AIR PUBLICATION

114J—0102—16

SSR AIRBORNE INSTALLATION
ARI.23187

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

L.T. Durrett

Ministry of Defence

FOR USE IN THE
ROYAL AIR FORCE
ROYAL NAVY

A. C. COSSOR LIMITED

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Michael Cary

Ministry of Defence

Sponsored for use in the ROYAL AIR FORCE by D Air Eng (RAF)

Publications authority: DATP/MOD (PE)

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Issued Nov. 74

PREFACE

IDENTIFICATION OF LEAVES

This publication was originally a commercial handbook which was at amendment state AL10 when converted into AP114J-0102-16.

The conversion AL was identified as 'MOD AL1 Oct 1967' and was followed by 'MOD AL2 Mar 69' which included one leaf also carrying the identification 'AL11 July 1968'. All other identifications on the leaves in these two amendments were identical with the 'commercial' leaves.

Neither the 'commercial' nor the 'MOD' methods of identification follow standard Air Publications practice.

This amendment and all future amendments will contain leaves, properly identified with the AP code, and numbered from AL12 (this amendment) onwards.

SSR AIRBORNE INSTALLATION ARI23187

ARI23187 comprises:

Transponder set 5841-99-107-1455 (Cossor SSR1600/2)

and

Control, transponder set 5841-99-107-2276 (Cossor SSR1601/6)

Additional items of equipment required for servicing (other than test equipment) are:

Mode C/D simulator unit
Bench interconnecting unit
Cable assembly (special)

Details of the transponder set, the controls, cable assembly (special) etc are given in this publication.

COMMERCIAL USE ONLY

The following items have no service application:

Transponder set Cossor SSR1600/1
Control, transponder set Cossor SSR1601/2

CONTENTS

PRELIMINARIES

LIST OF MODIFICATIONS INCLUDED

Mod No.	Unit	Brief Description
A4002/13	Tacard board No.10	Stabilization of -24 V rail to initial desense circuit.
A4384/14	AC/DC power supply	Modification to VT9/VT10 circuit
A4409/12	Self-test and local oscillator	Stabilization
A2209/7	Tacard board No.12	Improve timing of reply train
A2207/8) A2208/6) A2780/9) A3501/10)	All redundant since incorporation of new ac/dc power supply	
► B1059/16	EHT Power Supply	Prevention of relay contacts sticking ◄

COSSOR AIRBORNE TRANSPONDER S.S.R.1600

PLATE 1

CED 185

Section 1

GENERAL INFORMATION

Contents

ILLUSTRATIONS

GENERAL INFORMATION

1. Description

A. Performance and Range

(1) The Cossor Airborne Secondary Surveillance Radar Transponders S.S.R.1600/1 and 1600/2 are designed in accordance with the recommendations of ICAO and of ARINC Characteristic 532D. The equipment is suitable for unpressurised operation up to 40,000 feet. When used with standard type ground equipment the operational range of the Transponder extends to the radio horizon.

(2) The Transponder is designed to reply to interrogation signals of the three-pulse sidelobe suppression type. Interrogations by sidelobes are detected by comparison of the amplitudes of the first and second pulses. The transponder will also, without further adjustment, reply to 2 pulse s.l.s. and to suitable non-s.l.s. signals. The spacing between interrogation pulses is as follows:-

Mode A	8μs
Mode B	17μs
Mode C	21μs
Mode D	25μs

(3) The first (P1) and third (P2) pulses are the directional interrogation pulses. The second (P2) pulse, 2μS after P1, is the omnidirectional control pulse. When the amplitude of the first pulse is equal to or less than that of the second, the interrogation is considered to be from a sidelobe and a reply is not transmitted. If the amplitude of the first pulse is 6dB or more above that of the second, normal replies are transmitted. Differences between 0dB and 6dB lie in a 'grey region' and may or may not trigger the transponder.

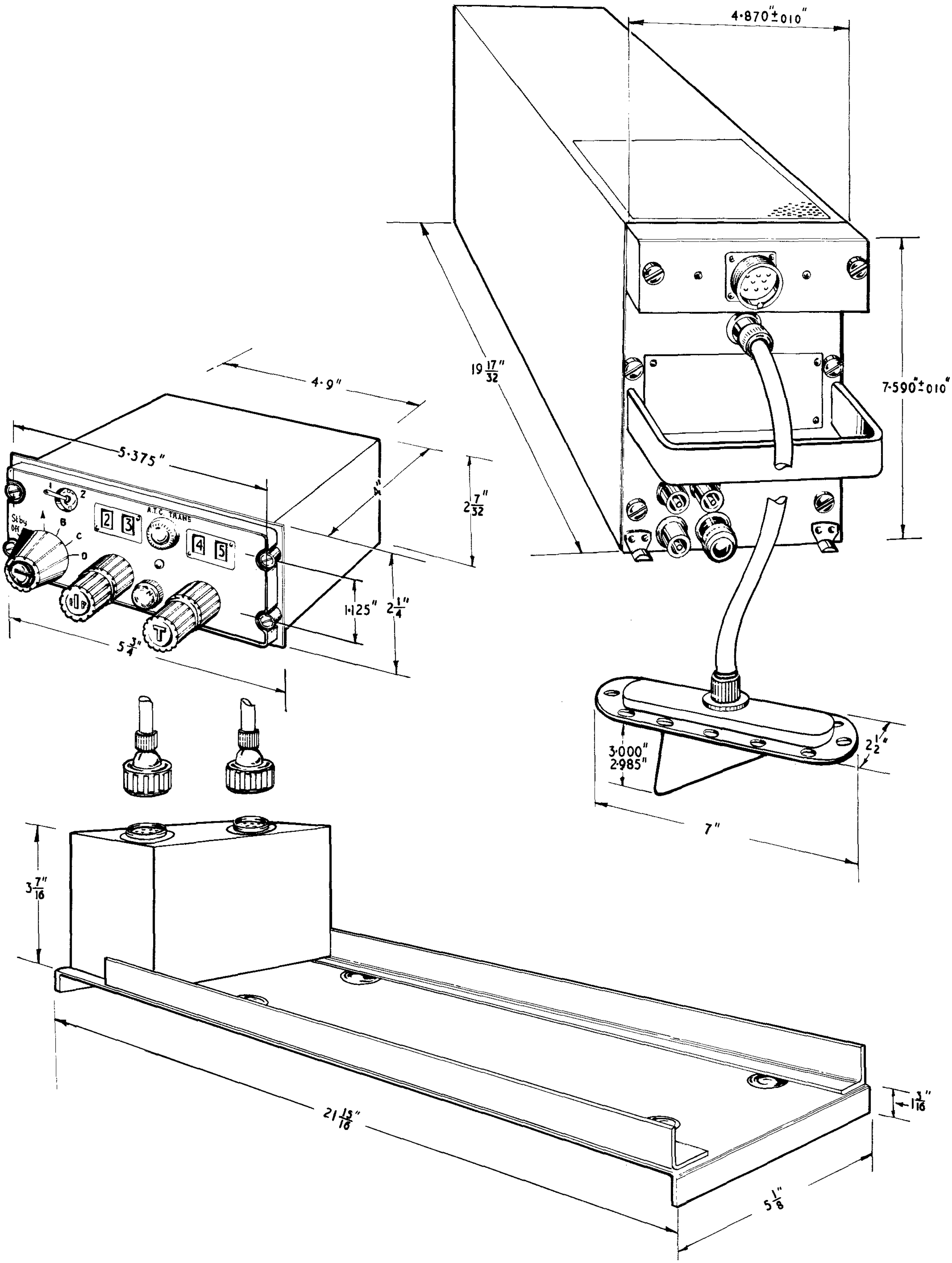


FIG.1 TRANSPONDER, CONTROL UNIT, MOUNTING TRAY, AND ANTENNA DIMENSIONS

(4) In reply to acceptable interrogations, the transponder emits trains of pulses consisting of:

(a) Two framing pulses (F1, F2) separated by 20.3µS.

(b) Any combination selected from twelve information pulses spaced at 1.45µS intervals between the framing pulses. There are 4096 possible combinations.

(c) A special Identification Pulse occurring 4.35µS after the second framing pulse.

Code switches on the Control Unit enable the required combination of pulses to be set up for transmission in reply to interrogations in modes A or B. Mode C interrogations produce pulse combinations according to the setting of switches in an altitude reporting device external to this equipment. Airframe Identity code pulse trains may be transmitted in reply to mode D interrogations; when delivered, however, a link in the transponder is set so that mode D interrogations produce replies according to the Control Unit code switch settings as for modes A and B. The Identification Pulse is transmitted only if the IDENT button on the Control Unit is pressed. A momentary pressure ensures transmission for about 20 seconds.

B. Further Development

The Transponder is designed to transmit the X pulse (10.35µS after F1) when introduced.

2. Installation

A. Preliminary Checks

(1) An installation drawing of the control unit backplate is given in Fig.2, and two interconnection diagrams in Figs.3 and 4 as the control unit is designed to operate with one or two transponders. The interconnection diagram shows two sockets, labelled SKTG(1) and SKTG(2), in Fig.4.

SKTG	SELECTOR	SELECTOR POSITION
19	'DIGITS'	1, 3, 5, 7.
20	''	2, 3, 6, 7.
28	''	4, 5, 6, 7.

(g) Check that with the IDENT button on the control unit pressed, SKTG/14 is connected to earth. (SKTG/32).

(h) Check that with the SELF TEST switch on the control unit operated, SKTG/11 is connected to earth (SKTG/32).

(i) With the FUNCTION and TRANSFER switches on the control unit set to the positions indicated, check that the following pins are connected to earth (SKTG/32).

SOCKET	PIN	FUNCTION SWITCH	TRANSFER SWITCH
SKTG(1)	9	A	-
''	10	B	-
''	12	D	-
''	22	ST'BY, A, B,C,D	-
''	23	A, B,C,D	No.1
SKTG(2)	9	A	-
''	10	B	-
''	12	D	-
''	22	ST'BY, A, B,C,D	-
''	23	A, B,C,D	No.2

(j) Check that with the LOSENS switch ON, SKTG/14 is connected to earth (SKTG/32).

(k) Check that with the AR switch ON, SKTG/1 is connected to earth (SKTG/32).

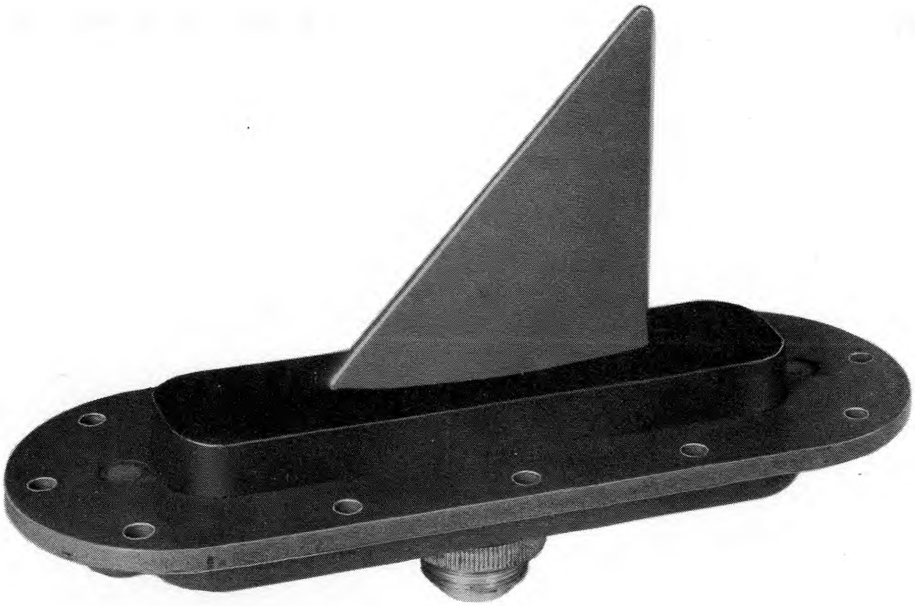
B. <u>Mounting Transponders</u>

(1) If the foregoing checks are completed satisfactorily the transponder(s) may be slid into the guide rails of the mounting tray(s). Ensure that the pins of PLG on the rear of the transponder are correctly aligned with their corresponding sockets on the mounting tray, then push the unit home firmly until plug and socket are fully engaged. The unit may be locked in position with the two knurled retaining nuts.

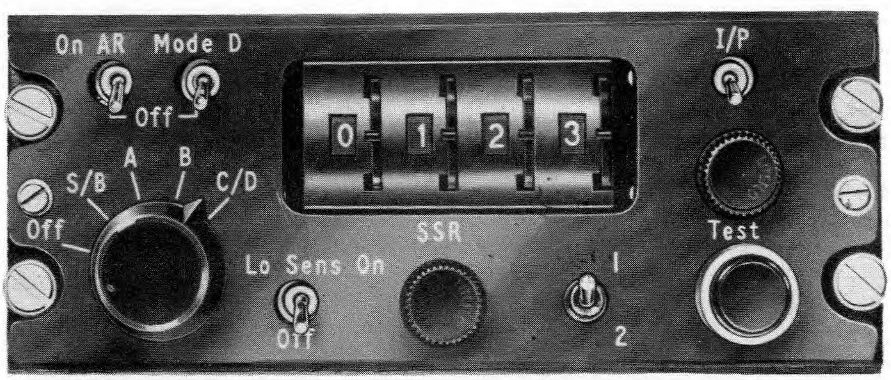
(2) Connect the antenna(s) to the ANTENNA connector on the front panel(s) of the unit(s).

<u>NOTE</u> If the REC.VIDEO, SUPPRESSION IN/OUT, or EXT.TRIG. connectors are not in use, they should be covered by the caps provided.

(3) Before switching on, ensure that the upper and lower ventilating surfaces of the transponder are unobstructed.



ANTENNA OMNI—100B



CONTROL, TRANSPONDER SET, TYPE 1601/6

CONTROL UNIT TYPE 1601/2

PLATE 2

Two-pulse SLS is no longer in use and the relevant circuits in the transponder have been disabled.

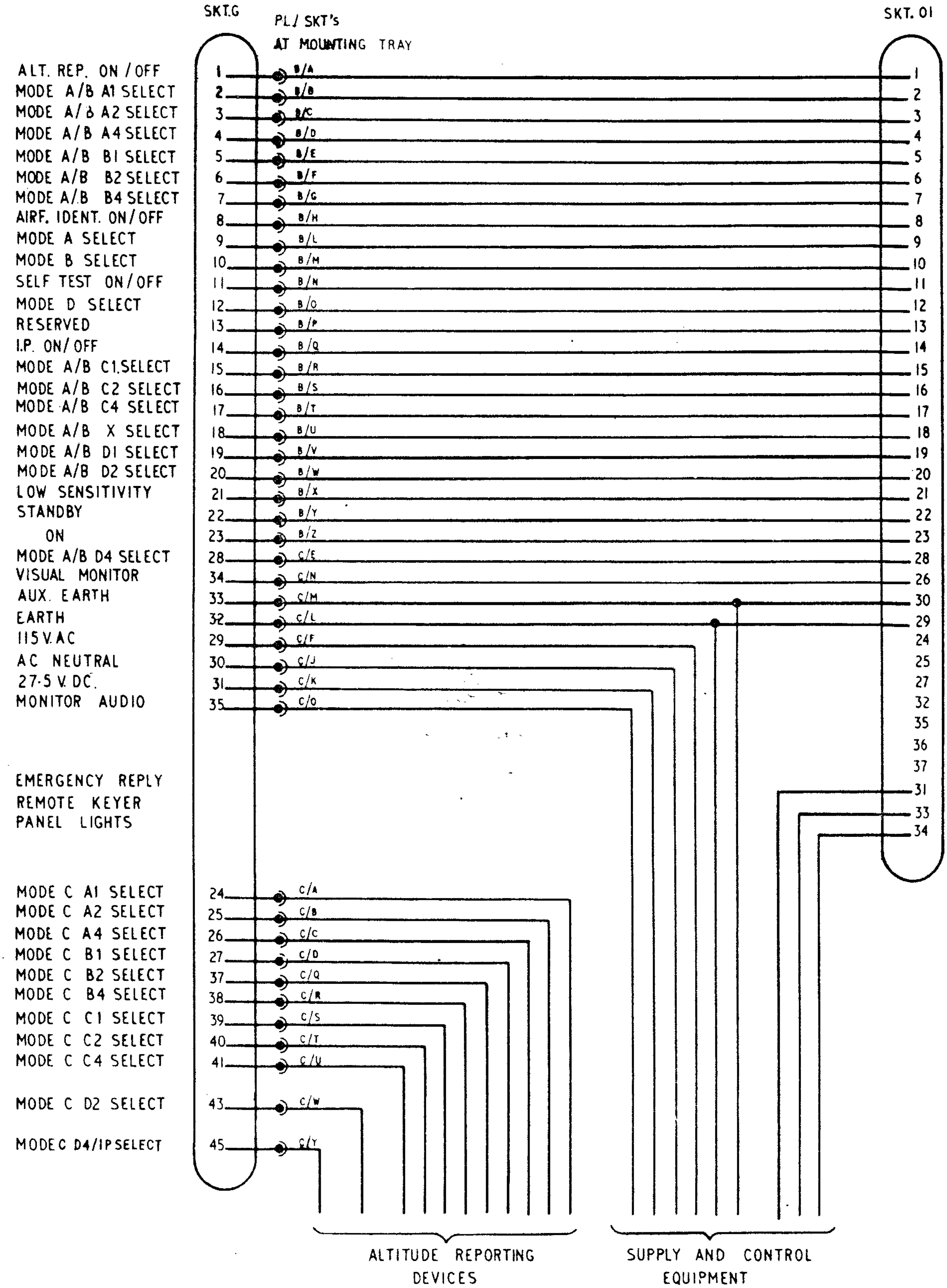


FIG. 3 INTERCONNECTION DIAGRAM FOR CONTROL UNIT 1601/6

SEE ALSO RADIO INSTALLATION MEMORANDUM No. 172

(c) Transmitter frequency

The transmitter is set to nominally 1090 Mc/s.

(d) Transmitter power output

The peak pulse output of the transmitter is not less than 750 watts.

(e) Power supplies

The transponder requires the following power supplies:

(i) 27.5 volts, + 10% - 20%, d.c. approximate consumption 1W.

(ii) 115 volts, ± 10%, a.c. frequency 300-1,000 c/s
Approximate consumption
Standby, or zero trigger, 45VA
Full interrogation, 58VA
The power factor of the equipment is between 0.90 leading and 0.85 lagging over the stated frequency range.

(iii) The transponder will also operate without modification or switching, on the 27.5V supply alone.

(f) No fuses are fitted. Provisional recommendations for external fuses are:-

d.c - 500 mA
a.c - 1.5A, slow blow.

(g) Power supply and Control Unit connections to the transponder are by a 45-way plug as shown in Dig. 3.

(3) Mechanical details

(a) The transponder complies in all respects with the dimensions for the long half ART given in ARINC Specification No. 404. The necessary installation dimensions are given in Fig.1(a).

(b) The weight of the transponder is approximately 22.75 lbs.

(c) The transponder is designed for use in mounting tray S.S.R 1254(G). Cooling is by convection from the bottom to the top ventilating surfaces. The ventilating surfaces must therefore be unobstructed.

(d) The centre of gravity of the transponder is within the limits stated in ARINC specification No.404.

C. Control Unit S.S.R. 1601/6

(1) The operation of the transponder is remotely controlled by control unit S.S.R. 1601/6. This unit provides all functions laid down in ARINC specification 532D-Supplement 1-I1J.

(2) Electrical Details

(a) Electrical connection between the control unit and the transponder is by a specially designed 37-way connector

(b) The control unit is fitted with two 28V 0.4A lamps providing back-illumination of the control markings and positions. The illumination complies with the requirements of specification EL1818. The illumination is controlled externally by the aircraft dimmable supply.

(3) Mechanical details

(a) Control unit dimensions and fixing details are given in Figure 1 (b)

(b) The weight of the control unit is approximately 2 lbs.

(4) Some early installations have Control Unit S.S.R.1601/2 in lieu of 1601/6. This unit is electrically and mechanically inter change-able but the layout is different. (See Plate 2).

D. Mounting tray (S.S.R. 1254/E)

The mounting tray complies with the requirements of ARINC Specification No. 404 and ARINC Characteristic No. 577 B.

(a) Dimensions are given in Fig.1.

(b) Weight approximately 2 lbs.

E. Antenna

The antenna recommended for the equipment is either
Aerial, Omni 100B, 10B/20275
or Aerial, Omni 4169, 10B/10435

The information formerly on this page has been incorporated in preceding pages.

Section 2

FUNCTIONAL DESCRIPTION

Contents

ILLUSTRATIONS

FUNCTIONAL DESCRIPTION
(Refer to block diagram)

1. Receiver

A. Antenna low-pass filter (bl.55)

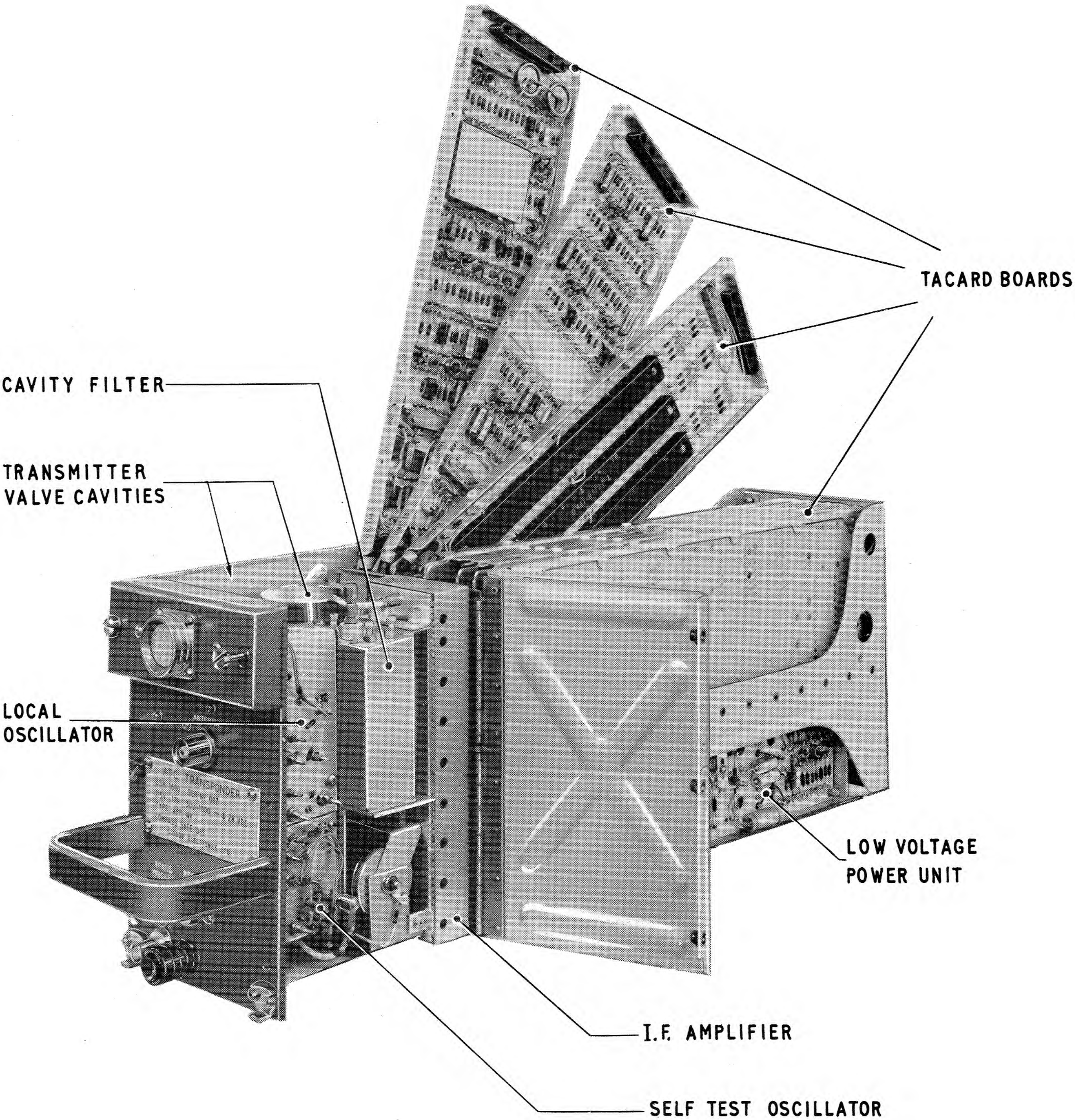
The low-pass filter is situated between the antenna socket and the antenna T-junction. The frequency characteristic of the filter is such that the received and transmitted signals are passed with little attenuation but spurious signals at harmonics of the transmitter frequency are rejected. The filter also protects the receiver against unwanted radiations above the filter cut-off frequency.

B. Antenna T-junction (bl.56)

The antenna T-junction comprises the connections between the antenna filter, the transmitter, and the receiver. The receiver branch of the T-junction is a coaxial line, equal to one quarter wavelength of the transmitted frequency. A high impedance is thus presented at the transmitted frequency which isolates the receiver from the transmitter output. Similarly a coaxial line equal to one quarter wavelength of the received frequency is presented to incoming signals in the transmitter branch, so that signals pass from the antenna, through the T-junction, to the band-pass filter.

C. Band-pass filter and mixer (bls.43 and 1)

Five tuned cavities and the mixer assembly are grouped together and contained in a rectangular block. Four of the cavities are coupled in series by a combination of inductive and capacitive elements to form a band-pass filter with a symmetrical response; the fifth cavity is part of the local oscillator. The rejection characteristic of the band-pass filter is such that signals outside the receiver pass-band are attenuated by more than 60 dB. Protection is therefore afforded to the mixer crystal, from break through of transmitter power, by both the T-junction and the band-pass filter. Input signals at 1030 Mc/s are passed by the filter to the mixer where a low-noise crystal combines them with the local oscillator output at 1090 Mc/s. The resultant intermediate frequency (I.F.) at 60 Mc/s is passed from the mixer to the I.F. amplifier.



R.H. SIDE VIEW WITH CASE REMOVED

PLATE 3

CED 187

D. Local Oscillator (bls. 3 and 2)

The local oscillator power is obtained from a crystal-controlled oscillator operating at a frequency of 90.833 Mc/s. This frequency is multiplied by a transistor tripler and diode quadrupler stage to a final frequency of 1090 Mc/s. This frequency is selected by the fifth cavity in the filter assembly and appropriately matched to the mixer crystal. The matching circuit also enables the output of the local oscillator to be adjusted to the required level.

E. I.F. Amplifier (bl. 4)

The I.F. amplifier consists of four similar stages employing negative feedback over each stage to produce a maximally flat frequency response. The use of cascode amplifying stages with individual negative feedback results in an amplifier which is very stable with temperature. Outputs are taken from the last three stages and combined in a video amplifier, using the principle of successive detection, to obtain a logarithmic response; an input signal variation of 55 dB is compressed into a video output variation of approximately 18 dB.

2. Decoder

The main function of the decoder is to detect interrogations on selected modes by examination of the mode spacing. Interrogations produce gate pulses which are used to trigger the encoder to transmit replies on the correct mode. Associated circuits are used to detect sidelobe interrogations and prevent the transmission of replies.

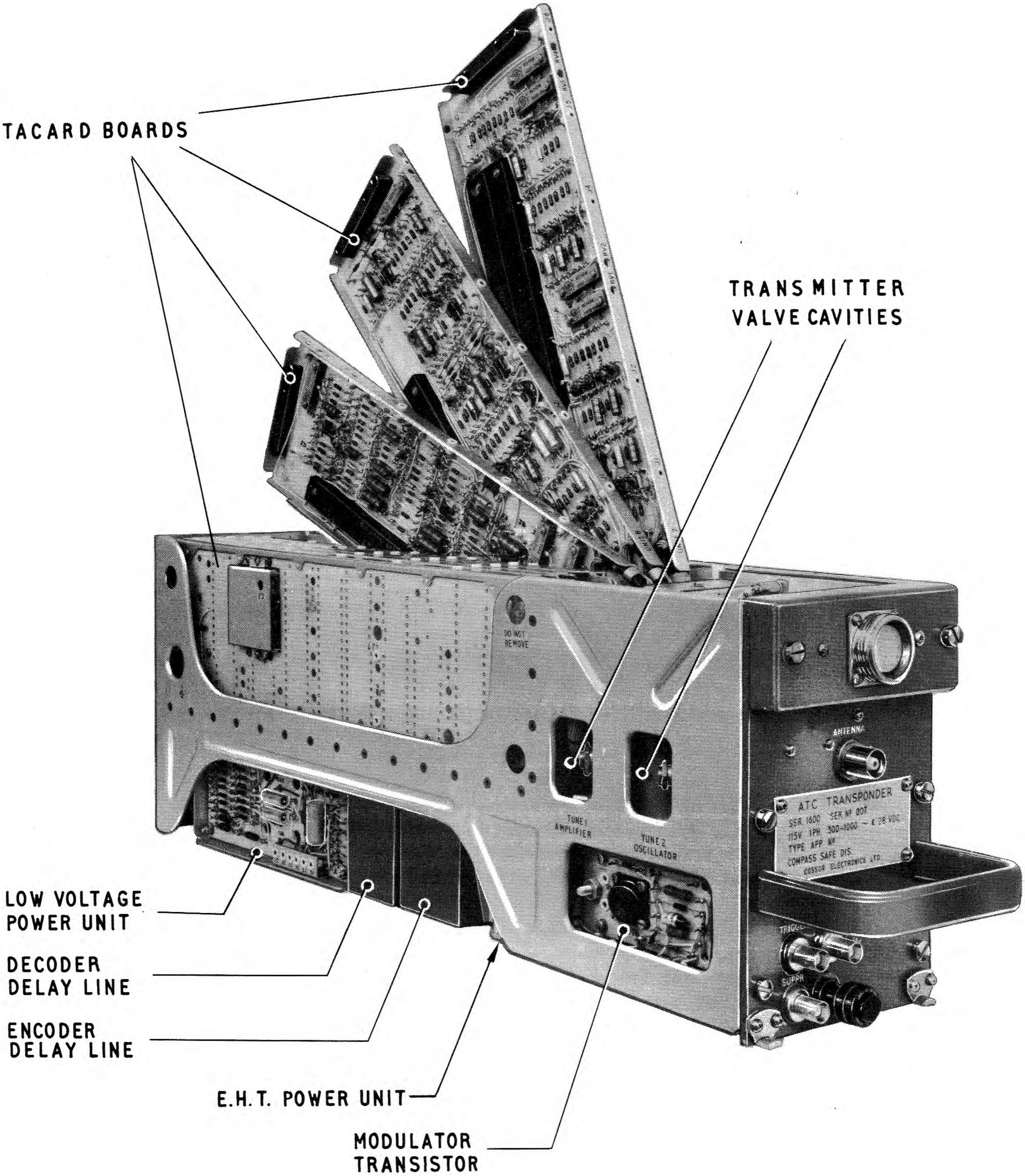
A. Video suppression (bls. 6 and 5)

The video suppression circuit inverts the input from the I.F. amplifier, and provide two outputs:

(a) a low output impedance signal - RECEIVER VIDEO

(b) drive for the video processing and subsequent decoder circuits.

Both the above outputs are suppressed if suppression pulses are received. The suppression pulses are received from the 2 and 3 pulse SLS circuits, or from a suppression pulse generator triggered during transmissions. Suppression pulses may also be derived from the SUPPRESSION PULSE IN/OUT socket.



L.H. SIDE VIEW WITH CASE REMOVED
PLATE 4

B. Receiver desensitisation (bls. 10 and 12)

(1) The receiver desensitisation circuit receives the output from the video suppression circuit. The level of the signal fed to the decoder circuits is reduced under any of the following conditions;

(a) transmitting reply groups at an excessive rate (GROUP COUNT DOWN)

(b) transmitting pulses at a higher rate than the transmitter can safely handle. (OVER INTERROGATION)

(c) generating SLS gates at an excessive rate (RATE LIMITING)

The reduction in signal level fed to the decoder causes the transponder to reply to close range signals in preference to weaker distant signals.

(2) Provision is made for a LOW SENSITIVITY ON/OFF switch to reduce the gain of the receiver by a pre-set amount. The SET LOW SENSITIVITY control may be adjusted for the required reduction in level, but is normally set to reduce the receiver gain by 12 dB.

(3) The output of the receiver desensitisation circuit is fed to the pulse width limiter and also via an emitter-follower to the SLS comparator circuit.

C. Pulse width limiter (bls. 14.16.17)

(1) The input pulse width is limited by this circuit to 0.8 us duration. The purpose of pulse width limiting is to prevent replies being triggered by long pulses such as might be produced by Tacan or other radar systems. Also pulse width limiting ensures that the delay line output amplitude is proportional to the input amplitude, and not the pulse width. The output of the limiter circuit is fed through an emitter-follower to drive the decoder delay line, 1DL1. Another output is taken from the limiter circuit via an emitter follower whose output feeds the spike eliminator.

D. Spike eliminator (bl.29)

The spike eliminator circuit ensures that extraneous noise spikes do not reach the decoder coincidence circuits. A delay line of 0.3 μs and an AND gate are used to eliminate signals of less than 0.3 μs duration. The output is fed to the mode coincidence gates. During self test operation, an additional input to the spike eliminator circuit is received from the self test re-trigger amplifier via an inhibit gate.

E. Delay line (bl.22)

The delay line is composed of LC sections in the form of T networks. The signal loss over the total delay of 25 μs is less than 4 dB. Taps on the delay line are provided at 3.2, 8, 17, 21 and 25 μs. The 3.2 μs tap is used to provide a delayed pulse for the pulse stretching circuit in the SLS circuits. Outputs from the 8, 17 and 25 μs taps are fed via the mode A, B and D selection gates, to the respective mode amplifiers. As modes A and B are never required simultaneously, a common mode amplifier is used. The 21μs tap is connected directly to the mode C amplifier giving automatic replies to mode C interrogations.

F. Mode selection gates (bls. 25, 31,32)

These three gates enable the mode A, B and D outputs from the delay line to be selected at the control unit. A loading network is connected to the mode A and B inputs from the delay line to compensate for variations of the mode C and D outputs when modes A or B are selected. No gate is provided for mode C; the delay line output is directly connected to the mode C amplifier, giving automatic replies for interrogations on this mode.

G. Mode amplifiers (bls. 34, 35, 36)

Only three amplifiers are provided, for modes A/B, C and D; modes A and B cannot be selected simultaneously. As the delay line output pulse amplitude decreases along the length of the line, the gain of each amplifier is set to compensate for the loss in pulse amplitude at the appropriate tap. Accurate compensation is necessary for the correct operation of the SLS circuits where pulse amplitudes are compared. The outputs of the amplifiers are fed to the mode coincidence gates.

H. Mode coincidence gates (bls. 49,40,51,52,53,54)

These three gates receive the outputs from the appropriate selector gates and mode amplifiers. The other inputs are undelayed pulses from the spike eliminator in the video processing circuits. Coincidence of the P3 and the P1 pulse, the latter delayed by the mode spacing, will occur on the interrogation mode; the mode selection gates must of course be set to pass the appropriate interrogation mode pulses. The gate outputs are fed to post gate amplifiers and then to the appropriate mode delay lines.

J. Mode delay lines (bls. 57,58,61)

The outputs of the post gate amplifiers are fed to three individual mode delay lines, each of which has a delay approximately 2 μs. The outputs to the mode gate pulse generators are taken from the ends of the lines. This 2 μs delay also provides part of the overall transponder delay.

K. Mode gate pulse generators (bls. 65,66,67)

(1) The pulse generators will normally be triggered by the delayed pulses from the coincidence gates. Each generator produces an output pulse of approximately 30 μs duration. Two output lines are taken from each generator, one to the common gate line, the other to the appropriate selector gate in the encoder. Additional controls, mounted on the control unit are used to switch the mode C and D pulse generators. These controls, ALTITUDE REPORTING ON/OFF and AIRFRAME IDENTITY ON/OFF disable the operation of the mode C and D pulse generators respectively, when set to the OFF positions.

(2) A link is provided in the mode D pulse generator output line to the selector gate, such that interrogations on mode D will produce replies according to the code settings for mode A/B. By altering the position of the link, a mode D interrogation may be made to perform on individual Mode D reply, the code determined by the code setting on the wires routed through the front panel plug. (SKT.H). The common gate line is connected to the encoded delay line drive circuit, and also to the timing oscillator where timing pulses are generated during the durations of the gate pulses.

3. Two pulse sidelobe suppression

Two pulse sidelobe suppression is no longer used and the relevant circuits in the transponder are disabled.

Two-pulse SLS is no longer used and the relevant circuits in the transponder are disabled.

4. Three pulse sidelobe suppression

This circuit is used to detect sidelobe interrogations by comparing the amplitude of the pulse at P2 position with that at the P1 position. During a sidelobe interrogation, an inhibit pulse will be produced, and this is used to suppress P3. The decoder will thus remain untriggered, and no reply will be transmitted.

A. Delay line drive circuit (bls. 19,20,)

From the decoder delay line drive circuit, the output is fed to the input of a delay line having a total delay of approximately 2 μs. A tap at approximately 1.4 μs drives the pulse stretcher in the 3 pulse circuits. The final output is unused.

B. Pulse stretcher (bl.24)

The input pulses, delayed by approximately 1.4 μs, are fed into a charging circuit in the pulse stretcher. A second pulse, delayed by 3.2 μs, from the main decoder delay line is used to initiate the discharge of the charging circuit. The discharge has an exponential decay, producing in total, a stretched pulse of approximately 3.2 μs duration at full amplitude.

C. Comparator (bl.23)

Delayed and stretched P1 pulses are compared in this circuit with the undelayed P2 pulses. A difference output will only be obtained when P2 is larger than P1, i.e. during a sidelobe interrogation. This difference output is fed to an AND gate with two other inputs.

D. AND gate(bl.26)

Three input signals are applied to the AND gate, the first being the difference signal from the comparator. A second input is obtained from the end of the 2 us delay line. This input ensures that the sidelobe information is decoded only at the P2 position. The third input, taken from the decoder delay line drive circuit, is used to ensure that decoding takes place at the correct P1 to P2 spacing. The decoder delay line drive pulse is used to give a sharp cut off to the mode rejection characteristic. The AND gate thus ensures that only genuine three pulse sidelobe interrogations trigger the suppression pulse generator.

E. Suppression pulse generator(bls. 27,28)

The output from the AND gate is fed to the suppression pulse generator via a post-gate amplifier. A second input is obtained from the 2 pulse inhibit gate generator. Either of these inputs will produce inhibit pulses of approximately 30 us duration, which are fed to the video suppression circuits via an OR gate. An additional output is fed to the rate limiter circuit, so that the receiver sensitivity may be reduced if sidelobe suppression pulses are produced at an excessive rate.

5. Decoder ancillary equipment

A. Suppression pulse generator (bls. 9,7)

The triggering input for the pulse generator is obtained from the encoder delay line drive circuit, which is driven by the common gate line. Suppression pulses of approximately 30 us duration produced during transmissions, are fed via an OR gate to suppress the video signals. The OR gate also receives as its other input, the pulses from the SLS pulse generator. The output pulse fed to the OR gate from the suppression pulse generator is also fed to the SUPPRESSION IN/OUT socket. Pulses fed out of this socket may be used to suppress other equipment used in the aircraft, during transmissions.

Similarly during transmissions produced by other equipment, the transponder may be suppressed by signals from the other units fed into the IN/OUT socket. These input signals are fed to the OR gate in the same way as the internal pulses. The suppression generator is inhibited during STANDBY operation by a bias derived from the timing oscillator control circuit, (bl.92).

B. Group count-down (bl.11).

This circuit is used to produce a bias voltage which when fed to the receiver desensitising circuits reduces the effective receiver gain. The circuit is set up so that the bias voltage is not produced until the rate of reply group transmission exceeds 1450 per second. Suppression pulses are 'counted" to initiate G.C.D. operation.

C. Over interrogation and rate limiter (bls. 13, 15)

Bias voltages used for receiver desensitisation are produced in these circuits in a similar manner to the group count-down circuit. For the over interrogation circuit, ripple voltage produced in the EHT power unit is used to operate the overload circuit. The circuit is normally set up so that the bias voltage is produced when over 2,300 interrogations are received per second. The action of the SLS rate limiter circuit is similar, producing a bias voltage when the rate of production of sidelobe inhibit pulses exceeds 3,000 per second.

D. Low sensitivity (bl.21)

This circuit also produces a voltage on the same bias line as the other three circuits. The SET LOW SENSITIVITY potentiometer may be set to give a gain reduction of from 6 - 50 dB when the LOW SENSITIVITY ON/OFF switch is set to the ON position. Normally the potentiometer is set to give a gain reduction of 12 dB.

E. Initial Desensitise Delay (bl.8)

This circuit produces a bias voltage used to desensitise the receiver for a period of approximately one minute after the power units are energised. This delay time is necessary to prevent the transponder replying to interrogations before the transmitter valves have 'warmed up'.

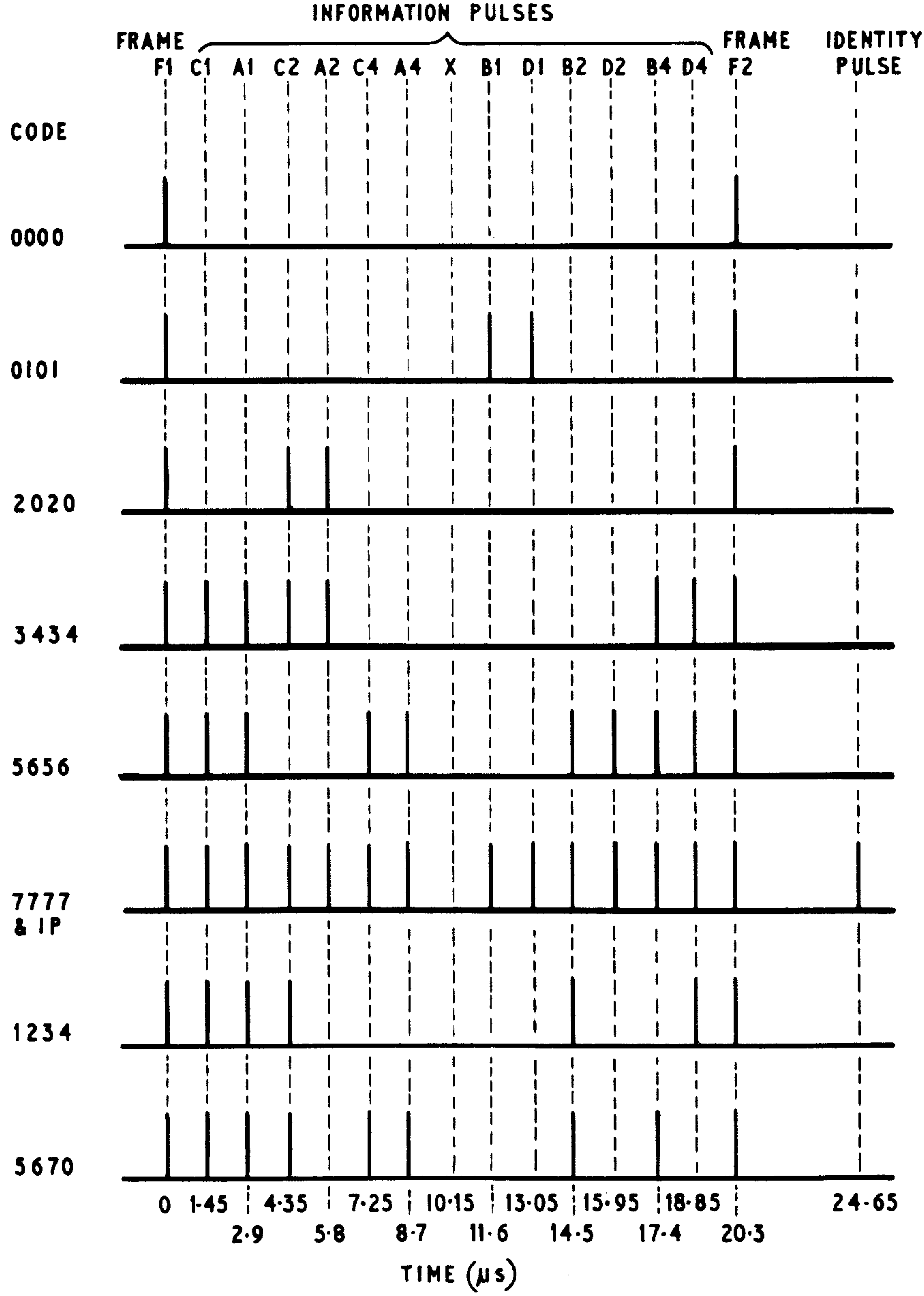


FIG 1 EXAMPLES OF CODE PULSE TRAINS.

6. Encoder

The function of the encoder is to produce a code pulse train, which will always contain the F1 and F2 pulses, and which may contain any of twelve information pulses. A pulse at 10.15 us may also be included under certain circumstances, as also may the IDENT pulse at 24.65 us.

F1	Frame pulse	To time reference
C1	Information pulse	1.45 us
A1	" "	2.9 us
C2	" "	4.35 us
A2	" "	5.8 us
C4	" "	7.25 us
A4	" "	8.7 us
X	X Pulse	10.15 us
B1	Information pulse	11.6 us
D1	" "	13.05 us
B2	" "	14.5 us
D2	" "	15.95 us
B4	" "	17.4 us
D4	" "	18.85 us
F2	Frame pulse	20.3 us
IP	Ident pulse	24.65 us

It is possible to transmit any of three codes, e.g.

(i) Mode A/B settings on control unit.
(ii) Mode C settings (for altitude reporting).
(iii) Mode D settings (for airframe identity reporting).

A. Delay line drive (bls. 68,71)

This circuit is fed from the common gate line in the encoder, and produces pulses which are fed into the decoder delay line. An additional output is fed to trigger the suppression generator associated with the video circuits, so that video signals may be suppressed during transmission of pulse trains.

B. Code selection gates (bls. 77,72)

Thirteen taps on the encoder delay line provide delayed pulses which are fed through buffer amplifiers to code selection gates. There are three selection gates for each code pulse, one for each mode (A/B, C and D) which feed the three mode lines. The mode A/B gate is controlled by wires connected to the control unit, which when earthed permit the passage of the pulses to the mode selection AND gates.

Mode C and mode D gates are similarly operated, by control wires which may be connected to automatic altitude reporting and airframe identity equipment, respectively. A filter is included for the mode C control wires to prevent interference by the automatic altitude reporting equipment.

C. Mode selection AND gates (bls. 82,83,84)

These gates are opened by the 30 us pulses from the mode gate pulse generators. Pulse trains from the code selection gates are thus only allowed to pass to the coarse gate on the same mode as the original interrogation.

D. F1 and F2 OR gate (bl. 79)

As the F1 and F2 pulses are transmitted in all pulse trains they are not fed to the mode AND gates. F1 and F2 are OR gated direct from the delay line and passed to the coarse gate.

E. Coarse gate (bl. 86)

The output of the coarse gate consists of F1, F2 and the selected reply code pulses on the same mode line as the original interrogation. These pulses are fed to the timing pulse gate.

F. Timing oscillator and gate (bls. 89,90,91,92)

(1) The timing oscillator is triggered from the decoder common gate line and produces accurately spaced pulses. These pulses are gated by the output from the coarse gate. The output from the timing pulse gate thus consists of accurately spaced pulses in a train selected by the code selection circuits.

(2) A control circuit inhibits the operation of the timing oscillator when the main function switch is in the STANDBY position. An inhibiting bias is also fed to the decoder suppression pulse generator, and to the external transmitter trigger inhibit gate.

G. Sub-modulator (bls. 93,94)

The sub-modulator is triggered either by the pulse train from the timing pulse gate, or from the EXTERNAL TX TRIGGER socket, both inputs being fed through an OR gate. Pulses are produced in the sub-modulator to drive the modulator transistor.

7. Encoder Ancillary Equipment

A. Ident-Pulse Hold-on (bls. 88,73,78)

(1) Pressing the IDENT button on the control unit causes the AND gate connected to the mode A/B line to pass the identity pulse (24.65 us). The identity pulse hold-on circuit is also triggered, holding the AND gate open for approximately 20 secs. Thus one depression of the control button causes the identity pulse to be transmitted for a period of 20 secs.

(2) A second AND gate, connected to the mode C line, is opened when the D4 pulse is selected on mode C. The identity pulse will then be automatically transmitted at the end of the code train. No provision for identity pulses is made on mode D.

8. Transmitter (bls. 74,69)

The transmitter consists of two stages, each employing a high reliability ceramic triode in a gold plated cavity. The first stage is a cathode modulated oscillator which drives a class C amplifier stage. Peak output power is approximately IKW, and the transmitter is not overloaded at a duty cycle of 0.01. Transmitter power is fed via the antenna T junction and low pass filter to the antenna itself. A probe, in the amplifier cavity, feeds the self test circuits, providing a detected output.

9. Self test

The self-test facility provides a 'go'; 'no-go' indication of correct operation of the transponder by testing certain functions. A pulse at 1030 Mc/s is generated and injected into the receiver. The output of the transmitter is detected and used to operate an aural and a visual monitor. Self testing may be initiated at the control unit, or by a button on the front panel of the transponder itself. Visual indication is provided by lamps, one on the control unit front panel, and a second on the transponder. Aural indications may also be fed out of the transponder.

A. Self test local oscillator (bls. 46,47,48)

(1) The self test local oscillator is driven from a crystal-controlled oscillator operating at 85.833 Mc/s. A transistor doubler, and a diode quadrupler are used to generate harmonics of the oscillator frequency. The fifth cavity in the filter circuit is used to select the final frequency of 1030 Mc/s.

(2) A multivibrator circuit, operating at approximately 500 c/s, drives a monostable circuit, producing 1 μs pulses. These 1 μs pulses are used to trigger the self test local oscillator.

B. Re-trigger amplifier (bls. 44, 45)

As only one pulse is generated by the self test local oscillator circuits, provision is made to operate the mode coincidence gates in the decoder by this single pulse, instead of a normal two pulse interrogation. This is achieved by feeding the input pulse to the coincidence gate, obtained from the decoder delay line, into the spike eliminator and thus to the other input of the coincidence gate. The coincidence gate will then have the required two inputs, and will pass a single pulse to the mode gate pulse generators. An inhibit gate, opened by the SELF TEST, ON signal, normally prevents the re-trigger amplifier output from reaching the spike eliminator.

C. Aural and Visual Monitors (bls. 70,76,81,87)

Detected r.f. pulses from the transmitter are fed through an amplifier into an AND gate, which is opened by the F2 pulse from the encoder delay line. Output pulses from the AND gate are fed to a comparison circuit, where the amplitude of the r.f. pulse is measured. If the amplitude is satisfactory the aural and visual monitor circuits are triggered. The use of the AND gate ensures that pulses are measured at the F2 position where transmitter power loss would be greatest in the event of transmitter failure.

10. Internal Power Supplies (bls. 75,80,85)

(1) The power supplies are produced in two separate units, the component parts of which are shown in Fig.3.

(2) The 115V a.c. supply is used to produce 40V d.c., which is fed to one input of an OR gate. The second input to the gate is the 27.5V d.c. supply voltage. Only if the a.c. supply, fails, or operation solely on d.c. is required, the 27.5 d.c. passes through the OR gate to the regulator.

(3) The regulator maintains a constant supply voltage to an inverter regardless of the fluctuations that may occur in the supply voltage or load current. Thus the rectified outputs of the inverter are stabilised, and provide the rail voltages for the transistor circuits.

(4) Three other outputs from the inverter provide the two valve heater supplies, and the e.h.t. supply. A small portion of the ripple voltage on the e.h.t. supply is used to trigger the over-interrogation circuitry when excess current is drawn, and a disable link is included to enable the supply to be disconnected.

Pages 17,18,19,20 not included

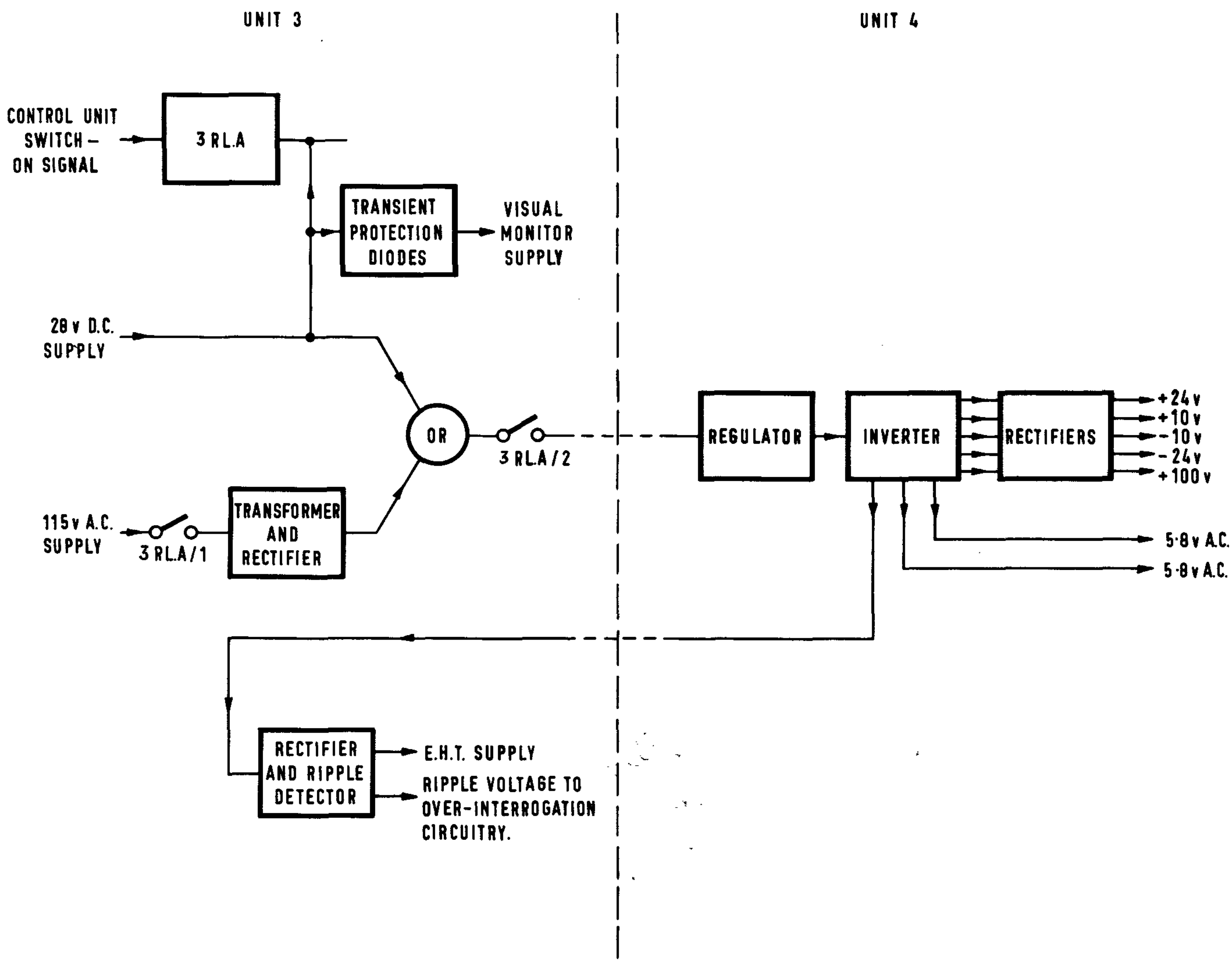
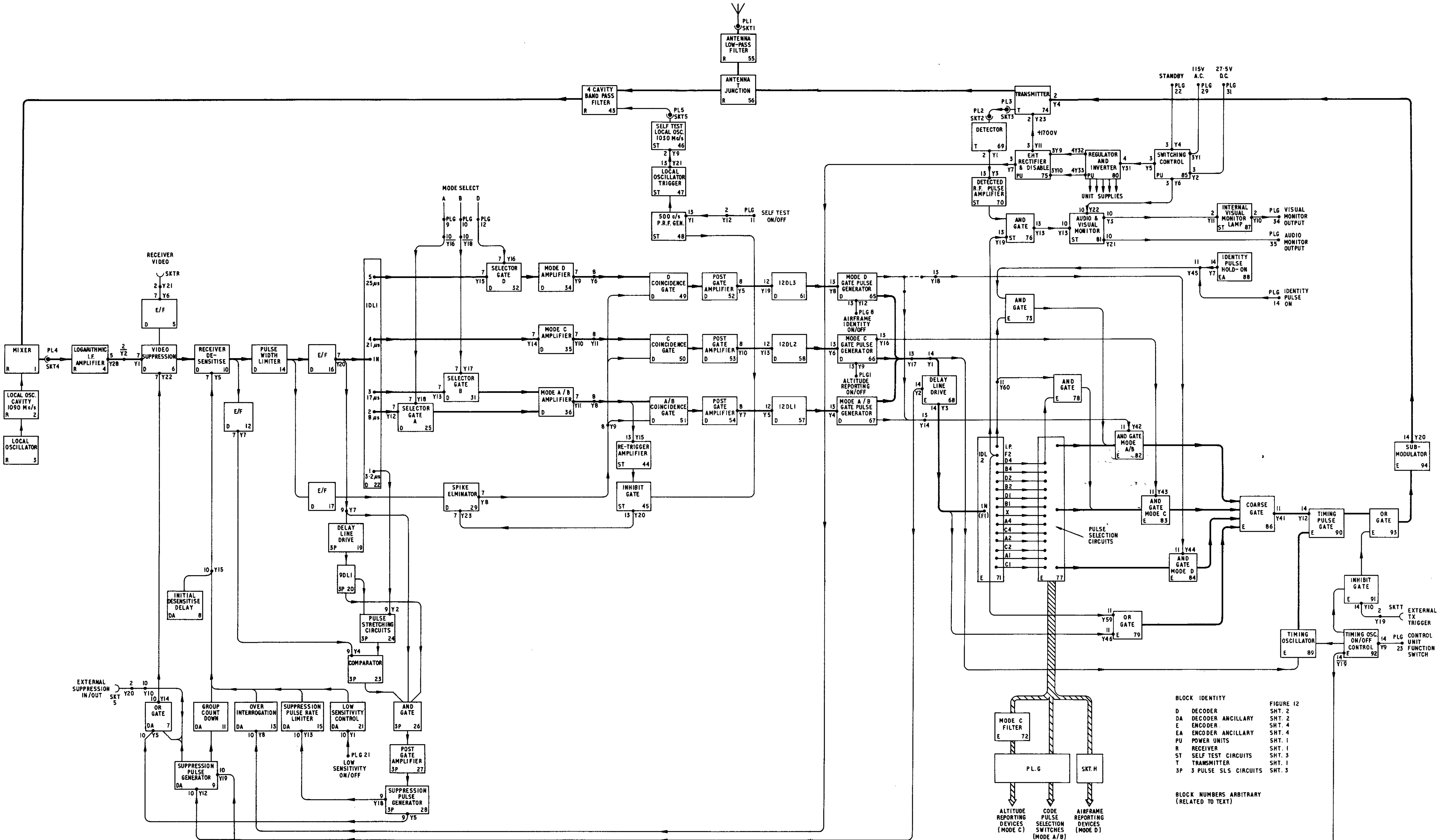


FIGURE 3
S.S.R. 1600/2 POWER UNIT.



M.O.D. AL2, Mar. 69

FIG.4. BLOCK DIAGRAM SSR 1600/2

Section 3

CIRCUIT DESCRIPTION

Contents

ILLUSTRATIONS

CIRCUIT DESCRIPTION (REFER TO FIG.12)

1. Power Units

Information on the Power Units
will be found on Page 46.

Information on the Power Units
will be found on page 46.

2. Receiver

A. T-Junction and Low-pass filter

(1) the antenna socket is connected to the T-junction via a low-pass filter which rejects any spurious outputs from the transmitter and protects the receiver from unwanted radiations at frequencies higher than the transmitter.

(2) The receiver arm of the T-junction is of such a length that it appears as an open circuit at the transmitter frequency. Therefore all the transmitter power passes into the antenna arm. The transmitter arm is of such a length that it appears as an open-circuit at the receiver frequency. Consequently, signals at 1030 Mc/s received by the antenna pass to the receiver without loss.

B. Filter and mixer assembly

(1) The filter consists of four quarter wave long coaxial cavities, short-circuited at one end, and with a small variable capacitor for tuning purposes at the other. Coupling between the first and second cavities and between the third and fourth cavities is inductive; coupling between the second and third cavities is capacitive. The cavities are tuned to provide a symmetrical frequency response which attenuates signals outside the receiver pass band by considerably more than 60 dB. The filter further protects the crystal mixer diode 2D7 from the transponder transmitter power, and high power radiations. It also prevents image frequency interference.

(2) The mixer consists of a low noise figure crystal mixer diode 2D7, terminating a coaxial line. It combines signal power at 1030 Mc/s from the band-pass filter, and local oscillator power at 1090 Mc/s from the local oscillator cavity, to produce a 60 Mc/s I.F. signal.

C. Local oscillator

(1) Transistor 2VT1 is connected as a common emitter, crystal-controlled, oscillator, operating at a frequency of 90.833 Mc/s. A tuned circuit, 2L1, 2C2, resonating at this frequency, is connected in the collector circuit, and feedback is taken directly from the collector to the emitter via 2C1. Capacitors 2C1 and 2C4 provide matching between the collector and the emitter. The crystal 2X1, connected between the base and earth, controls the frequency of oscillation by providing base de-coupling only at the crystal frequency. At all other frequencies heavy negative feedback is produced which prevents oscillation.

(2) The output signal from the oscillator is coupled via 2C5, from a tap on 2L1, to the emitter of the common base amplifier, 2VT2. Transistor 2VT2 is connected as a class C amplifier. The collector circuit, 2L2 2C6, is tuned to 272.5 Mc/s to select the third harmonic of input signal frequency, and 2VT2 thus acts as an X3 frequency multiplier.

(3) From the frequency multiplying stage, the output is taken from a tap on 2L2, through 2C9, to the base of 2VT3, a grounded emitter tuned amplifier. This stage is operated as a class-A amplifier with the collector circuit, 2L3 2C12, tuned to 272.5 Mc/s. Output from this stage is taken directly from the collector and coupled to the cathode of 2D1 via 2C13. Capacitor 2C13, in conjunction with 2R11, provides self-bias for 2D1.

(4) The diode 2D1 is a harmonic generator, and the signal from its anode is coupled into the local oscillator final cavity, via 2L4. This cavity is tuned to 1090 Mc/s, and thus selects the fourth harmonic of the input signal frequency applied to 2D1. 2L4 is used to assist in matching into the low input impedance of the cavity, and also to provide a means of adjusting the amplitude of the local oscillator output.

(5) Capacitors 2C12, 2C6 and 2C2, connected across the three tuned circuits associated with 2VT3, 2VT2 and 2VT1, have temperature coefficients such that they compensate for variations with temperature caused by other components in the circuits.

D. Logarithmic amplifier

(1) The amplifier consists basically of four feedback pair stages, having a frequency response centred on 60 Mc/s, and a bandwidth of 7 - 8.5 Mc/s. The principle of successive detection is used to obtain a logarithmic characteristic.

(2) Bias for transistors 5VT1, 2, 4, 6, 8, 10, 12 and 14, is provided by the potential divider 5R31, 5R32, from the +24 V line. The bias line is decoupled between each stage by resistors 5R24-30 and capacitors 5C10-18. The +24 V supply to the common collector loads 5R17-20, is decoupled by resistors 5R21-23, and capacitors 5C19-22. Resistors 5R2-8, connected to the decoupled -10 V line, with capacitors 5C23-33, provide a 'long tail' effect for transistors 5VT3, 5, 7, 9, 11, 13 and 15. This effect serves to keep the mean d.c. current through the cascoded amplifiers 5VT2-3, 5VT4-5, etc., at a constant value, producing good gain stability, and reducing the variations caused by tolerances on transistors. RV1 is included to provide a means of gain control of the amplifier, by variation of the supply voltage to stages 1 and 2.

(3) Stages 2 and 3 are exactly identical, whilst stages 1 and 4 exhibit only slight differences, thus the following description of stage 2 may be used generally for the other stages. Input signals to stage 2 are obtained from the tuned circuit formed by 5L3, the output capacity of 5VT2 and the input capacity of 5VT5, and fed to the base of 5VT5. 5VT5 has as part of its collector load, the common base stage 5VT4, which itself has a collector load 5R11, 5R18. 5VT7 and 5VT6 with 5L5 form a tuned cascode amplifier similar to that formed by 5VT5 and 5VT4 with 5L4. 5R18 is common to the collector circuits of both 5VT4 and 5VT6, so negative feedback is produced, serving to synthesise a maximally flat frequency response.

(4) Stage 1 has I.F. signals from the mixer diode fed to the emitter of 5VT1, via a tap on 5L1. 5VT1 is connected in common base configuration to provide a low input impedance to the amplifier. The choke 5L2 provides a d.c. path to earth for the mixer diode current. At stage 4, the final output from the amplifier is taken from the collector of 5VT14 via 5C9.

(5) The I.F. output from 5C9 is detected by 5D3 and fed to the base of 5VT18. In a similar manner, detected outputs are taken from stages 2 and 3, at the bases of 5VT9 and 5VT13, via diodes 5D1 and 5D2, to 5VT16 and 5VT17. The diodes 5D1, 5D2 and 5D3 are biassed in a forward direction by a potential of approximately half-a-volt, to improve the detection efficiency. This bias is obtained from another diode 5D6, also biassed in the forward direction by 5R42 from the -10 V line. Bias for 5VT16, 5VT17 and 5VT18 is derived from 5R41, also connected to the -10 V line, and is decoupled by 5C41. The emitter feedback resistors 5R46, 47 and 48, are connected to the junction of 5R41 and 5C41.

(6) Signals at the collectors of 5VT16, 5VT17 and 5VT18 are fed to an elemental delay line formed by 5C38, 5L10, 5C39, 5L11 and 5C40, which is terminated at either end by 5R51 and 5R52. 5VT16 collector is connected to 5R51, the delay line input; 5VT17 collector to the junction of 5L10 and 5L12; 5VT18 collector to the delay line output, 5R52. Delays in the two sections of the line are chosen to compensate for delays in the I.F. amplifier. Thus the pulses from stages 2, 3 and 4 arrive simultaneously at 5R52, where the summed output appears.

(7) Transistor 5VT19 amplifies and inverts the signal at its base, and the signal is fed to 5Y28, as the LOG.I.F. AMPLIFIER OUTPUT.

3. Decoder

A. Video suppression

(1) Negative-going video signals arriving from the logarithmic I.F. amplifier are taken via 7C1 to the base of 7VT1. Transistor 7VT1 is an inverter with an emitter-follower output provided by 7VT2. On receipt of the negative-going video suppression pulse the base of 7VT2 is held at earth potential and 7VT2 is cut off preventing the passage of any signals through the video amplifier. For monitoring purposes, an output is taken from 7VT2 emitter via another emitter follower 7VT3. From the emitter of 7VT3 the output is taken through a d.c. blocking capacitor 7C2, and 7D8, to the REC. VID. socket mounted on the transponder front panel. 7D8 has the double purpose of blocking the passage of the negative video suppression pulse, and preventing damage to 7VT3 which may be caused by positive pulses fed into the REC. VID. socket.

B. Receiver desensitisation

(1) Before arrival of the video signal at 7VT2 emitter, the anode of the diode 7D1 is approximately at earth potential. A negative potential is supplied to the cathode from the -10 V line, causing the diode to be forward biassed, and permitting free passage of signals to the bases of 7VT4 and 7VT5. However, the anode of 7D1 will be supplied with a negative bias from the receiver desensitisation bias line via 7R10, under the following conditions;

(a) Group count down; when the rate of reply groups exceeds 1400 per second.

(b) Sidelobe suppression rate limiting; when the sidelobe suppression rate exceeds 3000 suppressions per second.

(c) Over-interrogation; when the number of reply pulses per second exceeds the maximum safe load on the transmitter.

(2) From 7D1, positive-going pulses are passed to the base of 7VT4, an emitter follower. Positive-going pulses appearing at 7VT4 emitter are fed as drive to the three pulse sidelobe suppression circuit. A further output from 7D1 cathode supplies positive-going video pulses to the base of 7VT5. The output from 7VT5 is used to drive the pulse width limiter delay line.

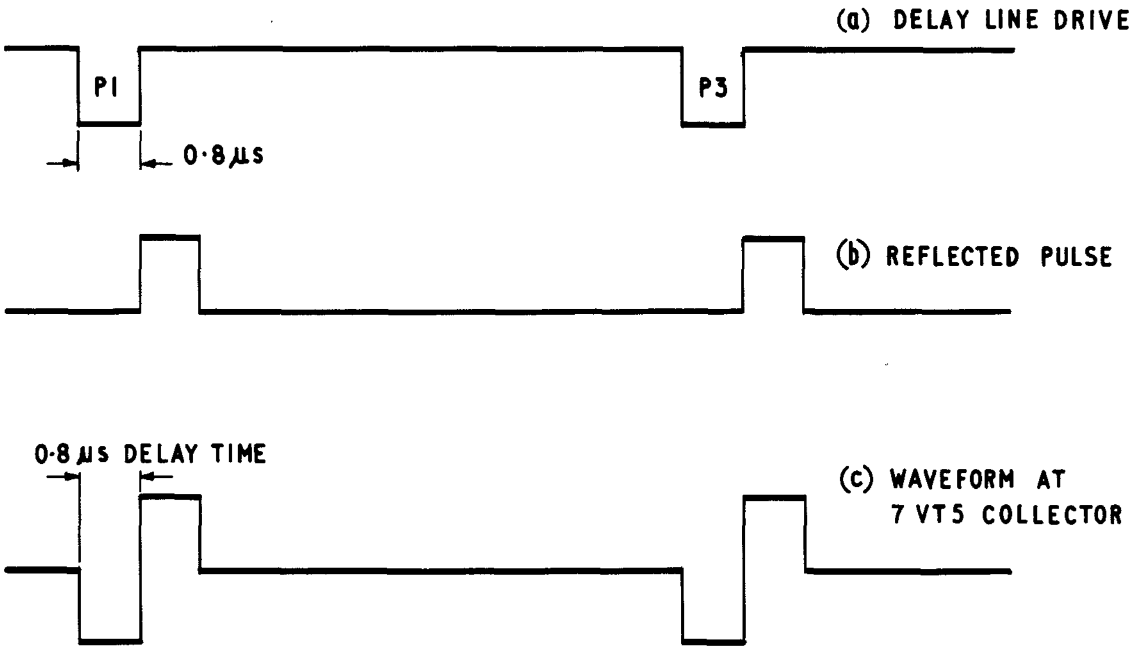


FIG. 1 IDEALISED PULSE WIDTH LIMITER WAVEFORMS FOR 0·8µs INPUT PULSE.

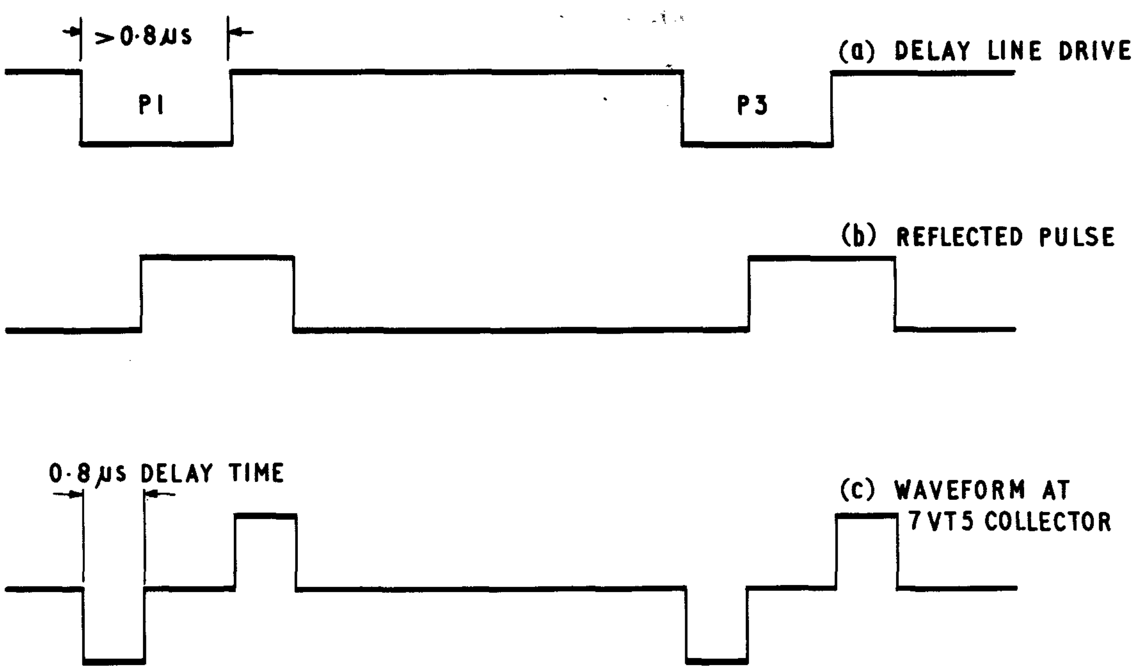


FIG. 2 IDEALISED PULSE WIDTH LIMITER WAVEFORMS FOR PULSE WIDTHS GREATER THAN 0·8µs

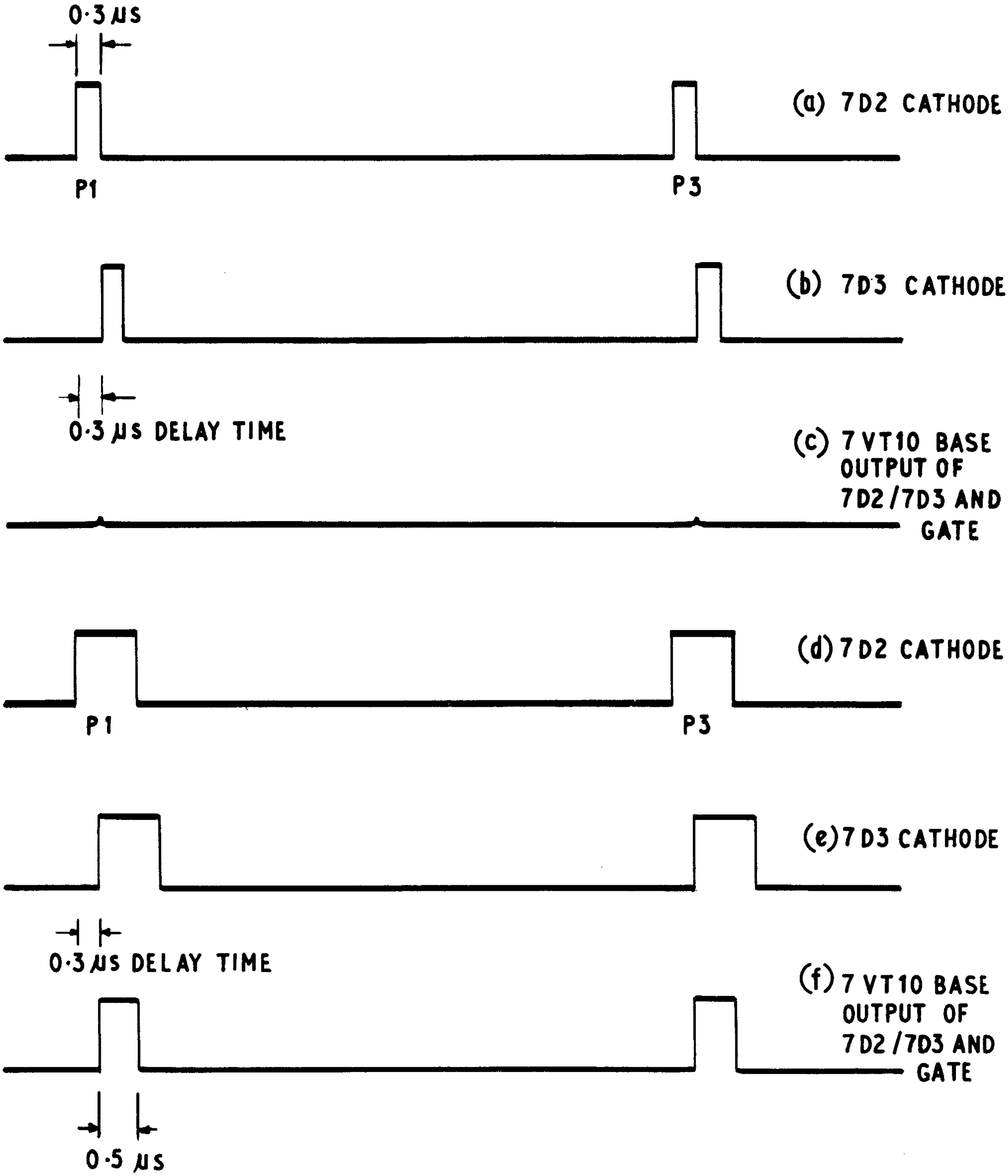


FIG.3 IDEALISED SPIKE ELIMINATOR WAVEFORMS

C. Pulse width limiter

(1) To limit the video pulse duration, a short circuited delay line 7DL1, is used in a pulse width limiter circuit. The line has a high cut-off frequency which ensures that no deterioration of the rise time of pulses passing down the line will occur. Delay time of the line is 0.4 us and its characteristic impedance is 470 ohms.

(2) In the pulse width limiter circuit, the line is terminated in a short-circuit and decoupled to earth via 7C8. Voltage pulses travelling down the line are therefore reflected in antiphase with the input pulses. Fig. 1 (a) shows pulses of 0.8 us duration passing down the line from 7VT5 collector. Fig. 1 (b) shows these pulses reflected in antiphase, finally appearing 0.8 us later at 7VT5 collector. The resultant waveform at 7VT5 collector is shown in Fig. 1 (c).

(3) Pulses of greater duration than 0.8 us passing down the line from 7VT5 collector are also reflected in antiphase, the leading edges of the reflected pulse appearing 0.8 us later at 7VT5 collector. These are shown in Fig. 2 (b). The resultant waveform appearing at 7VT5 collector is shown in Fig. 2 (c). Because the waveform in Fig. 2 (a) represents an arbitary pulse, it follows that any pulse width exceeding 0.8 us will be limited to 0.8 us before arriving at the base of 7VT6.

(4) 7VT6 amplifies and inverts the negative-going excursions of the waveform from 7VT5, and blocks the positive-going excursions at the base. Three outputs are taken from 7VT6 collector, which drive three emitter followers 7VT7, 7VT8, and 7VT9. Pulses from 7VT7 emitter are taken via a screened lead to the decoder delay line, 1DL1. 7VT8 output feeds the two pulse sidelobe suppression circuits, and 7VT9 output is passed to the spike eliminator delay line.

D. Spike eliminator

(1) Elimination of spikes and pulses of less than 0.3 us duration is achieved by using a delay line in conjunction with an AND gate. The line is the same as the line used in the pulse width limiter, but as a delay of only 0.3 us is required, the output is taken from a tapping point on the line.

(2) Diodes 7D2 and 7D3 together with 7R25 form an 'AND' gate, and only positive pulses arriving simultaneously at7D2 and 7D3 anodes can produce an output. Positive pulses of 0.3 us or less passing down the line are delayed by 0.3 us and, as shown in Fig. 3 (a), can never be coincident with the pulses appearing at 7D2 cathode.

No output is therefore produced at 7VT10 base. However, pulses of greater than 0.3 us duration are delayed for the same period in the line, and, as shown in Fig. 3(b), coincidence will occur for a period dependent upon the duration of the input pulses. Because of the action of the pulse width limiter the pulses arriving at the cathodes of the diodes are of no more than 0.8 us duration. Hence, the pulse appearing at 7VT10 base is normally of 0.5 us duration, and this pulse is amplified and inverted by 7VT10 before passing to the base of emitter follower 7VT11. The negative-going output pulses are fed from 7VT11 emitter to the decoder gates.

E. Mode selection

(1) A pulse pair, arriving from 7VT7 emitter in the video processing circuits, drives the decoder delay line. The lead carrying the pulse pair is screened, to prevent radiation of spurious pulses at the P1 position which may be picked up in other parts of the circuit and when later amplified may trigger the transponder. Design of the delay line, 1DL1, is optimum for the pulse width employed, that is 0.8 us; therefore the decoder line itself will give a measure of discrimination against spikes. After a delay corresponding to the mode spacing, pulses arrive at a tapping to which a take-off diode is connected. If the selector switch on the control unit is set to the correct mode, the pulse pair will be passed by the diode.

(2) Before the mode selection switch is set to the required mode position, the take-off diodes are back-biassed by a resistor chain connected to the +24 V rail. The diodes will thus not conduct positive pulses, appearing at their anodes from the line. When the selector switch is set to mode A, the junction of 7R31 and 7R32 is earthed through the switch, applying 24 V across 7R31, and removing the back-bias on 7D4 cathode. 7D4 now has a small forward bias and positive-going pulses are passed by 7D4 and arrive, via 7C16, at the base of 7VT12, a mode amplifier. Selection of mode B and mode D is similarly made and output pulses pass to mode amplifiers 7VT13 and 7VT17. Mode C is not selected by the switch; the pulse apir is taken directly from the delay line to the base of the amplifier 7VT15 via 7D7 and 7C20. Additional components are connected in the A and B mode selection circuitry to provide a constant mode C output when A, B or neither mode, is selected. When neither mode is selected diodes 7D9 and 7D10 are non-conducting. When either mode is selected, however, one diode will conduct, altering the bias on 7VT16. This change compensates for the loading effect produced on the delay line by the selection.

(3) Output pulses from each of the mode amplifiers are of equal amplitude to ensure accurate pulse comparison in the two pulse sidelobe suppression circuit. Settings of the potentiometers connected in the emitter circuits control the individual gains of the amplifiers, and are set for equalized output. Amplifiers 7VT12 and 7VT13 share a common collector load because mode A and mode B are never required simultaneously, and use the same reply codes. Amplified and inverted mode pulses appearing at the collector of each amplifier are passed to separate emitter followers 7VT14, 7VT16 and 7VT18, which feed the output to duo-diode coincidence gates.

F. Mode coincidence gates

(1) Diodes 8D10 and 8D11 form the decoder AND gate for mode A/B pulse pairs. Undelayed pulses arriving from the spike eliminator are fed to 8D11 anode, via 8C30, and pulses delayed by the mode spacing arrive via 8C28 at 8D10 anode and the cathode of 8D9. Coincidence occurs between the second pulse of the undelayed pair and the first pulse of the delayed pair, resulting in a single negative-going pulse output from the AND gate, which is passed to the base of the high-gain amplifier 8VT14. Operation of the mode C and mode D AND gates is identical to the operation of the mode A/B AND gate, a negative-going pulse from each gate passing separately to high gain amplifiers 8VT16 and 8VT18.

(2) The high-gain amplifier 8VT14 amplifies and inverts the negative-going pulse fed to its base, and from the collector, the positive-going pulse is fed to the base of 8VT15, an emitter follower. Output from 8VT15 emitter is a positive-going pulse which is fed to the mode A/B delay line, 12DL1. Mode C and mode D pulses are similarly amplified and inverted by 8VT16 and 8VT18 and fed via emitter followers 8VT17 and 8VT19 to the mode C and mode D delay lines, 12DL2 and 12DL3.

(3) Diodes 8D9, 8D12 and 8D15 are connected as an OR gate which permits the passage of pulses on separate lines to a common output line. Pulse pairs appearing at the anodes of the diodes are fed via the common output line to the two pulse sidelobe suppression circuits.

G. Decoder tolerance

(1) Considering the mode A/B gate initially, pulse pairs applied to 8D10 anode are approximately 0.8 μs in duration; a typical waveform is shown in Fig. 4 (b). At 8D11 anode the pulses are 0.5 μs in duration, and their nominal position with respect to the pulses at 8D10 anode is shown in Fig. 4 (a). Two conditions exist in which the gate will cease to decode.

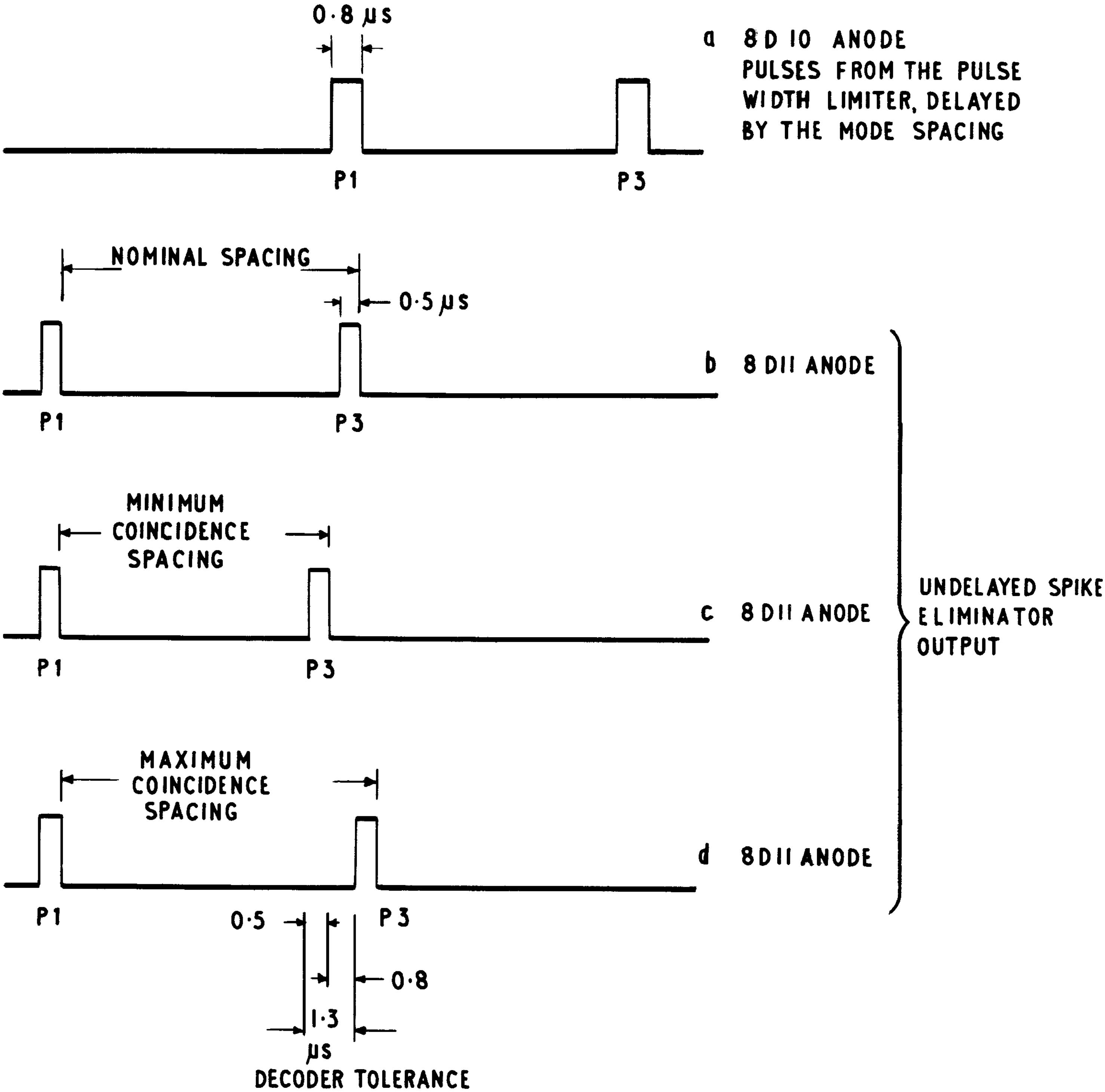


FIG.4 IDEALISED MODE A PULSES TO COINCIDENCE GATE.

(a) When the leading edge of the first pulse, P1 in Fig. 4(b), is coincident with the trailing edge of the second pulse, P3 in Fig. 4 (a).

(b) When the trailing edge of the first pulse, P1 in Fig. 4(b), is coincident with the leading edge of the second pulse, P3 in Fig. 4 (a).

(2) The duration between the two conditions in which the gate ceases to conduct is called decoder tolerance, and as can be seen from the illustration, is the width of the first pulse in Fig. 4 (b) plus the width of the second pulse in Fig. 4 (a).

Note: Measurement of pulse width in Fig. 4 (c) must be taken at about five per cent of the pulse amplitude.

H. Mode delay lines

(1) Mode delay lines are used to allow a delay of 3.0 us to elapse between the leading edge of the decoded pulse at P3 position of an interrogation, and the first framing pulse, F1, of the reply. This delay is a system requirement. A delay of this magnitude is also necessary for operation of two pulse sidelobe suppression. Detection of a sidelobe interrogation occurs after decoding and the delay enables an inhibit gate to be generated, which prevents the decoded output from reaching the mode gate generators. Each delay line has a characteristic impedance of 220 ohms.

(2) A mixer network consisting of 12R2, 12R3 and 12R4 is connected to the end of the mode A/B delay line (12DL1). The pulse entering the line is delayed by 3 us and will pass via resistor 12R2 to 12D2. 12D2 anode is nominally at earth potential and the cathode is connected via 12R5, to the wiper of 12RV1 (SET MIN TRIGGER). Minimum triggering level is normally set to give 50 per cent replies at -77 dBm power input and replies due to noise and spurious outputs at P1 position are eliminated.

(3) Normally the delayed positive-going trigger pulse is passed by 12D2 to the mode A/B gate generator, but may be suppressed by a pulse from the two pulse sidelobe inhibit gate generator. This negative-going pulse, of approximately 20 V amplitude and 3 us duration arrives at 12D2 anode via 12R4 approximately 1 us before the delayed mode A/B trigger pulse from the delay line. 12D2 is thus reverse biased and the trigger pulse is blocked, ensuring no output will pass to the encoder, The drive pulse for the two pulse sidelobe suppression circuits is obtained from a 0.5 us tap on 12DL1 via 12D1.

(4) Mode C and mode D delayed trigger pulses are similarly produced by 12DL2 and 12DL3, and may be blocked by 12D4 and 12D6. The drive pulses for the two pulse SLS generator are obtained via 12D3 and 12D5 from 0.5 u s taps on 12DL2 and 12DL3.

I. Mode gate pulse generator

(1) In the mode A/B gate pulse generator, 13VT9 is initially fully conducting; its collector is near emitter potential, holding 13VT10 cut-off by means of the resistor chain13R41, 13R39, connected to 13VT10 base. 13VT10 collector is therefore at earth potential. Diode 13D15 is fully conducting, and as 13VT9 base is at approximately 13VT9 emitter potential, 13C13 is fully charged. On the arrival of the positive-going trigger pulse, via 13C12 and 13D13, 13VT9 is switched off. The fall in 13VT9 collector potential is passed via 13R39 and 13R41 to the base of 13VT10, and 13VT10 is thus switched on. The potential of 13VT10 collector rises to near 13VT10 emitter potential, and the rise passes via 13D15 to 13C13. The potential at the junction 13R37 and 13C13 is thus raised, holding 13D15 non conducting. 13VT9 is now held cut-off by 13R35 connected to the +24V line. 13R36 and 13D14 prevent the safe reverse bias of 13VT9 base being exceeded.

(2) Capacitor 13C13 now charges via 13R37, with 13D15 blocking the discharge current from the base of 13VT9. When the potential at the junction of 13C13 and 13R37 falls sufficiently for 13D15 to start conducting, 13VT9 also begins to conduct once more. 13D16 prevents 13C13 re-charging through 13R42, ensuring a steep trailing edge on the output pulse. Diode 13D13 prevents the switching-on of 13VT9 by spurious negative pulses on the input line. The positive-going pulse from 13VT10 collector is fed to the common gate line via 13D17, and also to the mode A/B selection gate in the encoder via 13D18. The common gate output operates the timing oscillator and encoder drive. The pulse duration is approximately 30 u s and the pulse amplitude is approximately 10 V.

(3) Mode C gate pulse generator operates in a similar manner, feeding the mode C selection gate and the common gate line. Mode D gate pulse generator feeds the common gate line, but the output to the selection gate is taken to the mode A/B selection gate, as mode A/B and mode D have the same reply code. Provision is made, however, by means of a link, for connection to the mode D selection gate, if different reply codes are subsequently required. Switches in the control unit connected via PLG1 and PLG8 inhibit the operation of the altitude reporting and airframe identity gate pulse generator, mode C and mode D respectively, by removing the earth connections to 13R47 and 13R57, in their OFF positions.

4. Two-pulse sidelobe suppression

Two-pulse sidelobe suppression is no longer in use, and the relevant circuits in the transponder are disabled.

Pages 16 and 17 are therefore omitted.

2-pulse SLS is no longer used and the relevant circuits in the transponder are disabled.

5. Three pulse sidelobe suppression

Drive for the three pulse sidelobe suppression circuits is provided by input pulses fed from 7VT7 emitter in the video processing stage. As P1 and P2 pulses only are used, P3 is omitted from Fig. 6 and the waveform sketches are simplified accordingly. The unit may be sub-divided into the following parts:

A. Delay line

(1) Positive-going input pulses arrive, via 9C1, at the base of 9VT1, an emitter follower driving the 1.9μs delay line 9DL1. When the pulses are compared at 9VT8 collector in the comparator it is necessary for accurate comparison, that the pulse at P2 position appears in the centre of the stretched P1 pulse. For this reason the input to the pulse stretcher is taken via an emitter-follower 9VT4, from a tap on 9DL1. The tapping point may be adjusted during setting-up, for exact relative positioning of the two pulses.

(2) The final output of 9DL1 is taken to one input of the triple AND gate via 9C16, and also to the emitter of the grounded base amplifier 9VT2. The large value of 9R50 provides high gain from the stage, 9D11 preventing complete saturation of 9VT2. From the collector of 9VT2, the 1.9 μs delayed P1 pulse is fed to the pulse stretching circuit in the two pulse sidelobe suppresssion circuits.

B. Pulse stretcher

(1) Transistor 9VT4 is an emitter-follower, which receives the delayed pulses at its base. The output pulses at the emitter are used to charge 9C6, via 9D1, to the full amplitude of the pulse. 9VT5 is held just cut-off by the bias chain 9R8, 9R9, and as the high input impedance of 9VT6 permits negligible discharge, 9C6 retains its charge until 9VT5 is caused to conduct.

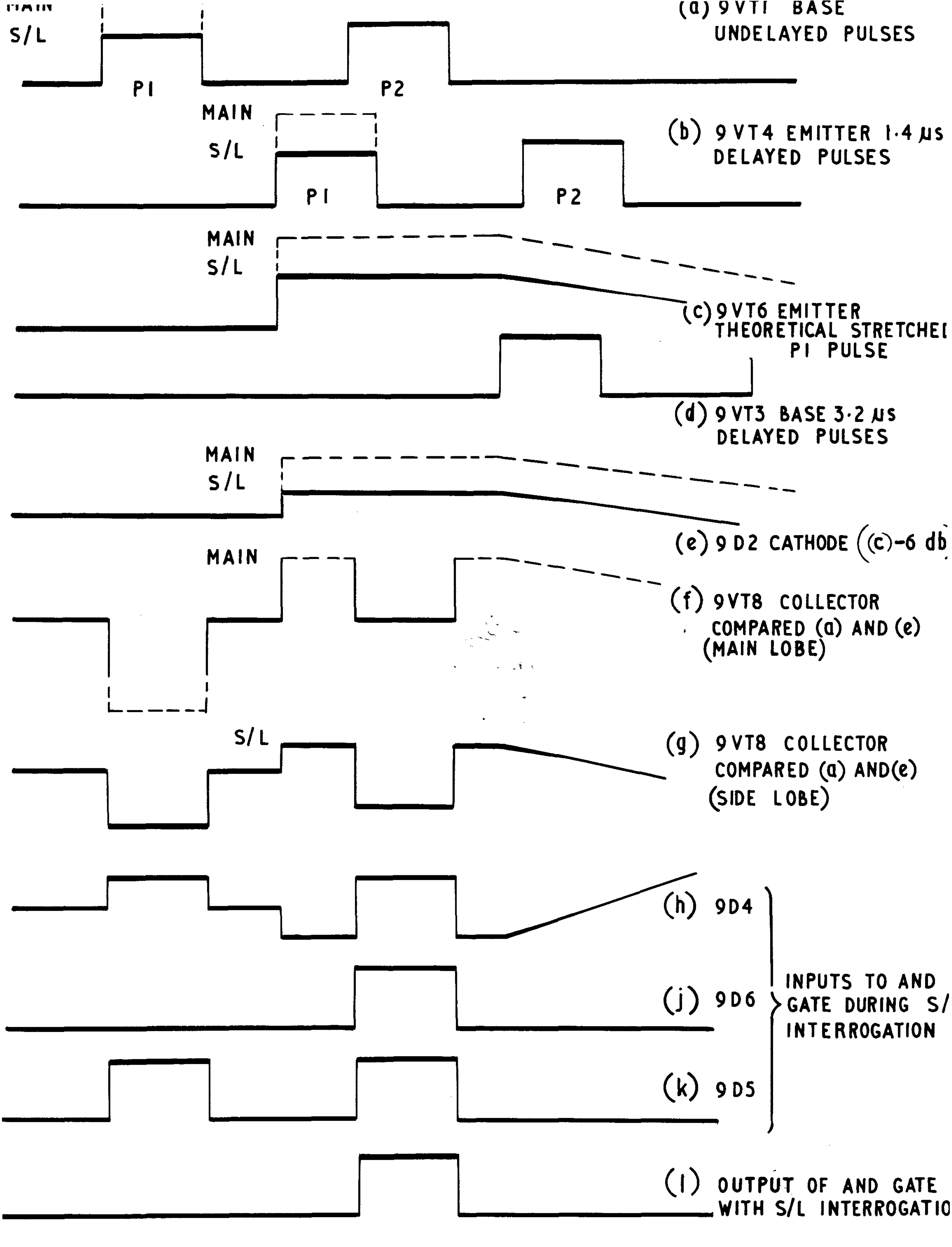


FIG 6. 3 PULSE SLS IDEALISED WAVEFORMS

(2) A tapping on the decoder delay line, 1DL1, after 3.2 us, provides the drive pulse which switches on 9VT5 ; this pulse is taken via emitter-follower 9VT3 and 9C5, to 9VT5 base. When 9VT5 is switched on it provides a path through which 9C6 may discharge exponentially, through 9R10. As the full amplitude of the input pulse P1 is present on 9C6 during the interval between the arrival of P1 and the arrival of the switching pulse, the output of 9VT6 is P1 stretched. P2 will also be stretched, but will not affect the operation of the circuits, and is therefore omitted in Fig. 6. The exponential recovery of the stretched pulse, which has a total duration of 8 us at maximum input gives a measure of discrimination against echoes appearing after P2 position, which might otherwise eventually trigger the inhibit gate unnecessarily. The relative positions of the input, output and trigger pulses is shown in Fig. 6 (b), (c) and (d).

C. Grey region setting

Positive-going stretched pulses pass from 9VT6 emitter to 9D2 anode via 9C7. Back-bias applied to 9D2 cathode which is adjusted by 9RV1 (SET GREY REGION), sets the level to which the stretched pulses must rise, before being passed by 9D2. 9RV1 is set to clip the equivalent of approximately 6dB from the stretched pulses. This provides a 'grey region' before which P1 stretched is compared with P2, (Fig. 6 (e)). Clipped pulses are fed via 9C8 to the base of 9VT7, an emitter-follower feeding the collector circuit of the comparator 9VT8.

D. Comparator

Pulses from the emitter of 7VT4 in the video processing stage are fed via 9C2 to the base of 9VT8. This input is used instead of the processed input fed to 9VT1, as echoes produced in the pulse width limiter circuit may attenuate the P2 pulse, and upset the operation of the comparator. The negative-going pulses produced at the collector of 9VT8 by this base input are compared with the stretched pulses from 9VT7. The resulting waveform is shown in Fig. 6 (f) or (g): this waveform consists of the positive-going stretched pulse, upon which the inverted input pulse is superimposed. The gain of the channel supplying the input pulses is set by 9RV2 (SET SLS SLOPE) connected in the emitter circuit of 9VT8, and is made equal to the gain of the channel supplying the stretched pulses. Equality of gain between the two channels reults in a level sidelobe suppression characteristic. Capacitor 9C11 is connected in the emitter circuit of 9VT8 to maintain the shape of the input pulses.

E. Triple AND gate

(1) The negative-going pulses from the comparator, appearing at 9VT9 base under sidelobe interrogation conditions, are amplified and inverted, and pass from the collector to the base of emitter-follower 9VT10. Diode 9D3 limits the amplitude of P1, and minimises spurious outputs from the AND gate at this position.

(2) Diodes 9D4, 9D5 and 9D6 form the AND gate; 9D4 receives the difference output of 9VT9 fed from 9VT10 emitter. The output from the delay line 9DL1 is fed to 9D6 via 9C16. This input ensures that the waveform is decoded at P2 position, and thus only genuine three pulse sidelobe interrogations are recognised, Diode 9D5 receives the original processed input, as fed to 9VT1, via 9C15; the form of this pulse ensures a good discrimination characteristic against pulse spacings greater or less than 2.0us. It also prevents the transponder replying to single, long pulses. The relative position of the three inputs is shown in Fig. 6. (h), (j) and (k).

(3) A single positive-going pulse output from the AND gate can only be obtained when a sidelobe interrogation is received, i.e. when P2 is larger than P1 minus 6 dB, as shown in Fig. 6 (g) and (h). This output, shown in Fig. 6 (l) is fed to the base of the high gain amplifier 9VT12. From the collector of 9VT12, the amplified and inverted pulse passes to the emitter-follower 9VT13 which in turn feeds its output to the cathode of 9D7 via 9C45. 9D7 also receives the output of the two pulse sidelobe inhibit gate generator via 8D18.

F. Minimum trigger setting

Diode 9D7 and 9RV3 (SET MIN TRIGGER) are arranged to set the minimum trigger of the 3 pulse sidelobe suppression gate generator. 9RV3 adjusts the back-bias on 9D7 so that maximum sensitivity may be obtained from the system, whilst noise and spurious outputs from the AND gate are removed. The trigger pulses at 9D7 are fed via 9C46 and 9D8 to the base of 9VT14, one half of a monostable multivibrator.

G. Suppression gate generator

(1) Transistors 9VT14 and 9VT15 are connected in a monostable multivibrator circuit which is essentially identical to those used in the mode gate pulse generators. A positive-going output, taken from 9VT14 collector, which has an amplitude of approximately 10 V and a duration of 35 us, is passed via 10D6, 10C23 and 10R11 to the base of 10VT3 and then to the video suppression circuit.

This circuit is used for it is a system requirement that the video signals be suppressed for a period of 35 us after a sidelobe interrogation. Obviously, with a three-pulse interrogation, P3 will be prevented from reaching the decoder and no replies will be transmitted.

(2) A second negative-going output, from 9VT15 collector, with an amplitude of approximately 20V is fed to the rate limiter. This output enables the rate limiter to desensitise the receiver when the rate of sidelobe suppressions exceeds nominally, 3000 per second.

6. Decoder Ancilliary Equipment

A. Suppression pulse generator

(1) Transistors 10VT1 and 10VT2 connected in a monostable multivibrator circuit, generate pulses used to suppress other equipment operating in the aircraft, and the internal video amplifier, whilst replies are being transmitted. The multivibrator is essentially identical to those used in the mode gate pulse generators. Trigger pulses arrive via 10C1 and 10D1 from the emitter of 14VT13 in the encoder delay line drive circuits. 14VT13 is fed from the common gate output of the mode gate generators, and is used to drive the delay line formed by 14L2-L5 and 14C21-25. As the output of this delay line drives the encoder, suppression pulses appear before replies are transmitted.

(2) When the equipment is in the STANDBY condition, the encoder is inoperative, so no suppression pulses are required. An inhibiting input is fed to 10D18 from 14VT23 in the timing oscillator control circuit. 14VT23 is switched off and its collector potential is at -10V. This potential, with zener diode 10D18 and 10R1 holds 10D1 back-biassed, preventing input pulses fed via 10C1 passing to 10VT1 base.

(3) From the collector of 10VT2, the output pulse, of approximately 24 V amplitude and 25-30 us duration, is fed via 10D4 to the SUPPRESSION IN/OUT socket on the transponder front panel. The suppression pulses are capable of working into an impedance of 300 ohms, 2,000 pF. The suppression pulses are also fed to one input of the OR gate 10D5, 10D6. A further output is taken from the collector circuit of 10VT2, at the junction of 10R8 and 10R9. This output is fed to the group count-down circuits via 10C6.

B. Video suppression.

(1) Diode 10D5, part of the OR gate 10D5, 10D6, receives the output of the suppression generator via 10D4, and also positive-going suppression pulses that may be fed in to the SUPPRESSION IN/OUT socket. Diode 10D4 prevents these positive-going input pulses from entering the suppression pulse generator, and 10D24 provides a path to earth for any spurious negative pulses. The other input to the OR gate, fed to 10D6 is taken from the suppression generator driven by the two and three pulse sidelobe suppression circuits.

(2) The OR gate output is taken via 10C23 and 10R11 to the base of 10VT3, which is normally non-conducting. 10VT3 collector is connected to the collector of 7VT1 in the video amplifier. The positive-going pulses at the base, switch on 10VT3, effectively short-circuiting the collector resistor of 7VT1 to earth. The output of the video amplifier is thus suppressed during replies, or after sidelobe interrogations.

C. Receiver desensitisation bias.

(1) This bias is produced by any of the three circuits; group count-down; three pulse sidelobe suppression rate limiter; transmitter overload. The common bias line is connected via 7R10 to the anode of 7D1 in the receiver desensitisation portion of the video processing circuits.

(a) Group count-down

When the transponder is not being interrogated, 10VT4 is non-conducting. No voltage is therefore dropped across 10R18, and 10C7 and 10C24 are uncharged. As interrogations commence, a fraction of the output pulse at 10VT2 collector is applied, via 10C6, to the base of 10VT4, which causes 10VT4 to conduct for pulse duration. Capacitors 10C7 and 10C24 charge up to the peak amplitude of the input pulse, and between pulses discharge through 10R18.

The time constant of 10R18, 10C7 and 10C24, is large compared with the pulse duration, so a series of saw-tooth waveforms is superimposed on the d.c. drop across 10R18 developed as 10VT4 conducts. The potential across 10R18 is fed to the base of the emitter-follower 10VT5, the emitter of which is connected to 10D8 anode.

Increase of the interrogation rate causes the positive d.c. potential across R18 to rise until the back-bias across 10D8 is exceeded. The potential at the base of 10VT6 is thus raised and 10VT6 starts to conduct. The potential of 10VT6 collector previously resting at +0.5 V, the forward potential drop across 10D12, now commences to go negative, taking the common output line with it. The maximum negative potential to which the common line can fall is fixed by zener diode 10D11 at -10 V. Potentiometer 10RV1 is normally set so that the transponder commences to count down at nominally 1450 pulse groups per second.

(b) <u>Sidelobe suppression rate limiter.</u>

The output from the suppression generator, which is driven by both the two and three pulse circuits, is fed to 10C5 from 9VT15 collector. Negative-going input pulses, fed via 10C5, are used to charge 10C9 which is connected in the emitter circuit of 10VT7. Increase of the sidelobe suppression rate develops an increasing negative potential across 10C9. When this potential exceeds the reverse-bias of the emitter/base junction of 10VT7, 10VT7 starts to conduct, resulting in a more negative potential at the collector. As 10VT7 collector is connected to the common output line, this negative potential is fed to the desensitisation portion of the video processing circuits to reduce the gain of the receiver. 10D11 limits the negative excursion of the potential as for the group count-down circuits. 10RV2 is normally set to desensitive the receiver when the rate of generation of suppressions exceeds the nominal 3,000 per second.

(c) <u>Over-interrogation.</u>

Resistor 10R26 is connected to 3R2 in the power unit, which in turn is connected between the earthy end of the e.h.t. transformer secondary winding and earth. The ripple waveform developed across 3R2 increases with the current in the secondary winding. This waveform charges 10C13 via 10R26 and 10D13 and causes a negative potential to be developed across 10R28. As the reply rate increases, the transmitter oscillator and r.f. amplifier draw additional current, which in turn increases the negative voltage across 10R28. When this voltage is sufficient to overcome the reverse bias of the base emitter junction of 10VT8, 10VT8 starts to conduct.

As 10VT8 collector is connected to the common output line, this negative potential is fed to the desentisation portion of the video processing circuits to reduce the gain of the receiver. 10RV3 is normally set to desensitise the receiver when the reply rate exceeds nominally 2300 reply pulses per sec.

(d) Low sensitivity

As mentioned previously the volt drop across 10D12, biassed in the forward direction by 10R29, holds the common output line at approximately +0.5 V when no desentisation bias is being produced. 10R4 and a LOW SENSITIVITY ON/OFF switch enable the sensitivity of the receiver to be decreased from the normal value. When the switch is set to the ON position, the wiper of 10RV4 is earthed, and the potential on the common output line falls to just below earth potential. By adjustment of 10RV4 the sensitivity may be reduced by 5-40 dB, but is normally set to give a reduction in gain of 12 dB.

(e) Initial desensitise delay.

This additional circuit, which is connected to the receiver desentisation bias line, prevents the transponder replying to interrogations for a period of approximately one minute after switching on. The delay time is necessary to allow the transmitter valve heaters to 'warm up' before the transmitter is operated.

Transistor 10VT16 is connected to produce constant-current charging of capacitor 10C27. The charging current passing through 10R59 produces a potential drop which holds the base of 10VT17 less negative than its emitter. The charging current now flows through the emitter/base junction of 10VT17, and the transistor conducts through zener diode 10D11. Thus during charging period the current through 10D11 produces a 10 V negative bias for the receiver desensitisation circuit.

After a period of approximately one minute, 10C27 becomes fully charged and current ceases to flow through the emitter/base junction of 10VT17. Transisistor 10VT17 is thus switched-off, removing the bias developed across 10D11. The receiver is no longer desensitised and the transponder may operate normally.

When the power units are switched-off, 10D22, and the now forward biassed collector/base junction of 10VT16, provide a discharge path for 10C27.

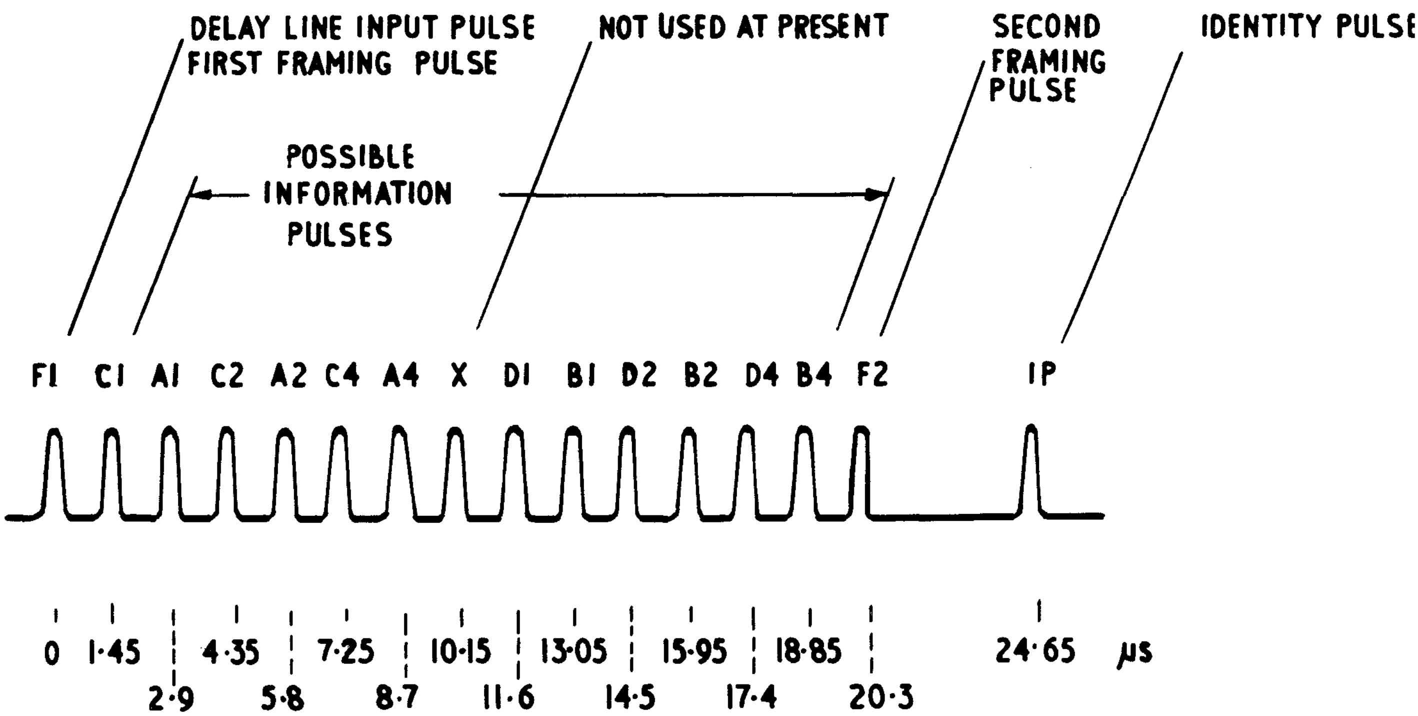


FIG.7 DELAY LINE PULSES

7. Encoder

A. Delay line drive

(1) The delay line drive circuit is triggered by a positive-going pulse from the common gate line which is fed to the base of 14VT13. Emitter-follower 14VT13 drives the auxiliary delay line 14L2-L5, 14C21-25, and the output from 14VT13 emitter arrives at the base of 14VT14, via 14C19 and 14R72 0.25 µs later. This delay is necessary so that pulses derived from the timing oscillator coincide with the gate pulses produced by 14VT13. The output from 14VT13 is also used to trigger the suppression generator, and thus suppressions are generated 0.25 µs before replies are triggered. 14VT14 amplifies the auxiliary delay line output to give a fast leading edge to the output pulse at the collector. The output pulse is differentiated by 14C16 and 14R42 and fed to the base of 14VT15 via 14D12. Transistor 14VT15 forms one half of a monostable trigger circuit, which produces the drive pulse for the main encoder delay line, of 22V amplitude and 0.9 µs duration.

(2) ◄ With no input, 14VT15 and 14VT16 are non-conducting. A negative-going input pulse at 14VT15 base causes 14VT15 to conduct, producing a positive-going pulse at the collector. The collector of 14VT15 is coupled to the base of 14VT16 via 14D13, 14C18 and 14R46, and thus the pulse from 14VT15 switches on 14VT16. Feedback of 14VT16 output to 14VT15 base is via 14R43 and 14C17, and the zener diode 14D24, so conventional monostable action follows. Zener diode 14D24 and the diode 14D23 limit the positive excursion of the pulse at 14VT15 collector to ensure that 14VT15 will not saturate. This has the effect of reducing the storage time of the transistor. The pulse duration at 14VT15 collector is determined by the time constant of 14C18, 14R44 and 14R46. Diode 14D13 isolates 14C18 and 14R44 from the collector circuit of 14VT15 allowing 14C18 to discharge through 14R44, and also 14VT15 collector potential to fall freely. Diode 14D14 prevents the base potential of 14VT16 from exceeding the maximum safe reverse emitter/base voltage. Output pulses are fed via 14C15 and 14C41 to the input of the encoder delay line 1DL2. ►

B. Encoder delay line, and code selection gates

(1) Fourteen tapping points are provided on the encoder delay line; the delay between each point and its neighbour is 1.45 µs. An additional tap provides a total delay 24.65 µs.

The line is terminated by resistor 11R98. To reduce the loading effects, tappings 1-13 are connected to emitter-followers; taps 14 and 15 are connected directly to diode selector circuits (11D37; and 11D39). Due to the attenuation of the line, progressively reduced outputs are normally obtained at each tapping point. Compensation for this attenuation is provided by a potentiometer network in the emitter circuits of each of the emitter followers.

(2) A positive-going pulse, 0.9 µs in duration is fed to the input terminal of the delay line from the delay line drive circuit. Output pulses, appropriately delayed are fed to the emitter followers. The outputs of the emitter followers feed the diode selection gates. The code pulse train consists of the following:

- (i) A framing pulse (F1)
- (ii) Six code pulses (C1, A1,C2,A2,C4 and A4)
- (iii) Code pulse (X)
- (iv) Six code pulses (B1,D1,B2,D2,B4,D4)
- (v) A framing pulse (F2)
- (vi) An identity pulse (IDENT)

(a) Framing pulses F1 and F2.

These pulses are produced for each code pulse train, and they function as marker pulses. F1 is the zero time pulse, and F2 the 20.3 µs marker. F1 (the delay line input pulse) is fed via diode 11D40 to 11R101 and then to the base of 11VT19. Similarly F2 is fed from the 20.3 µs tap via 11D37 to 11R101 and then 11VT19. Transistor 11VT19 forms part of the OR gate 11VT16, 11VT17, 11VT18, 11VT19, the output of which is used to drive the timing pulse gate circuits.

NOTE The F1 and F2 pulses are not gated by the mode gates and thus appear on any pulse train irrespective of the reply mode (A/B, C or D).

(b) Code pulse (X)

This pulse is not required at the present time, but the emitter follower and selection gates for lines C and D are provided.

(c) The identity pulse

The identity pulse occurs as the last pulse of the train and is derived from the 24.65 µs tap on the delay line. On mode A/B, the identity pulse is selected by the IDENT button on the control panel, which allows the IDENT pulse to appear on the mode A/B line via, 11D39 and 11C37. This is achieved by removing a back-bias on 11D39 which normally blocks the passage of the 24.65 µs pulse. The back-bias is removed by a pulse from the IDENT button/monostable. For mode C the IDENT pulse is fed to the mode C line only if the D4 pulse is selected. No identity pulse can be transmitted on mode D.

(d) Code pulse selection

Each emitter-follower feeds three diode selection gates, corresponding to modes A/B, C and C, the gates being primed by operation of the code selector switches. Considering 11VT1, an output pulse at its emitter is fed to the anodes of diodes 11D1, 11D2 and 11D3. When the code pulse fed through 11VT1 is selected by the selector switch, the back bias on the diodes, provided by the +24 V supply, is removed. Pulse 1 of mode A/B train is selected by earthing the junction of 11R25 and 11R26 through the selector switch, allowing the positive-going code pulse to pass via 11D1 to the mode A/B line. The selection of a further 11 pulses is performed in a similar manner, by earthing the junctions of resistors in configuration identical to those of 11R25 and 11R26. Thus any combination of a possible 12 pulses may be selected and fed via the common line to the base of 11VT13.

Mode C pulses are selected in a similar manner but the biassing resistors connected to the +24 V line for mode A are included in external filter circuits. These filter circuits are necessary to remove noise and spurious pulses on the control lines from the altitude measuring equipment which provides the mode C code pulse selection. The pulse train on the common line is fed to 11VT14. The pulse train for mode D is selected in a similar manner to mode A/B, and the common line feeds 11VT15.

C. AND gates

(1) The pulse trains on the common lines are fed to 11VT13 11VT14 and 11VT15, three emitter followers. Each of these transistors is reverse biassed by a voltage derived from the -10V rail and zener diode 11D41. This bias voltage (3.3 V) ensures that the emitter followers are cut-off between code pulses, and that the code pulses are sharply defined. It also eliminates the possible transmission of spurious code pulses, generated by delay line reflections or pick up, which might occur under fault conditions.

(2) Output pulses from the emitter-followers are AND gated with mode selection pulses produced by the mode gate pulse generators in the decoder. For example, if the transponder is interrogated on mode A/B, a 30.0 us pulse is fed to the gating diode 11D43; the pulse train is fed to 11D42. The resulting output of the AND gate is fed to the base of 11VT16. Mode C and mode D pulse train are similarly passed by the AND gates 11D44, 11D45 and 11D46, 11D47 and fed to 11VT17 and 11VT18.

D. Coarse gate

(1) Transistors 11VT16, 17, 18 and 19 (for F1 and F2), have a common collector load 11R121 and thus form an OR gate. Normally the -10 V line provides bias via 11R117, 118, 119 and 105, that holds the transistors switched off. The positive-going input pulses, from the AND gate and the OR gate, switch on the transistors, and provide negative-going output pulses. Thus the pulse train on any selected mode is passed to 14VT10 in the timing pulse gating circuits.

E. Timing oscillator

(1) Transistors 14VT2 and 14VT3 are connected in a modified Colpitts oscillator (frequency 690 Kc/s) which is prevented from oscillating by the damping effect of 14R4, connected across the oscillator tuned circuit via 14D3. When a positive going input pulse from the common gate output in the decoder is fed to the base of 14VT1, the transistor is switched on, and the potential at the junction of 14D26 and 14R4 rises. Diode 14D3 is then cut-off and the damping effect of 14R4 is removed from the tuned circuit. As 14R4 is connected to the -10 V line, the sudden virtual disconnection of this resistor causes the first oscillation in the tuned circuit to be positive-going. During positive-going peaks, feedback is applied via 14D4 and emitter follower 14VT3 to the junction of 14C4 and 14C5, to maintain oscillations. (Fig. 8 (a)).

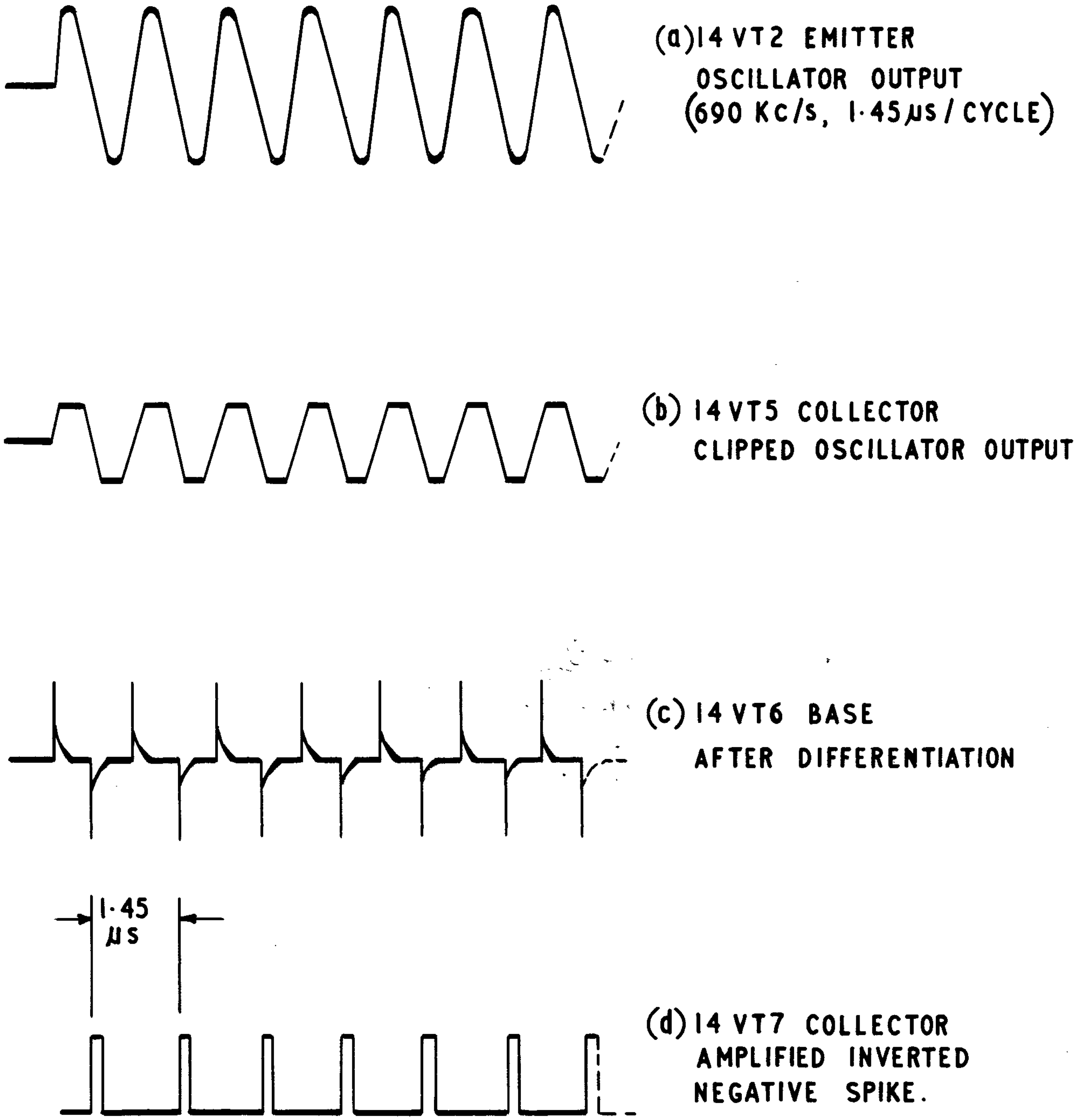


FIG. 8 IDEALISED TIMING OSCILLATOR WAVEFORMS

(2) Whilst the transmitter is in the STANDBY condition, no replies are required and 14VT23 is used to prevent operation of the timing oscillator. At STANDBY the earth connection to 14R70 is not made and 14VT23 is cut-off by bias from the +10 V supply. 14VT23 collector is held at approximately -10 V via 14R68 and 14R73 and 14D19 conducts. The tuned circuit is now damped by 14R73 through 14D19, and oscillations cease. 14VT23 collector potential at STANDBY is also used to inhibit the operation of the suppression generator, and to prevent external triggering by way of 14D21 in the timing pulse gate circuits.

(3) The output of the timing oscillator is fed to 14VT4 a buffer emitter-follower, from the emitter of 14VT2. From the emitter of 14VT4 the output is fed via 14R10 and 14C8 to the base of 14VT5. The base/emitter diode of 14VT5 clips the top of the negative half-cycles, and diode 14D4 clips the positive-half cycles, and maintains the waveform approximately symmetrical about earth. 14VT5 amplifies and inverts its base input, and feeds pulses to the differentiating network 14C9, 14R14. (Fig. 8 (b)).

(4) The differentiated output from 14VT5 is fed to the base of the amplifier 14VT6. (Fig. 8 (c)). Negative feedback developed across 14R16 in the emitter circuit of 14VT6 effectively increases the input impedance presented to the differentiating network, and reduces the drive required from 14VT5. Negative-going pulses at 14VT6 collector are coupled via 14C10, to the base of 14VT7. Transistor 14VT7 amplifies and inverts the pulses and a positive-going output is fed to 14VT10 in the timing pulse gating circuits. (Fig 8 (d)).

(5) The positive-going leading edges of the waveform at 14VT7 collector correspond in time with the maximum negative slope of the timing oscillator waveform at 14VT2. Since the oscillations in the timing oscillator start in the positive direction, the first negative maximum slope occurs after about one half-cycle. The auxiliary delay line, 14L2-L5, 14C21-C25 in the encoder delay line drive circuit is used to compensate for this half-cycle delay. Thus the pulses from the timing oscillator and those from the encoder gates coincide at 14VT10.

F. Timing pulse gates

(1) At the input to 14VT10, the negative-going code pulses from the coarse gate (Fig. 9 (b)) and AND gated,by means of a resistive gate, with the positive-going coincidence timing

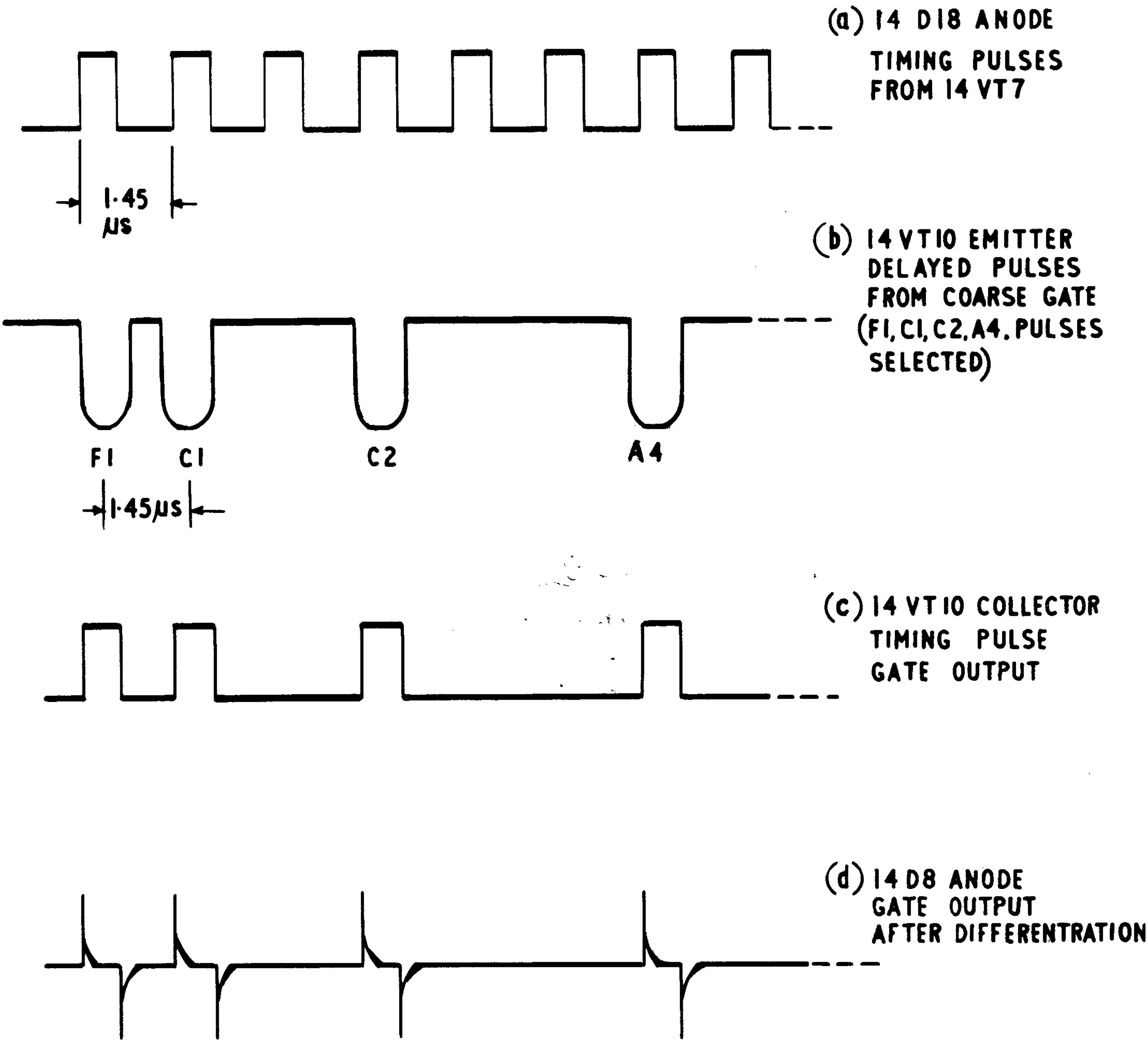


FIG 9. IDEALISED TIMING PULSE GATE WAVEFORMS

pulses from the timing oscillator (Fig. 9 (a)). With no output from the coarse gate, the output line is at a potential of +10 V, and so is the emitter of 14VT10. As the base of 14VT10 is held at +7 V, the transistor is cut-off. When output pulses from the coarse gate lower the potential of 14VT10 emitter to earth potential, positive-going timing pulses switch on 14VT10. It is important to note:

(i) The input from the coarse gate is negative-going.

(ii) The input from the timing pulse generator is positive-going.

(iii) Transistor 14VT10 amplifies and inverts signal (ii).

The negative-going pulse train from 14VT10 collector (Fig. 9 (c)) is differentiated by 14C14 and 14R31 and fed to one input of the OR gate 14D8, 14D9 (Fig. 9 (d)). The other input to this gate is obtained from 14VT22, which is fed from an AND gate, 14D21, 14D22.

(2) In order to trigger the transmitter from a separate source, an input may be fed to the TRANS TRIG socket, which by-passes the transponder receiver and decoding circuits. Before the arrival of these input pulses, diode 14D22 is conducting, and 14VT22 is cut-off. The negative-going input pulses switch on 14VT22 and the collector output is differentiated and fed to the OR gate 14D8, 14D9. If, however, the equipment is in the STANDBY condition, the negative potential from the collector of 14VT23 in the timing oscillator control circuit holds 14D22 cut-off via 14D21, and no input pulses may pass to 14VT22.

(3) The output of the OR gate 14D8, 14D9 passes to 14VT21, an emitter follower, which feeds the negative-going pulse train to the sub-modulator circuit via 14R61, 14C33 and the isolating diode 13D17.

G. Sub-modulator

(1) The sub-modulator monostable consists of three transistors, 14VT17, 18 and 19. With no input, 14VT17 is bottomed, and its collector potential is approximately +22 V. 14VT17 base potential is also near +22 V. Transistors 14VT18 and 14VT19 are held cut-off by the bias potential at 14VT17 collector via 14R55 and 14R34. The modulator transistor, 2VT6, is held cut-off, presenting a high impedance between the emitter of 14VT20 and earth.

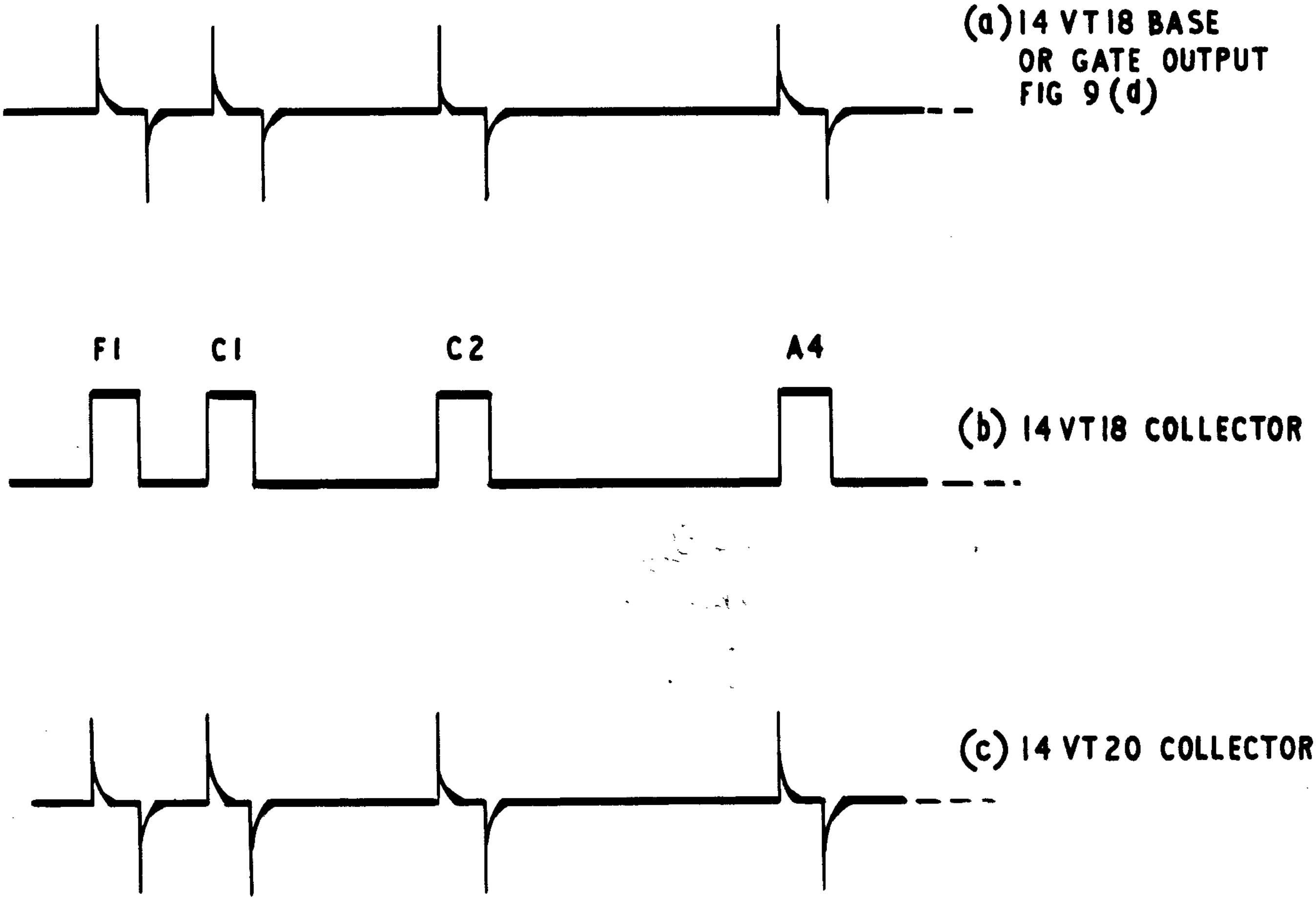


FIG. 10 IDEALISED SUB MODULATOR WAVEFORMS

(2) A negative-going input pulse at the base of 14VT18 (Fig.10 (a)) switches on 14VT18 and 14VT19, and positive going output pulses are produced at the collectors. The output of 14VT19 controls the modulator transistor, and this output is also fed back, via 14D10 and 14C27 to the base of 14VT17, switching 14VT17 off. The output of 14VT18 (Fig. 10 (b)) is differentiated by 14C30 and 14R59 and switches off 14VT20, so that the effective voltage swing at the input of the modulator transistor is from zero volts to +2 or 3 V.

(3) The width of the output pulse is determined by conventional monostable action and is dependent upon the time constant of 14C27, 14R53 and 14RV2. (Potentiometer 14RV2 is adjusted during setting up for correct pulse width and then locked-no adjustment should normally be performed during service). It should be noted that provided the width of the input pulse for the monostable is of sufficient duration to overcome the inherent delay of the monostable transistors, the conventional monostable action follows regardless of the input pulse.

(4) At the end of the operational period of the monostable, 14VT17 is again bottomed, and 14VT18 and 14VT19 are switched off. The negative-going waveform at the collector of 14VT18 is differentiated by 14C30 and 14R59, and 14VT20 conducts once more. The purpose of this latter operation is to speed-up the switch-off of the modulator transistor. 2VT6 is a power transistor and considerable hole storage exists when it is switched off. With 14VT20 conducting the modulator transistor 2VT6 quickly switches off via the low impedance of 14VT20 to the -10 V line (Fig. 10 (c)).

(5) Diode 14D16 protects 14VT20 from excess reverse emitter/base bias voltages. 14C29 is a 'speed-up' capacitor in the cross-coupling of the monostable circuits. 14C31 also is a 'speed-up' capacitor enabling 14VT19 to quickly establish base current in the modulator transistor. 14R60 limits the base current during the switch-on time of 2VT6.

8. Encoder ancillary equipment

A. IDENT pulse hold-on circuit

(1) This circuit enables the IDENT pulse to continue to be transmitted for a period of 6-30 seconds after the IDENT button is pressed. Transistors 14VT8 and 14VT9 are connected in a monostable multivibrator circuit with 14VT9 normally cut-off, and 14VT8 held conducting by the resistor chain 14RV1, 14R23 and 14R22.

Operation of the IDENT button causes the collector of 14VT9 to be earthed and 14D7 to conduct. The fall in potential is passed via 14C11 and 14C12, to cut off 14D6. 14VT8 is also cut off, and the rise in collector potential is passed via 14R20, to the base of 14VT9. Transistor 14VT9 conducts heavily, holding the collector potential just above earth. Thus the negative pulse supplied to the diode 11D39 via 11R97 in the code selection circuits when the IDENT button is pressed, remains present after the button is released.

(2) Capacitors 14C11 and 14C12 discharge through 14RV1 and 14R23 until the potential at the junction of 14C11 and 14R23 rises sufficiently for 14D6 to conduct once more. 14VT8 will switch-on, and 14VT9 switch-off, returning the circuit to its stable state. By varying the resistance in the discharge circuit for 14C11 and 14C12, 14RV1 controls the duration of the negative pulse at 14VT9 collector.

9. Transmitter

The transmitter includes two cylindrical cavities which are gold plated for reliable performance and long life. One cavity contains the oscillator valve V2, and the other the buffer amplifier valve V1.

A. Oscillator and Modulator.

(1) The oscillator valve 2V2 is connected in a grounded-grid circuit, which is constructed around a quarter wavelength coaxial cavity. One end of the cavity is short-circuited, and the other is terminated by the anode-grid capacitance of 2V2. Four symmetrically spaced loops in the cavity provide positive feedback to 2V2 cathode. Tuning is effected by means of a coaxial trimmer, which appears as a small lumped capacitance across the cavity. The output is taken from an inductive loop coupled to the cavity. Compensation for changes of valve anode-grid capacitance with temperatures, which would cause frequency variations, is provided by two bi-metallic strip capacitors in the anode-grid cavity.

(2) Modulating signals from sub-modulator circuits in the encoder are fed to the base of 2VT6 (Fig.11(a)). When no input is present, this transistor is cut-off, and 2V2 is held non-conducting by the bias on its cathode. This bias voltage is derived from the +100 V supply and is stabilized at 68 V by 2D5. Positive pulses arriving at 2VT6 base cause 2VT6 to conduct (Fig.11 (b)) and 2V2 cathode potential to fall. 2V2 conducts and oscillates until the end of the input pulse, (Fig. 11 (c)) when 2VT6 is cut-off once more, and bias is again applied to 2V2 cathode. During oscillation period, the current in 2V2 is limited by 2R13; 2R14 limits the current taken from the +100 V line by 2VT6.

B. Amplifier

(1) The amplifier stage is similar in construction to the oscillator, except for the omission of the feedback loops and temperature compensating capacitors. As well as amplifying the R.F. signal, this part of the circuit acts as a buffer between the antenna and oscillator, preventing frequency 'pulling' of the oscillator.

(2) Bias for the amplifier valve, also derived from 2D5 line, holds 2V2 non-conducting until an R.F. pulse arrives at the cathode. The e.h.t. supply for both the amplifier and oscillator valves is fed through a band-stop filter which acts as an R.F. choke.

(3) R.F. signals from the oscillator stage are fed to the cathode of 2V1 via 2C37, and the amplified output (Fig.11 (d)) is coupled to the T-junction by means of an inductive loop. A second output is fed to the transmitter self test circuits through the detector diode 2D4. This output (Fig.11 (e)) is approximately 20 dB below that fed to the antenna.

10. Self Test

A. P.R.F. Generator

(1) Transistors 13VT1 and 13VT2 are connected in a 500 c/s multivibrator circuit, the operation of which is inhibited when the test switches are in their OFF positions. Zener diode 13D1 is then conducting through 13R2, and the potential at the junction of 13D1 and 13D3 is approximately -14 V. 13D3 is also conducting, holding 13D4 and 13VT2 cut off.

(2) Switching either of the test switches earths the anode of 13D1 raising the potential at the junction of 13D1 and 13D3 to +5.6 V. Diode 13D3 is now cut-off, allowing the circuit to operate as a normal multivibrator at a frequency of 500 c/s. The inhibiting line from 13D1 is also used to control the inhibit gate in the re-trigger amplifier circuit.

B. Oscillator Trigger

(1) The output of the 500 c/s p.r.f generator is fed via a differentiating circuit 13C3, 13R9 and diode 13D5, to the base of 13VT3. Transistors 13VT3 and 13VT4 form a monostable circuit with both transistors initially cut-off.

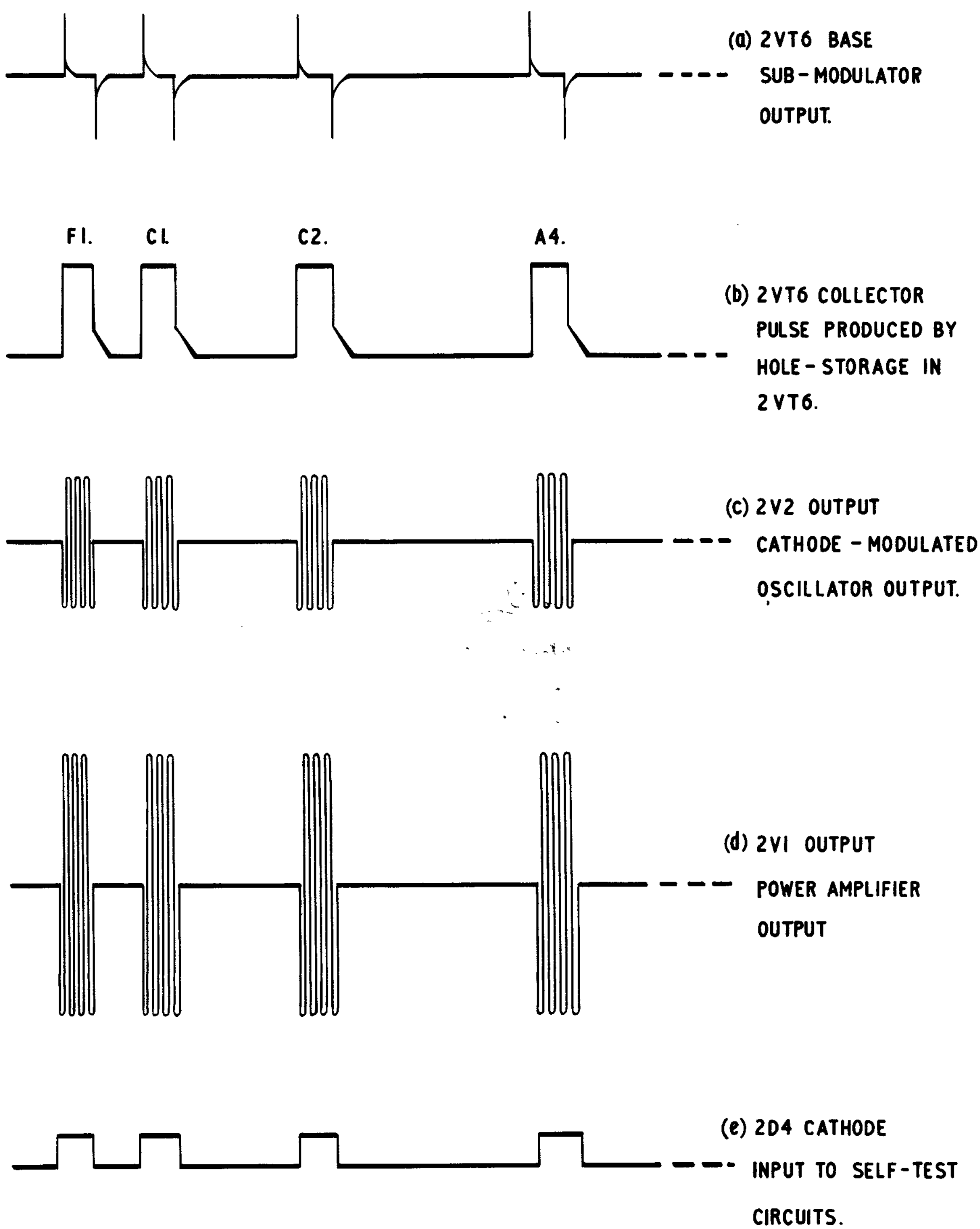


FIG. 11. IDEALISED TRANSMITTER WAVEFORMS

Diode 13D5 isolates the differentiating circuit from 13VT3. Negative-going spikes cause 13VT3 to start conducting. The rise in 13VT3 collector potential is passed via 13D33, 13C5 and 13R14 to the base of 13VT4. Transistor 13VT4 now starts to conduct and fall in collector potential is fed back to 13VT3 via 13R12 to hold 13VT3 'on'.

(2) Capacitor 13C5 now charges through 13R15 until the potential at the base of 13VT4 falls sufficiently negative for 13VT4 to cease conducting. The change in 13VT4 collector potential is fed via 13R12 to switch off 13VT3. The positive-going pulse at 13VT3 collector, which has a duration of approximately 1 us, is fed to trigger the local oscillator.

(3) Diodes 13D12 and 13D6 limit the reverse voltages applied to the bases of 13VT3 and 13VT4 respectively. Capacitor 13C4, connected across 13R12 speeds up the trailing edge of the output pulse. Diode 13D33 isolates the timing circuit from the collector of 13VT3.

C. <u>Self test local oscillator</u>

(1) Transistor 2VT4 is connected as a crystal-controll oscillator operating at 85.833 Mc/s. 2X2 controls the frequency of oscillation by providing a tuned feedback path from the collector circuit to the base. The output from the oscillator transistors is fed via 2C26 and 2R27 to 2VT5. When the oscillator is in the untriggered state, 2VT5 is held cut-off by the bias derived from the collector of 13VT13 via 2R25 and 2R26.

(2) On receipt of the positive-going trigger pulse from the monostable circuit, 2VT5 is switched on. The output from 2VT4 is amplified by 2VT5, operating as a non-linear amplifier. The tuned circuit 2C31, 2L7 selects the second harmonic of the input signal frequency, producing an output at 171.666 Mc/s.

(3) From VT5 the output is fed to 2D3. Diode 2D3 is also operating on its non-linear characteristic, producing harmonics of the input signal frequency. The fourth harmonic is selected by the 4 cavity band-pass filter circuit. 2L8 provides matching between 2D3 and the filter circuit, and 2VC1 is used to set the amplitude of the self-test oscillator output.

D. Re-trigger amplifier

(1) During self-testing, only single pulse interrogation is used. To operate a mode coincidence gate the input to the mode A/B gate is also fed through the re-trigger amplifier to the spike eliminator circuit which drives the coincidence gates. The output of the re-trigger amplifier is inhibited during normal operation by the bias line derived from 13D1 in the p.r.f. generator circuit.

(2) 13VT5 amplifies and inverts the pulse from the input to the coincidence gate. The output pulse from the collector is fed via 13C6 to 13D7. When the self test circuits are switched off, 13D8 is conducting, holding 13D7 cut off and preventing the passage of the pulse to the spike eliminator. Switching to either test position raises the potential at 13D8 cathode to +5.6 V, switching off 13D8. Diode 13D7 now conducts, and allows the re-trigger pulse to pass.

E. Detected r.f. pulse amplifier

(1) The detected r.f. pulse from the transmitter circuits is fed to the base of 13VT6, an emitter follower via 13RV1. The potentiometer 13RV1 is provided so that the amplitude of the output pulse may be adjusted during setting up until the minimum permissible output pulse will just pass the AND gate.

F. 2nd frame pulse amplifier

(1) To ensure that it is the F2 pulse that is used to trigger the audio and visual monitor circuits, an output is taken from the encoder delay line at the F2 position. This output is fed through emitter-follower 13VT7 to drive one input of the AND gate, via 13C9.

G. AND gate

(1) To provide a threshold voltage above which the amplitude of the detected r.f. pulse must rise before passing through the gate, zener diode 13D11 is conducting through 13R24. As mentioned in the amplifier circuit description, 13RV1 sets the amplitude of the output pulse at 13VT6 emitter so that the minimum permissible pulse just exceeds this threshold. The input from the F2 tap on the encoder delay line ensures that it is the F2 pulse that it is 'measured' against the threshold voltage.

(2) The output of the AND gate is passed to emitter-follower 13VT8, and the pulse at the emitter is fed to the audio and visual monitor circuits.

H. Audio and Visual Monitor

(1) Transistors 10VT9 and 10VT10 are connected in a monostable multivibrator circuit similar to those used in the mode gate generators. The circuit is triggered by positive-going pulses from the self-test circuit which appear, via 10C15 and 10D15, at the base of 10VT9. The output of the circuit, taken from 10VT10 collector, consists of long pulses (approx. 25.0 us) which are fed to the base of 10VT11, via 10RV5. From 10VT11, an emitter-follower, the output is taken via 10C18 to an audio monitor where the pulses are used to generate an audio tone to indicate that the transponder is replying.

(2) The output of 10VT10 is also fed, via 10C19 to the base of 10VT12. In the absence of an input signal, 10VT12 is not conducting, and 10C20 is discharged. When a negative-going input pulse arrives at 10C19, 10VT12 starts to conduct, and 10C20 charges, via 10R45, further towards the -24 V line potential. At the end of the input pulse, 10VT12 cuts off, and 10C20 starts to discharge through 10R44. If the repetition frequency of the input pulses is greater than approximately 200 pulses per second, C20 will charge to a greater potential with each successive input pulse. When the potential across 10C20 is sufficiently large to overcome the zener diode, 10D19, 10C20 will discharge through 10R46, 10D19, 10D20 and 10R47, and 10VT13 will be cut off. As 10VT13 and 10VT14 are connected as a monostable multivibrator, each time the zener diode is overcome, 10VT13 will be cut off and 10VT14 switched on for a period of approximately 3 seconds. A portion of the collector voltage change, taken from the junction of 10R55, 10R56 is used to switch on 10VT15. Transistor 10VT15 switches the 27.5 V visual monitor supply to the indicator lamps. 10VT15 is protected by 10D30.

11. Control Wire Filters

On many of the wires connected to the pins of PLG from the internal circuitry of the transponder, extraneous pulses and pick-up interference is possible. To prevent this interference being passed to the control unit, and the other equipment in the aircraft, filtering capacitors are connected to the wires, adjacent to PLG. For the sake of clarity these capacitors are not shown in Fig. 12, the circuit diagram, nor is the tagboard shown as a separate unit in Fig. 13, the interconnection diagram. A separate drawing, Fig. 14, shows the filter circuits.

12. Control Units S.S.R. 1601/2 and S.S.R. 1601/6.

A, General

1601/2 and 1601/6 are electrically and mechanically interchangeable but the layout is different (Plate 2). Both are fitted with transfer switches for two-transponder operation but these are inoperative because as installed they are strapped out internally. 1601/2 has a blanking plate over the right-hand code window, so that only 64 codes may be used but all switches and wiring are present.

B. Interconnections

Interconnections between the control unit and the transponder are made via a 37 way connector on the control unit (PL01) and a 45 way connector on the transponder (PLG). The interconnections are shown in Fig.3 of Sect.1 and the internal circuits in Figs.16 and 17 of this section.

C. Function Switch

(1) The function switch S05 has 5 positions, OFF, STANDBY, A, B and C/D. (in 1601/2 there are 6 positions C and D being separate). Wafer S05A is used for mode selection, S05B(F) for STANDBY switching and S05B(R) for ON switching

(2) With S05 set to OFF all power supplies to the transponder are switched off. When S05 is set the STANDBY PL01/22 and thus PLG/22 are connected to earth via S05B(F). Relay 4RL1 operates and all supplies are switched on. The receiver, however remains desensitized for about one minute so that interrogations cannot trigger responses. After this time the transponder is ready for operation except that the timing oscillator is disabled.

(3) When S05 is set to any of the mode positions PL01/22 remains earthed, maintaining the HT supplies to the transponder and PL01/23, PLG/23 are earthed by S05B(R). The tuning oscillator in the transponder will now operate and responses will be transmitted.

(4) The interrogation mode to which the transponder to required to reply is selected by setting S05 to A, B or C/D (A,B,C or D on 1601/2). Mode selection is achieved by earthing the mode selection wire from the transponder on S05A, opening the selector gates of the required mode. As mode C interrogations are automatically passed in the decoder, no selection wire is necessary and the relevant contacts of S05 are left unwired.

D. Code Selection Switches

(1) The selection of the information pulses to be transmitted in a reply group is acheived by switches S01, S02, S03 and S04. Code pulse control leads from the selection circuits in the encoder are connected to the control unit via pins 1-7, 15-20 and 28 on PLG (wires B-P inclusive) to the corresponding pins on PL01.

(2) The B, C and D wires, (AL, A2 and A4 selection) are connected to switch S01. Selection of any combination of the three pulses is effected by S01, and the position to which S01 is set is shown in an indicator window on the front panel of the control unit. The number so shown is the 'thousands' digit of the reply code, reading from left to right.

(3) The nine remaining pulses are selected in a similar manner by S02, S03 and S04. The positions to which the switches are set are shown in indicator windows on the front panel of the control Unit. Numbers shown are the 'hundreds', 'tens' and 'units' terms respectively, reading from left to right.

(4) If the code selection switches are set to 8888, PL01/33 is earthed via S04B. This is the remote keyer position, and is included to provide facilities for the application of remote automatic code selection, which may be a future requirement of the system. The selection of 8888 also renders the normal code selection system inoperative.

E. Emergency code selection

The reply code 7700 may be used by setting the code switches. An automatic device to over-ride any other setting of the code switches is envisaged but has not yet been introduced.

F. IDENT button

The IDENT switch is a toggle switch (in SSR 1601/2 it is a button concentric with the left hand code selector switch). When the switch is operated PL01/14 and PLG/14 are earthed, causing the identity pulse to be transmitted on mode A/B (see para.8A(1)). A monostable circuit included in the encoder causes the identity pulse to be transmitted for a variable period after the button is pressed. The exact hold-on time is dependent upon the setting of 14RV1 (see para.8A(2)).

G. SELF TEST switch

The self test switch S06 is a push-to-make button (in S.S.R. 1601/2 it is concentric with the right hand code selector switch). When the contact is made, PL01/11 and PLG/11 are connected to earth, and the self test circuits are allowed to operate (see para. 10A).

H. Visual monitor lamp

The visual monitor lamp ILP01, is mounted on the front panel of the control unit, and provides visual indication of transmitter operation. The brightness of the lamp may be controlled by twisting the lamp bezel in its mounting.

J. Control illumination

The control unit is provided with two lamps, PLP01 and PLP02, which illuminate the control markings and positions. A 28V d.c. supply for the lamps is fed to the control unit via PLP1/34 from an external source, where on/off switching and dimming of the lamps may be controlled. The lamps are accessible from the front of the control unit for filter colour changes, and bulb replacement.

K. Altitude Reporting Switch

S10, a single pole on-off switch controls the altitude reporting facility described in para.3.1(3). S10 earths PL01/1, PLG(1)/1 and PLG(2)/1 when set to ON.

◀13. S.S.R. 1600/2 Power Units

A. Introduction

(1) Internal supplies for the transponder circuits are obtained from two separate units; unit 3 and unit 4. The various parts of the supply circuitry are split between these units, as explained in the functional description. The units are designed to operate with either:

(a) +27.5 V d.c. and 115 V a.c. nominal inputs
(b) +27.5 V d.c. nominal input

(2) In either case, the 27.5 V d.c. supply is used to operate relay 3RLA, and to supply power to the visual monitor lamps. Diodes 3D5 and 3D12 are included in the visual monitor supply to protect the circuits from transient voltages on the 27.5 V d.c. line; when the 115 V a.c. is switched on diode 3D14 is cut off and the 27.5 V d.c. is isolated from the regulator; zener diode 3D13 protects the supply to the regulator from transient voltages on the 115 V a.c. line.

B. Output Voltages

(1) The following outputs are obtained from Unit 4:

+100V)
+ 24V)
+ 10V) for the transistor circuits
- 10V)
- 24V)
5.8V a.c. (Transmitter oscillator heater)
5.8V a.c. (Transmitter amplifier heater)

(2) The e.h.t. supply required for the transmitter, nominally 1.7kV, is obtained from transformer 4TS and rectified in Unit 3.

C. Supply Switching

(1) Setting the function switch on the control unit to STANDBY or any of the mode positions earths 3Y4 via PLG22, and energises relay 3RLA. One pair of relay contacts connect the 115V a.c. supply to the primary of 3T1, and the other pair connect the output of OR gate D6/D14 to the regulator.

Note In the STANDBY condition, the transponder circuits receive the full power supplies, but no replies will be made to interrogation signals. This is achieved by removing an earth connection from transistor 14VT23 and 14VT25 in the timing oscillator control circuit. This connection is correctly made when the function switch is in any of the mode positions.

D. Circuit Operation

(1) Input Circuit

As shown in Fig.12-1A the output of 3T1 is rectified by 3D1-4 and smoothed by 3C2-4 to produce approximately 40V. With both the a.c. and d.c. supplies connected, diode 3D14 is reverse biased, and only the 40V is connected to the regulator via contacts 3RLA. If the a.c. supply is not connected, or fails, 3D14 becomes forward biased and the 27.5V is connected to the regulator via contacts 2 and 4 of relay 3RLA.

(2) The regulator circuit consists of voltage regulator 4ML1, pass element 4VT1 with 4VT2, and overcurrent regulator 4VT3. 4ML1 contains a temperature-compensated reference voltage amplifier, an error amplifier, an output transistor, and an output current limiter. On the error amplifier pin 2 is the inverting input and pin 3 is the non-inverting input. The output voltage of the regulator circuit is sampled at 4RV1, and the reference voltage developed at pin 4 is taken to pin 3. When the voltage at the inverting input is below the reference voltage 4VT1 is switched on and the regulator input voltage is applied through 4L1 to the load. When the voltage at the slider of 4RV1 rises above the reference voltage 4ML-1 turns off. The output voltage now falls at a rate determined by 4L1 and 4C3/C4, and when it falls below the reference

voltage 4ML-1 turns on again and the output again rises. It can be seen, therefore, that the circuit works as a self oscillator, maintaining a constant voltage, set by 4RV1, across the load independent of input voltage and output load. The purpose of 4D9 is to provide a return path for the inductor current after 4VT1 turns off. The inductor is large enough to maintain a fairly constant current throughout the switching cycle. This current is supplied by the input voltage source for part of the cycle, whilst the inductor, supplying current through the diode, is the source for the remainder. The nominal frequency of oscillation is 10KHz.

The circuit is protected against heavy current demands by the circuit of 4VT3 and 4R13. All the inverter current passes through 4R13 and an increase of current causes 4VT3 to draw current from 4ML1-1, and this reduces the load current and therefore the current through 4R13. In the case of an overload or short circuit 4VT3 ensures the on to off time ratio of the regulator limits the current at the input to less than one ampere.

(3) Inverter

Transistors 4VT4 and 4VT5 are connected in a normal twin-transformer inverter circuit. Transformer 4T1 is wound on square hysteresis loop laminations to provide good switching waveforms, and 4D4 and 4R14 provide a starting bias at switch-on. The inverter transformer 4T2 has a bifilar-wound primary winding, half of which is wound on each limb of C-core laminations, to reduce the leakage inductance. ▶

(4) Supply lines

Five of the secondary windings on 4T2 are connected to bridge rectifiers to provide the supply rails for the transistor circuits. Two windings supply the 5.8V a.c. supplies required by the transmitter valve heaters, and the sixth winding provides the supply for the e.h.t. bridge rectifier in Unit 3. Resistor 3R3 is included between 3Y7 and chassis, to provide an increasing ripple voltage as the load produced by the transmitter increases. This voltage is fed to the over-interrogation circuits to reduce the sensitivity of the receiver when the transmitter becomes overloaded.

Note If the function switch were to be set directly to any of the mode positions, the full e.h.t. voltage would be almost instantaneously applied to the transmitter valves. Damage to the valves could be produced if replies were triggered under these conditions. To prevent this, a delay circuit is included in the receiver desensitisation circuits which prevents interrogations from triggering replies for a period of approximately one minute. The one minute delay allows the valve heaters to 'warm up' preparatory to transmitter operation.

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Circuit Diagram

The following pages give the values and locations of the components on Fig.12, the S.S.R.1600 circuit diagram, and on Fig.12-1A, the S.S.R.1600/2 circuit diagram. Four sheets comprise Fig.12 and one sheet Fig.12A. Each sheet has a location border, sheet 1 being numbered 10-19, sheet 2, 20-29 etc. Fig.12-1A is an alternative section of sheet 1 and has the letter A added after the reference number, e.g. 10A, 11A etc.

Ref.	Loc	Value	Ref.	Loc	Value	Ref.	Loc	Value
3R1	E17A	150	4R1	C11A	100	4C4	E15A	120μ
3R2	H16A	22	4R2	C12A	3.3K	4C5	F15A	.68μ
3R3	L11A	560	4R3	B12A	470			
			4R4	C12A	220	4RV1	D13A	1K
3C1	E18A	0.05μ	4R5	B14A	1K			
3C2	G18A	82μ	4R6	B13A	1M	4T1	F14A	
3C3	H18A	82μ	4R7	C13A	82	4T2	J14A	
3C4	H18A	82μ	4R8	C14A	470			
			4R9	D12A	3.3K	4L1	D11A	400μH
3D1	F17A	IS415	4R10	D16A	2.2K	4L2	F11A	100μH
3D2	F17A	IS415	4R11	E12A	4.7K			
3D3	F18A	IS415	4R12	F16A	120	4VT1	C11A	2N3791
3D4	F18A	IS415	4R13	F16A	0.15	4VT2	C11A	2N3243
3D5	H17A	IS5033	4R14	F12A	2.7K	4VT3	E15A	2N2484
3D6	G17A	IS415	4R15	F16A	120 or 150	◀ 4VT4	H14A	BU128 *
3D7	L10A	HSC4	4R16	G14A	7.5	4VT5	H15A	BU128 * ▶
3D8	L10A	HSC4	4R17	G15A	7.5			
3D9	L10A	HSC4	4R18	H14A	1K	4ML1	C13A	SN52723L
3D10	L10A	HSC4	4R19	H15A	1K			
3D11	G16A	IS115				4D1	C14A	IS111
3D12	H17A	IS115	◀ 4R26	K11A	2.2	4D2	C13A	IS111
3D13	H18A	IS5056A	4R27	K12A	2.2	4D3	E13A	IS111
3D14	G17A	IS415R	4R28	K13A	5.6 ▶	4D4	G14A	IS111
3D15	G17A	IS113	4R29	K14A	5.6	4D5	G14A	IS111
			4R30	K15A	22	4D6	G15A	IS111
3RLA	G16A					4D7	H14A	IS6056A
			4C1	C12A	4.7μ	4D8	H15A	IS6056A
3T1	E18A		4C3	D15A	120μ	4D9	D16A	IN3881

◀ * BUY 18S on replacement. ▶

Ref.	Loc	Value
2R1	F11	6.8k
2R2	F11	1.8k
2R3	F10	820
2R4	F11	51
2R5	G12	100
2R6	G11	1k
2R7	G12	470
2R8	G11	3.3k
2R9	H11	15k
2R10	H12	100
2R11	H11	22k
2R13	K13	22
2R14	K13	1k
2R15	K12	4.7k
2R17	J11	5x1M
2R30	G11	15k
2R32	P35	100
2C1	F11	4.7p
2C2	F11	25p
2C3	F10	1000p
2C4	F11	4.7p
2C5	F11	1000p
2C6	G11	3p
2C7	G11	1000p
2C8	G11	1000p
2C9	G11	100p
2C10	G11	1000p
2C11	H11	1000p
2C12	H11	3.9p
2C13	H11	22p
2C14	L12	100p
2C15	L12	100p
2C16	J11	0.25μ
2C17	M12	100p
2C18	M12	100p
2C19	K13	6.8μ
2C20	K13	1000p
2C33	F11	1000p
2C34	F12	1000p
2C37	M12	100p
2VT1	F11	2N918
2VT2	G11	2N918
2VT3	H11	2N918
2VT6	K13	2N3891
2V1	M12	ML7815
2V2	L12	ML7815
2D1	H11	IN3065

Ref.	Loc	Value
2D4	P12	IN3065
2D5	K15	IS5068
2D7	K10	IN21E
2L1	F10)	
2L2	G10)	SEE
2L3	H10)	PARTS
2L4	J11)	LIST
2L9	L12)	
2L10	L12)	
2L11	M12)	
2L12	M12)	
2X1	F11	90.833 MHz
2J1	Q12	
2J2	K13	
2J3	L13	
2J4	K12	
3R1	B10	150
3R2	D11	270
3C1	B10	.047μ
3D1	C10	HSC4
3D2	C10	HSC4
3D3	C10	HSC4
3D4	C10	HSC4
3T1	B10	
4R1	B17	22
4R2	B14	150
4R3	C12	2.2
4R4	C13	2.2
4R5	D13	3.9k
4R6	D14	1.5k
4R7	C14	5.6
4R8	D15	3.9k
4R9	D16	3.9k
4R10	C15	5.6
4R11	C11	22
4C1	B14	.047μ
4C2	C13	50μ
4C3	d13	22μ
4C4	C14	47μ
4C5	D14	22μ

Ref.	Loc	Value
4C6	C15	47μ
4C7	D15	22μ
4C8	D16	2.2μ
4C9	C16	50μ
4C10	D16	47μ
4C11	D16	22μ
4C12	C12	5μ
4VT1	D13	OC22
4VT2	D14	OC22
4VT3	D15	OC22
4VT4	D16	OC22
4D1	B17	IS111
4D2	B17	IS111
4D3	B18	IS5033
4D4	C12	IS111
4D5	C13	IS111
4D6	C12	IS111
4D7	C13	IS111
4D8	D13	5Z24C
4D9	C13	IS111
4D10	C14	IS111
4D11	C13	IS111
4D12	C14	IS111
4D13	D14	5Z10C
4D14	C14	IS111
4D15	C15	IS111
4D16	C14	IS111
4D17	C15	IS111
4D18	D15	5Z10C
4D19	C15	IS111
4D20	C16	IS111
4D21	C16	IS111
4D22	C16	IS111
4D23	C16	IS111
4D24	D16	5Z24C
4D25	C12	IS113
4D26	C12	IS113
4D27	C12	IS113
4D28	C12	IS113
4J1	D12	
4J2	D16	
4J3	D13	
4J4	D14	
4J5	D11	
4T1	B14	

Ref.	Loc	Value
4RL1	B17	
4SO1	A15	
5R1	F16	39k
5R2	H17	330
5R3	J17	270
5R4	K17	270
5R5	L17	330
5R6	M17	330
5R7	N17	330
5R8	P17	330
5R9	G15	2.2k
5R10	H15	1.8k
5R11	J15	2.2k
5R12	K15	2.2k
5R13	L15	2.2k
5R14	M15	1.5k
5R15	N15	2.2k
5R16	P15	1.5k
5R17	G14	470
5R18	J14	470
5R19	L14	820
5R20	N14	820
5R21	H14	51
5R22	K14	51
5R23	M14	51
5R24	G14	51
5R25	H14	51
5R26	J14	51
5R27	K14	51
5R28	L14	51
5R29	M14	51
5R30	N14	51
5R31	Q14	3.3k
5R32	Q15	2.2k
5R33		
5R34	J17	8.2k
5R35	J17	8.2k
5R36	K17	8.2k
5R37	L17	8.2k
5R38	M17	8.2k
5R39	N17	8.2k
5R40	H17	8.2k
5R41	G19	3.3k
5R42	G18	10k
5R43	K18	15k
5R44	M18	15k
5R45	P18	15k
5R46	L18	2.2k

Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value
5R47	M18	3.3k	5C24	J16	1000p	5VT7	K16	A1604
5R48	P18	1k	5C25	K16	1000p	5VT8	L15	A1604
5R49	L18	51	5C26	L16	1000p	5CT9	L16	A1604
5R50	N18	51	5C27	M16	1000p	5VT10	M15	A1604
5R51	L17	2.2k	5C28	N16	1000p	5VT11	M16	A1604
5R52	P17	2.2k	5C29	P16	1000p	5VT12	N15	A1604
5R53	Q17	2.2k	5C30	H16	1u	5VT13	N16	A1604
5R54	M18	1.5k	5C31	J16	1u	5VT14	P15	A1604
5R55	P17	18k	5C32	L16	1u	5VT15	P16	A1604
5R56	P18	820	5C33	P16	1u	5VT16	K18	C64
			5C34			5VT17	M18	C64
5C1	F16	1000p	5C35	K18	4.7p	5VT18	Q18	C64
5C2	G16	1000p	5C36	M18	4.7p	5VT19	Q18	V15216/1
5C3	H16	1000p	5C37	P18	4.7p			
5C4	J16	1000p	5C38	L18	4.7p	5D1	K17	1N3065
5C5	K16	1000p	5C39	N18	10p	5D2	M17	1N3065
5C6	L16	1u	5C40	N18	4.7p	5D3	P17	1N3065
5C7	M16	1u	5C41	J19	1u	5D4	K18	1N3067
5C8	N16	1u	5C42	K18	1000p	5D5	P18	1N3067
5C9	P16	1u	5C43	M18	1000p	5D6	K18	1N3067
5C10	G14	1000p	5C44	P18	1000p			
5C11	H14	1000p	5C45			5L1	F16)	
5C12	H14	1000p	5C46	M15	1p	5L2	G16)	
5C13	J14	1000p	5C47	P15	1p	5L3	G16)	
5C14	K14	1000p	5C48	K16	1.0u	5L4	J16)	SEE
5C15	L14	1000p	5C49	M16	1.0u	5L5	K16)	PARTS
5C16	N14	1000p	5C50	N16	1.0u	5L6	L16)	LIST
5C17	P14	1000p				5L7	M16)	
5C18	F14	.01u	5VT1	F15	2N918	5L8	N16)	
5C19	G14	1000p	5VT2	G15	2N918	5L9	P16)	
5C20	J14	1000p	5VT3	G16	2N918	5L10	L17)	
5C21	L14	1000p	5VT4	J15	A1604	5L11	N17)	
5C22	N14	1000p	5VT5	J16	A1604			
5C23	H16	1000p	5VT6	K15	A1604	5RV1	F17	10k

INTERCONNECTION POINT POSITIONS FOR FIG. 12.

IDL1
IN A24
1 A24
2 A25
3 A25
4 A27
5 A28
G A24

IDL2
IN A45
1 A45
2 B45
3 C45
4 D45
5 D45
6 E45
7 F45
8 G45
9 H45
10 H45
11 J45
12 K45
13 L45
14 L45
15 M45
G F45

C. Filt
1Y2 G48
1Y4 B48
1Y6 C48
1Y8 C48
1Y10 D48
1Y12 E48
1Y14 F48
1Y16 G48
1Y18 H48
1Y20 J48
1Y22 K48
1Y24 L48
1Y26 L48
1Y28 F47
1Y30 B47
1Y32 B47
1Y34 C47
1Y36 D47
1Y38 E47
1Y40 F47
1Y42 G47
1Y44 H47
1Y46 J47
1Y48 K47
1Y50 K47
1Y52 L47

Unit 2
2Y1 Q12
2Y2 Q18
2Y4 K13
2Y9 N34
2Y10 Q30
2Y11 P30
2Y12 J35
2Y19 E19
2Y20 E19
2Y21 E19
2Y25 N34
SKT1 Q11
SKT2 P12
SKT3 N12
SKT4 K10
SKT5 Q34
PL2 P12
PL3 N12
PL4 J10
PL5 N11
SKTR D19
SKTS D19
SKTT D19

Unit 3
3Y1 A10
3Y2 A11
3Y3 E11

Unit 4
4Y21 A17
4Y22 A15
4Y23 A14
4Y31 A18
4Y32 A14
4Y35 C18

Unit 5
5Y28 Q17

Unit 7
7Y1 A21
7Y5 C20
7Y6 C23
7Y7 D23
7Y8 H23
7Y9 F28
7Y10 F26
7Y11 F25
7Y12 A25
7Y13 A25
7Y14 A27
7Y15 A28
7Y16 C24
7Y18 B24
7Y19 E23
7Y20 E23
7Y22 B20
7Y23 G23

Unit 8
8Y1 A31
8Y4 A30
8Y5 J28
8Y6 F28
8Y7 J25
8Y8 F25
8Y9 F24
8Y10 J26
8Y11 F26
8Y15 H36
8Y18 A34
8Y19 H35

Unit 9
9Y2 D39
9Y4 G39
9Y5 N39
9Y6 J36
9Y7 A37
9Y13 C39
9Y18 Q37

Unit 10
10Y1 N20
10Y3 P30
10Y5 J23
10Y8 N21
10Y10 J23
10Y11 H32
10Y12 F20
10Y13 L23
10Y14 L23
10Y15 Q21
10Y16 B24
10Y18 C24
10Y19 F20
10Y20 B24
10Y21 N30
10Y22 Q31

Unit 11
11Y1 B48
11Y2 B48
11Y3 C48
11Y4 D48
11Y5 E48
11Y6 F48
11Y7 G48
11Y8 H48
11Y9 J48
11Y10 J48
11Y11 K48
11Y12 L48
11Y13 B47
11Y14 B47
11Y15 C47
11Y16 D47
11Y17 E47
11Y18 F47
11Y19 G47
11Y20 H47
11Y21 J47
11Y22 K47
11Y23 K47
11Y24 L47
11Y25 B48
11Y26 C48
11Y27 D48
11Y28 D48
11Y29 E48
11Y30 F48
11Y31 H48
11Y32 H48
11Y33 J48
11Y34 K48
11Y35 L48
11Y36 M48
11Y41 Q45
11Y42 N43
11Y43 N43
11Y44 P43
11Y45 Q49
11Y46 M43
11Y47 A45
11Y48 B45
11Y49 C45
11Y50 D45
11Y51 D45
11Y52 E45
11Y53 G45
11Y54 H45
11Y55 H45
11Y56 J45
11Y57 K45
11Y58 L45
11Y59 N43
11Y60 M45
11Y61 F45
11Y62 F47
11Y63 G48

Unit 12
12Y3 L25
12Y5 J25
12Y8 K29
12Y11 L26
12Y13 J26
12Y17 K24
12Y19 J28
12Y21 L28

Unit 13
13Y1 J35
13Y3 J31
13Y4 L25
13Y6 L26
13Y8 L28
13Y9 M25
13Y12 M27
13Y13 M32
13Y14 Q25
13Y15 J35
13Y16 Q26
13Y17 Q25
13Y18 Q28
13Y19 F32
13Y20 K35
13Y21 N34

Unit 14
14Y1 A40
14Y2 G43
14Y3 M43
14Y7 A44
14Y9 A41
14Y10 A43
14Y12 K42
14Y19 C40
14Y20 Q41

PL.G
PLG1 D17
PLG2 B49
PLG3 D49
PLG4 F49
PLG5 G49
PLG6 J49
PLG7 K49
PLG8 D17
PLG9 D17
PLG10 D17
PLG11 D17
PLG12 D17
PLG13 D17
PLG14 M49
PLG15 B49
PLG16 C49
PLG17 E49
PLG18 F49
PLG19 H49
PLG20 J49
PLG21 D18
PLG22 D18
PLG23 M49
PLG24 C49
PLG25 D49
PLG26 F49
PLG27 G49
PLG28 L49
PLG29 D18
PLG30 D18
PLG31 D18
PLG32 D18
PLG33 D18
PLG34 D18
PLG35 D19
PLG36 D19
PLG37 J49
PLG38 L49
PLG39 B49
PLG40 C49
PLG41 E49
PLG42 H49
PLG43 K49
PLG44 G49
PLG45 L49

SKT.H
B C49
C D49
D F49
E H49
F J49
H L49
J B49
P D49
R E49
S H49
T K49
U M49
W G49

INTERCONNECTION POINT POSITIONS FOR Fig.12-1A

Unit 3

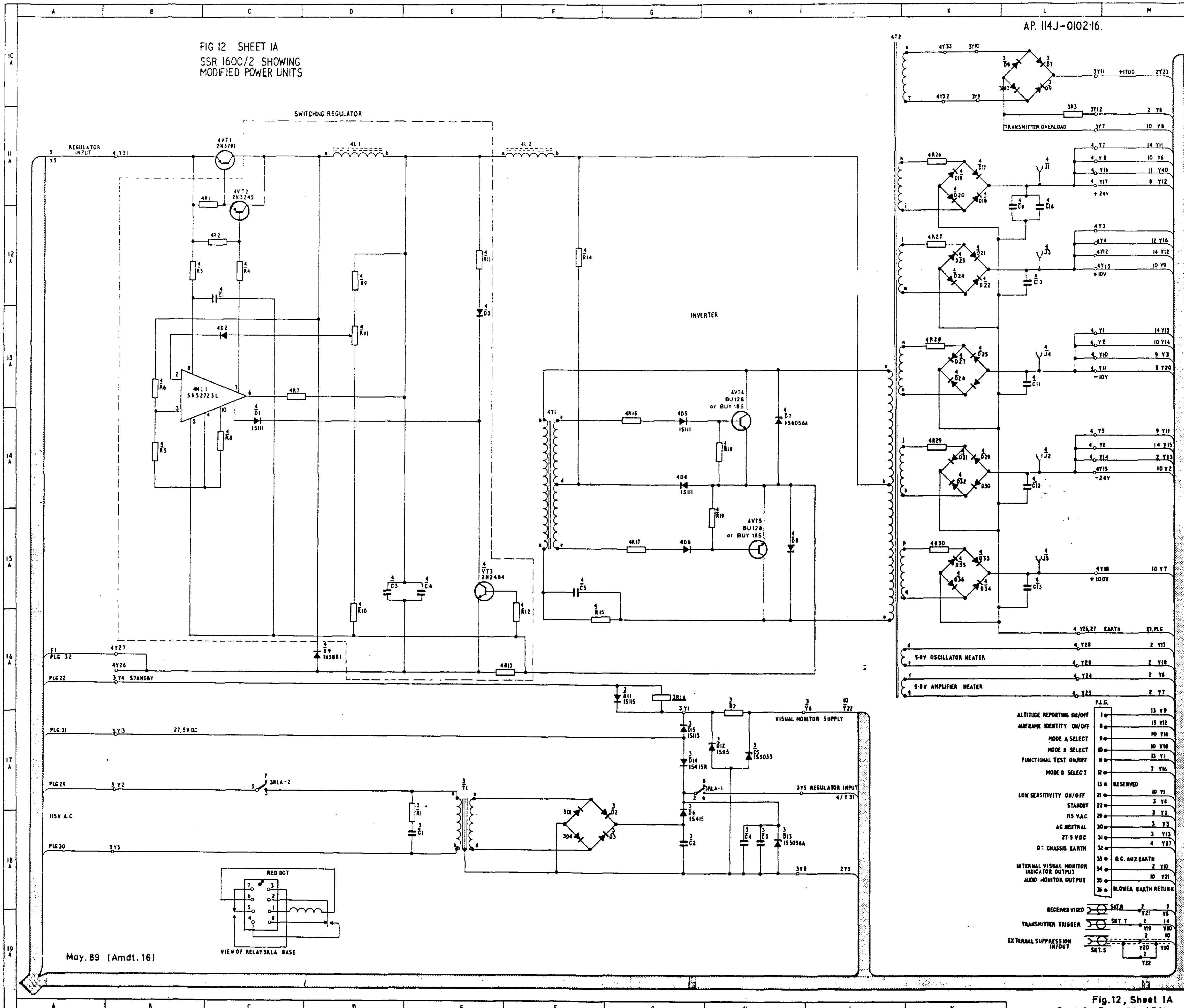
◀3Y1	G16A	
3Y2	B17A	M17A
3Y3	B18A	M17A
3Y4	B16A	M17A
3Y5	H17A	A11A
3Y6	H16A	
3Y7	L11A	
3Y9	K11A	
3Y10	K10A	
3Y11	L10A	
3Y12	L10A	
3Y13	B17A	M17A

Unit 4

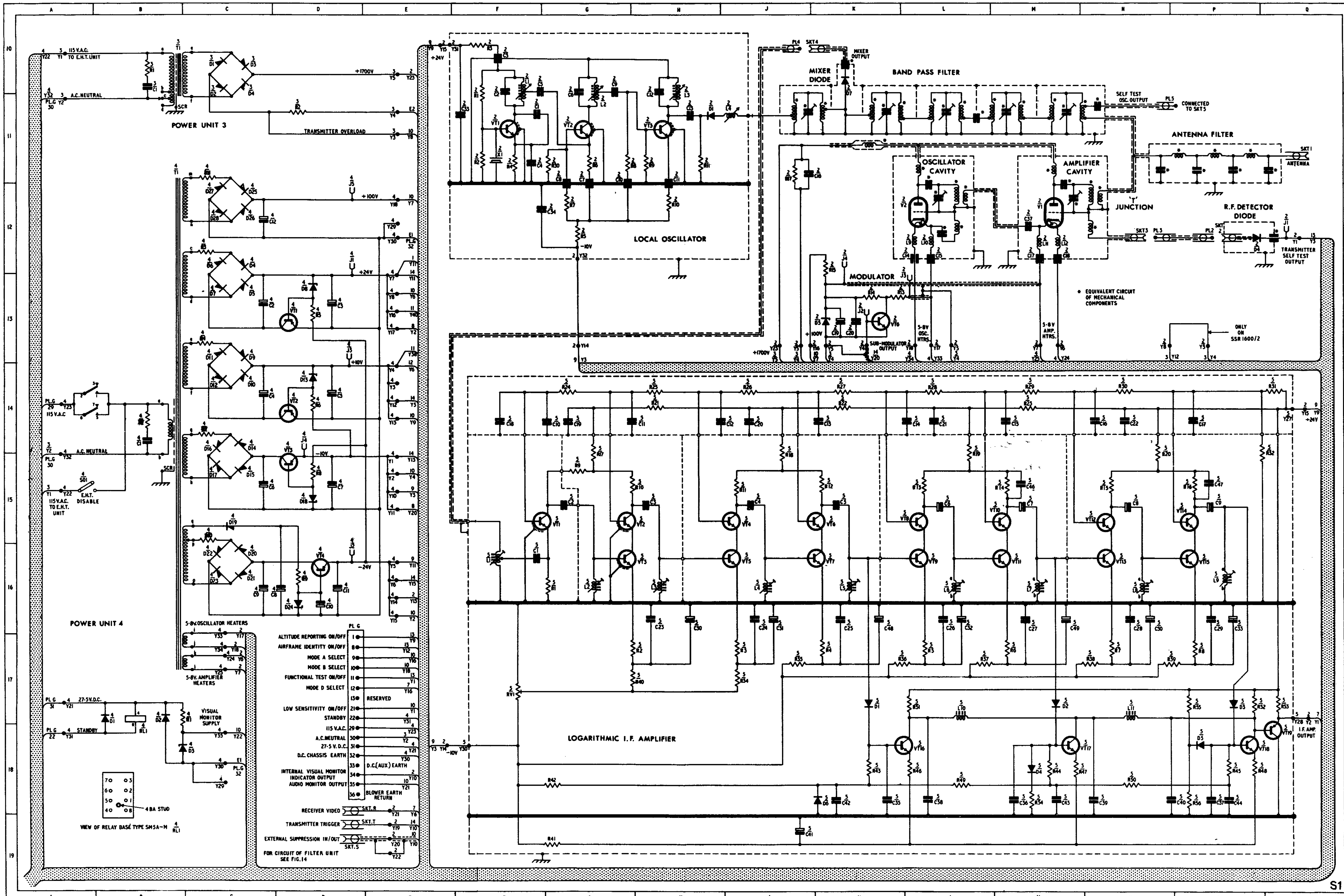
4Y1	L13A		
4Y2	L13A		
4Y3	L12A		
4Y4	L12A		
4Y5	L14A		
4Y6	L14A		
4Y7	L11A		
4Y8	L11A		
4Y10	L13A		
4Y11	L13A		
4Y12	L12A		
4Y13	L12A		
4Y14	L14A		
4Y15	L14A		
4Y16	L11A		
4Y17	L11A		
4Y18	L15A		
4Y24	L16A		
4Y25	L16A		
4Y26	L16A	A16A	
4Y27	L16A	A16A	M18A
4Y28	L16A		
4Y29	L16A		
4Y31	B11A	J17A ▶	

FIG 12 SHEET 1A

SSR 1600/2 SHOWING MODIFIED POWER UNITS



May. 89 (Amdt. 16)



POWER UNIT 3
POWER UNIT 4
LOCAL OSCILLATOR
MIXER DIODE
MIXER OUTPUT
BAND PASS FILTER
SELF TEST OSC. OUTPUT
CONNECTED TO SKT5
ANTENNA FILTER
ANTENNA
OSCILLATOR CAVITY
AMPLIFIER CAVITY
'T' JUNCTION
R.F. DETECTOR DIODE
TRANSMITTER SELF TEST OUTPUT
MODULATOR
SUB-MODULATOR OUTPUT
EQUIVALENT CIRCUIT OF MECHANICAL COMPONENTS
ONLY ON SSR 1600/2
LOGARITHMIC I.F. AMPLIFIER
I.F. AMP. OUTPUT
115 V.A.C. TO E.H.T. UNIT
A.C. NEUTRAL
TRANSMITTER OVERLOAD
E.H.T. DISABLE
5-8V. OSCILLATOR HEATERS
5-8V. AMPLIFIER HEATERS
VISUAL MONITOR SUPPLY
STANDBY
VIEW OF RELAY BASE TYPE SM5A-M
4 BA STUD
ALTITUDE REPORTING ON/OFF
AIRFRAME IDENTITY ON/OFF
MODE A SELECT
MODE B SELECT
FUNCTIONAL TEST ON/OFF
MODE D SELECT
RESERVED
LOW SENSITIVITY ON/OFF
115 V.A.C.
27·5 V.D.C.
D.C. CHASSIS EARTH
D.C.(AUX) EARTH
INTERNAL VISUAL MONITOR INDICATOR OUTPUT
AUDIO MONITOR OUTPUT
BLOWER EARTH RETURN
RECEIVER VIDEO
TRANSMITTER TRIGGER
EXTERNAL SUPPRESSION IN/OUT
FOR CIRCUIT OF FILTER UNIT SEE FIG. 14
S1

AL 9 Apr. 1967

Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value
1DL1	A26	KS97429	7R54	E28	560	7D5	B25	1N3067	8C38	H24	10u
			7R55	C24	27K	7D6	B28	1N3067	8C39	G24	10u
7R1	B21	22K	7R56	C26	33K	7D7	B27	1N3067	8C40	H29	10u
7R2	B22	100K				7D8	C23	1N270	8C41	F29	10u
7R3	B22	3.9K	7C1	A21	.01u	7D9	C24	1N3067			
7R4	C23	10K	7C2	C23	1u	7D10	C24	1N3067	8VT14	H25	V15216/1
7R5	C23	10K	7C5	B22	18p	7D11	D26	1N3067	8VT15	H24	C64
7R6	D25	820	7C6	B21	.04u				8VT16	H26	V15216/1
7R7	B21	3.9K	7C7	C22	1u	7DL1	D21	A97727/4	8VT17	H26	C64
7R8	B22	3.9K	7C8	D22	2.2u	7DL2	F23	A97727/4	8VT18	H28	V15216/1
7R9	C23	3.3K	7C9	D23	56p				8VT19	H28	C64
7R10	C21	10K	7C10	A29	2.2u	7J1	A21				
7R11	C23	2.2K	7C11	E23	2.2u	7J2	H23		8D9	G25	1N270
7R12	C23	33K	7C12	E23	2.2u	7J3	C21		8D10	G25	1N3067
7R13	D23	8.2K	7C13	F23	.01u	7J4	F25		8D11	G24	1N3067
7R14	C21	2.7K	7C14	H23	.01u	7J5	F26		8D12	G27	1N270
7R15	C21	470	7C15	B28	1u	7J6	F28		8D13	G26	1N3067
7R16	C22	330	7C16	C25	.01u	7J7	D23		8D14	G26	1N3067
7R17	C22	5.6K	7C17	D25	.01u	7J8	E23		8D15	G29	1N270
7R18	D22	1.5K	7C18	D28	.01u	7J9	E23		8D16	G28	1N3067
7R19	D23	3.3K	7C19	D26	2.2u				8D17	G27	1N3067
7R20	E22	470	7C20	C27	.01u	8R42	G25	470			
7R21	E23	2.7K	7C21	E27	1u	8R43	H25	39K	8J1	J24	
7R22	E22	470	7C22	D24	2.2u	8R44	G24	470	8J2	J26	
7R23	E23	2.7K	7C23	E23	2.2u	8R45	G26	470	8J3	J28	
7R24	F23	2.7K				8R46	H26	39K			
7R25	G22	33K	7RV1	D26	1K	8R47	G26	470	10R1	G21	220k
7R26	G22	2.2K	7RV2	E26	1K	8R48	G28	470	10R2	H21	220K
7R27	G23	1.5K	7RV3	D29	1K	8R49	H28	39K	10R3	H21	47K
7R28	G23	470	7RV4	E29	1K	8R50	G27	470	10R4	G21	2.2K
7R29	H23	2.2K				8R52	H28	4.7K	10R5	H21	1.5K
7R30	G23	8.2K	7VT1	B21	A1603	8R53	H25	470	10R6	H21	18K
7R31	C24	100K	7VT2	B21	C64	8R54	H24	6.8K	10R7	J21	1.2K
7R32	C25	100K	7VT3	C23	C64	8R55	H25	6.8K	10R8	J21	4.7K
7R33	C24	100K	7VT4	D23	C64	8R56	H26	470	10R9	J21	1K
7R34	C25	100K	7VT5	C21	C64	8R57	H26	6.8K	10R10	J22	2.2K
7R35	C24	100k	7VT6	D23	A1603	8R58	H26	6.8K	10R11	K23	12K
7R36	C25	100K	7VT7	E23	C64	8R59	H28	470	10R13	L23	4.7K
7R37	B28	470	7VT8	E23	C64	8R60	H27	6.8K	10R14	K23	47K
7R38	C25	10K	7VT9	F23	C64	8R61	H28	6.8K	10R15	N23	18K
7R39	E24	1.5K	7VT10	G23	C64	8R62	H24	51	10R16	J21	4.7K
7R40	D26	2.7K	7VT11	H22	V15216/1	8R63	F24	330	10R17	K21	220
7R41	D25	10K	7VT12	D25	C64	8R64	H29	51	10R18	K21	56K
7R42	E25	2.7K	7VT13	E25	C64				10R19	K22	10K
7R43	E26	680	7VT14	E25	V15216/1	8C28	G25	.01u	10R20	N22	2.2K
7R44	D27	1.5K	7VT15	D27	C64	8C29	G26	.01u	10R21	M23	2.2K
7R45	E25	680	7VT16	E26	V15216/1	8C30	G24	.04u	10R22	M23	10K
7R46	D28	10K	7VT17	E28	C64	8C31	G26	.04u	10R23	M23	100K
7R47	E27	1.5K	7VT18	E28	V15216/1	8C32	G28	.01u	10R24	M23	12K
7R48	E27	2.7K				8C33	G27	.04u	10R25	M22	4.7K
7R49	E28	2.7K	7D1	C21	1N3067	8C34	J25	2.2u	10R26	M21	2.2K
7R50	C28	10K	7D2	G22	1N3067	8C35	J26	2.2u	10R27	G21	82K
7R51	C28	100K	7D3	G23	IN3067	8C36	H29	2.2u	10R28	M21	100K
7R53	D28	680	7D4	B25	1N3067	8C37	J28	2.2u	10R29	N21	100K

Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value
10R30	M21	10K	10D7	J21	IN3067	12J1	J28		13VT12	N26	2G413
10R31	H22	27K	10D8	M21	IN3067	12J2	J26		13VT13	M28	2G413
10R32	N20	10K	10D9	M23	IN3067	12J3	J24		13VT14	N28	2G413
10R33	N21	27K	10D10	N23	IN3067						
10R52	H22	2.2K	10D11	N22	1S7100B	13R31	L29	51	13D14	M25	IN3067
10R54	H22	22K	10D12	N22	IN3067	13R32	P29	51	13D15	N24	IN3067
10R57	B23	10K	10D13	M21	IN3067	13R33	Q26	2.2K	13D16	N24	IN3067
10R58	B23	56K	10D14	N21	IN3067	13R34	M25	220k	13D17	P24	IN3067
10R59	P23	56K	10D18	F21	IS7150B	13R35	M25	220K	13D18	P25	IN3067
10R60	P22	10K	10D22	P23	1S111	13R36	M25	2.2K	13D19	M26	IN3067
10R62	P23	1K	10D23	H21	IN3067	13R37	N24	27K	13D20	M26	IN3067
10R63	P22	1.4K	10D24	J22	IN3067	13R38	M24	3.3K	13D21	N26	IN3067
			10D25	B24	IN3067	13R39	M24	3.9K	13D22	N26	IN3067
10C1	F21	330p	10D26	C24	IN3067	13R40	N24	1.5K	13D23	N26	IN3067
10C2	H21	2000p	10D27	B24	IN3067	13R41	N25	39K	13D24	P26	IN3067
10C3	H21	1000p	10D28	N22	IS111	13R42	P24	1.5K	13D25	P26	IN3067
10C5	L23	1.0μ	10D29	N22	IS111	13R43	M26	220K	13D26	M28	IN3067
10C6	J21	.01μ	10D31	P23	BZY88	13R44	M26	220K	13D27	M28	IN3067
10C7	K21	.04μ				13R45	M26	2.2K	13D28	N27	IN3067
10C8	N22	2.2μ	10J1	J23		13R46	N26	27K	13D29	N27	IN3067
10C9	N23	2.2μ	10J2	K21		13R47	M26	3.3K	13D30	N28	IN3067
10C10	M23	.04μ	10J4	M21		13R48	M26	3.9K	13D31	P27	IN3067
10C11	P22	.01μ				13R49	N26	1.5K	13D32	P28	IN3067
10C13	N21	1.0μ	12R1	J25	220	13R50	N26	39K			
10C14	M21	2.2μ	12R2	K25	560	13R51	P26	1.5K	13J3	P24	
10C23	K23	.04μ	12R3	K25	10K	13R52	P26	1.5K	13J4	P26	
10C24	K21	.04μ	12R4	K24	1K	13R53	M28	220K	13J5	P27	
10C25	J22	.04μ	12R5	L24	10K	13R54	M28	220K	13J6	Q25	
10C26	B23	.04μ	12R6	J26	220	13R55	M28	2.2K			
10C27	P23	140μ	12R7	K26	560	13R56	N27	27K			
10C29	P23	.02μ	12R8	K26	10K	13R57	M27	3.3K			
			12R9	K26	1K	13R58	M27	3.9K			
10RV1	M22	10K	12R10	L26	10K	13R59	N27	1.5K			
10RV2	M22	10K	12R11	J28	220	13R60	N28	39K			
10RV3	M20	10K	12R12	K28	560	13R61	P27	1.5K			
10RV4	N21	10K	12R13	K28	10K	13R62	P25	1.5K			
			12R14	K28	1K	13R63	Q28	1.5K			
10VT1	G21	2G413	12R15	L28	10K						
10VT2	J21	2N1132	12R16	L28	6.8K	13C16	L26	.04μ			
10VT3	L23	C111	12R17	L28	470	13C10	L29	2.2μ			
10VT4	K21	C64				13C11	P29	2.2μ			
10VT5	K21	C64	12C1	L28	1.0μ	13C12	L25	.04μ			
10VT6	N21	C64	12RV1	L28	10K	13C13	N24	1500p			
10VT7	N22	C64				13C14	M24	.002μ			
10VT8	N20	C64	12D1	K24	T1.71	13C15	M24	10μ			
10VT16	P22	2S322	12D2	L25	T1.71	13C17	N26	1500p			
10VT17	P23	C64	12D3	K26	T1.71	13C18	M26	.002μ			
			12D4	L26	T1.71	13C19	L28	.04μ			
10D1	G21	IN3067	12D5	K27	T1.71	13C20	N27	1500p			
10D2	H21	IN3067	12D6	L28	T1.71	13C21	M27	.002μ			
10D3	J21	IN3067	12D7	K28	T1.71						
10D4	J22	IN3067				13VT9	M24	2G413			
10D5	K23	IN3067	12DL1	J25	A97727/5	13VT10	N24	2G413			
10D6	K23	IN3067	12DL2	J26	A97727/5	13VT11	M26	2G413			
			12DL3	J28	A97727/5						

INTERCONNECTION POINT POSITIONS FOR FIG.12

1DL1

IN	A24
1	A24
2	A25
3	A25
4	A27
5	A28
G	A24

1DL2

IN	A45
1	A45
2	B45
3	C45
4	D45
5	D45
6	E45
7	F45
8	G45
9	H45
10	H45
11	J45
12	K45
13	L45
14	L45
15	M45
G	F45

C Filt

1Y2	G48
1Y4	B48
1Y6	C48
1Y8	C48
1Y10	D48
1Y12	E48
1Y14	F48
1Y16	G48
1Y18	H48
1Y20	J48
1Y22	K48
1Y24	L48
1Y26	L48
1Y28	F47
1Y30	B47
1Y32	B47
1Y34	C47
1Y36	D47
1Y38	E47
1Y40	F47
1Y42	G47
1Y44	H47
1Y46	J47
1Y48	K47
1Y50	K47
1Y52	L47

Unit 2

2Y1	Q12
2Y2	Q18
2Y4	K13
2Y9	N34
2Y10	Q30
2Y11	P30
2Y12	J35
2Y19	E19
2Y20	E19
2Y21	E19
2Y25	N34
SKT1	Q11
SKT2	P12
SKT3	N12
SKT4	K10
SKT5	Q34
PL2	P12
PL3	N12
PL4	J10
PL5	N11
SKTR	D19
SKTS	D19
SKTT	D19

Unit 3

3Y1	A10
3Y2	A11
3Y3	E11

Unit 4

4Y21	A17
4Y22	A15
4Y23	A14
4Y31	A18
4Y32	A14
4Y35	C18

Unit 5

5Y28	Q18

Unit 7

7Y1	A21
7Y5	C20
7Y6	C23
7Y7	D23
7Y8	H23
7Y9	F28
7Y10	F26
7Y11	F25
7Y12	A25
7Y13	A25
7Y14	A27
7Y15	A28
7Y16	C24
7Y18	B24
7Y19	E23
7Y20	E23
7Y22	B20
7Y23	G23

Unit 8

8Y1	A31
8Y4	A30
8Y5	J28
8Y6	F28
8Y7	J25
8Y8	F25
8Y9	F24
8Y10	J26
8Y11	F26
8Y15	H36
8Y18	A34
8Y19	H35

Unit 9

9Y2	D39
9Y4	G39
9Y5	N39
9Y6	J36
9Y7	A37
9Y13	C39
9Y18	Q37

Unit 10

10Y1	N20
10Y3	P30
10Y5	J23
10Y8	N21
10Y10	J23
10Y11	H32
10Y12	F20
10Y13	L23
10Y14	L23
10Y15	Q21
10Y16	B24
10Y18	C24
10Y19	F20
10Y20	B24
10Y21	N30
10Y22	Q31

Unit 11

11Y1	B48
11Y2	B48
11Y3	C48
11Y4	D48
11Y5	E48
11Y6	F48
11Y7	G48
11Y8	H48
11Y9	J48
11Y10	J48
11Y11	K48
11Y12	L48
11Y13	B47
11Y14	B47
11Y15	C47
11Y16	D47
11Y17	E47
11Y18	F47
11Y19	G47
11Y20	H47
11Y21	J47
11Y22	K47
11Y23	K47
11Y24	L47
11Y25	B48
11Y26	C48
11Y27	D48
11Y28	D48
11Y29	E48
11Y30	F48
11Y31	H48
11Y32	H48
11Y33	J48
11Y34	K48
11Y35	L48
11Y36	M48
11Y41	Q45
11Y42	N43
11Y43	N43
11Y44	P43
11Y45	Q49
11Y46	M43
11Y47	A45
11Y48	B45
11Y49	C45
11Y50	D45
11Y51	D45
11Y52	E45
11Y53	G45
11Y54	H45
11Y55	H45
11Y56	J45
11Y57	K45
11Y58	L45
11Y59	N43
11Y60	M45
11Y61	F45
11Y62	F47
11Y63	G48

Unit 12

12Y3	L25
12Y5	J25
12Y8	K29
12Y11	L26
12Y13	J26
12Y17	K24
12Y19	J28
12Y21	L28

Unit 13

13Y1	J35
13Y3	J31
13Y4	L25
13Y6	L26
13Y8	L28
13Y9	M25
13Y12	M27
13Y13	M32
13Y14	Q25
13Y15	J35
13Y16	Q26
13Y17	Q25
13Y18	Q28
13Y19	F32
13Y20	K35
13Y21	N34

Unit 14

14Y1	A40
14Y2	G43
14Y3	M43
14Y7	A44
14Y9	A41
14Y10	A43
14Y12	K42
14Y19	C40
14Y20	Q41

PL.G

PLG1	D17
PLG2	B49
PLG3	D49
PLG4	F49
PLG5	G49
PLG6	J49
PLG7	K49
PLG8	D17
PLG9	D17
PLG10	D17
PLG11	D17
PLG12	D17
PLG13	D17
PLG14	M49
PLG15	B49
PLG16	C49
PLG17	E49
PLG18	F49
PLG19	H49
PLG20	J49
PLG21	D18
PLG22	D18
PLG23	M49
PLG24	C49
PLG25	D49
PLG26	F49
PLG27	G49
PLG28	L49
PLG29	D18
PLG30	D18
PLG31	D18
PLG32	D18
PLG33	D18
PLG34	D18
PLG35	D19
PLG36	D19
PLG37	J49
PLG38	L49
PLG39	B49
PLG40	C49
PLG41	E49
PLG42	H49
PLG43	K49
PLG44	G49
PLG45	L49

SKT.H

B	C49
C	D49
D	F49
E	H49
F	J49
H	L49
J	B49
P	D49
R	E49
S	H49
T	K49
U	M49
W	G49

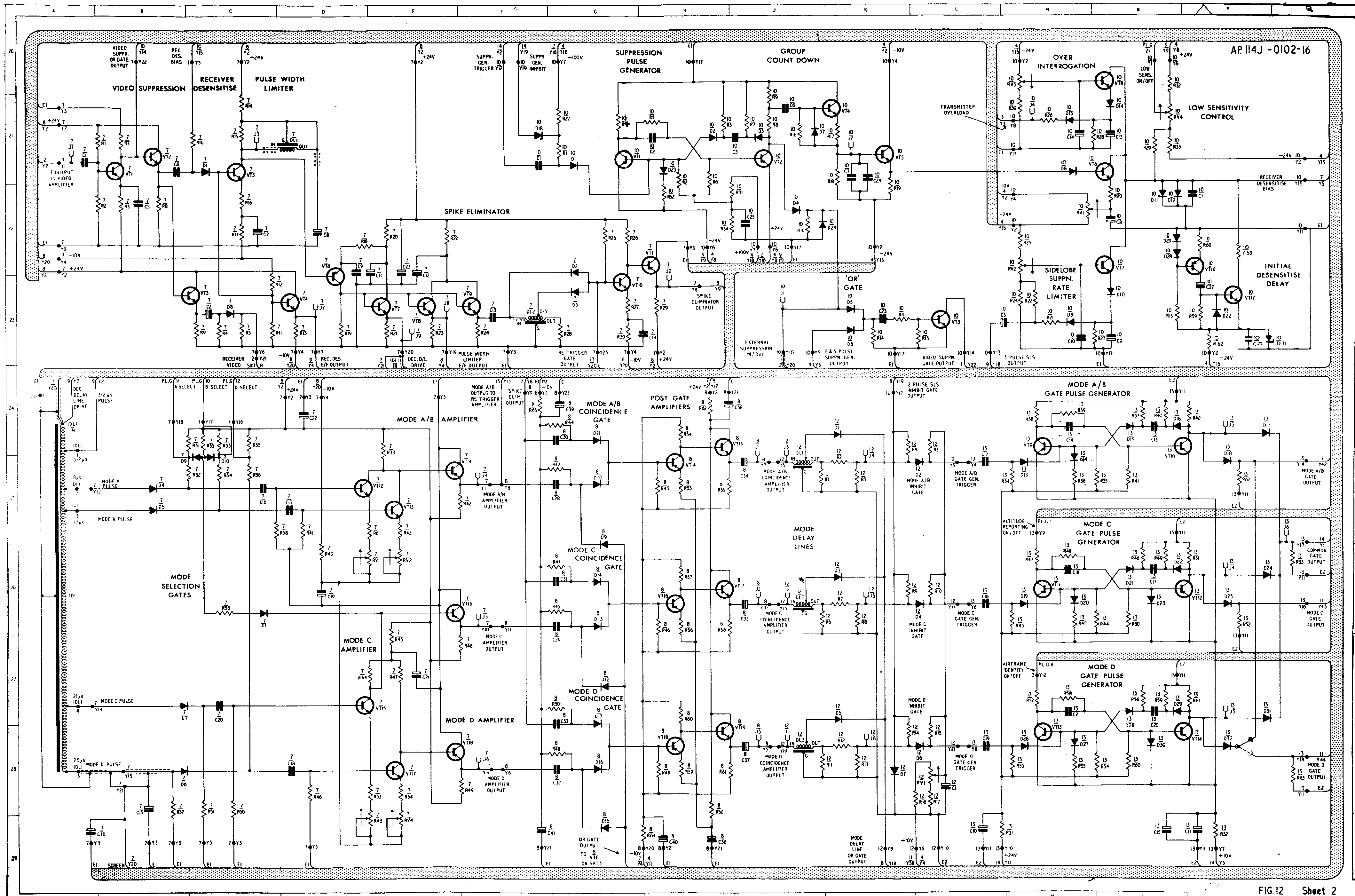


FIG.12 Sheet 2

Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value	Ref	Loc	Value
2R21	M36	3.3k	8R14	B33	1.8k	8VT1	B31	C64	9R21	G38	12k
2R22	M36	1.8k	8R15	B33	2.2k	8VT2	C30	C64	9R22	H39	10k
2R23	M35	220	8R16	D33	10k	8VT3	C31	C64	9R23	H38	680
2R25	N35	100	8R17	D33	1.2k	8VT4	C33	C64	9R24	H38	2.2k
2R26	N35	4.7k	8R18	D32	2.2k	8VT5	B33	C64	9R25	H39	18k
2R27	N35	10k	8R19	D33	1.8k	8VT6	B33	V15216/1	9R26	H38	27k
2R28	P35	1k	8R20	E33	47k	8VT7	C33	A1603	9R27	J38	1.8k
2R29	P35	3.3k	8R21	D33	470	8VT8	D32	C64	9R28	J39	470
2R31	P36	51	8R22	C31	470	8VT9	B34	C64	9R29	K37	47k
			8R23	B35	470	8VT10	E34	C64	9R30	J36	470
2C21	M36	1000p	8R24	B35	10k	8VT11	E34	V15216/1	9R31	J37	470
2C22	M36	1000p	8R25	B35	10k	8VT12	G34	C64	9R32	C38	560
2C23	M35	20p	8R26	E33	6.8k	8VT13	H34	C64	9R33	K37	6.8k
2C24	N35	1000p	8R27	E34	680				9R34	K38	470
2C25	N35	100p	8R28	E34	10k	8D1	B30	IN3067	9R35	K38	10k
2C26	N35	47p	8R29	E34	5.6k	8D2	D33	IN3067	9R36	L38	5.6k
2C27	P35	1000p	8R30	F33	10k	8D3	D31	IN3067	9R37	L37	22k
2C28	P36	1000p	8R31	F34	22k	8D4	D35	IN3067	9R38	L38	82k
2C29	P36	1u	8R32	F34	220k	8D5	F34	IN3067	9R39	L37	10k
2C30	P36	1000p	8R33	H33	27k	8D6	G34	IN3067	9R40	L38	33k
2C31	P35	14p	8R34	G34	100k	8D7	G35	IN3067	9R41	N37	47k
2C32	P35	1000p	8R35	G33	2.2k	8D8	H34	IN3067	9R42	L38	220k
2C38	M35	1000p	8R36	H33	6.8k	8D18	H34	IN3067	9R43	M38	220k
			8R37	G33	3.3k	8D19	A33	IS7047	9R44	M37	2.2k
2VC1	Q35	-	8R38	H34	15k				9R45	M37	3.3k
			8R39	H33	6.8k	8DL1	B33	97727/6	9R46	N37	1.2k
2VT4	M35	2N918	8R40	F33	22k				9R47	N38	22k
2VT5	P35	2N918	8R41	F34	82k	8J4	C33		9R48	N37	6.8
			8R51	A33	10k	8J5	H35		9R49	F37	12k
2D2			8R62	D30	51	8J6	F34		9R50	C38	5.6k
2D3	Q35	IN3065	8R64	F35	51	8J7	A30		9R51	F37	1k
2D6	Q30	IN3067				8J8	A31		9R52	E39	27
			8C1	B31	1500p	8J9	C31		9C1	B37	.04u
2L5	N35)	SEE	8C2	B31	.01u	8J10	B33		9C2	G38	.04u
2L7	P35)	PARTS	8C2	B31	1u	8J11	B34		9C3	B38	2.2u
2L8	Q35)	LIST	8C4	C31	.04u				9C4	C38	2.2u
			8C5	C34	25p	9R1	B37	82k	9C5	D38	2.2u
2X2	N35	85.833	8C6	C32	47p	9R2	B38	10k	9C6	E38	1500p
		Mc/s	8C7	B34	2.2u	9R3	B38	12k	9C7	E37	.04u
			8C8	B34	1u	9R4	C37	1k	9C8	F37	.04u
2PLP01	P31		8C9	D34	1u	9R5	D39	12k	9C9	G38	.04u
			8C10	D33	.01u	9R6	D38	270	9C10	H38	47p
2S01	H35		8C11	C31	2.2u	9R7	E38	12k	9C11	H39	25p
			8C12	B35	.01u	9R8	E39	39k	9C12	H39	1.0u
8R1	B31	560	8C13	E34	1u	9R9	E38	1.8k	9C13	J39	.04u
8R2	B31	4.7k	8C14	F34	.005u	9R10	E38	4.7k	9C14	J38	.04u
8R3	B31	100k	8C15	H34	200p	9R11	E38	10k	9C15	J36	.01u
8R5	B31	47k	8C16	G34	200p	9R12	F37	82k	9C16	J37	.01u
8R6	C31	12k	8C17	H34	.04u	9R13	F38	4.7k	9C17	K38	1u
8R7	C31	10k	8C27	F34	.01u	9R14	F37	82k	9C18	C37	.04u
8R8	C32	4.7k	8C38	D20	10u	9R15	F38	10k	9C41	D39	.005u
8R9	C32	1.8k	8C40	F35	10u	9R16	G38	10k	9C42	H37	1u
8R10	C33	1.5k				9R17	G37	10k	9C43	L39	1.0u
8R11	C33	270	8RV1	F34	10k	9R18	G38	1.8k	9C45	L38	.01u
8R12	B33	2.2k				9R19	G38	1.5k			
8R13	B34	4.7k				9R20	G38	33k			

Ref		
9C46	L37	.005u
9C47	N37	1000p
9C48	M37	2000p
9C49	H37	1.0u
9C50	F38	47u
9RV1	F37	10k
9RV2	G39	2.5k
9RV3	L38	10k
9VT1	B37	C64
9VT2	C38	V15216/1
9VT3	D38	C64
9VT4	E37	C64
9VT5	E38	C64
9VT6	E37	C64
9VT7	G37	C64
9VT8	G38	C64
9VT9	H38	A1603
9VT10	J38	C64
9VT12	K37	C64
9VT13	K37	V15216/1
9VT14	M37	C64
9VT15	N37	C64
9D1	E37	IN3067
9D2	F37	IN3067
9D3	H38	IN3067
9D4	J38	IN3067
9D5	J36	IN270
9D6	J37	IN270
9D7	L37	IN3067
9D8	M38	IN3067
9D9	N37	IN3067
9D10	N37	IN3067
9D11	C38	IN3067
9DL1	C37	A97727/5
9J1	A37	
9J2	H38	
9J3	K37	
9J4	M38	
9J5	L37	
9J6	N37	
9J7	G39	
9J8	D38	
9J9	C38	
10R34	H32	220k
10R35	J32	220k
10R36	K31	68k
10R37	J31	6.8k
10R38	J31	4.7k
10R39	K31	1.2k
10R40	K31	6.8k
10R41	K32	39k
10R42	L31	560
10R43	L32	4.7k
10R44	L32	27k
10R45	L32	1k
10R46	M32	5.6k
10R47	N31	100k
10R49	N31	3.3k
10R50	M31	10k
10R51	P32	47k
10R53	J30	10
10R55	P31	2.2k
10R56	P31	2.2k
10R61	M32	2.7k
10C12	J30	10u
10C15	H32	2000p
10C16	J31	2000p
10C17	K31	.01u
10C18	L31	12u
10C19	L32	1.0u
10C20	L32	2.2u
10C21	P31	140u
10C28	P31	.04u
10RV5	L31	10k
10VT9	J32	2S322
10VT10	K32	2S322
10VT11	L31	C64
10VT12	L32	2S322
10VT13	M32	C64
10VT14	P32	C64
10VT15	P30	2N1131
10D15	J32	IN3067
10D16	K31	IN3067
10D17	K31	IN3067
10D19	M32	IS7047B
10D20	M32	IN3067
10D21	N32	IN3067
10D30	P31	IS111
10J3	H32	
10J5	L31	
10J6	P30	
13R1	J34	10k
13R2	J35	1.2k
13R3	J33	3.3k
13R4	J34	3.3k
13R5	K33	33k
13R6	K33	33k
13R7	K34	3.3k
13R8	K33	3.3k
13R9	L34	1.5k
13R10	M33	22k
13R11		
13R12	L33	12k
13R13	M33	3.3k
13R14	M34	3.3k
13R15	M33	10k
13R16	L33	1.5k
13R17	K35	47k
13R19	J35	3.3k
13R20	J34	220
13R21	F31	1k
13R22	G31	5.6k
13R23	G31	1.5k
13R24	G31	2.2k
13R25	H32	4.7k
13R26	G32	1.5k
13R27	F32	2.2k
13R28	F32	2.2k
13R29	F32	33k
13R30	H32	10k
13R31	L35	51
13R32	J33	51
13R64	J34	1.2k
13R65	F31	1k
13C1	K34	.04u
13C2	J43	.04u
13C3	L34	330p
13C4	L34	220p
13C5	M34	560p
13C6	J35	1000p
13C7	G31	.04u
13C8	G31	1.0u
13C9	G32	.005u
13C10	L35	2.2u
13C11	J33	2.2u
13C22	K34	1.0u
13RV1	F31	1k
13VT1	J34	C111
13VT2	K34	C111
13VT3	N34	V15216/1
13VT4	L34	2N708
13VT5	J35	V15216/1
13VT6	G31	C64
13VT7	F32	C111
13VT8	H32	C111
13D1	J35	IS7056A
13D2	K34	IN3067
13D3	K34	IN3067
13D4	K34	IN3067
13D5	L34	IN3067
13D6	L34	IN3067
13D7	K35	IN3067
13D8	K35	IN3067
13D9	G31	IN3067
13D10	G32	IN3067
13D11	G32	IS7056B
13D12	M34	IN3067
13D33	M34	IN3067
13J1	G31	
13J2	L34	
13J7	F32	
13J8	N34	
13J9	J35	

INTERCONNECTION POINT POSITIONS FOR FIG.12

1DL1

IN	A24
1	A24
2	A25
3	A25
4	A27
5	A28
G	A24

1DL2

IN	A45
1	A45
2	B45
3	C45
4	D45
5	D45
6	E45
7	F45
8	G45
9	H45
10	H45
11	J45
12	K45
13	L45
14	L45
15	M45
G	F45

C. Filt

1Y2	G48
1Y4	B48
1Y6	C48
1Y8	C48
1Y10	D48
1Y12	E48
1Y14	F48
1Y16	G48
1Y18	H48
1Y20	J48
1Y22	K48
1Y24	L48
1Y26	L48
1Y28	F47
1Y30	B47
1Y32	B47
1Y34	C47
1Y36	D47
1Y38	E47
1Y40	F47
1Y42	G47
1Y44	H47
1Y46	J47
1Y48	K47
1Y50	K47
1Y52	L47

Unit 2

2Y1	Q12
2Y2	Q18
2Y4	K13
2Y9	N34
2Y10	Q30
2Y11	P30
2Y12	J35
2Y19	E19
2Y20	E19
2Y21	E19
2Y25	N34
SKT1	Q11
SKT2	P12
SKT3	N12
SKT4	N10
SKT5	Q34
PL2	P12
PL3	N12
PL4	J10
PL5	N11
SKTR	D19
SKTS	D19
SKTT	D19

Unit 3

3Y1	A10
3Y2	A11
3Y3	E11

Unit 4

4Y21	A17
4Y22	A15
4Y23	A14
4Y31	A18
4Y32	A14
4Y35	C18

Unit 5

5Y28	Q18

Unit 7

7Y1	A21
7Y5	C20
7Y6	C23
7Y7	D23
7Y8	H23
7Y9	F28
7Y10	F26
7Y11	F25
7Y12	A25
7Y13	A25
7Y14	A27
7Y15	A28
7Y16	C24
7Y18	B24
7Y19	E23
7Y20	E23
7Y22	B20
7Y23	G23

Unit 8

8Y1	A31
8Y4	A30
8Y5	J28
8Y6	F28
8Y7	J25
8Y8	F25
8Y9	F24
8Y10	J26
8Y11	F26
8Y15	H36
8Y18	A34
8Y19	H35

Unit 9

9Y2	D39
9Y4	G39
9Y5	N39
9Y6	J36
9Y7	A37
9Y13	C39
9Y18	Q37

Unit 10

10Y1	N20
10Y3	P30
10Y5	J23
10Y8	N21
10Y10	J23
10Y11	H32
10Y12	F20
10Y13	L23
10Y14	L23
10Y15	Q21
10Y16	B24
10Y18	C24
10Y19	F20
10Y20	B24
10Y21	N30
10Y22	Q31

Unit 11

11Y1	B48
11Y2	B48
11Y3	C48
11Y4	D48
11Y5	E48
11Y6	F48
11Y7	G48
11Y8	H48
11Y9	J48
11Y10	J48
11Y11	K48
11Y12	L48
11Y13	B47
11Y14	B47
11Y15	C47
11Y16	D47
11Y17	E47
11Y18	F47
11Y19	G47
11Y20	H47
11Y21	J47
11Y22	K47
11Y23	K47
11Y24	L47
11Y25	B48
11Y26	C48
11Y27	D48
11Y28	D48
11Y29	E48
11Y30	F48
11Y31	H48
11Y32	H48
11Y33	J48
11Y34	K48
11Y35	L48
11Y36	M48
11Y41	Q45
11Y42	N43
11Y43	N43
11Y44	P43
11Y45	Q49
11Y46	M43
11Y47	A45
11Y48	B45
11Y49	C45
11Y50	D45
11Y51	D45
11Y52	E45
11Y53	G45
11Y54	H45
11Y55	H45
11Y56	J45
11Y57	K45
11Y58	L45
11Y59	N43
11Y60	M45
11Y61	F45
11Y62	F47
11Y63	G48

Unit 12

12Y3	L25
12Y5	J25
12Y8	K29
12Y11	L26
12Y13	J26
12Y17	K24
12Y19	J28
12Y21	L28

Unit 13

13Y1	J35
13Y3	J31
13Y4	L25
13Y6	L26
13Y8	L28
13Y9	M25
13Y12	M27
13Y13	M32
13Y14	Q25
13Y15	J35
13Y16	Q26
13Y17	Q25
13Y18	Q28
13Y19	F32
13Y20	K35
13Y21	N34

Unit 14

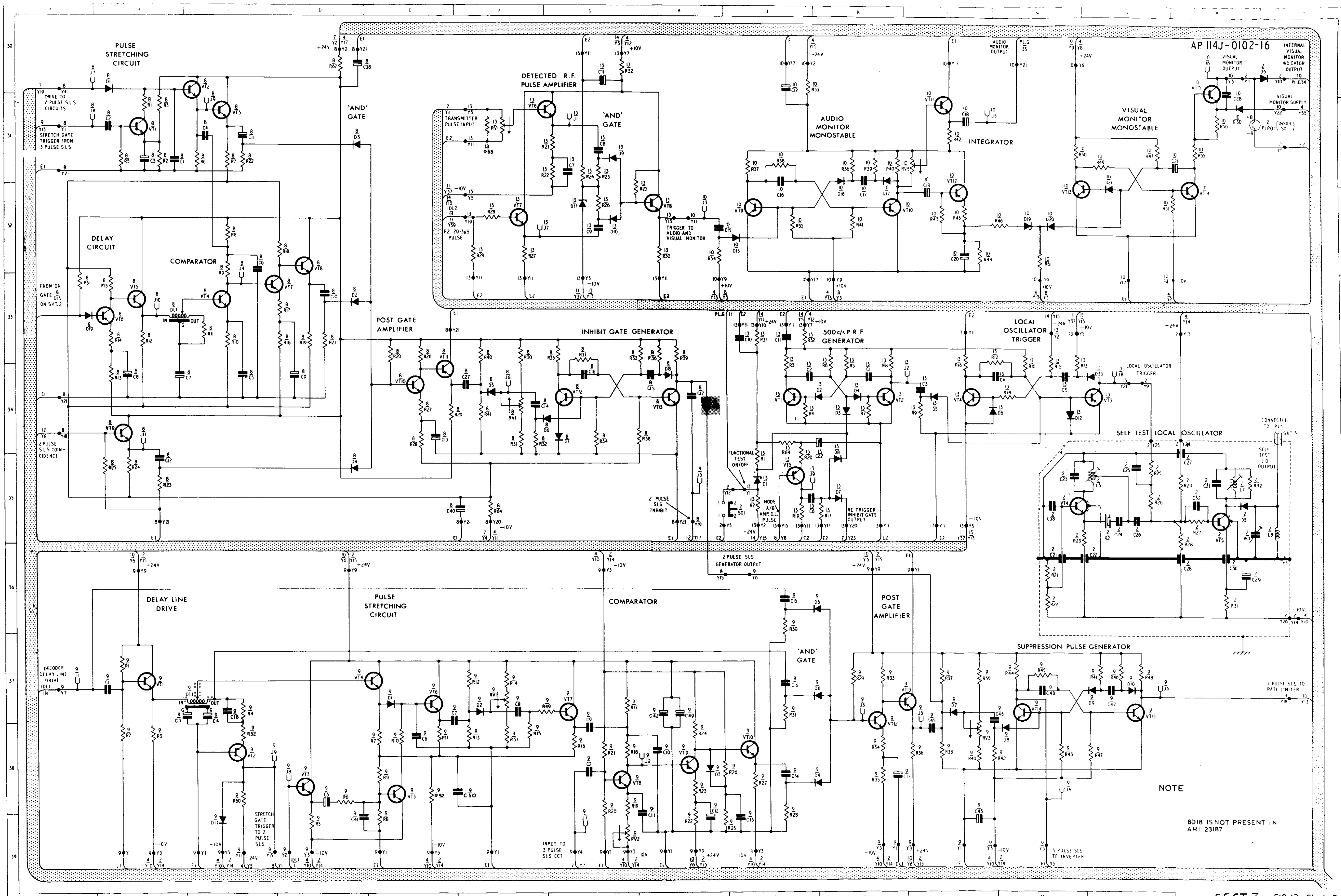
14Y1	A40
14Y2	G43
14Y3	M43
14Y7	A44
1Y49	A41
14Y10	A43
14Y12	K42
14Y19	C40
14Y20	Q41

PL.G

PLG1	D17
PLG2	B49
PLG3	D49
PLG4	F49
PLG5	G49
PLG6	J49
PLG7	K49
PLG8	D17
PLG9	D17
PLG10	D17
PLG11	D17
PLG12	D17
PLG13	D17
PLG14	M49
PLG15	B49
PLG16	C49
PLG17	E49
PLG18	F49
PLG19	H49
PLG20	J49
PLG21	D18
PLG22	D18
PLG23	M49
PLG24	C49
PLG25	D49
PLG26	F49
PLG27	G49
PLG28	L49
PLG29	D18
PLG30	D18
PLG31	D18
PLG32	D18
PLG33	D18
PLG34	D18
PLG35	D19
PLG36	D19
PLG37	J49
PLG38	L49
PLG39	B49
PLG40	C49
PLG41	E49
PLG42	H49
PLG43	K49
PLG44	G49
PLG45	L49

SKT. H

B	C49
C	D49
D	F49
E	H49
F	J49
H	L49
J	B49
P	D49
R	E49
S	H49
T	K49
U	M49
W	G49


AP 114J-0102-16
PULSE STRETCHING CIRCUIT
'AND' GATE
DETECTED R.F. PULSE AMPLIFIER
AUDIO MONITOR MONOSTABLE
INTEGRATOR
VISUAL MONITOR MONOSTABLE
DELAY CIRCUIT
COMPARATOR
POST GATE AMPLIFIER
INHIBIT GATE GENERATOR
500 c/s P.R.F. GENERATOR
LOCAL OSCILLATOR TRIGGER
SELF TEST LOCAL OSCILLATOR
DELAY LINE DRIVE
SUPPRESSION PULSE GENERATOR
NOTE
8D18 IS NOT PRESENT IN ARI 23187

Ref.	Loc.	Value	Ref.	Loc.	Value	Ref.	Loc.	Value	Ref.	Loc.	Value
1R1	L48	56K	IDL2	G45	KS92837	11R59	F48	56K	11R122	M45	1K
1R2	L48	22K				11R60	F47	56K	11R123	M46	1K
1R3	K48	56K	11R1	A46	470	11R61	G48	56K	11R124	M47	1K
1R4	K48	22K	11R2	A46	1.5K	11R62	G47	56K	11R125	F46	220
1R5	K48	56K	11R3	B46	390	11R64	G47	56K	11R126	Q48	47
1R6	K48	22K	11R4	B46	1.5K	11R65	H48	56K	11R127	F46	1.8K
1R7	J48	56K	11R5	C46	390	11R66	H47	56K	11R128	F47	56K
1R8	J48	22K	11R6	C46	1.5K	11R67	H48	56K	11R129	G48	56K
1R9	H48	56K	11R7	D46	270	11R68	H47	56K	11R130	G47	56K
1R10	H48	22K	11R8	D46	1.5K	11R70	H47	56K			
1R11	G48	56K	11R9	E46	270	11R71	H48	56K	11C1	A47	.005µ
1R12	G48	22K	11R10	E46	1.8K	11R72	H47	56K	11C2	B47	.005µ
1R13	F48	56K	11R11	E46	220	11R73	J48	56K	11C3	B47	.005µ
1R14	F48	22K	11R12	E46	1.8K	11R74	J47	56K	11C4	B47	.005µ
1R15	E48	56K	11R13	G46	180	11R76	J47	56K	11C5	B47	.005µ
1R16	E48	22K	11R14	G46	1.8K	11R77	J48	56K	11C6	C47	.005µ
1R17	D48	56K	11R15	H46	180	11R78	J47	56K	11C7	C47	.005µ
1R18	D48	22K	11R16	H46	1.8K	11R79	J48	56K	11C8	C47	.005µ
1R19	C48	56K	11R17	J46	150	11R80	J47	56K	11C9	C47	.005µ
1R20	C48	22K	11R18	J46	2.2K	11R82	K47	56K	11C10	D47	.005µ
1R21	B48	56K	11R19	J46	120	11R83	K48	56K	11C11	D47	.005µ
1R22	B48	22K	11R20	J46	2.2K	11R84	K47	56K	11C12	D47	.005µ
1R23	B48	56K	11R21	K46	82	11R85	K48	56K	11C13	D47	.005µ
1R24	B48	22K	11R22	K46	2.2K	11R86	K47	56K	11C14	E47	.005µ
1R25	F48	56K	11R23	L46	68	11R88	K47	56K	11C15	E47	.005µ
1R26	F48	22K	11R24	L46	2.2K	11R89	L48	56K	11C16	E47	.005µ
			11R25	A48	56K	11R90	L47	56K	11C17	F47	.005µ
1C1	L48	.04u	11R26	A47	56K	11R91	L48	56K	11C18	F47	.005µ
1C2	L48	.04u	11R28	B47	56K	11R92	L47	56K	11C19	G47	.005µ
1C3	K48	.04u	11R29	B48	56K	11R94	L47	56K	11C20	G47	.005µ
1C4	J48	.04u	11R30	B47	56K	11R95	L48	56K	11C21	G47	.005µ
1C5	H48	.04u	11R31	B48	56K	11R96	L47	56K	11C22	H47	.005µ
1C6	G48	.04u	11R32	B47	56K	11R97	M48	120K	11C23	H47	.005µ
1C7	F48	.04u	11R34	B47	56K	11R98	M46	680	11C24	H47	.005µ
1C8	E48	.04u	11R35	C48	56K	11R99	N44	1K	11C25	H47	.005µ
1C9	D48	.04u	11R36	C47	56K	11R100	N44	820	11C26	J47	.005µ
1C10	C48	.04u	11R37	C48	56K	11R101	P44	4.7K	11C27	J47	.005µ
1C11	C48	.04u	11R38	C47	56K	11R102	N45	22K	11C28	J47	.005µ
1C12	B48	.04u	11R40	C47	56K	11R103	N46	22K	11C29	J47	.005µ
1C13	G48	.04u	11R41	D48	56K	11R104	N47	22K	11C30	K47	.005µ
			11R42	D47	56K	11R105	P45	22K	11C31	K47	.005µ
1D1	L48	IN3067	11R43	D48	56K	11R106	N46	1K	11C32	K47	.005µ
1D2	L48	IN3067	11R44	D47	56K	11R107	N46	1K	11C33	L47	.005µ
1D3	K48	IN3067	11R46	D47	56K	11R108	N47	1K	11C34	L47	.005µ
1D4	J48	IN3067	11R47	D48	56K	11R109	N48	3.3K	11C35	L47	.005µ
1D5	H48	IN3067	11R48	D47	56K	11R110	P45	8.3K	11C36	L47	.005µ
1D6	G48	IN3067	11R49	E48	56K	11R111	P46	8.2K	11C37	M47	.005µ
1D7	F48	IN3067	11R50	E47	56K	11R112	P47	8.2K	11C38		
1D8	E48	IN3067	11R52	E47	56K	11R113	P45	3.3K	11C45	P48	2.2µ
1D9	D48	IN3067	11R53	E48	56K	11R114	P46	3.3K	11C46	F47	.005µ
1D10	C48	IN3067	11R54	E47	56K	11R115	P47	3.3K	11C47	G47	.005µ
1D11	C48	IN3067	11R55	E48	56K	11R117	P46	22K			
1D12	B48	IN3067	11R56	E47	56K	11T118	P46	22K	11VT1	A46	C64
1D13	G48	IN3067	11R58	F47	56K	11R119	P47	22K	11VT2	B46	C64
						11R121	P45	2.2K			

Ref.	Loc	Value	Ref.	Loc	Value	Ref.	Loc	Value	Ref.	Loc	Value
11VT3	C46	C64	11D35	L46	1N3067	14R32	D42	1.5K	14C17	K43	220p
11VT4	D46	C64	11D36	L46	1N3067	14R33	N41	560	14C18	K43	390p
11VT5	E46	C64	11D37	P44	1N3067	14R34	M42	1k	14C19	H44	100p
11VT6	E46	C64				14R35	L42	4.7k	14C20	J44	1μ
11VT7	G46	C64	11D39	M46	1N3067	14R39	L43	1k	14C21)		200p
11VT8	H46	C64	11D40	P44	1N3067	14R40	L44	6.8k	14C22)		680p
11VT9	J46	C64	11D41	N48	1S7033B	14R41	L43	1k	14C23)	G44	680p
11VT10	J46	C64	11D42	P45	1N3067	14R42	H44	15k	14C24)		680p
11VT11	K46	C64	11F43	P45	1N3067	14R43	K43	2.2k	14C25)		200p
11VT12	L46	C64	11D44	P46	1N3067	14R44	K43	3.3k	14C26	M40	10μ
11VT13	N45	C111	11D45	P46	1N3067	14R45	H43	2.2k	14C27	M41	220p
11VT14	N46	C111	11D46	P47	1N3067	14R46	K44	2.2k	14C29	M41	180p
11VT15	N47	C111	11D47	P47	1N3067	14R47	H44	47k	14C30	N42	560p
11VT16	P45	C111	11D48	F46	1N3067	14R48	G44	180	14R31	P41	.005μ
11VT17	P46	C111	11D49	G46	1N3067	14R49	J43	11	14C32	N42	10μ
11VT18	P47	C111				14R50	J44	15k	14C33	M42	560p
11VT19	P44	C111	11J1	N45		14R51	J43	4.7k	14C34	D42	56p
11VT20	F46	C64	11J2	M43		14R52	G44	2.2k	14C39	B43	220p
			11J3	Q45		14R53	M41	2.7k	14C40	F42	2.2μ
11D1	A46	1N3067	11J4	N46		14R55	M41	390	14C41	L43	.04μ
11D2	B46	1N3067	11J5	N47		14R56	N42	220			
11D3	B46	1N3067				14R57			14RV1	D43	250k
11D4	B46	1N3067	14R1	E42	10k	14R58	M41	470	14RV2	M42	2.5k
11D5	B46	1N3067	14R2			14R59	N42	470			
11D6	C46	1N3067	14R3			14R60	P41	27	14VT1	B40	C64
11D7	C46	1N3067	14R4	B41	2.7k	14R61	M42	270	14VT2	E41	C64
11D8	C46	1N3067	14R5	E41	68k	14R64	L42	1k	14VT3	F42	C64
11D9	C46	1N3067	14R6	E41	68k	14R65	D42	2.7k	14VT4	F41	C64
11D10	D46	1N3067	14R7	F42	33k	14R66	D42	22k	14VT5	G41	V15216/1
11D11	D46	1N3067	14R8	F42	10k	14R67	B43	82	14VT6	H41	C64
11D12	D46	1N3067	14R9	F42	5.6k	14R68	C42	1.5k	14VT7	H41	V15216/1
11D13	D46	1N3067	14R10	G41	1.5k	14R69	B41	1k	14VT8	E44	C64
11D14	E46	1N3067	14R11	G42	1.5k	14R70	B42	4.7k	14VT9	C44	C64
11D15	E46	1N3067	14R12	G42	100	14R71	J41	4.7k	14VT10	K41	C64
11D16	E46	1N3067	14R13	G41	1k	14R72	H43	4.7k	14VT13	G44	C111
11D17	F46	1N3067	14R14	H42	1k	14R73	C42	220	14VT14	H44	C111
11D18	F46	1N3067	14R15	J41	1k				14VT15	L44	2N1132
11D19	G46	1N3067	14R16	H42	56	14C1			14VT16	J44	1N708
11D20	G46	1N3067	14R17	H42	1k	14C2	D42	3-18p	14VT17	M41	U3049/1
11D21	G46	1N3067	14R18	H42	10	14C3	E41	68p	14VT18	N42	A1603
11D22	H46	1N3067	14R19	H41	680	14C4	E41	68p	14VT19	N41	U3049/1
11D23	H46	1N3067	14R20	D44	6.8k	14C5	E42	1000p	14VT20	P42	2N1132
11D24	H46	1N3067	14R21	E44	15k	14C6	E41	68p	14VT21	L42	2N995
11D25	H46	1N3067	14R22	E44	10k	14C7	C42	1μ	14VT22	D42	C64
11D26	J46	1N3067	14R23	D44	22k	14C8	G41	.005μ	14VT23	C42	2S322
11D27	J46	1N3067	14R24	C43	10k	14C9	H41	100p			
11D28	J46	1N3067	14R25	C44	68k	14C10	H41	100p	14D3	C41	1N3067
11D29	J46	1N3067	14R26	C43	6.8k	14C11	C44	140μ	14D4	F42	1N3067
11D30	K46	1N3067	14R27	K41	2.7k	14C12	C44	140μ	14D5	G42	1N3067
11D31	K46	1N3067	14R28	K41	2.2k	14C13	J41	220μ	14D6	D44	1N3067
11D32	K46	1N3067	14R29	J41	220	14C14	J41	56p	14D7	C44	1N3067
11D33	L46	1N3067	14R30	J41	1k	14C15	L43	.04μ	14D8	L41	1N3067
11D34	L46	1N3067	14R31	K41	1.5k	14C16	H44	1000p	14D9	L42	1N3067

Ref	Loc	Value
14D10	N41	IN3067
14D11	N41	IN3067
14D12	H44	IN3067
14D13	L43	IN3067
14D14	K44	IN3067
14D15		
14D16	N42	IN3067
14D17	M42	IN3067
14D18	J41	IN3067
14D19	C41	IN3067
14D20	D42	IN3067
14D21	C42	IN3067
14D22	C43	IN3067
14D23	L43	IN3067
14D24	K44	IS7033B
14D25	B41	IN3067
14D26	B41	IN3067
14L1	D42	300uH
14L2)		(
14L3)	G44	(SEE
14L4)		(PARTS
14L5)		(LIST
14J1	N41	
14J2	G43	
14J3	B40	
14J4	K41	
14J5	J41	
14J6	F41	
14J7	L43	
14J8	L42	

INTERCONNECTION POINT POSITIONS FOR FIG. 12

IDL1

IN	A24
1	A24
2	A25
3	A25
4	A27
5	A28
G	A24

IDL2

IN	A45
1	A45
2	B45
3	C45
4	D45
5	D45
6	E45
7	F45
8	G45
9	H45
10	H45
11	J45
12	K45
13	L45
14	L45
15	M45
G	F45

C.Filt

1Y2	G48
1Y4	B48
1Y6	C48
1Y8	C48
1Y10	D48
1Y12	E48
1Y14	F48
1Y16	G48
1Y18	H48
1Y20	J48
1Y22	K48
1Y24	L48
1Y26	L48
1Y28	F47
1Y30	B47
1Y32	B47
1Y34	C47
1Y36	D47
1Y38	E47
1Y40	F47
1Y42	G47
1Y44	H47
1Y46	J47
1Y48	K47
1Y50	K47
1Y52	L47

Unit 2

2Y1	Q12
2Y2	Q18
2Y4	K13
2Y9	N34
2Y10	Q30
2Y11	P30
2Y12	J35
2Y19	E19
2Y20	E19
2Y21	E19
2Y25	N34
SKT1	Q11
SKT2	P12
SKT3	N12
SKT4	K10
SKT5	Q34
PL2	P12
PL3	N12
PL4	J10
PL5	N11
SKTR	D19
SKTS	D19
SKTT	D19

Unit 3

3Y1	A10
3Y2	A11
3Y3	E11

Unit 4

4Y21	A17
4Y22	A15
4Y23	A14
4Y31	A18
4Y32	A14
4Y35	C18

Unit 5

5Y28	Q17

Unit 7

7Y1	A21
7Y5	C20
7Y6	C23
7Y7	D23
7Y8	H23
7Y9	F28
7Y10	F26
7Y11	F25
7Y12	A25
7Y13	A25
7Y14	A27
7Y15	A28
7Y16	C24
7Y18	B24
7Y19	E23
7Y20	E23
7Y22	B20
7Y23	G23

Unit 8

8Y1	A31
8Y4	A30
8Y5	J28
8Y6	F28
8Y7	J25
8Y8	F25
8Y9	F24
8Y10	J26
8Y11	F26
8Y15	H36
8Y18	A34
8Y19	H35

Unit 9

9Y2	D39
9Y4	G39
9Y5	N39
9Y6	J36
9Y7	A37
9Y13	C39
9Y18	Q37

Unit 10

10Y1	N20
10Y3	P30
10Y5	J23
10Y8	N21
10Y10	J23
10Y11	H32
10Y12	F20
10Y13	L23
10Y14	L23
10Y15	Q21
10Y19	F20
10Y21	N30
10Y22	Q31

Unit 11

11Y1	B48
11Y2	B48
11Y3	C48
11Y4	D48
11Y5	E48
11Y6	F48
11Y7	G48
11Y8	H48
11Y9	J48
11Y10	J48
11Y11	K48
11Y12	L48
11Y13	B47
11Y14	B47
11Y15	C47
11Y16	D47
11Y17	E47
11Y18	F47
11Y19	G47
11Y20	H47
11Y21	J47
11Y22	K47
11Y23	K47
11Y24	L47
11Y25	B48
11Y26	C48
11Y27	D48
11Y28	D48
11Y29	E48
11Y30	F48
11Y31	H48
11Y32	H48
11Y33	J48
11Y34	K48
11Y35	L48
11Y36	M48
11Y41	Q45
11Y42	N43
11Y43	N43
11Y44	P43
11Y45	Q49
11Y46	M43
11Y47	A45
11Y48	B45
11Y49	C45
11Y50	D45
11Y51	D45
11Y52	E45
11Y53	G45
11Y54	H45
11Y55	H45
11Y56	J45
11Y57	K45
11Y58	L45
11Y59	N43
11Y60	M45
11Y61	F45
11Y62	F47
11Y63	G48

Unit 12

12Y3	L25
12Y5	J25
12Y8	K29
12Y11	L26
12Y13	J26
12Y17	K24
12Y19	J28
12Y21	L28

Unit 13

13Y1	J35
13Y3	J31
13Y4	L25
13Y6	L26
13Y8	L28
13Y9	M25
13Y12	M27
13Y13	M32
13Y14	Q25
13Y15	J35
13Y16	Q26
13Y17	Q25
13Y18	Q28
13Y19	F32
13Y20	K35
13Y21	N34

Unit 14

14Y1	A40
14Y2	G43
14Y3	M43
14Y7	A44
14Y9	A41
14Y10	A43
14Y12	K42
14Y19	C40
14Y20	Q41

PL.G

PLG1	D17
PLG2	B49
PLG3	D49
PLG4	F49
PLG5	G49
PLG6	J49
PLG7	K49
PLG8	D17
PLG9	D17
PLG10	D17
PLG11	D17
PLG12	D17
PLG13	D17
PLG14	M49
PLG15	B49
PLG16	C49
PLG17	E49
PLG18	F49
PLG19	H49
PLG20	J49
PLG21	D18
PLG22	D18
PLG23	M49
PLG24	C49
PLG25	D49
PLG26	F49
PLG27	G49
PLG28	L49
PLG29	D18
PLG30	D18
PLG31	D18
PLG32	D18
PLG33	D18
PLG34	D18
PLG35	D19
PLG36	D19
PLG37	J49
PLG38	L49
PLG39	B49
PLG40	C49
PLG41	E49
PLG42	H49
PLG43	K49
PLG44	G49
PLG45	L49

SKT.H

B	C49
C	D49
D	F49
E	H49
F	J49
H	L49
J	B49
P	D49
R	E49
S	H49
T	K49
U	M49
W	G49

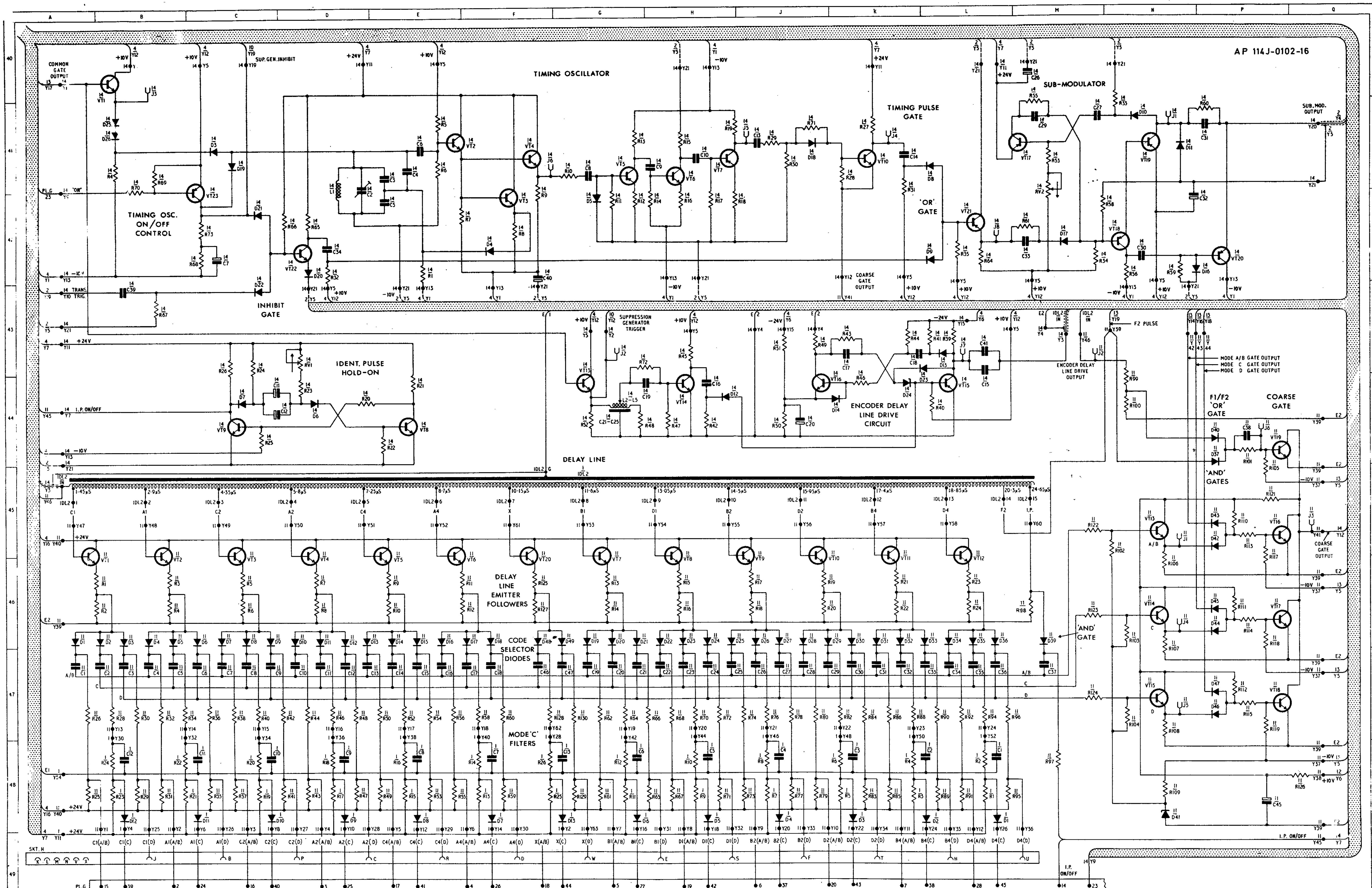


Fig. 12, Sheet 4

FIG. 13A INTERCONNECTION DIAGRAM SSR 1600/2

Fig.13. Not Included

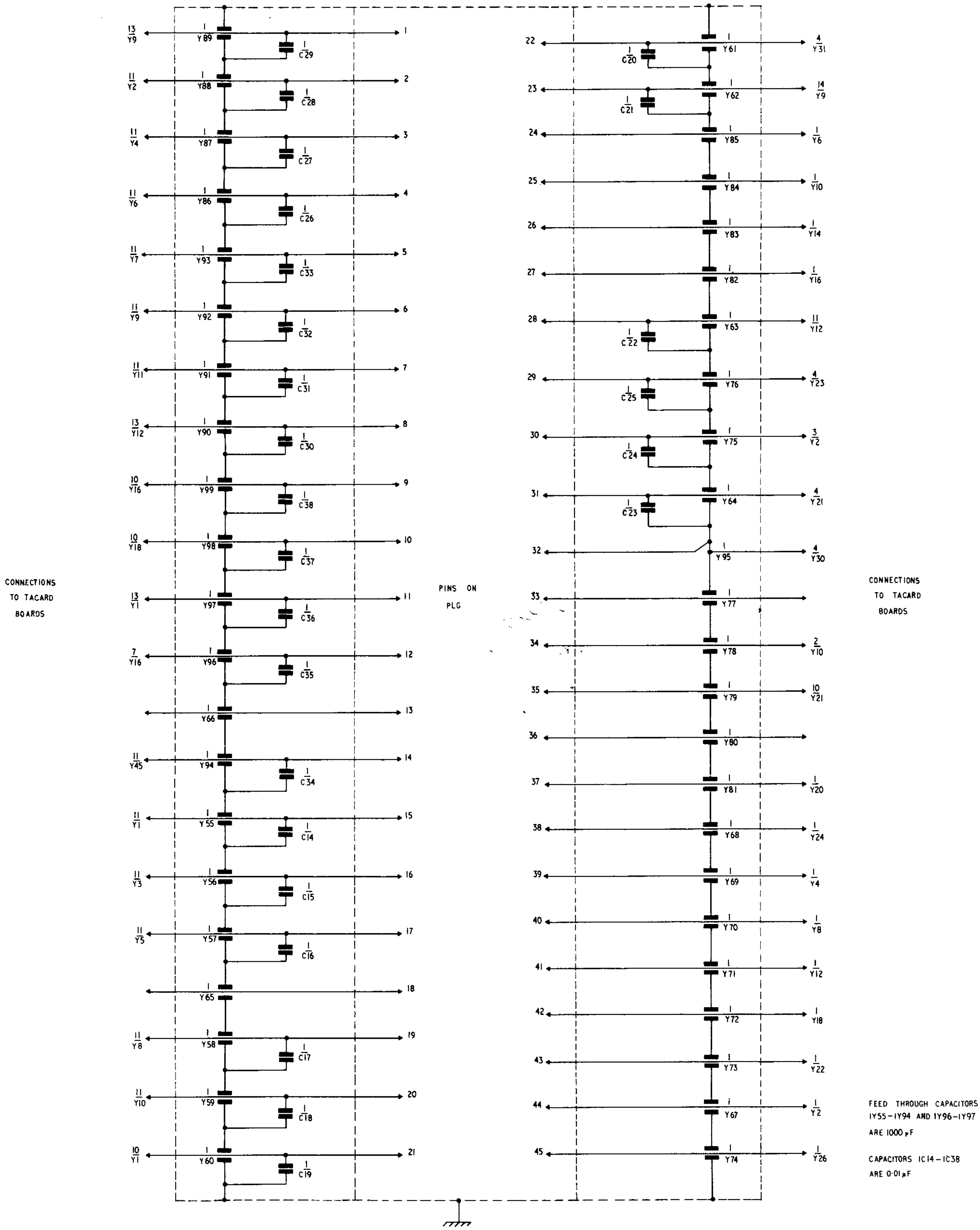


FIG. 14 FILTER UNIT

FIG.15 NOT INCLUDED

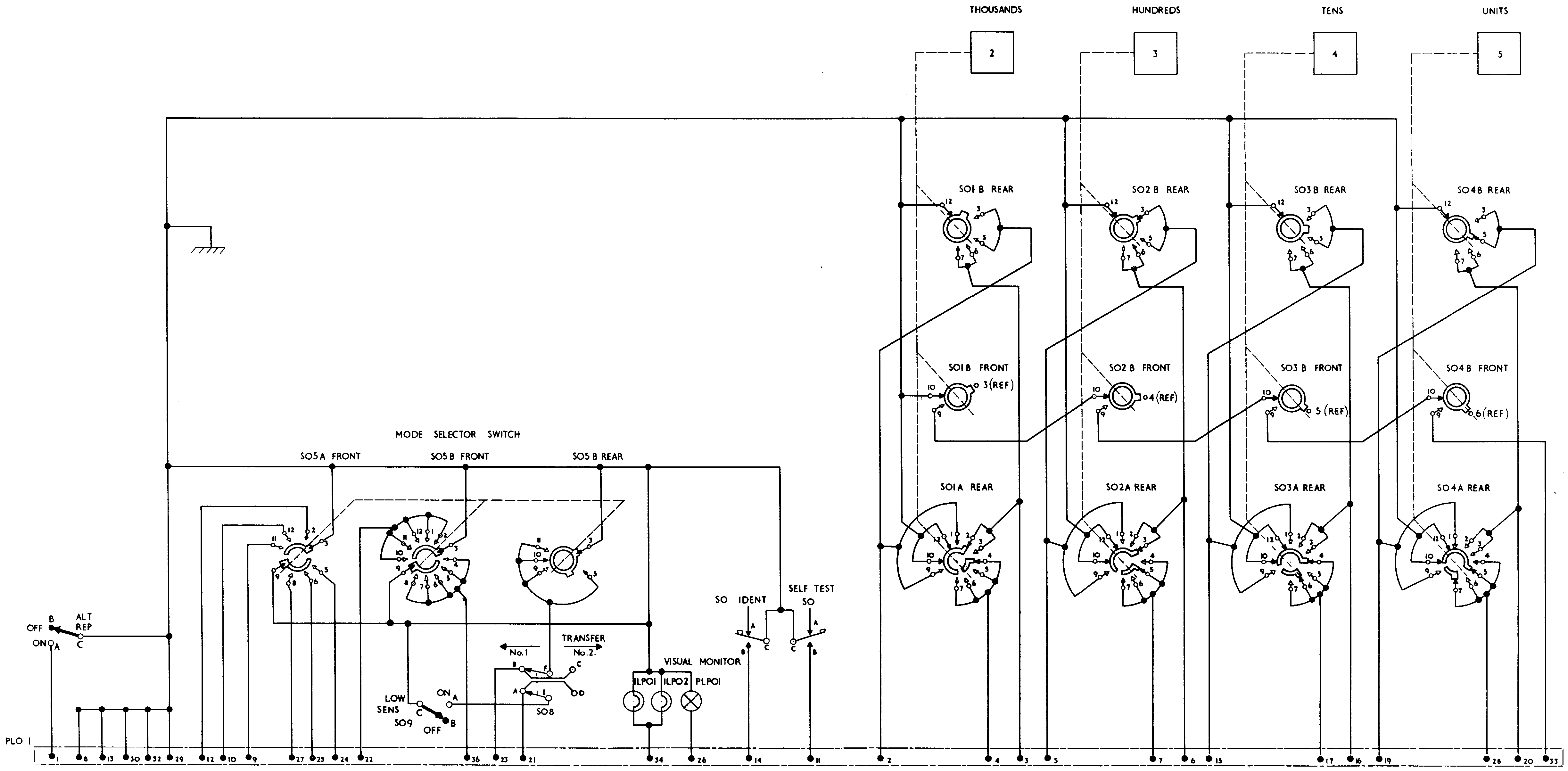
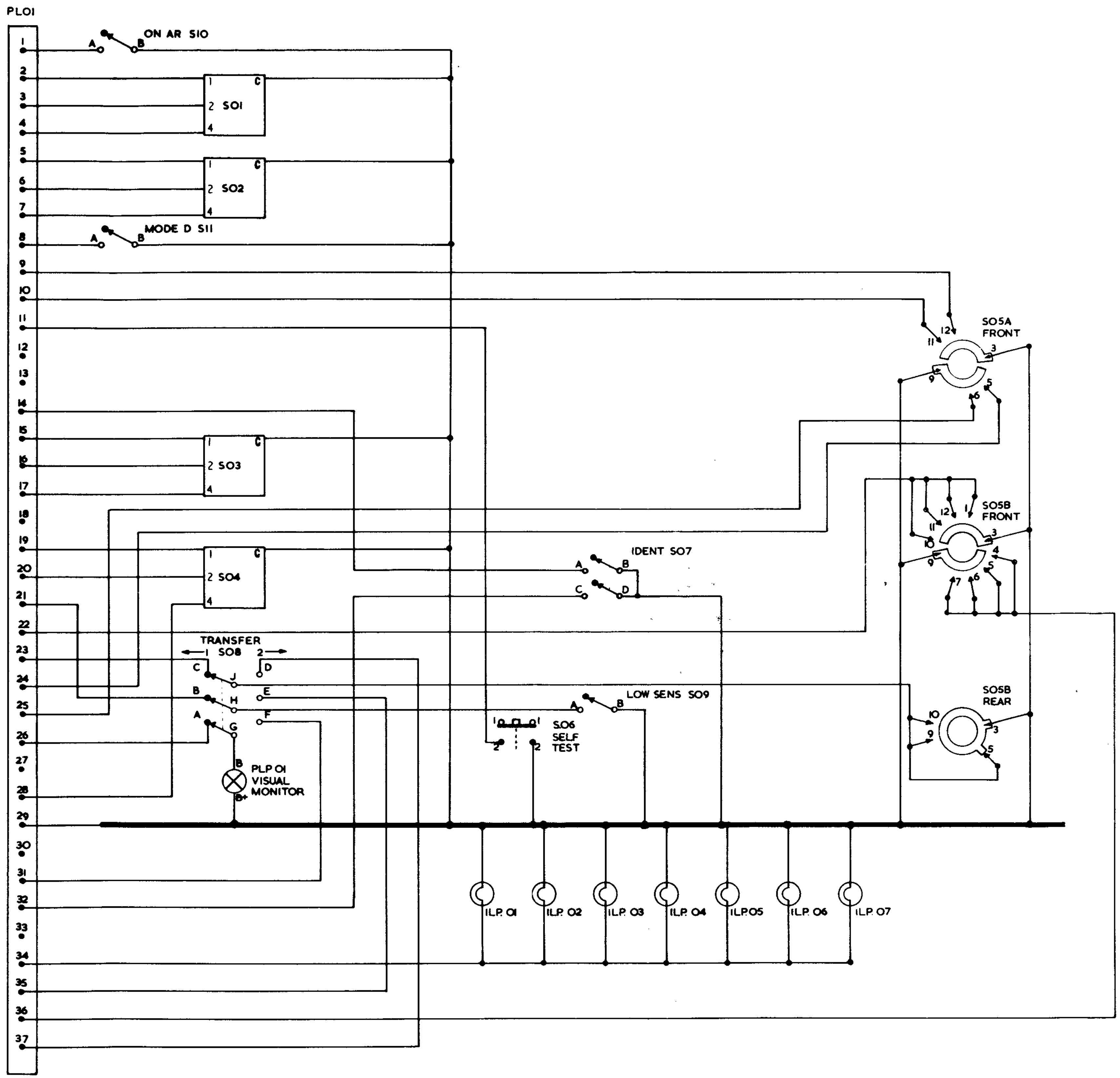


FIG. 16 CONTROL UNIT SSR. 1601/2

PLUG PIN NUMBERS AND CONNECTIONS			
PLO1	PLG1	PLG2	FUNCTION
1	1	1	ALTITUDE REPORTING ON/OFF
2	2	2	MODE A/B - A1 SELECT (B)
3	3	3	MODE A/B - A2 SELECT (C)
4	4	4	MODE A/B - A4 SELECT (D)
5	5	5	MODE A/B - B1 SELECT (E)
6	6	6	MODE A/B - B2 SELECT (F)
7	7	7	MODE A/B - B4 SELECT (G)
8	8	8	AIRFRAME IDENTITY ON/OFF
9	9		MODE A SELECT (1)
10	10		MODE B SELECT (1)
11	11	11	SELF TEST ON/OFF
12	12		MODE D SELECT (1)
13			RESERVED
14	14	14	IDENTITY PULSE ON/OFF
15	15	15	MODE A/B - C1 SELECT (J)
16	16	16	MODE A/B - C2 SELECT (K)
17	17	17	MODE A/B - C4 SELECT (L)
18	18	18	MODE A/B-X SELECT NOT USED
19	19	19	MODE A/B-D1 SELECT (N)
20	20	20	MODE A/B-D2 SELECT (O)
21	21		LOW SENSITIVITY ON/OFF (1)
22	22		STAND BY (1)
23	23		ON (1)
24		9	MODE A SELECT (2)
25		10	MODE B SELECT (2)
26	34	34	VISUAL MONITOR OUTPUT
27		12	MODE D SELECT (2)
28	28	28	MODE A/B D4 SELECT (P)
29	32	32	EARTH
30	33	33	AUX. EARTH
31			EMERGENCY (+28V)
32			RESERVED
33			REMOTE KEYER
34			PANEL LIGHTS
35		21	LO SENS (2)
36		22	STAND BY (2)
37		23	ON (2)

PIN NO.	PLUG CONNECTIONS FUNCTION
1	ALTITUDE REPORTING ON/OFF
2	CODE PULSE A1 B WIRE
3	CODE PULSE A2 C WIRE
4	CODE PULSE A4 D WIRE
5	CODE PULSE B1 E WIRE
6	CODE PULSE B2 F WIRE
7	CODE PULSE B4 G WIRE
8	AIRFRAME IDENT
9	MODE A No 1
10	MODE B No 1
11	FUNCTIONAL TEST
12	MODE D (RESERVED)
13	RESERVED
14	IDENTITY PULSE No 1
15	CODE PULSE C1 J WIRE
16	CODE PULSE C2 K WIRE
17	CODE PULSE C4 L WIRE
18	CODE PULSE X M WIRE (NOT USED)
19	CODE PULSE D1 N WIRE
20	CODE PULSE D2 O WIRE
21	LOW SENS No 1
22	STANDBY No 1
23	ON No 1
24	MODE A No 2
25	MODE B No 2
26	VISUAL MONITOR No 1
27	MODE D No 2 (RESERVED)
28	CODE PULSE D4 P WIRE
29	GROUND
30	AUX GROUND (RESERVED)
31	VISUAL MONITOR No 2
32	IDENTITY PULSE No 2
33	REMOTE KEYER (RESERVED)
34	PANEL LIGHTS
35	LOW SENS No 2
36	STANDBY No 2
37	ON No 2



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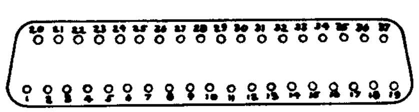


VIEW ON WIRING FACE OF PLUG

FIG. 17 CONTROL, TRANSPONDER SET, TYPE 1601/6 CIRCUIT DIAGRAM

Section 4

ROUTINE INSPECTION AND MAINTENANCE OF TRANSPONDER

Contents

ILLUSTRATIONS

ROUTINE INSPECTION AND MAINTENANCE OF TRANSPONDER

1. Removal of units from aircraft

Slacken the two thumb screws at the lower frontof the mounting tray and pull the transponder straight forward using the withdrawal handle provided.

2. Disassembly

A. Removal of transponder cover

Release the Dzus fastener located above the 45 way connector at the rear of the unit and slide the cover away from the front panel. Take care not to damage the anodised finish on the chassis.

B. Removal of sub-units

(1) The transponder is designed as an integrated unit and the sub-assembly boards should not be removed. However, it may be necessary to remove the R.F. head assembly to facilitate cleaning and maintenance. This is achieved as follows:

(a) Remove the two screws on the right-hand side of the front panel.

(b) Slacken the captive screw at the top of the right-hand side of the front panel.

The front section of right-hand side panel will then be released, and may be swung open, enabling servicing of the I.F unit, local oscillator, and self-test local oscillator to be performed.

(2) If the R.F. head assembly is required to be removed completely then the following procedure should be carried out:

(a) Remove the two screws on the left-hand side of the front Panel.

(b) Slacken the captive screw at the top of the left-hand side of the front panel.

(c) Slacken the spring-loaded screw at the rear of the gold-plated cavities.

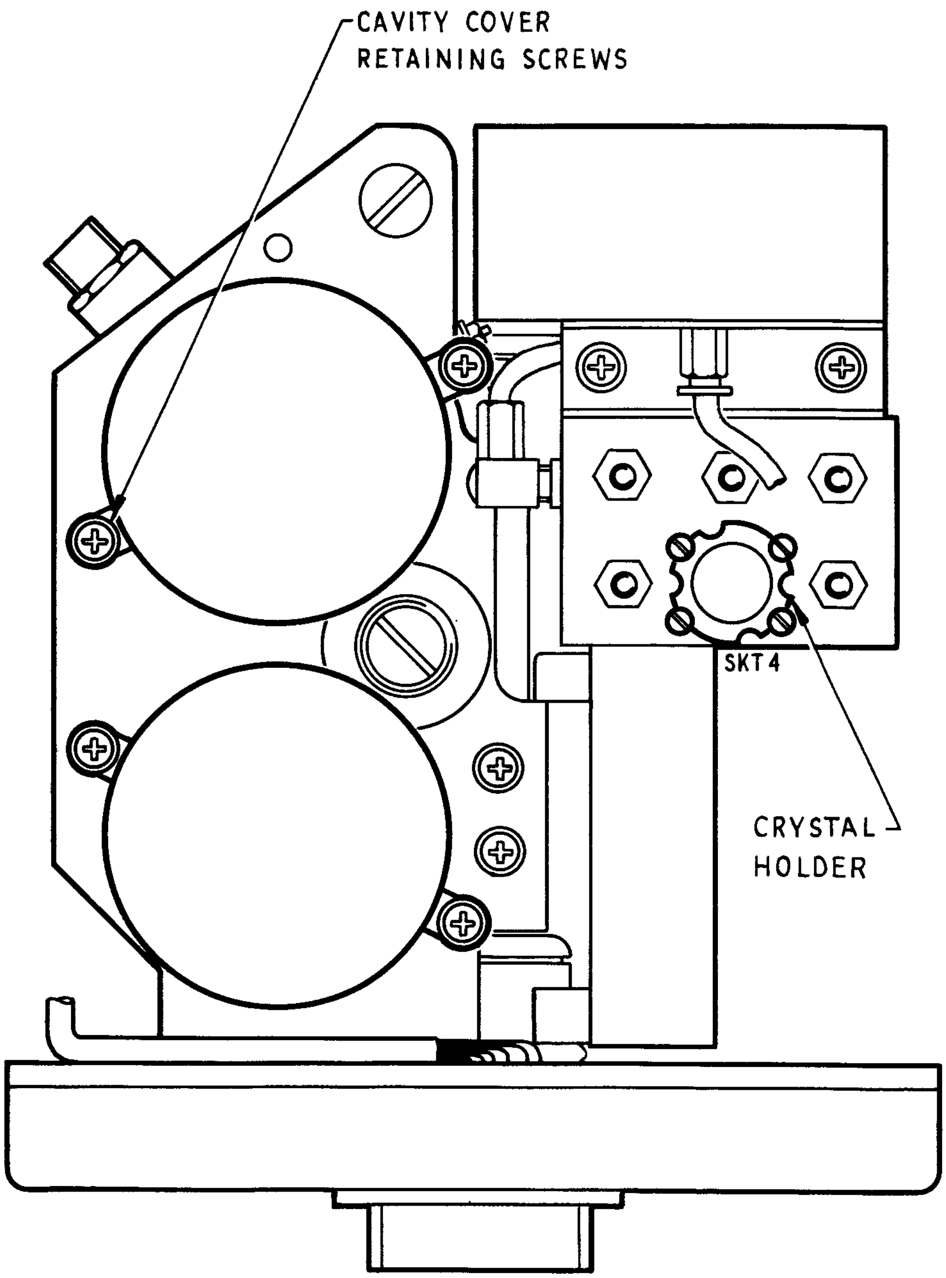


FIG. 1 R.F. UNIT

The complete R.F. head assembly may now be withdrawn, using the handle on the front panel, and the tucked cableform will allow the R.F head to stand on the bench, close to the transponder chassis.

(3) All the components in the transponder are readily accessible and can, therefore, be serviced with the sub-units in situ. Six of the eight tacard assemblies can, if necessary, be swung out of the frame to give access to individual components and are installed in two distinct groups of three. Each group is handled in a similar manner.

(a) Through the access holes provided in the side frame, remove three of the four bolts securing the group of three tacards. The bolt to be left in poition is the upper one of the pair adjacent to the R.F head.

(b) Using the last bolt as a pivot, swing up the tacard selected for examination.

NOTE In this position, tacards are most susceptible to damage. Do not exert undue pressure on the unit.

(c) The centre pair of tacards are fixed and cannot be pivoted. Access to these units is obtained by swinging clear the other three tacards of either group.

(d) Should it prove necessary to replace a complete tacard assembly, then the cableform feeding the assembly unit must be unsoldered from the terminal board. Removal of the pivot bolt will then free the assembly.

C. Resonant cavities

(1) No attempt should be made to disassemble the resonant cavities embodied in the R.F head since reassembly demands the use of special tools. In the unlikely event of failure, the oscillator and amplifier cavities must be replaced as a complete assembly as referred in the illustrated parts lists.

(2) To replace the lighthouse triodes in either the oscillator or amplifier cavities, undo the two captive screws in the end cover and remove the cover. The valve can now be withdrawn by gripping the knurled boss on its end and pulling straight out. Care should be taken not to damage the contact fingers in the cavity when replacing a valve.

D. Crystal

The crystal is located in the top of the Filter and Mixer assembly. To remove the crystal, slacken the four retaining screws and twist the crystal mounting until the semi-circular cutouts in the flange lie beneath the retaining screws. Remove the mounting and lift out the crystal.

3. Cleaning

A. General

Compressed air should normally be used for internal cleaning. Only sufficient pressure for the purpose should be applied and care must be taken not to disturb the chassis wiring.

B. Use of solvents

The use of mild solvents to remove grease and grime is allowable provided that excessive quantities are not applied. Carbon Tetrachloride is a suitable solvent and should be applied either with fluffless cotton wool or a camel hair brush. Dry finally with compressed air.

4. Inspection

The purpose of inspection is to ensure that components and wiring have not deteriorated during service. Accordingly, inspect all components and wiring for evidence of cracked or defective insulation, overheating, mechanical damage or distortion, and any other indication that the item should be replaced.

5. Repair and Replacement

A. Generally speaking the repair of electronic components used in the transponder is not feasible and defective items will require replacement. Any replacement made must employ a component both electrically and physically identical with the unserviceable part removed. Refer to the parts list to fulfill this requirement.

B. Replaced components must duplicate in all respects the position of the original. Connecting leads should follow the same route and be kept as short as possible, consistent with this requirement. All components are readily accessible and no special instructions are required for their replacement.

C. After replacement of a faulty component, a thorough check of the affected circuit must be made. Before the transponder is returned to service, it should be tested in accordance with section 6.

6. Re-assembly

A. General

When re-assembling the transponder, ensure that all components are clean and free from excessive soldering flux and cleaning fluids. Check that all parts which have been removed are correctly replaced and that all flying leads are properly mated. Finally, before replacing the cover, make sure that all internal parts are thoroughly dry and free from condensation.

B. R.F head assembly

To replace the R.F head assembly:-

Caution The clearance between the side frames and the R.F head is very small. Great care must therefore be exercised to prevent damage to the gold-plating on the cavities and the anodised finish of the side frames.

(a) Slide the unit into position between the side frames and loosely insert the two screws on the left-hand side of the front panel.

(b) Close the right-hand side panel, and loosely insert the two screws on the right-hand side of the front panel.

(c) Tighten the spring-loaded screw at the rear of the gold-plated cavities.

(d) Tighten all the six screws on the front panel.

(e) Replace the cableform in its original route.

C. Replacement of transponder cover

Slide on the cover from the rear of the transponder towards the front panel until the 45 way connector at the rear is positioned in the hole at the back of the cover. Secure the Dzus fastener above the 45 way connector.

7. Storage

The Cossor Airborne Transponder Type S.S.R 1600 can be stored at temperatures between -50°C and +75°C without deterioration. It is unaffected by conditions of humidity provided that care is taken to ensure that internal parts are dry and free from condensation when the unit is returned to service.

Section 5

ROUTINE INSPECTION AND MAINTENANCE OF CONTROL UNIT

Contents

ROUTINE INSPECTION AND MAINTENANCE

OF CONTROL UNIT

1. Removal of unit from aircraft

Release the four Dzus fasteners located at the corners of the front panel and remove the control unit by gentle pressure from the finger tips applied under the edges of the front panel. Withdraw the unit from its mounting.

Note:

Do not attempt to withdraw the control unit by pulling on any of the control knobs, switches, lamps or protective bosses.

2. Disassembly

A. Removal of the control unit cover

Release the Dzus fastener located above the 37 way connector at the rear of the unit and slide the cover away from the front panel.

B. Removal of sub-units

User organizations should not attempt disassembly of the control unit. In the case of major part replacements becoming necessary, the unit should be returned to the manufacturer for refurbishment.

3. Servicing

A. General

Internal cleaning should be carried out with compressed air or a suitable vacuum cleaner. When compressed air is used, the pressure must be just sufficient for the purpose intended.

B. Solvents

Mild solvents may be used for the removal of grease and grime, provided that excessive quantities are not applied. Carbon tetrachloride is suitable for this purpose, but care must be exercised to keep solvents out of contact with printed surfaces and plastic parts.

C. Lubrication

Lubricate all moving parts, except switches, with grease to DTD 825.

4. Reassembly

When reassembling the control unit, ensure that all components are clean and free from excessive soldering flux and cleaning fluids. All internal parts must be thoroughly dry and free from condensation. Replace the cover and secure the Dzus fastener.

5. Storage

The Cossor Airborne Control Unit S.S.R.1601 can be stored at temperatures between -50°C and +75°C without deterioration. Ensure that internal parts are dry and free from condensation when it is returned to service.

SECTION 6

TESTING AND ALIGNMENT (DEPTH 3C)

CONTENTS

TESTING AND ALIGNMENT

Introduction

1 The major part of the transponder circuitry is contained on the tacard boards and in the power units, the remainder being in the RF Head assembly. Overall test procedures have been prepared for a transponder with the RF units already aligned. The alignment procedures are included at the rear of this section.

Test equipment and power supply requirements

2. The tables below list all equipment necessary to perform a servicing operation to Depth 3C.

TABLE 1 POWER SUPPLY REQUIREMENTS

QTY	ITEM
2	Power supply units, variable over range 100 V to 130 V, at 400 Hz single phase rated at 100 VA.
1	Power supply 27.5 V dc, 3A, variable over range 22 V to 31 V.

TABLE 2 DUMMY LOADS

QTY	ITEM
1	1 k ± 5% 1/2 W resistor in parallel with 180pF capacitor (for REC.VID.SKT.R.).
1	300 ohm ± 5% 1/2 W resistor in parallel with a 2000pF, 250 V working capacitor (for EXT.SUPN. SKT.S.).
1	500 ohm ± 5%, 1/2 W resistor.
1	100 ohm ± 5%, 1/2 W resistor.

TABLE 3 TEST EQUIPMENT REQUIREMENTS (DEPTH 3C)

Sect/Reference NATO No	Nomenclature	Qty
5QP/6625-99-6209571	Multimeter No 1 Mk 2	1
or		
5QP/6625-99-1057049	Multimeter Set (CT498A)	1
10S/6625-99-1048464	Leak Locator (CT105)	1
6C/6685-99-6507758	Leak Detector Set (LD172/30)	1
or		
6C/6625-99-6348599	Leak Indicator (LD172)	1
or		
10S/6625-99-1048463	Leak Indicator Kit (CT106)	1
5QP/6625-99-4350451	Voltmeter (0-150V AC)	1
10S/6625-99-6575085	Universal Timer Counter (Racal Dana 9904 Opt 04A)	1
or		
10S/6625-99-9723958	Counter Electronic Digital (HP5245L)	1
or		
110AF/6625-99-1966472	Counter Electronic Frequency (HP5246L)	1
110S/6625-00-9418474	Converter Frequency (HP5254C)	1
or		
110D/6625-00-0701490	Converter Frequency (HP5254B)	1
10ZZ/211950	ATC DME Test Set) comprising	1
or	) items (1) to	
110S/6625-99-1960356	ATC DME Test Set) (10)	1
(1) Not required	Cabinet Electronic Racking	1
(2) 10AF/6625-99-1966472	Counter Electronic Frequency HP5246L	1
(3) 110S/6625-99-1966473	Generator Signal HP8614A	1
(4) 110D/6625-99-1966474	Modulator Signal Generator HP8403A	1
(5) 10T/6625-99-1966475	Wave Meter HP8905A	1
(6) 110S/6625-99-1966476	Calibrator Electrical Power HP8900B	1
(7) 110S/6625-99-1966477	Monitor Isolator HP13505A	1
(8a) 110S/6625-00-9418474	Converter Frequency HP5254C	1
or		
(8b) 110D/6625-00-0701490	Converter Frequency HP5254B	1

TABLE 3 TEST EQUIPMENT REQUIREMENTS (continued)

Sect/Reference NATO No	Nomenclature	Qty
(9) 10S/5895-99-10795768	Generator Pulse	1
(10) 10K/5841-99-6531933	Generator Pulse (Cossor) (ARI 23134 only)	1
10S/6625-99-7485980	Oscilloscope Set (Philips PM3217)	1
or 10S/6625-99-1949182	Oscilloscope Set (HP180A/C66)	1
or 110S/6625-00-1356977	Oscilloscope (MF) (HP180C)	1
10D/6625-99-1949185 (Plug-in	Time Base Unit (HP1821A)	1
10U/6625-99-1949184 (Units for (HP 180C	Vertical Amplifier (HP1801A)	1
Not Required	Test Set Control Unit 30 MU manufacture	1
10D/5895-99-1079562	Test Rack RF Sub-Assembly, comprising items (1) to (15)	1
(1) 10S/6625-99-1949182	Oscilloscope HP180A/C66	1
(2)	Crystal Set Microwave	1
(3) 10T/6625-99-1966475	Standing Wavemeter HP8905A	1
(4) 110S/6625-00-8723215	Signal Generator HP8614A	1
(5)	Strip Line Modulator	1
(6)	RF Monitoring Unit, comprising items (a) to (d)	1
(a) 110T/6625-00-9666728	Frequency Meter 536A	1
(b) 10S/6625-99-5198443	Wattmeter Absorption HP431C	1
(c) 110AJ/6625-00-8861955	Thermistor Mount HP478A	1
(d)	Crystal Calibrator	1
(7)	Control Unit, comprising items (a) to (j)	1
(a) /5985-00-8378664	Directional Coupler HP776D	1
(b) /5950-00-8116466	Crystal Detector HP420B	2
(c) 110B/ 9136848	Attenuator Fixed AB-10N	1
(d)	Hybrid H240	1
(e)	Co-axial Directional Coupler 782-30 (S-AGE)	2
(f) 10ZZ/206567	Directional Coupler Temline 752-3 (S-AGE)	2
(g)	50 ohm Co-axial Termination 9200 (S-AGE)	2
(h)	Attenuator 20 dB Weinschel 10-20	1

TABLE 3 TEST EQUIPMENT REQUIREMENTS (continued)

Sect/Reference NATO No	Nomenclature	Qty
(i) 10B/5905-99-2234026	Attenuator 10 dB 6531-3	1
(j)	Crystal Detector Sanders OD-PM	2
(8)	PRF Generator	1
(9)	Metering and Heater Variac Unit	1
(10)	EHT Power Unit	1
(11)	Regulated Power Supply APT M4504	1
(12)	Meter Lamps Panel	1
(13)	Power Distribution Panel	1
(14)	Power Unit	1
(15)	Fan Units	2
10S/5895-99-1079563	Test Set Oscillator, comprising items (1) to (7)	1
(1) 110T/6625-00-9666728	Frequency Meter HP536A	1
(2) 10S/6625-99-5198443	Wattmeter Absorption HP431C	1
(3) 110AJ/6625-00-8861955	Thermistor Mount HP478A	1
(4) 110D/6625-00-6009901	Crystal Detector HP420A	1
(5)	RF Oscillator Test Set	1
(6)	Band-pass Filter 1030 MHz (Cossor Type 644 (G31/1)	1
(7)	Band-pass Filter 1090 MHz (Cossor Type 645 (G31/2)	1
10S/5895-99-1079561	Test Rack IF, comprising items (1) to (13)	1
(1) 10S/6625-99-1029761	Display Oscilloscope Airmec Type 279 (Obsolete)	1
(2)	Switching Unit (Cossor Type TC4170/1	1
(3)	Counter Control Unit (Cossor Type TC4170/2)	1
(4)	Control Monitor Unit (Cossor Type TC4170/5)	1
(5)	Panel Amplifier IF (Cossor Type TC021-C5)	1
(6)	Test Jig Type 80104/1	1
(7)	Power Supply Unit (Cossor Type TC4170/7)	1
(8)	Generator Sweep (Type SM2000 (Modified)	1
(9)	Generator Sweep, Plug-in Head (Type L6-M (Modified)	1
(10)	Attenuator RF 0-50 dB (Switchable) (Type TA50)	1
(11)	Marker Generator (Cossor Type TC4172/2	1
(12)	Marker Generator (Cossor Type TC4172/3	1
(13)	Marker Generator (Cossor Type TC4172/4	1

TABLE 3 TEST EQUIPMENT REQUIREMENTS (continued)

Sect/Reference NATO No	Nomenclature	Qty
10S/5895-99-1079564	Panel Oscillator Test Set, comprising (1) to (36)	1
(1) 10S/6625-99-1949182	Oscilloscope Set HP180A/066	1
(2) 110S/6625-00-0132630	Voltmeter Digital HP3440A (Obsolete)	1
(3)	Power Supplies, Control Panel (Cossor Type TC003M6/1)	1
(4)	Generator PRF (Cossor Type 701)	3
(5)	Timing Unit (Cossor Type 702)	11
(6)	Generator, Positive Pulse (Cossor Type 703)	5
(7)	Generator, Negative Pulse (Cossor Type 704)	3
(8)	Generator, Positive Pulse (Cossor Type 705)	2
(9)	Binary Unit (Cossor Type 706)	1
(10)	Power Unit (Gresham Lion Type GX 30/2/24V)	1
(11)	Power Unit (Gresham Lion Type GX 60/2/45V)	1
(12)	Power Unit (Gresham Lion Type GX 60/1/36V)	1
(13)	Power Unit (Gresham Lion Type GX 60/1/44V)	1
(14)	Power Unit (Gresham Lion Type GX 30/2/20V)	2
(15)	Power Unit (Gresham Lion Type GX 30/1/22V)	1
(16)	Power Unit (Gresham Lion Type GX 30/1/24V)	1
(17)	Power Unit (Gresham Lion Type GX 60/1/35V)	2
(18)	Power Unit (Gresham Lion Type GX 15/1/10V)	1
(19)	Power Unit (Gresham Lion Type GX 30/1/28V)	1
(20)	Board 1 Test Panel (Cossor Type TC005M6)	1
(21)	Board 2 Test Panel (Cossor Type TC006M6)	1
(22)	Board 4 Test Panel (Cossor Type TC008MS)	1
(23)	Board 5 Test Panel (Cossor Type TC009M6)	1
(24)	Board 6 Test Panel (Cossor Type TC010M6	1

TABLE 3 TEST EQUIPMENT REQUIREMENTS (continued)

Sect/Reference NATO No	Nomenclature	Qty
(25)	Board 7 Test Panel (Cossor Type TC011M6)	1
(26)	Board 8 Test Panel (Cossor Type TC012M6)	1
(27)	Board 9 Test Panel (Cossor Type TC013M6)	1
(28)	Board 10 Test Panel (Cossor Type TC014M6)	1
(29)	Board 11 Test Panel (Cossor Type TC015M6)	1
(30)	Board 12 Test Panel (Cossor Type TC016M6)	1
(31)	Board 13 Test Panel (Cossor Type TC017M6)	1
(32)	Board 14 Test Panel (Cossor Type TC018M6)	1
(33)	Board 15 Test Panel (Cossor Type TC019M6)	1
(34)	High Voltage Supply Test Panel (Cossor Type TC046M6)	1
(35)	Low Voltage Supply Test Panel (Cossor Type TC045M6)	1
(36) /5841-99-6536682	Panel Test Cossor 805383 (ARI 23134 only)	1
10D/5895-99-1079851	Simulator Unit (RR/C/283556)	1
10S/5895-99-1079850	Bench Interconnecting Unit	1
Not Required	Amplifier Panel(30MU Manufacture)	1
10ZZ/209194	HVPS Test Jig 805764	1
5P/6130-99-6428102	Power Supply Farnell LT30-1	1
10HS/5841-99-1079852	Cable Assembly (ARI 23187 only) Pt No RR/B285184	1
10HS/5895-99-1950449	Cable Assembly Pt No. KSK11956	1
4GD/1660-99-2055387	Low Pressure Nitrogen Walk Round Kit	1
5A/7290-99-9723881	Drier Electric Hand	1
5A/6125-99-4345664	Adaptor Nozzle (used with previous item)	1
6B/6645-99-5213169	Stopwatch	1

TABLE 3 TEST EQUIPMENT REQUIREMENTS (continued)

Sect/Reference NATO No	Nomenclature	Qty
10AG/5895-99-1077472	Withdrawal Tool (Component Board) Cossor KSK 11940	1
10AD/6625-99-0010827	Adaptor (Test) Cossor KSK 12611	1
10AD/5895-99-1077065	Adaptor (Test) Cossor KSK 11953	1
4XA/6650-99-2062620	Magnifier Illuminated	1
1B/3439-99-1278853	Soldering Iron Electric Weller TCP-1	1
1H/5120-99-9721495	Inserter Electric Plug to Socket Contact	1
1H/5120-99-9721492	Extractor Electric Plug to Socket Contact	1
1M/5120-99-2237678	Terminal Hand Crimping Tool	1
1B/3439-99-1278855	Tip Electrical Soldering Iron Weller PT-CC8	1
1H/5120-99-1241005	Insertion Tool Contact Electrical CIT 20	1
1H/5120-00-9870785	Extractor Tool	1
1B/3439-99-1278854	Tip Electrical Soldering Iron Weller PTCC7	1
1B/3439-99-1278865	Holder Soldering Iron Weller BH2 (S)	1
10AG/5120-99-1199481	Tool Contact (Cossor Pt No B51441/13)	1
10AG/5120-99-1199482	Tool Contact (Cossor Pt No B51441/12)	1
10L/5895-99-9563379	Control Transponder Set Type 1503 Pt No D/GA 81450	1
10L/5841-99-1072276	Control Transponder Set Type 1601/6 - Pt No D/GA 86919/6	1
10D/5841-99-1071455	Transponder - Pt No SSR1600/2	1

Voltage checks

3. The measurements called for in this section are checks of supply voltages and should be made before functional tests are commenced. The transponder and control unit should be connected with both ac and dc supplies adjusted to their normal values. The function switch on the control unit should be set to ST'BY, the code selector switch to 0000, and the transfer switch, if fitted, to No.1.

A Low Voltage Power Unit.

(a) 4J1 : between +21.6 and +25.2 V dc
(b) 4J2 : between -21.6 and -25.2 V dc

(c) 4J3 : between +9.0 and +10.5V d.c.

(d) 4J4 : between -9.0 and -10.5V d.c.

(e) 4J5 : between +95 and 105V d.c.

(f) 4Y33 and 4Y34 : between 5.7 and 5.9V r.m.s.

(g) 4Y24 and 4Y25 : between 5.7 and 5.9V r.m.s.

B. High Voltage Power Unit

Using the test meter, measure the potential between 3Y5 and chassis. A reading in excess of 1.5kV should be obtained.

4. Receiver and Decoder Preliminary Checks

(1) Set the function switch on the control unit to OFF and connect the control unit, transponder under test, Transponder Test Set and DME/ATC Test Set, power supplies and oscilloscope as shown in Fig. 2. Set the test equipment as listed below:-

T1	INTERROGATION:	2nd INT DELAY	-	OFF
	SIDELOBE SUPPRESSOR:	AMPLITUDE	-	OFF
	SYNC		-	FIXED
	No.2 INT PULSE		-	ON

The positions of the other controls on this unit are unimportant at this stage.

T3 Set dial to 1Gc/s, tuning for peak on indicator.

T4	SAMPLE RATE	fully anti-clockwise
	Input Switch	PLUG-IN
	TIME BASE	1mS
	FUNCTION	FREQUENCY

T5 Depress LINE RF ALC and AM buttons. Set FREQUENCY to 1030Mc/s as shown in the associated window.
Adjust Δ F for fine control so that counter (T4) reads 30000Kc/s.
Set SQUARE WAVE control fully anti-clockwise.

T6 Depress LINE and ATC buttons.
Set SLS LEVEL to 0.

T7 Set FUNCTION switch to NORMAL.

Switch on the test equipment as listed below:-

T1	ON
Main switch in upper bezel of T2	
T5	LINE
T6	LINE
T7	Depress Line Indicator Lamp
T8	Set switch to MON.CAL.
T9	ON

Check that pilot lamps, where fitted, are glowing.

(2) Set the Control Unit function switch and the MODE switch on T1 to A, the Code Selector switches to 0000 and the Transfer switch, if fitted, to No.1. Check that the frequency is 1030 Mc/s (T4 reads 30000Kc/s). Set RATE on T1 to 500c/s. On the Transponder Set 7RV1, 7RV2, 7RV3 and 7RV4 fully clockwise.

Connect the oscilloscope to 7J1 and vary the input level by adjusting the attenuator on T5 until the observed pulse amplitudes are 1 Volt. The noise level should not exceed 0.4V ptp, and can be adjusted by means of RV1 on the I.F. Amplifier (para.15A(2), page 31).

A. Mode A

Connect the oscilloscope to 8J1. The amplitudes of the observed pulses must be 8.0 ± 1V.

B. Mode B

Set the function switch and the mode switch on T1 to B. The amplitude of the observed pulses must be 8.0 ± 1V.

C. Mode C

Set the Altitude Reporting switch if fitted to ON; set T1 Mode switch to C and connect the oscilloscope to 8J2.

The amplitude of the observed pulse must be 8.0 ± 1V.

D. Set the Airframe Ident switch, if fitted, to ON. Set function switch and T1 mode switch to D, and connect the oscilloscope to 8J3. The amplitude of the observed pulse must be 8.0 ± 1V.

E. Receiver Characteristics

Set T1 mode switch and function switch to A. Check that T1 Rate Switch is set to 500c/s. and that T4 indicates 30,000Kc/s. Set T5 attenuator to -80dBm.

Connect the oscilloscope to 7J1 and note the peak pulse amplitude. Adjust T5 attenuator to -70dBm and again note the peak pulse amplitude. Repeat every 10dBm to -20dBm. The results must lie within the shaded area of the curve of Fig.3.

5. Pulse Levels

(1) Set the function switch to A, the code selectors to 0000 and the transfer switch, if fitted, to 1. Set T1 mode switch to A. Check that frequency is 1030Mc/s and PRF is 500c/s. Connect oscilloscope to 7J1 and adjust T5 attenuator so that the peak pulse is 1.0V.

(2) With the oscilloscope connected to 8J4 increase the level of the input pulse to -25dBm by adjustment of T5 attenuator. Check that the ditch pulse does not extend below the baseline by more than 0.2V. Adjust 7RV1 if necessary to obtain this amplitude.

(3) Set the function switch and T1 mode switch to B. Keep the input level at -25dBm. Check that the ditch pulse does not extend below the baseline by more than 0.2V. Adjust 7RV2 if necessary.

(4) Set the function switch and T1 mode switch to C. Check that the ditch pulse does not extend below the baseline by more than 0.2V. Adjust 7RV3 if necessary.

(5) Set the function switch and T1 mode switch to D. Check that the ditch pulse does not extend below the baseline by more than 0.2V. Adjust 7RV4 if necessary.

2-pulse SLS is no longer used and the relevant circuits in the transponder are disabled

2-pulse SLS is no longer used and the relevant circuits in the transponder are disabled

6. Decoder intermediate checks

Set the function switch and T1 mode switch to B, the code selectors to 0000 and the transfer switch, if fitted, to No.1.

A. Gate pulse generator

(1) Set T5 attenuator to -25dBm and connect the oscillator to 13J3. Check that the mode A/B gate pulse is within the following limits:-

Amplitude	:	7.5 to 9.0V positive
Width	:	27 to 32µs.

(2) Set T1 mode switch to C and connect the oscilloscope to 13J4. Check that mode C gate pulse is within the following limits:-

Amplitude	:	7.5 to 9.0V positive
Width	:	27 to 32µs.

(3) Set function switch and T1 mode switch to D and connect the oscilloscope to 13J5. Check that the mode D gate pulse is within the following limits:-

Amplitude	:	7.5 to 9.0V positive
Width	:	27 to 32µs.

B. Suppression pulse generator

(1) Set T1 mode switch and the function switch to A, and connect the oscilloscope across the load (para. 2G (b)) in SKT.S. Check that the observed pulse is within the following limits:-

Amplitude	:	not less than 20V
Polarity	:	positive
Width	:	27.0 to 32.0µs at 20V level
Rise time	:	not more than 0.5µs
Decay time	:	not more than 1.5µs.

7. Receiver bandwidth and trigger checks

(1) Set the function switch and T1 mode switch to A, the code selectors to 0000, and the transfer switch, if fitted, to No.1. Check that frequency is 1030Mc/s and PRF is set to 500c/s. Reset the counter input switch to 1V and timebase to 1s.

(2) Count the suppression pulses. Set T5 attenuator to give 50% replies (i.e. counter shows 250c/s). The level must be not more than -76dBm. The measured level is MINIMUM TRIGGER LEVEL and should be noted for future reference. Increase the input by 3dB, e.g. if -77dBm increase to -74dBm.

A. Bandwidth

(1) Vary the frequency by means of the control on T5. The bandwidth between the two frequencies (one higher and one lower) at which 50% replies are obtained must be not less than 6.0Mc/s.

(2) Reset the attenuator on T5 to a new value 37dBm higher e.g. if it was -74dBm increase to -37dBm. Again vary the frequency. The bandwidth between the two frequencies at which 50% replies are obtained must be not more than 28Mc/s.

(3) Increase the signal level by a further 20dBm and again vary the frequency. The bandwidth between the two frequencies at which 50% replies are obtained must be not more than 50Mc/s.

B. Image Frequency

Set the frequency to 1150Mc/s as follows:-

Set dial on T3 to 1.1, tuning to a max. reading on the indicator.
Set frequency control on T5 to 1150Mc/s as shown in the window.
Reset the counter input switch to PLUG IN and the timebase to 1mS.
Adjust the Δ F control on T5 so that the counter reads 50,000Kc/s.
Reset the counter input switch to 1V and the timebase to 1s.

By adjustment of T5 attenuator, check that the input signal level at which 50% replies are received (counter reads 250c/s) is greater than 60dBm above minimum trigger level (para. 7.2 above).

C. Trigger Level

(1) Set the function switch and T1 mode switch to B. Reset the frequency to 1030Mc/s. (para. 4 (1) T5). Check that T1 RATE switch is set to 500c/s. By adjustment of T5 attenuator check that the input signal level at which 50% replies are received is -76 ± 1dBm.

(2) Set T1 mode switch to C and check that the level at which 50% replies are received is -76 ± 1dBm.

(3) Set T1 mode switch and the function switch to D and check that the level at which 50% replies are received is -76 ± 1dBm.

D. Video Output

(1) Set T5 attenuator to -74dBm. Connect oscilloscope across the 1K load (para. 2Ga) in the REC VID socket of the transponder (SKTR). The observed waveform must have the following characteristics:-

Amplitude	:	not less than .45V
Polarity	:	positive
Rise time	:	not greater than 0.3µs
Decay time	:	not greater than 0.7µs
Width	:	not less than 0.3µs.

Reset T5 attenuator to -25dBm and check that:-

Amplitude	:	not less than 5V
Width	:	not greater than 1.2µs.

(2) Reset T5 attenuator in steps and note the pulse amplitude for each decrease of 5dBm. The results must all lie within the shaded area of the curve of Fig. 5.

8. Decoder Checks

Set T1 mode switch and the function switch to A, the code selectors to 7777 and the transfer switch, if fitted, to No.1. Check that the frequency is 1030Mc/s and the PRF is set to 500c/s.

A. Mode operation

(1) Connect the oscilloscope to 10J1 and observe that suppression pulses are present. Set T1 mode switch to B, C & D respectively and note that pulses are present only on positions A and C, but not B and D.

(2) Set function switch to B and check that pulses are present on T1 mode switch positions B and C and not A and D.

(3) Set function switch to C and check that pulses are present only on T1 mode switch position C but not A, B and D.

(4) Set function switch to D and check that pulses are present only on T1 mode switch positions C and D but not A and B.

(5) Switch No. 2 INTERROGATION PULSE on T1 to OFF and set T5 attenuator to -20dBm. Set T4 input switch to 1V and TIMEBASE to 1s. Check that the counter registers not more than 5 pulses per second averaged over 30s.

(6) Repeat the operation of para. (5) with the function switch set to C, B and A respectively.

(7) Restore No.2 Interrogation Pulse on T1.

B. Two pulse sidelobe suppression

(1) Set the function switch and T1 mode switch to A. Set T5 attenuator to -70dBm and T6 SLS LEVEL to -1dB. Set T4 input switch to 1V and Timebase to 1s.

(2) Check that at least 95% replies are received (counter reads 475p/s) as the attenuator is adjusted over the range from -70dBm to -25dBm. Adjust 7RV1 to attain this if necessary.

(3) Reset T5 attenuator to -77dBm and SLS LEVEL on T6 to -7dB. Check that suppression pulses are generated not more than 5% (counter reads 25p/s) as the attenuator is adjusted over the range from -77dBm to -25dBm.

(4) Repeat (2) and (3) with the function switch and T1 mode switch set to B. Adjust 7RV2 if necessary.

(5) Repeat (2) and (3) with the function switch and T1 mode switch set to C. Adjust 7RV3 if necessary.

(6) Repeat (2)and (3) with the function switch and T1 mode switch set to D. Adjust 7RV4 if necessary.

C. Mode tolerance

(1) Set the function switch and T1 mode switch to D. Set SLS LEVEL on T6 to 0. Adjust T5 attenuator until the counter reads 50% replies (counter reads 250p/s). By means of the SPACING control on T1 decrease the spacing by 0.2μs. Increase the input level to regain 50% replies. The increase must not exceed 3dB.

(2) Repeat (1) with the spacing increased by 0.2μs.

(3) Set T5 attenuator to -25dBm and adjust the pulse spacing to the points where no replies are obtained. The changes from nominal spacing must not exceed 1μs.

(4) Repeat (1), (2) and (3) on mode C.

(5) Repeat (1), (2) and (3) on mode B.

(6) Repeat (1), (2) and (3) on mode A.

9. Three pulse sidelobe suppression

(1) Turn SLS AMPLITUDE control on T1 to 2 (the exact value is unimportant). Set SLS POSITIION control on T1 so that spacing between 1st and second pulses is 2μs as seen on the oscilloscope connected to 7J1. Adjust the SLS WIDTH control until the second pulse is the same width as the first. Adjust T5 attenuator until the pulse is 1V high. Set the mode switch on T1 and the function switch to B.

(2) Connect the oscilloscope to the following points and check that the observed pulse amplitudes and widths are within the limits stated.

A. Delay circuit

(1) Emitter of 9VT1, Amplitude of P1 1.0 ± 0.2V positive-going
Amplitude of P2 0.8 ± 0.2V positive-going

(2) 9J9 Amplitude of P1 1.5 to 2.1V (positive-going portion)
Amplitude of P2 1.5 to 2.1V (positive-going portion)

B. Pulse stretching circuit

(1) 9J8 Amplitude of P1 0.9 ± 0.1V (positive-going portion)
Amplitude of P2 0.7 ± 0.1V (positive-going portion)
Delay of P1 w.r.t. P1 at 7J1 3.2 ± 0.1μs

(2) Emitter of 9VT6, Amplitude of P1 0.6 ± 0.1V (positive-going portion)
Width of P1 2.6 to 3.0μs

(3) Emitter of 9VT7, Set 9RV1 to give P1 0.4 ± 0.05V peak.

C. Comparator

(1) 9J2. The observed waveform must be as Fig. 4 (c), and P2 must be added to the stretched pulse. The amplitude of the positive stretched pulse must be 0.5 ± 0.1V.

(2) Set T5 attenuator to -25dBm and adjust 9RV2 until the 'ditch' pulse projects below the baseline by not more than 0.5V. Reset the input level to give 1.0V at 7J1.

(3) Emitter of 9VT10. Amplitude of 2nd pulse 1.0 ± 0.1V (positive-going portion).

D. AND gate

(1) Cathode of 9D6. Amplitude of 1st pulse. 1.0 ± 0.1V (positive-going portion). Delay w.r.t. to P1 pulse at 7J1. 2.0 ± 0.1µs.

(2) 9J3. Positive amplitude 0.8 ± 0.1V.

E. Post gate amplifier

(1) 9J5. Negative amplitude 9 ± 1.0V.

F. Suppression pulse generator

(1) Connect the oscilloscope to 9J6, and adjust 9RV3 until 100% triggering is obtained. The observed pulse must be within the following limits:-

Amplitude	:	not less than 18.0V
Width	:	30 ± 10µs
Rise time	:	not greater than 0.1µs
Decay time	:	not greater than 0.5µs.

(2) Set T5 attenuator to -80dBm and adjust 9RV3 until the observed pulse is appearing for 50% of the display time.

(3) Increase the input level to -25dBm, and check that the delay of the start of the pulse with respect to P1 at 7J1 does not alter (i.e. remains triggered at the P2 position).

(4) Set T5 attenuator to -77dBm and SLS LEVEL on T6 to 0. Check that T4 input switch is at 1V and timebase at 1mS. Check that suppression pulses are not generated for more than 5% of the display time (counter reads 25). Increase the input at T5 attenuator to -25dBm. The condition must hold over the whole range of inputs. Restore T5 attenuator to -75dBm.

(5) Set SLS LEVEL on T6 to -6dB. Check that 95% replies (counter reads 475) are obtained over the range -75 to -25dBm.

(6) Repeat paras. (4) and (5) with the function switch and T1 mode switch set to A.

G. Spacing tolerance

Set T5 attenuator to -77dBm and SLS LEVEL on T6 to 0. Set the function switch and T1 mode switch to B and connect the oscilloscope to 9J6. Adjust the spacing between the first and second pulses by means of T1 POSITION control above 2μs and note the position at which 10% inhibit pulses are counted (counter reads 50p/s). The position must not be outside the limits 2.0 to 2.6μs.

H. Turn T1 SLS AMPLITUDE control to OFF.

10. Decoder auxilliary circuit checks

(1) Set the function switch and T1 mode switch to B.

A. Low sensitivity (if fitted)

Switch to LOW SENS and set 10RV2 fully anti-clockwise. Check that the LOW SENS control (10RV4) can be adjusted to give 50% replies (counter reads 250p/s) with input levels, as set at T5

attenuator, not greater than -37dBm and not less than -72dBm. Set 10RV4 until 50% replies are obtained with T5 attenuator set to -65dBm.
Restore the LOW SENS switch to normal.

B. Group count-down

(1) Set the function switch and T1 mode switch to A, and T5 attenuator to -25dBm. Set T1 RATE control to 500c/s.

(2) Set 10RV1 until 100% replies are just attained (counter reads 500p/s). Set T1 RATE control to 100c/s and check that the reading on the counter does not exceed 550p/s.

(3) Set T1 RATE control to 2000c/s and reset 10RV1 until 100% replies are just obtained (counter reads 2000p/s). Set T1 RATE control to 4000c/s and check that the reading on the counter does not exceed 2400p/s.

(4) Set T1 RATE control to 1450c/s and adjust 10RV1 until 100% replies (counter reads 1450p/s) are just obtained.

C. Sidelobe suppression rate limiter

(1) Connect the oscilloscope to 7J1. Set SLS AMPLITUDE to 2 (exact value is unimportant), and adjust the second pulse by means of SLS POSITION control on T1 to 2μs after the first pulse. Set T1 RATE control to 2000c/s. Set T5 attenuator to -25dBm and the SLS LEVEL control on T6 to 0.

(2) Set the function switch and T1 mode switch to A. Connect the counter to 9J6, by removing the plug from the transponder SUPPN socket and contriving a suitable connection to the jack. Adjust 10RV2 until 50% replies

are obtained (counter reads 1000p/s). Set RATE control on T1 to 3500c/s and readjust 10RV2 until 50% replies are again obtained (counter reads 1750p/s).

(3) Set RATE control on T1 to 3000c/s and adjust 10RV2 to give just 100% replies.

(4) Turn SLS AMPLITUDE control on T1 to OFF and reset RATE control on T1 to 500c/s.

11. Transmitter and encoder checks

(1) Set the code selectors to 0000 and the transformer switch, if fitted, to No. 1. Set the function switch and T1 mode switch to B. Reconnect the counter to SKTS on the transponder.
Adjust T5 attenuator to give 100% replies (counter reads 500p/s).

A. Modulator

(1) Connect the oscilloscope to 2VT6 collector. The amplitudes of the two pulses must be within the range 61 to 75V.

(2) Adjust 14RV2 until the width of each pulse is 0.45 ± .05μs.

B. Transmitter frequency

(1) Check the frequency of the transmitter by tuning the FREQUENCY control on T9 for a peak on the meter. Read the frequency on the dial and apply any known corrections. The frequency should be 1090Mc/s. If necessary tune the transmitter cavity as described in Section 6, para.16E.

C. <u>R.F. pulse shape and spacing</u>

(1) Connect the oscilloscope to the MONITOR: XMTR socket of T7 and set the switch to NORMAL. Set the code selectors to 7777 and observe the presence of 14 pulses. Set the width of the last pulse to 0.45μs by adjustment of 14RV2.

(2) Each of the 14 pulses must fall within the following limits:-

Width	:	0.35μs min., 0.55μs max.
Rise time	:	0.1μs max.
Decay time	:	0.2μs max.

(3) With the second channel of the oscilloscope connected to the MARKER socket on T1 and the SPACING switch set to 1.45μs, check the spacing between the leading edges of the first and last pulses is 20.3μs (14 x 1.45μs). Correct if necessary by adjustment of 14C2.

(4) Depress and release the IDENT button and check that the I.P. appears 4.35μs after the last framing pulse.

D. <u>Transponder delay and jitter</u>

(1) Set the function switch to OFF and connect a shorting link across 10R9 to disable the GCD circuits. Set T1 RATE control to 2000c/s and T5 attenuator to -25dBm.

(2) Set the function switch and mode switch on T1 to B. Measure the delay between the leading edge of the 2nd interrogation pulse observed at 7J1 and the leading edge of the F1 pulse observed at the MONITOR: XMTR socket on T7. The delay must lie between the limits 2.5 and 3.5μs. The jitter on the delay must be not greater than 0.1μS. Set the function switch to OFF and remove the link across 10R9.

E. Coding check

(1) Set the function switch to B, set T1 RATE control to 500c/s and the code selectors to 0000. Observe the output on the MONITOR: XMTR socket on T7 and check that only F1 and F2 pulses are present.

(2) Set the code selectors to the positions shown below and observe pulses at the corresponding intervals.

Code Selector	Pulses at interval after F1 (microseconds)					
1000	2.9					
2000		5.8				
3000	2.9	5.8				
4000			8.7			
5000	2.9		8.7			
6000		5.8	8.7			
7000	2.9	5.8	8.7			
0100				11.6		
0200					14.5	
0300				11.6	14.5	
0400						17.4
0500				11.6		17.4
0600					14.5	17.4
0700				11.6	14.5	17.4
0010	1.45					
0020		4.35				
0030	1.45	4.35				
0040			7.25			
0050	1.45		7.25			
0060		4.35	7.25			
0070	1.45	4.35	7.25			

Code Selector	Pulses at interval after F1 (microseconds)		
0001	13.05		
0002		15.5	
0003	13.05	15.5	
0004			18.85
0005	13.05		18.85
0006		15.5	18.85
0007	13.05	15.5	18.85

F. <u>IDENT pulse selector</u>

(1) Press and release the IDENT button. The IP must be a single pulse, 4.35µs after F2. Switch the code selectors to 7777, and set 14RV1 fully clockwise. Check that the IP remains present for not less than 40 seconds after the button is pressed once more.

(2) Set 14RV1 fully anti-clockwise, and check that the IP remains present for not more than 6 seconds after the IDENT button is pressed. Set 14RV1 to give a display time of 20 secs. after button is pressed.

G. <u>Mode C selectors</u>

(1) Set the function switch and T1 mode switch to C and the code selectors to 0000. The output at MONITOR: XMTR on T7 must consist of two framing pulses (F1 and F2) having the following limits:-

Width	:	0.35 to 0.55µs
Spacing	:	20.3 ± 0.05µs

(2) Using the mode C code selector simulator unit, set the control switch (SB) to NORMAL, and the code selector to the following positions and check the presence of the indicated pulses.

C switch pos.	Output pulse spacing from F1 in μs)
1	1.45
2	2.9
3	4.35
4	5.8
5	7.25
6	8.7
7	11.6
8	13.05
9	14.5
10	15.95
11	17.4
12	18.85 and 24.65

(3) Set the control switch to +2V and repeat para. (2).

(4) Set the control switch to 1.5k and repeat para. (2).

(5) Set the control switch to OFF .

H. Mode D selectors

(1) Set the function switch to OFF. On unit 13 move link A from the A/B code position to D position. This enables the mode D interrogation to open the mode D code selector gate instead of the mode A/B gate. Set the function switch and T1 mode switch to D. Set the code selectors to 0000. Check that the output consists of only two framing pulses. (F1 and F2).

(2) Insert the cannon plug (para. 2 (R)) with pins B, C, D, E, F, H, J, P, R, S, T, U, and W linked together, into SKT.H. Connect the linked pins to chassis and check that the output consists of 15 pulses.

(3) Set the function switch to OFF, remove the cannon plug, and return link A on unit 13 to the A/B position. Set the function switch to D, and check that the output consists of only two framing pulses.

(4) Set the code selectors to 7777 and check that all fourteen pulses are present. Also check that the IP appears 4.35μs after F2 when the IDENT button is pressed.

I. <u>RF output power</u>

(1) Set the function switch to OFF, the code selectors to 7777, T1 RATE control to 1450c/s and connect a shorting link across 10R9. Set the function switch to D and using the power meter T8 measure the output power by the following procedure:-

Connect the oscilloscope to VIDEO OUT on T8. Adjust the NULL control on T8 until the two baselines coincide. Switch to MEASURE on T8. Adjust the FINE and COARSE controls on T8 until the upper trace coincides with the modulation peaks of the lower trace.
Read the output power on T8 and switch back to MONITOR CAL.

The output power must be not less than 700W.

(2) Observe the amplitudes of the 14 pulses at the MONITOR: XMTR socket on T7. The smallest pulse must be not less than 0.95 of the largest.

(3) Set the function switch to ST'BY. No output must be obtained from the transponder.

J. <u>Over-interrogation</u>

(1) Set the function switch and T1 mode switch to A.
Set the code selectors to 7777.

Set T5 attenuator to 6dB above minimum trigger level, and T1 RATE control to 2300c/s. Check that T4 input switch is set to 1V and timebase to 1sec.

(2) Adjust 10RV3 until 100% replies (counter reads 2300p/s) are just attained. Set the function switch to OFF and remove the shorting link across 10R9.

K. Suppression pulse position

(1) Set T1 RATE control to 1000c/s, the function switch to A and connect the 300 ohm load (para. 2Gb) at SKT.S. Connect the oscilloscope across the load and measure the time delay between the 20V point of the leading edge of the suppression pulse, and the 10% amplitude point on the F1 pulse as observed at the MONITOR: XMTR socket on T7. The 10% point must not occur earlier than the 20V point. Disconnect both channels of the oscilloscope.

L. Audio output

(1) Connect the 500 ohm load (para. 2G (c)) between PLG35 and chassis or PLG32, and connect the oscilloscope to 10J5. Set 10RV5 to give maximum amplitude of the displayed waveform.

(2) Measure the output power by the following method:-

Measure the mark/space ratio (R1)
Measure the peak voltage of the waveform (V1)
Then the output power $P1 = R1 \times V1^2 \times 2$ mW.
This value must be not less than 100mW.

(3) Remove the 500 ohm load and replace it by the 100 ohm (para. 2G (d)). Measure the mark/space ratio R2 and the peak voltage V2.

Then the output power $P2 = V2^2 \times 2$ mW
This value must be not less than 50mW.

(4) Adjust 10RV5 to the required level of output power.

M. <u>Auxiliary trigger</u>

(1) Set the function switch to C. Set T5 attenuator to -100dBm. Connect the pulse generator (para. 2.0) to transponder SKT.T (TRANS.TRIG). Set the pulse generator to provide two pulses as follows:-

Amplitude	:	not less than 17V positive-going
Width	:	1.0μs max.
Spacing	:	1.45μs
P.R.F.	:	500c/s

(2) The RF output power, measured as described in para. 11 I (1), and shape as observed on the oscilloscope connected to the MONITOR:XMTR socket on T7 must meet the following requirements:-

Peak Power	:	not less than 700W
Width	:	0.35 to 0.55μs
Rise time	:	0.1μs max.
Decay time	:	0.2μs max.

(3) Check that the delay time between the 50% amplitude point on the leading edge of the input video pulse, and a similar point on the output pulse is 0.4 ± 0.2μs.

(4) Set the function switch to ST'BY and check that no output is obtained from the transponder. Remove the connections from SKT.T.

N. Initial desensitize delay

(1) Set the function switch to OFF. Check and if necessary reset the frequency to 1030Mc/s (para. 4 (1)). Set T1 RATE control to 500c/s and mode switch to A. Set T5 attenuator to -30dBm. Set the code selector to 7777. Connect the oscilloscope to the MONITOR: XMTR socket on T7.

(2) Set the function switch to A. The 14 demodulated pulses must appear not sooner than 60 seconds after switching on.

12. Self test circuits

A. Setting-up

(1) Set the function switch and T1 mode switch to A, the code selectors to 0000 and the transfer switch, if fitted, to No.1.
Check that the frequency is 1030Mc/s (para.4 (1)).
Set T1 RATE control to 500c/s.
Set input level at T5 attenuator to 6dB above minimum trigger level (para. 7 (2)).

(2) Connect the oscilloscope to 7J1 and measure the amplitude of the pulses. Note the value.

(3) Set T5 attenuator to -100dBm.
Press the SELF TEST button, either on the transponder or on the control unit. Adjust 2VC1 in the Self Test local oscillator to give the same amplitude of video pulse as was measured in para. (2).

(4) Set the function switch to OFF and disconnect the EHT disable link. Connect a variable voltage 400c/s supply to 3Y1 and 3Y2.

Set T5 attenuator to obtain 100% replies.

(5) Switch the code selector to 0000 and function switch to A. Adjust the variable 400 Hz supply mentioned in para.(4) until the output power is 250W (as measured in para.11.1(1)). Set the pulse width to 0.45μs by means of 14RV2 (as measured in para.11.C (1)).

(6) Connect the oscilloscope to 10J5, and adjust 13RV1 until the audio multivibrator is just triggered as shown by the displayed waveform.

(7) Set the function switch to OFF, disconnect the variable supply, and reconnect the EHT DISABLE link.

(8) Set the function switch to A, and check that the audio monostable is now triggered, as shown by the displayed waveform at 10J5. Also check that the visual monitor lamp is lit.

B. Self test operation check

(1) Check that the LO-SENS switch is switched off, and that for a single installation the Transfer Switch is set at 1. If the check is being carried out without the aid of the specified test gear, ensure that a suitable 50 ohm load is connected to the aerial socket.

(2) Set the function switch and T1 mode switch to A. Set T5 attenuator to -100dBm. Allow the visual monitor lamp to go out.

(3) Wait 90 secs then depress and release the SELF TEST button and observe that the visual monitor lamp lights. Check that the lamp goes out again after not less than 10 seconds.

(4) Set the function switch and T1 mode switch to B. Repeat para.(3).

13. Power consumption

(1) Set the function switch and T1 mode switch to B. Set the code selectors to 7777 and the transfer switch, if fitted, to No.1. Check that the frequency is 1030MHz and that T1 RATE control is set to 500 Hz. Set T4 input switch to 1V and timebase to 1s. Adjust T5 attenuator until just 100% replies are received (counter reads 500p/s).

(2) Check that the AC supply is 115V r.m.s. 400 Hz. The supply current must not exceed 500mA.

(3) ◀ Set T1 RATE control to 100▶. The supply current must not exceed 500mA.

(4) Set the function switch to OFF and disconnect the test equipment.

14. Test procedure modifications for S.S.R. 1600/2

A. Voltage checks (Sub-section 3).

No modifications are necessary to the test points or the voltage limits permissible, but the 115V a.c. supply should be switched off and the rail voltages rechecked using the DC input only, over a range of voltages from 22 to 31V.

B. Disabling the e.h.t.

◄ To disable the e.h.t. on transponder 1600/2, unsolder the wires connected to terminals s and r on 4T2.

C. Self-test circuit setting-up procedure (12A (4))

Paragraph 12A (4) should be amended to read as follows:
(4) Set the function switch to OFF, and disconnect the e.h.t. Connect a variable voltage e.h.t. supply to 3Y11 and 3Y7 (negative).►

15. I.F. Amplifier alignment

A. Alignment preparation

(1) Remove the chassis lower dust cover from the I.F. amplifier, disconnect and remove capacitors C46 and C47 (Fig.7).

(2) Set RV1 13 turns from fully anti-clockwise. This position normally provides an acceptable noise level but may be modified slightly if necessary to attain the value of 0.4V ptp (para.4(2), page 6).

(3) Connect termination pins B to C, E to F with short wire links.

(4) Connect the power supplies and test equipment to the I.F. amplifier (Fig.8b). Ensure that the supply polarity and potential are correct.

B. Alignment procedure

(1) Set the Signal Generator to produce a carrier frequency of 61 MHz modulated by a square wave of 400 Hz. Adjust the attenuators to provide a display on the oscilloscope of 1V P/P.

(2) Adjust transformer cores L6, 7, 8 and 9 for maximum amplitude of displayed output, attenuate the signal generator output to maintain a displayed waveform of 1V amplitude.

(3) Disconnect the power supplies and test equipment, remove the links B to C, E to F and connect G to H, I to J.

(4) Re-connect power supplies and test equipment and adjust transformer cores L2, 3, 4 and 5 for maximum displayed output for a signal input of 58.0 MHz. Adjust attenuators to set the amplitude of displayed waveform to 1V.

(5) Disconnect power supplies and test equipment, remove links G to H, I to J. Re-connect C46 and C47 and replace chassis lower dust cover.

(6) Re-connect power supplies and test equipment. Set signal generator to 60 MHz adjusting the attenuators to provide a displayed waveform of 1V P/P amplitude. Note the attenuator reading and increase the output 3dB. Detune the signal generator until the displayed waveform is 1V in amplitude, note the frequency (f1) and re-tune to 60 MHz, checking amplitude of displayed waveform at this frequency. Continue tuning past 60 MHz and note frequency (f2) when the displayed waveform falls to 1V P/P. The difference between f1 and f2 should be at least 7 MHz. The centre frequency should lie between 59 and 61 MHz.

16. Alignment Procedure for Local and Self-test Oscillators

(1) These units cannot be aligned satisfactorily without taking into account the effects of units connected to them. For this reason, the alignment equipment includes some of the other units that comprise the R.F. Head.

A. Voltage checks

(1) Remove the cores from 2L1 and 2L5 and connect the test set to the local oscillator, self-test oscillator and I.F. amplifier points indicated in Fig.10. Disconnect SKT5/PL5 and SKT4/PL4 and the leads connected to 2Y24, 25, 26, 31 and 32, and 5Y27, 28 and 30.

(2) Switch on the power supplies at the test set and allow a 10 mins 'warm-up' period. Check that the voltage between the emitter of 2VT1 and chassis is within the range 0.81 to 0.91V positive.

(3) Check that the voltage between the junction of 2R3 and 2L1, and chassis is within the range 8.5 to 9.65V positive.

(4) Check that the voltage between the junction of 2R7 and 2R30, and chassis, is within the range 8.5 to 9.5V negative.

(5) Check that the voltage between the emitter of 2VT3 and chassis is within the range 8.2 to 9.0V negative.

(6) Check that the voltage between the junction of 2R21 and 2R22 and chassis, is within the range 6.0 to 7.5V negative.

(7) Check that the voltage between the junction of 2R28 and 2R29, and chassis, is within the range 12.05 to 13.35V negative.

(8) Switch off the power supplies.

B. Alignment

(1) Replace the cores of 2L1 and 2L5, and set the cores of 2L1, 2L2, 2L3, 2L5, and 2L7 to their approximate mid-positions. Set the core of 2L4 and the potentiometer 2VC1, fully anti-clockwise.

(2) Switch on the power supplies, and with the meter (para. 16 A (2)) on the 25V d.c. range connected between the junction of 2R3 and 2L1, and chassis, tune 2L1 for maximum indication on the meter.

(3) Remove the meter, and connect the test set lead terminated in a BNC socket to SKT.4, on the cavity filter. Switch to READ to monitor the crystal current.

Note: If at any time throughout the procedure detailed in paras. (4) to (7) inclusive, the indication on the crystal current meter reaches 1mA, then the core of 2L4 must be adjusted so that the indication falls to 0.9mA.

(4) Adjust screw number 5 on the cavity filter, and the core of 2L3 for maximum indication on the meter.

(5) Adjust the core of 2L2 for maximum indication on the meter.

(6) Re-adjust the core of 2L1 for maximum indication on the meter.

(7) Re-adjust screw 5, 2L3, and 2L2, for maximum indication on the meter.

(8) Adjust the core of 2L4 so that the indication on the meter is 0.9mA.

(9) Set the switch from READ to OFF, and disconnect the BNC connector.

(10) Connect SKT5/PL5, SKT4/PL4, and the 50 ohm load to SKT1, via the coaxial adaptor.

(11) Set the core of 2L5 fully anti-clockwise, and then with the meter connected between the junction of 2R21 and 2R22, and chassis, adjust the core of 2L5 until the meter reading falls to a minimum.

(12) Remove the meter, connect the oscilloscope to 5Y28.

(13) Adjust the cores of 2L5 and 2L7 to obtain maximum amplitude of the waveform displayed on the oscilloscope, adjusting the sensitivity of the oscilloscope to obtain maximum accuracy.

(14) Switch off the power supplies, and disconnect all the test equipment. Re-connect the internal wiring to the appropriate points on the RF unit.

17. Alignment Procedure for Complete RF Head Assembly

(1) This procedure is for use after the IF Amplifier and oscillators have been aligned according to the instructions contained in 7.15 and 7.16.

(2) The RF Head Assembly consists of

(a) Local oscillator
(b) Self-test oscillator
(c) I.F. amplifier
(d) Transmitter oscillator and amplifier cavities
(e) Cavity filter and mixer crystal
(f) Band-pass filter
(g) 'T' junction
(h) Interconnecting leads.

A. Preliminary operations

(1) ◀ Disconnect the lead connect to 5Y28, and disable the e.h.t.▶ Unscrew the four adjusting screws on the cavity filter as far as possible (screw 5 should have been set and locked during oscillator alignment).

(2) Remove the crystal mixer diode, 2D7, and check the noise factor using the microwave crystal test set (para.2, AE). The noise factor is satisfactory if the indication on the test set meter is within the range 21 to 25 divisions. Replace the crystal, but leave PL4 disconnected. Disconnect SKT5/PL5.

(3) Unscrew the self-test pickup probe from the amplifier cavity as far as possible, and connect the 1kΩ resistor between 2Y1 and 2Y5.

B. Cavity filter alignment

(1) Connect the test equipment and the transponder as shown in Fig.11, and set and check the frequency of the signal generator (para.2Q) at 1030MHz with 1kHz squarewave modulation.

Note: Throughout the procedures in paras. (2) to (8) inclusive, ensure that that the indication on the crystal current meter does not rise above 0.9mA, by adjustment of the signal generator output level.

(2) Adjust screws 1, 2 and 3, on the cavity filter as follows:

(a) screw 1 for maximum indication on the standing wave meter.

(b) screw 2 for minimum indication on the standing wave meter.

(c) screw 3 for maximum indication on the standing wave meter.

(3) Set and check the signal generator at 1030Mc/s with no modulation (CW), at a level sufficient to give a reading of 0.65 to 0.75mA on the crystal current meter.

(4) Adjust screw 4 on the cavity filter to give maximum indication on the crystal current meter, reducing the signal generator output level as necessary.

(5) Check the 'set zero' and 'set power level' controls on the signal generator, then set the output level to give a crystal current reading of 0.7mA.

(6) Remove the lead from SKT.1 and reconnect to the power meter (para. 17 A (5)). Check that the indication on the meter is not greater than 0.5mW.

Note: The lengths of the interconnecting leads must not be changed between tests (5), (6), (7), and (8).

(7) Remove the lead from the power meter, and reconnect to SKT.1. Set and check the signal generator at 1025Mc/s C.W., and check the 'set zero' and 'set power level' controls. Check that the indication on the crystal current meter is not less than 0.6mA.

(8) Repeat para. (7) with the signal generator set to 1035Mc/s.

C. Final I.F. amplifier alignment

(1) Disconnect the crystal current meter from SKT.4 and replace PL.4. Connect the oscilloscope to 5Y28 and move the I.F. amplifier away from the RF Head assembly so that 5L1 may be adjusted.

(2) Set the signal generator modulation to give 2μS pulses at 28.5kc/s on 1030Mc/s, and check the carrier frequency.

(3) Set the function switch on the control unit to STANDBY, and increase the signal generator output until pulses are just visible on the oscilloscope when it is set to its most sensitive range. Tune 5L1 to give maximum pulse amplitude.

(4) Vary the signal generator output attenuator over the range -80 to -20dB in 10dB steps, and note the pulse amplitude at each step. Plot the points obtained on a graph of pulse amplitude against attenuator settings.

(5) Verify that the deviations from the best mean straight line drawn between the points on the graph do not exceed 1.5dB in either direction (see Fig.12).

(6) Vary the signal generator frequency over the range 1020 to 1040Mc/s, in 2Mc/s steps, and note the output attenuator settings required to give an observed pulse amplitude of 1V peak at each step.

(7) Plot a graph of attenuator settings against input frequency and from it, verify that the bandwidth at a level 3dB below the peak response is not less than 6Mc/s.

(8) Set the function switch on the control unit to OFF, disconnect the test equipment, and replace the IF amplifier.

D. <u>Transmitter cavity alignment</u>

(1) Connect the test equipment as shown in Fig. 13 (a) and set the function switch on the control unit to STANDBY.

(2) Using the meter, (para. 2 D), check that the voltages between the feed-through capacitors 2C18 and 2C17, 2C15 and 2C14, are within the range 5.7 to 5.9V r.m.s.

(3) Using the oscilloscope, check that the d.c. potential between 2C17 and chassis is within the range 64.5 to 71.5V.

<u>Note</u>: If the measurements taken in (2) and (3) are not satisfactory, on no account proceed with the following tests.

(4) Set the function switch on the control unit to any of the mode positions, and the P.R.F. of the pulse generator (para. 2 K) to 28.5kc/s. Check, using the oscilloscope, that the waveform at 2C15 is as shown in Fig.14 (a). If necessary, adjust potentiometer 14R2 to set the pulse width at approximately 0.45μS.

(5) Connect the variable EHT supply (para. 2 M), to 2Y23, and slowly raise the voltage to 1kV. Check that the waveform at 2C15 is as shown in Fig.14 (b), and using potentiometer 14R2 set the width of the pulse to 0.45 ± 0.1μS.

(6) Connect the second channel of the oscilloscope to the crystal detector (para. 2 AD), and adjust the amplifier cavity tuning screw for maximum amplitude of the displayed pulses, noting that the pulse width at 2C15 remains within the range 0.45 ± 0.1μS.

(7) Switch off the EHT supply, disconnect the oscilloscope, and reconnect the test equipment as shown in Fig.13 (b). Set the EHT voltage to 1kV.

(8) Tune the frequency meter (para. 2 AB) until the power level on the power meter dips, and note the frequency setting at the bottom of the 'dip'. Check that the frequency is the required operating frequency (normally 1090Mc/s).

(9) If the frequency is not that required, make progressive adjustments to the oscillator cavity tuning screw and repeat (6), (7) and (8) until the operating frequency is obtained, with maximum output pulse amplitude.

(10) Slowly raise the EHT voltage to 1.6kV, repeat para. (8) and if necessary para. (9). Retune the frequency meter and note the indication on the power meter. From this reading, calculate the output power in mW, allowing for the losses in the attenuator and cables.

(11) Switch off the EHT supply, and reconnect the test equipment as in Fig. 13 (a). Switch on the EHT supply and note the pulse width as observed on the oscilloscope connected to the crystal detector.

(12) Multiply the value obtained in para. (10) by the factor obtained in para. (11) to obtain the peak output power in watts, and verify that this is not less than 700 watts.

(13) Adjust the self-test pick-up loop in the amplifier cavity to give a pulse amplitude of between 5 and 8V as seen on the oscilloscope connected across the 1kΩ. resistor.

(14) Switch off the EHT, set the function switch on the control unit to OFF, disconnect the test equipment, remove the 1kΩ resistor, and reconnect the lead to 5Y28. Reconnect the EHT DISABLE link.

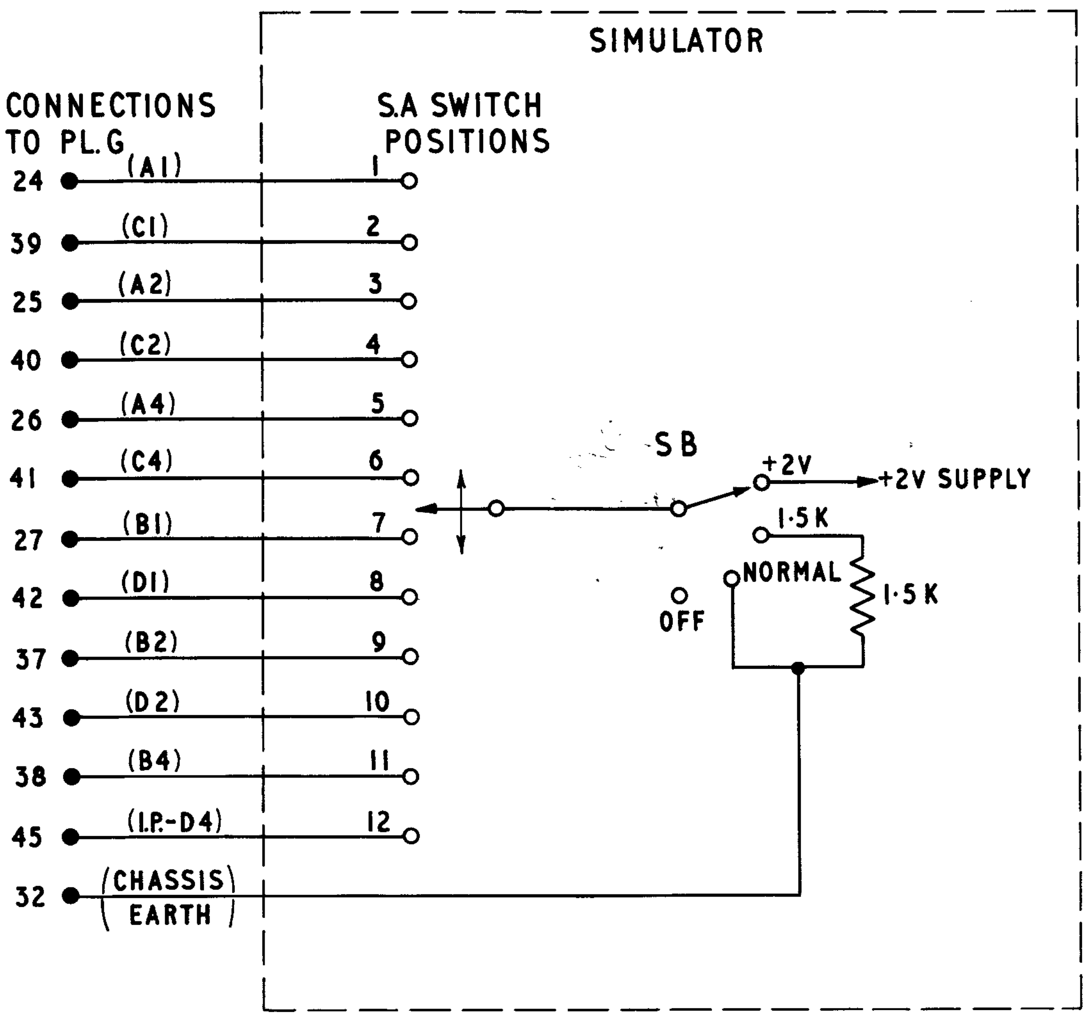
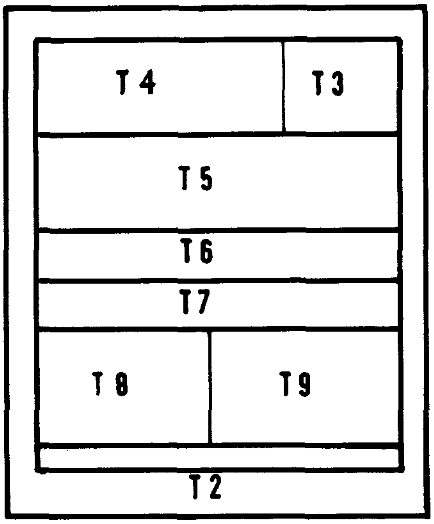
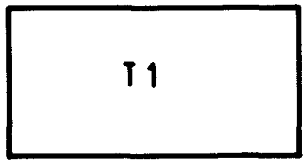


FIGURE 1
MODE 'C' CODE SELECTOR SIMULATOR

FOR DESIGNATIONS OF TEST GEAR SEE PAGE 1





LIST OF INTERCONNECTIONS

T3, INPUT 50Ω—T5 RF POWER OUTPUTS UNCAL.
T5, RF OUTPUTS CAL–T6, RF POWER INPUT
T5, EXTERNAL A. M. INPUT–T6, SLS
T6, R F POWER OUTPUT–T7 SIG.GEN.
T7, WAVEMETER—T9 RF IN
T7, POWER METER–T8 RF IN

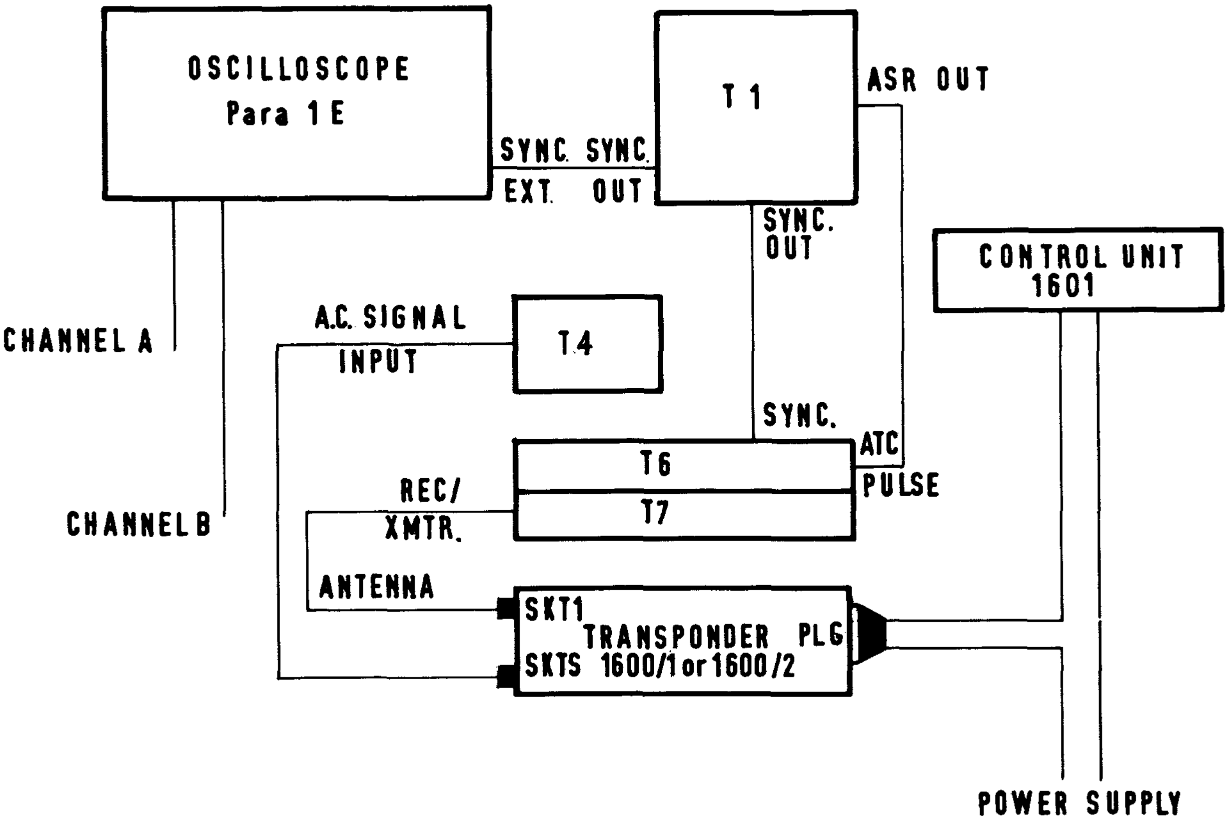


FIGURE: 2

TEST EQUIPMENT: INTERCONNECTIONS

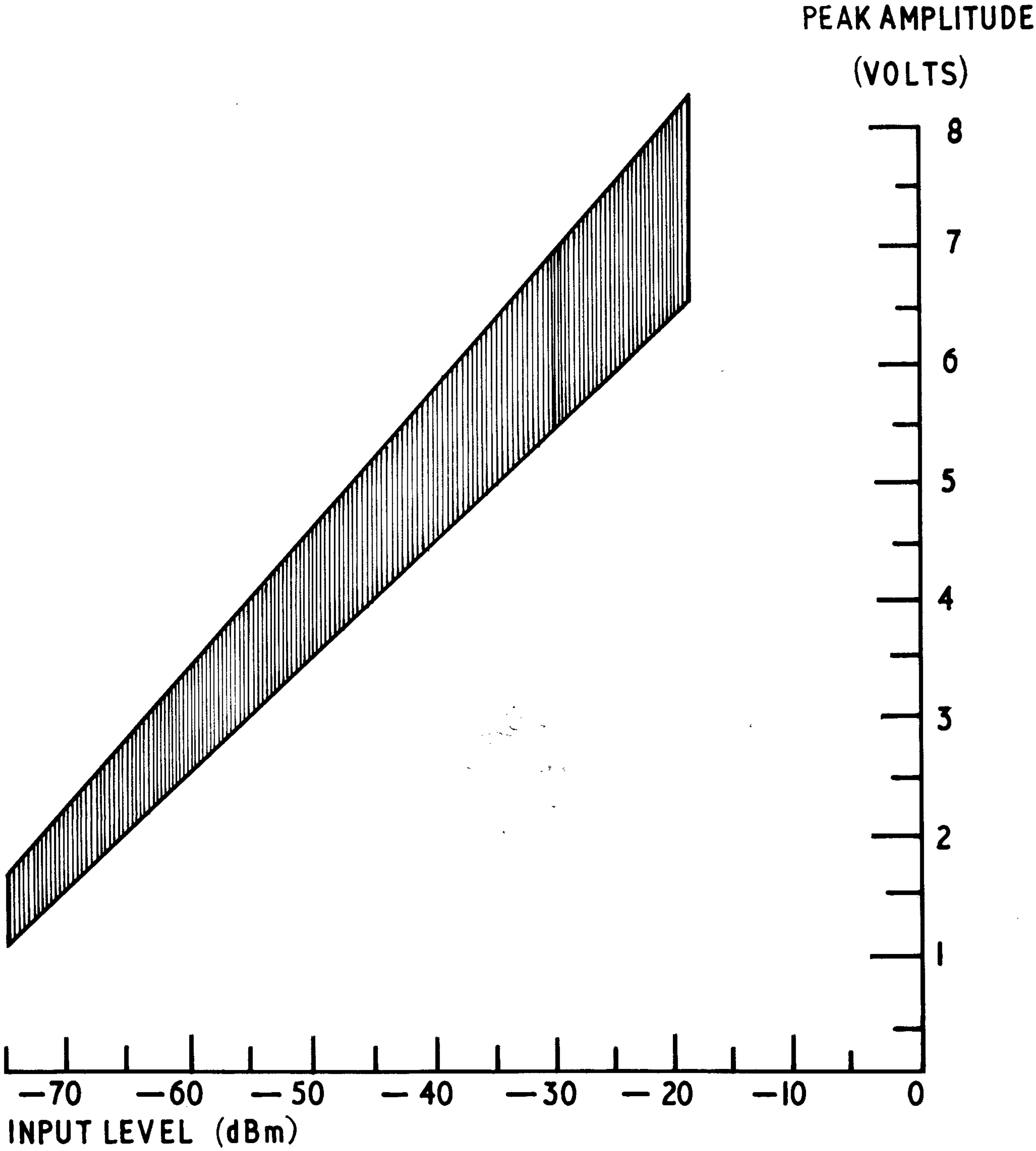


FIGURE : 3

GRAPH OF INPUT LEVEL AGAINST
OUTPUT AT 7J1

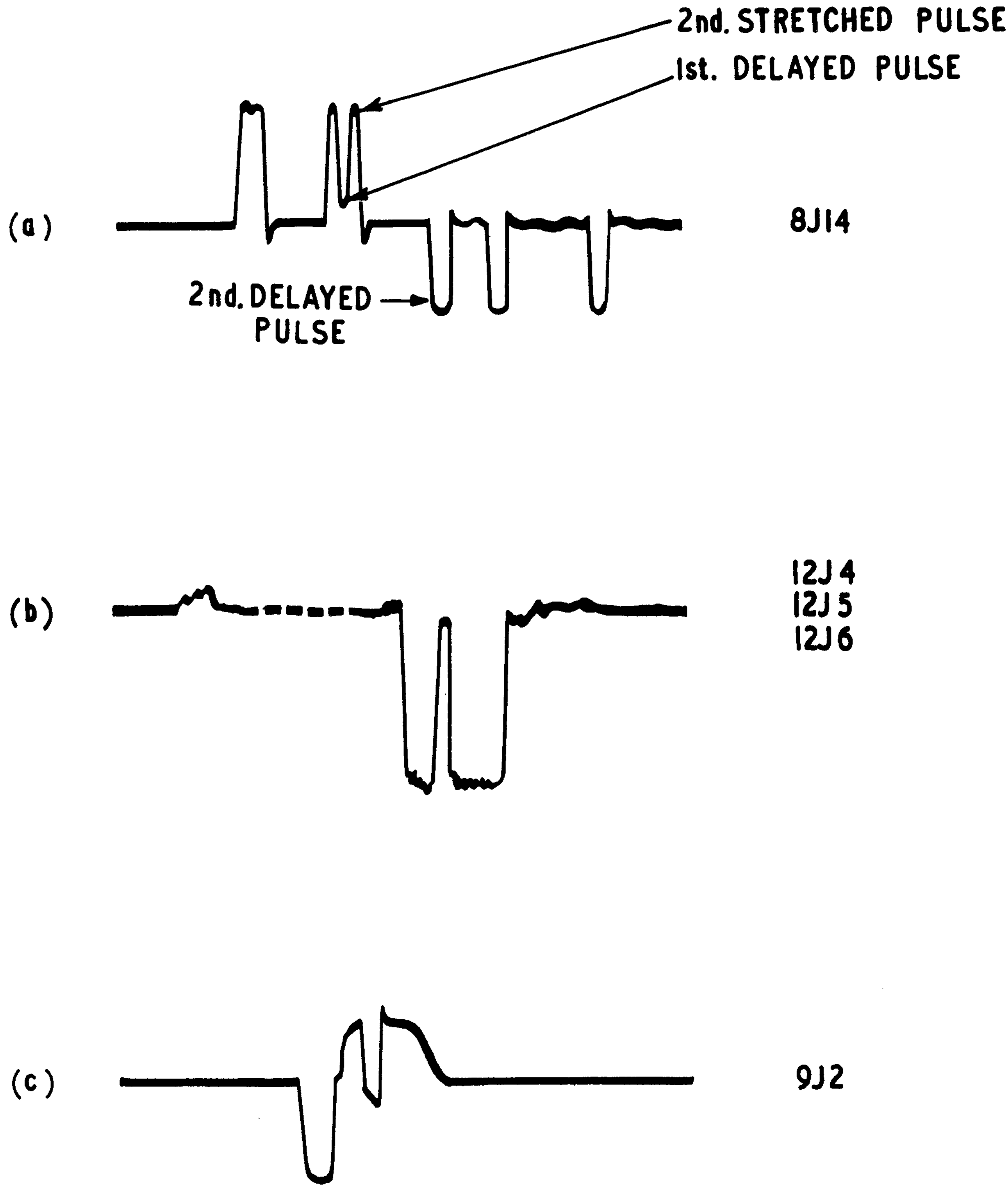


FIGURE 4

TYPICAL TEST WAVEFORMS

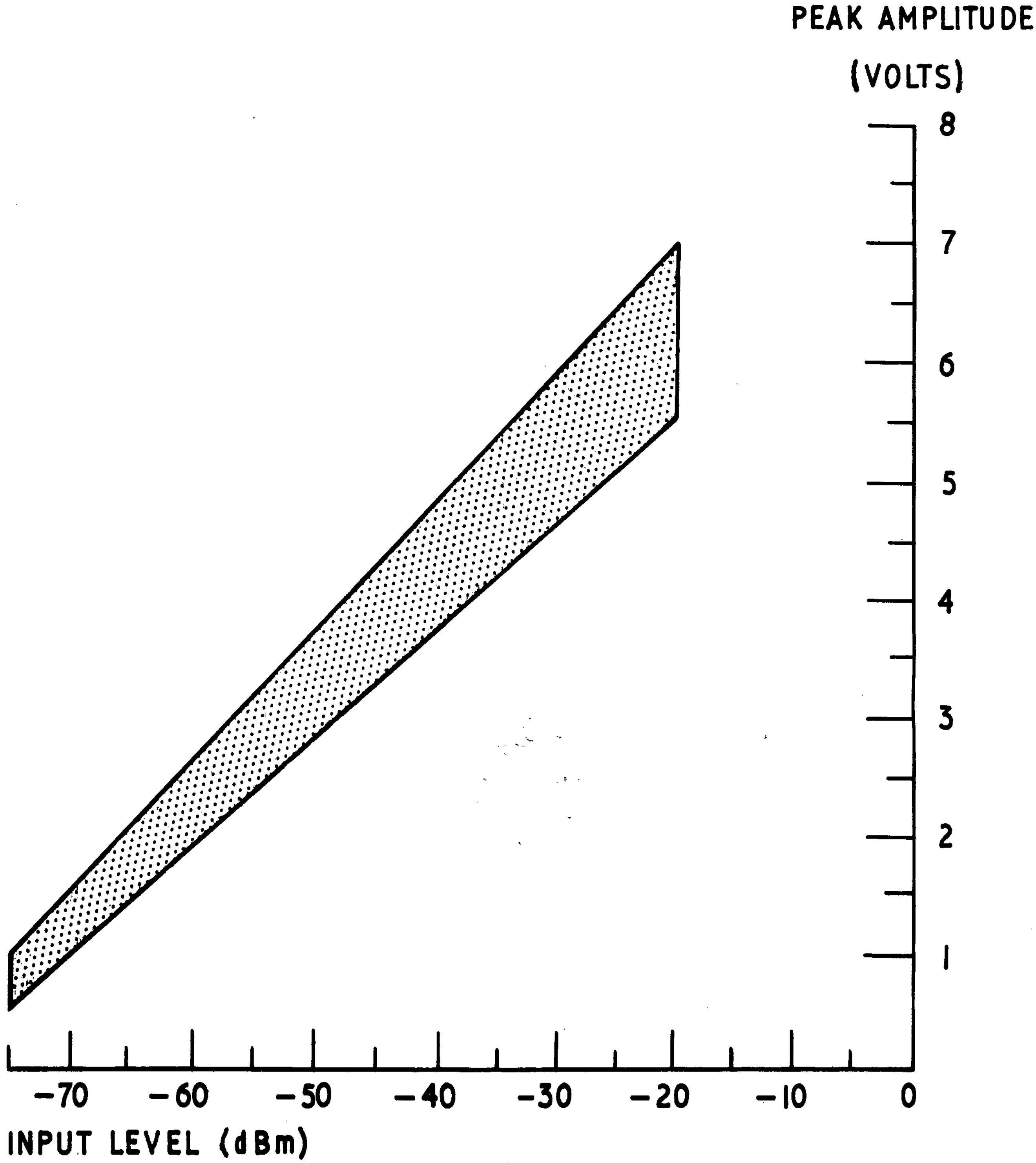


FIGURE 5

GRAPH OF INPUT LEVEL AGAINST OUTPUT AT SKT.R

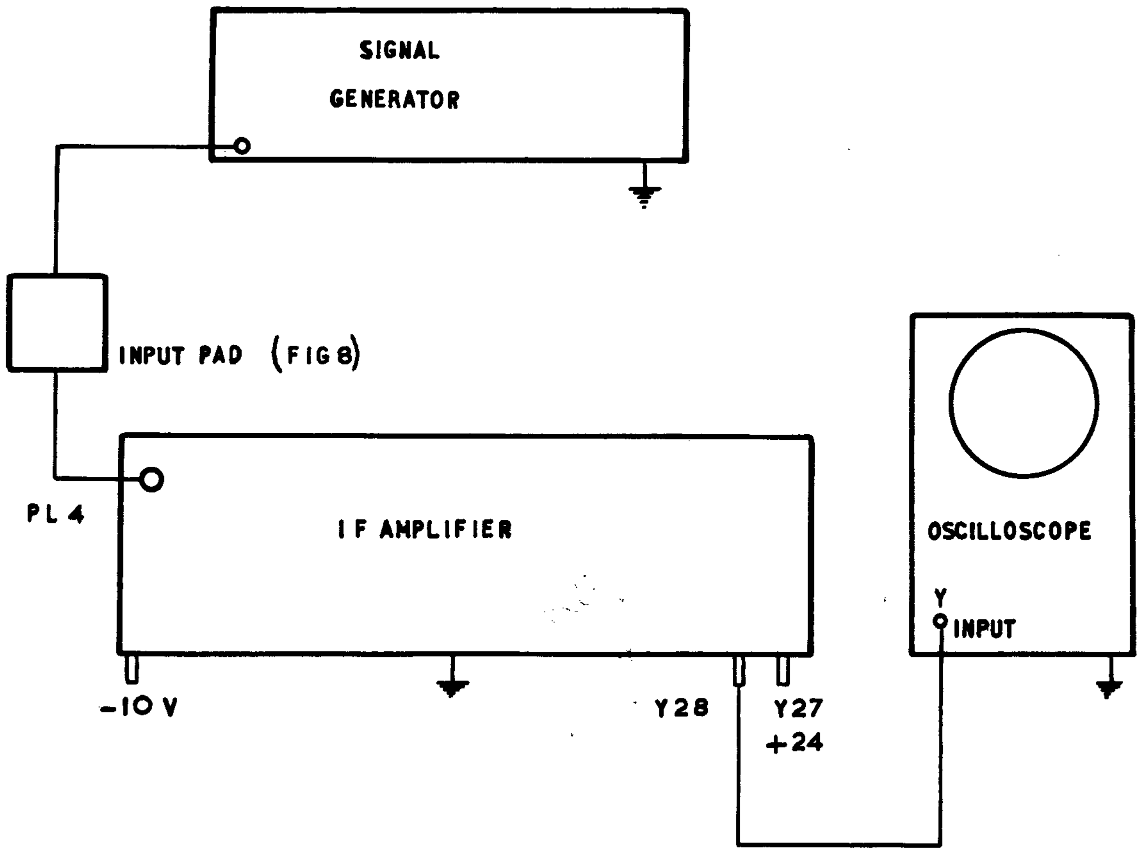


FIG. 7a

TEST EQUIPMENT CONNECTION
I.F. ALIGNMENT

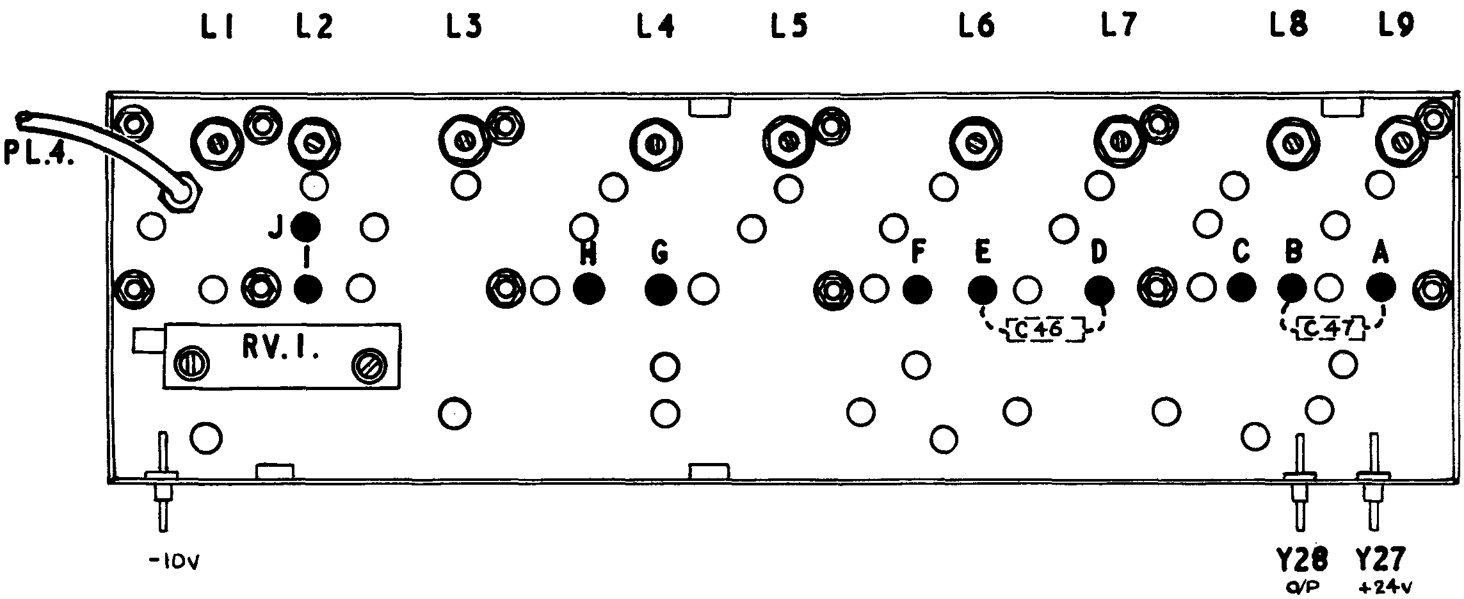


FIG. 7b

LAYOUT OF COMPONENTS TO BE ADJUSTED DURING I.F. AMPLIFIER ALIGNMENT

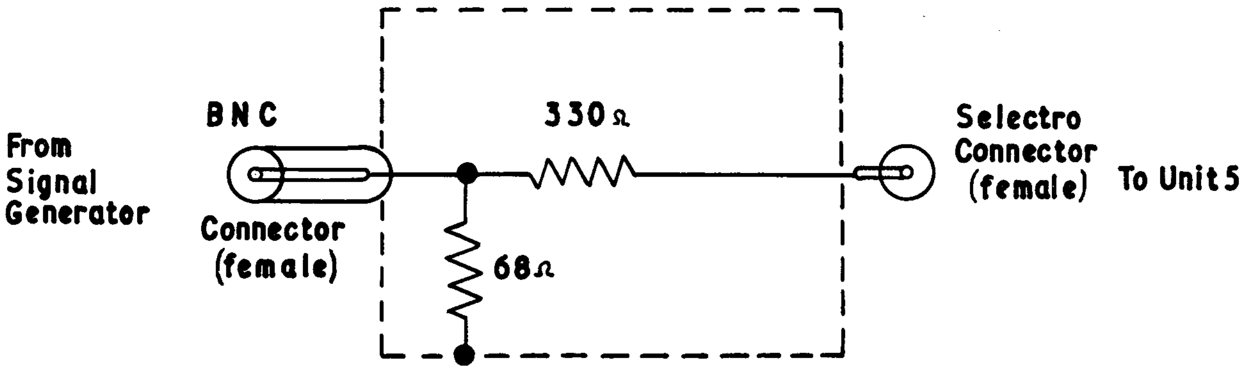


FIG.8 INPUT PAD

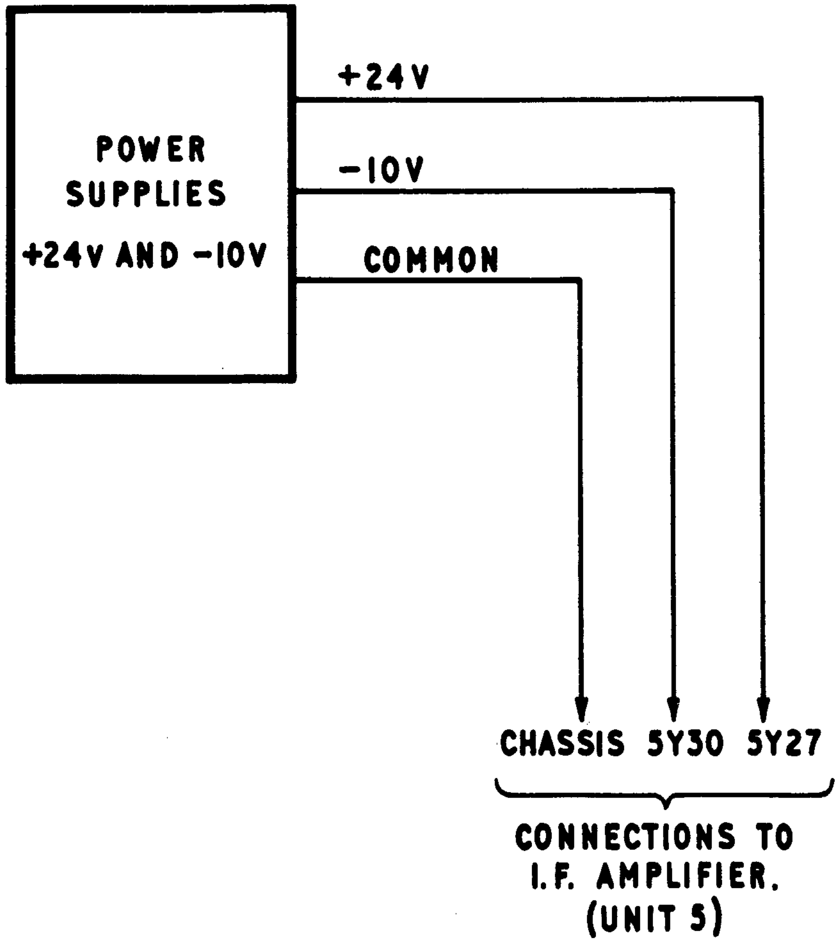


FIGURE 9

POWER SUPPLIES FOR I.F. AMPLIFIER.

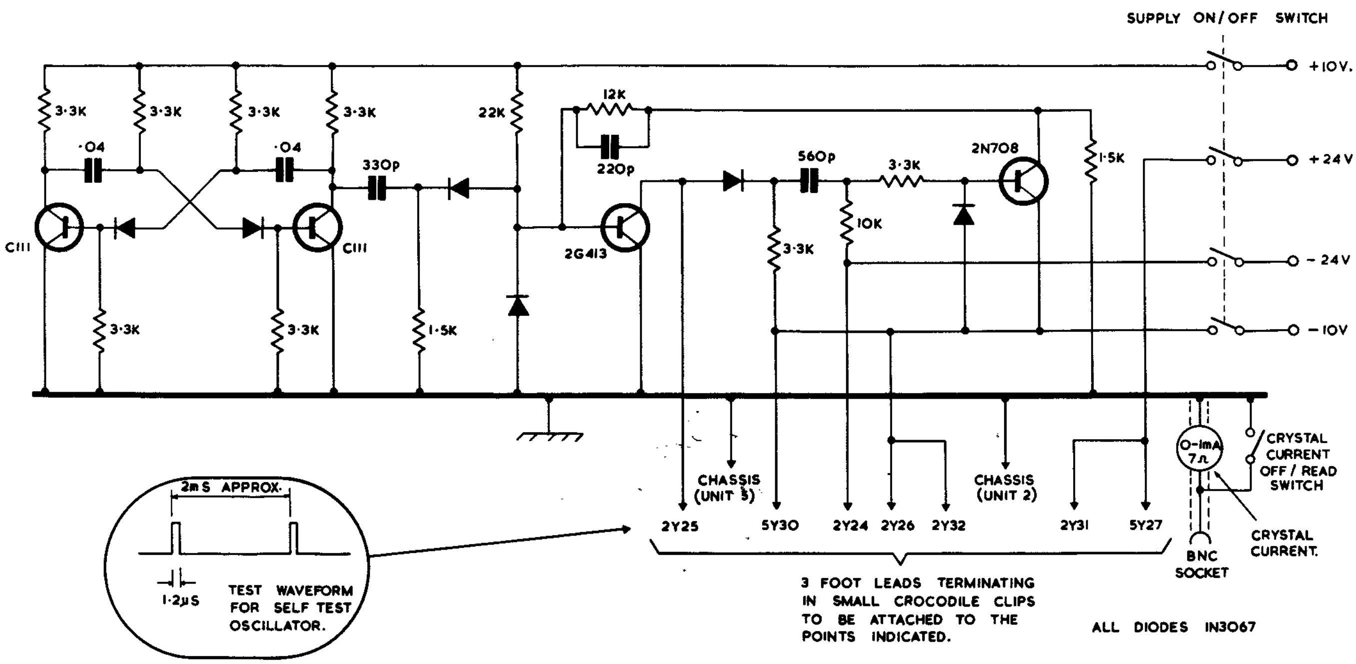


FIGURE 10.

OSCILLATORS TEST SET.

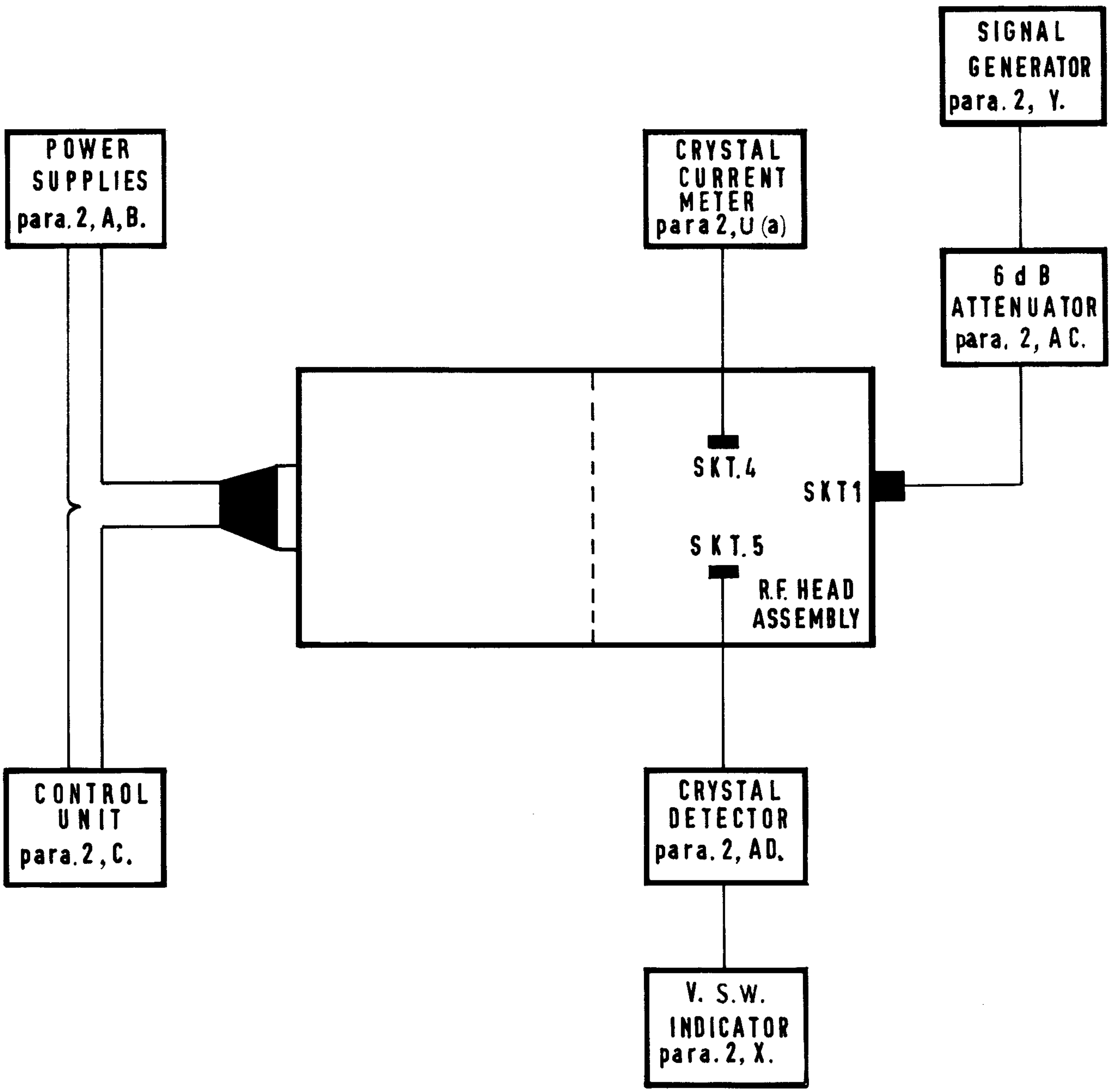


FIGURE: 11

TEST EQUIPMENT INTERCONNECTIONS FOR FILTER ALIGNMENT

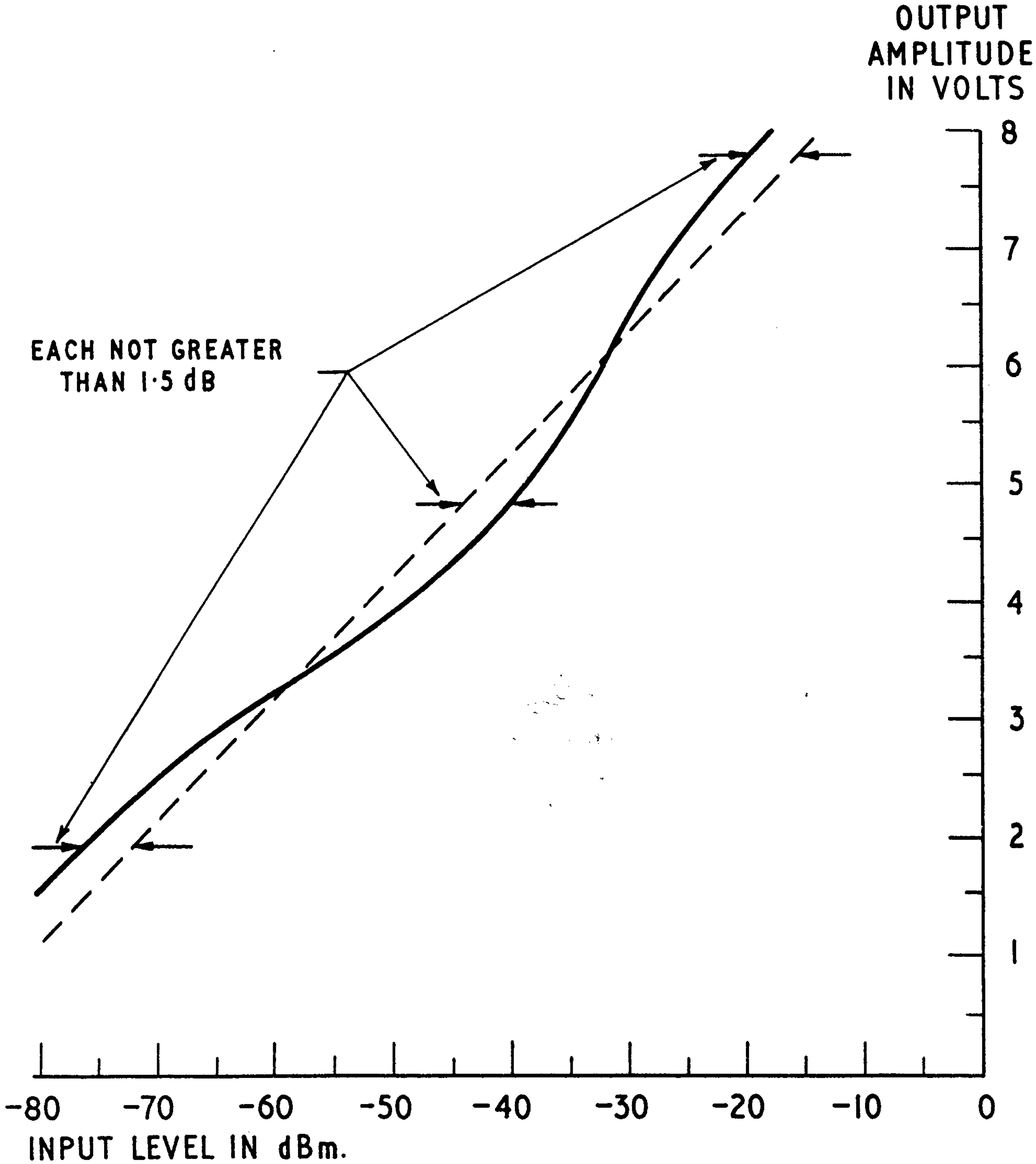


FIGURE 12

I.F. AMPLIFIER LOGARITHMIC RESPONSE.

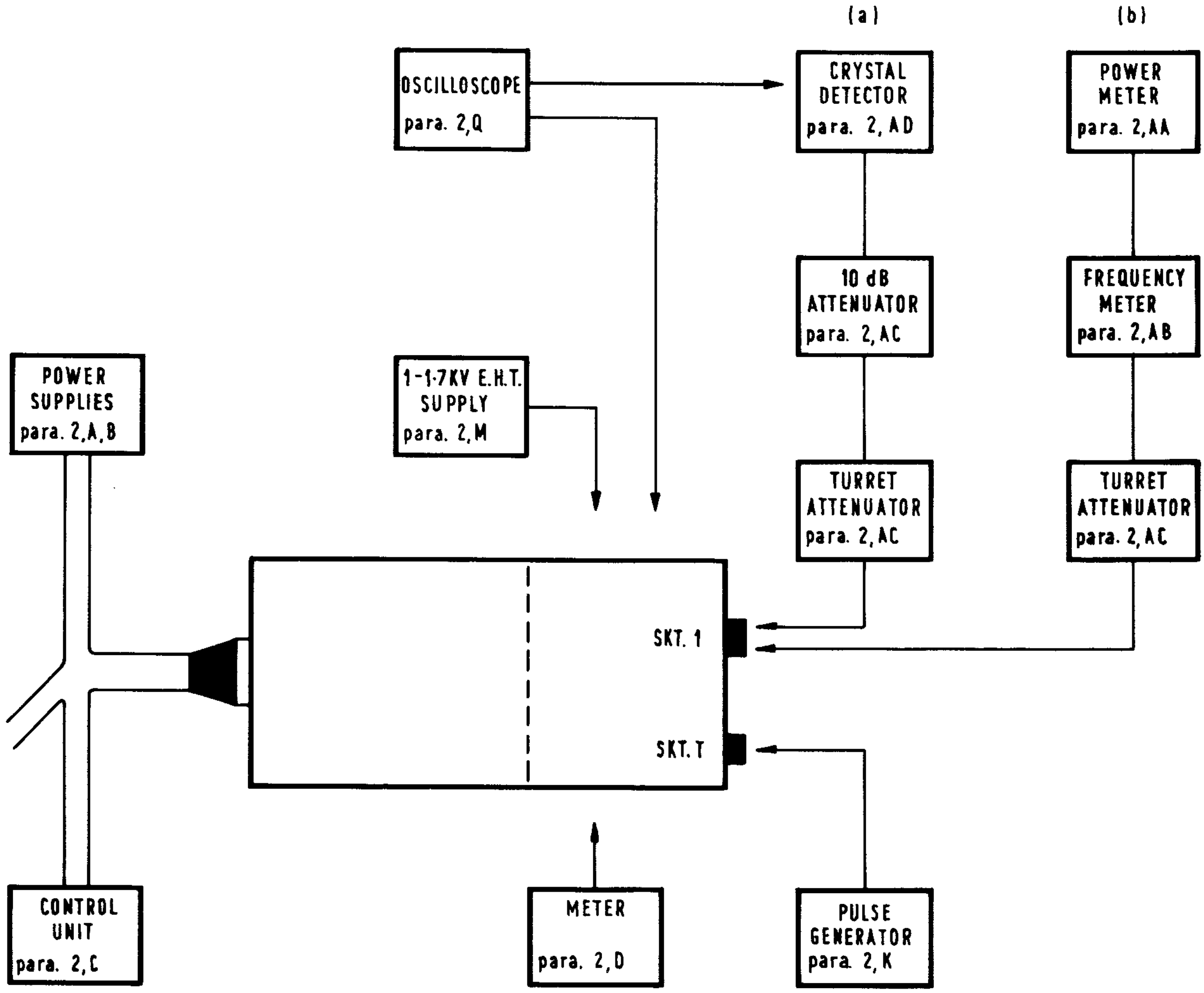
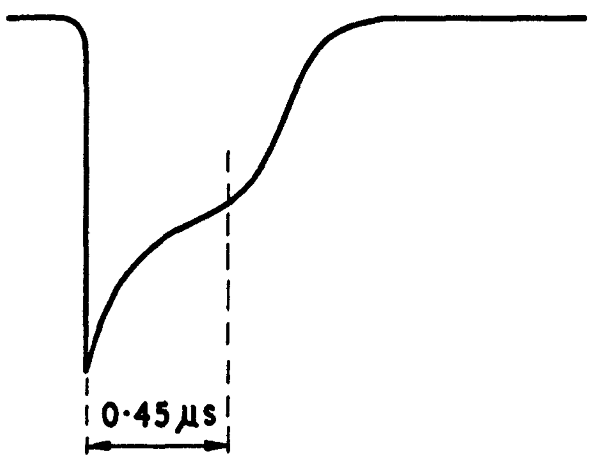
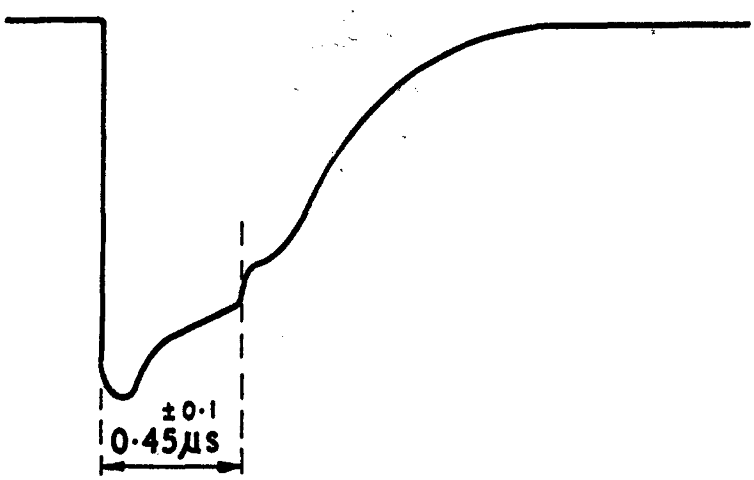


FIGURE 13
TEST EQUIPMENT INTERCONNECTIONS
(a) CAVITY ALIGNMENT.
(b) OUTPUT POWER MEASUREMENTS.



(a) MODULATOR PULSE - TX INOPERATIVE.



(b) MODULATOR PULSE - TX OPERATING.

FIGURE 14
TRANSMITTER TEST WAVEFORMS.

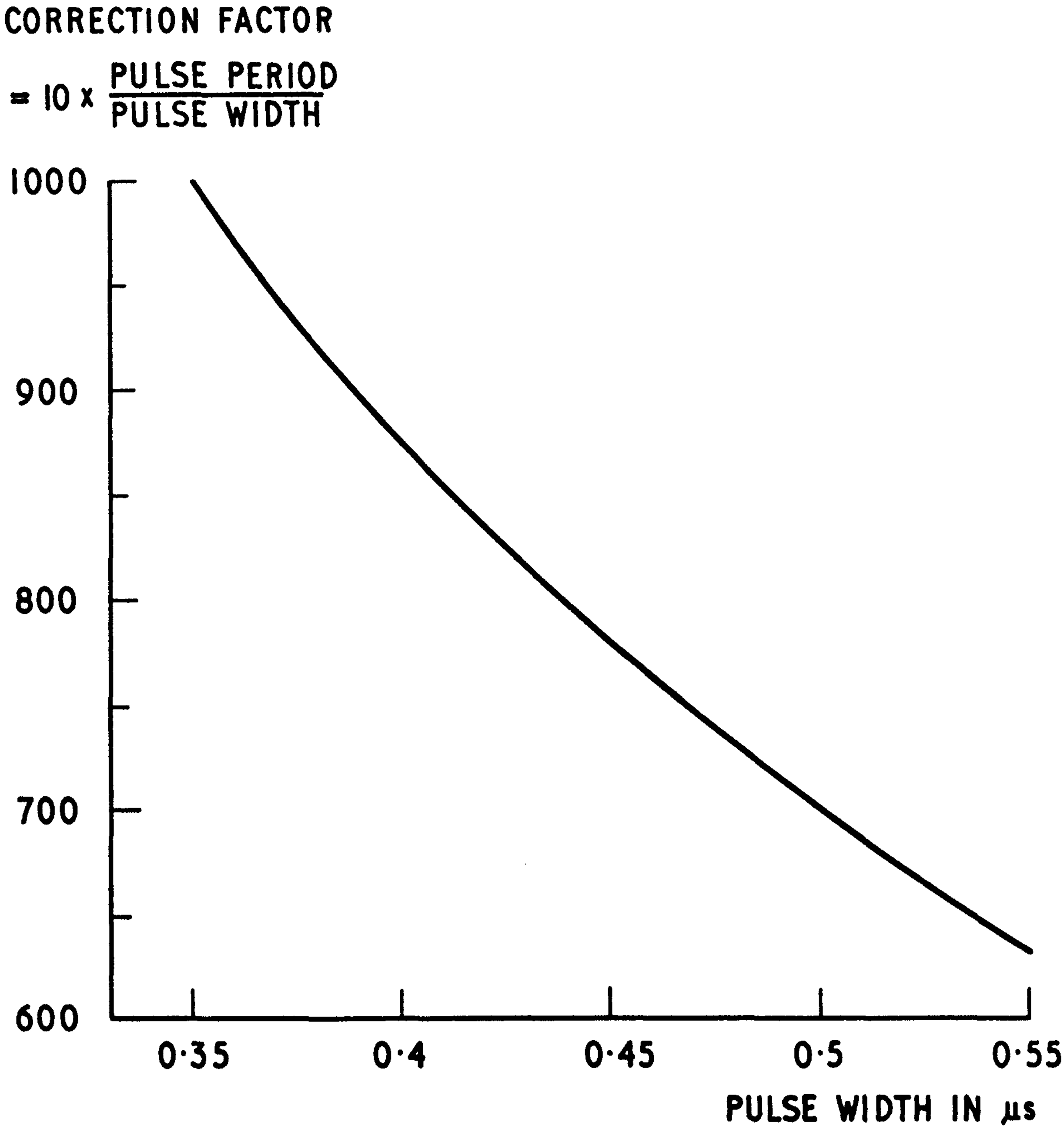


FIGURE 15
PEAK / MEAN POWER CORRECTION
FACTOR DETERMINATION.

Ancillary Test Equipment

1. General

The units and cable assembly described in the following paragraphs have been designed to facilitate bench testing of the transponder used in ARI.23187 installations. They have been developed jointly by the R.A.F. and R.N. and produced in R.N. workshops for Service use.

2. Mode C/D simulator unit

As stated in Section 1, para.5, code selection is achieved in different ways. Switches for modes A and B are provided on the control unit, but mode D switches are on a unit which is not normally included in the installation and mode C responses are initiated by an automatic altitude encoder. Thus mode C and D replies cannot normally be checked on the bench. To overcome this, the mode C/D simulator unit is provided.

3. The unit, illustrated in fig.16, consists of a small box with four edge-controlled switches mounted on the front. Connections are made via a 25-pole plug at the rear.

4. A circuit diagram of the simulator unit is given in fig.19 and fig.21 shows how it is connected into the bench set-up. Operation of the switches earths the appropriate lines in the code selection matrix.

5. Bench interconnecting unit

With the exception of the aerial and test sockets, all connections into and out of the transponder are made via a 45-pole plug at the rear of the unit. To facilitate bench testing an interconnection unit is provided through which some of the transponder connections are made. The unit affords fusing and switching of the a.c. and d.c. supplies, a means of waveform observation and the ability to feed in trigger and suppression pulses.

6. The unit is illustrated in fig.17 and a circuit diagram is given in fig.20. No detailed description is necessary since the unit is largely self explanatory,

all the controls and sockets being clearly identified. The two single-pole sockets on the front panel permit monitoring of the variable 14/28V d.c. supply under load conditions. Connections to the unit are made through two plugs and two sockets at the rear.

7. Cable assembly

To enable the units described in the foregoing paragraphs to be used, a special cable assembly is supplied for the ARI.23187 transponder. This assembly is illustrated in fig.18 and the method of use is shown in fig.21 which is also a detailed interconnection diagram for the bench layout.

FIG.16
MODE C/D SIMULATOR UNIT

FIG. 17
BENCH INTERCONNECTING UNIT:
GENERAL VIEW

FIG. 18
CABLE ASSEMBLY: GENERAL VIEW

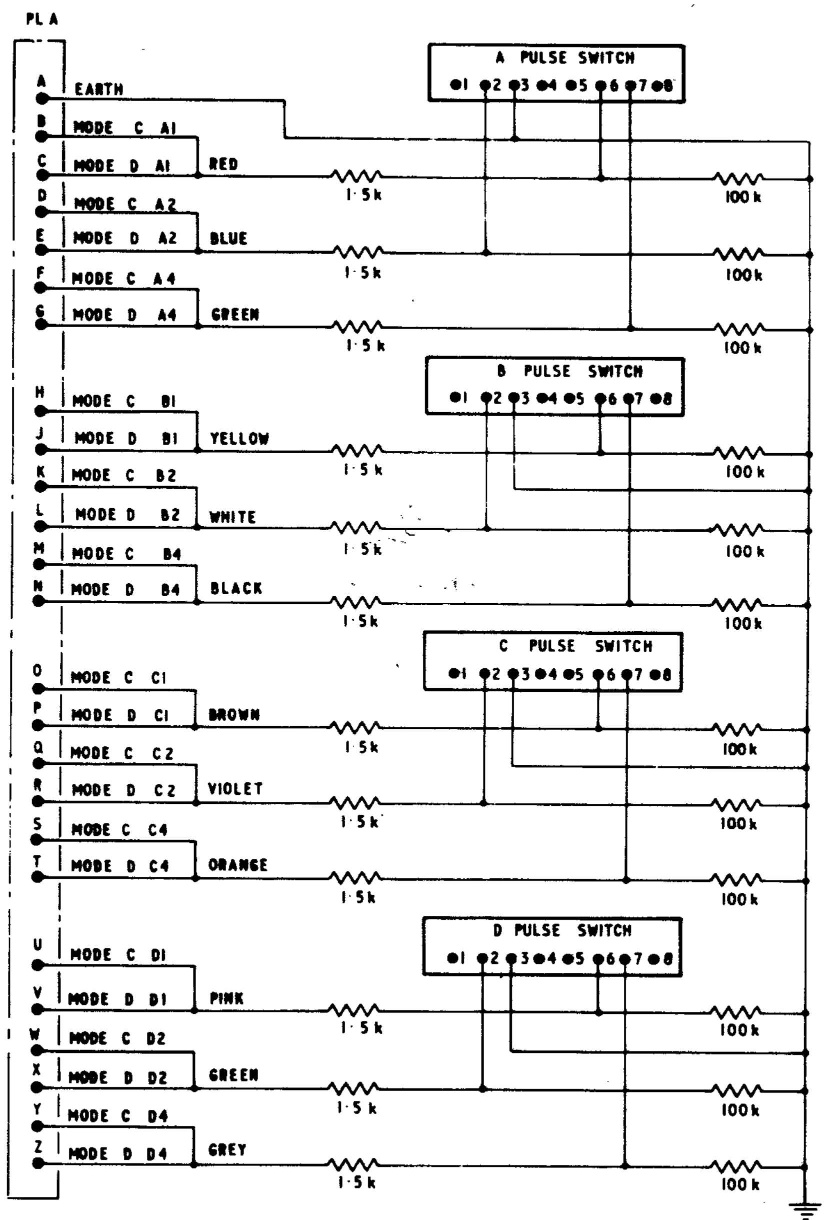


Fig.19 Mode C/D Simulator Unit
Circuit Diagram

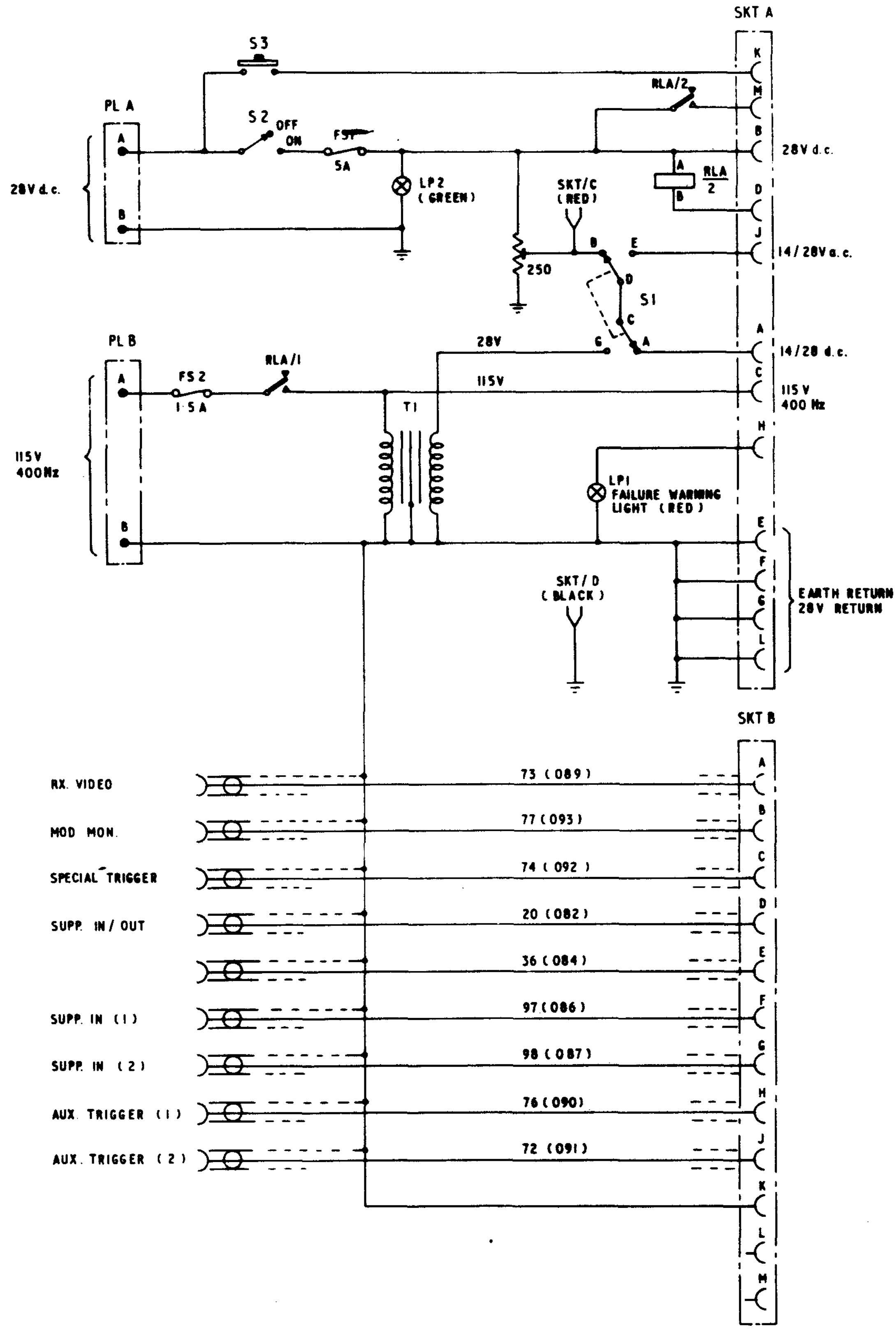


Fig.20 : Bench Interconnecting Unit
Circuit Diagram

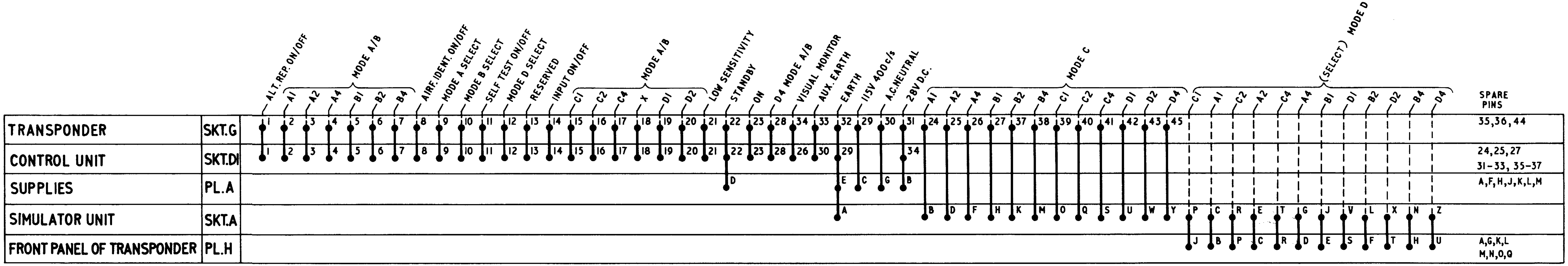


FIG.21: A.R.I. 23187 CABLE ASSEMBLY, SPECIAL PURPOSE: ELECTRICAL INTERCONNECTIONS

SECTION 6.1

FILTER BENCH SERVICING (DEPTH 2B)

CONTENTS

Introduction

1 This schedule has been written to provide filter check facilities for use with high reliability category 'A' equipment, ARI 23187, where 2nd line regionalized servicing for this installation will normally be carried out at specified 3rd line depots or stations.

2 The schedule is to enable servicing personnel to categorize equipments removed from aircraft during defect rectification, as either serviceable or unserviceable items, and so prevent serviceable units from being inadvertently returned to 2nd line regionalized servicing depots for repair.

3 The schedule is based on the use of the 1st line test set, Cossor CRM 544, where specific checks are carried out on a GO-NO/GO principle. A suitable oscilloscope may be used to monitor the various outputs available on the bench interconnecting unit to amplify the indications given by the test set.

Use of Schedule

4 It is intended that the schedule be used for:

4.1 Acceptance checks of equipment received from 2nd line regionalized servicing depots.

4.2 Filter checks after replacement servicing at 1st line.

4.3 To confirm serviceability after incorporation of modifications or STI's.

Under no circumstances should this schedule be used to attempt to carry out 2nd line servicing.

Safety precautions and servicing notes

5 Interrogation of the transponder 1600 is to be carried out only via direct umbilical connection to the test set CRM 544, using the 17 dB + 39 dB fixed attenuators connected in series. No attempt should be made to trigger the transponder via any other method unless it is correctly loaded into the 56 dB antenna attenuator. Failure to observe this precaution may cause damage to the RF amplifier and transmitter cavity.

Glossary

6 The servicing operations detailed in this schedule have the meaning given in the Concise Oxford Dictionary except for the following:

6.1 Inspect - Review the work carried out by tradesmen to ensure it has been performed satisfactorily.

6.2 Check - Make a comparison of a measurement of time, pressure, temperature, resistance, dimension or other quanity with a known figure for that measurement.

6.3 Test - Ascertain, by use of the appropriate test equipment, that a component or system functions correctly.

6.4 Examine - Carry out survey of the condition of an item. For example the condition of an item may be impaired by one or more of the following:

6.4.1 Insecurity of attachment.

6.4.2 Cracks or fractures.

6.4.3 Corrosion, contaimination or deterioration.

6.4.4 Distortion.

6.4.5 Loose or missing rivets.

6.4.6 Chafing, fraying, scoring or wear.

6.4.7 Faulty or broken locking devices.

6.4.8 Loose chips or packing on, obstruction of, or leaks from pipelines.

6.4.9 External damage.

6.4.10 Discolouration due to overheating, or leaking of fluids, etc.

6.5 Fit - Correctly attach one item to another.

6.6 Refit - Fit an item which has previously been removed.

6.7 Replace - Remove an item and fit a new or serviced item.

6.8 Disconnect - Uncouple or detach cables, pipelines or controls.

6.9 Reconnect - Reserve of sub-para 6.8.

6.10 Operate - Ensure an item or system functions correctly, as far as can be ascertained without the use of test equipment or reference to measurement.

TABLE 1 TEST EQUIPMENT REQUIREMENTS

Sect/Reference NATO No.	Nomenclature	Qty
10S/6625-99-1048464	Leak Locator (CT105)	1
6C/6685-99-6507758 or	Leak Detector Set (LD172/30)	1
6C/6625-99-6348599 or	Leak Indicator (LD172)	1
10S/6625-99-1048463	Leak Indicator Kit (CT106)	1
10S/5895-99-1950883 or	Test Set IFF/SSR (Cossor CRM544)	1
110S/6625-99-1960544	Test Set Transponder (TS008)	1
10D/5895-99-1079851	Simulator Unit (RR/C/283556)	1
10S/5895-99-1079850	Bench Interconnecting Unit	1
10HS/5895-99-1079853	Cable Assembly ARI 23134 only Pt No. RR/B285183	1
10HS/5841-99-1079852	Cable Assembly ARI 23187 only Pt No. RR/B285184	1
4GD/1660-99-2055387	Low Pressure Nitrogen Walk Round Kit	1
IC/5120-99-9106057	Wrench Socket Head 0.050	1
10H/5935-99-0130925	Socket Electrical S04AF1-2/0	1
10H/5935-99-0130926	Socket Electrical S04AF1-2/1	1
10AR/5935-99-0142982	Clamp Cable Electric Plug SB104A-371	2

FILTER BENCH SERVICING SCHEDULE (Cont'd)

Item No.		Item	Operation
	(b)	RF output socket.	Connect, via RF cable and the 17 dB and 39 dB fixed attenuators (total 60 dB), to transponder aerial output.
	(c)	Power switch.	Set to 'ON', and check power indicator lamp lights.
	(d)	Function switch.	Set to SELF TEST and check meter indicates at nominal setting on -dB scale.
3.9	Control transponder set type 1601/6.		
	(a)	Transfer switch.	Set to 1.
	(b)	'LO SENS' switch.)	
	(c)	'AR' switch.)	Set to 'OFF'.
	(d)	Mode 'D' switch.)	
	(e)	Code switches.	Set to '0000'.
	(f)	Function switch.	(i) Set to 'S/BY' and allow 1 minute warm-up.
			(ii) Set to 'A' Mode.
	(g)	Self Test button.	(i) Depress and check Green confidence lamp lights.
			(ii) Release.
4	Transponder Type 1600 Serviceability Tests		
4.1	Control transponder set type 1601/6.)		Carry out system check in accordance with the following tabulated test procedures:
4.2	Test set CRM 544.)		

NB1 An oscilloscope may be used to monitor the various outputs on the bench interconnecting unit to identify and localise particular faults.

NB2 The Green confidence lamps on the control unit and transponder will light whenever the transponder is being interrogated by the test set.

FILTER BENCH SERVICING SCHEDULE (Cont'd)

Item No.	Item	Operation	
TEST	CU Type 1601/6 Switch Position	CRM 544 Switch Position	Meter Indication
1	'AR' and 'D' Mode switches to 'ON'. 'LO SENS' switch to 'OFF'. Code switches to 7777. Transfer switch to 1. Function switch to 'A'.	Mode switch to 3A. Function switch to 'FREQ/PWR'.	Green.
2	Function switch to 'B'.	Mode switch to 'B'.	Green.
3	Function switch to 'C/D'.	Mode switch to 'C'.	Green.
4	As for Test 3.	Mode switch to 'D'.	Green.
5	'LO SENS' switch to 'ON' Function switch to 'A'.	Mode switch to 3A.	Red.
6	'LO SENS' switch to 'OFF'. Code switches to '0000'.	Code switches to 0000. Function switch to 'REPLY'.	Green
7	Operate code switches in sequence as below:	Operate code switches in sequence as below. Check meter indicates Green at each coincident setting.	Green
	1000,2000,3000,4000,5000, 6000,7000,0100,0200,0300, 0400,0500,0600,0700,0010, 0020,0030,0040,0050,0060, 0070,0001,0002,0003,0004, 0005,0006,0007,0000.	1000,2000,3000,4000,5000, 6000,7000,0100,0200,0300, 0400,0500,0600,0700,0010, 0020,0030,0040,0050,0060, 0070,0001,0002,0003,0004, 0005,0006,0007,0000.	
8	Operate Mode C code switches in sequence as in Test 7.	Operate code switches in sequence as in Test 7 with Mode switch to C.	Green
9	Code switches to '7777'. Function switch to 'A'.	Code switches to '7777'. Mode switch to '3A'. Function switch to 'NO REPLY'.	Red

FILTER BENCH SERVICING SCHEDULE (Cont'd)

Item No.	Item	Operation	
TEST	CU Type 1601/6 Switch Position	CRM 544 Switch Position	Meter Indication
10	Code switches to 0000.	Code switches to '0000'. Mode switch to '3A'. Function switch to 'NO REPLY'.	Red
11	As for Test 9.	Function switch to 'REPLY RATE'.	Approx. 10% to 90% deflection.
12	As for Test 9.	Function switch to 'IDENT'.	Red
13	Press and release I/P switch.	As for Test 11.	Green for approx. 20 secs.
14	Function switch to 'B'.	Mode switch to Mode 'B'.	Red
15	Press and release I/P switch.	As for Test 13.	Green for approx. 20 secs.

5 General

5.1 Test set CRM 544.

(a) Power switch.) Set to 'OFF'.
(b) Power cable.) Disconnect and stow.
(c) RF output socket.) Disconnect RF cable and attenuators and stow.

5.2 Control transponder set type 1601/6.

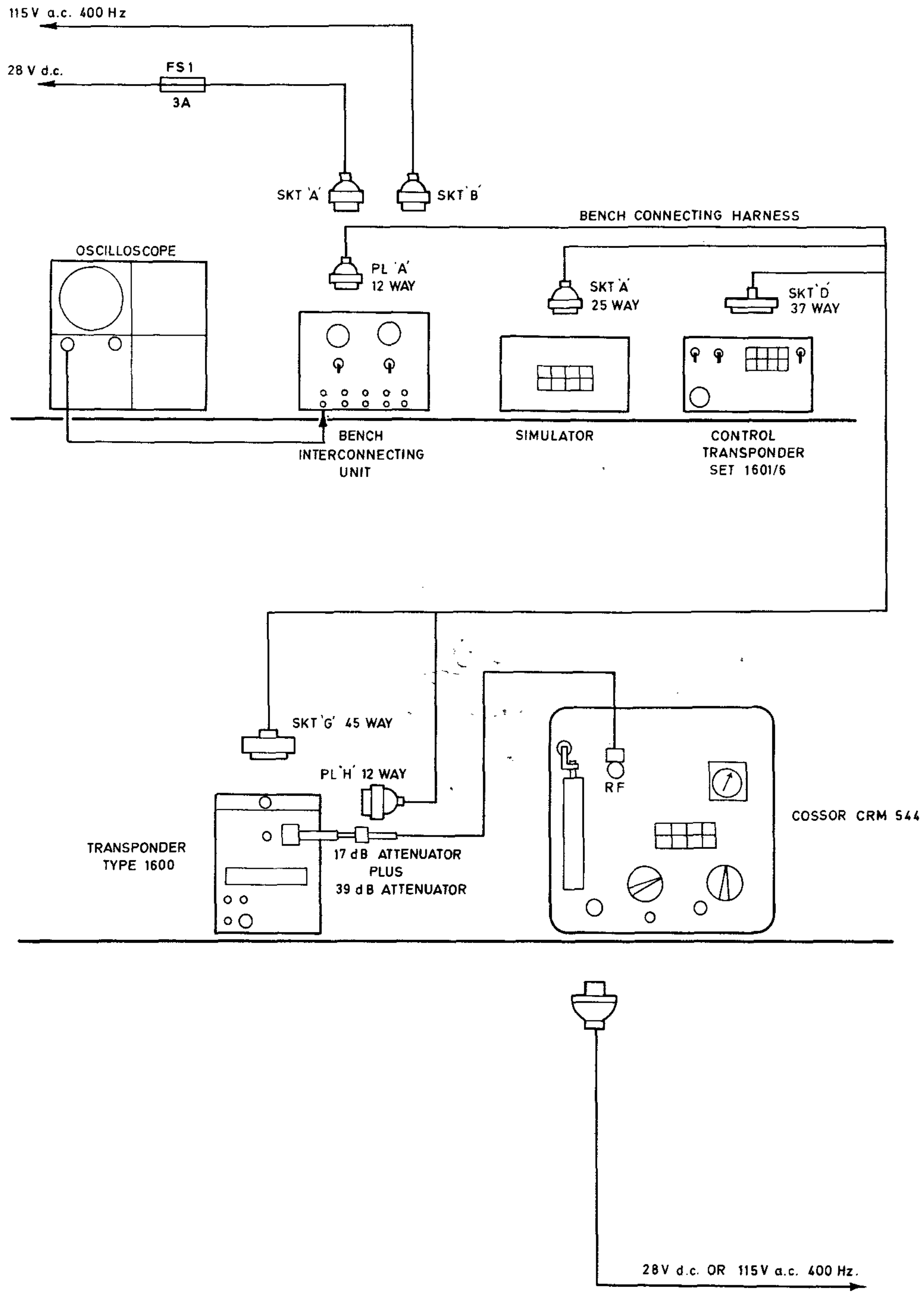
(a) 'AR' and Mode 'D'.) switches.) Set to 'OFF'.
(b) 'LO SENS' switch.)

(c) Code switches. Set to '0000'.

(d) Function switch. Set to 'OFF'.

FILTER BENCH SERVICING SCHEDULE (Cont'd)

Item No.	Item	Operation
5.3	Bench interconnecting unit power switch.	Switch to 'OFF'.
5.4	Transponder type 1600.)	Disconnect from test bench.
5.5	Control transponder set 1601/6.)	
6	Servicing forms	Sign.



ARI 23187 FILTER BENCH SERVICING FIG. 1

SECTION 7

TROUBLE SHOOTING

NOT INCLUDED

Section 8

ILLUSTRATED PARTS LISTS

Contents

ILLUSTRATIONS

Printed for Her Majesty's Stationery Office
by I.S.I. Washington
Demand No. 176822, 205, 6/75, 1909 (10178-22)

SECTION 8

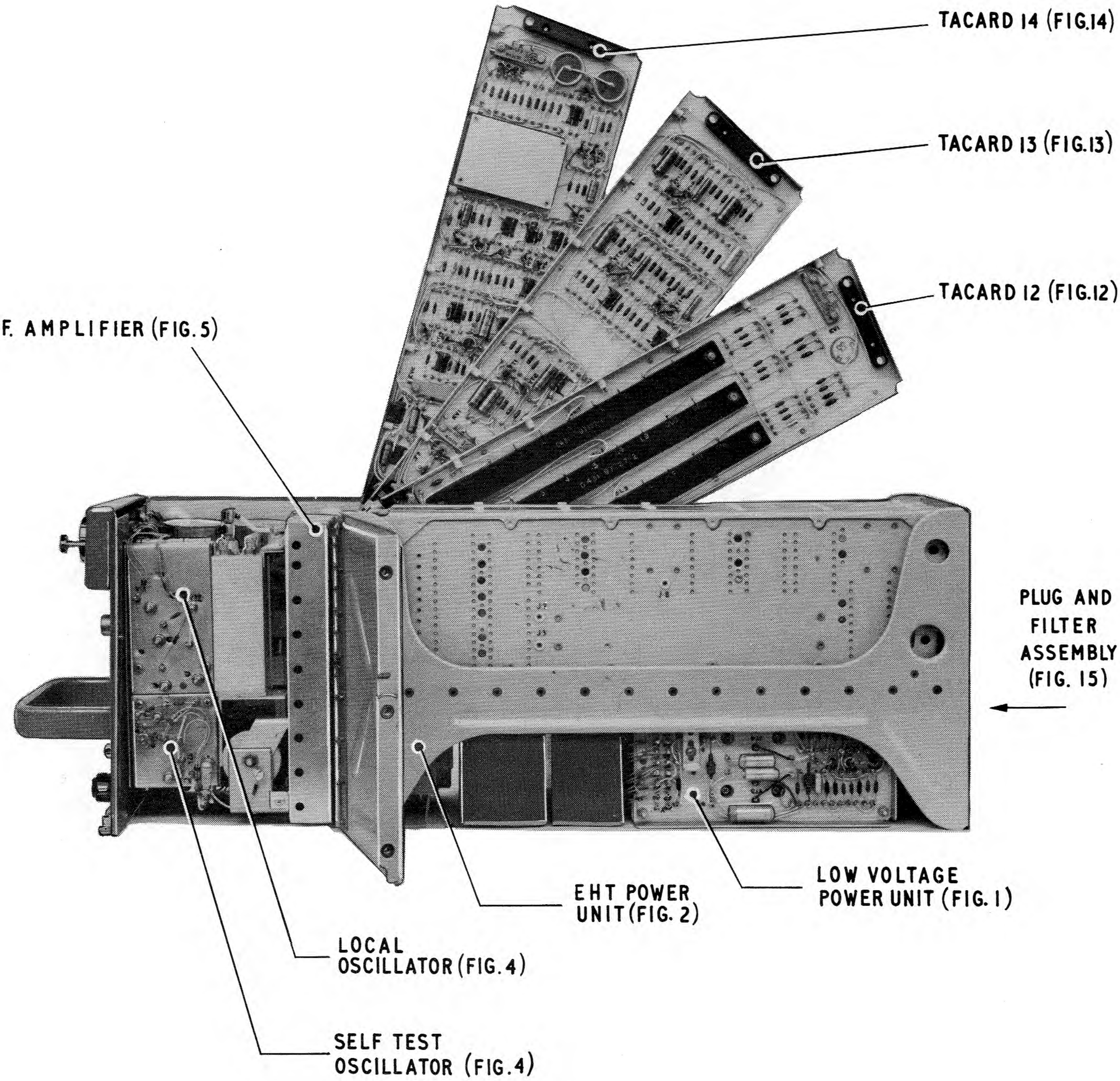
ILLUSTRATED PARTS LISTS

NOTES

The parts list for the S.S.R 1600 transponder has been divided into one short list of the sub-assemblies and separate lists for each of these. Plates 5 and 6 show the location of the sub-assemblies and give the numbers of the illustrations for each unit. A separate list is included for the control unit S.S.R 1601.

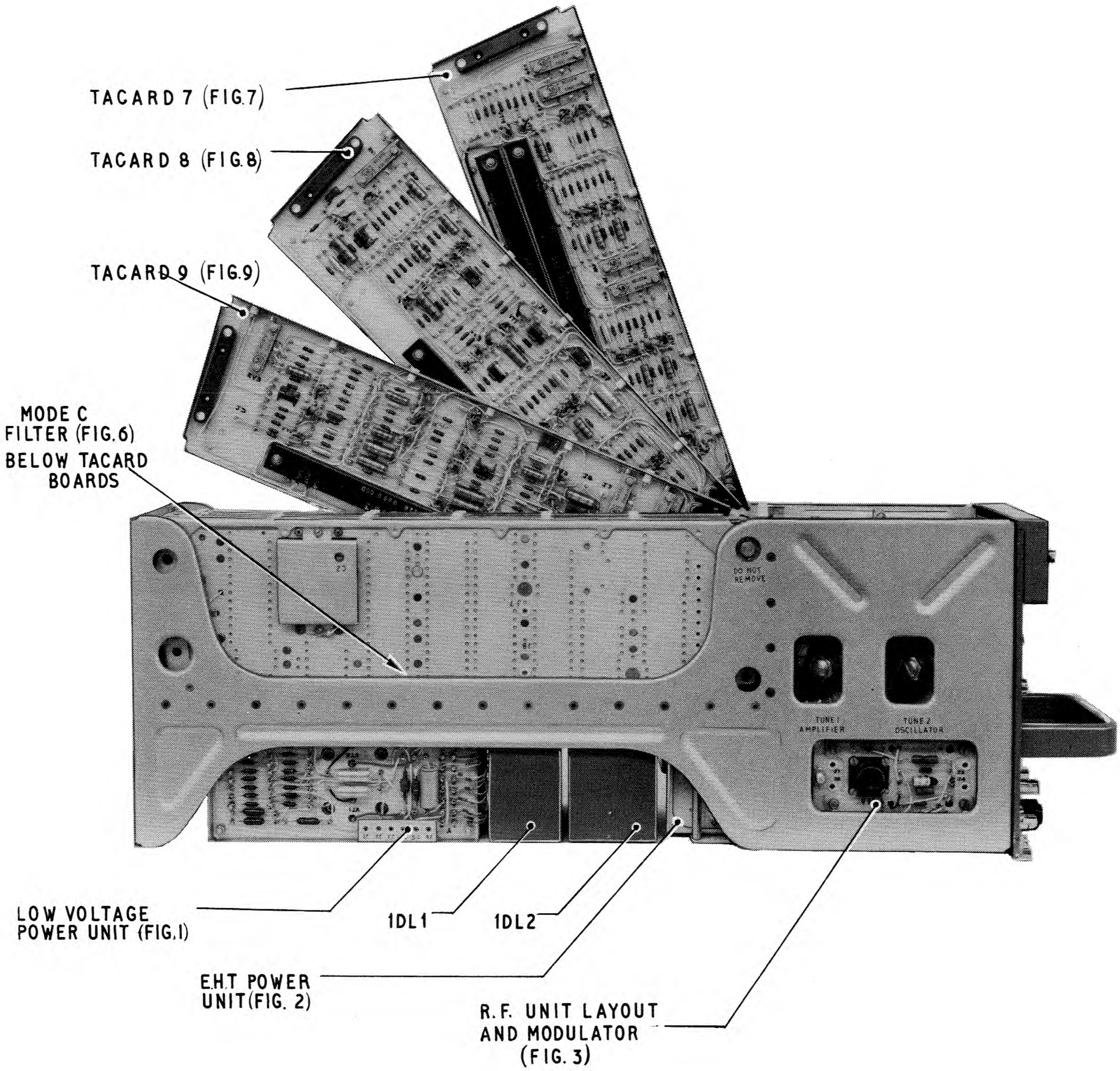
Vendor's names and part numbers have not been included in the lists, mainly to save space. A vendor code is given, usually consisting of two or possibly three letters. The first letter or pair of letters is the component designation and the last is a code letter for the type or style. A key to the code, included at the rear of this section ensures the procurement of the correct component for replacement.

Components having the vendor code C are supplied by Cossor Electronics Ltd., and reference numbers for these are given in the lists.



R. H. SIDE VIEW
PLATE 5

CED 189



L. H. SIDE VIEW
PLATE 6

CED 190

Plates 5 and 6 - Transponder S.S.R.1600

Page	Fig.	Description	Part No.	Vendor Code
6	1	Low voltage power unit	D/GA86904/1	C
10	2	EHT power unit	D/GA86903/1	C
12	3	RF unit	D/GA86902/1	C
15	4	Local and self-test oscillators	D/SA86902/201	C
19	5	IF amplifier	D/GA86905/1	C
25	6	Mode C filter	C/SA86900/138	C
29	7	Tacard board 7	D/GA86907/1	C
35	8	Tacard board 8	D/GA86908/1	C
41	9	Tacard board 9	D/GA86909/1	C
47	10	Tacard board 10	D/GA869010/1	C
53	11	Tacard board 11	D/GA869011/1	C
63	12	Tacard board 12	D/GA869012/1	C
67	13	Tacard board 13	D/GA869013/1	C
73	14	Tacard board 14	D/GA869014/1	C
82	15	Plug and filter assembly	C/SA86900/112	C
86	16	Control, Transponder Set Type 1601/6	See page 85	C
88	17	Control Unit 1601/2	See page 85	C
90	18	SSR 1600/2 Power Unit (Unit 3)	D/GA86904/2	C
94	19	SSR 1600/2 Power Unit (Unit 4)	D/GA86903/2	C

Fig. 3 R.F. Unit

Item		Reference No.	Vendor Code
1	IF Strip assembly (Fig. 5)	D/GA86905/1	C
2	Antenna 'T' junction assembly	B/SA86902/163	C
3	Filter and Mixer assembly	C/SA86902/202	C
	Diode 2D7		DE
4	Self-test and Local Oscillator (Fig.4)	B/SA86902/201	C
5	Modulator Board assembly	B/SA86902/118	C
	Resistors 2R 13 22 ±5% 0.1W		RG
	2R 14 1k ±5% 1W		RC
	2R 15 4.7k 5% ¼W		RA
	Capacitors 2C 19 6.8uF ±20% 75V		CBB
	2C 20 1000pF +50.25% 500V		CM
	Transistor 2VT6		VJ
	Diodes 2D5		DJ
	2D6		DA
6	Lead assembly	B/SA86902/186	C
7	Crystal Detector assembly	B/SA86902/211	C
	Diode 2D4		DQ
8	Amplifier and Oscillator assembly	D/SA86902/203	C
	Valves 2V1 and 2V2		VZ
	Capacitor 2C37 100pF ±20% 500V	A97543/2	C
9	Front Panel assembly		
	Push-button switch (S01)		SA
	Illuminated switch knob		KA
	Bulb 28V		BC
	Chassis receptacles SKT.R		PC
	SKT.S		PC
	SKT.T		PC
	Coloured washer (blue)	A56902/56	C
	Coloured washer (brown)	A56902/57	C
	Coloured washer (red)	A56902/58	C
	Hold-down hook	A56902/130	C
	Socket (SKT.H)		PB
10	Bleeder assembly 2R17 5X 1M ±10%	A/SA88869	C
11	'O' Ring seal (0.734" ID)	KU92721/15	C
12	Capacitor 2C16 0.25uF 2,500V		CS

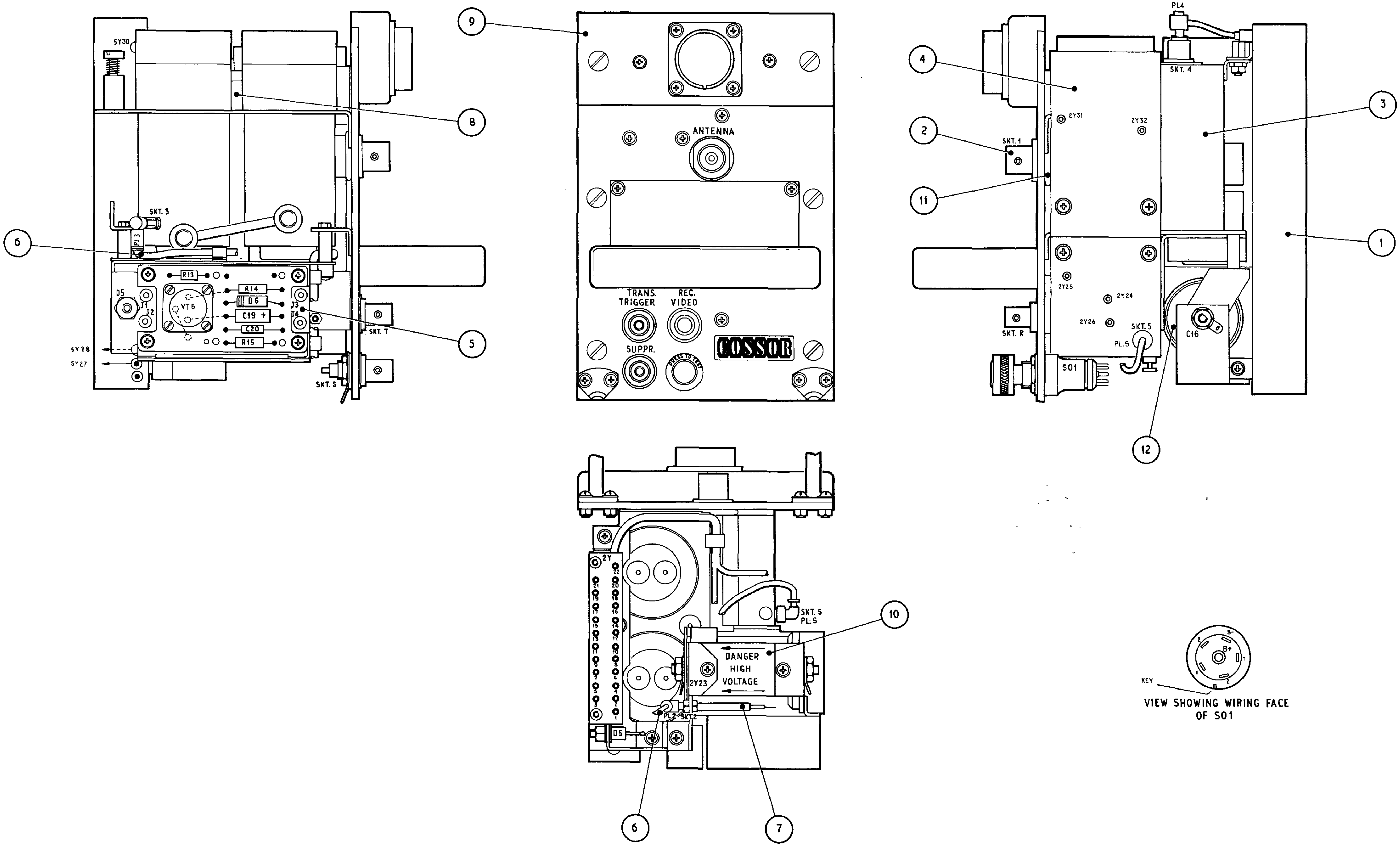


FIG. 3. R.F. UNIT (UNIT 2)

Fig. 4 Local and Self-test Oscillators

Cct.Ref.	Pos'n.	Value	Tol	Rating	Ref.No.	Vendor Code
2R1	D3	6.8k	±5%	¼W		RA
2R2	D3	1.8k	±5%	¼W		RA
2R3	G4	820	±5%	¼W		RA
2R4	G3	51	±5%	¼W		RA
2R5	H4	100	±5%	¼W		RA
2R6	C4	1k	±5%	¼W		RA
2R7	H4	470	±5%	¼W		RA
2R8	C5	3.3k	±5%	¼W		RA
2R9	D5	15k	±5%	¼W		RA
2R10	G5	100	±5%	¼W		RA
2R11	C6	22k	±5%	¼W		RA
2R30	G4	15k	±5%	¼W		RA
2C1	C4	4.7p	±¼pF	750V		CL
2C2	D4	25p	±1pF	750V		CL
2C3	D4	1000p	-25%+50%	500V		CM
2C4	C3	4.7p	±¼pF	750V		CL
2C5	C4	1000p	-20%+80%	750V		CK
2C6	C5	3p	+¼pF	750V		CL
2C7	B4	1000p	-25%±50%	500V		CM
2C8	D4	1000p	-25%+50%	500V		CM
2C9	E5	100p	±5%	350V		CR
2C10	C5	1000p	-25%+50%	500V		CM
2C11	D5	1000p	-25%+50%	500V		CM
2C12	D6	3.9p	±¼pF	750V		CL
2C13	D6	22p	±1pF	750V		CL
2C33	G3	1000p	-20%+80%	750V		CK
2C34	H4	1000p	-20%+80%	750V		CK
2VT1	C4					VF
2VT2	C4					VF
2VT3	D5					VF
2D1	C6					DT
2L1	D4				B/SA8879/8	C
2L2	D5				B/SA88797/21	C
2L3	D6				B/SA88797/18	C
2L4	B6				B/SA88906	C
2X1	D3					XA

Fig. 4 Local and Self-test Oscillator (cont.)

Cct. Ref	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
2R21	S3	3.3k	±5%	$\frac{1}{4}$W		RA
2R22	T3	1.8k	±5%	$\frac{1}{4}$W		RA
2R23	L4	220	±5%	$\frac{1}{4}$W		RA
2R25	M3	1.2k	±5%	$\frac{1}{4}$W		RA
2R26	M3	820	±5%	$\frac{1}{4}$W		RA
2R27	N3	1k	±5%	$\frac{1}{4}$W		RA
2R28	M4	820	±5%	$\frac{1}{4}$W		RA
2R29	M3	3.3k	±5%	$\frac{1}{4}$W		RA
2R31	R3	51	±5%	$\frac{1}{4}$W		RA
2R32	N3	100	±5%	TR4		RA
2C21	L3	1000p	-25%+50%	500V		CM
2C22	L4	1000p	-25%+50%	500V		CM
2C23	L3	20p	+1pF	750V		CN
2C24	M4	1000p	±20%	750V		CM
2C25	M3	100p	±10%	750V		CO
2C26	M3	47p	±5%	750V		CO
2C27	M3	1000p	-25%+50%	500V		CM
2C28	M4	1000p	-25%+50%	500V		CM
2C29	R3	1μF	±20%	35V		CY
2C30	N3	1000p	-25%+50%	500V		CM
2C31	N3	14p	±5%	750V		CO
2C32	N3	1000p	±20%			CM
2VC1	N4				A/SA88935	C
2VT4	L4					VF
2VT5	N3					VF
2D3	N4					DQ
2L5	L3				B/SA88797/22	
2L7	N3				B/SA88797/19	C
2L8	N4	(Two turns of 22 WG wire)			B/SA88797/207	
SKT.5	R4				A97563	C
2X2	L4					XB

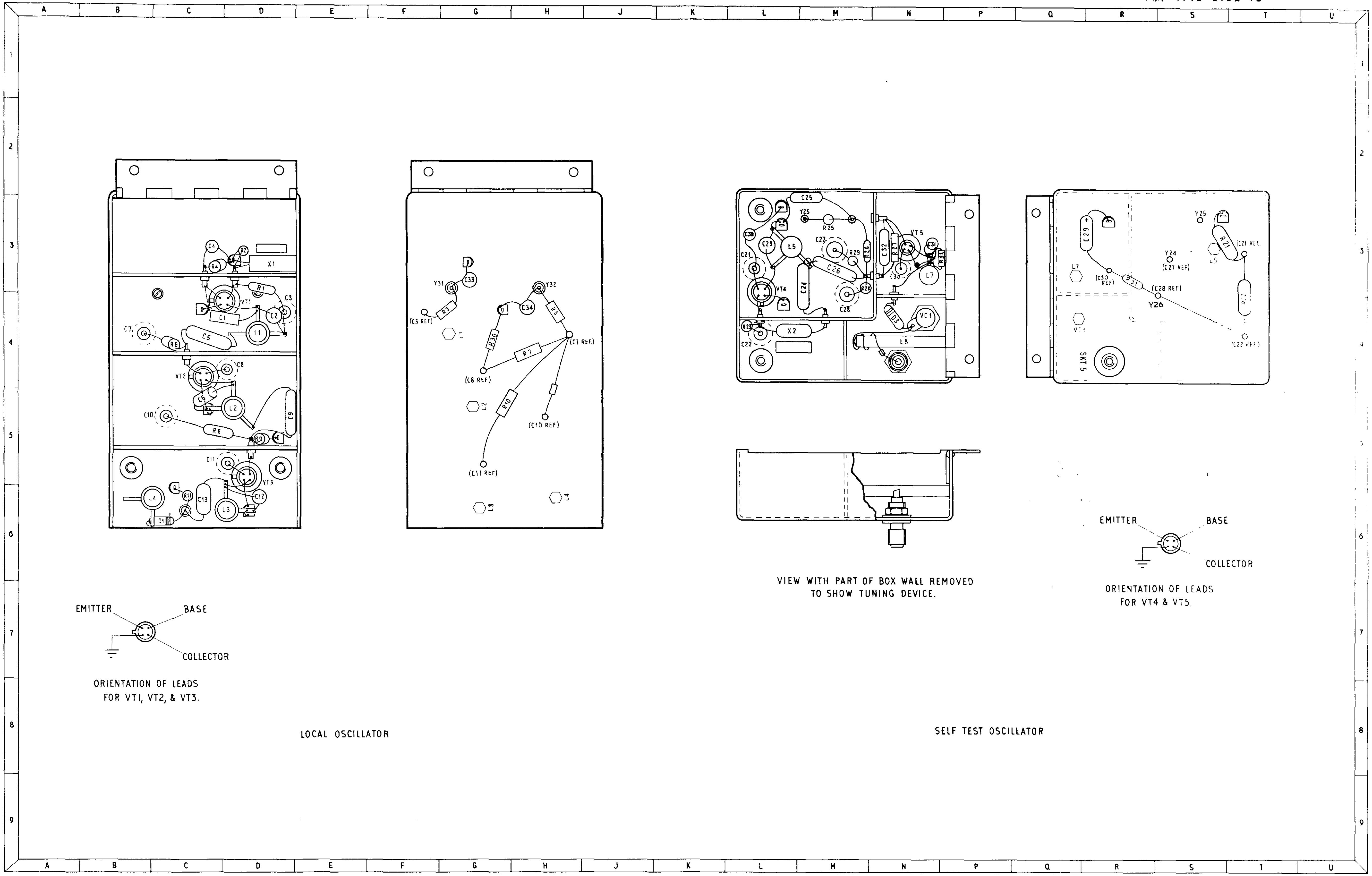


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FIG. 4. LOCAL AND SELF TEST OSCILLATORS.

Fig. 5 I.F. Amplifier

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
5R1	B2	39k	±5%	$\frac{1}{4}$W		RA
5R2	B3	330	±5%	$\frac{1}{4}$W		RA
5R3	B4	270	±5%	$\frac{1}{4}$W		RA
5R4	B4	270	±5%	$\frac{1}{4}$W		RA
5R5	B5	330	±5%	$\frac{1}{4}$W		RA
5R6	B6	330	±5%	$\frac{1}{4}$W		RA
5R7	B7	330	±5%	$\frac{1}{4}$W		RA
5R8	B8	330	±5%	$\frac{1}{4}$W		RA
5R9	B3	2.2k	±5%	$\frac{1}{4}$W		RA
5R10	C3	1.8k	±5%	$\frac{1}{4}$W		RA
5R11	B4	2.2k	±5%	$\frac{1}{4}$W		RA
5R12	C5	2.2k	±5%	$\frac{1}{4}$W		RA
5R13	B6	2.2k	±5%	$\frac{1}{4}$W		RA
5R14	C6	1.5k	±5%	$\frac{1}{4}$W		RA
5R15	B8	2.2k	±5%	$\frac{1}{4}$W		RA
5R16	C8	1.5k	±5%	$\frac{1}{4}$W		RA
5R17	C3	470	±5%	$\frac{1}{4}$W		RA
5R18	C4	470	±5%	$\frac{1}{4}$W		RA
5R19	C6	820	±5%	$\frac{1}{4}$W		RA
5R20	C7	820	±5%	$\frac{1}{4}$W		RA
5R21	G3	51	±5%	$\frac{1}{4}$W		RA
5R22	G5	51	±5%	$\frac{1}{4}$W		RA
5R23	G7	51	±5%	$\frac{1}{4}$W		RA
5R24	G2	51	±5%	$\frac{1}{4}$W		RA
5R25	H4	51	±5%	$\frac{1}{4}$W		RA
5R26	H5	51	±5%	$\frac{1}{4}$W		RA
5R27	H5	51	±5%	$\frac{1}{4}$W		RA
5R28	H6	51	±5%	$\frac{1}{4}$W		RA
5R29	H7	51	±5%	$\frac{1}{4}$W		RA
5R30	H8	51	±5%	$\frac{1}{4}$W		RA
5R31	G9	3.3k	±5%	$\frac{1}{4}$W		RA
5R32	G9	2.2k	±5%	$\frac{1}{4}$W		RA
5R33						
5R34	G3	8.2k	±5%	$\frac{1}{4}$W		RA
5R35	G4	8.2k	±5%	$\frac{1}{4}$W		RA
5R36	G5	8.2k	±5%	$\frac{1}{4}$W		RA
5R37	G6	8.2k	±5%	$\frac{1}{4}$W		RA
5R38	G7	8.2k	±5%	$\frac{1}{4}$W		RA
5R39	G8	8.2k	±5%	$\frac{1}{4}$W		RA
5R40	G3	8.2k	±5%	$\frac{1}{4}$W		RA

Fig. 5 I.F. Amplifier (contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
5R41	D3	3.3k	±5%	¼W		RA
5R42	D2	10k	±5%	¼W		RA
5R43	D4	15k	±5%	¼W		RA
5R44	D6	15k	±5%	¼W		RA
5R45	D7	15k	±5%	¼W		RA
5R46	D3	1.8k	±5%	¼W		RA
5R47	D5	2.7k	±5%	¼W		RA
5R48	D6	1k	±5%	¼W		RA
5R49	K4	51	±5%	¼W		RA
5R50	K6	51	±5%	¼W		RA
5R51	D3	2.2k	±5%	¼W		RA
5R52	D7	2.2k	±5%	¼W		RA
5R53	D6	2.2k	±5%	¼W		RA
5R54	D4	1.5k	±5%	¼W		RA
5R55	D8	18k	±5%	¼W		RA
5R56	D8	820	±5%	¼W		RA
5C1	B2	1000p	-20%+80%	750V		CK
5C2	B2	1000p	-20%+80%	750V		CK
5C3	C3	1000p	-20%+80%	750V		CK
5C4	C4	1000p	-20%+80%	750V		CK
5C5	C5	1000p	-20%+80%	750V		CK
5C6	C6	1u	±20%	35V		CY
5C7	B7	1u	±20%	35V		CY
5C8	B8	1u	±20%	35V		CY
5C9	C8	1u	±20%	35V		CY
5C10	G2	1000p	-20%+80%	750V		CK
5C11	G3	1000p	-20%+80%	750V		CK
5C12	G5	1000p	-20%+80%	750V		CK
5C13	H5	1000p	-20%+80%	750V		CK
5C14	H6	1000p	-20%+80%	750V		CK
5C15	H6	1000p	-20%+80%	750V		CK
5C16	H7	1000p	-20%+80%	750V		CK
5C17	H8	1000p	-20%+80%	750V		CK
5C18	H2	.01u	±20%	250V		CF
5C19	G3	1000p	-20%+80%	750V		CK
5C20	G4	1000p	-20%+80%	750V		CK
5C21	G6	1000p	-20%+80%	750V		CK
5C22	G8	1000p	-20%+80%	750V		CK
5C23	G3	1000p	-20%+80%	750V		CK
5C24	G4	1000p	-20%+80%	750V		CK
5C25	G5	1000p	-20%+80%	750V		CK

Fig. 5 I.F. Amplifier (cont'd)

Cct.Ref	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
5C26	G5	1000p	-20%+80%	750V		CK
5C27	G6	1000p	-20%+80%	750V		CK
5C28	G7	1000p	-20%+80%	750V		CK
5C29	G8	1000p	-20%+80%	750V		CK
5C30	G2	1u	±20%	35V		CY
5C31	H3	1u	±20%	35V		CY
5C32	H5	1u	±20%	35V		CY
5C33	G8	1u	±20%	35V		CY
5C34						
5C35	C6	4.7p	±¼p	750V		CP
5C36	C8	4.7p	±¼p	750V		CP
5C37	C5	4.7p	±¼p	750V		CP
5C38	D4	4.7p	±¼p	750V		CP
5C39	D5	10p	±5%	750V		CP
5C40	D7	4.7p	±¼p	750V		CP
5C41	D3	1u	±20%	35V		CY
5C42	K3	1000p	-20%+80%	750V		CK
5C43	K5	1000p	-20%+80%	750V		CK
5C44	K7	1000p	-20%+80%	750V		CK
5C45						
5C46	G6	1p	±10%	750V		CQ
5C47	G8	1p	±10%	750V		CQ
5C48	G4	1.0u	±20%	35V		CY
5C49	G6	1.0u	±20%	35V		CY
5C50	G7	1.0u	±20%	35V		CY
5VT1	B2					VF
5VT2	B3					VF
5VT3	B3					VF
5VT4	C4					VB
5VT5	B4					VB
5VT6	C5					VB
5VT7	B5					VB
5VT8	C6					VB
5VT9	B6					VB
5VT10	C7					VB
5VT11	B6					VB
5VT12	C7					VB
5VT13	B7					VB
5VT14	C8					VB
5VT15	B8					VB
5VT16	D3					VC
5VT17	D5					VC
5VT18	C7					VC
5VT19	D6					VL

Fig. 5 I.F. Amplifier (contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref. No.	Vendor Code
5D1	C5					DQ
5D2	C7					DQ
5D3	C8					DQ
5D4	D4					DA
5D5	D8					DA
5D6	D2					DA
5L1	B2				B/SA88936/2	C
5L2	B3				B/SA88936/4	C
5L3	B3				B/SA88936/4	C
5L4	B4				B/SA88936/1	C
5L5	B5				B/SA88936/3	C
5L6	B6				B/SA88936/1	C
5L7	B7				B/SA88936/3	C
5L8	B8				B/SA88936/1	C
5L9	B8				B/SA88936/1	C
5L10	L4				KA88112/2	C
5L11	L6				KA88112/2	C
PL4	S1					PA

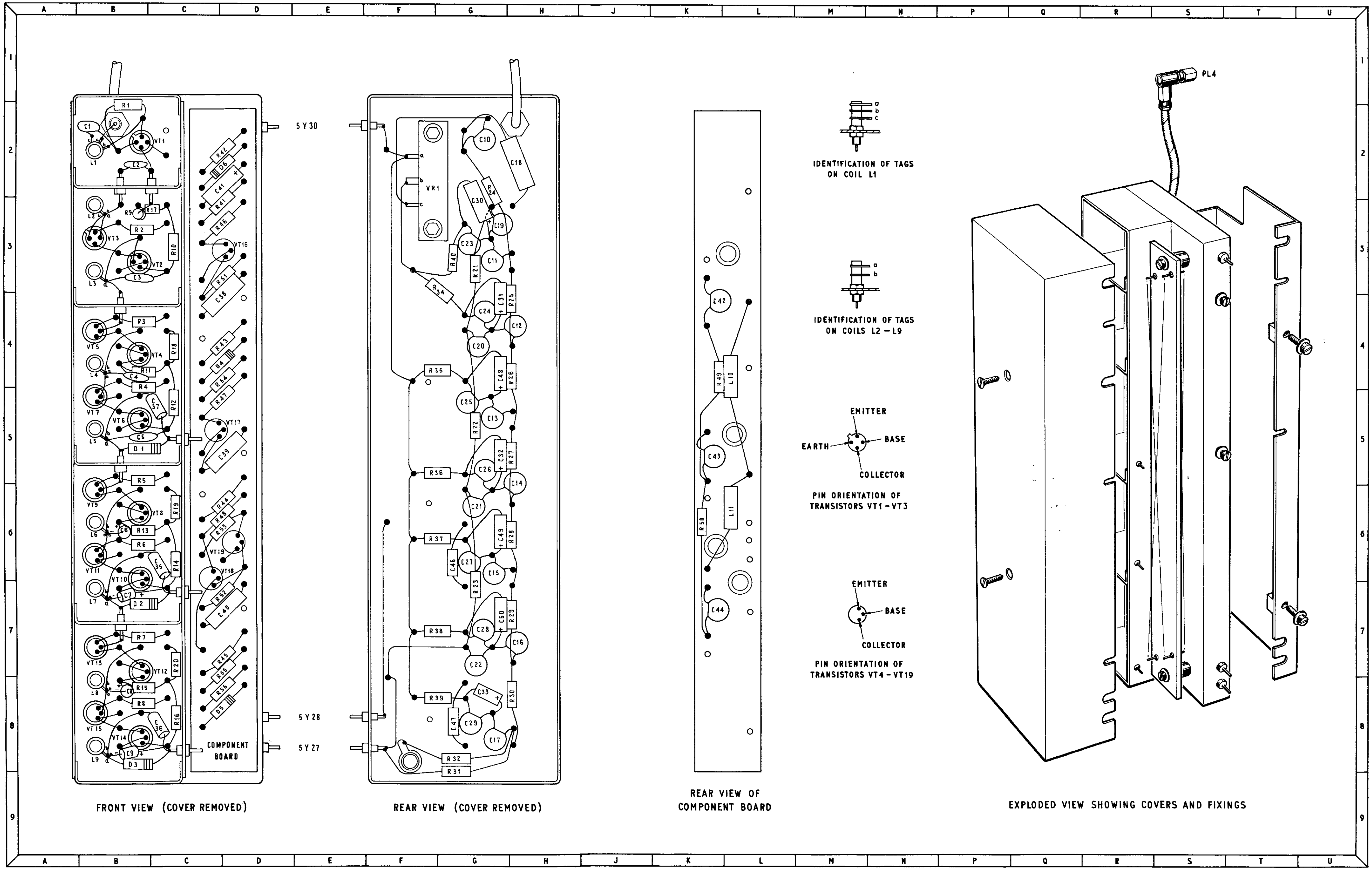

FIG. 5 LOGARITHMIC I.F. AMPLIFIER

Fig. 6 C Filter

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
1R1	G4	56k	±5%	¼W		RA
1R2	H6	22k	±5%	¼W		RA
1R3	H4	56k	±5%	¼W		RA
1R4	H6	22k	±5%	¼W		RA
1R5	H4	56k	±5%	¼W		RA
1R6	J6	22k	±5%	¼W		RA
1R7	J4	56k	±5%	¼W		RA
1R8	J6	22k	±5%	¼W		RA
1R9	J4	56k	±5%	¼W		RA
1R10	J6	22k	±5%	¼W		RA
1R11	K4	56k	±5%	¼W		RA
1R12	K6	22k	±5%	¼W		RA
1R13	L4	56k	±5%	¼W		RA
1R14	L6	22k	±5%	¼W		RA
1R15	L4	56k	±5%	¼W		RA
1R16	L6	22k	±5%	¼W		RA
1R17	M4	56k	±5%	¼W		RA
1R18	M6	22k	±5%	¼W		RA
1R19	M4	56k	±5%	¼W		RA
1R20	M6	22k	±5%	¼W		RA
1R21	N4	56k	±5%	¼W		RA
1R22	N6	22k	±5%	¼W		RA
1R23	N4	56k	±5%	¼W		RA
1R24	N6	22k	±5%	¼W		RA
1R25	P4	56k	±5%	¼W		RA
1R26	P6	22k	±5%	¼W		RA
1C1	G6	0.04u	±20%	250V		CI
1C2	H6	0.04u	±20%	250V		CI
1C3	H6	0.04u	±20%	250V		CI
1C4	J6	0.04u	±20%	250V		CI
1C5	J6	0.04u	±20%	250V		CI
1C6	K6	0.04u	±20%	250V		CI
1C7	K6	0.04u	±20%	250V		CI
1C8	L6	0.04u	±20%	250V		CI
1C9	L6	0.04u	±20%	250V		CI
1C10	M6	0.04u	±20%	250V		CI

Fig. 6 C Filter (contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
1C11	M6	0.04u	±20%	250V		CI
1C12	N6	0.04u	±20%	250V		CI
1C13	N6	0.04u	±20%	250V		CI
1D1	G4					DA
1D2	H4					DA
1D3	H4					DA
1D4	J4					DA
1D5	J4					DA
1D6	K4					DA
1D7	K4					DA
1D8	L4					DA
1D9	L4					DA
1D10	M4					DA
1D11	M4					DA
1D12	N4					DA
1D13	N4					DA

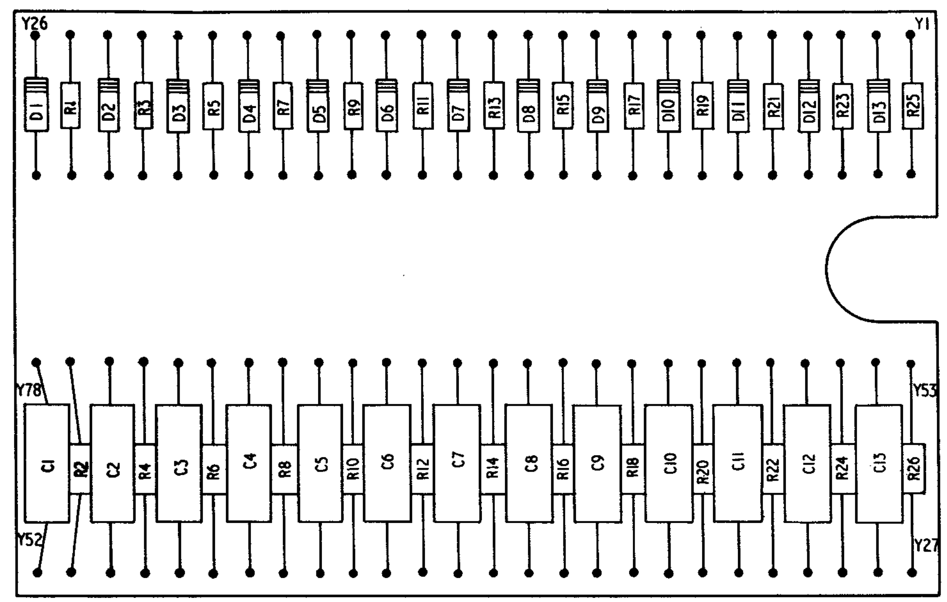

FIG.6 'C' FILTER

Fig. 7 Tacard 7

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
7R1	P4	22k	±5%	¼W		RA
7R2	R4	100k	±5%	¼W		RA
7R3	P4	3.9k	±5%	¼W		RA
7R4	R4	10k	±5%	¼W		RA
7R5	R4	10k	±5%	¼W		RA
7R6	L4	820	±5%	¼W		RA
7R7	R4	3.9k	±5%	¼W		RA
7R8	P5	3.9k	±5%	¼W		RA
7R9	P5	3.3k	±5%	¼W		RA
7R10	R5	10k	±5%	¼W		RA
7R11	R5	2.2k	±5%	¼W		RA
7R12	P5	33k	±5%	¼W		RA
7R13	P5	8.2k	±5%	¼W		RA
7R14	R6	2.7k	±5%	¼W		RA
7R15	R6	470	±5%	¼W		RA
7R16	P6	330	±5%	¼W		RA
7R17	P6	5.6k	±5%	¼W		RA
7R18	R6	1.5k	±5%	¼W		RA
7R19	P6	3.3k	±5%	¼W		RA
7R20	R7	470	±5%	¼W		RA
7R21	P6	2.7	±5%	¼W		RA
7R22	L5	470	±5%	¼W		RA
7R23	N5	2.7k	±5%	¼W		RA
7R24	N5	2.7k	±5%	¼W		RA
7R25	L5	33k	±5%	¼W		RA
7R26	L4	2.2k	±5%	¼W		RA
7R27	N4	1.5k	±5%	¼W		RA
7R28	N4	470	±5%	¼W		RA
7R29	L4	2.2k	±5%	¼W		RA
7R30	N4	8.2k	±5%	¼W		RA
7R31	F4	100k	±5%	¼W		RA
7R32	F4	100k	±5%	¼W		RA
7R33	F4	100k	±5%	¼W		RA
7R34	F4	100k	±5%	¼W		RA
7R35	C5	100k	±5%	¼W		RA
7R36	C5	100k	±5%	¼W		RA

Fig. 7 Tacard 7 (cont'd)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
7R37	C6	470	±5%	¼W		RA
7R38	H4	10k	±5%	¼W		RA
7R39	F4	1.5k	±5%	¼W		RA
7R40	H5	2.7k	±5%	¼W		RA
7R41	H5	10k	±5%	¼W		RA
7R42	F5	2.7k	±5%	¼W		RA
7R43	E4	680	±5%	¼W		RA
7R44	E4	1.5k	±5%	¼W		RA
7R45	F4	680	±5%	¼W		RA
7R46	C6	10k	±5%	¼W		RA
7R47	C6	1.5k	±5%	¼W		RA
7R48	E4	2.7k	±5%	¼W		RA
7R49	C6	2.7k	±5%	¼W		RA
7R50	E4	10k	±5%	¼W		RA
7R51	E5	100k	±5%	¼W		RA
7R53	C5	680	±5%	¼W		RA
7R54	C5	560	±5%	¼W		RA
7R55	E6	27k	±5%	¼W		RA
7R56	E6	33k	±5%	¼W		RA
7C1	P4	.01uF	±20%	250V		CH
7C2	R5	1uF	±20%	35V		CY
7C3						
7C4						
7C5	P5	18pF	±1pF	350V		CR
7C6	P5	.04uF	±20%	250V		CI
7C7	P6	1uF	±20%	35V		CY
7C8	R6	2.2uF	±20%	35V		CAA
7C9	R6	56pF	±2%	350V		CR
7C10	R7	2.2uF	±20%	35V		CAA
7C11	P6	2.2uF	±20%	35V		CAA
7C12	L5	2.2uF	±20%	35V		CAA
7C13	N4	.01uF	±20%	250V		CH
7C14	N4	.01uF	±20%	250V		CH
7C15	C6	1uF	±20%	35V		CY
7C16	H4	.01uF	±20%	250V		CH
7C17	H4	.01uF	±20%	250V		CH
7C18	C7	.01uF	±20%	250V		CH
7C19	H5	2.2uF	±20%	35V		CAA
7C20	E5	.01uF	±20%	250V		CH

Fig. 7 Tacard 7 (contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
7C21	E4	1.0uF	±20%	35V		CY
7C22	F5	2.2uF	±20%	35V		CAA
7C23	P4	2.2uF	±20%	35V		CAA
7RV1	K4	1k			B97454/25	C
7RV2	J4	1k			B97454/25	C
7RV3	C4	1k			B97454/25	C
7RV4	C4	1k			B97454/25	C
7VT1	Q4					VA
7VT2	Q4					VC
7VT3	Q5					VC
7VT4	Q5					VC
7VT5	Q5					VC
7VT6	Q6					VA
7VT7	Q6					VC
7VT8	M5					VC
7VT9	M5					VC
7VT10	M4					VC
7VT11	M4					VL
7VT12	G4					VC
7VT13	G4					VC
7VT14	G5					VL
7VT15	D4					VC
7VT16	D4					VL
7VT17	D5					VC
7VT18	D6					VL
7D1	R5					DA
7D2	L4					DA
7D3	L4					DA
7D4	H4					DA
7D5	H4					DD
7D6	C6					DA
7D7	E5					DA
7D8	R4					DR
7DL1	J6				A97727/4	C
7DL2	J5				A97727/4	C

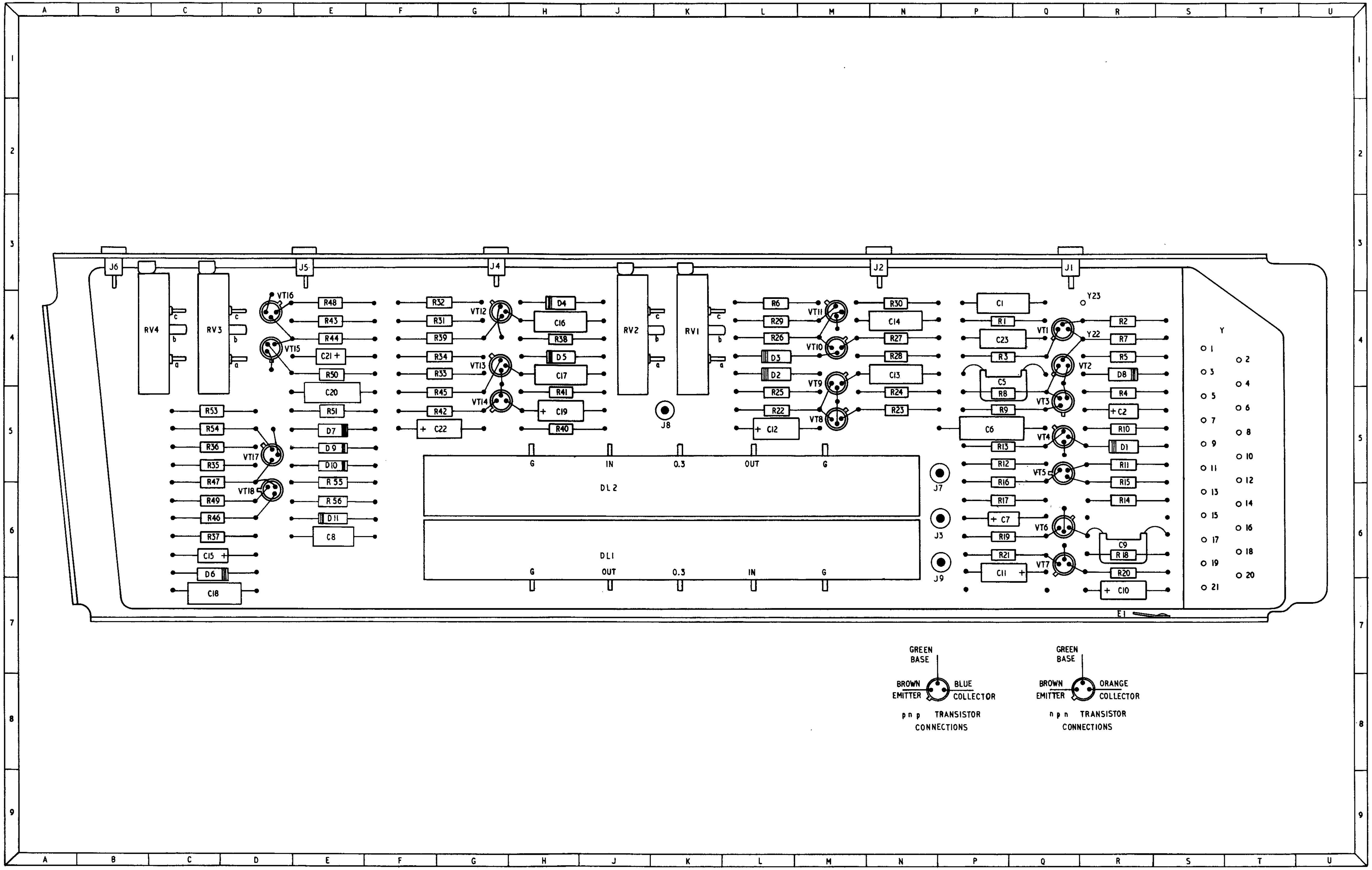

FIG.7 TACARD 7

Fig. 8 Tacard 8

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
8R1	K4	560	±5%	¼W		RA
8R2	H4	4.7k	±5%	¼W		RA
8R3	J4	100k	±5%	¼W		RA
8R4						
8R5	K4	47k	±5%	¼W		RA
8R6	H5	12k	±5%	¼W		RA
8R7	H5	10k	±5%	¼W		RA
8R8	K4	4.7k	±5%	¼W		RA
8R9	K5	1.8k	±5%	¼W		RA
8R10	J5	1.5k	±5%	¼W		RA
8R11	D6	270	±5%	¼W		RA
8R12	L5	2.2k	±5%	¼W		RA
8R13	N5	4.7k	±5%	¼W		RA
8R14	N6	1.8k	±5%	¼W		RA
8R15	L5	2.2k	±5%	¼W		RA
8R16	K5	10k	±5%	¼W		RA
8R17	K6	1.2k	±5%	¼W		RA
8R18	G6	2.2k	±5%	¼W		RA
8R19	G5	1.8k	±5%	¼W		RA
8R20	E5	47k	±5%	¼W		RA
8R21	E5	470	±5%	¼W		RA
8R22	G5	470	±5%	¼W		RA
8R23	E5	470	±5%	¼W		RA
8R24	G4	10k	±5%	¼W		RA
8R25	E4	10k	±5%	¼W		RA
8R26	E4	6.8k	±5%	¼W		RA
8R27	G4	680	±5%	¼W		RA
8R28	G4	10k	±5%	¼W		RA
8R29	E4	5.6k	±5%	¼W		RA
8R30	D3	5.6k	±5%	¼W		RA
8R31	D4	22k	±5%	¼W		RA
8R32	D4	220k	±10%	.1W		RC
8R33	D5	27k	±5%	¼W		RA
8R34	D4	100k	±10%	.1W		RA
8R35	D5	2.2k	±5%	¼W		RA

Fig. 8 Tacard 8 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
8R36	D5	6.8k	±5%	¼W		R A
8R37	C5	3.3k	±5%	¼W		R A
8R38	C6	15k	±5%	¼W		R A
8R39	D6	6.8k	±5%	¼W		R A
8R40	F3	22k	±5%	¼W		R A
8R41	G4	82k	±5%	¼W		R A
8R42	R4	470	±5%	¼W		R A
8R43	Q4	39k	±5%	¼W		R A
8R44	Q4	470	±5%	¼W		R A
8R45	R6	470	±5%	¼W		R A
8R46	Q5	39k	±5%	¼W		R A
8R47	Q6	470	±5%	¼W		R A
8R48	N5	470	±5%	¼W		R A
8R49	L5	39k	±5%	¼W		R A
8R50	L5	470	±5%	¼W		R A
8R51	N5	10k	±5%	¼W		R A
8R52	R4	4.7k	±5%	¼W		R A
8R53	R4	470	±5%	¼W		R A
8R54	Q4	6.8k	±5%	¼W		R A
8R55	Q4	6.8k	±5%	¼W		R A
8R56	R5	470	±5%	¼W		R A
8R57	Q5	6.8k	±5%	¼W		R A
8R58	Q5	6.8k	±5%	¼W		R A
8R59	N4	470	±5%	¼W		R A
8R60	L4	6.8k	±5%	¼W		R A
8R61	L4	6.8k	±5%	¼W		R A
8R62	L4	51	±5%	¼W		R A
8R63	L4	330	±5%	¼W		R A
8R64	R6	51	±5%	¼W		R A
8C1	L4	1500pF	±5%	350V		C R
8C2	K4	.01uF	±20%	250V		C H
8C3	H4	1.0uF	±20%	35V		C Y
8C4	K5	.04uF	±20%	250V		C I
8C5	G4	25pF	±5%	350V		C R

Fig. 8 Tacard 8 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
8C6	K5	47pF	±5%	350V		CR
8C7	D6	2.2uF	±20%	35V		CAA
8C8	N5	1.0uF	±20%	35V		CY
8C9	K5	1.0uF	±20%	35V		CY
8C10	G5	.04uF	±20%	250V		CH
8C11	G5	2.2uF	±20%	35V		CAA
8C12	E4	.01uF	±20%	250V		CH
8C13	G4	1.0uF	±20%	35V		CY
8C14	D4	.005uF	±20%	250V		CH
8C15	D5	82pF	±2%	350V		CR
8C16	B5	2000pF	±20%	750V		CV
8C17	D6	.04uF	±20%	250V		CI
8C27	E4	.01uF	±20%	250V		CH
8C28	R4	.01uF	±20%	250V		CH
8C29	R5	.01uF	±20%	250V		CH
8C30	Q5	.04uF	±20%	250V		CI
8C31	Q6	.04uF	±20%	250V		CI
8C32	N5	.01uF	±20%	250V		CH
8C33	R6	.04uF	±20%	250V		CI
8C34	Q4	2.2uF	±20%	35V		CAA
8C35	Q5	2.2uF	±20%	35V		CAA
8C36	R5	2.2uF	±20%	35V		CAA
8C37	L4	2.2uF	±20%	35V		CAA
8C38	N4	10uF	±20%	35V		CDD
8C39	N4	10uF	±20%	35V		CDD
8C40	Q6	10uF	±20%	35V		CDD
8C41	R7	10uF	±20%	35V		CDD
8RV1	C4	10k			B97454/22	C
8VT1	J4					VC
8VT2	J4					VC
8VT3	J5					VC
8VT4	J5					VC
8VT5	M5					VC

Fig.8 Tacard 8 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
8VT6	M5					VL
8VT7	J5					VA
8VT8	F5					VC
8VT9	F4					VC
8VT10	F4					VC
8VT11	F4					VL
8VT12	C4					VC
8VT13	C5					VC
8VT14	Q4					VL
8VT15	Q4					VC
8VT16	Q5					VL
8VT17	Q5					VC
8VT18	M5					VL
8VT19	M4					VC
8D1	K4					DA
8D2	E5					DA
8D3	G5					DA
8D4	E5					DA
8D5	E4					DA
8D6	D4					DA
8D7	D4					DA
8D8	D5					DA
8D9	R4					DR
8D10	R4					DA
8D11	Q4					DA
8D12	R5					DR
8D13	R6					DA
8D14	Q6					DA
8D15	N5					DR
8D16	N5					DA
8D17	L5					DA
8D18	D6					DA
8DL1	K6				A97727/6	C

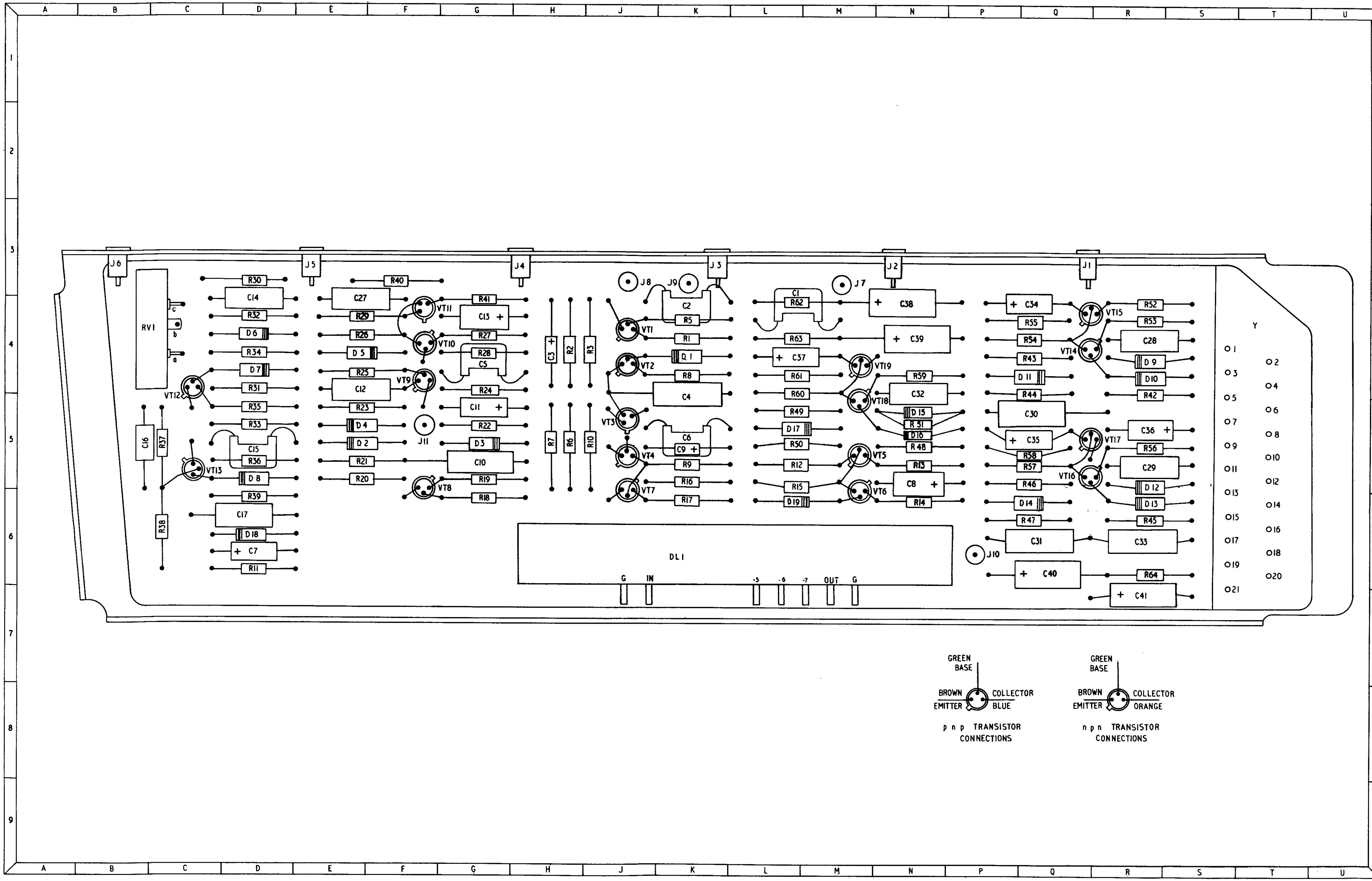

FIG.8 TACARD 8

Fig. 9 Tacard 9

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
9R1	Q5	82k	±5%	¼W		RA
9R2	Q6	10k	±5%	¼W		RA
9R3	Q6	12k	±5%	¼W		RA
9R4	D6	1k	±5%	¼W		RA
9R5	M4	12k	±5%	¼W		RA
9R6	L4	270	±5%	¼W		RA
9R7	L5	12k	±5%	¼W		RA
9R8	L4	39k	±5%	¼W		RA
9R9	L4	1.8k	±5%	¼W		RA
9R10	L4	4.7k	±5%	¼W		RA
9R11	L5	10k	±5%	¼W		RA
9R12	J5	82K	±5%	¼W		RA
9R13	L5	4.7k	±5%	¼W		RA
9R14	J5	82k	±5%	¼W		RA
9R15	L6	10k	±5%	¼W		RA
9R16	J6	10k	±5%	¼W		RA
9R17	P5	10k	±5%	¼W		RA
9R18	P5	1.8k	±5%	¼W		RA
9R19	M5	1.5k	±5%	¼W		RA
9R20	M5	33k	±5%	¼W		RA
9R21	M5	12k	±5%	¼W		RA
9R22	M5	10k	±5%	¼W		RA
9R23	M6	680	±5%	¼W		RA
9R24	P5	2.2k	±5%	¼W		RA
9R25	P6	18k	±5%	¼W		RA
9R26	P6	27k	±5%	¼W		RA
9R27	G5	1.8k	±5%	¼W		RA
9R28	G6	470	±5%	¼W		RA
9R29	J4	47k	±5%	¼W		RA
9R30	G6	470	±5%	¼W		RA
9R31	G5	470	±5%	¼W		RA
9R32	E6	330	±5%	¼W		RA
9R33	G5	6.8k	±5%	¼W		RA
9R34	G4	470	±5%	¼W		RA
9R35	G4	10k	± 5%	¼W		RA

Fig. 9 Tacard 9 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
9R36	F3	5.6k	±5%	¼W		RA
9R37	F4	22k	±5%	¼W		RA
9R38	D4	82k	±5%	¼W		RA
9R39	F4	10k	±5%	¼W		RA
9R40	D4	33k	±5%	¼W		RA
9R41	D5	47k	±5%	¼W		RA
9R42	F4	220k	±5%	.1W		RG
9R43	F4	220k	±5%	.1W		RG
9R44	F4	2.2k	±5%	¼W		RA
9R45	F5	3.3k	±5%	¼W		RA
9R46	D6	1.2k	±5%	¼W		RA
9R47	F5	22k	±5%	¼W		RA
9R48	D5	6.8k	±5%	¼W		RA
9R49	L6	12k	±5%	¼W		RA
9R50	F6	5.6k	±5%	¼W		RA
9R51	Q5	1k	±5%	¼W		RA
9R52	Q6	27	±10%	.1W		RG
9C1	R5	.04uF	±20%	250V		CI
9C2	P4	.04uF	±20%	250V		CI
9C3	P6	2.2uF	±20%	35V		CAA
9C4	F6	2.2uF	±20%	35V		CAA
9C5	M4	2.2uF	±20%	35V		CAA
9C6	L5	1500pF	±5%	350V		CR
9C7	K6	.04uF	±20%	250V		CI
9C8	K5	.04uF	± 20%	250V		CI
9C9	R6	.04uF	±20%	250V		CI
9C10	P5	47pF	±5%	350V		CR
9C11	M4	25pF	±5%	350V		CR
9C12	M5	1.0uF	±20%	35V		CY
9C13	M6	.04uF	±20%	250V		CI
9C14	G6	.04uF	±20%	250V		CI
9C15	G5	.04uF	±20%	250V		CI
9C16	G5	.01uF	±20%	250V		CH
9C17	G4	1.0uF	±20%	35V		CY
9C18	D6	0.04uF	±20%	250V		CI
9C41	M4	.005uF	±20%	250V		CH
9C42	J5	1.0uF	±20%	35V		CY

Fig. 9 Tacard 9 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
9C43	J3	1.0uF	±20%	35V		CY
9C44						
9C45	G4	.01uF	±20%	250V		CH
9C46	D4	.005uF	±20%	250V		CH
9C47	D5	1000pF	±5%	350V		CR
9C48	F5	2000pF	±20%	750V		CM
9C49	F5	1.0uF	±20%	35V		CY
9C50	Q6	47uF	±20%	35V		CLL
9RV1	R4	10k			B97454/22	C
9RV2	Q4	2.5k			B97454/24	C
9RV3	C4	10k			B97454/22	C
9VT1	R5					VC
9VT2	E6					VL
9VT3	N4					VC
9VT4	K5					VC
9VT5	K4					VC
9VT6	K5					VC
9VT7	K6					VC
9VT8	N5					VC
9VT9	N5					VA
9VT10	H5					VC
9VT12	H4					VC
9VT13	H4					VL
9VT14	E4					VC
9VT15	E5					VC
9D1	L5					DA
9D2	J5					DA
9D3	M6					DA
9D4	J5					DA
9D5	J4					DA
9D6	J4					DR
9D7	D4					DA
9D8	D4					DA
9D9	D5					DA
9D10	D5					DA
9D11	F5					DA
9DL1	H6				A97727/5	C

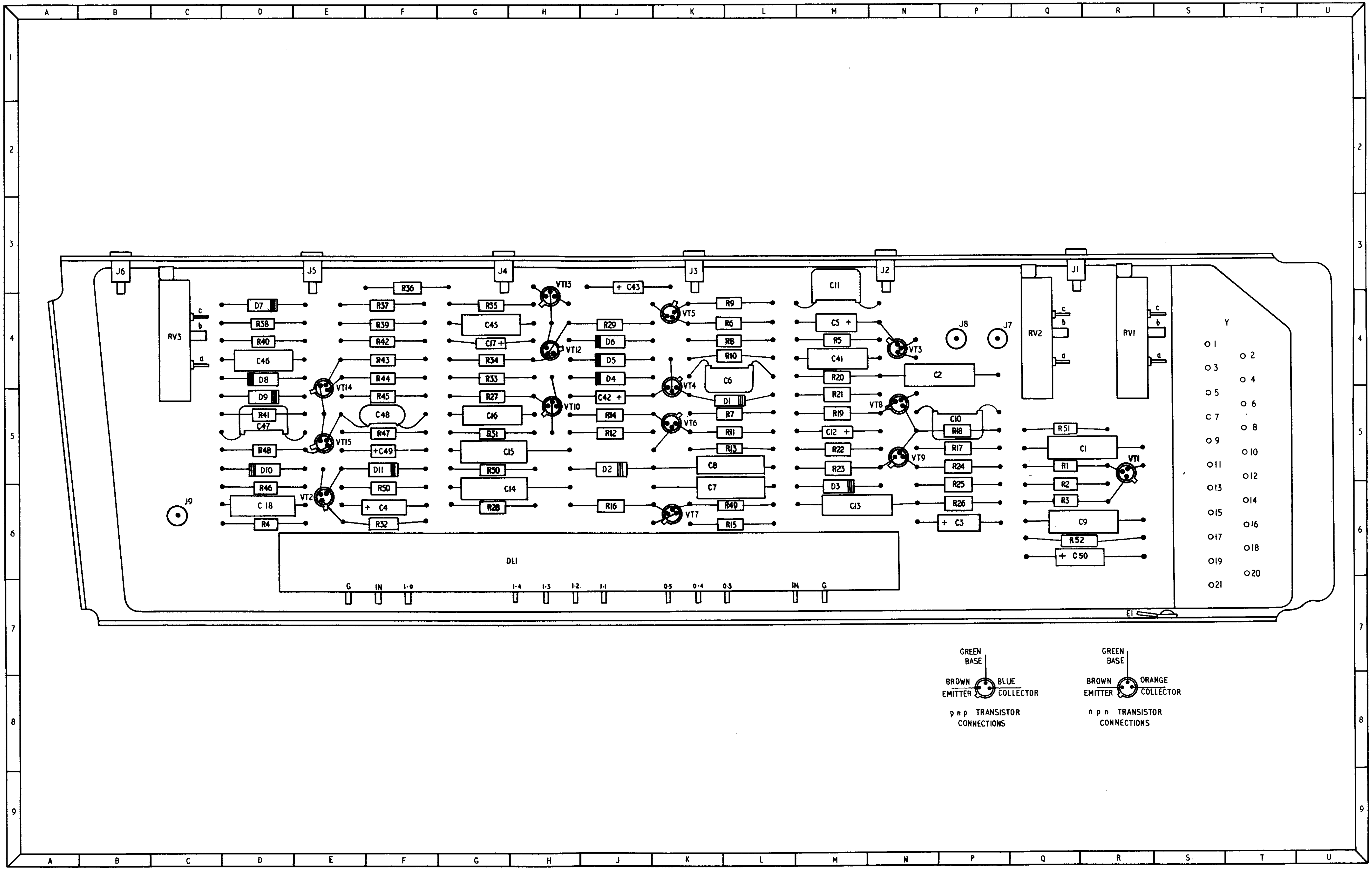

FIG.9 TACARD 9

Fig. 10 Tacard 10

Cct. Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
10R1	D4	220k	±5%	0.1W		RG
10R2	D4	220k	±5%	0.1W		RG
10R3	F4	47K	±5%	$\frac{1}{4}$W		RA
10R4	F3	2.2k	±5%	$\frac{1}{4}$W		RA
10R5	F4	1.5k	±5%	$\frac{1}{4}$W		RA
10R6	F4	18k	±5%	$\frac{1}{4}$W		RA
10R7	D5	1.2k	±5%	$\frac{1}{4}$W		RA
10R8	F5	4.7k	±5%	$\frac{1}{4}$W		RA
10R9	F5	1k	±5%	$\frac{1}{4}$W		RA
10R10	F5	2.2k	±5%	$\frac{1}{4}$W		RA
10R11	F6	12k	±5%	$\frac{1}{4}$W		RA
10R12	N6	100k	±5%	$\frac{1}{4}$W		RA
10R13	F5	4.7k	±5%	$\frac{1}{4}$W		RA
10R14	D6	47k	±5%	$\frac{1}{4}$W		RA
10R15	N4	18k	±5%	$\frac{1}{4}$W		RA
10R16	G7	4.7k	±5%	$\frac{1}{4}$W		RA
10R17	J6	220	±5%	$\frac{1}{4}$W		RA
10R18	J6	56k	±5%	$\frac{1}{4}$W		RA
10R19	J6	10k	±5%	$\frac{1}{4}$W		RA
10R20	J5	2.2k	±5%	$\frac{1}{4}$W		RA
10R21	D6	2.2k	±5%	$\frac{1}{4}$W		RA
10R22	G4	10k	±5%	$\frac{1}{4}$W		RA
10R23	F6	100k	±5%	$\frac{1}{4}$W		RA
10R24	G4	12k	±5%	$\frac{1}{4}$W		RA
10R25	G4	4.7k	±5%	$\frac{1}{4}$W		RA
10R26	K4	2.2k	±5%	$\frac{1}{4}$W		RA
10R27	G5	82k	±5%	$\frac{1}{4}$W		RB
10R28	K5	100k	±5%	$\frac{1}{4}$W		RA
10R29	J5	100k	±5%	$\frac{1}{4}$W		RA
10R30	K4	10k	±5%	$\frac{1}{4}$W		RA
10R31	G5	27k	±5%	$\frac{1}{4}$W		RA
10R32	K5	10k	±5%	$\frac{1}{4}$W		RA
10R33	G4	27k	±5%	$\frac{1}{4}$W		RA
10R34	M5	220k	±5%	0.1W		RG
10R35	M5	220k	±5%	0.1W		RG

Fig. 10 Tacard 10 (contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
10VT11	L7					VC
10VT12	Q6					VM
10VT13	P6					VC
10VT14	P5					VC
10VT15	T4					VH
10VT16	P4					VM
10VT17	P4					VC
10D1	D4					DA
10D2	F4					DA
10D3	D5					DA
10D4	F5					DA
10D5	D5					DA
10D6	D6					DA
10D7	J7					DA
10D8	J6					DA
10D9	D6					DA
10D10	D6					DA
10D11	F6					DO
10D12	D7					DA
10D13	K5					DA
10D14	K5					DA
10D15	M5					DA
10D16	M6					DA
10D17	K6					DA
10D18	G5					DP
10D19	N6					DL
10D20	N6					DA
10D21	N6					DA
10D22	N5					DF
10D23	D3					DA
10D24	F5					DA
10D25	S5					DA
10D26	S5					DA
10D27	S5					DA
10D28	N4					DF
10D29	N4					DF
◀ 10D31	S5	16V Zener			BZY88	▶

Fig.10 Tacard 10 (Contd.)

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
10C11	F7	.01uF	±20%	250V		CI
10C12	P7	10uF	±20%	35V		CDD
10C13	K5	1.0uF	±20%	35V		CY
10C14	K5	2.2uF	±20%	35V		CAA
10C15	M5	2000pF	±10%	750V		CM
10C16	K6	2000pF	±10%	750V		CM
10C17	M6	.01uF	±20%	250V		CI
10C18	S6	12uF	-20% +50%	70V		CV
10C19	N6	1.0uF	±20%	35V		CY
10C20	Q6	2.2uF	±20%	35V		CAA
10C21	N5	140uF	±20%	30V		CU
10C22						
10C23	D6	.04uF	±20%	250V		CI
10C24	J6	.04uF	±20%	250V		CI
10C25	K4	.04uF	±20%	250V		CI
10C26	S5	.04uF	±20%	250V		CI
10C27	Q4	140uF	±20%	30V		CU
10C29	S5	.02uF	±20%	250V		
10RV1	R4	10k			B97454/22	C
10RV2	H4	10k			B97454/22	C
10RV3	M4	10k			B97454/22	C
10RV4	J4	10k			B97454/22	C
10RV5	S4	10k			B97454/22	C
10VT1	E4					VL
10VT2	E5					VI
10VT3	E5					VD
10VT4	H6					VC
10VT5	H5					VC
10VT6	H5					VC
10VT7	E7					VC
10VT8	L5					VC
10VT9	L6					VM
10VT10	L6					VM

Fig. 10 Tacard 10 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
10VT11	L7					VC
10VT12	Q6					VM
10VT13	P6					VC
10VT14	P5					VC
10VT15	T4					VH
10VT16	P4					VM
10VT17	P4					VC
10D1	D4					DA
10D2	F4					DA
10D3	D5					DA
10D4	F5					DA
10D5	D5					DA
10D6	D6					DA
10D7	J7					DA
10D8	J6					DA
10D9	D6					DA
10D10	D6					DA
10D11	F6					DO
10D12	D7					DA
10D13	K5					DA
10D14	K5					DA
10D15	M5					DA
10D16	M6					DA
10D17	K6					DA
10D18	G5					DP
10D19	N6					DL
10D20	N6					DA
10D21	N6					DA
10D22	N5					DF
10D23	D3					DA
10D24	F5					DA
10D25	S5					DA
10D26	S5					DA
10D27	S5					DA
10D28	N4					DF
10D29	N4					DF
RL13 10D31	S5	16V	Zener	BZY88		

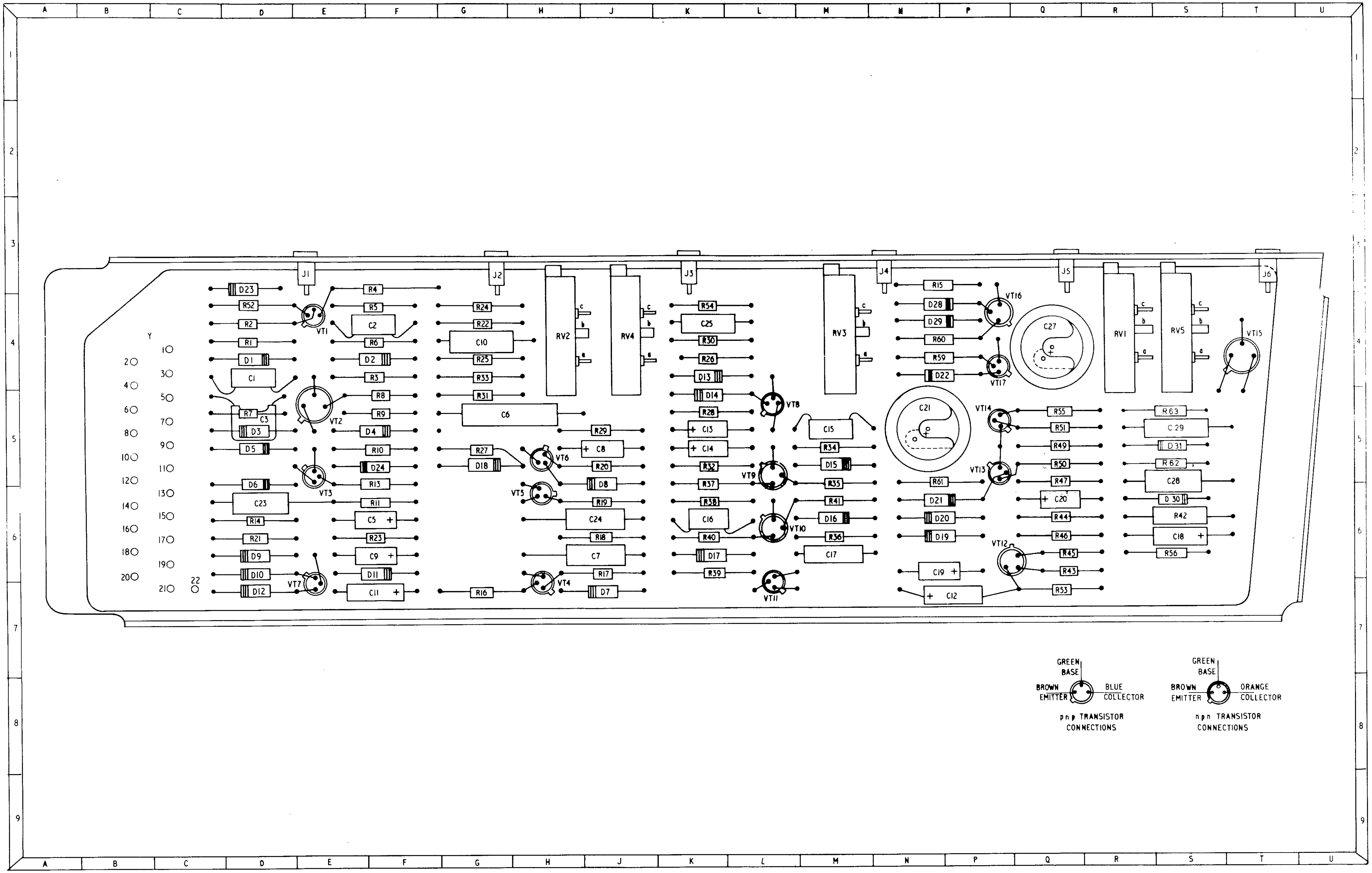

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FIG. 10 TACARD 10

Fig. 11 Tacard 11

Cct.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
11R1	T6	470	±5%	¼W		RA
11R2	T6	1.5k	±5%	¼W		RA
11R3	S6	390	±5%	¼W		RA
11R4	S6	1.5k	±5%	¼W		RA
11R5	S6	390	±5%	¼W		RA
11R6	S6	1.5k	±5%	¼W		RA
11R7	R6	270	±5%	¼W		RA
11R8	R6	1.5k	±5%	¼W		RA
11R9	R6	270	±5%	¼W		RA
11R10	R6	1.8k	±5%	¼W		RA
11R11	Q6	220	±5%	¼W		RA
11R12	Q6	1.8k	±5%	¼W		RA
11R13	Q6	180	±5%	¼W		RA
11R14	Q6	1.8k	±5%	¼W		RA
11R15	P6	180	±5%	¼W		RA
11R16	P6	1.8k	±5%	¼W		RA
11R17	P6	150	±5%	¼W		RA
11R18	N6	2.2k	±5%	¼W		RA
11R19	P6	120	±5%	¼W		RA
11R20	N6	2.2k	±5%	¼W		RA
11R21	N6	82	±5%	¼W		RA
11R22	N6	2.2k	±5%	¼W		RA
11R23	M6	68	±5%	¼W		RA
11R24	M6	2.2k	±5%	¼W		RA
11R25	T6	56k	±5%	¼W		RA
11R26	T5	56k	±5%	¼W		RA
11R27						
11R28	H6	56k	±5%	¼W		RA
11R29	G4	56k	±5%	¼W		RA
11R30	G5	56k	±5%	¼W		RA
11R31	S4	56k	±5%	¼W		RA
11R32	S5	56k	±5%	¼W		RA
11R33						
11R34	G6	56k	±5%	¼W		RA
11R35	G4	56k	±5%	¼W		RA

Fig.11 Tacard 11 (contd.)

Cct.Ref	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
11R36	G5	56k	±5%	¼W		RA
11R37	S4	56k	±5%	¼W		RA
11R38	S5	56k	±5%	¼W		RA
11R39						
11R40	G6	56k	±5%	¼W		RA
11R41	F4	56k	±5%	¼W		RA
11R42	F5	56k	±5%	¼W		RA
11R43	R4	56k	±5%	¼W		RA
11R44	R5	56k	±5%	¼W		RA
11R45						
11R46	F6	56k	±5%	¼W		RA
11R47	F4	56k	±5%	¼W		RA
11R48	F5	56k	±5%	¼W		RA
11R49	R4	56k	±5%	¼W		RA
11R50	R5	56k	±5%	¼W		RA
11R51						
11R52	F6	56k	±5%	¼W		RA
11R53	E4	56k	±5%	¼W		RA
11R54	E5	56k	±5%	¼W		RA
11R55	Q4	56k	±5%	¼W		RA
11R56	Q5	56k	±5%	¼W		RA
11R57						
11R58	E6	56k	±5%	¼W		RA
11R59	E4	56k	±5%	¼W		RA
11R60	E5	56k	±5%	¼W		RA
11R61	Q4	56k	±5%	¼W		RA
11R62	Q5	56k	±5%	¼W		RA
11R63						
11R64	E6	56k	±5%	¼W		RA
11R65	D4	56k	±5%	¼W		RA
11R66	D5	56k	±5%	¼W		RA
11R67	D4	56k	±5%	¼W		RA
11R68	P5	56k	±5%	¼W		RA
11R69						
11R70	D6	56k	±5%	¼W		RA

Fig.11 Tacard 11 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
11R71	D4	56k	±5%	¼W		RA
11R72	D5	56k	±5%	¼W		RA
11R73	P4	56k	±5%	¼W		RA
11R74	P5	56k	±5%	¼W		RA
11R75						
11R76	D6	56k	±5%	¼W		RA
11R77	C4	56k	±5%	¼W		RA
11R78	C5	56k	±5%	¼W		RA
11R79	N4	56k	±5%	¼W		RA
11R80	N5	56k	±5%	¼W		RA
11R81						
11R82	C6	56k	±5%	¼W		RA
11R83	C4	56k	±5%	¼W		RA
11R84	C5	56k	±5%	¼W		RA
11R85	N4	56k	±5%	¼W		RA
11R86	N5	56k	±5%	¼W		RA
11R87						
11R88	C6	56k	±5%	¼W		RA
11R89	B4	56k	±5%	¼W		RA
11R90	B5	56k	±5%	¼W		RA
11R91	M4	56k	±5%	¼W		RA
11R92	M5	56k	±5%	¼W		RA
11R93						
11R94	H6	56k	±5%	¼W		RA
11R95	H4	56k	±5%	¼W		RA
11R96	H5	56k	±5%	¼W		RA
11R97	M4	120k	±5%	¼W		RA
11R98	L4	680	±5%	¼W		RA
11R98	J6	1k	±5%	¼W		RA
11R100	L6	820	±5%	¼W		RA
11R101	L5	4.7k	±5%	¼W		RA
11R102	L5	22k	±5%	¼W		RA
11R103	J6	22k	±5%	¼W		RA
11R104	J4	22k	±5%	¼W		RA
11R105	L4	22k	±5%	¼W		RA

Fig.11 Tacard 11 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
11R106	L5	1k	±5%	¼W		RA
11R107	J6	1k	±5%	¼W		RA
11R108	J4	1k	±5%	¼W		RA
11R109	L5	3.3k	±5%	¼W		RA
11R110	J5	8.2k	±5%	¼W		RA
11R111	L7	8.2k	±5%	¼W		RA
11R112	L4	8.2k	±5%	¼W		RA
11R113	J5	3.3k	±5%	¼W		RA
11R114	L6	3.3k	±5%	¼W		RA
11R115	L4	3.3k	±5%	¼W		RA
11R116						
11R117	L5	22k	±5%	¼W		RA
11R118	J6	22k	±5%	¼W		RA
11R119	J4	22k	±5%	¼W		RA
11R120						
11R121	J4	2.2k	±5%	¼W		RA
11R122	L5	1k	±5%	¼W		RA
11R123	J7	1k	±5%	¼W		RA
11R124	J4	1k	±5%	¼W		RA
11R125	L6	220	±5%	¼W		RA
11R126	J3	47	±5%	.1W		RG
11R127	M6	1.8k	±5%	¼W		RA
11R128	J6	56k	±5%	¼W		RA
11R129	H5	56k	±5%	¼W		RA
11R130	H4	56k	±5%	¼W		RA
11C1	T4	.005uF	±20%	250V		CH
11C2	H6	.005uF	±20%	250V		CH
11C3	H4	.005uF	±20%	250V		CH
11C4	S4	.005uF	±20%	250V		CH
11C5	G6	.005uF	±20%	250V		CH
11C6	G4	.005uF	±20%	250V		CH
11C7	S4	.005uF	±20%	250V		CH
11C8	G6	.005uF	±20%	250V		CH
11C9	G4	.005uF	±20%	250V		CH
11C10	R4	.005uF	±20%	250V		CH

Fig. 11 Tacard 11 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref. No.	Vendor Code
11C11	F6	.005µF	±20%	250V		CH
11C12	F4	.005µF	±20%	250V		CH
11C13	R4	.005µF	±20%	250V		CH
11C14	F6	.005µF	±20%	250V		CH
11C15	F4	.005µF	±20%	250V		CH
11C16	Q4	.005µF	±20%	250V		CH
11C17	E6	.005µF	±20%	250V		CH
11C18	E4	.005µF	±20%	250V		CH
11C19	Q4	.005µF	±20%	250V		CH
11C20	E6	.005µF	±20%	250V		CH
11C21	E4	.005µF	±20%	250V		CH
11C22	P4	.005µF	±20%	250V		CH
11C23	D6	.005µF	±20%	250V		CH
11C24	D4	.005µF	±20%	250V		CH
11C25	P4	.005µF	±20%	250V		CH
11C26	D6	.005µF	±20%	250V		CH
11C27	D4	.005µF	±20%	250V		CH
11C28	N4	.005µF	±20%	250V		CH
11C29	C6	.005µF	±20%	250V		CH
11C30	C4	.005µF	±20%	250V		CH
11C31	N4	.005µF	±20%	250V		CH
11C32	B6	.005µF	±20%	250V		CH
11C33	B4	.005µF	±20%	250V		CH
11C34	M4	.005µF	±20%	250V		CH
11C35	H6	.005µF	±20%	250V		CH
11C36	H4	.005µF	±20%	250V		CH
11C37	M4	.005µF	±20%	250V		CH
11C38						
11C39						
11C40						
11C41						
11C42						
11C43						
11C44						
11C45	L3	2.2µF	±20%	35V		CAA

Fig.11 Tacard 11 (Contd.)

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
11C46	H6	.005uF	±20%	250V		CH
11C47	H4	.005uF	±20%	250V		CH
11VT1	T6					VC
11VT2	S6					VC
11VT3	S6					VC
11VT4	R6					VC
11VT5	R6					VC
11VT6	Q6					VC
11VT7	Q6					VC
11VT8	P6					VC
11VT9	P6					VC
11VT10	N6					VC
11VT11	N6					VC
11VT12	M6					VC
11VT13	K5					VD
11VT14	K7					VD
11VT15	K4					VD
11VT16	K5					VD
11VT17	K6					VD
11VT18	K4					VD
11VT19	K5					VD
11VT20	M6					VC
11D1	T5					DA
11D2	H6					DA
11D3	H5					DA
11D4	S5					DA
11D5	G6					DA
11D6	G5					DA
11D7	S5					DA
11D8	G6					DA
11D9	F5					DA
11D10	R5					DA

Fig. 11 Tacard 11 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
11D11	F5					DA
11D12	F5					DA
11D13	R5					DA
11D14	F6					DA
11D15	E5					DA
11D16	Q5					DA
11D17	E6					DA
11D18	E5					DA
11D19	Q5					DA
11D20	E6					DA
11D21	D5					DA
11D22	P5					DA
11D23	D6					DA
11D24	D5					DA
11D25	P5					DA
11D26	D6					DA
11D27	D5					DA
11D28	N5					DA
11D29	D6					DA
11D30	C5					DA
11D31	M5					DA
11D32	C6					DA
11D33	C5					DA
11D34	M5					DA
11D35	H6					DA
11D36	H5					DA
11D37	K6					DA
11D39	M4					DA
11D40	K6					DA
11D41	K5					DK
11D42	K5					DA
11D43	K6					DA
11D44	L6					DA
11D45	L6					DA

Fig.11 Tacard 11 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
11D46	L4					DA
11D47	L4					DA
11D48	J6					DA
11D49	J5					DA

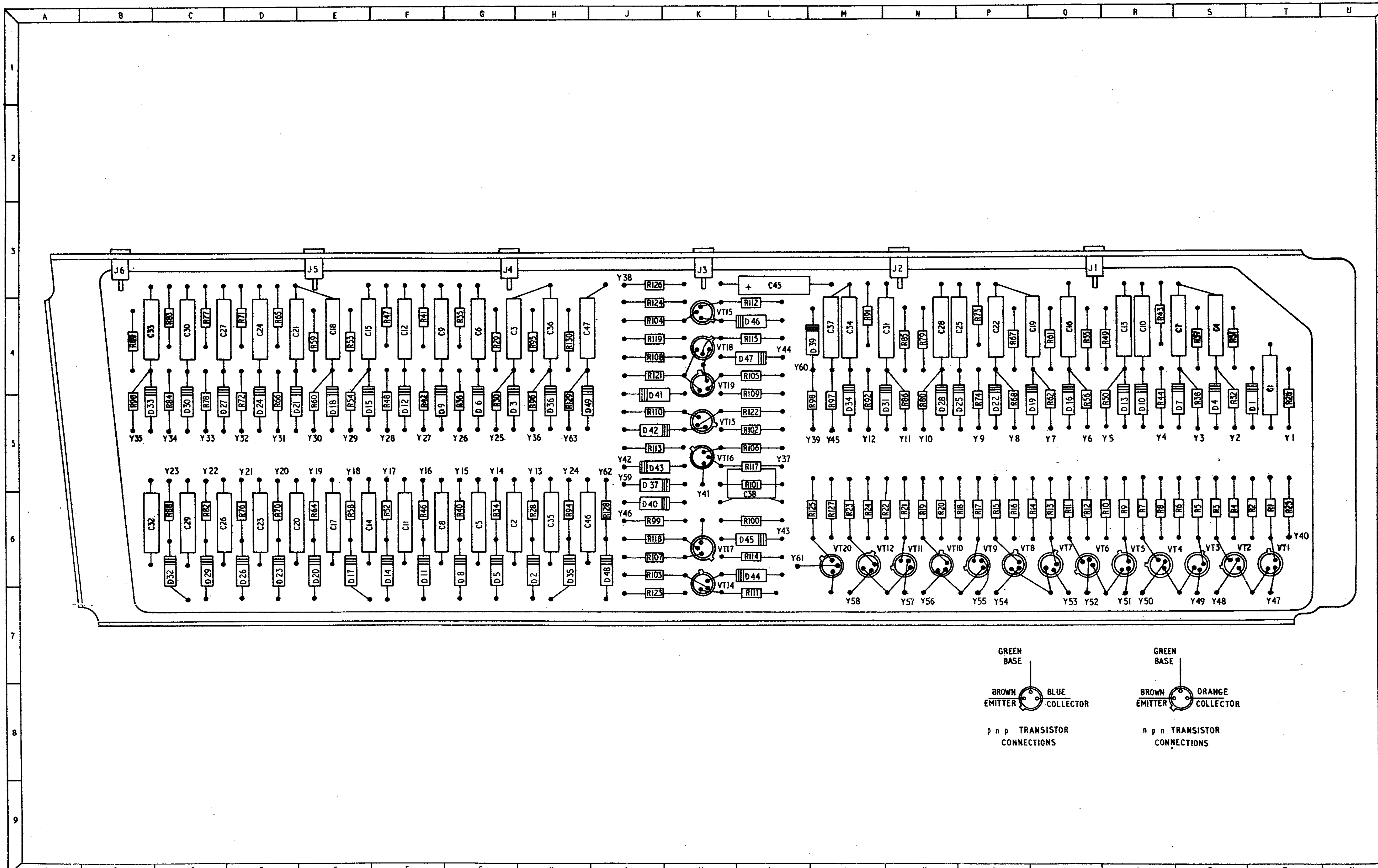

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FIG. 11 TACARD II

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
◀ 12R1	Q4	220	±5%	¼W		RA ▶
12R2	Q4	560	±5%	¼W		RA
12R3	R4	10k	±5%	¼W		RA
12R4	R4	1k	±5%	¼W		RA
12R5	Q4	10k	±5%	¼W		RA
◀ 12R6	Q5	220	±5%	¼W		RA ▶
12R7	Q5	560	±5%	¼W		RA
12R8	R5	10k	±5%	¼W		RA
12R9	R5	1k	±5%	¼W		RA
12R10	Q5	10k	±5%	¼W		RA
◀ 12R11	Q6	220	±5%	¼W		RA ▶
12R12	Q6	560	±5%	¼W		RA
12R13	R6	10k	±5%	¼W		RA
12R14	R6	1k	±5%	¼W		RA
12R15	Q6	10k	±5%	¼W		RA
12R16	R3	6.8k	±5%	¼W		RA
12R17	R4	470	±5%	¼W		RA
12C1	Q6	1.0µF	±20%	35V		CY
12RV1	S4	10k			B97454/22	C
12D1	D3					DS
12D2	R4					DS
12D3	D4					DS
12D4	R5					DS
12D5	D6					DS
12D6	R6					DS
12D7	R6					DS
12DL1	J4				A97727/5	C
12DL2	J5				A97727/5	C
12DL3	J6				A97727/5	C

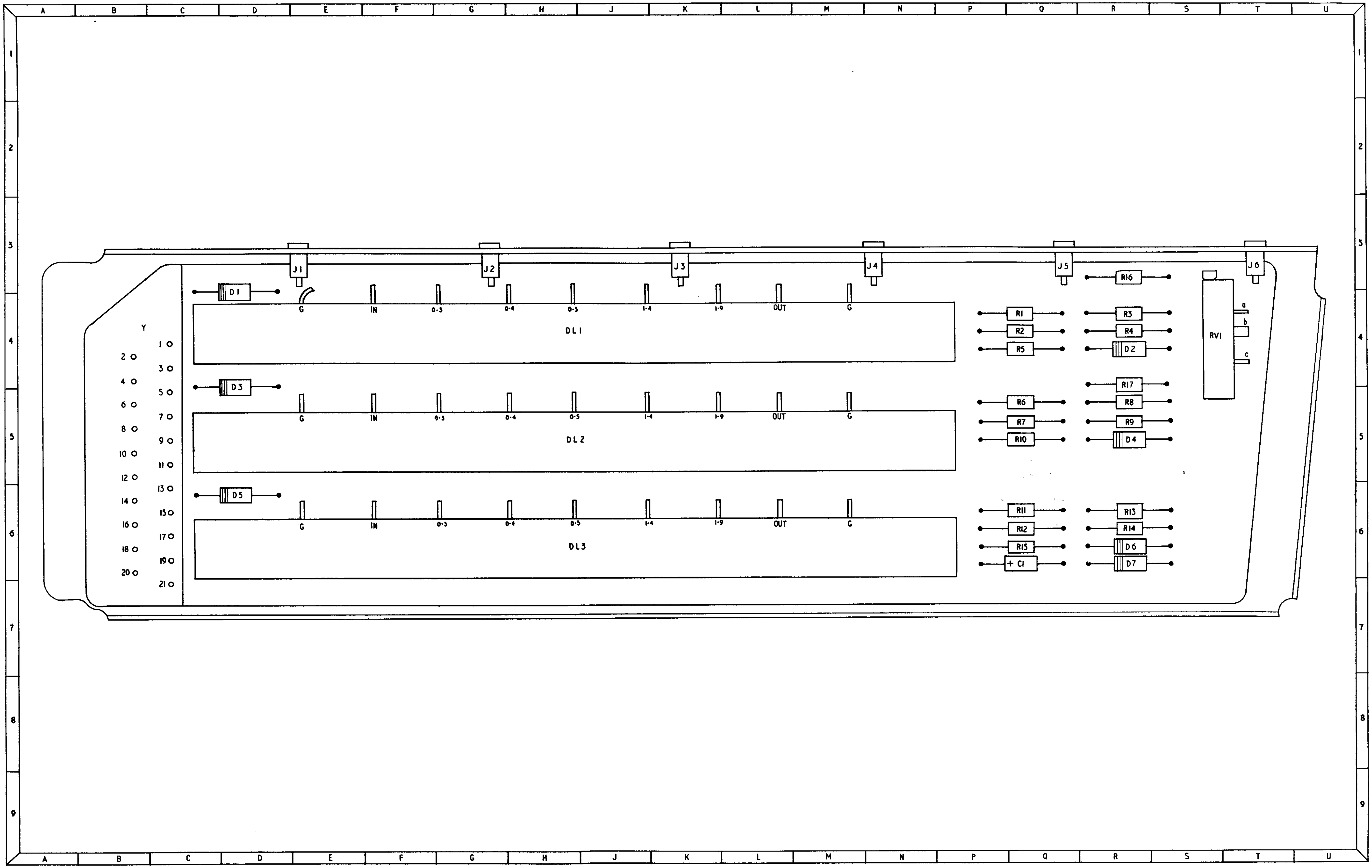


FIG. 12 TACARD 12

Fig.13 Tacard 13

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
13R1	D4	10k	±5%	¼W		RA
13R2	D4	1.2k	±5%	¼W		RA
13R3	J4	3.3k	±5%	¼W		RA
13R4	J4	3.3k	±5%	¼W		RA
13R5	J4	33k	±5%	¼W		RA
13R6	J3	33k	±5%	¼W		RA
13R7	G4	3.3k	±5%	¼W		RA
13R8	G5	3.3k	±5%	¼W		RA
13R9	G5	1.5k	±5%	¼W		RA
13R10	G6	22k	±5%	¼W		RA
13R11						
13R12	G5	12k	±5%	¼W		RA
13R13	E6	3.3k	±5%	¼W		RA
13R14	G6	3.3k	±5%	¼W		RA
13R15	G6	10k	±5%	¼W		RA
13R16	G6	1.5k	±5%	¼W		RA
13R17	D6	47k	±5%	¼W		RA
13R19	E7	3.3k	±5%	¼W		RA
13R20	D6	220	±5%	¼W		RA
13R21	D4	1k	±5%	¼W		RA
13R22	G4	5.6k	±5%	¼W		RA
13R23	E5	1.5k	±5%	¼W		RA
13R24	E5	2.2k	±5%	¼W		RA
13R25	D6	4.7k	±5%	¼W		RA
13R26	D5	1.5k	±5%	¼W		RA
13R27	D5	2.2k	±5%	¼W		RA
13R28	D5	2.2k	±5%	¼W		RA
13R29	D7	33k	±5%	¼W		RA
13R30	J6	10k	±5%	¼W		RA
13R31	J5	51	±5%	¼W		RA
13R32	J6	51	±5%	¼W		RA
13R33	S5	2.2k	±5%	¼W		RA
13R34	M4	220k	±5%	0.1W		RG
13R35	M4	220k	±5%	0.1W		RG
13R36	M4	2.2k	±5%	¼W		RA

Fig.13 Tacard 13 (Contd.)

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
13R37	P4	27k	±2%	¼W		RA
13R38	P4	3.3k	±5%	¼W		RA
13R39	P5	3.9k	±5%	¼W		RA
13R40	M5	1.5k	±5%	¼W		RA
13R41	M5	39k	±5%	¼W		RA
13R42	M5	1.5k	±5%	¼W		RA
13R43	Q4	220k	±5%	0.1W		RG
13R44	Q4	220k	±5%	0.1W		RG
13R45	Q4	2.2k	±5%	¼W		RA
13R46	S4	27k	±2%	¼W		RA
13R47	S4	3.3k	±5%	¼W		RA
13R48	S5	3.9k	±5%	¼W		RA
13R49	Q5	1.5k	±5%	¼W		RA
13R50	Q5	39k	±5%	¼W		RA
13R51	Q5	1.5k	±5%	¼W		RA
13R52	Q5	1.5k	±5%	¼W		RA
13R53	Q6	220k	±5%	0.1W		RG
13R54	Q6	220k	±5%	0.1W		RG
13R55	M6	2.2k	±5%	¼W		RA
13R56	P6	27k	±2%	¼W		RA
13R57	P6	3.3k	±5%	¼W		RA
13R58	P6	3.9k	±5%	¼W		RA
13R59	S6	1.5k	±5%	¼W		RA
13R60	M6	39k	±5%	¼W		RA
13R61	S6	1.5k	±5%	¼W		RA
13R62	M5	1.5k	±5%	¼W		RA
13R63	S6	1.5k	±5%	¼W		RA
13R64	D6	1.2k	±5%	¼W		RA
13R65	E4	1k	±5%	¼W		RA
13C1	H5	.04uF	±20%	250V		CI
13C2	G4	.04uF	±20%	250V		CI
13C3	J5	330pF	±10%	350V		CR
13C4	G6	220pF	±10%	350V		CR
13C5	G6	560pF	±10%	350V		CR

Fig.13 Tacard 13 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
13C6	E6	1000pF	±2%	350V		CR
13C7	G4	.04µF	±20%	250V		CI
13C8	E5	1.0µF		35V		CY
13C9	D5	.005µF	±20%	250V		CH
13C10	J5	2.2µF	±20%	35V		CAA
13C11	J6	2.2µF	±20%	35V		CAA
13C12	N4	.04µF	±20%	250V		CI
13C13	M4	1500pF	±2%	350V		CR
13C14	N5	.002µF	±20%	250V		CI
13C15	Q6	10µF	±20%	35V		CDD
13C16	S4	.04µF	±20%	250V		CI
13C17	Q4	1500pF	±2%	350V		CR
13C18	S5	.002µF	±20%	250V		CG
13C19	S6	.04µF	±20%	250V		CI
13C20	M6	1500pF	±2%	250V		CR
13C21	N6	.002µF	±20%	250V		CG
13RV1	E4	1k			B97454/25	C
13VT1	H4					VD
13VT2	H4					VD
13VT3	G6					VL
13VT4	G6					VE
13VT5	E6					VL
13VT6	E4					VC
13VT7	E5					VD
13VT8	H6					VD
13VT9	N4					VL
13VT10	N5					VL
13VT11	R4					VL
13VT12	R5					VL
13VT13	N6					VL
13VT14	N6					VL

Fig. 13 Tacard 13 (Contd)

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
13D1	D4					DM
13D2	J4					DA
13D3	D4					DA
13D4	G4					DA
13D5	G5					DA
13D6	E5					DA
13D7	G6					DA
13D8	D5					DA
13D9	D6					DA
13D10	D6					DA
13D11	E6					DN
13D12	J5					DA
13D13	P4					DA
13D14	M4					DA
13D15	P4					DA
13D16	M5					DA
13D17	P5					DA
13D18	P5					DA
13D19	S4					DA
13D20	Q4					DA
13D21	S4					DA
13D22	Q5					DA
13D23	S4					DA
13D24	S5					DA
13D25	S5					DA
13D26	P5					DA
13D27	M6					DA
13D28	P6					DA
13D29	M6					DA
13D30	M7					DA
13D30	M7					DA
13D31	Q6					DA
13D32	Q6					DA
13D33	E6					DA

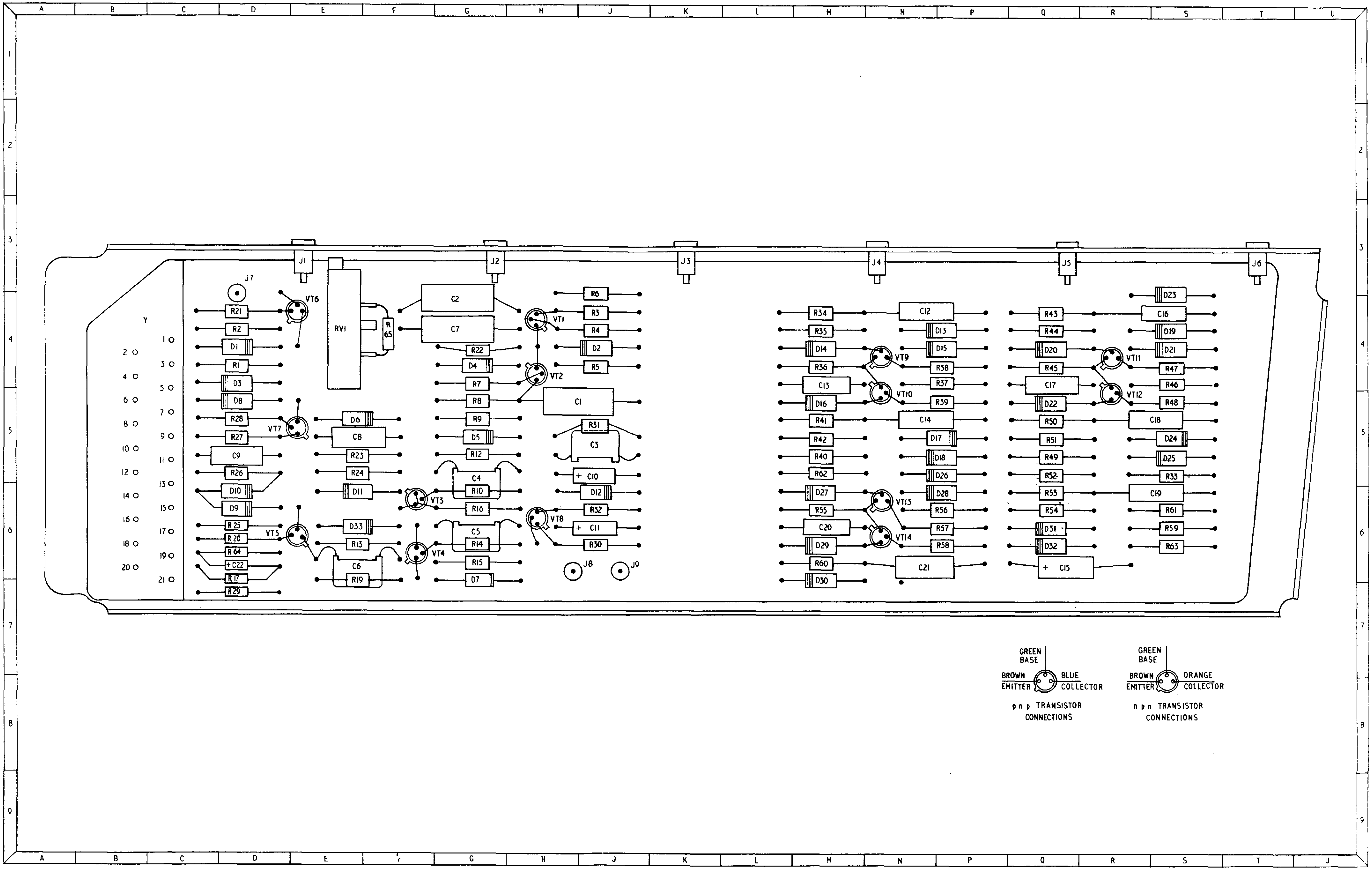


FIG.13 TACARD 13

Fig. 14 Tacard 14

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No	Vendor Code
14R1	K4	10k	±5%	¼W		RA
14R2						
14R3						
14R4	M4	2.7k	±5%	¼W		RA
14R5	R5	68k	±5%	¼W		RA
14R6	R5	68k	±5%	¼W		RA
14R7	R6	33k	±5%	¼W		RA
14R8	R7	10k	±5%	¼W		RA
14R9	R6	5.6k	±5%	¼W		RA
14R10	R7	1.5k	±5%	¼W		RA
14R11	P6	1.5k	±5%	¼W		RA
14R12	P6	100	±5%	¼W		RA
14R13	M6	1k	±5%	¼W		RA
14R14	K6	1k	±5%	¼W		RA
14R15	M6	1k	±5%	¼W		RA
14R16	K6	56	±5%	¼W		RA
14R17	K5	1k	±5%	¼W		RA
14R18	M6	10	±5%	.1W		RG
14R19	M5	680	±5%	¼W		RA
14R20	R4	6.8k	±5%	¼W		RA
14R21	R4	15k	±5%	¼W		RA
14R22	R4	10k	±5%	¼W		RA
14R23	R5	22k	±5%	¼W		RA
14R24	R5	10k	±5%	¼W		RA
14R25	R4	68k	±5%	¼W		RA
14R26	R3	6.8k	±5%	¼W		RA
14R27	M5	2.7k	±5%	¼W		RA
14R28	K5	2.2k	±5%	¼W		RA
14R29	M5	220	±5%	¼W		RA
14R30	K5	1k	±5%	¼W		RA
14R31	G7	1.5k	±5%	¼W		RA
14R32	J7	1.5k	±5%	¼W		RA
14R33	E5	560	±5%	¼W		RA
14R34	E6	1k	±5%	¼W		RA
14R35	J6	4.7k	±5%	¼W		RA

Fig.14 Tacard 14

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code.
14R36						
14R37						
14R38						
14R39	J4	1k	±5%	$\frac{1}{4}$W		RA
14R40	G4	6.8k	±5%	$\frac{1}{4}$W		RA
14R41	J5	1k	±5%	$\frac{1}{4}$W		RA
14R42	J4	15k	±5%	$\frac{1}{4}$W		RA
14R43	G5	2.2k	±5%	$\frac{1}{4}$W		RA
14R44	J5	3.3k	±5%	$\frac{1}{4}$W		RA
14R45	G4	2.2k	±5%	$\frac{1}{4}$W		RA
14R46	J6	2.2k	±5%	$\frac{1}{4}$W		RA
14R47	J4	47k	±5%	$\frac{1}{4}$W		RA
14R48	F4	180	±5%	$\frac{1}{4}$W		RA
14R49	G5	1k	±5%	$\frac{1}{2}$W		RB
14R50	G6	15k	±5%	$\frac{1}{4}$W		RA
14R51	J6	4.7k	±5%	$\frac{1}{4}$W		RA
14R52	J4	2.2k	±5%	$\frac{1}{4}$W		RA
14R53	E6	2.7k	±5%	$\frac{1}{4}$W		RA
14R54						
14R55	D6	390	±5%	$\frac{1}{4}$W		RA
14R56	E6	220	±5%	$\frac{1}{4}$W		RA
14R57	D6	330	±5%	$\frac{1}{4}$W		RA
14R58	D5	470	±5%	$\frac{1}{4}$W		RA
14R59	D6	470	±5%	$\frac{1}{4}$W		RA
14R60	D5	27	±5%	.1W		RG
14R61	G6	270	±5%	$\frac{1}{4}$W		RA
14R62						
14R63						
14R64	J6	1k	±5%	$\frac{1}{4}$W		RA
14R65	K6	2.7k	±5%	$\frac{1}{4}$W		RA
14R66	M7	22k	±5%	$\frac{1}{4}$W		RA
14R67	K6	82	±5%	$\frac{1}{4}$W		RA
14R68	K4	1.5k	±5%	$\frac{1}{4}$W		RA
14R69	M4	1k	±5%	$\frac{1}{4}$W		RA
14R70	K4	4.7k	±5%	$\frac{1}{4}$W		RA

Fig.14 Tacard 14 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
14R71	K5	4.7k	±5%	$\frac{1}{4}$W		RA
14R72	J4	4.7k	±5%	$\frac{1}{4}$W		RA
14R73	K4	220	±5%	$\frac{1}{4}$W		RA
14C1						
14C2	N4	3-18pF				CJJ
14C3	P5	68pF	±2%	750V		CGG
14C4	Q5	68pF	±2%	750V		CHH
14C5	Q4	1000pF	±10%	350V		CR
14C6	R6	68pF	±5%	350V		CR
14C7	K4	1μF	±20%	35V		CY
14C8	P7	.005μF	±20%	250V		CH
14C9	M6	100pF	±10%	350V		CR
14C10	K6	100pF	±10%	350V		CR
14C11	SR	140μF	±20%	30V		CU
14C12	S6	140μF	±20%	30V		CU
14C13	M5	220pF	±5%	350V		CR
14C14	M5	56pF	±10%	350V		CR
14C15	G5	0.04μF	±20%	250V		CI
14C16	G4	1000pF	±10%	350V		CR
14C17	G5	220pF	±10%	350V		CR
14C18	J5	390pF	±5%	350V		CR
14C19	J4	100pF	±5%	350V		CR
14C20	G6	1μF	±20%	35V		CY
14C21	D4	200pF	±2%	350V		CR
14C22	D5	680pF	±2%	350V		CR
14C23	E4	680pF	±2%	350V		CR
14C24	D4	680pF	±2%	350V		CR
14C25	E4	200pF	±2%	350V		CR
14C26	D5	10μF	±20%	35V		CDD
14C27	F6	220pF	±10%	350V		CR
14C28						
14C29	D6	180pF	±5%	350V		CR
14C30	D6	560pF	±5%	350V		CR
14C31	D5	.005μF	±20%	250V		CH
14C32	E5	10μF	±20%	35V		CDD
14C33	G6	560pF	±5%	350V		CR
14C34	K7	56pF	±10%	350V		CR
14C39	F7	220pF	±10%	350V		CR

Fig.14 Tacard 14 (Contd.)

Cct.Ref.	Pos'n	Value	Tol.	Rating	Ref.No.	Vendor Code
14C40	R6	2.2uF	±20%	35V		CAA
14C41	J5	.04uF	±20%	250V		CI
14RV1	S4	250k			B97454/18	C
14RV2	E4	2.5k			B97454/24	C
14C2	N4	5-35pF				CII
14L1	N5	300uH			B/GA 31023	C
14L2	E4				B/GA 31071/3	C
14L3	D4				B/GA 31071/1	C
14L4	E4				B/GA 31071/1	C
14L5	G4				B/GA 31071/2	C
14VT1	L4					VC
14VT2	S6					VC
14VT3	Q6					VC
14VT4	Q6					VC
14VT5	N6					VL
14VT6	L6					VC
14VT7	L5					VL
14VT8	S4					VC
14VT9	S4					VC
14VT10	L5					VC
14VT11						
14VT12						
14VT13	H4					VD
14VT14	H4					VD
14VT15	H5					VI
14VT16	H5					VE
14VT17	E6					VA
14VT18	E6					VA
14VT19	E5					VG
14VT20	E6					VI
14VT21	H6					VG
14VT22	L6					VC.
14VT23	L4					VM

Fig.14 Tacard 14 (Contd.)

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
14D1						
14D2						
14D3	M4					DA
14D4	R6					DA
14D5	P7					DA
14D6	R4					DA
14D7	R5					DA
14D8	G6					DA
14D9	J6					DA
14D10	E5					DA
14D11	E5					DA
14D12	G4					DA
14D13	J4					DA
14D14	J6					DA
14D15	D6					DA
14D16	D7					DA
14D17	E6					DA
14D18	K5					DA
14D19	M4					DA
14D20	M6					DA
14D21	M7					DA
14D22	K7					DA
14D23	G5					DA
14D24	G5					DK
14D25	M4					DA
14D26	M4					DA

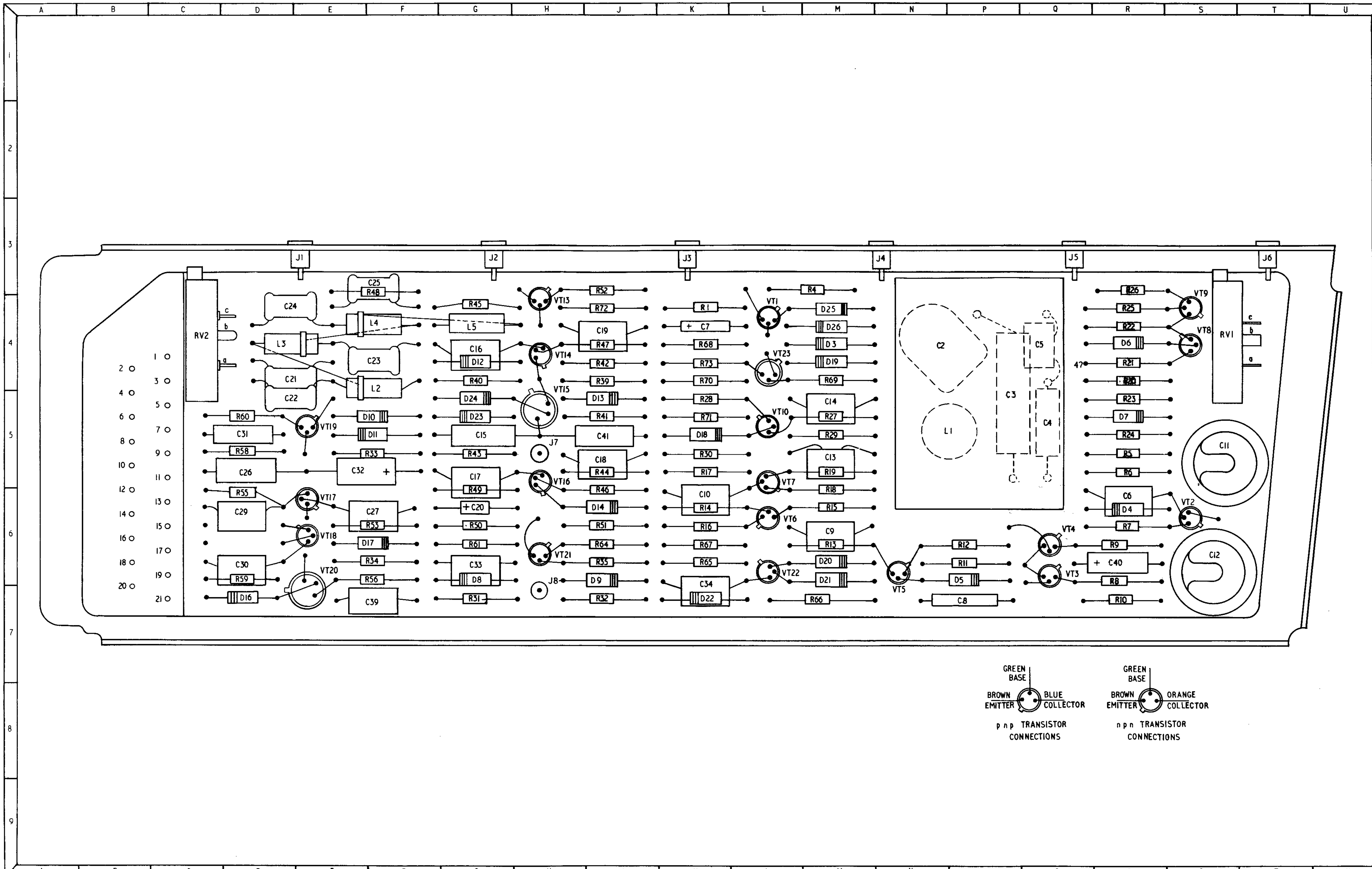


FIG. 14 TACARD 14

Fig.15 Plug and Filter Assembly

Cct.Ref.	Value	Tol.	Rating	Ref.No.	Vendor Code
PLG	45-way				PD
1C14	.01μ	+100-0%	250V		CMM
1C15	.01μ	+100-0%	250V		CMM
1C16	.01μ	+100-0%	250V		CMM
1C17	.01μ	+100-0%	250V		CMM
1C18	.01μ	+100-0%	250V		CMM
1C19	.01μ	+100-0%	250V		CMM
1C20	.01μ	+100-0%	250V		CMM
1C21	.01μ	+100-0%	250V		CMM
1C22	.01μ	+100-0%	250V		CMM
1C23	1μ	+10%	160V		COO
1C24	.01μ	+100-0%	250V		CMM
1C25	.01μ		2kV		CB
1C26	.01μ	+100-0%	250V		CMM
1C27	.01μ	+100-0%	250V		CMM
1C28	.01μ	+100-0%	250V		CMM
1C29	.01μ	+100-0%	250V		CMM
1C30	.01μ	+100-0%	250V		CMM
1C31	.01μ	+100-0%	250V		CMM
1C32	.01μ	+100-0%	250V		CMM
1C33	.01μ	+100-0%	250V		CMM
1C34	.01μ	+100-0%	250V		CMM
1C35	.01μ	+100-0%	250V		CMM
1C36	.01μ	+100-0%	250V		CMM
1C37	.01μ	+100-0%	250V		CMM
1C38	.01μ	+100-0%	250V		CMM
1Y55 to 1Y99	1,000pF feed-through	+80-20%	500V DC		CNN

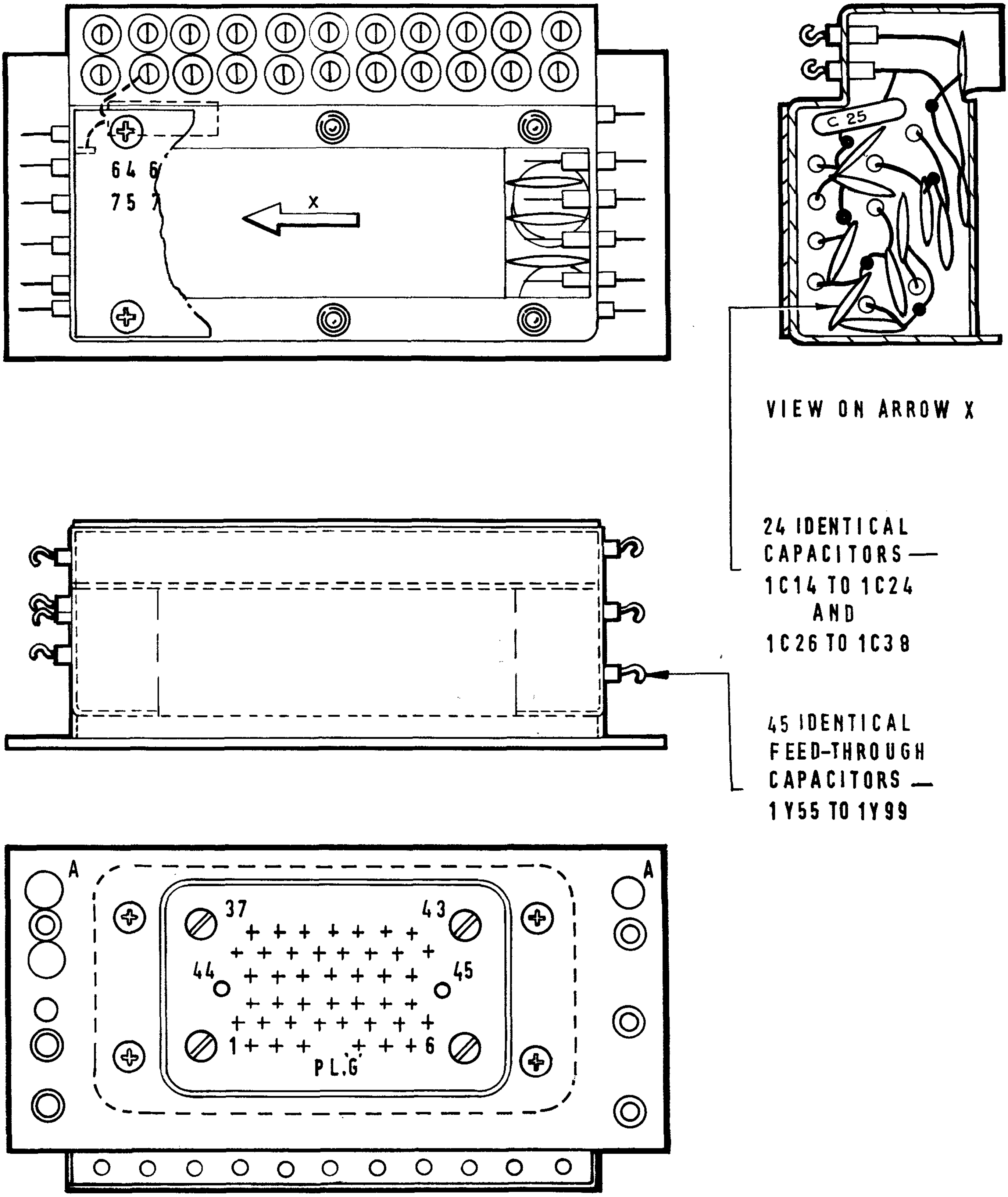


FIG.15 PLUG AND FILTER ASSEMBLY

Illustrated Parts Lists for

Control Units 1601

Description	Mfrs. Part No.	Ref. No.	Vendor Code
Control Unit 1601/2	D/GA86919/2		C
Control, Transponder Set, Type 1601/6	D/GA86919/6	5841-99-107-2267	C

Control Unit 1601/6

Item	Description	Reference No.	Vendor Code
1	Switch Module	A910101	C
	Bulb, 28V sub-miniature	A910102	C
2	Knob, Mode	B72972	C
	Lampholder base		BD
	Bulb, 28V 0.04A	6420-99-995-9118	-
	Filter		FC
3	Switch, Pushbutton	A99657	C
	Knob, light indicator	6210-99-107-1470	-
4	Switch, toggle SP	B910062/7	C
5	Switch, toggle DP	B910062/11	C
6	Switch, toggle TPCO	B910881	C
7	Switch Assembly, wafer	B/SA86919/406	C
8	Front Panel Assembly	B/SA86919/401	C
9	Lampholder base		BD
	Bulb 28V .04A	6420-99-995-9118	-
	Filter		FA
	Filter Seal		FB
10	Plastek Panel	C56919/375	C
11	Plug DC37P	KS95790/1	C
	Housing	KS95791	C
	Sleeve, floating mounting	KS95722	C
12	Dust Cover Assembly	B/SA 86919/405	C

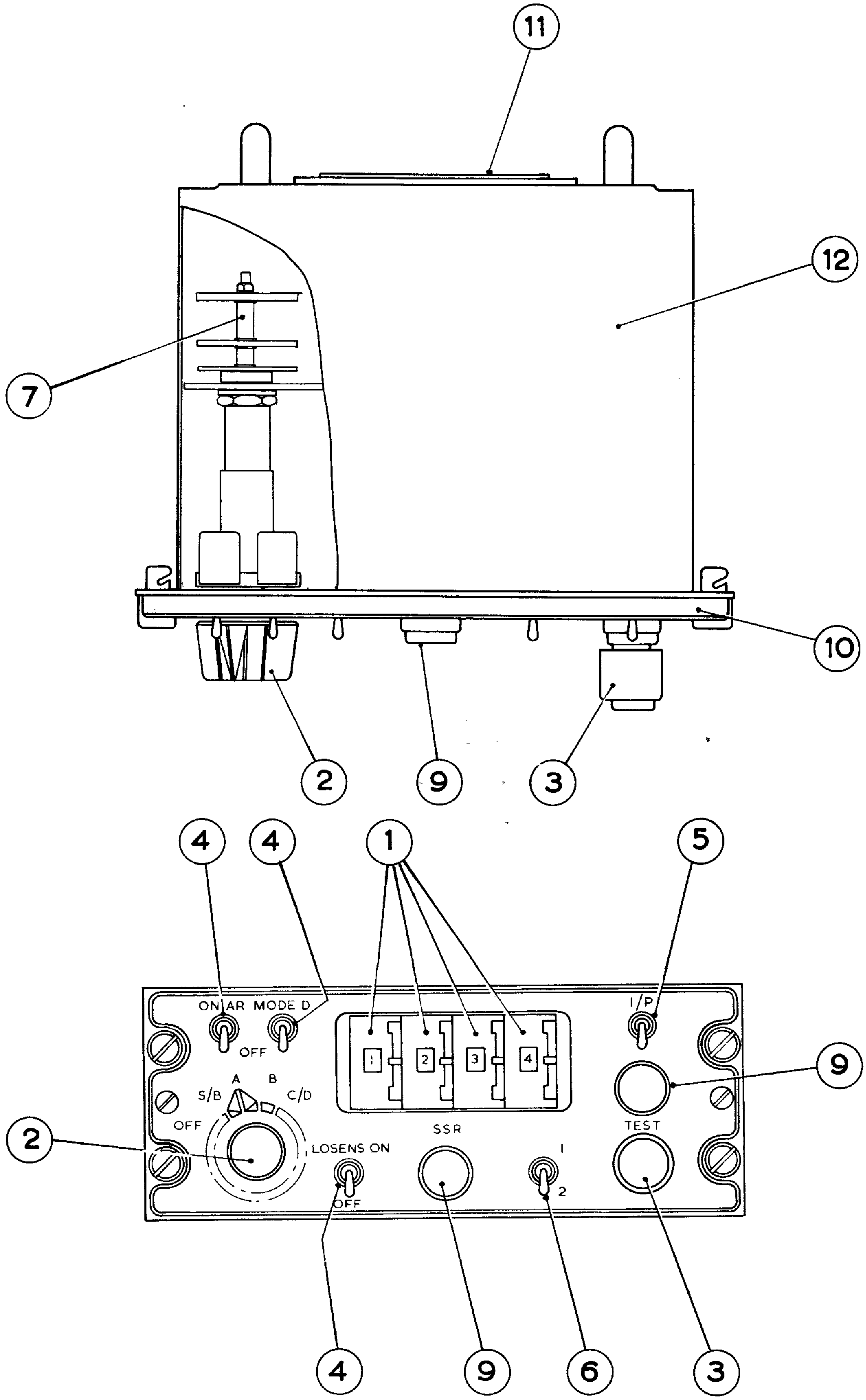


FIG 16 CONTROL UNIT 1601/6

CONTROL, TRANSPONDER SET, TYPE 1601/6

Fig. 16 Control Unit 1601/2

Item	Description	Reference No.	Vendor Code
1	Switch and Dial assembly	C/SA86919/345	C
	Switch wafers S01	B 97794	C
	S02	B 97793	C
	S03	B 97794	C
	S04	B 97793	C
	S05	B 97770	C
	micro S06	KS95798	C
	micro S07	KS95798	C
2	Knob, Mode	B 56919/311	C
	Lampholder (ILP02)		BB
	Bulb	KS95234/1	C
	Filter		FC
	Lampholder Base		BD
3	Knob, Large	A56919/309	C
4	Knob, Small	A56919/308	C
5	Button, Test	A56919/310	C
6	Button, Ident	A56919/313	C
7	Indicator Lamp (PLP01)		
	Lampholder		BA
	Bulb	KS95234/1	C
	Lampholder base		BD
8	Panel Illumination lamp		
	Lampholder base		BD
	Bulb	KS95234/1	C
	Filter		FA
	Filter Seal		FB
9	Toggle switch (S08. D.P.)		SB
10	Mode switch		
	Switch wafer (S05)	B 97770	C
11	Bezel LH	A56919/314	C
12	Bezel RH	A56919/315	C
13	Plastek panel	C56919/295	C
14	Front panel assembly	C/SA86919/333	C
15	Backplate assembly	C/SA86919/338	C
	Plug (PL01)	KS95790	C
16	Dust cover	B/SA86919/343	C
17	Toggle switch (S09. D.P.)		SC
18	Toggle switch (S10. D.P.)		SC

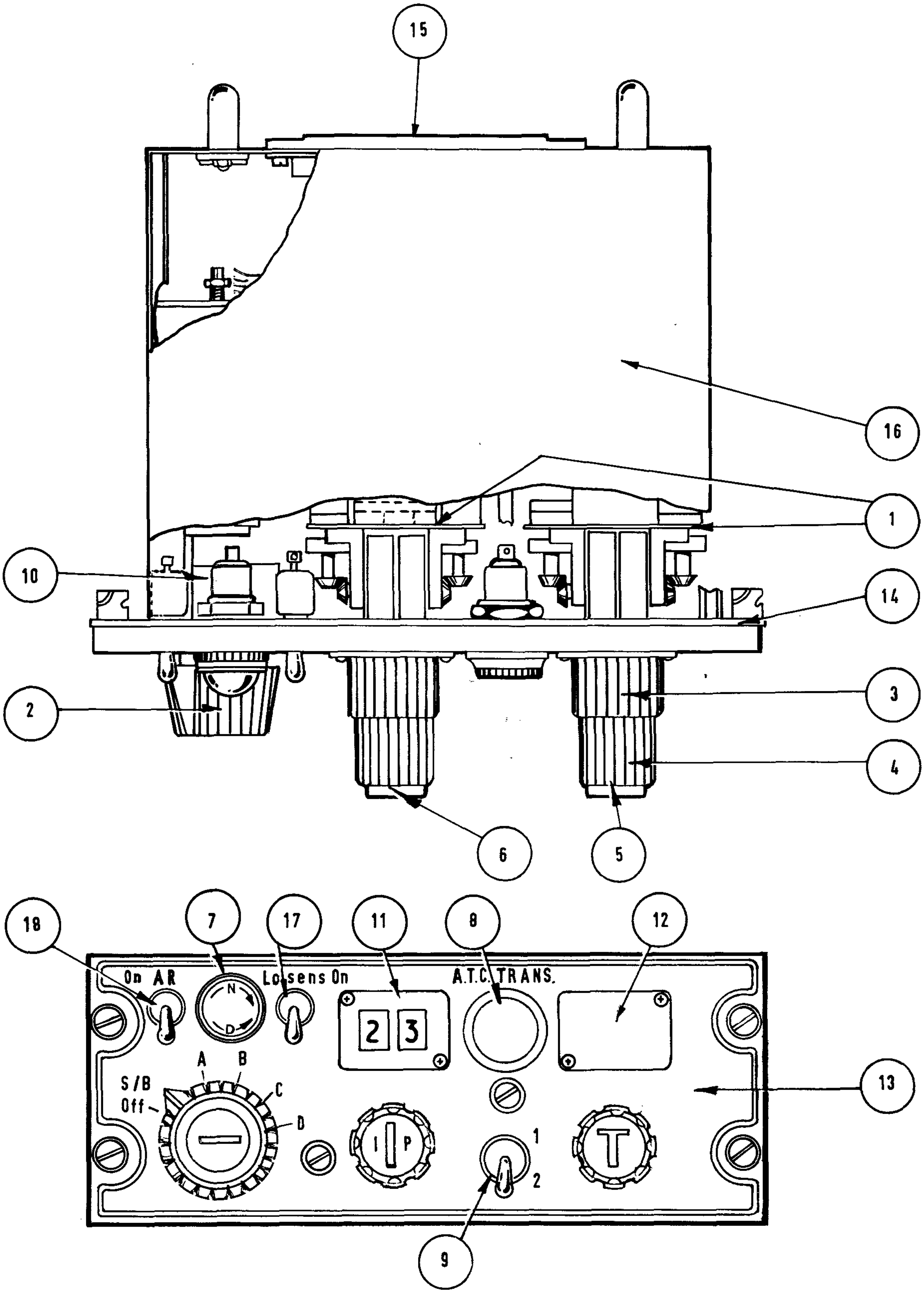


FIG.17 CONTROL UNIT 1601/2

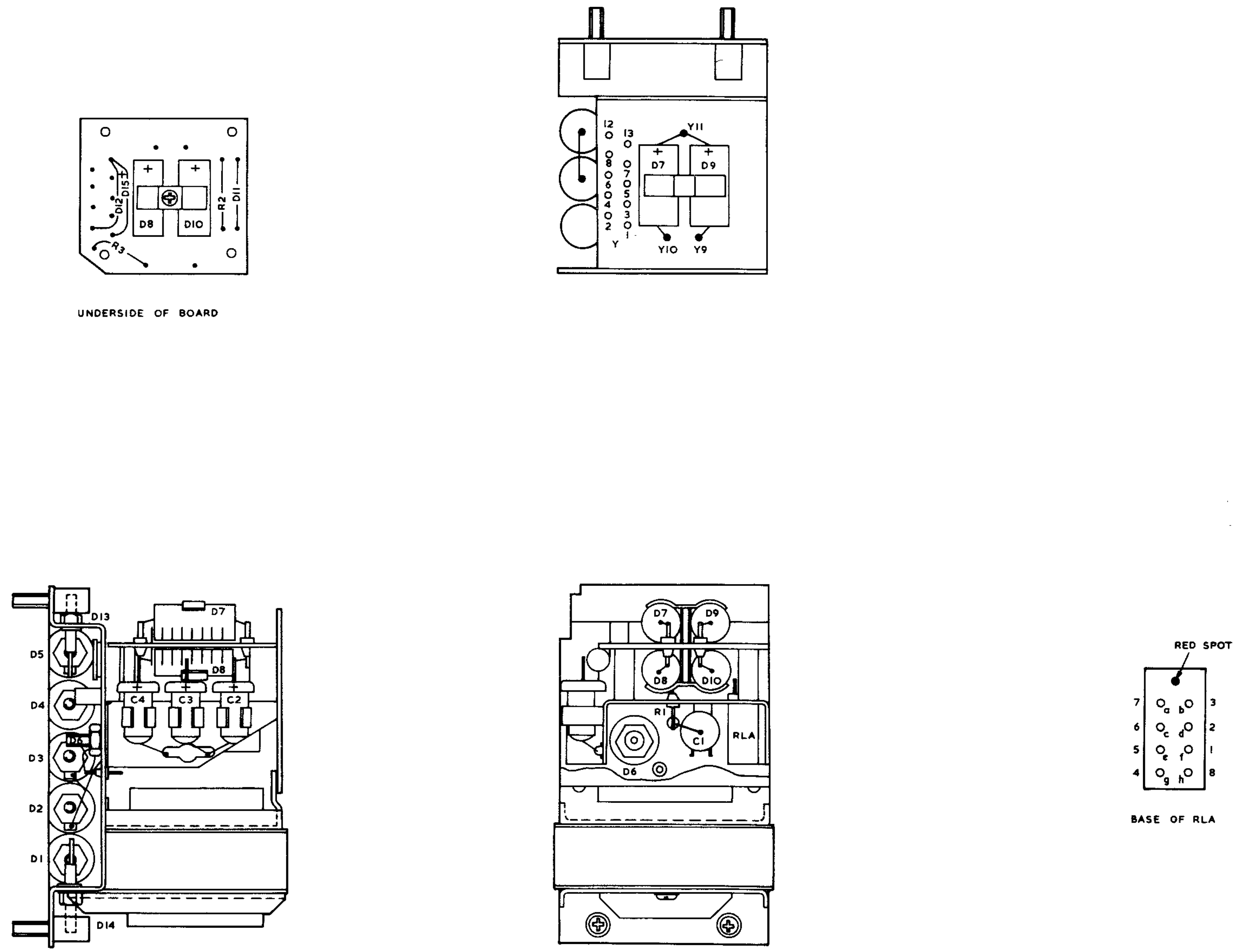
Illustrated Parts Lists for

S.S.R.1600/2 Power Units

Description	Mfrs. Part No.	Ref.No.	Vendor Code
Power Unit (Unit 3)	D/GA86903/2		C

Fig. 18 S.S.R.1600/2 Power Unit

Cct.Ref.	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
3R1	L6	150	±5%	½W		RB
3R2	G3	22	±5%	½W		RB
3R3	F3	560	±5%	TR4		RA
3C1	L7	.05μ	±20%	300V		CKK
3C2	G6	82μ	+20-15%	50V		CD
3C3	G6	82μ	+20-15%	50V		CD
3C4	F6	82μ	+20-15%	50V		CD
3D1	F7	IS415				DU
3D2	F7	IS415				DU
3D3	F7	IS415				DU
3D4	F6	IS415				DU
3D5	F6	IS5033				DI
3D6	F6	IS415				DU
3D7	G6	HSC4				DB
3D8	G6	HSC4				DB
3D9	L6	HSC4				DB
3D10	L6	HSC4				DB
3D11	G3	IS115				DV
3D12	F3	IS115				DV
3D13	F6	IS5056A				DM
3D14	F8	IS415R				
3D15	F3	IS113				DG
3RLA	L6	975Ω				RLB
3T1	L7				B/GA31290	C



NOTE :- 3D6 IS INOPERATIVE OR ABSENT IN SSR 1600/3

FIG. 18 S.S.R. 1600/2 POWER UNIT (UNIT 3)

Illustrated Parts Lists for

S.S.R. 1600/2 Power Units (continued)

Description	Mfrs. Part No.	Ref. No.	Vendor Code
Power Unit (Unit 4)	D/GA86904/2		C

Fig. 19 S.S.R.1600/2 Power Unit 4

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
4R1	M7	100	±5%	$\frac{1}{4}$W		RA
4R2	J7	3.3k	±5%	$\frac{1}{4}$W		RA
4R3	J7	470	±5%	$\frac{1}{4}$W		RA
4R4	J7	220	±5%	$\frac{1}{4}$W		RA
4R5	J8	1k	±5%	$\frac{1}{4}$W		RA
4R6	K8	1M	±5%	$\frac{1}{4}$W		RA
4R7	J8	27	±5%	$\frac{1}{4}$W		RA
4R8	K7	470	±5%	$\frac{1}{4}$W		RA
4R9	K7	3.3k	±2%	$\frac{1}{4}$W		RA
4R10	K8	2.2k	±2%	$\frac{1}{4}$W		RA
4R11	J8	4.7k	±5%	$\frac{1}{4}$W		RA
4R12	K8	120	±5%	$\frac{1}{4}$W		RA
4R13	M8	0.15	±5%	3W		
4R14	E5	2.7k	±5%	$\frac{1}{4}$W		RA
4R15	G6	120/150	±5%	6W		
4R16	E5	7.5	±5%	2W		
4R17	G5	7.5	±5%	2W		
4R18	E5	1k	±5%	$\frac{1}{4}$W		RA
4R19	F5	1k	±5%	$\frac{1}{4}$W		RA
4R26	K3	2.2	±10%	2.6W		RD
4R27	K3	2.2	±10%	2.6W		RD
4R28	K2	5.6	±10%	2.6W		RD
4R29	K2	5.6	±10%	2.6W		RD
4R30	K2	22	±5%	2.6W		RD
4C1	J8	4.7μ	±10%	50V		
4C3	L8	120μ	±20%	70V		
4C4	L8	120μ	±20%	70V		
4C5	G6	0.68μ	±10%	100V		
4C9	L2	150μ	±20%	30V		
4C10	L2	47μ	±20%	35V		CFF
4C11	L2	47μ	±20%	35V		CFF
4C12	L2	140μ	±20%	30V		CT
4C13	J3	5μ	±20%	200V		CX
4C16	L3	330μ	±20%	30V		

Fig. 19 S.S.R.1600/2 Power Unit 4 (continued)

Cct.Ref	Pos'n	Value	Tol	Rating	Ref.No.	Vendor Code
4VT1	P5	2N3791			B914400	
4VT2	L7	2N3245			B915473/2	
4VT3	K8	2N2484			B99249/2	
4VT4	E5	BU128			A915470	
4VT5	G5	BU128			A915470	
4ML1	J7	SN52723L			B912533/4	
4D1	K7	IS111			B99169/1	DF
4D2	K7	IS111			B99169/1	DF
4D3	K8	IS111			B99169/1	DF
4D4	F5	IS111			B99169/1	DF
4D5	E4	IS111			B99169/1	DF
4D6	G4	IS111			B99169/1	DF
4D7	E5	IS6056A			B99163/7	
4D8	E6	IS6056A			B99163/7	
4D9	Q5	IN3881			A912386	
4D17	J3	IS111			B99169/1	DF
4D18	J3	IS111			B99169/1	DF
4D19	J3	IS111			B99169/1	DF
4D20	J3	IS111			B99169/1	DF
4D21	J3	IS111			B99169/1	DF
4D22	J3	IS111			B99169/1	DF
4D23	J2	IS111			B99169/1	DF
4D24	J2	IS111			B99169/1	DF
4D25	J2	IS111			B99169/1	DF
4D26	J2	IS111			B99169/1	DF
4D27	J2	IS111			B99169/1	DF
4D28	J2	IS111			B99169/1	DF
4D29	J2	IS111			B99169/1	DF
4D30	J2	IS111			B99169/1	DF
4D31	J2	IS111			B99169/1	DF
4D32	J2	IS111			B99169/1	DF
4D33	J2	IS113				DG
4D34	J2	IS113				DG
4D35	J2	IS113				DG
4D36	J2	IS113				DG
4RV1	K7	1K	±20%	$\frac{1}{4}$W		
4T1	F6				B/832487	
4T2	K5				B/GA31289	
4L1	L7	400μH			A832491	
4L2	R5	10μH			A332500	

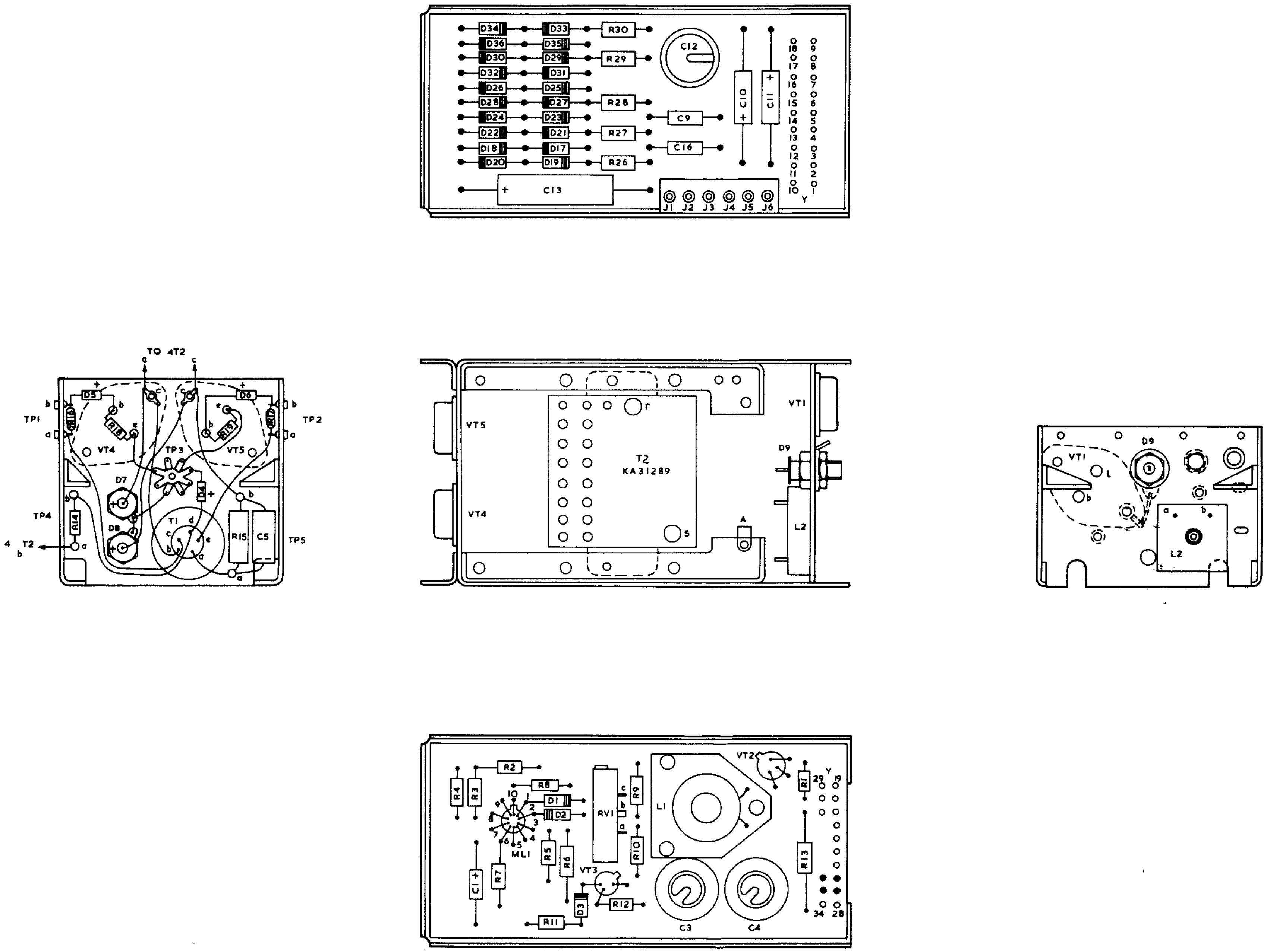


FIG. 19 S.S.R.1600/2 POWER UNIT (UNIT 4)

VENDOR CODES

CODE	DESCRIPTION	PATTERN	VENDOR
CAPACITORS			
CA	Aluminium Foil, moulded polypropylene	17901	Dubilier
CB	High voltage plate ceramicon	K7000/CP1	Erie
CC	Feed-through ceramic	CFT2500	Erie
CD	Tantalum, electrolytic	109D 826 X0050 TO	Sprague
CF	Metallised, paper	BM 13kV	Hunts
CG	Paper, metallised, tubular	CPM5A	Hunts
CH	Paper, metallised, tubular	CPM5B	Hunts
CI	Paper, metallised, tubular	CPM5D	Hunts
CJ	Silver mica, encapsulated	A25E	Johnson Matthey
CK	Disc, ceramic	07K	Lemco
CL	Tubular, ceramic	307N750	Lemco
CM	Feed-through (patt.B)	310K	Lemco
CN	Tubular ceramic	310N30	Lemco
CO	Tubular ceramic	310N750	Lemco
CP	Tubular ceramic	310P100	Lemco
CQ	Tubular ceramic	310S	Lemco
CR	Miniature sintered silver mica	1106S	Lemco
CS	Non-insulated, plastic film	OF30-25	Plastic Cap.Inc.
CT	Electrolytic, tantalum	TA507	Plessey
CU	Electrolytic, tantalum	TA14030	Plessey
CV	Electrolytic, tantalum	E1270	Plessey
CW	Disc ceramic	400/1/0217/002	Plessey
CX	Electrolytic, tantalum	HV5200C3/1	Tansitor
CY	Electrolytic, tantalum	K1J35S	Union Carbide
CZ	Electrolytic, tantalum	K2R2J75S	Union Carbide
CAA	Electrolytic, tantalum	K2R2J35S	Union Carbide
CBB	Electrolytic, tantalum	K6R8J75	Union Carbide
CCC	Electrolytic, tantalum	K6R8J20S	Union Carbide
CDD	Electrolytic, tantalum	K10J35S	Union Carbide
CEE	Electrolytic, tantalum	K22J35S	Union Carbide
CFF	Electrolytic, tantalum	K47RJ35S	Union Carbide
CGG	Ceramic	MIN-R-120-K	Gulton
CHH	Ceramic	MIN-S-27-J	Gulton
CJJ	Variable (3-18pF)	C004/EA/18E	Mullard
CKK	Aluminium Foil, moulded polypropylene	660M	Dubilier
CLL	Electrolytic, tantalum	K47J35S	Union Carbide
CMM	Disc, ceramic	K4500,8131-025	Dubilier
CNN	Lead-through, ceramic	CFT3000	Erie
COO	Metalised film	TFM	Wima
RESISTORS			
RA	Metaloxide film insulated	TR4	Electrosil
RB	Metaloxide film insulated	TR5	Electrosil
RC	Metaloxide film insulated	TR6	Electrosil
RD	Wirewound, vitreous enamelled	RVW3-J	Painton or Welwyn
RE	Wirewound, vitreous enamelled	RVW4-J	Painton or Welwyn
RG	Composition insulated	15	Erie

VENDOR CODES (cont'd)

CODE	DESCRIPTION	PATTERN	VENDOR
DIODES			
DA	Silicon, planar	1N3067	Fairchild
DB	Silicon, high voltage	MSC4	Hughes
DC	Silicon, zener	SZ10C	Mullard
DD	Silicon, zener	SZ24C	Mullard
DE	Microwave diode	1N21E	Silvania
DF	Silicon	1S111	Texas
DG	Silicon	1S113	Texas
DH	Silicon	1S411	Texas
DI	Silicon, zener	1S5033	Texas
DJ	Silicon, zener	1S5068	Texas
DK	Silicon, zener	1S7033B	Texas
DL	Silicon, zener	1S7047B	Texas
DM	Silicon, zener	1S7056A	Texas
DN	Silicon, zener	1S7056B	Texas
DO	Silicon, zener	1S7100B	Texas
DP	Silicon, zener	1S7150B	Texas
DQ	Silicon, zener	1N252	Transitron
DR	Germanium	1N270	Transitron
DS	Silicon	T171	Texas
DT	Silicon, planar	1N3065	Fairchild
DU	Silicon	1S415	Texas
DV	Silicon	1S115	Texas
TRANSISTORS			
VA	Silicon planar, epitaxial, PNP	A1603	Fairchild
VB	Silicon planar, epitaxial, NPN	A1604	Fairchild
VC	Silicon planar, NPN	C64	Fairchild
VD	Silicon planar, NPN	C111	Fairchild
VE	Silicon planar, NPN	2N708	Fairchild
VF	Silicon planar, epitaxial, NPN	2N918	Fairchild
VG	Silicon planar, epitaxial, PNP	2N995	Fairchild
VH	Silicon, PNP	2N1131	Fairchild
VI	Silicon, PNP	2N1132	Fairchild
VJ	Silicon planar, epitaxial, PNP	2N2891	Fairchild
VK	High Freq. Power PNP	OC22	Mullard
VL	Germanium PNP	U15216/1	Fairchild
VM	Germanium PNP	2S322	Texas
VN	Silicon planar, NPN	2N1711	Texas
VO	Germanium power PNP	2N1908	Texas
VP		2G210	Texas
VQ		U3049/1	Fairchild

CRYSTALS

XA	90.833 Mc/s	4202/ATS ES	S.T.C.
XB	85.833	4202/ATS ES	S.T.C.

VENDOR CODES (contd.)

CODE	DESCRIPTION	PATTERN	VENDOR
RELAYS			
RLA	Two-pole, changeover	A24NR	C.P. Clare
RLB	Two-pole, changeover	'F'RP7632	C.P. Clare
VALVES			
VZ	Ceramic, disc-seal, triode	ML7815	Machlett
PLUGS AND SOCKETS			
PA	Right-angle plug	3005	Sealectro
PB	Box mounting socket	K02-19-205N	Cannon
PC	Chassis receptacle (50Ω)	BNC	
PD	45-way plug	DPD-45-35P-1A	Cannon
INTERCONNECTION CABLE			
WA	PTFE coaxial, 50Ω	RG188/U	Sealectro
SWITCHES			
SA	Single-pole changeover	C180	Page Eng.
SB	Double-pole changeover	8867K4	Cutler-Hammer
SC	Single-pole changeover	8866K7	Cutler-Hammer
SD	Triple-pole changeover	MST 305D	Alco
KNOBS			
KA	Illuminated switch knob	46B	Page Eng.
BULBS AND LAMPHOLDERS			
BB	Dimmer lampholder	80/10/0315/ Green	Thorn
BD	Lampholder base	80/10/0063	Thorn
LAMP FILTERS AND SEALS			
FA	Filter, standard	80/10/0059/ Grey/Clear	Thorn
FB	Filter seal (for FA)	80/10/0027	Thorn
FC	Filter, long	80/10/0755/ Grey/Clear	Thorn