3.8 Reduce the backing electrode dc voltage in 0.5 V steps, repeating ops 3.6 and 3.7 each time, to a minimum of 0.5 V. At some d.c. level of the backing electrode, optimum uniformity of the unbroken trace and the writing speed will be obtained. Set the backing electrode to this voltage.
- 3.9 Switch off, disconnect the voltmeter and switch on again.
- 4.0 Set erase amplitude (R1017).
- 4.1 Set TIME/DIV to 20  $\mu$ s and VARIABLE to CAL.
- 4.2 Turn R1017 fully clockwise and depress ERASE to clear the screen.
- 4.3 Depress RESET and notice that no trace can be stored.
- 4.4 Turn R1017 slightly anti-clockwise. Depress ERASE and then RESET. Observe if there is a stored trace. If there is no stored trace, turn R1017 slightly more anti-clockwise and repeat till the trace is just stored and is unbroken on any part of the screen.
- 5.0 Set preset intensity (R1012).
- 5.1 Set TIME/DIV to 1 ms and VARIABLE to CAL. Select PERSIST and turn VARIABLE fully anticlockwise (OFF).
- 5.2 Depress ERASE to clear the screen.
- 5.3 Keeping SET POS depressed, adjust R1012 so that the spot is of low enough intensity and is not likely to flood the screen rapidly but can be seen to move, on turning the vertical POSITION control.
- 6.0 Set compensation (C1016).
- 6.1 Connect oscilloscope to SK805/13.
- 6.2 Turn VARIABLE PERSIST fully clockwise.
- 6.3 Adjust C1016 so that the displayed pulse has a flat top.
- 6.4 Replace the left-hand vertical plug-in.

#### 4.3.7 CALIBRATOR ADJUSTMENT

Normally, no further amplitude adjustments are required to the calibrator outputs. In the event of its failure requiring resistor replacement then the amplitude should be checked and if required R127 should be adjusted.

For Service Manuals Contact  
 MAURITRON TECHNICAL SERVICES  
 8 Cherry Tree Rd, Chinnor  
 Oxon OX9 4QY  
 Tel:- 01844-351694 Fax:- 01844-352554  
 Email:- enquiries@mauritron.co.uk

# CHAPTER 5

## COMPONENTS LIST

Values of resistors are stated in ohms or multiples of ohms; ratings at 70°C are in watts or sub-multiples of watts. Values of capacitors are stated in sub-multiples of farads; ratings at 70°C are in volts or kilovolts.

Whenever possible, exact replacements for components should be used, although locally available alternatives may be satisfactory for standard components.

Any order for replacement parts should include:

For Service Manuals Contact  
**MAURITRON TECHNICAL SERVICES**  
 8 Cherry Tree Rd, Chinnor  
 Oxon OX9 4QY  
 Tel:- 01844-351694 Fax:- 01844-352554  
 Email:- enquiries@mauritron.co.uk

1. Instrument type
2. Instrument serial number
3. Component circuit reference

4. Component part number
5. Component value

### CIRCUIT REFERENCE BLOCKS

The table below gives the blocks of circuit references, so that the reader can relate the items listed in this chapter and their location in the circuitry and printed circuit boards in Chapter 6.

Circuit Reference		Circuit	Fig.	P.C. Board No.
From	To			
1	100	Trigger and Sweep Generator	2	158
101	140	X-Amplifier and Calibrator	4	158
151	170	Time/Div Switch	3	-
301	350	E.H.T. Control - CRT	5	163
351	370	Bright-Up	5	161
401	450	Power Supply	6	162
801	880	Mother Board	1	175
1000	1060	Storage circuit	7	176

### ABBREVIATIONS

BM	Button mica	CMP	Cermet preset	PS	Polystyrene
C	Carbon	E	Electrolytic	Se	Selenium
CP	Carbon preset	Ge	Germanium	Si	Silicon
CV	Carbon variable	MF	Metal film	SM	Silver mica
CER	Ceramic	MO	Metal oxide	WW	Wire-wound
CT	Ceramic trimmer	PE	Polyester	WWP	Wire-wound preset
CM	Cermet thick film	PP	Polypropylene	WWV	Wire-wound variable

### TEKTRONIX UK LIMITED

36 - 38 Coldharbour Lane, Harpenden, Hertfordshire, England

Telephone: Harpenden 63141

Telex: 25559

All requests for repairs or replacement parts should be directed to the Tektronix Field Office or representative in your area. This procedure will assure you the fastest possible service.

CIR REF	PART NUMBER	VALUE F	DESCRIPTION			RATING Volts	Eff. Ser.No.
			TYPE	TOL %			
C1	285-0915-00	100 n	PE	20		100	
C2	281-0710-00	10 n	CER			250	
C3	285-0854-00	100 p	PS	2		350	
C4	285-0854-00	100 p	PS	2		350	
C6	281-0734-00	100 n	CER			30	
C7	285-0869-00	47 p	PS	2 p		350	
C8	290-0623-00	4.7 μ	E			25	
C9	285-0873-00	200 p	PS	5		350	
C11	281-0729-00	1.5 μ	PE	20		63	
C12	285-0854-00	100 p	PS	2 p		350	
C13	281-0710-00	10 n	CER			250	
C14	281-0734-00	100 n	CER			30	
C15	285-0874-00	470 p	PS	5		125	
C16	281-0734-00	100 n	CER			30	
C17	285-0873-00	200 p	PS	5		350	
C18	285-0867-00	20 p	PS	1 p		350	
C19	281-0155-00	2-22 p	PP			500	
C20	281-0734-00	100 n	CER			30	
C21	281-0734-00	100 n	CER			30	
C22	281-0154-00	2-12 p	PP			500	
C24	281-0734-00	100 n	CER			30	
C25	281-0734-00	100 n	CER			30	
C26	281-0734-00	100 n	CER			30	
C27	281-0710-00	10 n	CER			250	
C100	281-0734-00	100 n	CER			30	
C101	285-0872-00	180 p	PS	2		350	
C102	281-0710-00	10 n	CER			250	
C103	285-0844-00	39 p	PS	2 p		350	
C104	285-1015-00	4.7 n	PE			160	
C105	285-0800-00	10 n	PE	20		250	
C106	290-0556-00	22 μ	E			25	
C151	285-1033-00	220 n	PE	20		160	
C152	285-1070-00	3.3 n	PS	10		400	
C153	285-0941-00	80 p	PS	1		350	
C154	285-0942-00	10 n	PE	1		125	
C155	285-0943-00	1 μ	PE	1		160	
C156	281-0734-00	100 n	CER			30	
C300	281-0710-00	10 n	CER			250	
C301	285-0759-00	2.2 n	PS	5		125	
C302	281-0680-00	470 p	CER	20		1.5 k	
C303	281-0680-00	470 p	CER	20		1.5 k	
C304	290-0492-00	4.7 μ	E			25	
C305	290-0495-00	47 μ	E			40	
C306	285-0799-00	33 n	PE	20		250	
C307	281-0677-00	10 n	CER			2 k	
C308	281-0706-00	30 n	CER	20		1.5 k	
C309	285-1015-00	4.7 n	PE	20		160	
C311	281-0779-00	2.2 n	CER			2 k	
C312	281-0706-00	30 n	CER	20		1.5 k	
C313	281-0710-00	10 n	CER			250	

CIR REF	PART NUMBER	VALUE F	DESCRIPTION			RATING Volts	Eff. Ser.No.
			TYPE	TOL %			
C314	281-0710-00	10 n	CER			250	
C315	281-0677-00	10 n	CER			2 k	
C316	285-1046-00	100 n	PE	20		160	
C351	281-0710-00	10 n	CER			250	
C352	285-0796-00	100 n	PE	20		250	
C353	281-0710-00	10 n	CER			250	
C401	285-0793-00	10 n	PE	20		630	
C402	285-0793-00	10 n	PE	20		630	
C403	285-0793-00	10 n	PE	20		630	
C404	290-0547-00	330 μ	E			160	
C405	290-0624-00	2.2 m	E			40	
C406	290-0624-00	2.2 m	E			40	
C407	285-1058-00	10 n	PE	20		400	
C408	290-0494-00	47 μ	E			25	
C409	285-0915-00	100 n	PE	20		100	
C411	290-0635-00	4.7 μ	E			63	
C412	285-0870-00	120 p	PS	2		350	
C413	285-0796-00	100 n	PE	20		250	
C414	290-0556-00	22 μ	E			25	
C415	290-0556-00	22 μ	E			25	
C416	290-0664-00	4.7 μ	E			160	
C417	290-0556-00	22 μ	E			25	
C801	281-0710-00	10 n	CER			250	
C802	281-0710-00	10 n	CER			250	
C803	281-0710-00	10 n	CER			250	
C804	281-0710-00	10 n	CER			250	
C805	281-0710-00	10 n	CER			250	
C807	285-0800-00	10 n	PE	20		250	
C808	285-0800-00	10 n	PE	20		250	
C809	285-0920-00	56 p	PS	2		350	
C811	285-0920-00	56 p	PS	2		350	
C812	281-0157-00	5.5-65.5 p	PP			500	
C813	281-0191-00	10-60 p	CT	30		250	
C814	285-0869-00	47 p	PS	2 p		350	
C815	285-0869-00	47 p	PS	2 p		350	
C816	285-0842-00	15 p	PS	1 p		350	
C817	285-0842-00	15 p	PS	1 p		350	
C818	290-0377-00	1 m	E			16	
C819	281-0710-00	10 n	CER			250	
C821	290-0344-00	1.6 m	E			10	
C822	285-0920-00	56 p	PS	2		350	
C823	285-0920-00	56 p	PS	2		350	
C824	281-0710-00	10 n	CER			250	
C825	281-0710-00	10 n	CER			250	
C1001	281-0710-00	10 n	CER			250	
C1002	285-1063-00	390 p	PS			160	606057
C1003	290-0690-00	1 μ	E			63	

CIR REF	PART NUMBER	VALUE F	DESCRIPTION			RATING Volts	Eff. Ser.No.
			TYPE	TOL %			
C1004	290-0635-00	4.7 $\mu$	E			63	
C1005	281-0734-00	100 n	CER			30	
C1006	290-0635-00	4.7 $\mu$	E			63	
C1007	285-1014-00	1 $\mu$	PE	20		63	
C1008	285-1053-00	3.3 n	PS	5		160	
C1009	281-0723-00	1.8 p	CER	0.1 p		500	
C1011	285-0888-00	220 n	PE	5		250	
C1013	285-0867-00	20 p	PS	1 p		350	606152
C1014	285-0873-00	200 p	PS	5		350	606057
C1015	285-0912-00	10 n	PE	5		630	

CIR REF	PART NUMBER	VALUE F	DESCRIPTION			RATING Volts	Eff. Ser
			TYPE	TOL %			
C1016	281-0156-00	1.4-6.4 p	PP			500	
C1017	285-0912-00	10 n	PE	5		630	
C1018	285-0854-00	100 p	PS	2 p		350	606
C1021	285-0850-00	1 n	PS	5		125	
C1022	285-0796-00	100 n	PE	20		250	
C1023	281-0734-00	100 n	CER			30	
C1024	285-0796-00	100 n	PE	20		250	
C1025	281-0734-00	100 n	CER			30	
C1026	285-0796-00	100 n	PE	20		250	

CIR REF	PART NUMBER	VALUE	DESCRIPTION	TYPE	TOL %	RATING	Eff. Ser.
D1	152-0062-0T	75 V	1N914	Si		50 mA	
D2	152-0062-01	75 V	1N914	Si		50 mA	
D3	152-0062-0T	75 V	1N914	Si		50 mA	
D4	152-0062-01	75 V	1N914	Si		50 mA	
D5	152-0062-01	75 V	1N914	Si		50 mA	
D6	152-0062-01	75 V	1N914	Si		50 mA	
D7	152-0062-01	75 V	1N914	Si		50 mA	
D8	152-0062-01	75 V	1N914	Si		50 mA	
D9	152-0062-01	75 V	1N914	Si		50 mA	
D11	152-0062-01	75 V	1N914	Si		50 mA	
D12	152-0062-0T	75 V	1N914	Si		50 mA	
D13	152-0575-00		L.E.D.	Si		50 mA	
D14	152-0062-0T	75 V	1N914	Si		50 mA	
D15	152-0472-00	5.6 V	Zener	Si		50 mA	
D16	152-0062-01	75 V	1N914	Si		50 mA	
D17	152-0062-01	75 V	1N914	Si		50 mA	
D18	152-0062-01	75 V	1N914	Si		50 mA	
D19	152-0062-01	75 V	1N914	Si		50 mA	
D21	152-0062-01	75 V	1N914	Si		50 mA	
D22	152-0472-00	5.6 V	Zener	Si		50 mA	
D23	152-0469-00		Rectifier	Si			
D24	152-0416-00	8.2 V	Zener	Si			
Si For Service Manuals Contact MAURITRON TECHNICAL SERVICES 8 Cherry Tree Rd, Chinnor Oxon OX9 4QY Tel:- 01844-351694 Fax:- 01844-352554 Email:- enquiries@mauritron.co.uk							
D101	152-0062-01	75 V	1N914	Si		50 mA	
D102	152-0062-01	75 V	1N914	Si		50 mA	
D103	152-0062-01	75 V	1N914	Si		50 mA	
D104	152-0062-01	75 V	1N914	Si		50 mA	
D105	152-0473-00	6.8 V	Zener	Si		330 mW	
D301	152-0062-01	75 V	1N914	Si		50 mA	
D302	152-0468-00	150 V	BAX16	Si		200 mA	
D303	152-0567-00	3 kV	SCM30	Si			
D304	152-0567-00	3 kV	SCM30	Si			
D305	152-0388-00	130 V	Zener	Si		330 mW	
D351	152-0062-01	75 V	1N914	Si		50 mA	
D352	152-0062-01	75 V	1N914	Si		50 mA	

CIR REF	PART NUMBER	VALUE	DESCRIPTION	TYPE	TOL %	RATING	Eff. Ser.No.
D401	152-0341-00	450 V	DDO56	Si		500 mA	
D402	152-0341-00	450 V	DDO56	Si		500 mA	
D403	152-0341-00	450 V	DDO56	Si		500 mA	
D404	152-0341-00	450 V	DDO56	Si		500 mA	
D405	152-0339-00	50 V	1N4001	Si		500 mA	
D406	152-0339-00	50 V	1N4001	Si		500 mA	
D407	152-0339-00	50 V	1N4001	Si		500 mA	
D408	152-0339-00	50 V	1N4001	Si		500 mA	
D409	152-0339-00	50 V	1N4001	Si		500 mA	
D411	152-0339-00	50 V	1N4001	Si		500 mA	
D412	152-0339-00	50 V	1N4001	Si		500 mA	
D413	152-0339-00	50 V	1N4001	Si		500 mA	
D414	152-0348-00	6.2 V	Zener	Si	5	330 mW	
D415	152-0062-01	75 V	1N914	Si		50 mA	
D416	152-0062-01	75 V	1N914	Si		50 mA	
D417	152-0468-00	150 V	BAX16	Si		200 mA	
D801	152-0062-01	75 V	1N914	Si		50 mA	
D802	152-0062-01	75 V	1N914	Si		50 mA	
D803	152-0062-01	75 V	1N914	Si		50 mA	
D804	152-0062-01	75 V	1N914	Si		50 mA	
D805	152-0062-01	75 V	1N914	Si		50 mA	
D806	152-0062-01	75 V	1N914	Si		50 mA	
D807	152-0062-01	75 V	1N914	Si		50 mA	
D808	152-0062-01	75 V	1N914	Si		50 mA	
D809	152-0062-01	75 V	1N914	Si		50 mA	
D811	152-0062-01	75 V	1N914	Si		50 mA	
D812	152-0339-00	50 V	1N4001	Si		500 mA	
D813	152-0339-00	50 V	1N4001	Si		500 mA	
D814	152-0339-00	50 V	1N4001	Si		500 mA	
D815	152-0339-00	50 V	1N4001	Si		500 mA	
D1001	152-0062-01	75 V	1N914	Si		50 mA	
D1003	152-0062-01	75 V	1N914	Si		50 mA	
D1004	152-0062-01	75 V	1N914	Si		50 mA	
D1005	152-0062-01	75 V	1N914	Si		50 mA	
D1006	152-0062-01	75 V	1N914	Si		50 mA	
D1007	152-0062-01	75 V	1N914	Si		50 mA	
D1008	152-0062-01	75 V	1N914	Si		50 mA	
D1009	152-0062-01	75 V	1N914	Si		50 mA	
D1011	152-0062-01	75 V	1N914	Si		50 mA	
D1012	152-0062-01	75 V	1N914	Si		50 mA	
D1013	152-0062-01	75 V	1N914	Si		50 mA	
D1014	152-0062-01	75 V	1N914	Si		50 mA	
D1015	152-0062-01	75 V	1N914	Si		50 mA	
D1016	152-0062-01	75 V	1N914	Si		50 mA	
D1017	152-0062-01	75 V	1N914	Si		50 mA	
D1018	152-0062-01	75 V	1N914	Si		50 mA	
D1019	152-0062-01	75 V	1N914	Si		50 mA	
D1021	152-0062-01	75 V	1N914	Si		50 mA	
D1022	152-0062-01	75 V	1N914	Si		50 mA	

606057

CIR REF	PART NUMBER	VALUE	DESCRIPTION	Eff. Ser.No.
FS401	159-0069-00	2 A	1.25" lg. 100-125 V	
FS401	159-0073-00	1 A	1.25" lg. 200-250 V	
FS402	159-0073-00	1 A	1.25" lg. 200-250 V	

IC1	155-0056-00		Inter: Circuit Tek	
IC2	155-0042-03		Inter: Circuit Tek	

L101	108-0482-00	160 μH	Inductor Fixed	
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L301	108-0483-00	16 μH	Inductor Fixed	
L302	108-0753-00		Trace Rotate	

LP401	150-0074-00	6.5 V	Lamp 0.15 A	
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CIR REF	PART NUMBER	VALUE Ohms	DESCRIPTION TYPE	TOL %	RATING W	Eff. Ser.No.
R1	317-0224-01	220 k	C	5	125 m	
R2	311-0756-00	47 k	CP	20	250 m	
R3	317-0224-01	220 k	C	5	125 m	
R4	317-0103-01	10 k	C	5	125 m	
R5	317-0682-01	6.8 k	C	5	125 m	
R6	317-0682-01	6.8 k	C	5	125 m	
R7	317-0471-01	470	C	5	125 m	
R8	317-0432-01	4.3 k	C	5	125 m	
R9	317-0622-01	6.2 k	C	5	125 m	
R10	317-0471-01	470	C	5	125 m	
R11	317-0392-01	3.9 k	C	5	125 m	
R12	317-0432-01	4.3 k	C	5	125 m	
R13	317-0822-01	8.2 k	C	5	125 m	
R14	317-0682-01	6.8 k	C	5	125 m	
R15	317-0183-01	18 k	C	5	125 m	
R16	317-0473-01	47 k	C	5	125 m	
R17	317-0273-01	27 k	C	5	125 m	
R18	317-0273-01	27 k	C	5	125 m	
R19	317-0471-01	470	C	5	125 m	
R20	317-0561-01	560	C	5	125 m	
R21	317-0223-01	22 k	C	5	125 m	
R22	317-0273-01	27 k	C	5	125 m	
R23	317-0561-01	560	C	5	125 m	
R24	317-0562-01	5.6 k	C	5	125 m	
R25	311-0802-00	4.7 k	CP	20	250 m	
R26	317-0123-01	12 k	C	5	125 m	
R27	317-0273-01	27 k	C	5	125 m	
R28	317-0222-01	2.2 k	C	5	125 m	
R29	317-0682-01	6.8 k	C	5	125 m	
R30	317-0102-01	1 k	C	5	125 m	
R31	317-0472-01	4.7 k	C	5	125 m	
R32	311-0798-00	2.2 k	CP	20	250 m	
R33	317-0153-01	15 k	C	5	125 m	
R34	317-0472-01	4.7 k	C	5	125 m	
R35	317-0472-01	4.7 k	C	5	125 m	
R36	317-0682-01	6.8 k	C	5	125 m	
R37	317-0125-01	1.2 M	C	5	125 m	
R38	317-0102-01	1 k	C	5	125 m	
R39	317-0221-01	220	C	5	125 m	
R40	317-0331-01	330	C	5	125 m	
*R41	311-1540-00	22 k	CV	20	250 m	

\*R41 & R61 ganged

CIR REF	PART NUMBER	VALUE Ohms	DESCRIPTION TYPE	TOL %	RATING W	Eff. Ser.No.
R42	317-0104-01	100 k	C	5	125 m	
R43	317-0822-01	8.2 k	C	5	125 m	
R44	317-0622-01	6.2 k	C	5	125 m	
R45	317-0182-01	1.8 k	C	5	125 m	
R46	317-0103-01	10 k	C	5	125 m	
R47	317-0472-01	4.7 k	C	5	125 m	
R48	317-0472-01	4.7 k	C	5	125 m	
R49	317-0911-01	910	C	5	125 m	
R50	317-0101-01	100	C	5	125 m	
R51	317-0822-01	8.2 k	C	5	125 m	
R52	317-0105-01	1 M	C	5	125 m	
R53	317-0100-01	10	C	5	125 m	
R54	317-0752-01	7.5 k	C	5	125 m	
R55	317-0471-01	470	C	5	125 m	
R56	317-0123-01	12 k	C	5	125 m	
R57	311-0798-00	2.2 k	CP	20	250 m	
R58	317-0680-01	68	C	5	125 m	
R59	317-0123-01	12 k	C	5	125 m	
R60	317-0222-01	2.2 k	C	5	125 m	
*R61	311-1540-00	22 k	CV	20	250 m	
R62	317-0223-01	22 k	C	5	125 m	
R63	317-0562-01	5.6 k	C	5	125 m	
R64	317-0332-01	3.3 k	C	5	125 m	
R65	317-0121-01	120	C	5	125 m	
R66	317-0223-01	22 k	C	5	125 m	
R67	317-0561-01	560	C	5	125 m	
R68	321-0850-48	27 k	MF	1	125 m	
R69	317-0122-01	1.2 k	C	5	125 m	

R73	321-1313-48	18 k	MF	1	125 m	
R74	317-0103-01	10 k	C	5	125 m	

R76	317-0272-01	2.7 k	C	5	125 m	
R77	317-0472-01	4.7 k	C	5	125 m	
R78	317-0101-01	100	C	5	125 m	

R100	321-0850-48	27 k	MF	1	125 m	
R101	317-0223-01	220 k	C	5	125 m	
R102	317-0103-01	10 k	C	5	125 m	
R103	301-0223-01	22 k	C	5	500 m	
R104	317-0681-01	680	C	5	125 m	
*R105	311-1546-00	100 k	CV	20	250 m	
R106	307-0424-00	4.3 k	MO	5	3	
R107	301-0302-01	3 k	C	5	500 m	
R108	311-0712-00	100	CP	20	250 m	
R109	311-1541-00	22 k	CV	20	250 m	

R111	315-0333-02	33 k	C	5	250 m	
R112	317-0561-01	560	C	5	125 m	
R113	317-0101-01	100	C	5	125 m	
R114	311-0995-00	680	CP	20	250 m	
R115	317-0823-01	82 k	C	5	125 m	
R116	307-0424-00	4.3 k	MO	5	3	
R117	301-0302-01	3 k	C	5	500 m	

R119	301-0223-01	22 k	C	5	500 m	
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R121	315-0222-01	2.2 k	C	5	250 m	
R122	317-0154-01	150 k	C	5	125 m	
R123	317-0822-01	8.2 k	C	5	125 m	
R124	325-0123-00	10.1	MF	0.5	125 m	
R125	321-0093-42	90.9	MF	0.5	125 m	
R126	317-0103-01	10 k	C	5	125 m	
R127	311-0717-00	220	CP	20	250 m	

\*\*With S101

CIR REF	PART NUMBER	VALUE Ohms	DESCRIPTION			Eff. Ser.No.
			TYPE	TOL %	RATING W	
R128	321-0280-48	8.06 k	MF	1	125 m	
R129	317-0683-01	68 k	C	5	125 m	
R151	321-1606-48	72 k	MF	1	125 m	
R152	321-1392-48	120 k	MF	1	125 m	
R153	321-1421-48	240 k	MF	1	125 m	
R154	321-1604-48	720 k	MF	1	125 m	
R155	325-0157-00	1.2 M	MF	1	250 m	
R156	325-0158-00	2.4 M	MF	1	250 m	
R157	324-0619-40	7.2 M	MF	1	1	
R158	321-1229-48	2.4 k	MF	1	125 m	
R159	321-1605-48	48 k	MF	1	125 m	
R161	324-1584-40	12 M	MF	1	1	
R162	317-0100-01	10	C	5	125 m	
R163	311-1547-00	5 k	CV	20	250 m	
R164	317-0101-01	100	C	5	125 m	
R165	317-0391-01	390	C	5	125 m	
R301	311-0850-00	15 k	CP	20	250 m	
R302	315-0153-01	15 k	C	5	250 m	
R303	301-0515-01	5.1 M	C	5	500 m	
R304	301-0515-01	5.1 M	C	5	500 m	
R305	301-0515-01	5.1 M	C	5	500 m	
R306	301-0225-01	2.2 M	C	5	500 m	
R307	301-0225-01	2.2 M	C	5	500 m	
R308	317-0103-01	10 k	C	5	125 m	
R309	317-0221-01	220	C	5	125 m	
R310	317-0221-01	220	C	5	125 m	
R311	317-0124-01	120 k	C	5	125 m	
R312	317-0331-01	330	C	5	125 m	
R313	317-0102-01	1 k	C	5	125 m	
R314	307-0184-00	15 k	MO	5	1.5	
R315	317-0330-01	33	C	5	125 m	606301
R316	317-0184-01	180 k	C	5	125 m	
R317	311-0910-00	2.2 M	CP	20	250 m	
R318	317-0273-01	27 k	C	5	125 m	
R319	301-0915-02	9.1 M	C	5	500 m	
R321	301-0915-02	9.1 M	C	5	500 m	
R322	301-0915-02	9.1 M	C	5	500 m	
R323	317-0103-01	10 k	C	5	125 m	
R324	315-0684-01	680 k	C	5	250 m	
R325	301-0395-01	3.9 M	C	5	500 m	
R326	301-0395-01	3.9 M	C	5	500 m	
R327	311-1347-01	2.5 M	CP	20	250 m	
R328	311-1544-00	5 k	CP	20	250 m	
R329	317-0333-01	33 k	C	5	125 m	
R331	317-0273-01	27 k	C	5	125 m	
R332	311-0765-00	100 k	CP	20	250 m	
R333	311-1543-00	100 k	C	20	250 m	
R334	317-0104-01	100 k	C	5	125 m	
R335	317-0394-01	390 k	C	5	125 m	
R351	311-1543-00	100 k	C	20	250 m	
R352	317-0393-01	39 k	C	5	125 m	

CIR REF	PART NUMBER	VALUE Ohms	DESCRIPTION			Eff. Ser.No.
			TYPE	TOL %	RATING W	
R353	317-0223-01	22 k	C	5	125 m	
R354	317-0680-01	68	C	5	125 m	
R355	317-0103-01	10 k	C	5	125 m	
R356	317-0393-01	39 k	C	5	125 m	
R357	317-0103-01	10 k	C	5	125 m	
R358	317-0333-01	33 k	C	5	125 m	
R359	317-0562-01	5.6 k	C	5	125 m	
R361	317-0821-01	820	C	5	125 m	
R362	317-0562-01	5.6 k	C	5	125 m	
R363	317-0100-01	10	C	5	125 m	
R402	315-0683-02	68 k	C	5	250 m	
R403	315-0562-02	5.6 k	C	5	250 m	
R404	317-0223-01	22 k	C	5	125 m	
R405	308-0725-00	2.7	WW	10	1	
R406	308-0784-00	2.2	WW	10	1	606345
R407	308-0726-00	1.5	WW	10	1	
R408	317-0274-01	270 k	C	5	125 m	
R409	317-0100-01	10	C	5	125 m	
R410	317-0471-01	470	C	5	125 m	
R411	317-0332-01	3.3 k	C	5	125 m	
R412	317-0334-01	330 k	C	5	125 m	
R413	317-0472-01	4.7 k	C	5	125 m	
R414	315-0472-02	4.7 k	C	5	250 m	
R415	307-0144-00	10 k	MO	5	1.5	
R416	317-0562-01	5.6 k	C	5	125 m	
R417	317-0103-01	10 k	C	5	125 m	
R418	317-0822-01	8.2 k	C	5	125 m	
R419	315-0183-01	18 k	C	5	250 m	
R420	317-0101-01	100	C	5	125 m	
R421	317-0104-01	100 k	C	5	125 m	
R422	317-0683-01	68 k	C	5	125 m	
R423	317-0103-01	10 k	C	5	125 m	
R424	321-0296-48	11.8 k	MF	1	125 m	
R425	317-0101-01	100	C	5	125 m	
R426	321-0298-48	12.4 k	MF	1	125 m	
R427	321-0871-48	6.8 k	MF	1	125 m	
R428	311-1419-00	1.5 k	WW	10	1	
R429	321-1313-48	18 k	MF	1	125 m	
R431	315-0473-02	47 k	C	5	250 m	
R432	321-0351-48	44.2 k	MF	1	125 m	
R433	317-0472-01	4.7 k	C	5	125 m	
R434	321-0289-48	10 k	MF	1	125 m	
R435	307-0427-00	2.2	C	5	125 m	
R801	317-0182-01	1.8 k	C	5	125 m	
R802	317-0182-01	1.8 k	C	5	125 m	
R803	317-0182-01	1.8 k	C	5	125 m	
R804	317-0182-01	1.8 k	C	5	125 m	
R805	311-1449-00	4.7 k	CP	20	75 m	
R806	317-0271-01	270	C	5	125 m	
R807	311-1449-00	4.7 k	CP	20	75 m	
R808	317-0271-01	270	C	5	125 m	
R809	317-0820-01	82	C	5	125 m	
R811	317-0621-01	620	C	5	125 m	
R812	317-0820-01	82	C	5	125 m	
R813	317-0820-01	82	C	5	125 m	
R814	317-0621-01	620	C	5	125 m	



CIR REF	PART NUMBER	VALUE Ohms	DESCRIPTION			Eff. Ser.No.
			TYPE	TOL %	RATING W	
R815	317-0820-01	82	C	5	125 m	
R816	317-0561-01	560	C	5	125 m	
R817	317-0101-01	100	C	5	125 m	
R818	317-0101-01	100	C	5	125 m	
R819	317-0561-01	560	C	5	125 m	
R821	317-0561-01	560	C	5	125 m	
R822	317-0101-01	100	C	5	125 m	
R823	317-0101-01	100	C	5	125 m	
R824	317-0561-01	560	C	5	125 m	
R825	317-0391-01	390	C	5	125 m	
R826	317-0391-01	390	C	5	125 m	
R827	317-0391-01	390	C	5	125 m	
R828	317-0391-01	390	C	5	125 m	
R832	317-0821-01	820	C	5	125 m	
R833	317-0821-01	820	C	5	125 m	
R834	317-0182-01	1.8 k	C	5	125 m	
R835	317-0182-01	1.8 k	C	5	125 m	
R836	317-0152-01	1.5 k	C	5	125 m	
R837	317-0152-01	1.5 k	C	5	125 m	
R838	317-0103-01	10 k	C	5	125 m	
R839	317-0152-01	1.5 k	C	5	125 m	
R841	311-1447-00	470	CP	20	75 m	
R842	317-0184-01	180 k	C	5	125 m	
R843	302-0271-01	270	C	10	500 m	
R844	317-0823-01	82 k	C	5	125 m	
R845	303-0561-00	560	C	5	1	
R846	303-0561-00	560	C	5	1	
R847	303-0561-00	560	C	5	1	
R848	303-0561-00	560	C	5	1	
R849	311-1446-00	220	CP	20	75 m	
R851	311-1446-00	220	CP	20	75 m	
R852	317-0103-01	10 k	C	5	125 m	
R853	317-0223-01	22 k	C	5	125 m	
R854	317-0391-01	390	C	5	125 m	
R855	317-0223-01	22 k	C	5	125 m	
R856	317-0432-01	4.3 k	C	5	125 m	
R857	317-0432-01	4.3 k	C	5	125 m	
R858	317-0560-01	56	C	5	125 m	
R859	317-0560-01	56	C	5	125 m	
R861	307-0284-00	540	MO	5	3.25	
R862	307-0420-00	1 k	MO	5	5	
R863	307-0420-00	1 k	MO	5	5	
R864	307-0420-00	1 k	MO	5	5	
R865	307-0420-00	1 k	MO	5	5	
R866	307-0318-00	330	MO	5	1.5	
R867	307-0318-00	330	MO	5	1.5	
R868	317-0104-01	100 k	C	5	125 m	
R869	311-1472-00	100	C	20	500 m	
R871	311-1472-00	100	C	20	500 m	
R872	317-0820-01	82	C	5	125 m	
R873	317-0820-01	82	C	5	125 m	
R1001	301-0685-02	6.8 M	C	5	500 m	
R1002	317-0105-01	1 M	C	5	125 m	
R1003	317-0124-01	120 k	C	5	125 m	
R1004	317-0103-01	10 k	C	5	125 m	
R1005	317-0472-01	4.7 k	C	5	125 m	

CIR REF	PART NUMBER	VALUE Ohms	DESCRIPTION			Eff. Ser.No.
			TYPE	TOL %	RATING W	
R1006	317-0153-01	15 k	C	5	125 m	
R1007	317-0103-01	10 k	C	5	125 m	
R1008	317-0103-01	10 k	C	5	125 m	
R1009	317-0224-01	220 k	C	5	125 m	
R1011	317-0223-01	22 k	C	5	125 m	
R1012	311-0750-00	22 k	CP	20	250 m	
R1013	317-0223-01	22 k	C	5	125 m	
R1014	317-0823-01	82 k	C	5	125 m	
R1015	317-0223-01	22 k	C	5	125 m	
R1016	317-0223-01	22 k	C	5	125 m	
R1017	311-0735-00	10 k	CP	20	250 m	
R1019	311-0735-00	10 k	CP	20	250 m	60650
R1021	317-0573-01	51 k	C	5	125 m	60650
R1022	317-0103-01	10 k	C	5	125 m	
R1023	317-0224-01	220 k	C	5	125 m	
R1024	317-0225-01	2.2 M	C	5	125 m	60650
R1025	317-0184-01	180 k	C	5	125 m	
R1026	317-0472-01	4.7 k	C	5	125 m	
*R1028	317-1676-00	100 k	CV	20	250 m	60650
R1029	317-0223-01	22 k	C	5	125 m	
R1031	317-0102-01	1 k	C	5	125 m	
R1032	317-0273-01	27 k	C	5	125 m	
R1033	317-0225-01	2.2 M	C	5	125 m	
R1034	317-0105-01	1 M	C	5	125 m	
R1035	317-0223-01	22 k	C	5	125 m	
R1036	317-0223-01	22 k	C	5	125 m	
R1037	317-0154-01	150 k	C	5	125 m	
R1038	317-0105-01	1 M	C	5	125 m	
R1039	317-0154-01	150 k	C	5	125 m	
R1041	317-0223-01	22 k	C	5	125 m	
R1042	307-0136-00	18 k	MO	5	1.5	
R1043	317-0563-01	56 k	C	5	125 m	
R1044	317-0244-01	240 k	C	5	125 m	
R1045	317-0473-01	47 k	C	5	125 m	
R1046	317-0682-01	6.8 k	C	5	125 m	
R1047	311-0750-00	22 k	CP	20	250 m	
R1048	317-0153-01	15 k	C	5	125 m	
R1049	317-0102-01	1 k	C	5	125 m	606152
R1051	317-0473-01	47 k	C	5	125 m	
R1052	317-0473-01	47 k	C	5	125 m	
R1053	317-0393-01	39 k	C	5	125 m	
R1054	317-0273-01	27 k	C	5	125 m	
R1055	311-0765-00	100 k	CP	20	250 m	
R1056	311-0735-00	10 k	CP	20	250 m	
R1057	317-0123-01	12 k	C	5	125 m	
R1058	317-0445-01	56 k	C	5	125 m	606501
R1059	317-0183-01	18 k	C	5	125 m	606501
R1061	317-0682-01	6.8 k	C	5	125 m	606501
CIR REF	PART NUMBER	DESCRIPTION	Eff. Ser.No.			
S1	260-1566-00	Push button Trig Mode				
S2	260-1567-00	Push button Sweep				
S3	260-1565-00	Push button Trace Locate				
S4	260-1563-00	Push button Trig Source				
S101	311-1546-00	Push-Pull x 5 (with R105)				
S151	260-1562-00	Rot. 22 Pos. T/DIV				

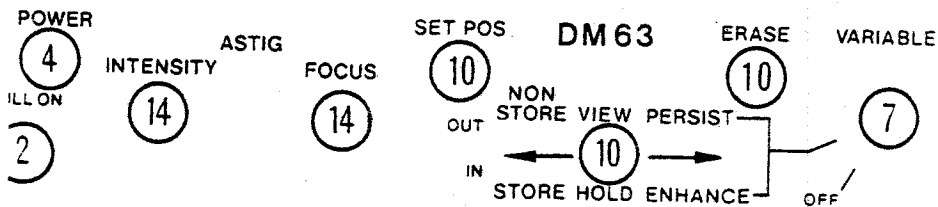
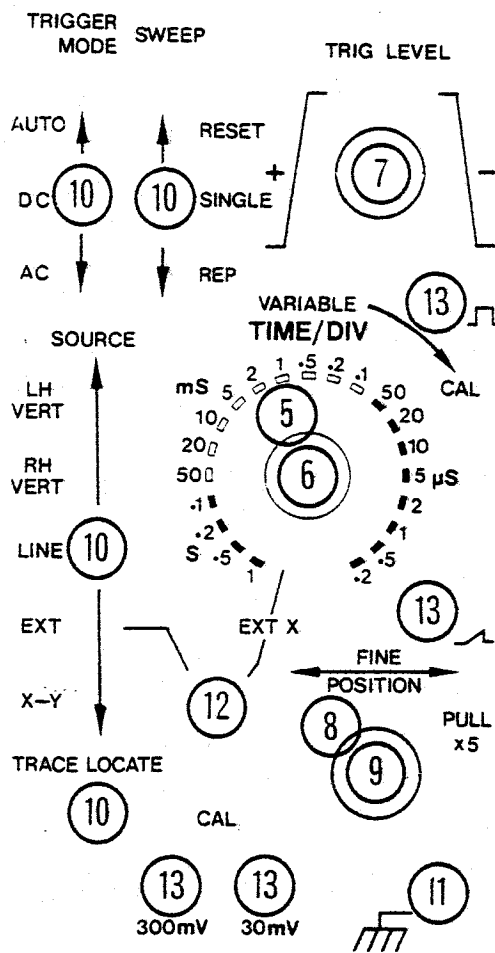
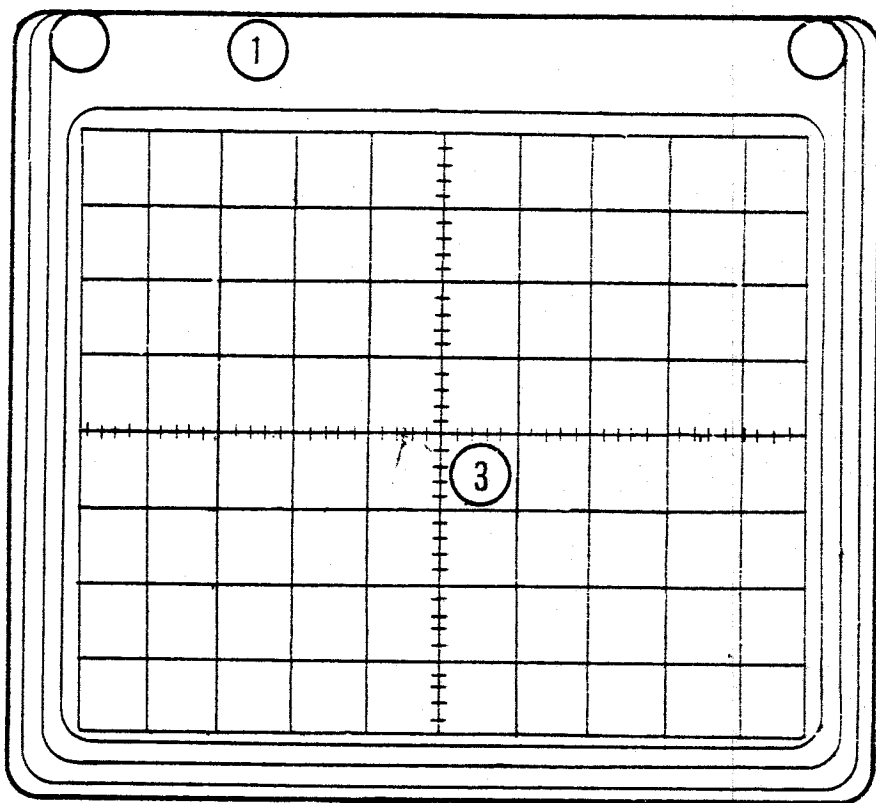
\*With S1006



## ASSEMBLIES

ASSEMBLY	PART NUMBER	INCLUDES
Display Unit Module	640-0502-00	Pt.Nos. 426-1069-00, 644-0046-00; 626-0449-00, 670-3053-00 and 670-3357-00. Cir.ref. LP401, R327, R328, R333, R351, R1028 and SK351.
EHT Unit	670-3053-00	Pt.No. 650-0021-00. Cir.ref. PC161, PC163, D303, D304 and T301.
Quintupler	650-0021-00	Sealed Unit.
PC161 Wired	670-3039-01	Cir.ref. C351 to C353, D351, D352, R352 to R359, R361 to R363 and TR351 to TR353.
PC163 Wired EHT	670-3041-01	Cir.ref. C300 to C309, C311 to C314, D301, D302, L301, R301 to R319, R321 to R326, R329, R331, R332, R335, TH301 and TR301 to TR303.
Shield CRT	626-0449-00	Pt.Nos. 337-2001-00, 354-0420-00.
PC176 Wired Storage CCT	670-3357-00	Cir.ref. C1001 to C1009, C1011 to C1019, C1021 to C1026, D100 to D1009, D1011 to D1019, D1021, D1022, R1001 to R1009, R1011 to R1019, R1021 to R1027, R1029, R1031 to R1039, R1041 to R1049, R1051 to R1057, S1001 to S1005, TR1001 to TR1009, TR1011 to TR1017.
Timebase Unit	644-0046-00	Pt.No. 262-0972-00 Cir.ref. PC158, D13, R41, R61, R105, R109, S2, SK1, SK2, SK3, SK101 and SK102.
PC158 Wired Trig & Sweep Gen. "X" Amp and Cal.	670-3036-01	Cir.ref. C2 to C9, C11 to C20, C22 to C26, C100 to C106, D1 to D9, D11, D12, D14 to D17, D19, D21 to D23, D101 to D105, R1 to R37, R39, R40, R42 to R49, R51 to R58, R62 to R69, R71, R73, R74, R76, R100 to R104, R106, R107, R111 to R114, R116, R117, R119, R121 to R129, ST, S3, S4, TR1 to TR4, TR101 to TR105.
Switch T/Div	262-0972-00	Cir.ref. C151 to C156, R151 to R159, R161 to R163 and S151.
Power Unit	620-0237-00	Pt.Nos. 426-1070-00 and 620-0238-00.
Power Supply	620-0238-00	Pt.No. 136-0315-00. Cir.ref. PC162, FS401, S401 and T401.
PC162 Wired	670-3040-00	Cir.ref. C401 to C409, C411 to C417, D401 to D409, D411 to D417, FS402, R402 to R417, R419 to R429, R431 to R435, SK401, TR401 to TR409, TR411 to TR416.
PC175 Wired Mother Board	670-3356-01	Cir.ref. C801 to C805, C807 to C809, C811 to C819, C821 to C825, D801 to D809, D811 to D815, R801 to R809, R811 to R819, R821 to R828, R832 to R839, R841 to R849, R851 to R859, R861 to R869, R871 to R873, SK801 to SK804.

For Service Manuals Contact  
**MAURITRON TECHNICAL SERVICES**  
 8 Cherry Tree Rd, Chinnor  
 Oxon OX9 4QY  
 Tel:- 01844-351694 Fax:- 01844-352554  
 Email:- enquiries@mauritron.co.uk



FRONT PANEL

# MECHANICAL

DESCRIPTION	PART NUMBER	LOCATION
Bezel	200-1579-00	1
Bush	358-0425-00	Display
Clip	344-0261-00	2
Clip	344-0245-00	Power Unit
Clip Fuse	344-0247-00	PC162
Clip Push On	344-0246-00	Power Unit
CRT Shield	337-2001-00	
CRT Rear Location	354-0420-00	
Connector CRT Neck	131-0645-00	
Connector Male BNC	131-0649-00	Accessory
Coupling Assy.	640-0030-00	2
Cover Cabinet	390-0277-00	
Cover Rear	200-1578-01	
Cover EHT	200-1374-00	
Eyelet	210-0735-00	PCB
Eyelet	210-0739-00	PCB
Filter	378-0819-00	3
Foot Lifting	348-0169-00	
Foot	348-0168-00	
Guide	351-0336-00	PC175
Grommet 3/8" i/d	348-0160-00	EHT
Grommet 1/4" i/d	348-0161-00	EHT
Handle	367-0168-00	
Holder Bulb	136-0311-00	4
Holder Fuse	352-0153-00	Power Unit
Holder Fuse	352-0152-00	PC162
Holder Transistor (TO-5)	136-0183-00	PCB
Holder Transistor (TO-18)	136-0343-00	PCB
Holder Valve	136-0293-00	PC162
Insulated Ceramic Beads	361-0254-00	PCB
Knob	366-1404-00	2
Knob, Grey/Black	366-1387-00	5
Knob, Red	366-1266-01	6
Knob, Grey/Black	366-1266-00	14
Knob, Grey/Black	366-1239-02	7
Knob, Grey/Black	366-1254-01	8
Knob, Red	366-1255-00	9
Knob, Push Button	368-1403-00	10
Key Allen 1.5 mm A/F	033-0674-00	Accessory
Key Polarizing	131-1364-00	Socket Edge Conn.
Latch	105-0348-00	Cover Cabinet
Lug Solder 3/8" i/d	210-0275-00	Display & Timebase Unit
Lug Pillar	210-0291-00	EHT
Nut Terminal	220-0647-00	11
Nut Chrome	220-0527-00	5, 7 & 9
PDA Connector Body	204-0563-00	
PDA Connector Bush	358-0531-00	
Power Cord UK	161-0084-00	
Power Cord USA	161-0084-01	
Post Terminal	129-0374-00	11
Packaging	004-1142-00	Accessory
Quintupler	650-0021-00	EHT
Screw M3 x 3 mm	213-0248-00	5 to 9 & 14
Spacer	361-0479-00	
Spacer	385-0209-00	Display
Spacer	361-0575-00	Display
Spacer	385-0215-00	PC161
Spacer	361-0198-00	PC163
Spacer	385-0206-00	PC158
Socket	131-1268-00	13
Socket BNC	131-0650-01	Z Mod & 12
Socket Edge Conn. 8 way	131-1444-00	PC175
Socket Edge Conn. 16 way	131-1282-01	PC175
Socket Edge Conn. 16 way	131-1443-00	PC175
Socket IC 16 pin	136-0561-00	
Socket IC 10 pin	136-0241-00	
Tape PVC Adhesive	253-0108-00	CRT
Voltage Selector Plug	134-0102-00	Rear
Washer	210-1075-00	Foot

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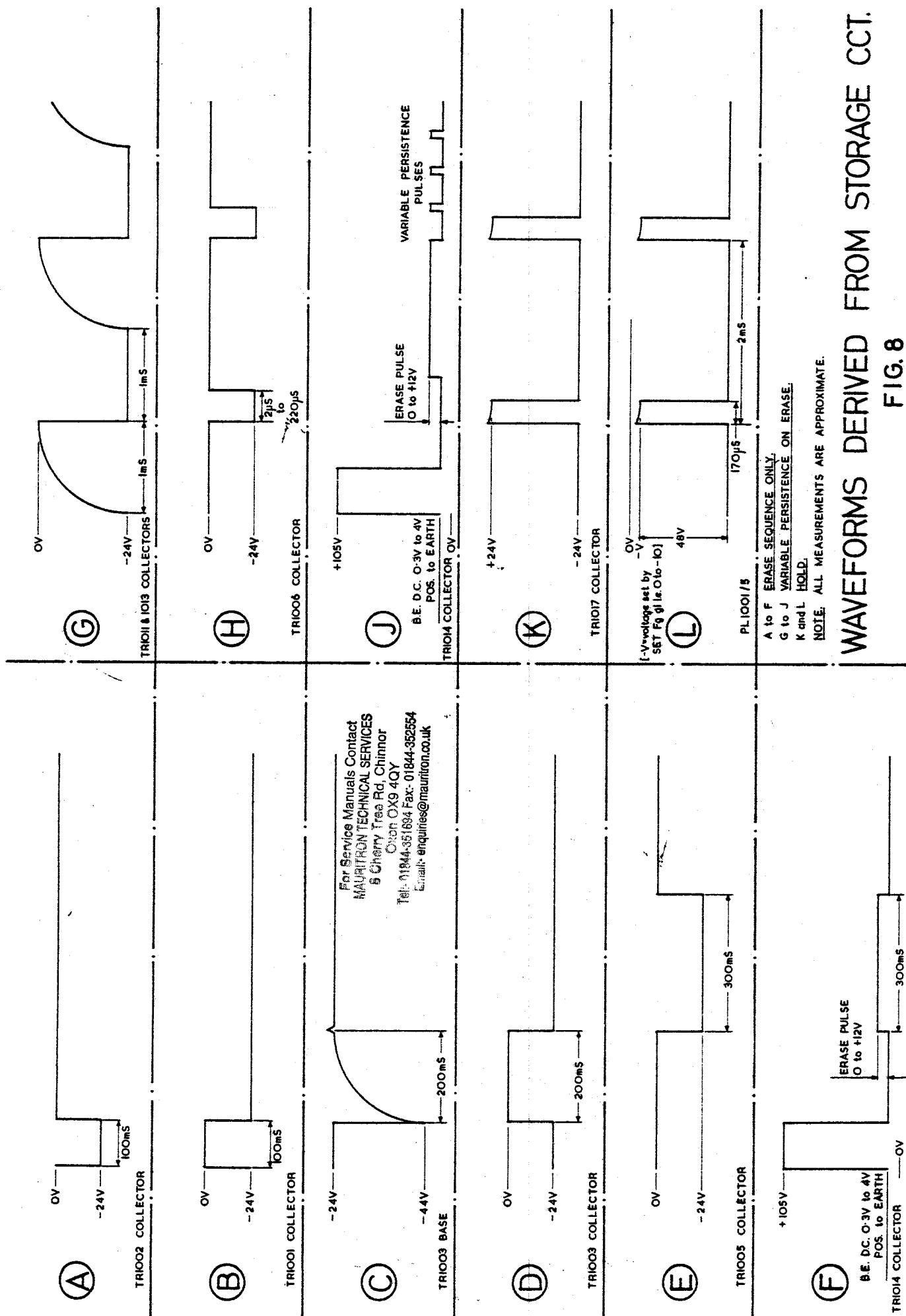
# CHAPTER 6

## CIRCUIT DIAGRAMS AND PC BOARDS

To minimize the risk of misinterpretation of component values on circuit diagrams, the decimal point has been replaced by the multiplier or sub-multiplier of the basic unit. For instance, 2.2 megohms is shown as 2M2 and 1.8 picofarads is shown as 1p8.

To aid the reader further, in addition to the block Circuit Reference Table in Chapter 5.1, to locate a component in the circuit diagrams a table is provided at the top of each circuit diagram, in which the circuit reference will appear, where practicable, directly above the component being sought.

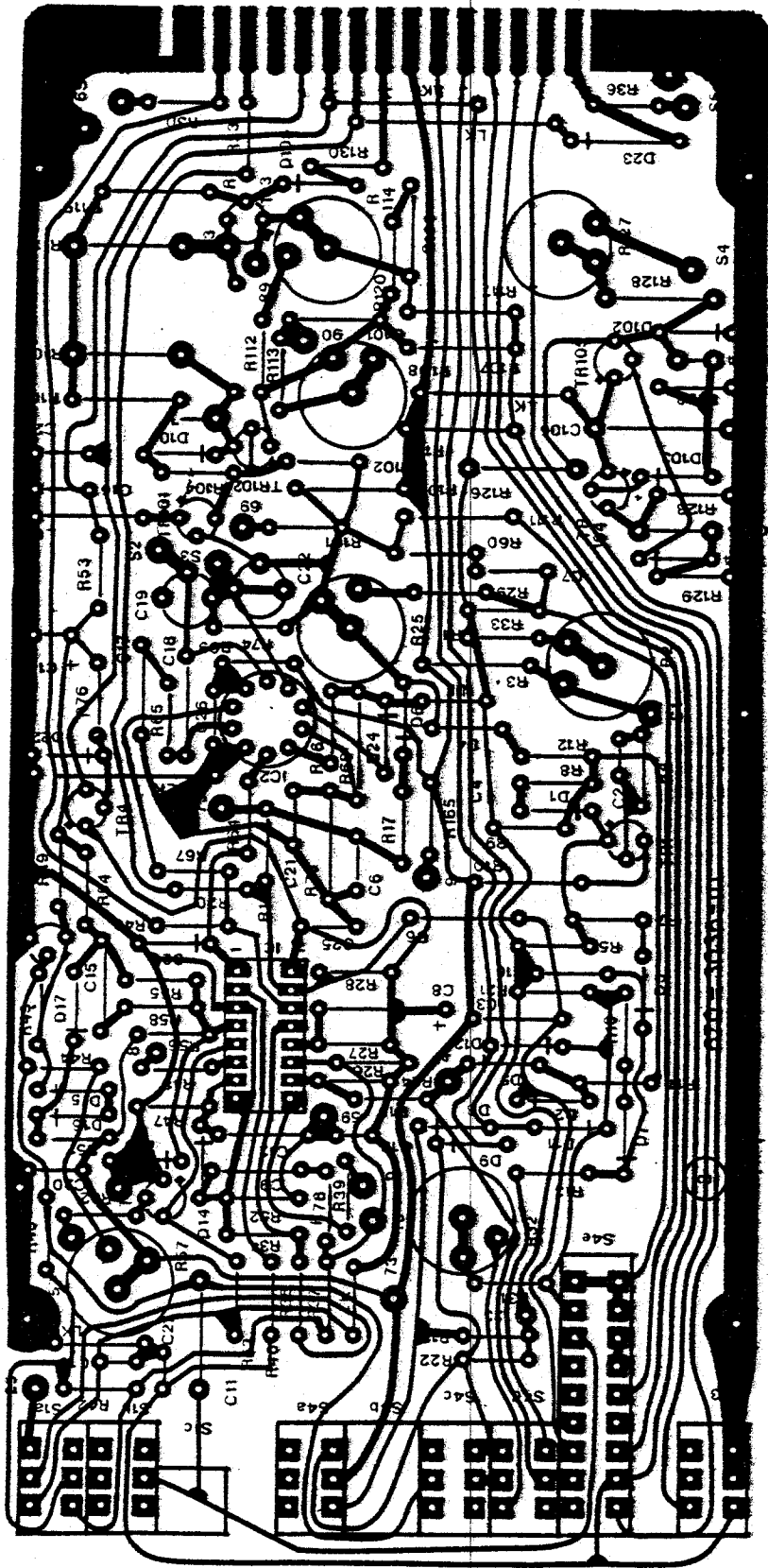
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A to F ERASE SEQUENCE ONLY.  
 G to J VARIABLE PERSISTENCE ON ERASE.  
 K and L HOLD.  
 NOTE: ALL MEASUREMENTS ARE APPROXIMATE.

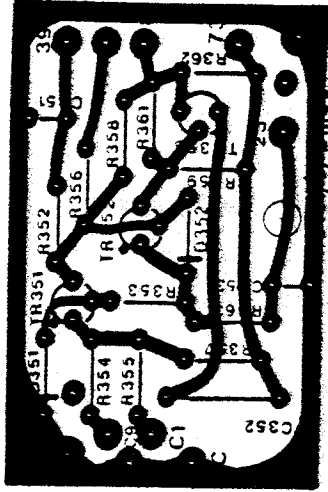
**WAVEFORMS DERIVED FROM STORAGE CCT. FIG. 8**



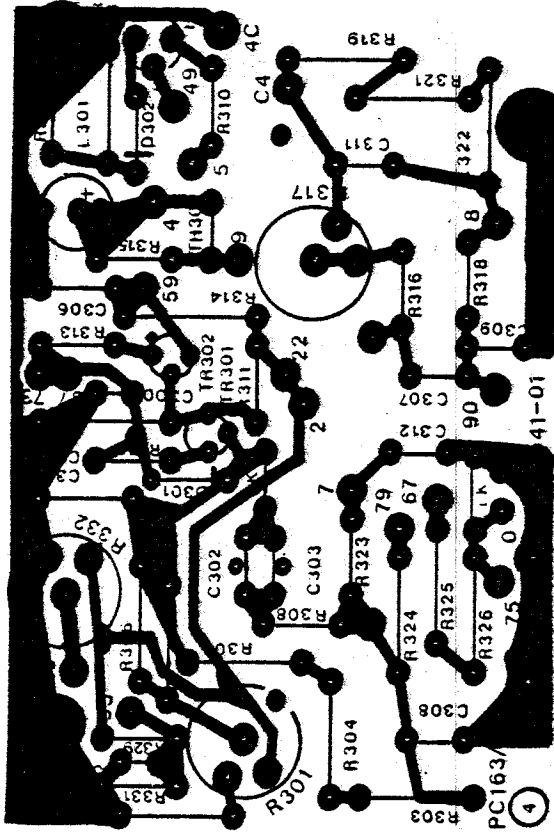
PRINTED CIRCUIT BOARD P.C.158

FIG.9





P.C. 161

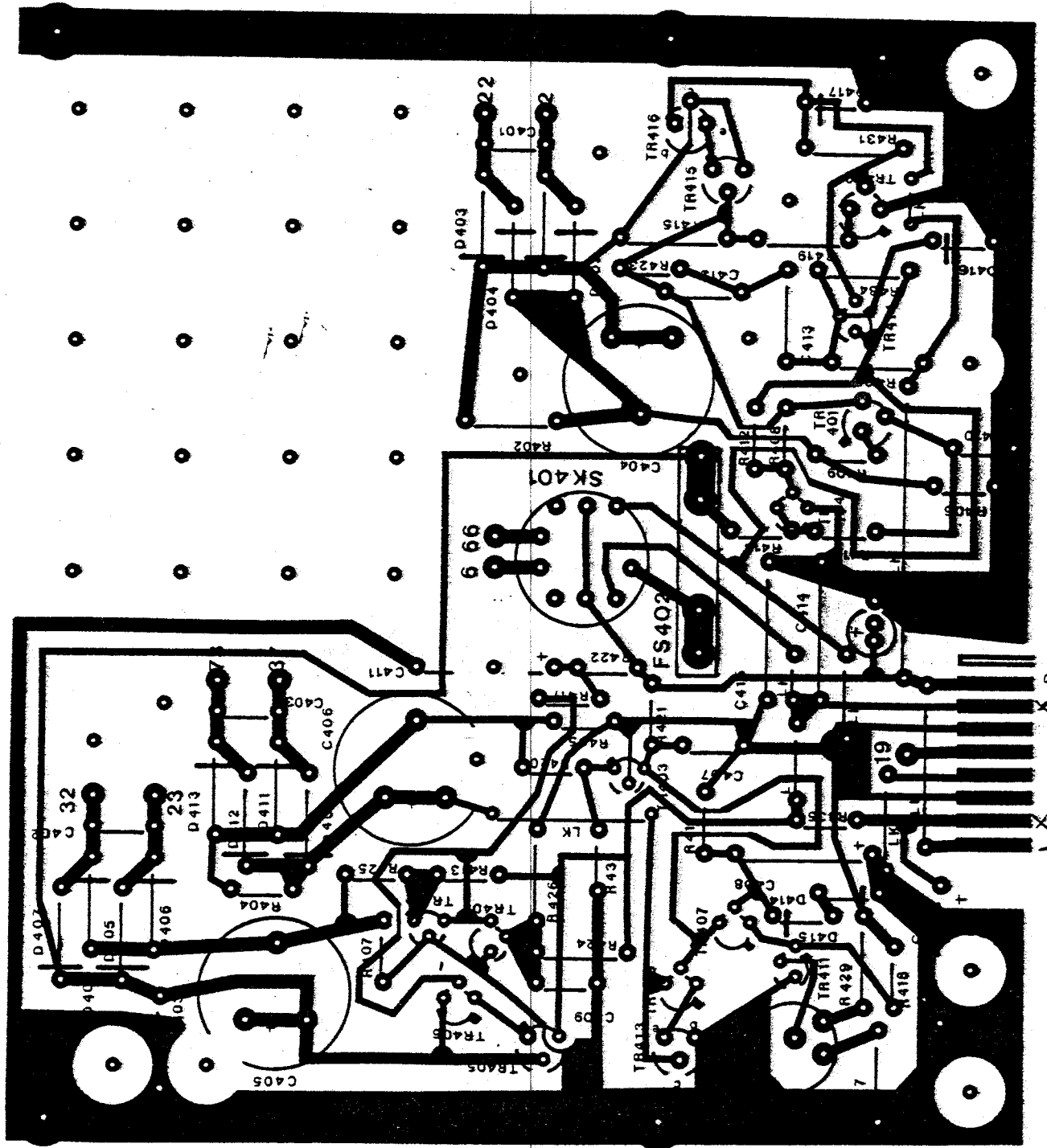


P.C. 163

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PRINTED CIRCUIT BOARDS

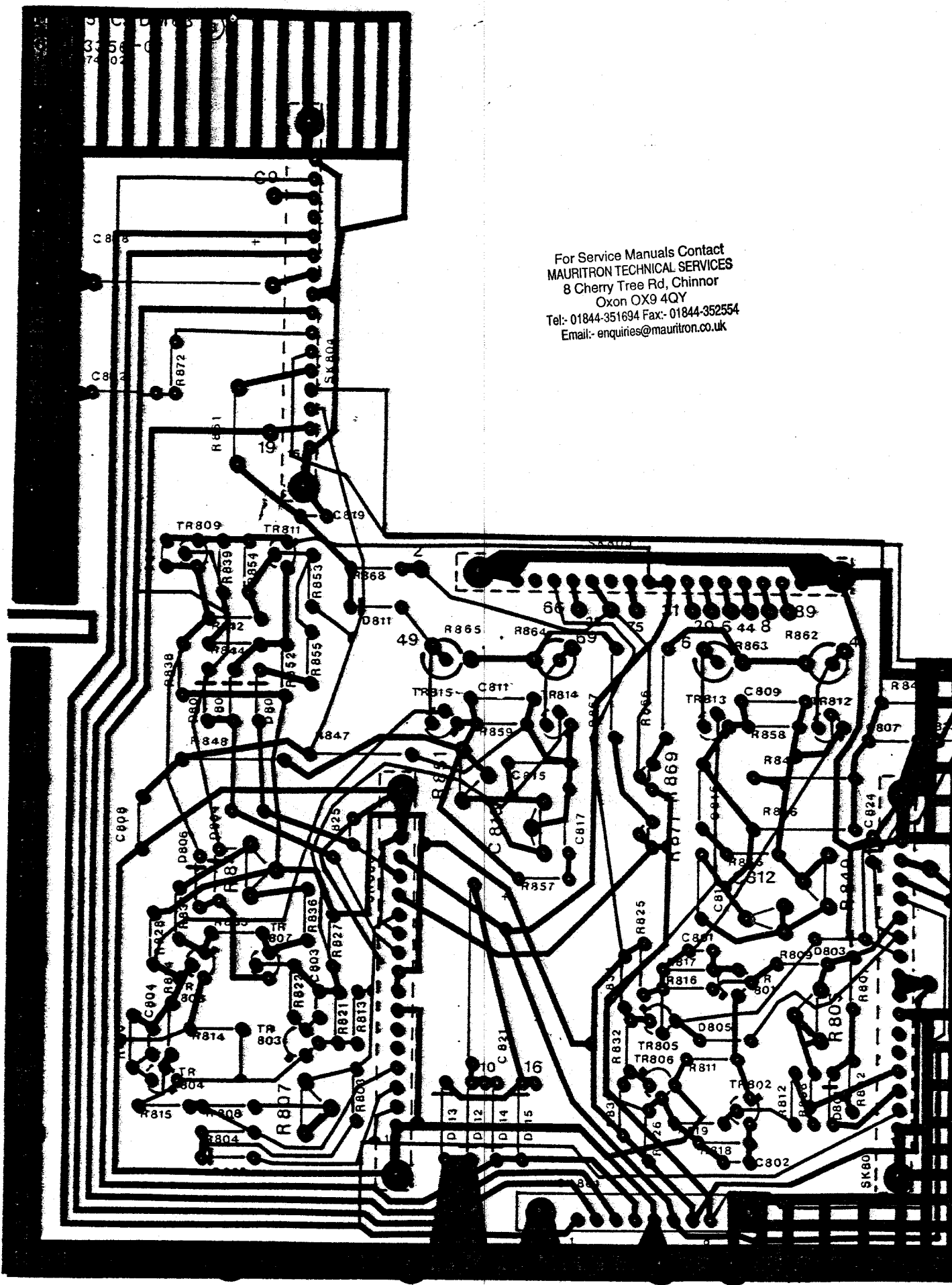
FIG.10



PRINTED CIRCUIT BOARD P.C.162

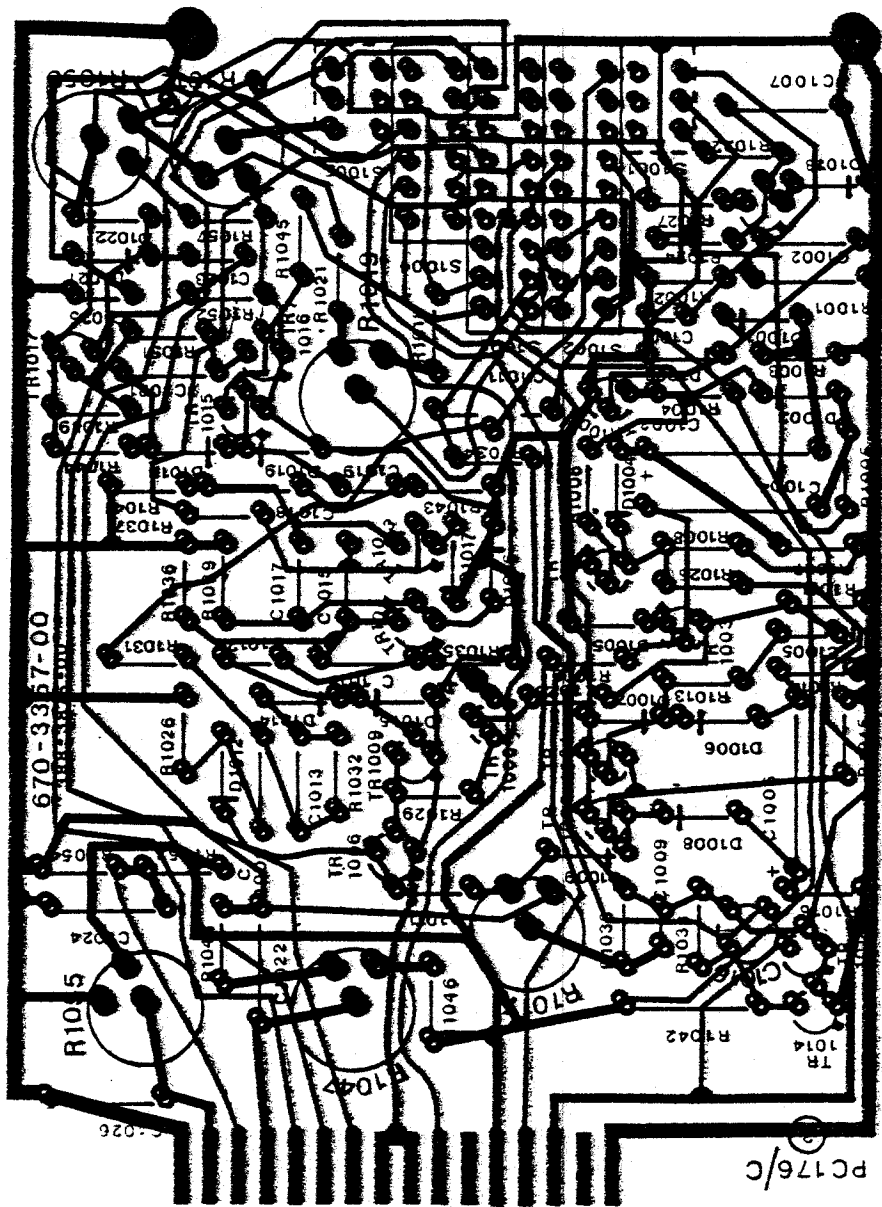
3356-0  
7402

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PRINTED CIRCUIT BOARD P.C.175

FIG.12



STORAGE CONTROL  
 PRINTED CIRCUIT BOARD PC.176

FIG. 13

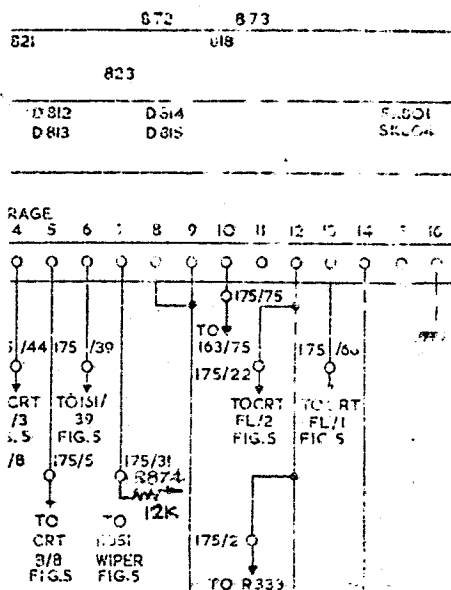
INSTRUMENT TYPE	ISSUE NO.	AMENDMENT LIST	DATE
Description of Amendment			Effective from Serial Number
(1) Page 5/2 Fig. 2  C5 ADD 285-0854-00 100p PS 2% 350V C15 CHANGE to read 205-0838-00 75p PS 2% 350V			25-6-78  729451 729451
(2) Page 5/3 Fig. 5  C1009 CHANGE to read 281-0800-00 3p9 CER n.25p 400V D353 ADD 152-0062-01 75V 1N911 SL 500mA			703901 607201
(3) Page 5/4 Fig. 6 & 7  D410 ADD 152-0339-00 50V 1N4001 SL 500mA D1020 ADD 152-0062-01 75V 1N911 SL 50mA			607201 607201
(4) Page 5/5  FS402 CHANGE to read 159-0077-00 250mA R45 CHANGE to read 317-0202-01			607151 729451
(5) Page 5/6 Fig. 5  R303 DELETE R304 CHANGE to read 307-0628-00 15M CM R305 DELETE R306 CHANGE to read 307-0537-00 1.1M CM R307 DELETE R317 CHANGE to read 311-2027-00 CMP 1W R319 CHANGE to read 307-0628-00 15M CM R321 DELETE R322 CHANGE to read 307-0627-00 12M CM R352 CHANGE to read 317-0477-00 36k R356 CHANGE to read 317-0363-00 39p R364 ADD 317-0101-01 100 C 5% 125m R410 CHANGE to read 317-0581-01 680 C 5% 125m		For Service Manuals Contact MAURITRON TECHNICAL SERVICES 8 Cherry Tree Rd, Chinnor Oxon OX9 4QY Tel:- 01844-351694 Fax:- 01844-352554 Email:- enquiries@mauritron.co.uk	729650 729650 729650 729650 704051 704051 607201 607201
(6) Page 5/7 Fig. 7  R874 ADD 317-0123-01 12% C 5% 125m R1021 CHANGE to read 317-0513-01  R1030 ADD 317-0224-01 220k CF 5% 125m			704051 Manual Correction  729451

# MANUAL AMENDMENT LIST

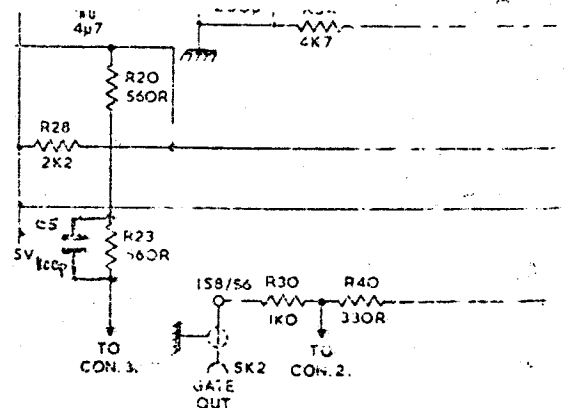
Manual Pt. No. 070-1736-00

INSTRUMENT TYPE	DM63	ISSUE NO.	3	AMENDMENT LIST	2	DATE	23-6-78
Description of Amendment							Effective from Serial Number
(7) Page 5/8 Fig. 2  TR2 CHANGE to read 151-0317-00 BC109C TR102 CHANGE to read 151-0525-00 ) TR103 CHANGE to read 151-0525-00 ) TR412 CHANGE to read 151-0525-00 ) TR1012 CHANGE to read PNP )							729451  Manual Correction
(8) Page 5/9  PC163 Wired CHANGE to read 670-3041-05 EdT CHANGE Cir ref R321 to read R322							729650
(9) Page 5/11  ADD Cover Elec moulded 200-2208-00 Location voltage selector. CHANGE Holder Fuse to read 352-C490-00 ) CHANGE Key Allen 1.5mm A/F 003-0674-00 )  ADD Screw M2 x 4mm chrome 213-0802-00 Location voltage selector. ) ADD Spacer Mounting 6BA 129-0706 00 Location voltage selector. )  ADD Washer Lock 6BA 210-1210-00 Location voltage selector. ) ADD Washer Plain 210-1290-00 Location voltage selector. )							711901  Manual Correction  711901  711901

(10) Fig. 1.

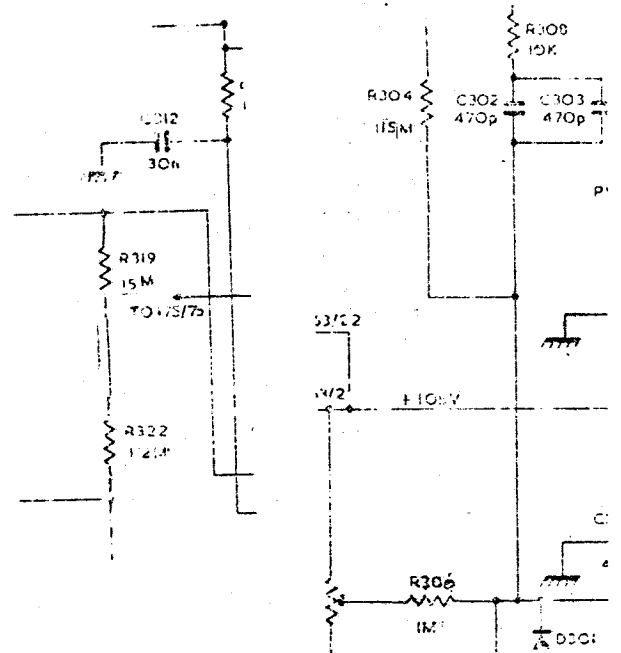
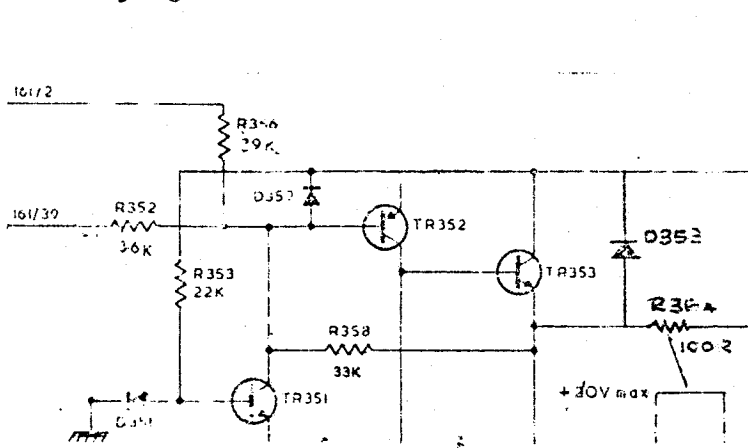


(11) Fig. 2



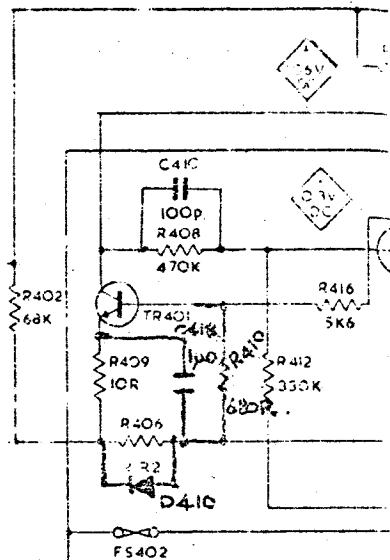
INSTRUMENT TYPE DM63	ISSUE NO. 3	AMENDMENT LIST 2	DATE 23-6-78
Description of Amendment			Effective from Serial Number

(12) Fig. 5

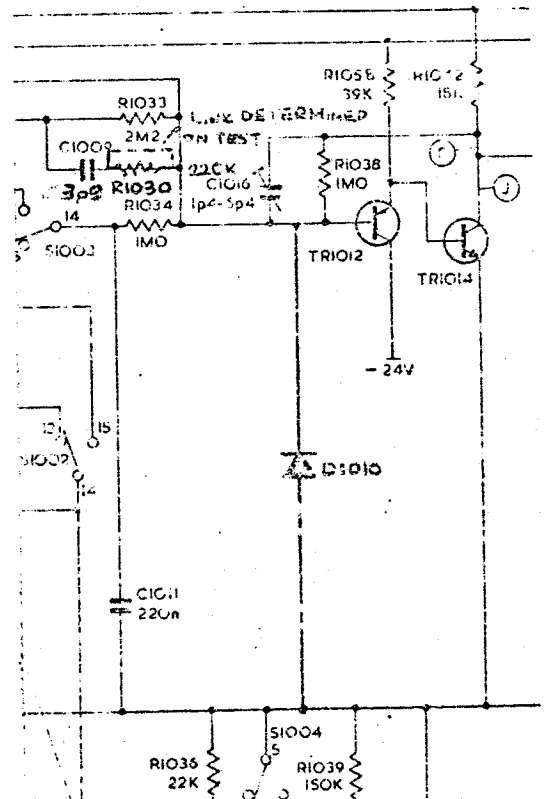


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(13) Fig. 6



(14) Fig. 7

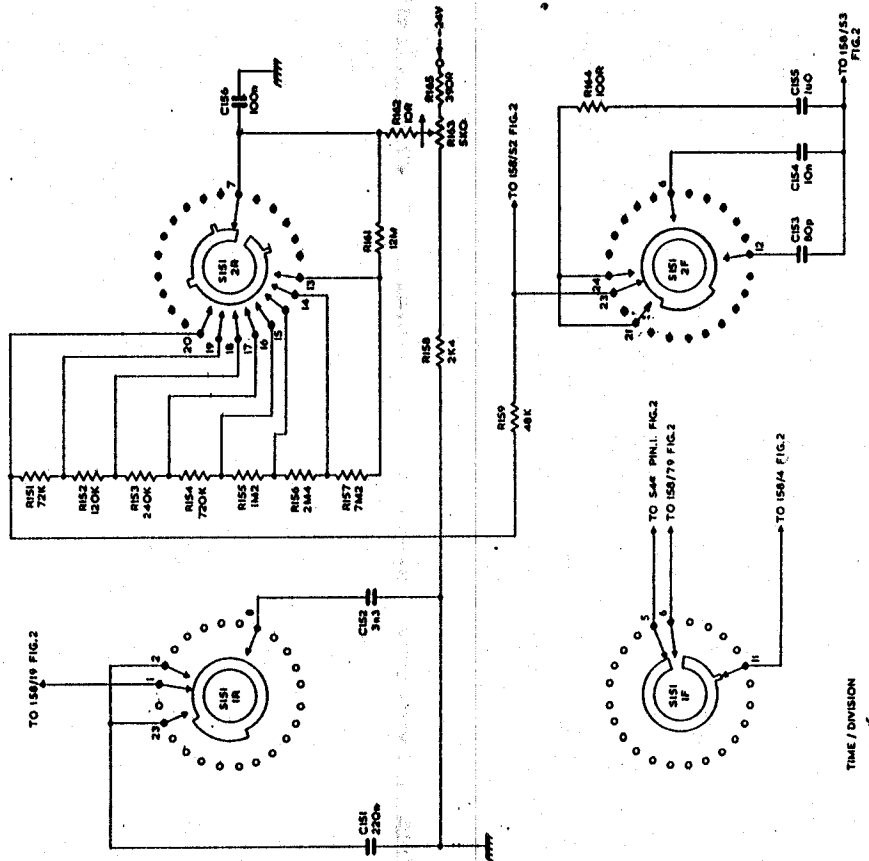








151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
S1S1														

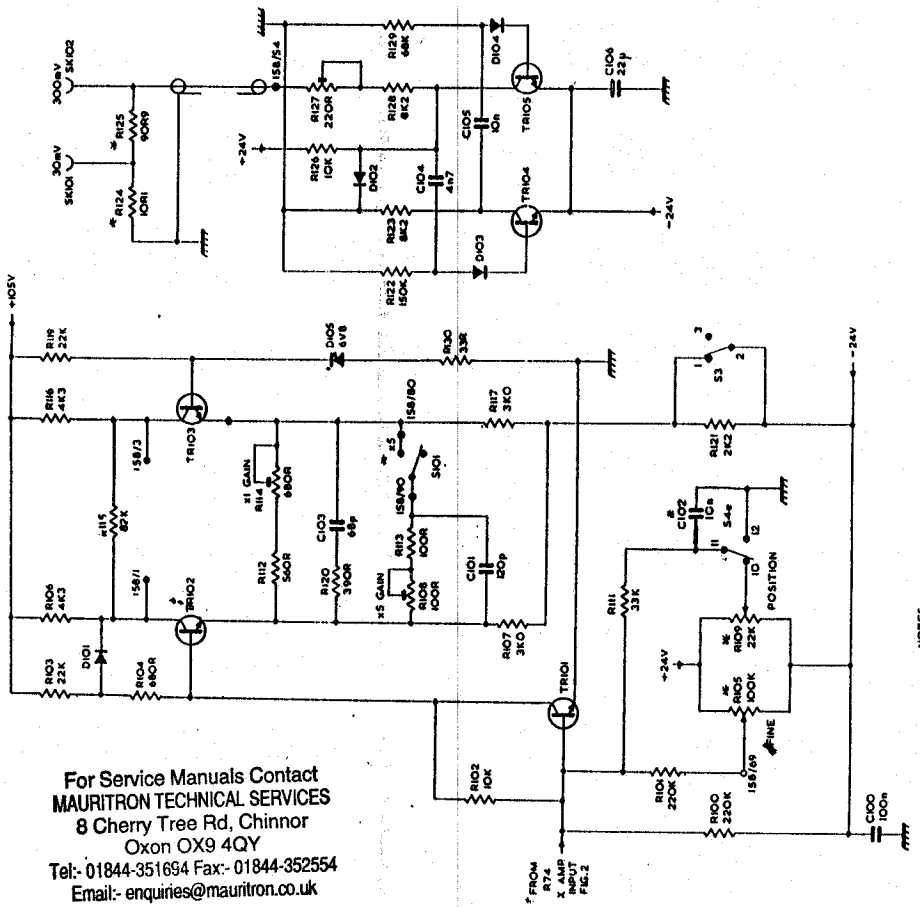


NOTES  
 1. SWITCH IS SHOWN IN FULLY ANTICLOCKWISE POSITION.  
 2. NUMBER OF POSITIONS 22.

TIME / DIV. SWITCH DM63  
 FIG.3.

100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
RESISTORS																				
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
CAPACITORS																				
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
MISC																				

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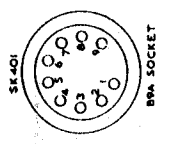
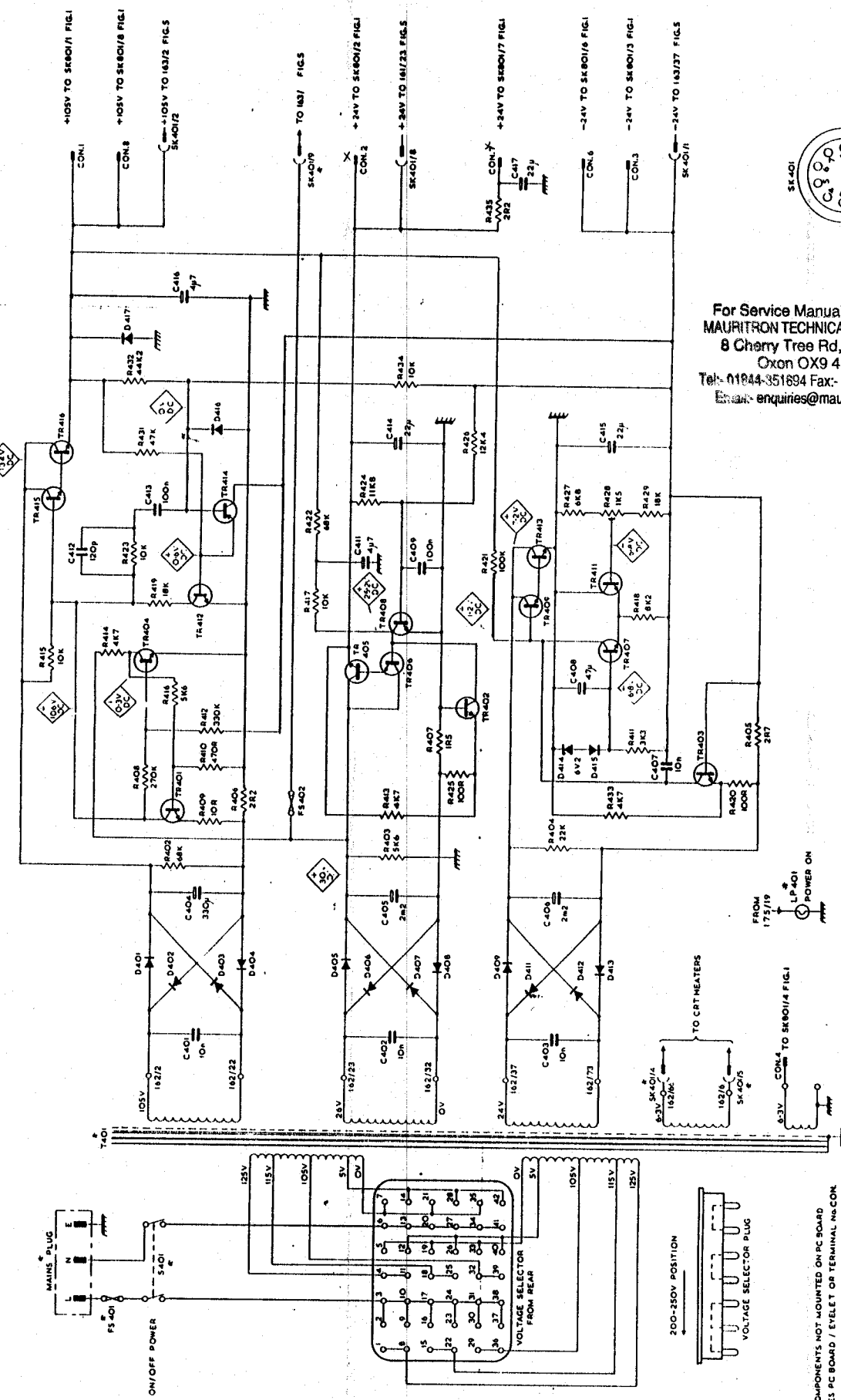


NOTES  
 1. \* DENOTES COMPONENTS NOT MOUNTED ON PC BOARD.  
 2. 158/PO DENOTES PC BOARD EYELET OR TERMINAL No. CONNECTION.

X AMPLIFIER — PC.158 — CALIBRATOR DM63  
 FIG.4



RESISTORS	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	424	425	426	427	428	429	430	431	432	433	434	435																																																																																								
CAPACITORS	D401	D402	D403	D404	D405	D406	D407	D408	D409	D410	D411	D412	D413	D414	D415	D416	D417																																																																																																				
MISC.	FS401	FS402	FS403	FS404	FS405	FS406	FS407	FS408	FS409	FS410	FS411	FS412	FS413	FS414	FS415	FS416	FS417	TR401	TR402	TR403	TR404	TR405	TR406	TR407	TR408	TR409	TR410	TR411	TR412	TR413	TR414	TR415	TR416	TR417	TR418	TR419	TR420	TR421	TR422	TR423	TR424	TR425	TR426	TR427	TR428	TR429	TR430	TR431	TR432	TR433	TR434	TR435	TR436	TR437	TR438	TR439	TR440	TR441	TR442	TR443	TR444	TR445	TR446	TR447	TR448	TR449	TR450	TR451	TR452	TR453	TR454	TR455	TR456	TR457	TR458	TR459	TR460	TR461	TR462	TR463	TR464	TR465	TR466	TR467	TR468	TR469	TR470	TR471	TR472	TR473	TR474	TR475	TR476	TR477	TR478	TR479	TR480	TR481	TR482	TR483	TR484	TR485	TR486	TR487	TR488	TR489	TR490	TR491	TR492	TR493	TR494	TR495	TR496	TR497	TR498	TR499	TR500

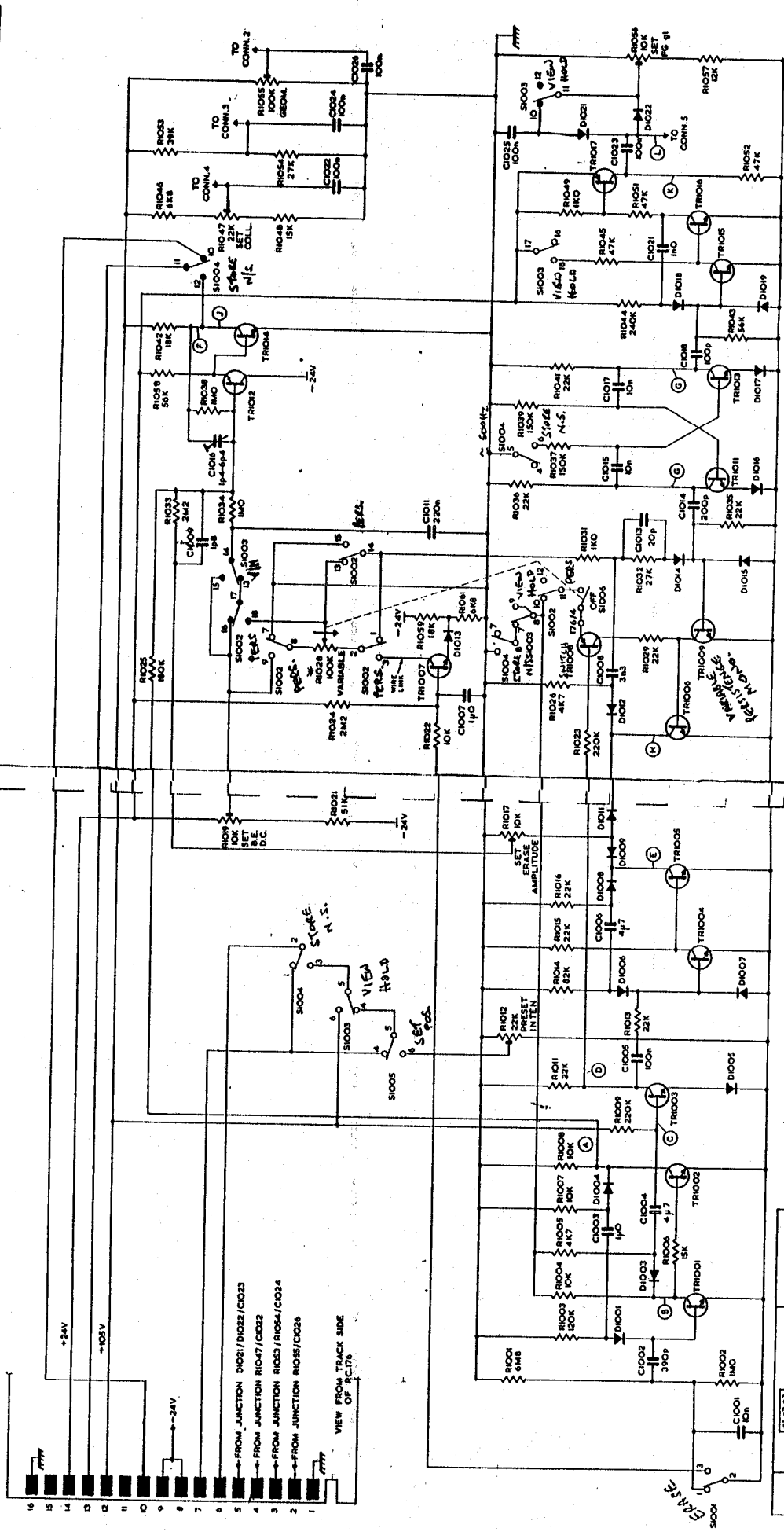


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POWER SUPPLY PC 162 — DM63 FIG. 6

NOTE:  
 1. L DENOTES COMPONENTS NOT MOUNTED ON PC BOARD  
 2. 162/22 DENOTES PC BOARD / EYELET OR TERMINAL NO.CON.

RESISTORS	1001	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	
	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	
CAPACITORS	1001	1002	1003	1004													
MISC.	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017
CONNECTOR	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017



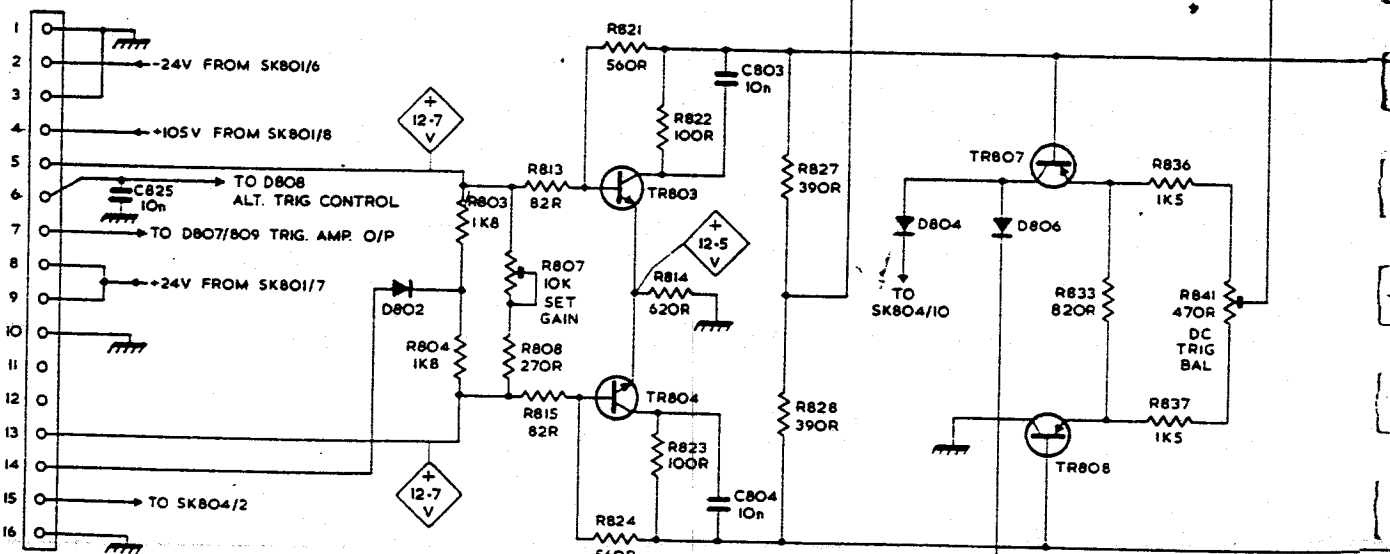
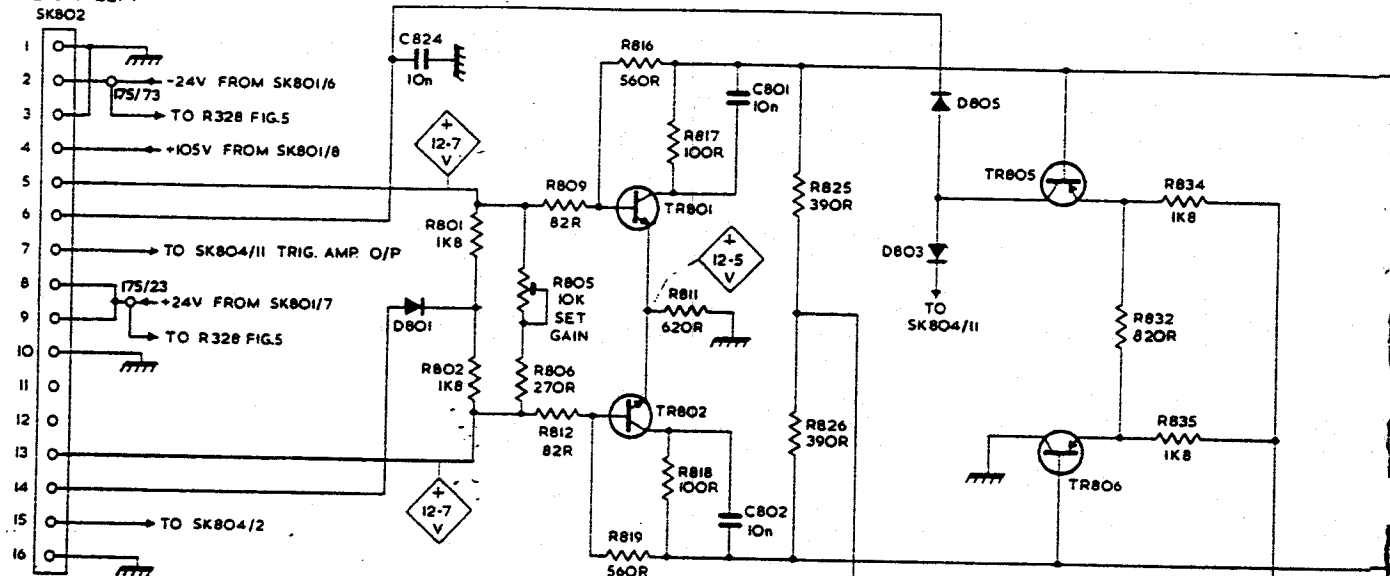
NOTES  
 1. D1014 DENOTES PC BOARD EYELET OR TERMINAL IN CONNECTOR  
 2. \* DENOTES COMPONENTS NOT MOUNTED ON PC BOARD.  
 3. SKETCH OF SWITCHES IS SHOWN LOOKING FROM COMPONENT SIDE OF PC.176.

1001	1002	1003	1004	1005
ERASE	PERSET/EMANCE	VIEW/HOLD	NON STORE/STORE	SET POSITION

STORAGE CIRCUIT—PC.176 DM63  
 FIG. 7

RESISTORS	801	805	809	816	817	825	832	834
	802	806	813	819	818	826	833	835
	803	807	812	821	822	827		836
	804	808	815	824	823	828		837
				811	814			
CAPACITORS						801		841
	825					802		
		824				803		
						804		
MISC.		D801		TR801			D803	TR805
SK802		D802		TR802			D804	TR806
SK803				TR803			D805	TR807
				TR804			D806	TR808

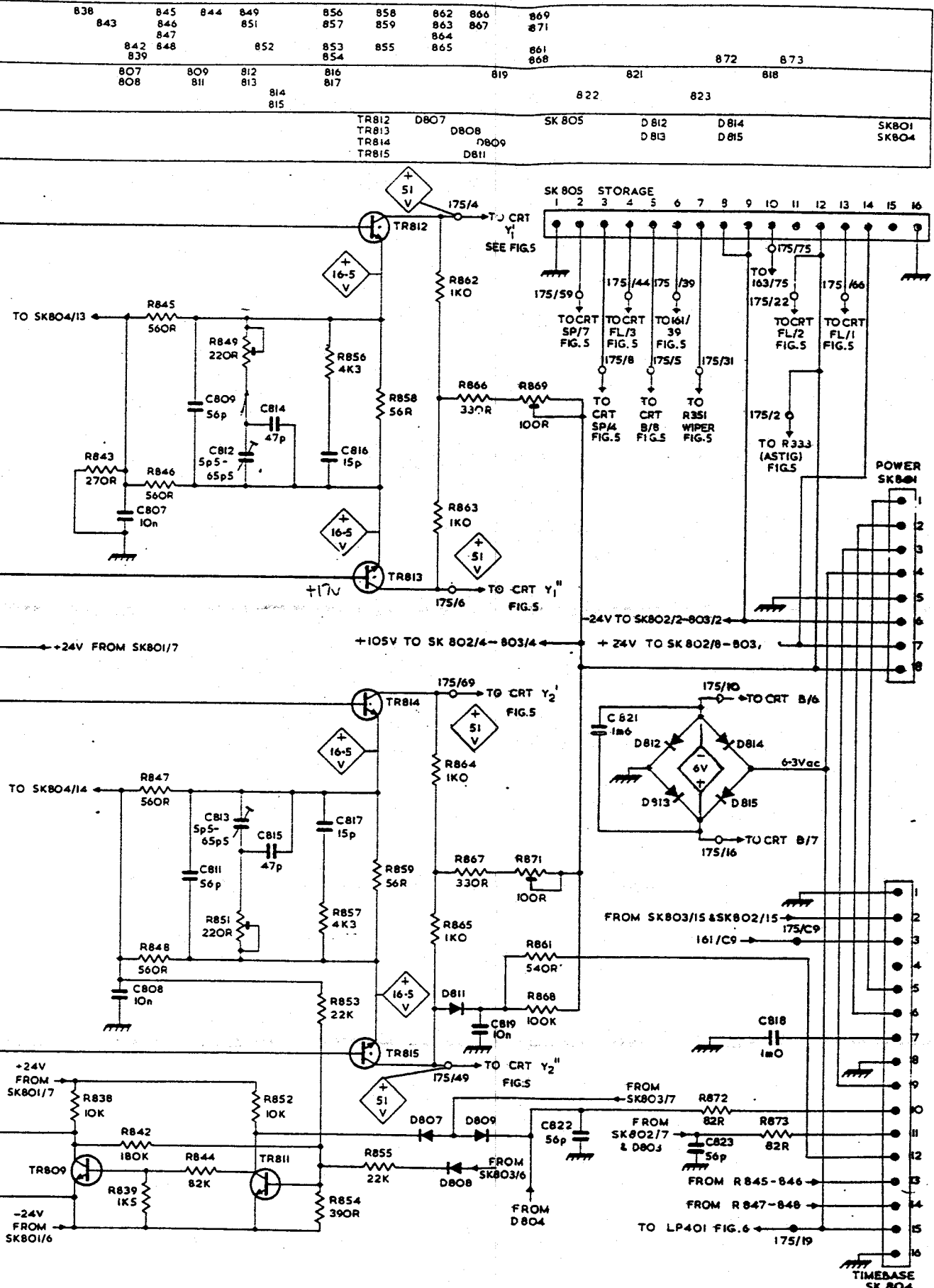
PLUG-IN LEFT  
SK802



PLUG IN RIGHT  
SK803

NOTES  
 1. \* DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.  
 2. 175/73 DENOTES P.C. BOARD/EYELET OR TERMINAL No. CONNECTION.

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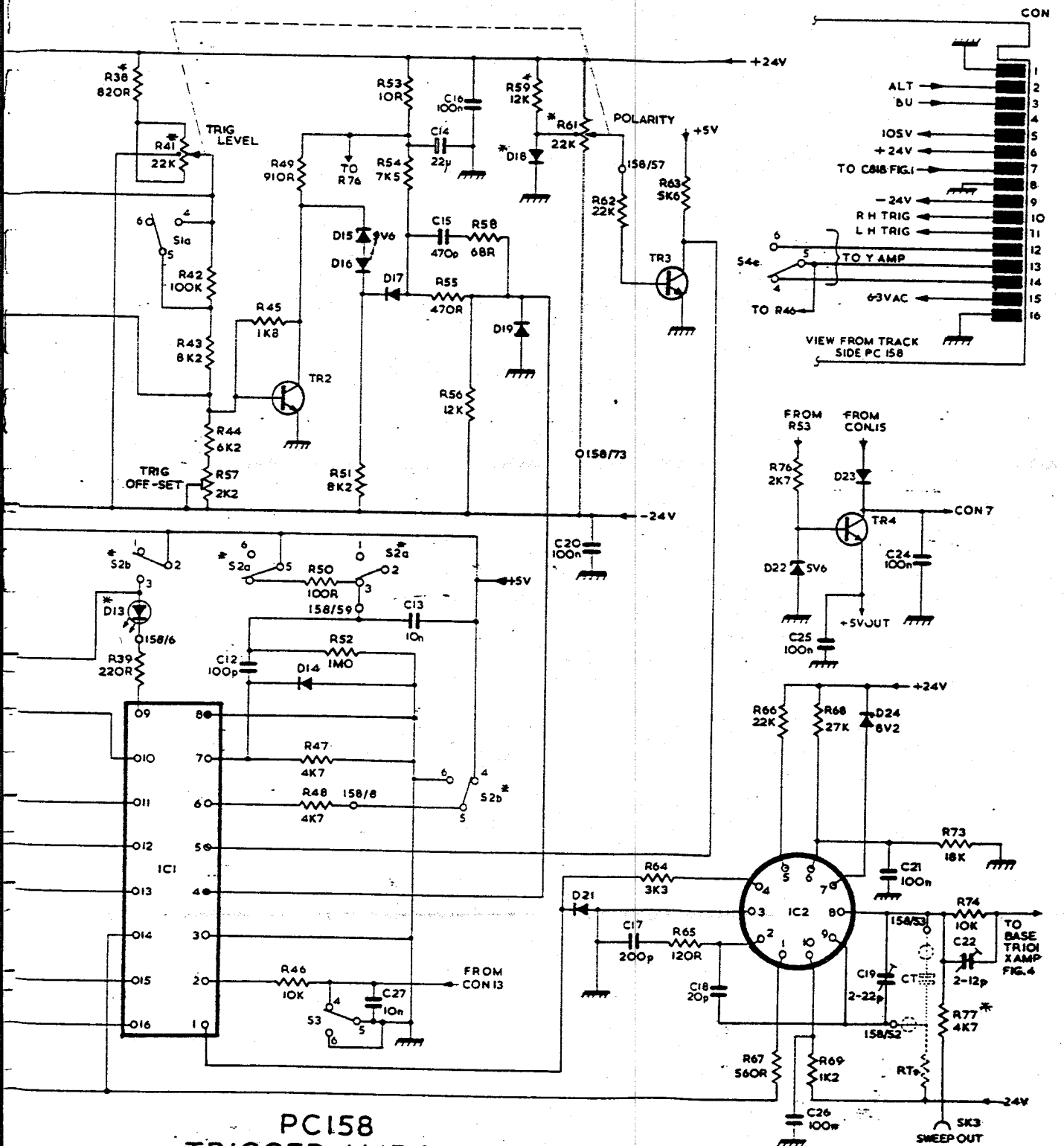


MOTHER BOARD - P.C.175 - DM63  
 FIG.1





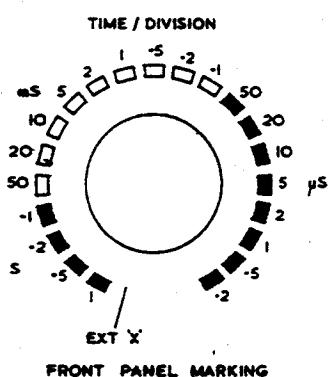
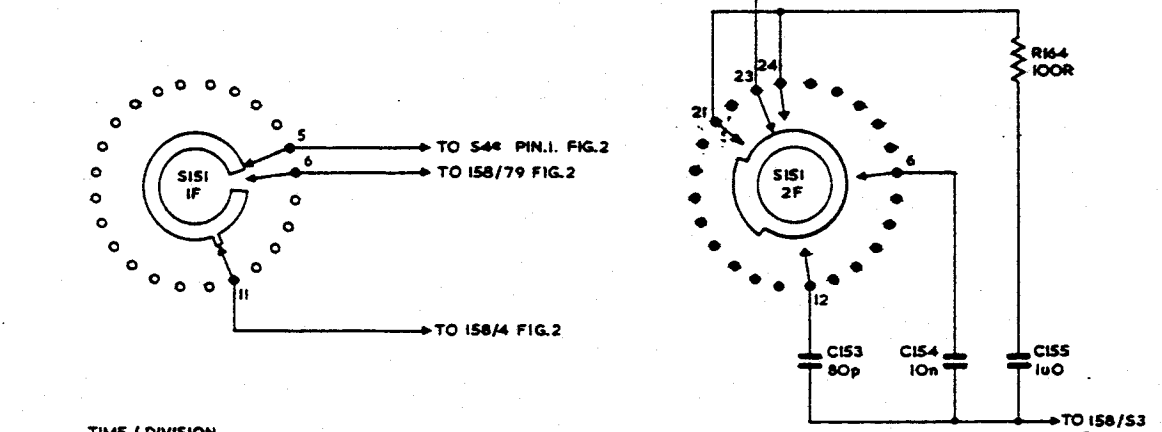
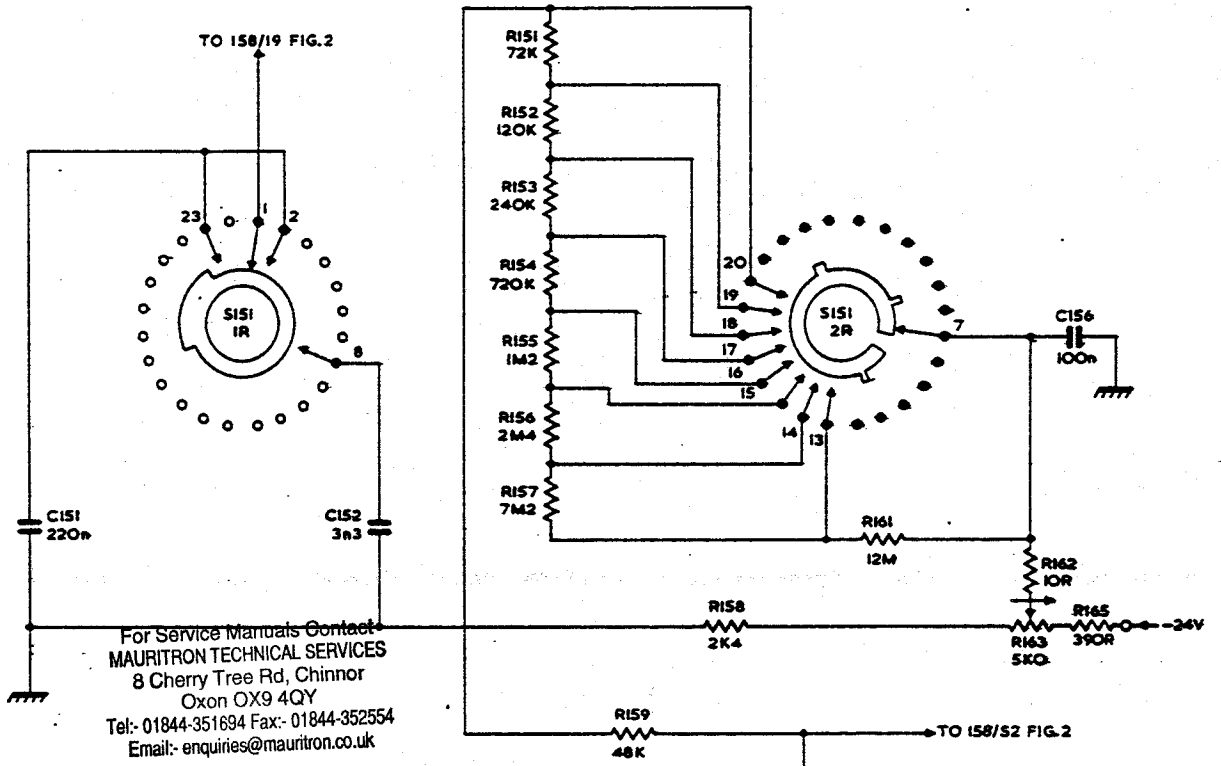
38	41	42	45	49	46	53	55	56	50	61	62	63	66	73			
39		43		47	48	54						64	65	74			
		44		50	51			56					67	68	71	77	
		57		52	52								76	69			
	12					13	15	16		20	17	18		19	24	22	23
						27	14							26	25	21	
D13	S16		TR2	D15	D16	D17	S2b	D18	D19	D21	TR3		D22	TR4	SK3		
	S26		D14	S3				D19					S4e	D24			



PCI58  
TRIGGER AMP &  
SWEEP GENERATOR DM63  
FIG.2

- NOTES.  
1. \* INDICATES COMPONENTS NOT MOUNTED ON PC BOARD  
2. 158/29 INDICATES PC BOARD/EYELET OR TERMINAL No CONNECTION

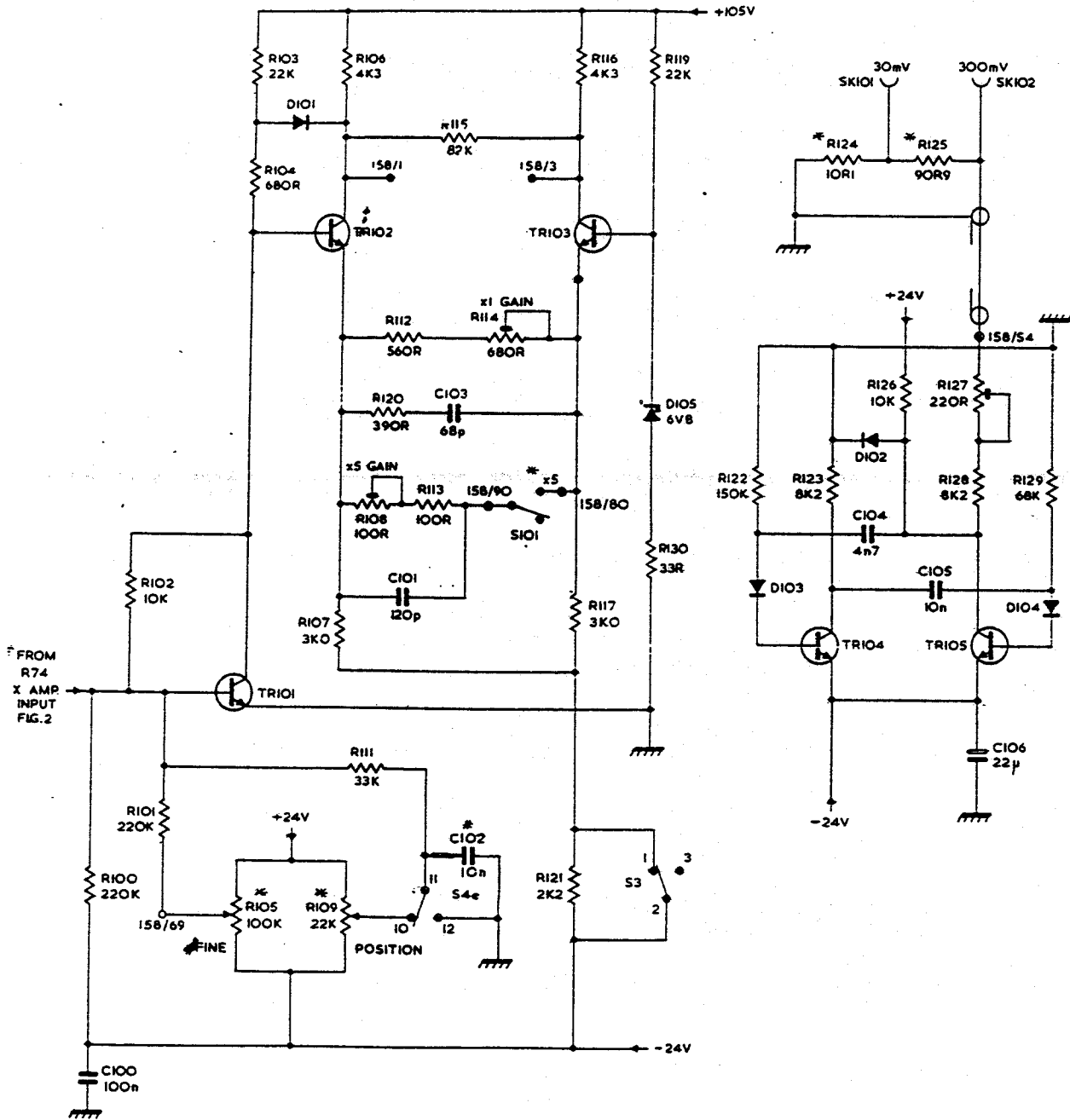
	151	152	159	158	161	162	163	164
								165
	151	152			153	154	155	156
	S151							



- NOTES
1. SWITCH IS SHOWN IN FULLY ANTICLOCKWISE POSITION.
  2. NUMBER OF POSITIONS 22.

TIME / DIV. SWITCH DM63  
 FIG.3.

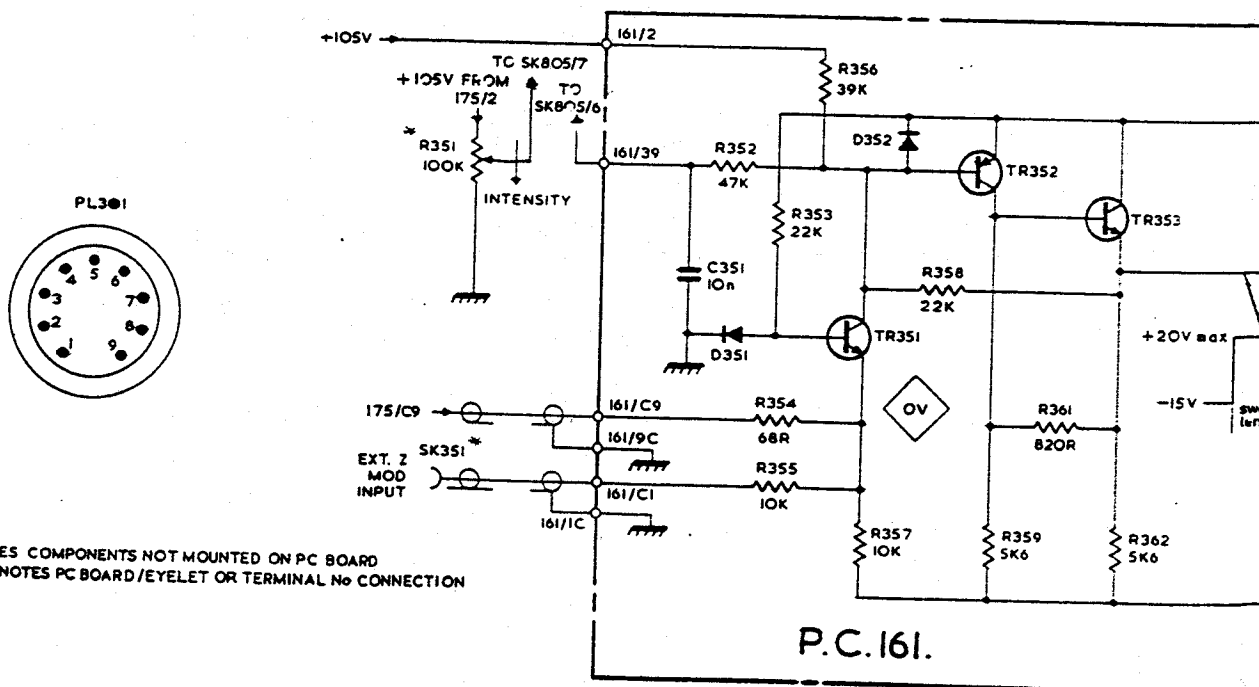
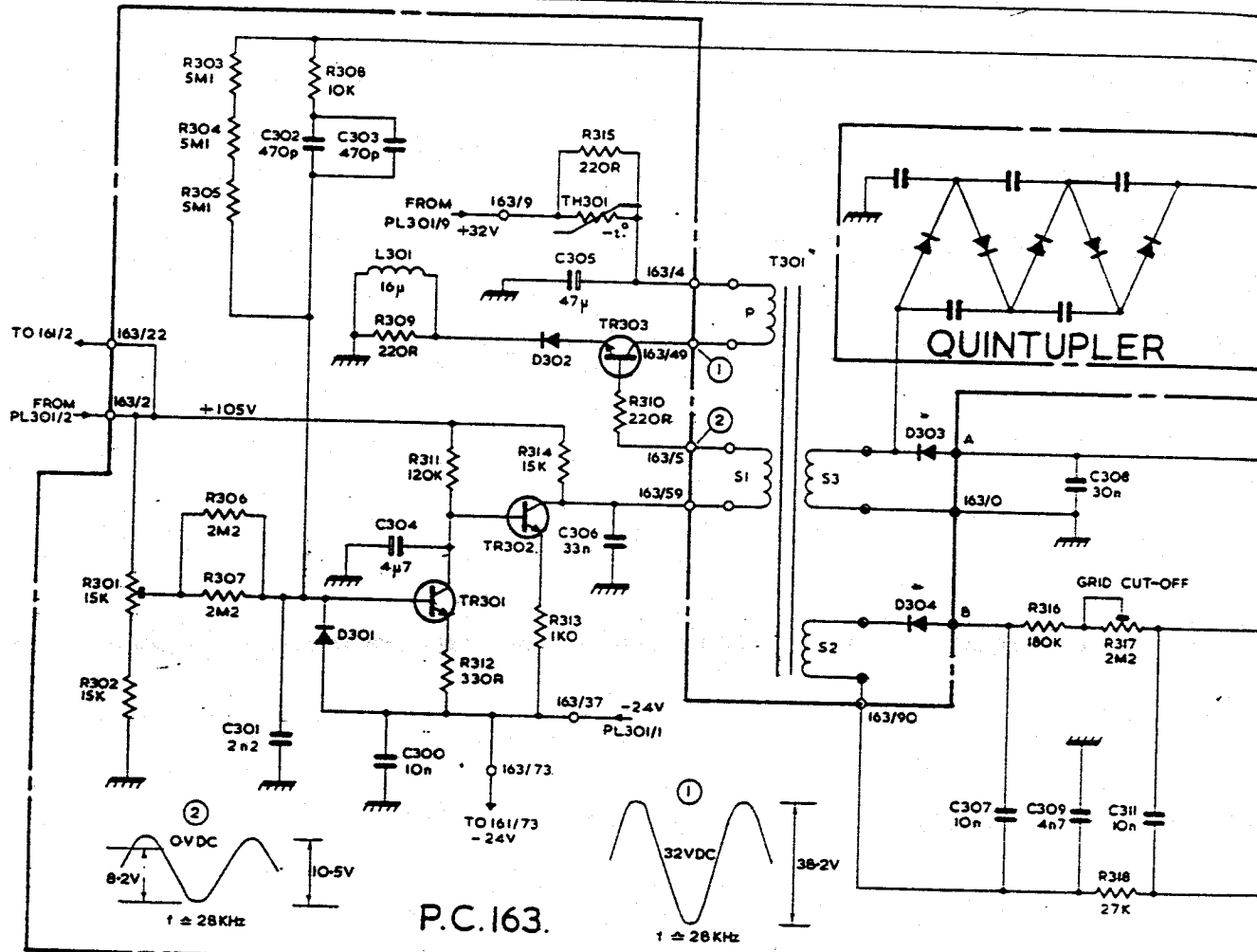
RESISTORS	IO1	IO3 IO4 IO5	IO6 IO7	II2 IO8 IO9	II3 IO8 IO9	II4 IO8 IO9	II6 II7	II9 IO3	I22	I23 I24	I25 I26	I27 I28	I29
	IOO	IO2		IO1	IO2						IO4	IO5	
CAPACITORS				IO1	IO3							IO6	
MISC		TRIO1	TRIO2			TRIO3		DIO5	DIO3	TRIO4	DIO2	TRIO5	DIO4
			DIO1		S4e	SIO1		S3		SKIO1	SKIO2		



- NOTES
- \* DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.
  - 158/90 DENOTES P.C. BOARD EYELET OR TERMINAL No. CONNECTION.

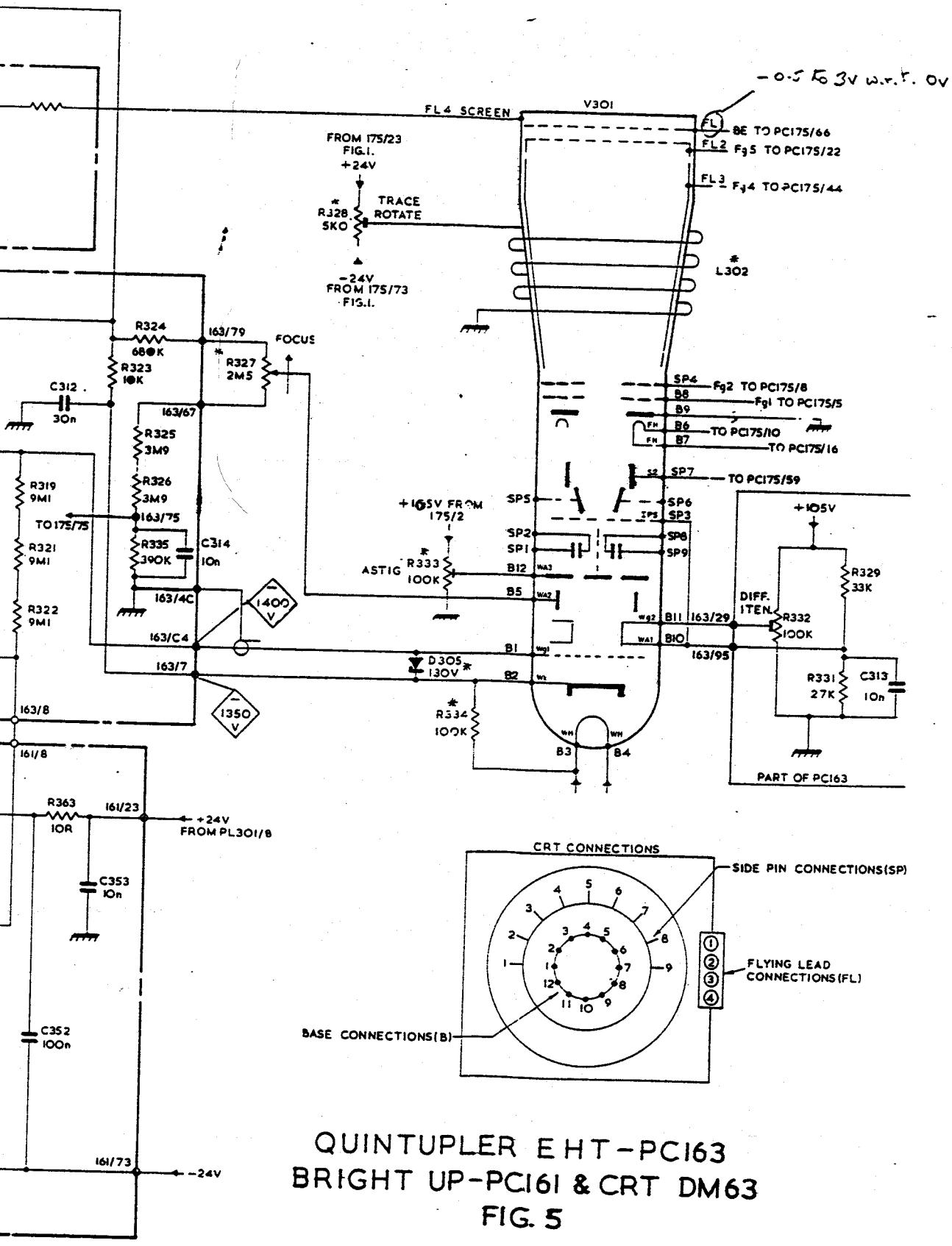
X AMPLIFIER — P.C.158 — CALIBRATOR DM63  
FIG. 4

RESISTORS	301 302	303 304 305 306 307	308	309	311 312	313 314 315	352	353 354 355	357	358	359	316 317 318 361 362
CAPACITORS		301 302	303 304 300			305 306	351		356		307 308 309	311
MISC.			D301 L301	TR301		D302 TR302 TH301		T301		D303 D304	D352	TR352 TR353



**NOTES**  
 1. \* DENOTES COMPONENTS NOT MOUNTED ON PC BOARD  
 2. 163/2 DENOTES PC BOARD/EYELET OR TERMINAL No CONNECTION

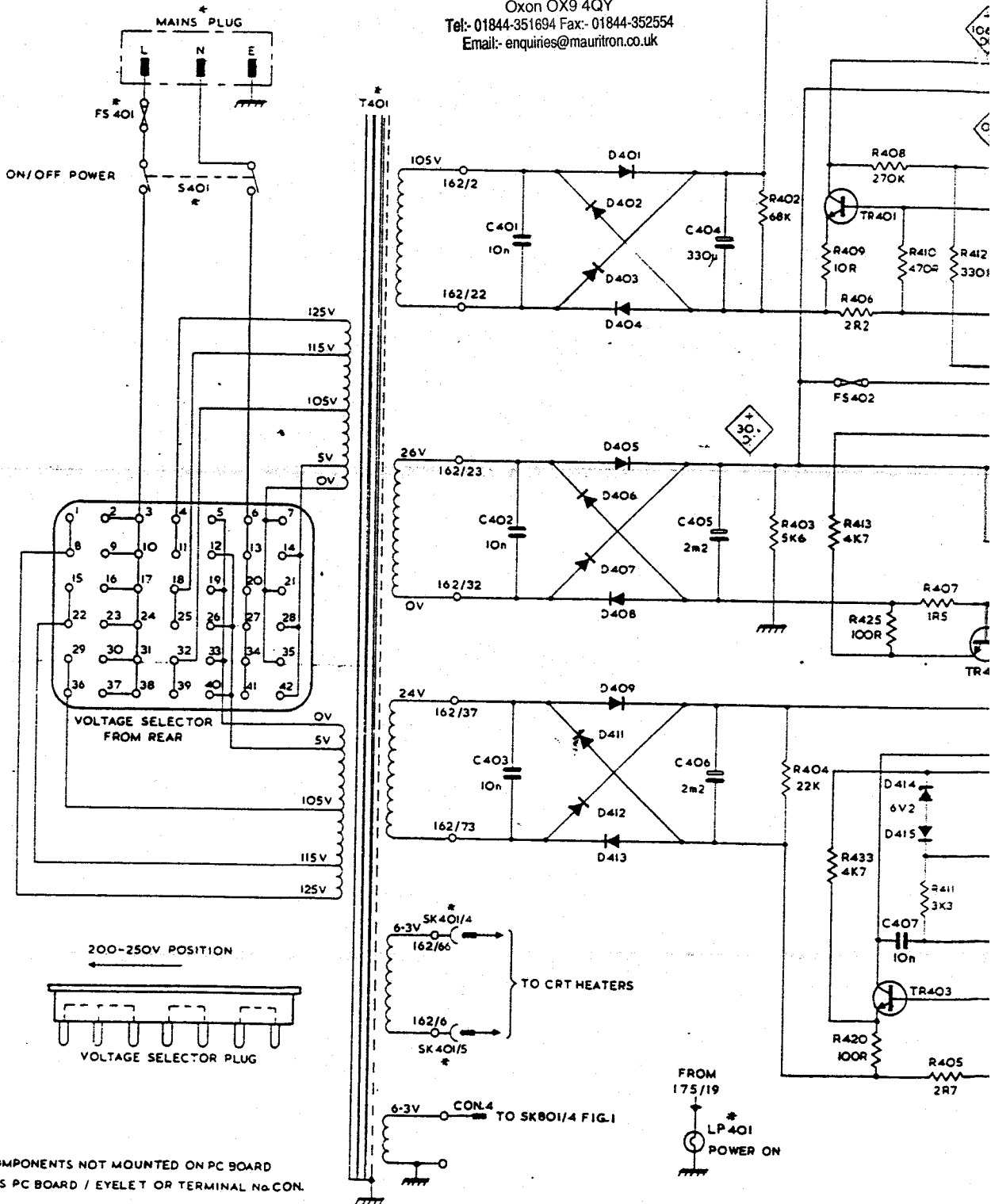
319	323	324	327	328	333	332	329
321		325			334		331
322	363	335					
312	353	314*			V301	L302	313
352					D305		



QUINTUPLER EHT-PCI63  
 BRIGHT UP-PCI61 & CRT DM63  
 FIG. 5

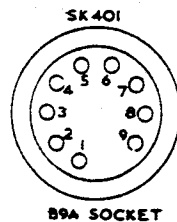
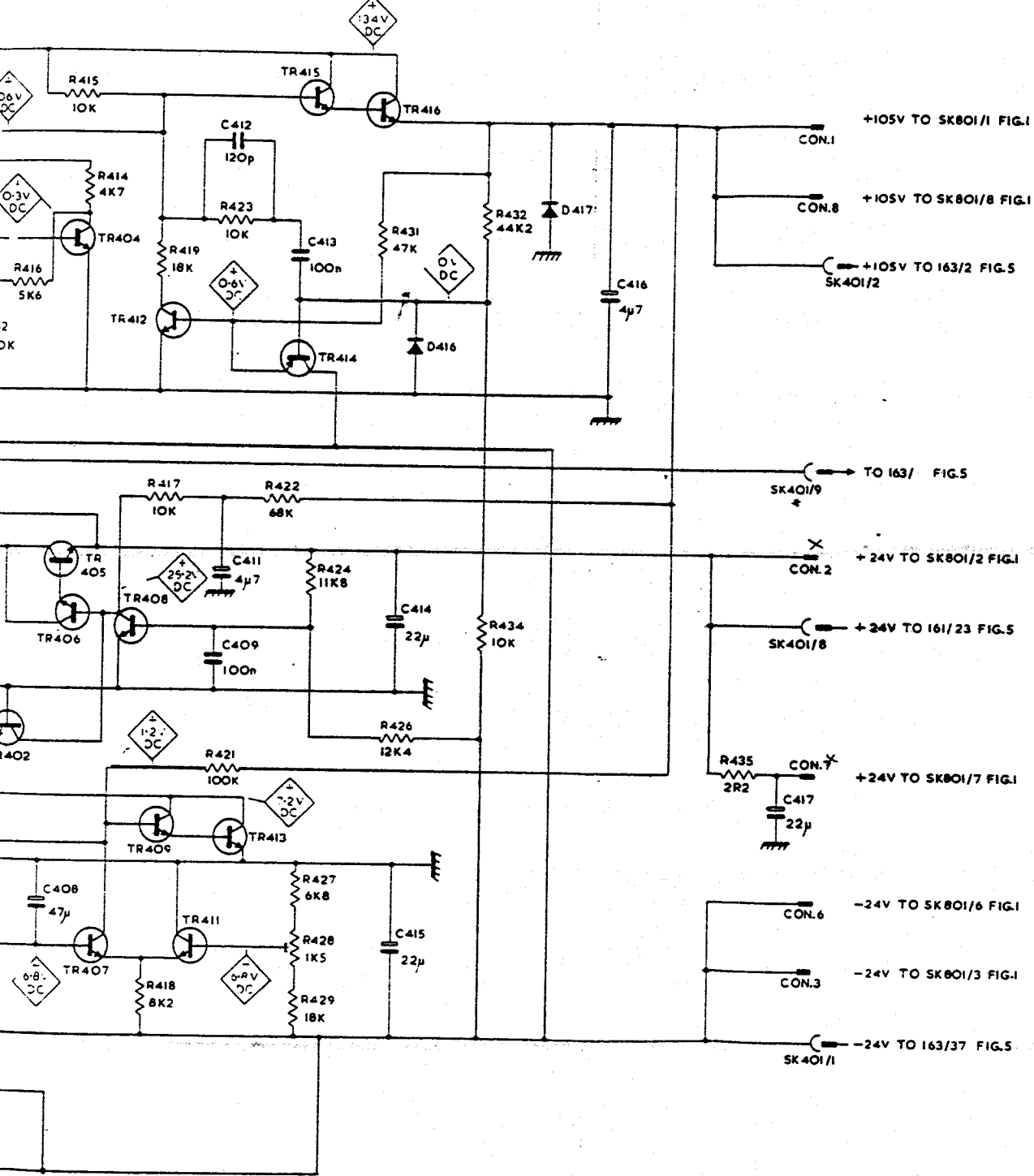
RESISTORS									402	408	420	407
									403	409	406	410
									404	413	425	412
CAPACITORS									401			
									402			
									403			
MISC.										404		
										405		
										406		
											407	
	FS 401	S 401		T 401	D 401	D 405	D 409				TR 401	TR
					D 402	D 406	D 411				FS 402	D 414
					D 403	D 407	D 412					D 415
					D 404	D 408	D 413	LP 401				TR 403

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- NOTES**
- \* DENOTES COMPONENTS NOT MOUNTED ON PC BOARD
  - 162/2 DENOTES PC BOARD / EYELET OR TERMINAL No CON.

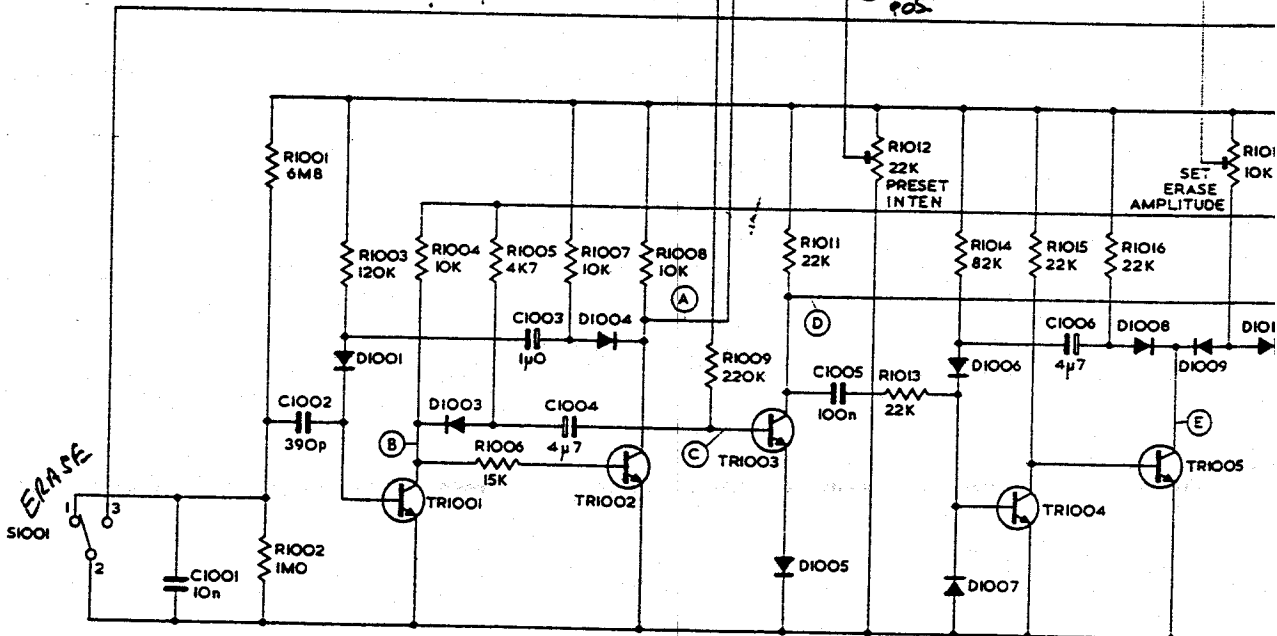
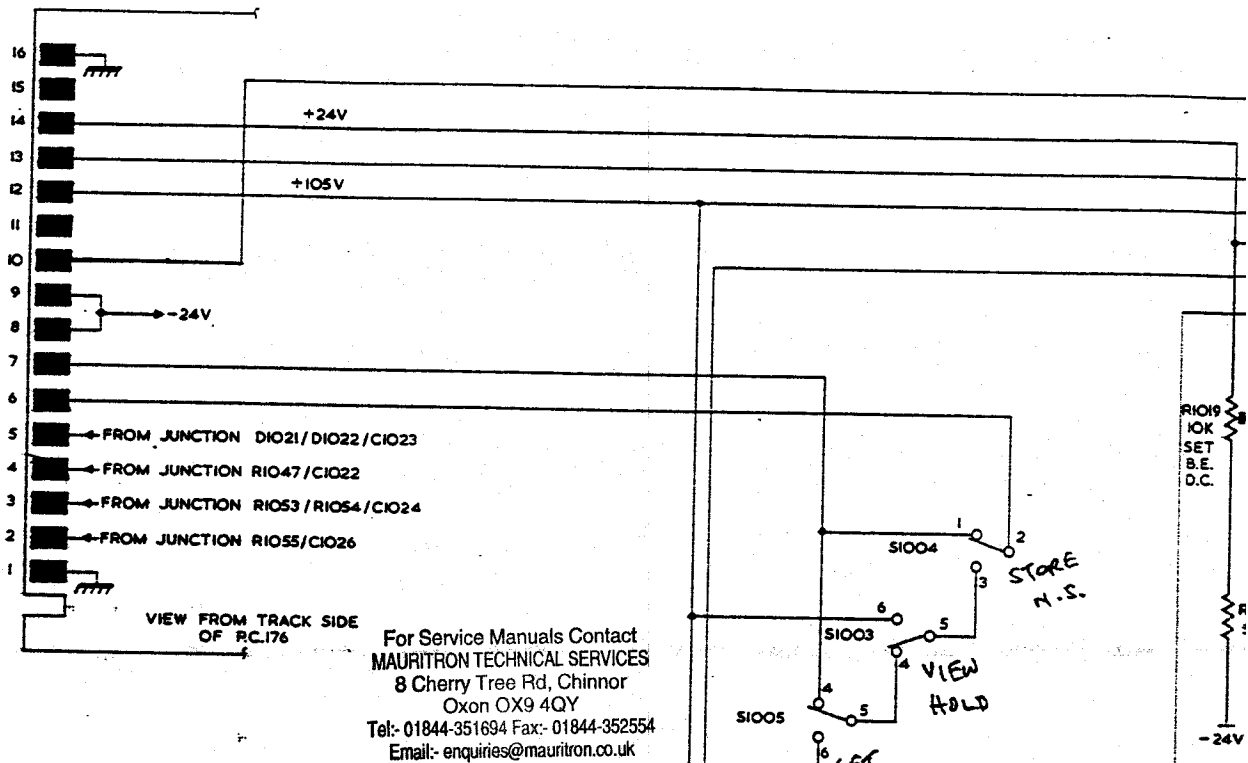
416	415	419	423	424	431	432	
414		417	421	422	427	428	
		418		429	426	434	
			412				435
			411	413	414		
408		409			415		416
R402	TR404	TR412	TR415				
	TR405	TR408	TR414				
	TR406	TR409			D416		D417
		TR411	TR413		TR416		



DM63 FIG. 6.

RESISTORS	1001 1002	1003	1004	1005 1006	1007	1008	1009	1011	1012 1013	1014	1015	1016	1017
CAPACITORS	1001	1002	1003	1004	1005	1006							
MISC.		D1001 D1002	D1003 TR1001	D1004 TR1002	D1005 TR1003	D1006 D1007	D1008 D1009	S1005	S1003	TR1004 S1004	TR1005		

CONNECTOR



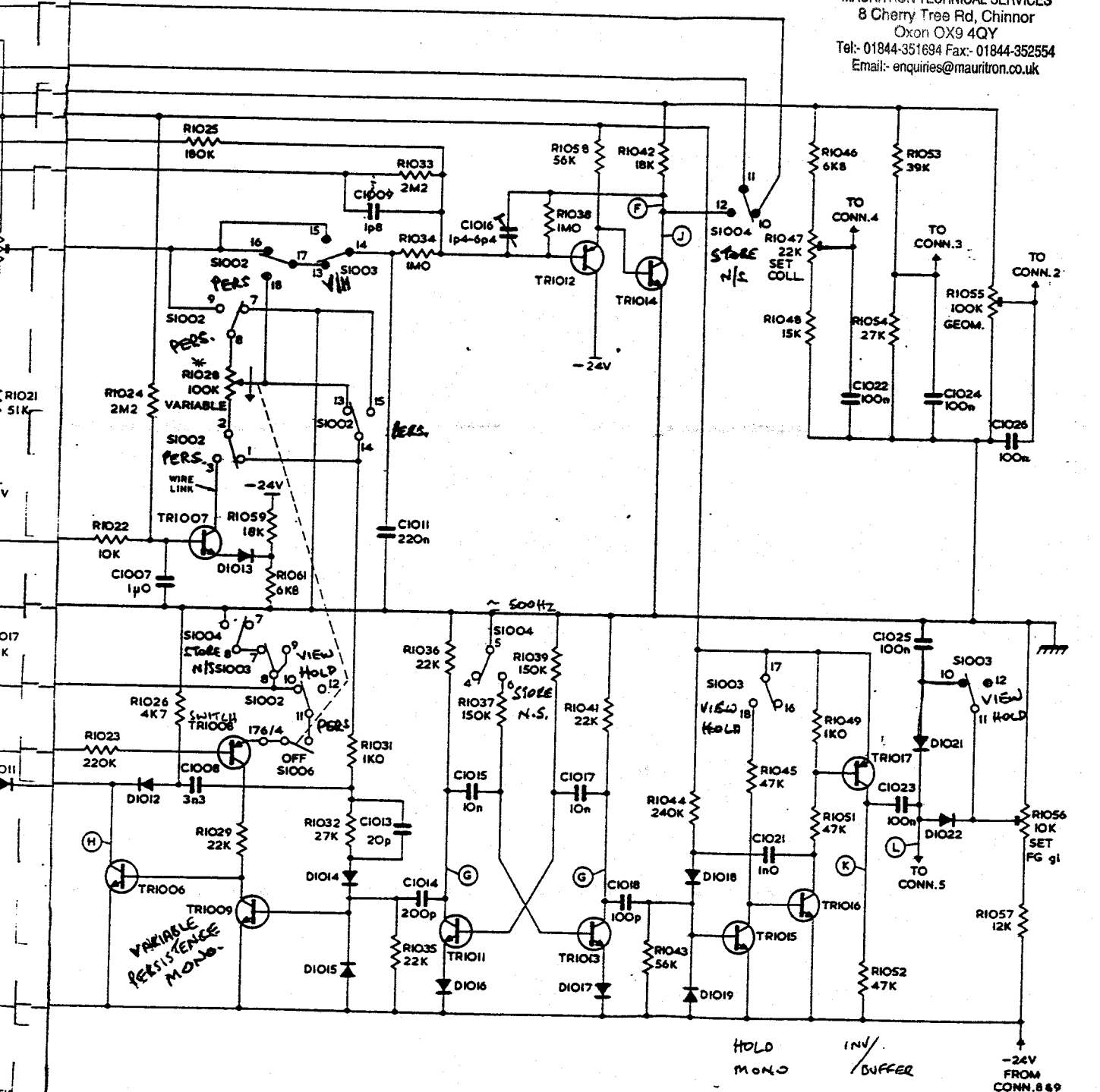
S1001	<table border="1"> <tr><td>o1</td><td>o2</td><td>o3</td></tr> <tr><td>o4</td><td>o5</td><td>o6</td></tr> </table>	o1	o2	o3	o4	o5	o6	ERASE																		
o1	o2	o3																								
o4	o5	o6																								
S1002	<table border="1"> <tr><td>o1</td><td>o2</td><td>o3</td><td>o7</td><td>o8</td><td>o9</td><td>o10</td><td>o11</td><td>o12</td><td>o13</td><td>o14</td><td>o15</td></tr> <tr><td>o4</td><td>o5</td><td>o6</td><td>o10</td><td>o11</td><td>o12</td><td>o13</td><td>o14</td><td>o15</td><td></td><td></td><td></td></tr> </table>	o1	o2	o3	o7	o8	o9	o10	o11	o12	o13	o14	o15	o4	o5	o6	o10	o11	o12	o13	o14	o15				PERSIST/ENHANCE
o1	o2	o3	o7	o8	o9	o10	o11	o12	o13	o14	o15															
o4	o5	o6	o10	o11	o12	o13	o14	o15																		
S1003	<table border="1"> <tr><td>o1</td><td>o2</td><td>o3</td><td>o7</td><td>o8</td><td>o9</td><td>o13</td><td>o14</td><td>o15</td></tr> <tr><td>o4</td><td>o5</td><td>o6</td><td>o10</td><td>o11</td><td>o12</td><td>o16</td><td>o17</td><td>o18</td></tr> </table>	o1	o2	o3	o7	o8	o9	o13	o14	o15	o4	o5	o6	o10	o11	o12	o16	o17	o18	VIEW/HOLD						
o1	o2	o3	o7	o8	o9	o13	o14	o15																		
o4	o5	o6	o10	o11	o12	o16	o17	o18																		
S1004	<table border="1"> <tr><td>o1</td><td>o2</td><td>o3</td><td>o7</td><td>o8</td><td>o9</td></tr> <tr><td>o4</td><td>o5</td><td>o6</td><td>o10</td><td>o11</td><td>o12</td></tr> </table>	o1	o2	o3	o7	o8	o9	o4	o5	o6	o10	o11	o12	NON STORE/STORE												
o1	o2	o3	o7	o8	o9																					
o4	o5	o6	o10	o11	o12																					
S1005	<table border="1"> <tr><td>o1</td><td>o2</td><td>o3</td></tr> <tr><td>o4</td><td>o5</td><td>o6</td></tr> </table>	o1	o2	o3	o4	o5	o6	SET POSITION																		
o1	o2	o3																								
o4	o5	o6																								

- NOTES.
1. 176/4 DENOTES P.C. BOARD EYELET OR TERMINAL No. CONNECTOR
  2. \* DENOTES COMPONENTS NOT MOUNTED ON P.C. BOARD.
  3. SKETCH OF SWITCHES IS SHOWN LOOKING FROM COMPONENT SIDE OF PC.176.



IO22 IO23	IO24	IO28 IO29	IO31 IO32	IO33 IO34 IO35	IO36	IO37	IO38 IO39	IO41 IO42 IO43	IO44	IO45 IO46 IO47 IO48 IO49 IO51	IO52 IO53 IO54	IO55 IO56
IO07	IO08	IO09 IO10 IO11	IO13 IO14	IO15 IO16	IO17 IO18	IO21	IO22	IO23	IO24 IO25	IO26		
DIO12 TRIO06	TRIO07 DIO13	TRIO09 SIO02	DIO14 DIO15	SIO03 SIO06	DIO16 TRIO11	DIO17 TRIO12	TRIO14 TRIO13	DIO18 DIO19	SIO04 TRIO15	TRIO16 SIO03	TRIO17	DIO21 DIO22 SIO03

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 Tel: 01844-351694 Fax: 01844-352554  
 Email: enquiries@mauritron.co.uk



STORAGE CIRCUIT—P.C.176 DM63  
 FIG. 7