SECTION 4

F.M. TRANSLATOR EQUIPMENT EP7/1 AND EP7/1X

4.1 Introduction

The EP7/1 translator equipment is designed to improve local signal coverage of Band-II f.m. transmissions. The translator converts the Home, Light and Third signal frequencies, without demodulation, to three other channels, suitable for local reception. The inherent difficulties and distortions normally introduced during demodulation and modulation processes are therefore avoided. Because of its comparative simplicity, the translator provides greater reliability than a conventional receiver-transmitter system.

In the F.M. Translator, EP7/1, the three Band-II signals are received on a single aerial, and their frequencies reduced by a common oscillator to three i.f. signals. After amplification these signals are then frequency-changed again, by means of a second common oscillator, to the required Band-II output channels. Fig. 4.1 shows the general schematic form of the equipment. The photograph in Fig. 4.2 shows details of a three-channel translator unit and a set of complete bay equipment with automatic change-over facilities.

Since this is an f.m. system, there is no special problem of amplitude linearity, but the relatively small bandwidth and high frequencies used introduce filtration problems. In most instances coaxial filters have to be used to supplement lumped filters. The transmission of all three services from one site and the use of a common mast for transmission and reception contribute considerably to the filtration difficulties. Most of the Home, Light and Third broadcast frequencies are spaced by 2·2 MHz (that is, 4·4 MHz overall spacing), but as all but two of the channels so far allocated are inside a 7-MHz bandwidth, most sets of received and retransmitted signals overlap. Even if there were a free choice of frequencies, the spacing could not be more than 1·1 MHz. Feedback between transmitting and receiving aerials makes filtration extremely difficult if the separation between neighbouring channels is less than 0·5 MHz.

The selection of input channel frequencies is determined primarily by local reception conditions, and of output frequencies by possible interference with other Stations. Defects produced in the sound translator by coupling between the receiving and transmitting aerials are similar in principle to those described for the television translator in Section 1 of Instruction T.13. In respect of the

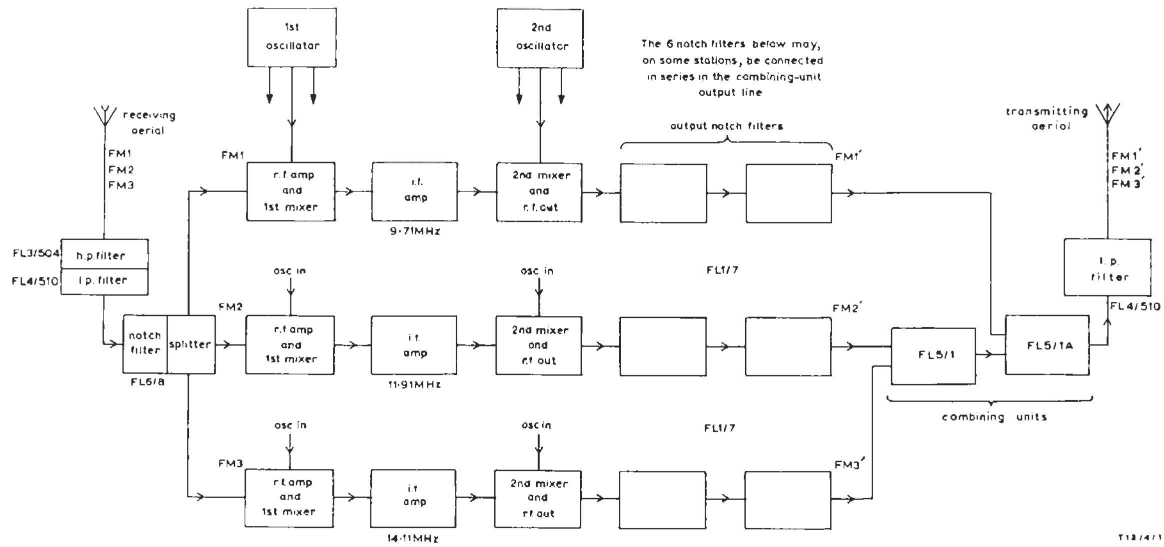


Fig. 4.1 Schematic of EP7/1 Translator

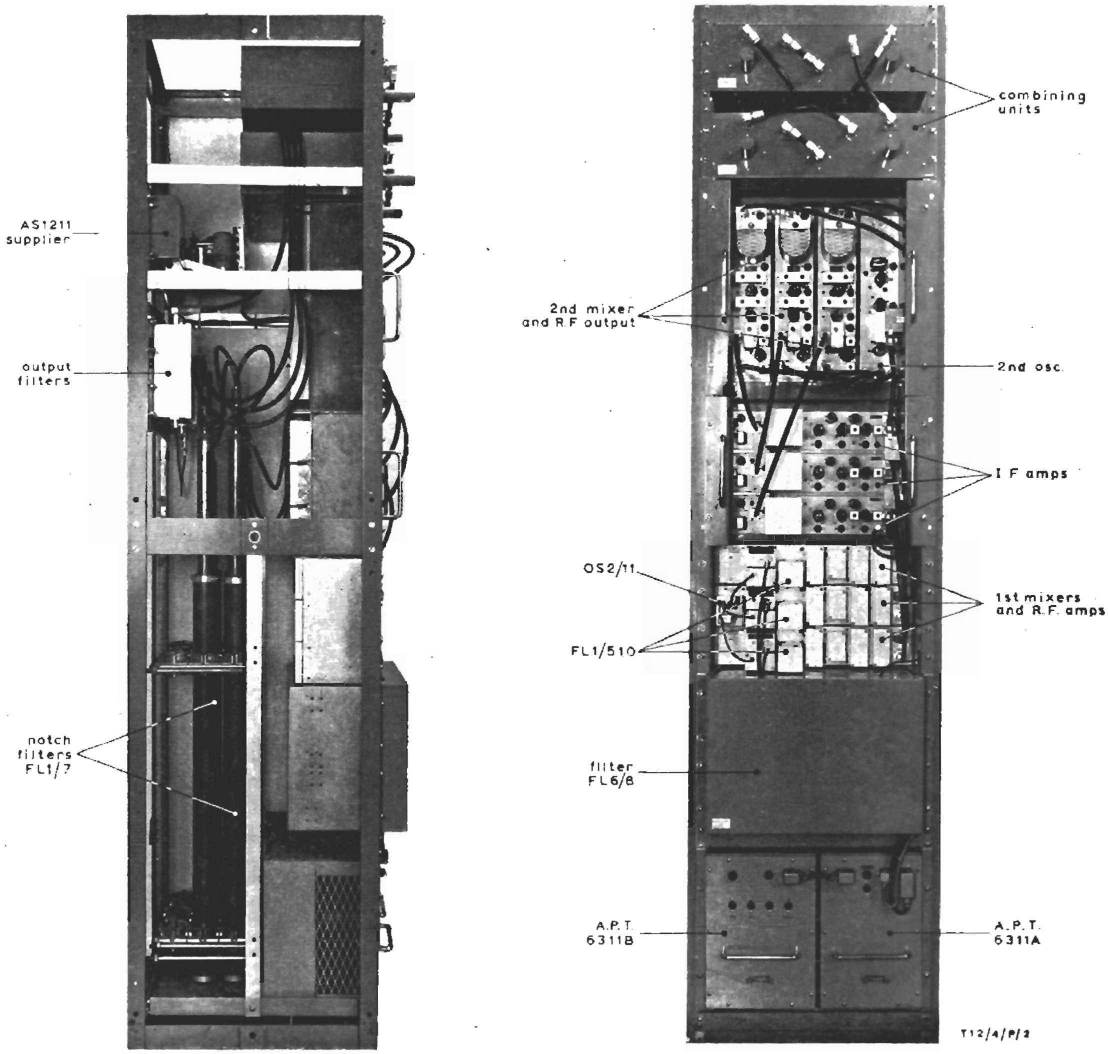


Fig. 4.2 EP7/1: Front (right) and Side Views

EP7/1 the chief effects are high noise level and instability. Aerial coupling problems are more acute in the f.m. translator, since all f.m. transmissions in this country are horizontally polarised and high attenuation between aerials mounted on the same mast is more difficult to obtain.

From the design viewpoint, the handling of three channels simultaneously gives a choice of either a wideband amplifier to accommodate three channels, or separate narrow-band channels. The narrow-band system used in the EP7/1 provides better filtration within the translator.

The EP7/1 was designed on the assumption that a common oscillator system would minimise the risk of introducing intermodulation products or cross-talk 'burbles'. A single oscillator is therefore provided where the spacing between Home and Light and Light and Third carrier frequencies is 2·2 MHz. Additional oscillators are necessary where these spacings are irregular.

Referring to the schematic, Fig. 4.1, the incoming f.m. signals FM1, FM2 and FM3, after passing together through high-pass and low-pass filters (FL3/504 and FL4/510) and the notch and splitter unit (FL6/8), are connected to the three front-end units containing r.f. amplifiers, oscillators and first mixers. The output of the mixers provides i.f. signals at 9·71 MHz, 11·9 MHz and 14·11 MHz. Each i.f. signal is further amplified in the i.f. unit and then applied to a second oscillator and mixer, which provides the final translation to signals at the required output frequency. These new outputs at FM1′, FM2′ and FM3′ pass through combining units, via notch filters and an output low-pass filter, to the common transmitting aerial. Individual output power is adjusted to provide 8·2 watts *to the aerial.*

4.2 Assemblies

The f.m. translator equipment described in this Section is coded in a non-standard fashion; the EP7/1 designation embraces the complete bay of equipment. Translator sub-units have not been coded separately.

When an installation excludes change-over facilities, the translators and auxiliary equipment are contained on a single bay, which is coded EP7/1. When automatic change-over facilities are required, the complete equipment, including two sets of translators, is contained on two bays, each being coded EP7/1X.

4.2.1 EP7/1

Fig. 4.2 shows the complete assembly of a single bay of equipment. The three-channel First Mixer, I.F. and Second Mixer units are each supplied with unmounted spare assemblies. A meter panel is not supplied with an EP7/1 and metering is provided by the panel on a nearby BA13/501. All valved sub-units are provided with feed-monitoring sockets for use with a PTM/6. D.C. interconnections are wired through glass-insulated terminals, and r.f. connections through coaxial type-C or type-BNC connectors.

4.2.2 EP7/1X

Fig. 4.3 shows the layout of a double-bay installation which includes, in addition to the

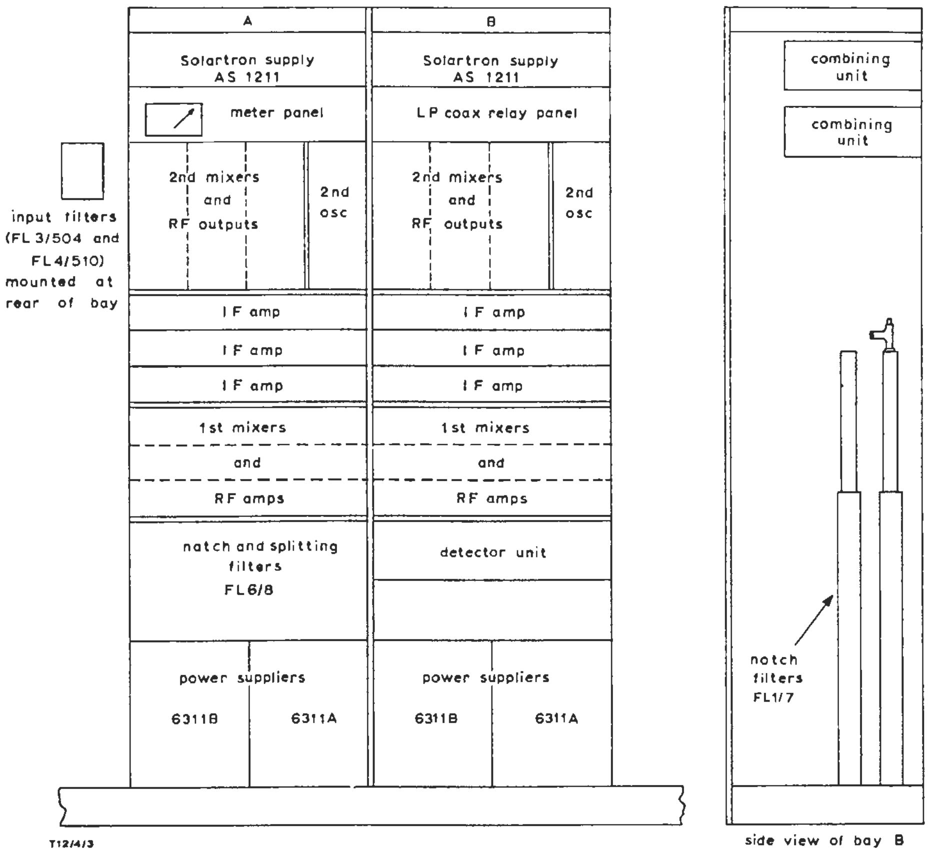


Fig. 4.3 Layout of Two-bay Assembly EP7/1X

EP7/1 equipment, change-over panels, metering panel and probe, and standby translators.

4.3 Circuit Description (EP7/1 Units)

4.3.1 First Mixer and R.F. Amplifier (Figs. 8 and 9)

Fig. 8 is a circuit diagram of this unit, using transistors throughout, and Fig. 9 gives details of the filter which it incorporates.

This front-end unit is basically similar to the unit used in the RC5/3 receiver, described in Instruction RS.2, Section 6. In addition to a few minor component changes, the major differences between the two front ends are the EP7/1's inclusion of an oscillator buffer stage, VT2, and its use of VT6 as an i.f. amplifier, instead of as a limiter and feed stage to a discriminator.

Although three front-end units are required on each EP7/1, only one oscillator OS2/11A is required provided the channel spacings are 2·2 MHz. Where, however, the spacings are unequal, more than one oscillator is necessary in order to maintain the standard intermediate frequencies.

Power is supplied from a transistor unit made by Solartron Ltd; see 4.3.7.

4.3.2 First Oscillator (OS2/11A)

This oscillator and another three variants of the type are used in the RC5/3 receiver mentioned previously. The A and B versions are single-frequency oscillators differing only in working below and above carrier frequency, respectively. The C and D units have a three-crystal assembly in a single B7G-type envelope, and a three-way switch for selecting the crystal suiting requirements; they also operate below and above signal frequency, respectively.

The OS2/11A oscillator is fully described in Section 6 of Instruction RS.2. The circuit diagram is given here, in Fig. 4.4, particularly to supplement the setting-up procedure detailed under 4.5.3. Note that the heater circuit, unused in the receiver application, is provided with a 6·3-volt a.c. supply as shown in Fig. 8.

4.3.3 I.F. Amplifier (Figs. 10 and 11)

This comprises a single tuned amplifier followed by two untuned stages with an inter-stage filter designed to restrict the i.f. response to $f_0 \pm 100$ kHz, with ± 600 kHz between rejection notches.

Referring to the circuit diagram, Fig. 10, the i.f. signal input is attenuated by a π-network, which is adjusted to provide correct muting level. The network precedes paralleled resistors R1, R25 which provide an input impedance of 75 ohms

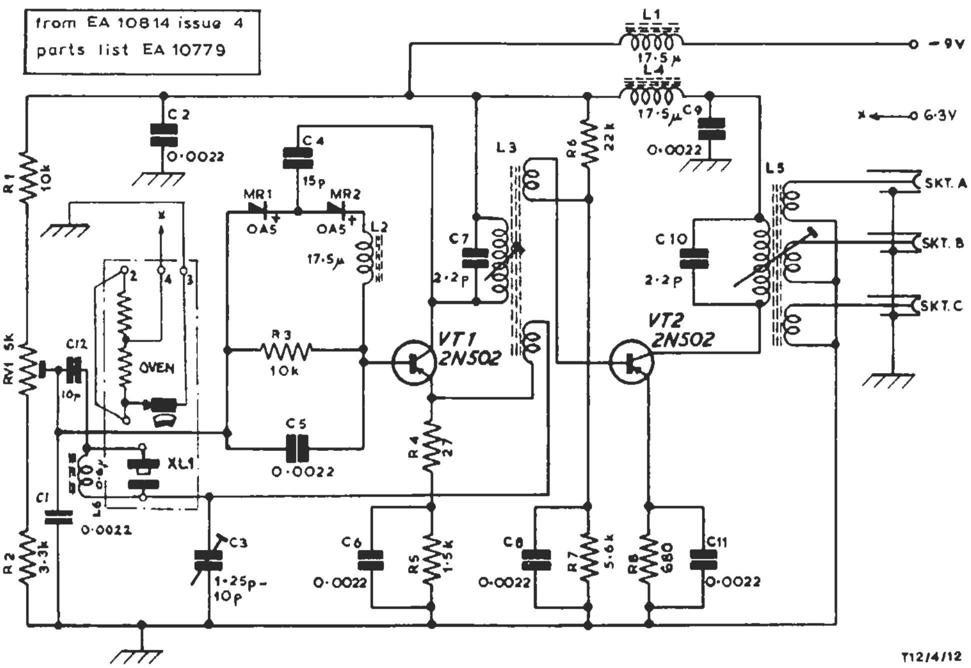


Fig. 4.4 Oscillator OS2/11A: Circuit

when L1, C2 are at resonance. The pentode amplifier has a tuned circuit C9, L3, which is followed by a further stage of amplification in which V2 is untuned. Anode and screen supplies for V1 and V2 are stabilised by V4, V5.

The i.f. filter, shown in Fig. 11, is similar to the network used in the front-end unit, but has an additional section providing attenuation at f_0 — 600 kHz.

V3 is a limiter amplifier, the signal limiting level being controlled by the rectifiers MR1, MR2. The muting circuit, provided by TR1, monitors the i.f. and preceding stages, and is used for the suppression of carrier output when either (a) r.f. signal input falls below the useful level, or (b) carrier input is removed at the end of a transmission period. The bias of TR1 is adjusted in conjunction with the input π-attenuator so that relay RLA de-operates, removing the earth from tag 3, when the input signal falls below a predetermined level. This tag 3 is connected to tag 3 of the output amplifier unit (see Fig. 13), and the removal of its earth places sufficient bias on the amplifier output-stage (V3) to ensure suppression of the carrier output. By this means carrier suppression can be effected on any one of the three channels whilst normal service is maintained on the other two. The RLA contacts are used also to remove the short-circuit across a *Demute* lamp, which is therefore lit on each of the operative translators.

When automatic change-over is used, muting is applied via the change-over panel.

4.3.4 Second Oscillator (Fig. 12)

The oscillator unit, as shown in Fig. 12, raises the i.f. signal to the required Band-II output frequency. The Cathodeon miniature-type crystal XL1, operating at 10·7 MHz below carrier frequency, is temperature-stabilised in a thermostatically-controlled oven. It maintains oscillation in V1, connected as an earthed-grid triode, and is provided with anode-cathode feedback via L2. Output tuning is effected by preset capacitor C6. V2 and V3 are tuned amplifiers from which is obtained a Band-II output at the required level for driving the second mixer.

4.3.5 Second Mixer and R.F. Output (Fig. 13)

Referring to Fig. 13, V1 is an oscillator buffer amplifier in which L1 and C1 provide a tuned input circuit. The tuned anode of this amplifier includes an inductor L2, centre-tapped to provide oscillator injection into the mixer input transformer L3. This forms the input circuit for the i.f. signal fed from the i.f. amplifier and provides a 3·3-kilohm termination, at resonance, to the 75-ohm connecting cable between the two units. The output impedance of the i.f. unit is, however, approximately 50 ohms in the limiting condition, and 3·3 kilohms unlimited. These circuits are carefully aligned so that the limiting and unlimiting gains are equal, and this alignment takes into account the capacitance of the interconnecting cable, which forms part of the mixer input circuit.

The limiting/unlimiting gain-setting is important, particularly on a Station which has a marginal feedback figure. From a consideration of the figure-of-merit expression ($S_m - L_m - 6$ dB) it is seen that if L_m is marginal any appreciable increase in translator gain results in an unacceptable figure-of-merit. This condition produces excessive radiated noise which, when fed back to the translator as an input signal, restores the limiting action and reduces the i.f. gain. A limiting condition is therefore produced which can, during deep fading or at switch-off times, cause failure of the muting system.

V2 is a double-triode push-pull amplifier, with anode tuning inductively coupled to V3. This is a double-tetrode push-pull stage with tuned grid and anode circuits. In this stage neutralising is provided by including a 1-in. length of 22 swg wire soldered to the anode on pin 6. This provides a small degree of feedback to the grid circuit on pin 3.

The power-output stage also uses a double-tetrode, V4, in a push-pull circuit with grid and anode tuning. The output is inductively coupled into a coaxial connector; this provides 10—13 watts of output power into a 50-ohms unbalanced load.

Rectifier MR1 and the associated circuit provide d.c. monitoring of the r.f. output at SKTG.

4.3.6 Combining Unit

This is an f.m. helical-resonator type, supplied by Pye T.V.T. Ltd. It accepts the output of the three output amplifiers and feeds them into a common aerial feeder. The unit is Type 63071, comprised of two panels and described in the Pye instruction-and-maintenance manual.

4.3.7 Power Suppliers (Fig. 14)

The main supply is obtained from a pair of A.P.T. Type-6311 units, with the circuit arrangement given in Fig. 14. Information about this equipment is available in Instruction T.13, Section 2.

In addition a transistor supply-unit is used to provide the First Mixer and R.F. Amplifier unit with d.c. at 12 volts. This is a Solartron unit, Type AS1211, although some early installations were fitted with the Type AS854. Full description of these units is given in the manufacturer's instruction manual.

line. Two brass stubs, D and E, form a capacitive element between the inner core and the two copper tubes. The complete inner assembly is a sliding fit inside the outer tube, thus providing variable tuning for the attenuation notch. After adjustment, the assembly can be clamped at the short-circuit point by means of a Jubilee clip.

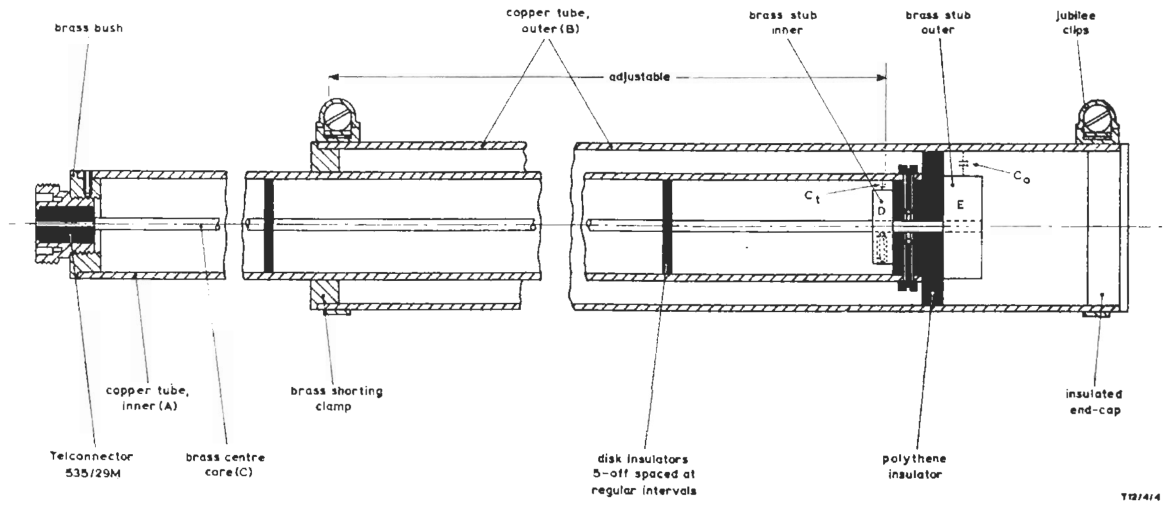


Fig. 4.5 Construction of Notch Filter FL1/7

4.3.8 Notch Filters FL1/7

Two of these are connected in the output circuit of each translator, and they provide a 20-dB attenuation notch at the input frequency of the same translator. They therefore discriminate against input-frequency components in the translator output.

In some equipment where spurious output frequencies close to the translator input frequencies are present, it has been found necessary to connect six FL1/7 filters in the combining-unit output line. This remedy is avoided if possible, since it results in greater power losses. Electrical isolation of each filter assembly from its neighbours is ensured by connecting them through 0·25-λ lengths of coaxial cable.

Fig. 4.5 shows the mechanical construction of the filter, which comprises two copper tubes (A and B) and a brass inner core C. The centre core and the inner tube form the input coaxial line, and the two copper tubes form a short-circuited coaxial line.

Fig. 4.6(a) shows the single coaxial line formed by the inner core and the inner copper tube. This line has a length l and is terminated in C_t. From the general expression for a loss-free line it can be shown that at 90 MHz, the Band-II mid-frequency, Z_{oc} is effectively inductive (jx).

The outer coaxial line, formed by the two copper tubes shown in Fig. 4.6(b) constitutes a short-circuited line with variable length x. The variable effective impedance, Z_{sc}, of this outer line is coupled into the inner line by the capacitance C_o, having reactance X_{co}. For any given frequency therefore, a length x can be found such that the combination of Z_{oc} and $(Z_{sc} + X_{co})$ produces the required high-attenuation notch at the feeder input. This is given by:

$$Z_{in} = Z_{oc} + (Z_{sc} + X_{co}) = 0; \text{see Fig. 4.6(c)}$$

Filter connections are normally made via Telcon connectors but, since these are comparatively lossy, type-C connectors are used in the *In Line* condition.

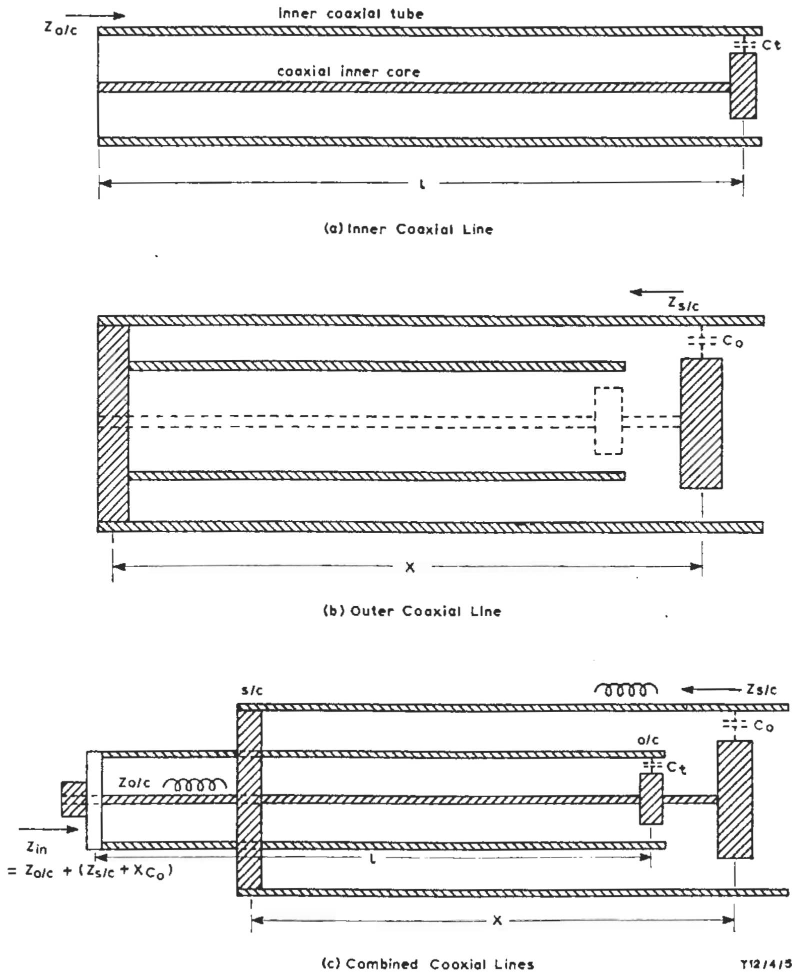


Fig. 4.6 Constituents of FL1/7 Filter

4.3.9 Filters FL3/504 and FL4/510

These filters are intended to restrict the bandwidth of the system in order to further attenuate unwanted components in the output.

In the input circuit a high-pass filter and a low-pass filter are used to form a bandpass network with a pass-band from 87·5 — 95 MHz approximately. The aerial circuit includes one low-pass filter, intended to attenuate 2nd-harmonic components and therefore having a cut-off frequency of 100 MHz approximately.

These filters are described in Section 2 of Instruction T.13.

4.3.10 Splitter and Input Filter FL6/8

This panel performs two basic functions at the input of the translators:

(a) It provides splitting filters between the aerial and each translator, which accept the wanted and rejected the unwanted input frequencies.

(b) It provides a notching filter giving approximately 80 dB of attenuation in the aerial circuit at translator-radiated output frequencies.

The unit comprises a mild-steel panel (19 in. by 12¼ in.) on which are mounted 18 helical resonators.

The resonators are of the form shown in Fig. 4.7, and consist of a 6 s w g copper-wire helix and a brass eddy-current trimmer plate which provides a fine control of inductance. The assembly is mounted in a cylindrical copper box. The trimmers are available as screwdriver-slot adjustments on the front panel.

The helix frequency coverage is:

4·5 turns 90—97 MHz
5 turns 85—92 MHz

Tuning within these two bands is obtained by moving the end-turn fixing in the canister slot provided. This opens or closes the helix winding. The front-panel eddy-current trimmers provide additional fine tuning.

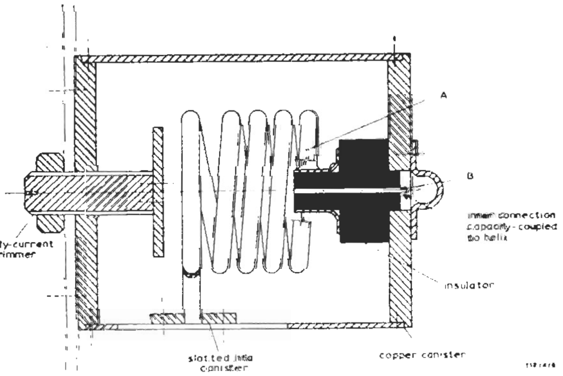


Fig. 4.7 Construction of FL6/8 Resonator

The end turn at A in Fig. 4.7 is capacitively-coupled to the case by the 18 s w g wire shown at B. The whole assembly therefore comprises a series tuned circuit having very-low impedance at resonance.

Referring to the diagram of two sets of resonators in Fig. 4.8, each aerial notch filter (NR1, NR2 and NR3) consists of a group of four series resonators tuned to the particular translator frequencies adopted for local radiation of Light, Third and Home programmes. The front-panel trimmers for these resonators are marked *Light NR1a-d*, *Third NR2a-d* and *Home NR3a-d*. When the resonators are tuned to the unwanted frequencies appropriate to these channels, they apply a very-low impedance path to earth; approximately 80 dB of rejection is provided at the unwanted frequencies. The output of the filters is connected to the splitter filters, SR1—SR3, and they, as shown by the diagram, provide each of the translators with an input containing only the required signal.

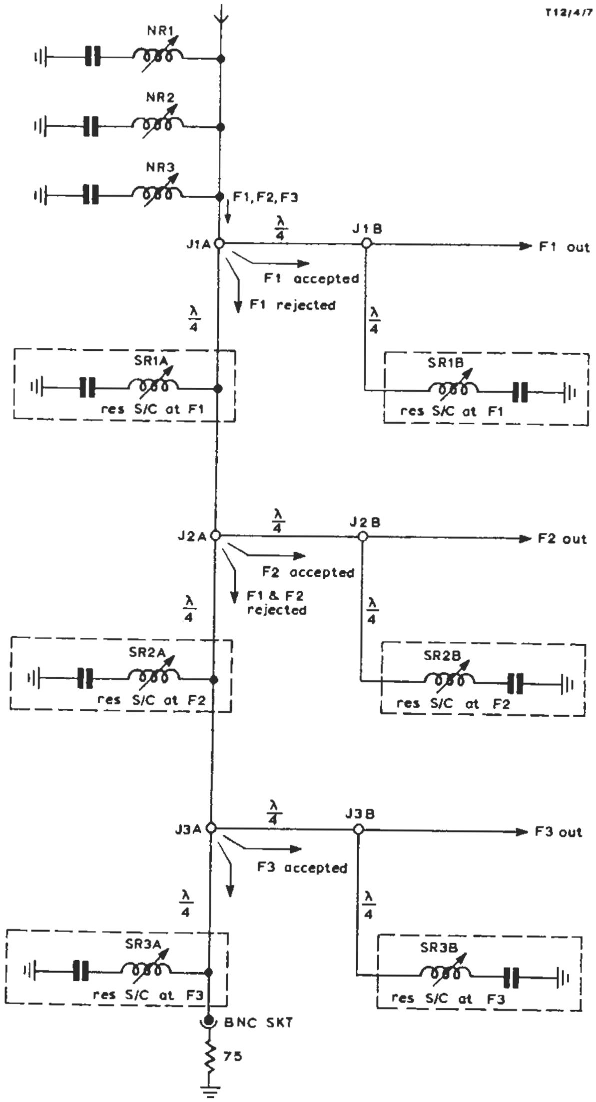


Fig. 4.8 Three-frequency System of FL6/8 Resonators

If SR1A and SR1B are tuned to resonance at frequency F1, they provide low-impedance paths to earth at that frequency. The 0·25λ-line impedance transformations provide a through path for F1 signals in the SF1 Out direction and a high impedance to F1 in the J2A direction. Consideration of impedance at F2 and F3 shows that they are similarly provided with through- and stop-paths in the appropriate directions.

Interconnections are by means of coaxial cables terminated in BNC sockets. A connector-mounted

75-ohm load is normally plugged into a socket marked *Load*, thus providing correct termination for the filter chain.

4.4 Performance Specification (EP7/1)

Input-frequency range	87·5—100 MHz.
Input impedance	75 ohms, unbalanced (v.s.w.r. not greater than 1·3).
Input signal level (min.)	250 μV.
Intermediate frequencies	9·71, 11·91 and 14·11 MHz.
Output-frequency range	87·5—100 MHz.
Frequency translation	Normally between ±0·6 MHz and ±1·6 MHz.
Stability of frequency translation	Within ±500 Hz.
Output power (*to aerial*)	Adjustable to 8·2 watts.
Output impedance	50 ohms, unbalanced (v.s.w.r. not greater than 1·3).
Distortion (a.f.)	At ±75-kHz deviation, not greater than 1 per cent.
Noise	Should not exceed −50 dB unweighted, relative to ±75-kHz deviation.
Unwanted terms in output	Should be 60 dB below normal level.
Figure of merit	Not less than 60 dB with four input and two output r.f. notch filters, and assuming a frequency spacing of 0·6 MHz between input and output carrier frequencies.
Power consumption	450 watts, approximately.

4.5 Alignment of Translator Units

4.5.1 Test Equipment

Listed below is all the apparatus required for carrying out complete tests as described. The diagrams mentioned provide constructional details of particular items. The variable attenuators are used in pairs, each capable of introducing a total loss of 99 dB. In further description the term *variable attenuation* is to be accepted as referring to one of these combinations.

Avometer, Model 8
Portable Test Meter PTM/6 (or a 100-μA meter built out to 10 kilohms).
Three F.M. Signal Generators (Marconi TF.995/A1 or A2).
F.M. Deviation Meter (Marconi TF.934).
Valve-voltmeter (Marconi TF.1041C).
Oscilloscope (Cossor 1035).
Electronic Counter (Hewlett and Packard).
Polyskop (Rohde and Schwarz SWOB BN4244).
Power Meter; 50 ohms, 0—25 watts.
Wave Analyser; high impedance, 1 kHz.
Variable attenuators; two of 0—9 dB and two of 0—90 dB (S.T. and C. 74600).
Communication receivers (Eddystone 77OR and 77OU).
Communication receiver (G.E.C. BRT400K, or equivalent).
Tone source; 40 Hz to 10 kHz, with output impedance of 600 ohms and level variable up to +20 dB.
Amplifier GPA/4A.
Test Programme Meter.
Four FL1/7 (or equivalent) filters.
Four star pads; 75 ohms (see Fig. 1.14 in Instruction T.13).
Dummy-box i.f. filter.
High-dissipation attenuator: 10 dB, to dissipate 30 watts (see Fig. 1.12 in Instruction T.13).
Capacitors; 1 pF.
0·01 μF (mica or ceramic).
Resistors; 75, 82, 430, 470 and 500 ohms, and 313 kilohms.
Termination: 75 ohms.

4.5.2 D.C. Measurements

When no signal is applied to the input, the following voltage and current readings should be obtained by use of a Model-8 Avometer.

First Mixer and I.F. Amplifier

Total current taken by VT1 (at pin 5 on the screening box): 4·8 mA ± 1 mA.

Voltage between pin 6 of screening box and earth: 9·7 volts ± 1 volt.

Emitter-earth voltages: VT3, VT4, VT5: 5·5 volts ±1 volt,
VT6: 3·9 volts ±0·8 volt.

Feed Currents

Unit	PTM/6 Reading		
	V1	*V2*	*V3*
I.F.	60 ± 15	80 ± 15	85 ± 15
Second Osc.	43 ± 10	28 ± 8	75 ± 20
R.F. Out	77 ± 20	27 + 7	—

4.5.3 First Mixer and R.F. Amplifier
I.F. Amplifier (*Fig. 8*)

1. Disconnect L5 *of the i.f. filter* from the input to the i.f. amplifier.
2. Disconnect C25 from VT5 and connect it via a 470-ohm resistor to earth.
3. Terminate socket C in 75 ohms.
4. Between the base of VT3 and earth connect a series chain consisting of a 0·01-µF capacitor, a 430-ohm resistor and an 82-ohm resistor. Connect the Polyskop across the 82-ohm resistor.
5. Connect the Polyskop probe to the base of VT4.
6. Set C19 to minimum.
7. Adjust C16, L6 and C12, L5 for maximum output at the centre frequency, f_0.
8. Increase C19 for a symmetrical slightly over-coupled response with peaks ±100 kHz. Maximum disturbance of the pass-band response should be less than 0·5 dB.
9. Connect the Polyskop probe across the 470-ohm resistor terminating VT4.
10. Adjust C21 for a slightly over-coupled response with peaks ±90 kHz.
11. Fit a resistor across L7, to give a gain of approximately 30 dB between the base of VT3 and the 470-ohm resistor.
12. Reconnect C25 to VT5.
13. Transfer the probe to the base of VT6.
14. Set C35 to minimum. Adjust C27, L8 and C33, L9 for maximum output at f_0.
15. Increase C35 for a symmetrical slightly over-coupled response, with peaks ±80 kHz. Maximum disturbance of the pass-band response should be less than 0·5 dB.
16. Connect socket C to the 75-ohm input of the Polyskop.
17. Set C43 to minimum.
18. Adjust C37, L10 and C42, L11 for maximum output at f_0.
19. Increase C43 for a symmetrical, slightly over-coupled response with peaks ±70 kHz. Maximum disturbance of the pass-band response should be less than 0·5 dB.
20. Measure the gain between the base of VT3 and socket C. This should be 62 dB (±2dB), the 1-dB points being approximately ±100 kHz away.

Note: The input level should be kept as low as possible to prevent overloading. Approximate Polyskop-attenuator settings for aligning are:

VT3: 20 dB
VT4: 35 dB
VT5: 50 dB
VT6: 65 dB

First Oscillator (OS2/11A)

Oscillator-circuit details are to be seen in Fig. 4.4, and external connection of the unit is shown in Fig. 8.

1. Measure total current by connecting the Avometer in series with the 12-volt supply. It should be 4·4 mA ± 1·7 mA.
   Measure the emitter-earth voltages, which should be:
   VT1: 1·7 volts ± 1·0 volt
   VT2: 1·25 volts ± 0·5 volt
2. Terminate the three oscillator outputs with 100-ohm resistors and check output voltage at all three sockets.
3. Tune L3 and L5 for maximum output voltage.

Note: L3 has an asymmetric resonance curve. Its core should be positioned to tune on the flat side of resonance, and at least ¼-turn away from the resonance point. This precaution is necessary to avoid excessive changes of output which would occur at the highly-sensitive resonance point.

4. Adjust C3 to place the oscillating frequency within ±500 Hz of nominal, as measured on a Hewlett-Packard counter.

Note: It may be necessary to trim L3 slightly on some units. If so, the precaution mentioned under 3 should be observed.

5. By adjustment of the external resistor (R8 in Fig. 8), reduce the effective operating-supply voltage to 7 volts as measured on the OS2/11 tag. Then set RV1 to the position at which oscillation only just ceases.
6. Restore the operating voltage to 9 volts. Remove the crystal and two of the three output terminations, and check that there is no output

from the oscillator.

The test procedure applies to the other OS2/11 oscillators, but with operations from 3 onward carried out for Light, Third and Home crystals in the C and D versions.

I.F. Filter (*Fig. 9*)

The alignment of the i.f. filter is best carried out with the filter completely removed from the chassis.

1. Fit the filter in a dummy box that gives access to C1a—C5a.
2. Connect a 430-ohm resistor in series with a 75-ohm resistor and connect both across the secondary of L5. Connect the junction of the 75-ohm resistor and L5 to earth.
3. Connect a 430-ohm resistor in series with an 82-ohm resistor and connect both between one side of L1 and earth (the 82-ohm resistor to earth).
4. Connect a signal generator across the 82-ohm resistor and a receiver across the 75-ohm resistor.
5. Tune the signal generator and the receiver to $f_0 - 600$ kHz, and adjust C2a for minimum input to the receiver.
6. Re-tune the signal generator to $f_0 + 600$ kHz and adjust C4a for minimum input to the receiver.
7. Replace the signal generator and receiver with a Polyskop. Adjust C1a, C3a and C5a for a symmetrical response centred about f_0.
8. Measure the loss at $f_0 \pm 150$ kHz and at $f_0 \pm 600$ kHz. With reference to the loss at f_0, the loss at $f_0 \pm 150$ kHz should be 1·5 dB ±0·5 dB, and at $f_0 \pm 600$ kHz it should be greater than 28 dB.
9. Measure the insertion loss into 500 ohms, with the input signal connected to L5 and one half of L1 terminated.
10. Repeat the test with the termination on the other half of L1. Insertion loss should be 4·5 dB ±1·0 dB, with 0·2 dB between halves.
11. Reconnect the filter to the i.f. amplifier.
12. Connect the Polyskop probe to the base of VT4.
13. With the 82-ohm and 430-ohm resistors across one half of L1 and earth, readjust C5a for a symmetrical response. Check that the 1-dB points are about ±110 kHz.
14. Reconnect L1 to MR1 and MR2.

Buffer Stage (*Fig. 8*)

1. Disconnect the earthy side of L3 and connect it via a 0·01-μF capacitor to earth.
2. Connect an Avometer (on its 1-mA range) across this 0·01-μF capacitor.
3. Adjust C9 for maximum d.c. reading; this current should not be less than 0·15 mA.
4. Restore L3 to normal.

R.F. Amplifier (*Fig. 8*)

1. Connect the output from the Polyskop to socket A.
2. Adjust C1 and C4 to give maximum output at the operating frequency.
3. Measure the insertion gain; this should be approximately 62 dB.
4. Adjust value of resistor across L7, in the i.f. amplifier, to give an insertion gain of 62 dB (±2 dB).

4.5.4 I.F. Amplifier (*Fig. 10*)

1. Across socket E connect a 3·3-kilohm resistor.
2. Remove the connections to the filter and join them together with a lead, keeping their respective positions constant relative to the filter.
3. Inject a 300-μV unmodulated signal into the *Test* socket.
4. With a valve-voltmeter across the 3·3-kilohm resistor, adjust C2 and C9 for maximum output.
5. Measure the output voltage V_0. It should be greater than 0·7 volt, 0·5 volt and 0·4 volt for an f_0 of 9·71, 11·91 and 14·11 MHz respectively. For a frequency change of $f_0 \pm 400$ kHz the output should drop about 3 dB.
6. Set the signal generator to 7·5 mV, and check that the output voltage is 3·7 volts ±0·3 volt.
7. Increase the input by 6 dB. The output voltage should not increase by more than 0·5 volt.
8. Check that a further increase of 6 dB produces no change in output voltage.
9. Set RV1 fully clockwise and set the signal generator to 1 mV.
10. Gradually increase the input signal until RLA operates, as indicated by lighting of ILP1. The setting of the signal-generator attenuator should be less than 9·5 mV.
11. Reduce the input smoothly and check that RLA releases within a change of 3 dB.
12. Set RV1 fully counter-clockwise and increase the input signal to 18 mV.
13. Select that value for R23 (to the nearest preferred value) which prevents RLA operating.
14. Reset RV1 fully clockwise.

I.F. Filter (*Fig. 11*)

1. Connect in series with the 3·3-kilohm resistor a 75-ohm resistor, and connect the receiver across it. Reconnect the i.f. filter.
2. Set the signal generator and the receiver to f_0 −600 kHz.
3. Adjust C6 and then C4 for minimum input to the receiver.
4. Reset the signal generator and receiver to f_0 +600 kHz and adjust C2 for minimum input to the receiver.
5. Replace the signal generator and receiver with the Polyskop.
6. Adjust C1, C3, C5 and C7 to obtain a slightly asymmetric curve, with a flat top response ±100 kHz and a maximum disturbance of 0·5 dB.
7. Repeat the alignment a number of times for optimum response.
8. Remove the Polyskop and reconnect the signal generator and receiver.
9. Measure the relative loss at f_0 ±150 kHz and at f_0 ±600 kHz. Compared with the loss at f_0, the loss at f_0 ±150 kHz should be 1 dB ±1 dB. The loss at f_0 +600 kHz should be greater than 28 dB, and at f_0 —600 kHz greater than 35 dB.
10. Reset the signal generator to f_0 and connect a valve-voltmeter across the 3·3-kilohm resistor.
11. Adjust the signal-generator attenuator to give the same output voltage (V_0) previously measured. The attenuator reading should be 310 μV (±1 dB).
12. Connect the signal generator with an output of 80 mV to the *Input* socket.
13. Select a 75-ohm attenuator which, when connected between this socket and the *Test* socket, allows RLA to just operate.

4.5.5 Second Oscillator (*Fig. 12*)

1. Check that the crystal oven is working, as shown by lamp ILP1 lighting and extinguishing at regular intervals.
2. Remove crystal XL1 and replace it with a 56-ohm resistor.
3. Loosely couple the communication receiver to the oscillator and check that C6 gives an oscillation range of 76—84 MHz.
4. Terminate one output socket with 75 ohms and connect a valve-voltmeter across this termination.
5. Check that an output greater than 1·5 volts can be obtained at each frequency, adjusting C14, C15 and C22 to suit.
6. Set C6 to give the required frequency and trim for maximum output.
7. With valve-voltmeter, measure the voltage at the junction of L1 and C2, and the voltage across R2.
8. Adjust the value of R4 such that the difference between the two voltages is about 400 mV.
9. Replace the 56-ohm resistor with the crystal.
10. Re-trim C6, C14, C15 and C22 for maximum output. The voltage difference should be approximately as previously measured.
11. Check that the output frequency is correct.

4.5.6 Second Mixer and R.F. Output (*Fig. 13*)

1. Connect tag 3 to earth. Connect a 50-ohm wattmeter to socket H and set C18 to mid-capacitance. Connect a PTM/6 to the feed socket of V3.
2. Vary C23 while observing the PTM/6 reading to see that V3 does not go into oscillation. If there is self-oscillation, indicated by a feed-current increase, suppress it by adjusting the neutralising wire on the V3 valve-holder.
3. Trim C18 and C23 for maximum feed-current.

Oscillator Buffer Stage

1. Connect the output from the second oscillator to socket A. Connect the valve-voltmeter to the junction of C9 and L3.
2. Adjust L1 and L2 for maximum voltage; it may be necessary to add capacitance to C1 at some frequencies.

Note: The input voltage should be reduced so that output voltage does not exceed 3 volts during alignment of L1 and L2. With the second oscillator restored to normal, the voltage at C9, L3 should exceed 8 volts.

R.F. Output Amplifier

1. Terminate the amplifier output into the high-dissipation attenuator.
2. Connect the PTM/6 to the feed socket for V2. Connect a signal generator, adjusted to the required i.f., to socket B.
3. Adjust C12, C17, and L3 for minimum feed-reading.
4. Transfer the PTM/6 to feed socket of V3.
5. Adjust C18 and C23 for maximum feed-reading.
6. Transfer the PTM/6 to feed socket of V4.
7. Adjust C26 and C30 for maximum feed-reading.
8. Transfer the PTM/6 to socket G.

9. Increase the output from the signal generator for an output power of approximately 10 watts.
10. Repeat the alignment for maximum reading on the PTM/6 at socket G, fitting capacitors C42, C43, C44, C45, C46, C41 and C40 where trimmers are at maximum.
11. Increase the signal-generator output until output power remains constant.
12. Set RV1 for 12·5 watts. The reading on the PTM/6 at V4 feed-socket should be 75 µA ±10 µA, and the reading at socket G about 60 µA.

Final Alignment

1. Interconnect the individual units and terminate the output socket in a 50-ohm wattmeter.
2. Connect a Polyskop to the *Input* socket of the i.f. unit.
3. Connect the Polyskop probe to the i.f. output socket at the rear of the chassis.
4. Remove the lead connecting the i.f. unit to the power-output unit, then reconnect these units through a 3·3-kilohm resistor. Note the amplitude of the i.f. curve.
5. Restore a direct connection with the output unit, *taking care to use the same connector lead,* and adjust L3 for a similar amplitude.
6. In place of the Polyskop, substitute a signal generator tuned to the i.f.
7. Adjust C12 for maximum power output. This should be at least 13 watts with RV1 set to maximum.

Note: It may be necessary to increase the coupling of L3 to obtain maximum power.

8. Adjust the value of C11 to restore the out-of-limiting gain.
9. Remove the earth from tag 3.

4.6 Overall EP7/1 Bay Tests

4.6.1 Input Notch and Splitter Unit (FL6/8)

1. Connect a Polyskop and Selektomat to the *N.F. Input* and *N.F. Output* sockets.
2. Using a marker set to the translator output frequencies, adjust N.F.1—4 to give a maximum rejection to FM1; N.F.5—8 a maximum rejection to FM2 and N.F.9—12 a maximum rejection to FM3. The rejection in each instance should be at least 60 dB.
3. Transfer the connections to *S.F. Input* and *Load.* Connect the three S.F. outputs to the input sockets on the first-mixer units.
4. Using a marker set to the translator-input frequencies, adjust R1A and R1B to give a maximum rejection to FM1, R2A and R2B for maximum rejection to FM2, and R3A and R3B for maximum rejection to FM3.
5. Reconnect *N.F. Output* to *S.F. Input.*

4.6.2 Output Filters FL1/7

The FL1/7's should be connected in pairs. Their tuning should be adjusted to give maximum rejection to the three translator-input frequencies. The rejection should be approximately 20 dB for each pair.

4.6.3 Tests on Aligned Translators with Feedback

As already described, the translator system uses a receiving and a transmitting aerial mounted on a common mast. Feedback therefore exists between the output and input of translators, which must be taken into account in the overall tests. The relationship between feedback, translator gain and figure-of-merit, has been described in Instruction T.13, Section 1, and is expressed as $S_m - L_m - 6$ dB = figure-of-merit, where S_m is the translator gain and L_m the feedback figure.

Since the specified figure-of-merit for the EP7/1 translator is 60 dB with translator gain at maximum, it follows that:

$$106 - L_m - 6 = 60$$
$$\therefore L_m = 40 \text{ dB}$$

All EP7/1's have undergone an overall test with 40 dB of feedback, the standard value adopted for installations up to the present time.

1. Connect the test circuit as shown in Fig. 4.9, and set the variable attenuator to give an overall loss in the external feedback path of 40 dB, taking into account the loss occurring in the splitting pads and load attenuator.
2. Adjust the signal generator to give the translator an input voltage of 125 µV, and set the signal-generator frequency accurately to the input frequency of each channel in turn.

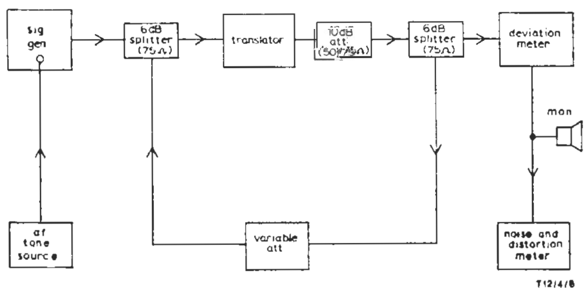


Fig. 4.9 Translator Overall-test Schematic

3. Check and adjust the operation of the muting circuits. Check the performance of the translator on each channel individually in respect of harmonic distortion, a.m. component, noise and spurious-output terms.
4. Repeat these measurements with all three channels operating simultaneously, using the combined output from three separate signal generators.

Note: If a high-dissipation attenuator is not available, the translator output power may conveniently be dissipated in a reel of several hundred feet of 50-ohm coaxial cable, suitably terminated.

5. Check the output power at the output socket of each translator; it should be not less than 12·5 watts, as measured on a 50-ohm power meter.

The meter can be moved to any point in the output chain to check the loss introduced by the combining units, the notch filters and low-pass filters. The specified loss in the combining unit is not greater than 1 dB for each transmitter. The notch filters introduce a loss of approximately 0·2 dB per pair, and the low-pass filters not more than 0·5 dB each.

4.7 EP7/1X Low-power Change-over System

This equipment is used for automatic selection and control of duplicate translators on one or more f.m. channels at unattended stations. The operation of the equipment is dependent upon the presence or absence of an adequate r.f. signal received from the master station. In the low-power system both main and standby translators are nominally 10 watts output; the output to aerial is adjusted to 8·2 watts.

Each translator has its own separate d.c. supply (50 volts) and the A (main) translator 50 volts is used for control of the A side of the change-over panel. The Station 50-volt supply is used for control of the B side of the change-over panel and the coaxial relays. Operation is therefore independent of the A-translator supply. If the Station 50-volt supply fails, the A translator is switched to the aerial.

Referring to Fig. 4.3, the EP7/1X (low power) is equipped with automatic change-over panels, comprising:

(a) a detector panel, containing one detector unit for each translator,
(b) a low-power change-over panel, containing one change-over relay circuit for each pair of translators, and
(c) a low-power coaxial relay panel, containing one relay for each pair of translators.

In the event of complete failure or serious reduction of radiated output power from a translator, a probe detector in the output circuit de-energises the detector relay. This initiates change-over action in the low-power panel. Reduction or failure of the i.f. output results in muting, via the low-power change-over panel, of the output stages. If the fault condition persists for longer than one second, the change-over panel switching de-mutes the standby translator and initiates coaxial-relay switching of the output circuit. Amended operational information is passed to the TIP/2.

Referring to the schematic of the r.f. circuit, Fig. 4.10, the receiving-aerial input is fed through input bandpass filters, which restrict the system bandwidth to the required Band-II frequencies, and thence to the splitting notch filters FL6/8. Their outputs are connected to translator inputs via Hatfield balun transformers. Each pair of translators has the individual outputs connected to the make and break contacts of a coaxial relay to connect one or the other through filters and combining unit to the transmitting aerial.

Although some of the units are mounted on adjacent bays and are therefore not part of the EP7/1X assembly, they are essentially part of the change-over system and have been included in the following description of change-over units.

4.7.1 Detector Unit (Fig. 15)

As already mentioned, one detector circuit is required for each translator. The circuits are constructed on individual printed boards, each mounted in an Eddystone box. Thus, for a three-channel station, six boxes containing a total of six detector circuits are supplied and fitted on a 5-in. panel and mounted on bay B.

Fig. 15 gives the circuit details for a pair of printed boards. Each circuit is built around a sensitively-balanced relay RLA. Under normal a.g.c. bias conditions, as seen on tag E, the relay is energised by current supplied by transistor TR2, via R5 and the 50-volt supply. Thus the RLA1 contacts are made and short-circuiting tags 6 and 7. This is the 50-volt return circuit for the change-over panel control circuits.

The d.c. input to tag E is obtained from detected r.f. induced in a probe on the translator output. If for any reason this, and consequently the d.c. level at E, is seriously reduced or completely

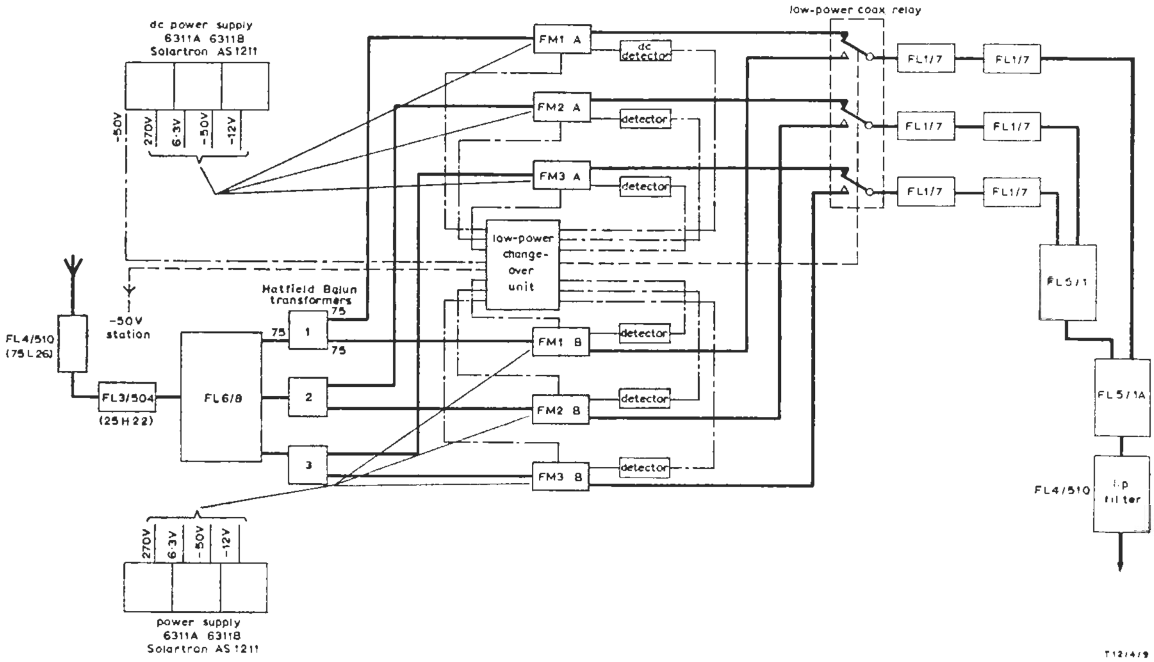


Fig. 4.10 Arrangement of Translators with Low-power Change-over Facility

removed, the base of TR1 becomes less negative than the base of TR4, and TR3 conducts. The current in RLA is therefore neutralised, the relay releases its contacts and translator change-over action is promoted.

The preset reference level at H, obtained from the d.c. across RV1, determines the bias on TR3 and therefore the d.c. input level at which the relay releases. ZD1 and ZD2 are supply stabilisers. Feed sockets (SKTF—SKTJ) are available on the detector front-panel for monitoring 50-volt negative and 275-volt positive supplies on each board.

Fig. 15 gives the D.C.C. code and title, but they may not appear on the equipment.

4.7.2 Translator Change-over Panel (Fig. 16)

For a three-channel f.m. system, three separate change-over circuits are required and these are contained on a single 7½ in. panel on a miscellaneous bay.

Referring to Fig. 16, the panel is controlled from its associated detectors, which place short-circuits across PLA tags when translators are operational. Automatic change-over to the standby condition occurs when the operational-detector's return circuit is interrupted for more than one second. The panel operation is fully described in Instruction T.13, Section 2, as applied to the t.v. translator system. Information passed from the change-over panels to the coaxial-switch panel determines the connection of the translator output circuits.

Fig. 16 gives the D.C.C. code and title, but they may not appear on the equipment.

4.7.3 Low-power Coaxial Relay Panel

Three coaxial-relay switches (B. and R. Type AO7) associated with the three f.m. channels are mounted on a 5-in. panel. The switch contacts normally connect the output notch filters to the three main-translator outputs. When a relay is energised by 50 volts applied from the change-over panel, the corresponding output circuit is switched to the standby-translator output.

4.8 EP7/1X High-power Change-over System

This system uses three Marconi 100-watt power amplifiers; see Fig. 4.11. Although normally 100 watts, operational power output is reduced to 10 watts in the event of amplifier failure. This reduction is regarded as acceptable for the comparatively short periods of time involved.

If an amplifier fails, the combining-unit output is

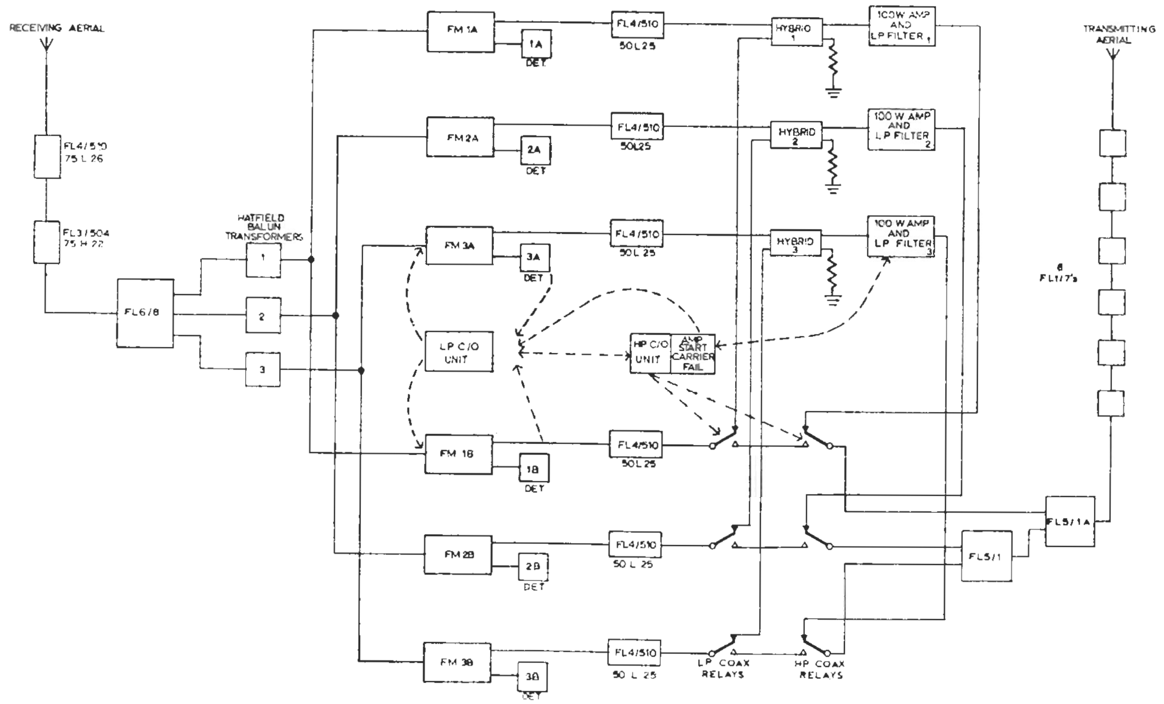


Fig. 4.11 Arrangement of Translators with High-power Change-over Facility

switched by coaxial relays from the amplifier output directly to the B-translator output, thus bypassing the amplifier and its harmonic filter. Operation of this change-over is controlled by the low-power change-over panel which, when the A translator is restored, switches on the amplifier. This contains a 90-seconds delay circuit which allows a warm-up period, during which a carrier-fail relay is locked out, thus preventing action by the high-power change-over panel.

Amplifier carrier-failure initiates change-over action, the actual change-over being delayed by about 10 seconds to allow for unimportant short breaks in transmission. The change-over action first shuts down the amplifier and then simulates failure of the A translator, this initiates change-over to the B translator. After a 0·5-second delay, the h.p. coaxial relays effect the transfer of B-translator output so as to bypass the amplifier.

Referring to the h.p. system schematic Fig. 4.11, it will be seen that the translator input circuit, the l.p. change-over panel and detector units are similar to the low-power system shown in Fig. 4.10. The A-translator outputs are applied via filters and hybrid units to the amplifiers and thence to the combining unit via break contacts on the h.p. coaxial relay. The B translator outputs are normally terminated in the hybrid unit, via the l.p. coaxial-relay break contacts.

When a fault occurs in the A translator (amplifier unaffected) the system relay-timing ensures that, although translator B becomes operational, coaxial-relay switching does not occur and the B translator feeds via the hybrid to the 100-watt amplifier. When change-over occurs due to an amplifier fault, the B outputs are switched via the make contacts of both coaxial relays to the combining-unit input.

In an h.p. system it has been found necessary to connect the six notch filters in line in the combining-unit output, in order to obtain maximum rejection of unwanted products. As in the l.p. system, each pair of translators (A and B) are supplied with change-over circuits, so that automatic change-over can be effected on any one channel, whilst normal operation is maintained on the other two.

4.8.1 100W./10W. Change-over Panel (*Fig. 17*)

The relay equipment is contained on a 7-in. panel and comprises three similar relay circuits, each of which is identical in form and operation to the

100W./10W. panel described for the t.v. system in Instruction T.13, Section 2. The panel is mounted on an adjacent Type-12 Bay.

Referring to Fig. 17, each relay set is controlled by a return circuit from the l.p. change-over panel and by carrier-fail relay contacts in the 100-watt amplifier. Failure in the amplifier results in the opening of the carrier-fail contacts and after 10 seconds RLD releases. RLC contacts then close and operate both coaxial relays. The channel is then operating on the standby translator, connected directly to the combining unit.

Fig. 17 gives the D.C.C. code and title, but they may not appear on the equipment.

4.8.2 High-power Coaxial Relay Panel

Three relays (B. and R. Type AO1O) are on this 5¼-in. panel, mounted on an adjacent bay. They are operated in the event of amplifier failure, by 50 volts supplied from the high-power change-over panel. In the break position, the relay contacts connect the amplifier outputs to the combining-unit inputs. In the make position, the combining-unit inputs are connected to the standby-translator outputs via the l.p. coaxial relays.

4.8.3 Hybrid Units and Loads

A 10-in. panel, mounted on bay A, contains three hybrid boxes and three hybrid-load boxes. The hybrids consist of suitable lengths of coaxial cable (Type T3022) to form 0·25λ- and 0·75λ-sections of rings as shown in Fig. 4.12. The 50-ohm loads are six 300-ohms Electrosil resistors, connected in parallel inside an Eddystone box.

Referring to Fig. 4.12, each input has a 0·25λ path and a 1·25λ path to the output point. Signals arriving at the output, being displaced by λ, are additive and therefore a transmission path exists. The two paths separating inputs A and B are, however, displaced by 0·5λ and signals are subtractive, so no transmission path exists and the inputs are electrically isolated. Similar consideration of path lengths shows that power input to the ring is shared between the translators and the dummy load.

4.8.4 R.F. Power Amplifier

This is supplied by M.W.T. Ltd., and is an F.M. Amplifier Type 5692A. It delivers 100 watts of r.f. into 50 ohms. A full description of the amplifier is contained in the manufacturer's manual, T.4772.

The three amplifiers are mounted on an adjacent

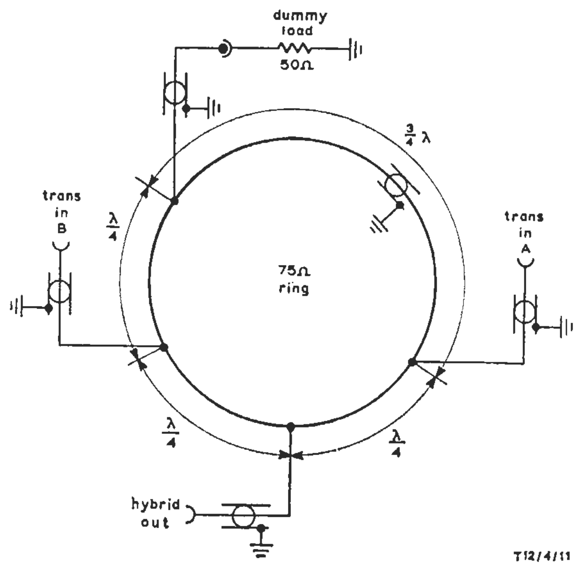


Fig. 4.12 Hybrid-ring Arrangement

bay and are each complete with a power supply, a carrier-fail relay circuit and a low-pass filter.

4.9 Overall EP7/1X Tests

In addition to the test already described for the EP7/1 equipment, the following tests can be carried out on the change-over units associated with the low-power or high-power systems.

4.9.1 Detector Unit: Setting-up

1. Connect a 50-ohm wattmeter to the r.f. output of the channel to be set up.
2. Turn the translator standby switch to *On*.
3. Adjust the power output of the translator by means of the output control (adjacent to r.f. output socket), to the required change-over level. The output stage can be detuned if this control has insufficient range.
4. Adjust the preset control on the detector panel until the corresponding pre-test light is just extinguished.
5. Increase the power output until the pre-test lamp is lit.
6. Check, by reducing the power output, the level at which the pre-test lamp is just extinguished; further slight adjustment of the preset control may be necessary. The on/off differential should be less than 0·5 dB.
7. Retune the output stage and set the power output to normal.

8. Turn the translator standby switch to *Off*.
9. Repeat on other channels as necessary.

4.9.2 Translator Change-over Panel: Tests

1. Apply an input signal and increase the level slightly until one or both translator *De-mute* lamps are lit.

Note: Even if only one *De-mute* lamp is on, both A and B pre-test lamps on the change-over panel should be illuminated. The position of the translator selector switch determines which *Translator On* lamp is lit.

2. Increase the input level to light both *De-mute* lamps.
3. Check that the other translator is now muted (V4 feed is zero). The de-mute lamp on the translator remains lit.
4. Operate the translator change-over switch several times. The translators should always change over and both pre-test lamps remain lit.
5. Remove the two-pin plug from the r.f. output stage of the *On* translator and check that change-over occurs to the other translator. The correct pre-test lamp should now be extinguished.
6. Adjust the translator change-over switch to select the simulated-faulty translator and replace the r.f. input plug.
7. Check that the correct pre-test lamp and the corresponding *On* lamps are lit.
8. Repeat for all channels.

4.9.3 100W./10W. Change-over Panel and Coaxial Relays

Test on FM1 channel

If a 100-watt amplifier is fitted and functioning correctly, with r.f. present at its output, there is a short-circuit across PLD1 and PLD2 in the h.p. change-over panel.

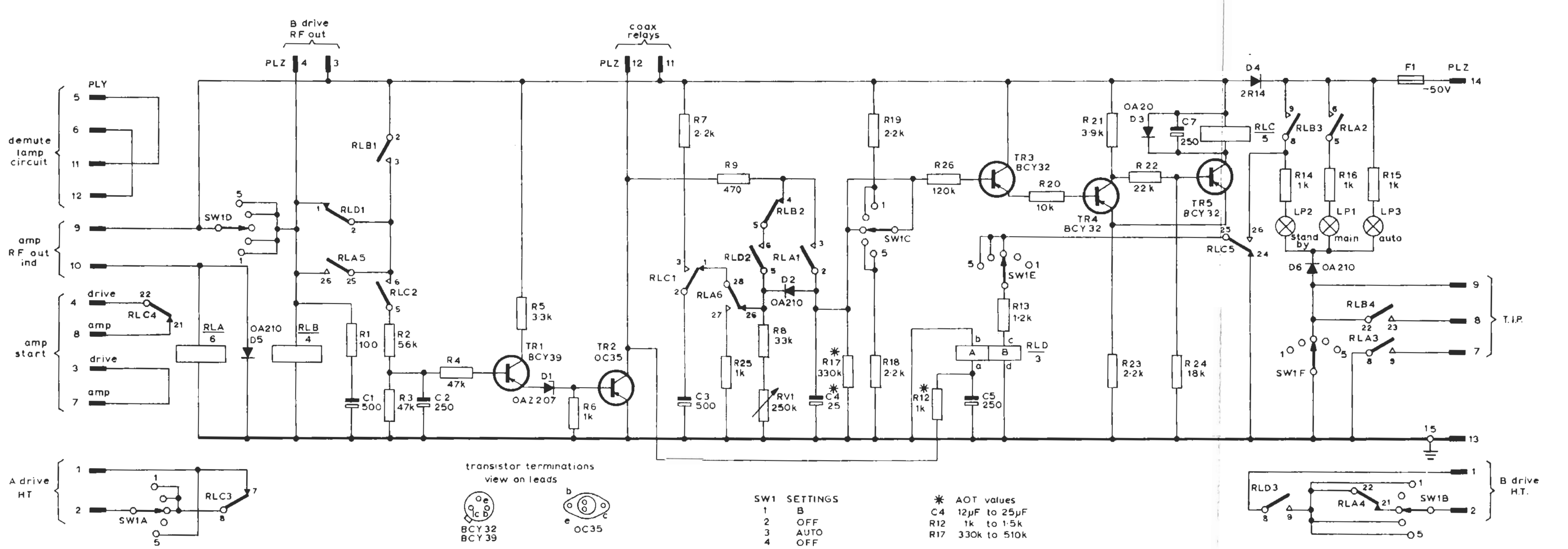
In the absence of an amplifier, a connection should be made across PLD1 and PLD2 to simulate carrier-fail detector action. Connection between PLA1 and PLA2 is also required and is normally provided from the low-power change-over panel. An external short-circuit can be applied, if necessary, to simulate normal operation of the l.p. panel.

Under these conditions RLD should operate, the *R.F. Out* light should be illuminated. After approximately 90 secs. RLA should operate, due to closure of the thermal-delay contact, B1. The panel is now prepared for its control functions. Relay A is held via its own contact A1, the thermal relay B should release and take no further part in the operating cycle.

1. Break the connection between PLD1 and PLD2, either by switching off the amplifier or by removing the artificial short-circuit.
   (i) After approximately 10 seconds RLD releases and the *R.F. Out* lamp should be extinguished. RLC operates, causing the amplifier to be shut down and the coaxial relays to operate.
   (ii) The high-power relays should operate after about 0·5 second delay.
2. Repeat item 1 and check that if normal conditions are restored within 10 seconds, change-over action does not occur.
3. Restore the short-circuit condition across PLD1 and PLD2 and remove the short-circuit across PLA1 and PLA2, thus simulating a translator shut-down condition. All relays should release, (RLD after 10 seconds) and the apparatus should close down.
4. Repeat these tests for FM2 and FM3 channels, using appropriate PLA and PLD tags.

PWG/JR(X)/1266

from PID 9465.3 1A3 issue 2 (rev)
parts list PID 9465.1.2A, 3A, 4A4

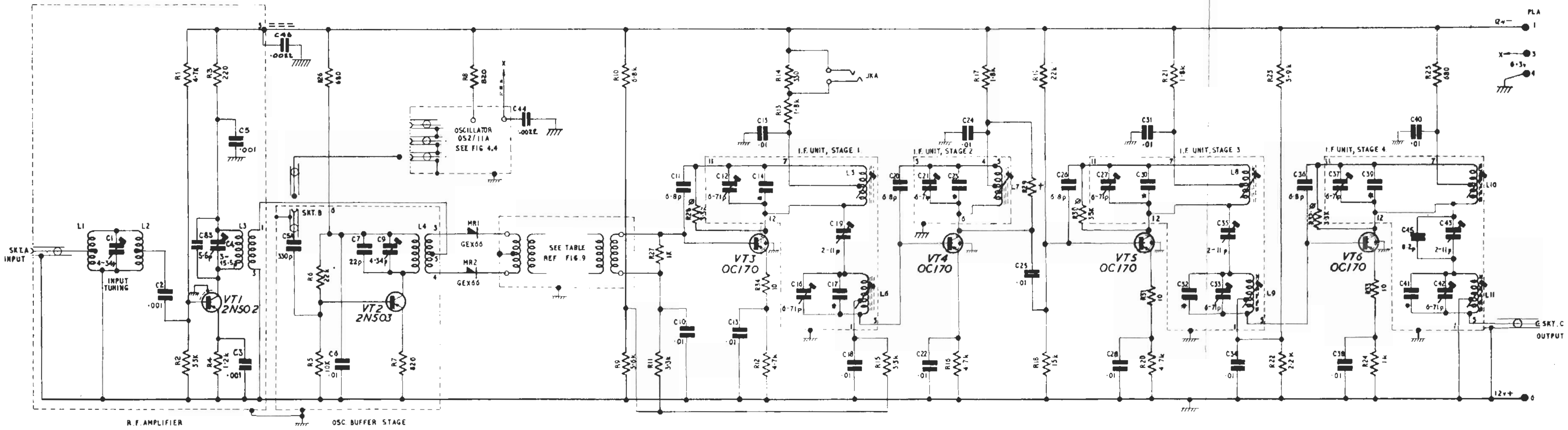


100W/10W CHANGE-OVER UNIT MK II : CIRCUIT

The D.C.C. code and title of this equipment are UN21/4 and Translutor Change-over Relay Unit

FIG.8

from DD8236 issue 6
parts list DA8237



† VALUE TO BE DETERMINED ON TEST

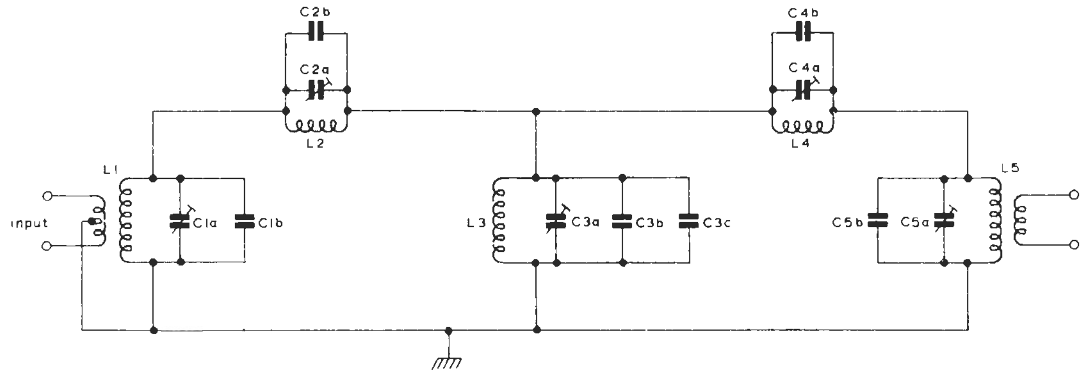
Ø FOR 9·71Mc/s ONLY

FUNDAMENTAL FREQ.	* VALUE OF CAPACITORS IN PARALLEL WITH 6–71p VARIABLES				I.F. FILTER CIRCUIT DETAILS	
	C14 C17	C23	C30 C32	C39 C41		
9·71 Mc/s	300pF	47pF	300pF	180pF	DET 1	FIG.9
11·91 Mc/s	240pF	33pF	240 pF	120pF	DET 2	
14·11 Mc/s	220pF	27pF	240pF	100pF	DET 3	

FM TRANSLATOR EQUIPMENT EP7/1 : FIRST MIXER & RF AMPLIFIER : CIRCUIT

FIG 9

from DA8154 issue 2
parts list: see notes



Circuit Ref	Det 1	Det 2	Det 3
L1	1·35	0·942	0·642
L4	2·96	2·03	1·460
L3	0·692	0·478	0·326
L2	3·48	2·31	1·66
L5	1·418	0·974	0·662
C1a	6–71	6–71	6–71
C1b	150	150	150
C2a	6–71	6–71	6–71
C2b	47	47	47
C3a	6–71	6–71	6–71
C3b	330	330	330
C3c	27	27	27
C4a	6–71	6–71	6–71
C4b	56	56	56
C5a	6–71	6–71	6–71
C5b	150	150	150

Fundamental frequencies

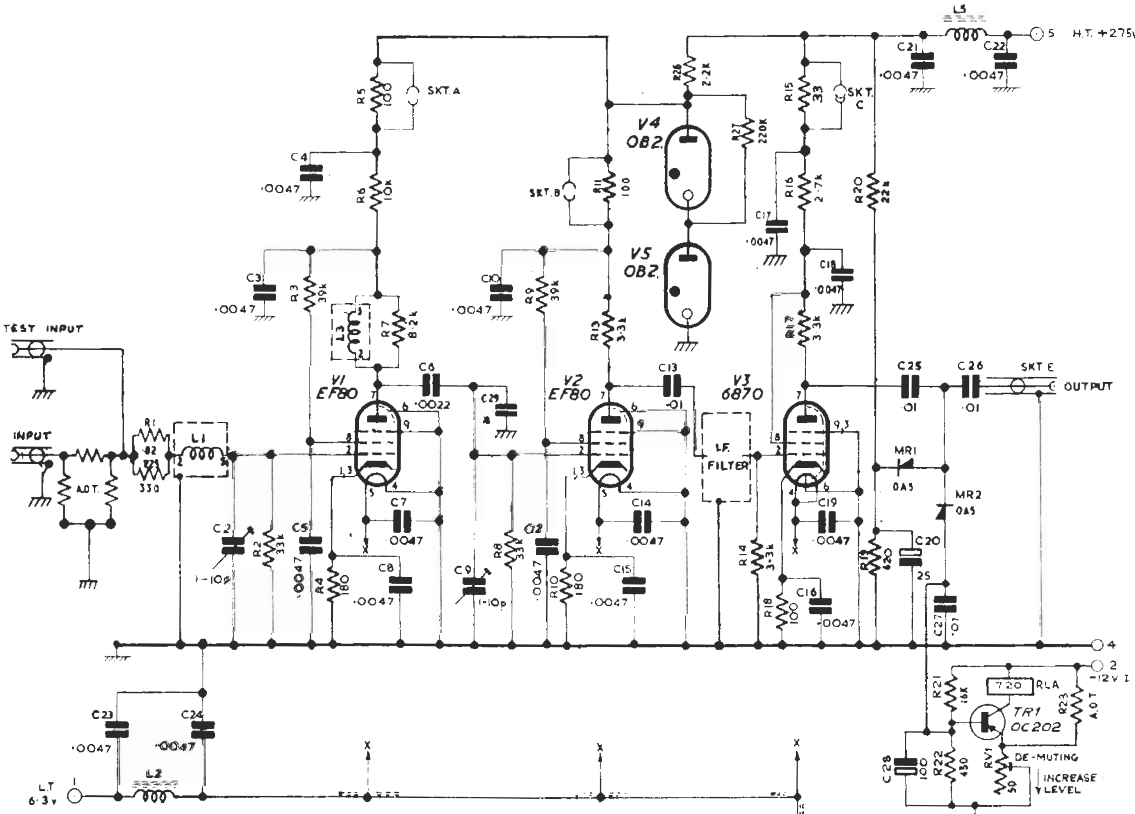
Det 1 = 9·71 mc/s — parts list DA8155
Det 2 = 11·91 mc/s — parts list DA8156
Det 3 14·11 mc/s — parts list DA8157

L in µH
C in pF

FM TRANSLATOR EQUIPMENT EP7/1 : I.F. FILTERS (INPUT R.F. AMP & 1st MIXER) : CIRCUIT

FIG. 10

from DB7879 issue 7
parts list DA7880



* FOR VALUE SEE TABLE.

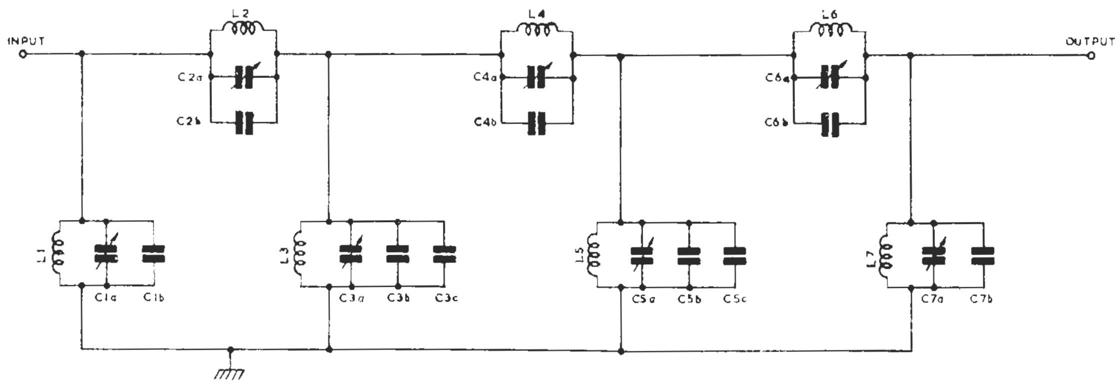
FREQ. Mc/s.	C29
14·11	4·7p
11·91	5·6p
9·71	10p

NOTE –
I.F. FILTER TO SUIT FREQUENCY
9·71 Mc/s DET 1
11·91 Mc/s DET 2 } FIG. II
14·11 Mc/s DET 3

FM TRANSLATOR EQUIPMENT EP7/1 : I.F. AMP UNIT : CIRCUIT

FIG 11

from DB 8242 issue 3
parts list: see notes



Circuit Ref	Det 1	Det 2	Det 3	Circuit Ref	Det 1	Det 2	Det 3
L1	1·418	0·974	0·662	C3a	6-71	6-71	6-71
L2	2·96	2·03	1·46	C3b	220	220	220
L3	0·692	0·478	0·326	C3c	120	120	150
L4	3·48	2·31	1·66	C4a	6-71	6-71	6-71
L5	0·675	0·487	0·321	C4b	47	47	47
L6	3·48	2·31	1·66	C5a	6-71	6-71	6-71
L7	1·35	0·942	0·642	C5b	220	220	220
				C5c	120	120	150
C1a	6-71	6-71	6-71	C6a	6-71	6-71	6-71
C1b	150	150	150	C6b	47	47	47
C2a	6-71	6-71	6-71	C7a	6-71	6-71	6-71
C2b	39	39	39	C7b	150	150	150

L in μH
C in pF

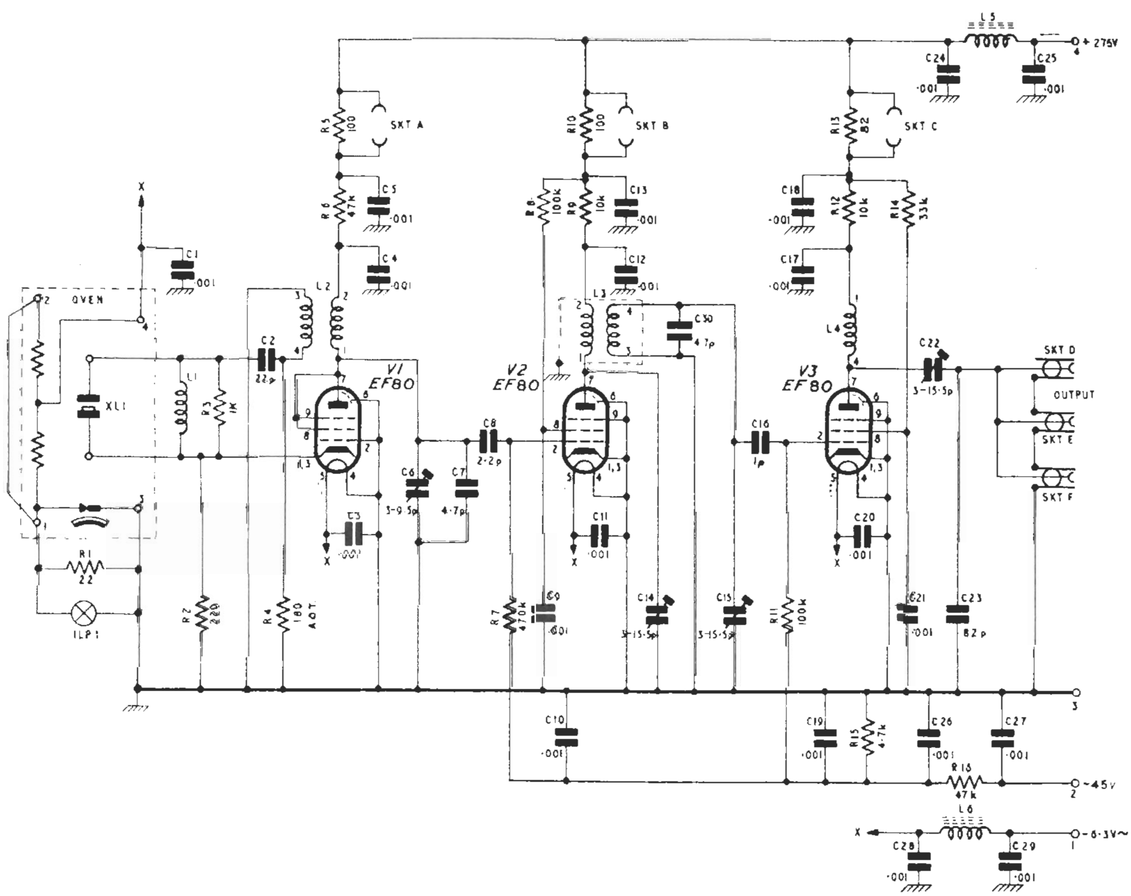
Fundamental frequencies

Det 1 = 9·71 Mc/s — parts list DA8243
Det 2 = 11·91 Mc/s — parts list DA8250
Det 3 = 14·11 Mc/s — parts list DA8251

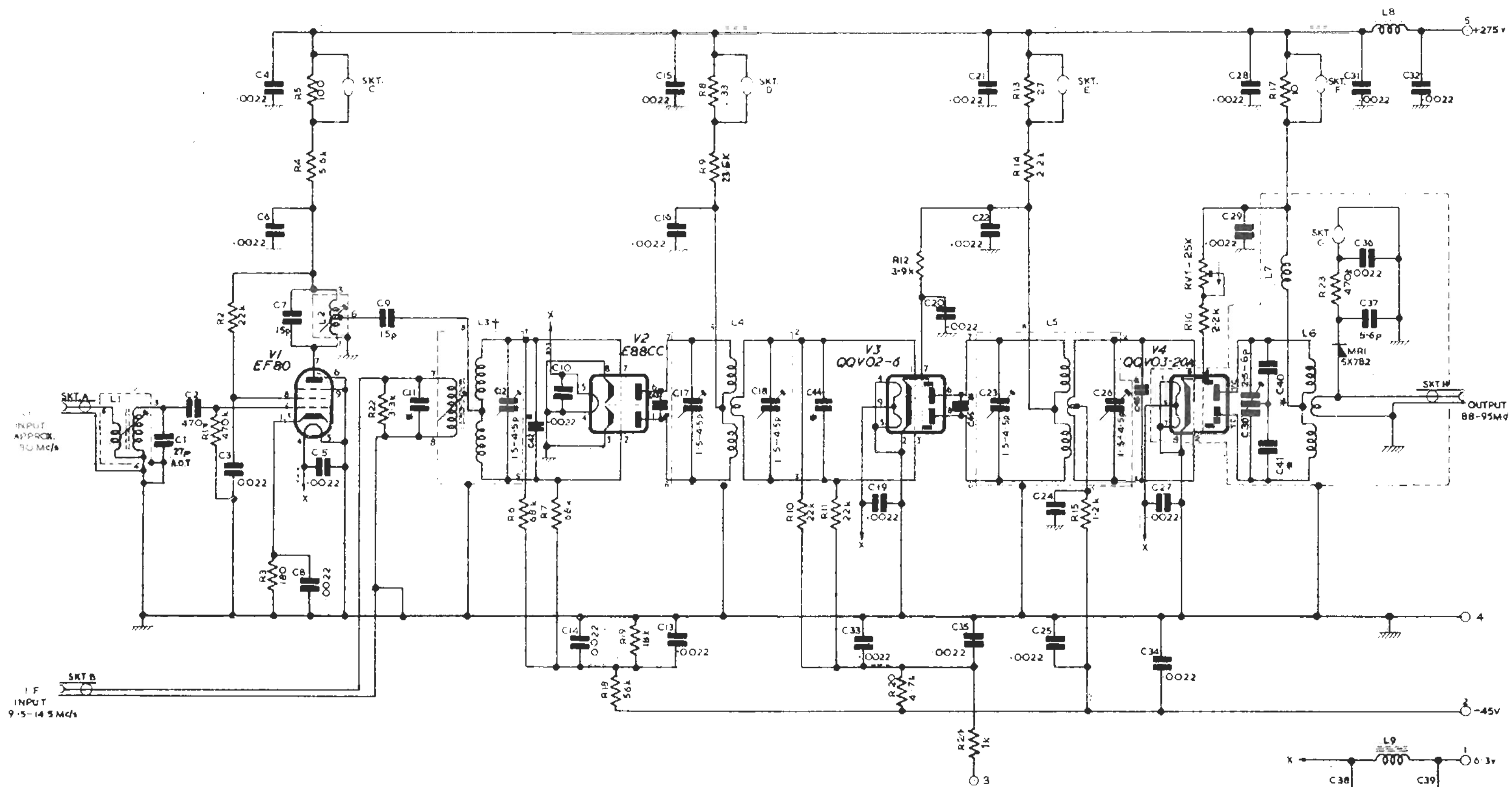
FM TRANSLATOR EQUIPMENT EP7/1: IF FILTERS (IF UNIT): CIRCUIT

FIG. 12

from DB 8074 issue 5
parts list DA 8075



FM TRANSLATOR EQUIPMENT EP7/1 : SECOND OSCILLATOR UNIT : CIRCUIT



NOTES:-

V3 IS TO BE NEUTRALISED AS DIRECTED ON WIRING DRAWING CG 7777 NOTE 1.

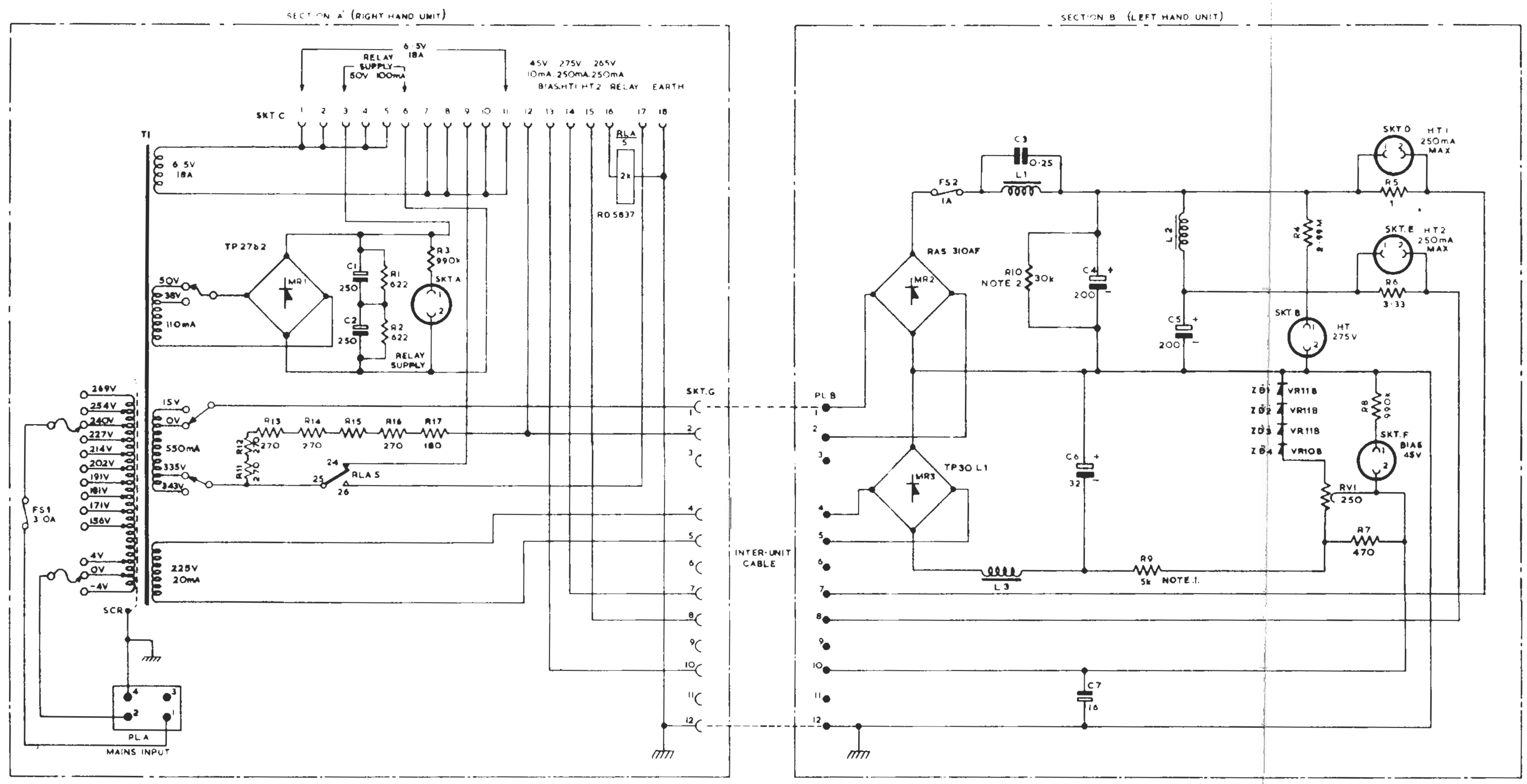
✱ VALUE OF THESE COMPONENTS TO BE DETERMINED ON TEST

† L3 FOR 9·71 Mc/s & 11·91 Mc/s USE EA12041
L3 FOR 14·11 Mc/s USE CA12SAT

FM TRANSLATOR EQUIPMENT EP7/1 : SECOND MIXER & RF OUTPUT CHASSIS : CIRCUIT

FIG. 13

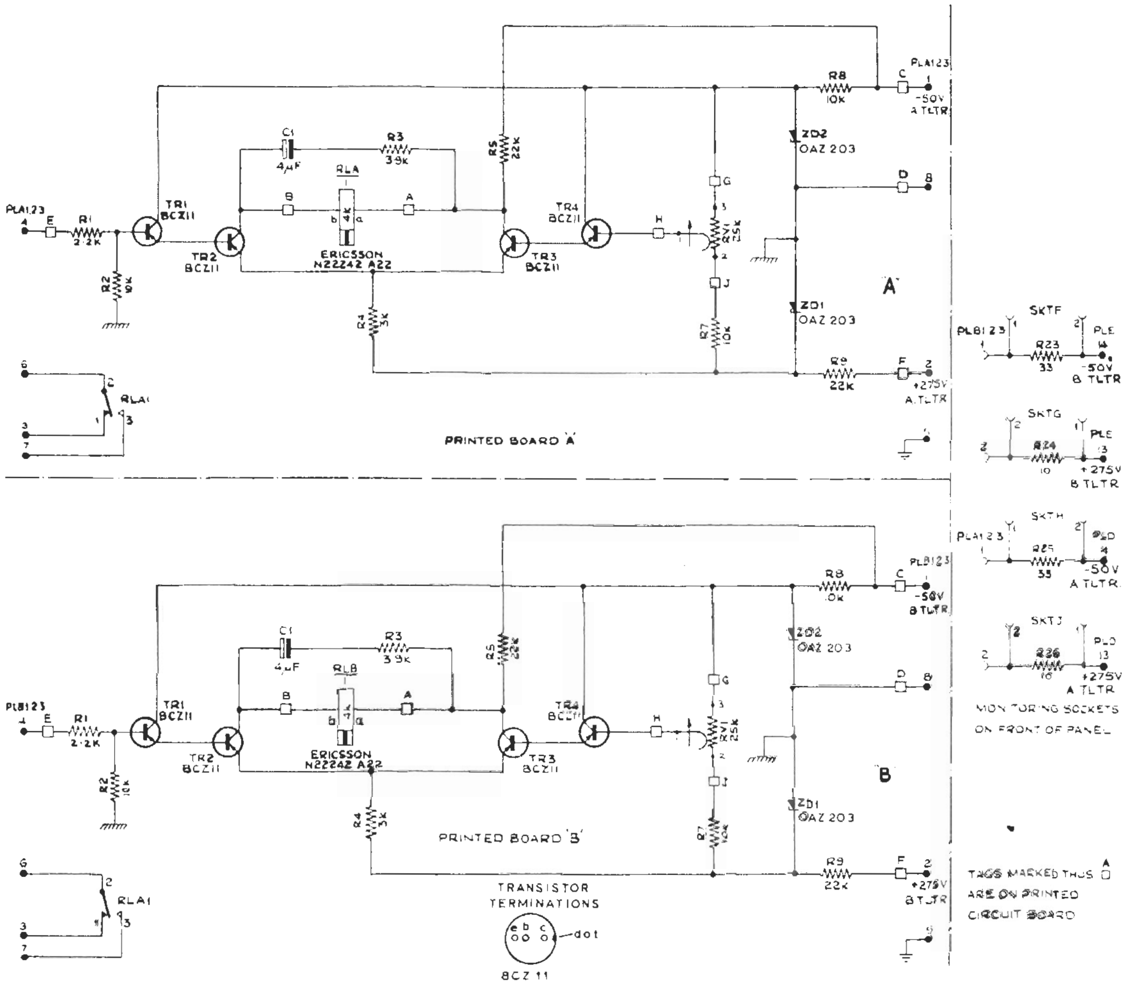
from ED11006 issue 2 (rev)
parts list EA11005



POWER SUPPLIER (A.P.T. LTD. MODEL 6311 A - B) : CIRCUIT

FIG 15

from PID8584 3.18 issue 2
parts list PID8584 1.2A



COMP	TYPE	TOLERANCE PER CENT
C1	U.C.C. SM56S	
R1	Erie 9 0·25W	10
R2	Erie 9 0·25W	10
R3	Erie 9 0·25W	10
R4	Erie 109 0·25W	2
R5	Erie 9 0·25W	10
R7	Erie 9 0·25W	10
R8	Erie 9 0·25W	10
R9	Painton P301A 4·5W	5
RV1	Plessey CP161/01/211 0·25W	20

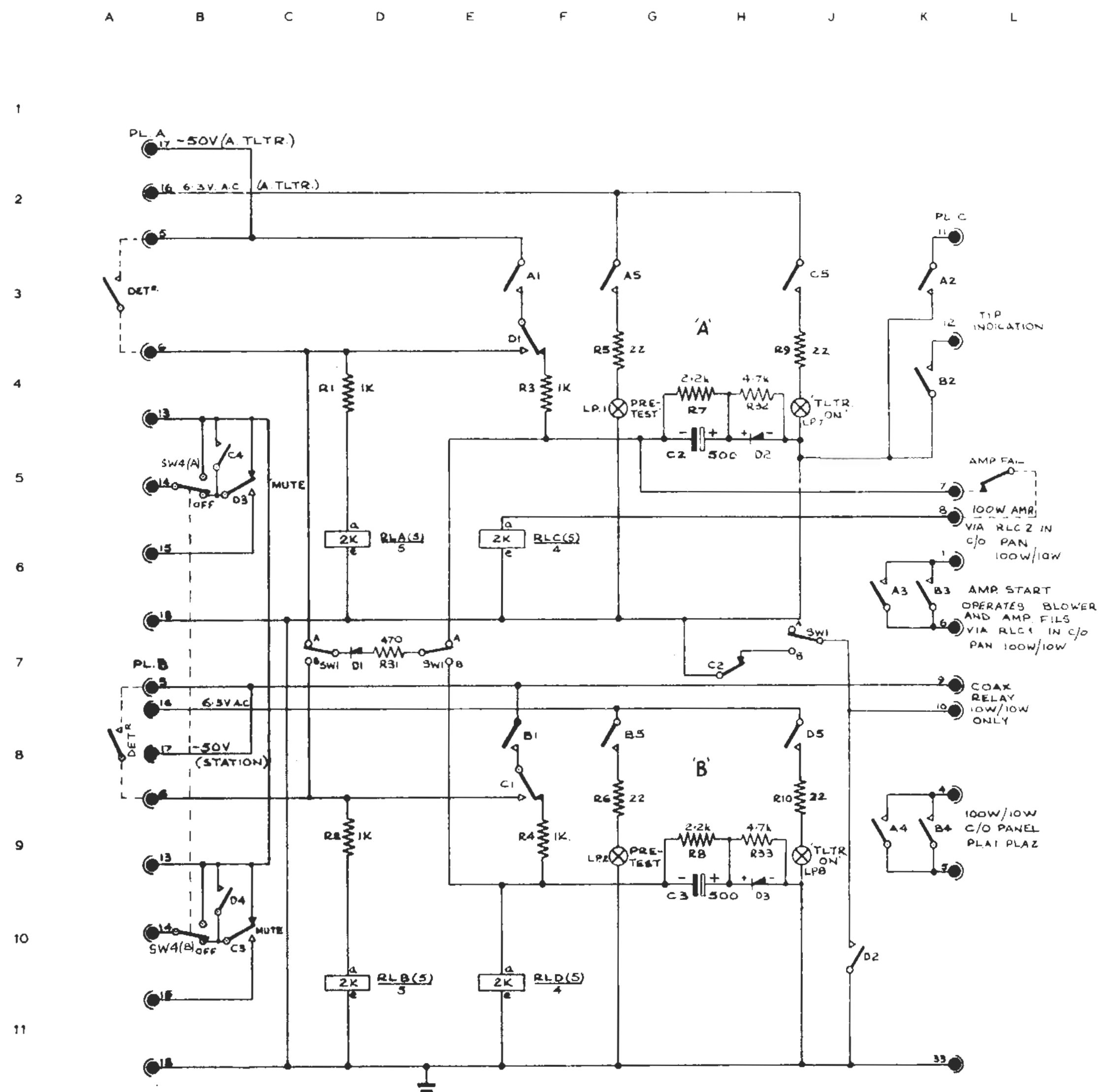
all above are duplicated

DETECTOR UNIT: CIRCUIT

The D.C.C. code and title of this equipment are
UN20/7 and F.M. Translator Detector Unit

FIG 16

from PID 9120.3.1E issue 2
parts list PID 9120.1.2A



NOTE
1. SW.4A & SW.4B ARE USED AS MUTING OVER-RIDES ON THE STANDBY TRANSLATOR

COMP FM1(LIGHT)	LOC	TYPE	TOLERANCE PER CENT	EQUIVALENTS FM2(THIRD)	EQUIVALENTS FM3(HOME)
C2	G5	Plessey CE17027/1 50v		C5	C8
C3	G9	Plessey CE17027/1 50v		C6	C9
D1	D7	Westinghouse 16 BM4		D4	D7
D2	H5	Westinghouse 16 BM4		D5	D8
D3	H9	Westinghouse 16 BM4		D6	D9
R1	D4	Painton P306A	5	R11	R21
R2	D9	Painton P306A	5	R12	R22
R3	F4	Painton P306A	5	R13	R23
R4	F9	Painton P306A	5	R14	R24
R5	G4	Erie 9	10	R15	R25
R6	G9	Erie 9	10	R16	R26
R7	G4	Erie 9	10	R17	R27
R8	G9	Erie 9	10	R18	R28
R9	J4	Erie 9	10	R19	R29
R10	J9	Erie 9	10	R20	R30
R31	D7	Erie 9	10	R34	R37
R32	H4	Erie 9	10	R35	R38
R33	H9	Erie 9	10	R36	R39
RLA	D6	A.E.I RD5837		RLE	RLJ
RLB	D11	A.E.I RD5837		RLF	RLK
RLC	E6	A.E.I RD5837		RLG	RLL
RLD	E11	A.E.I. RD5837		RLH	RLM

CONNECTOR NUMBERING

PLA(18 POLE) & PLB(18 POLE)

FM1 (LIGHT)	FM2 (THIRD)	FM3 (HOME)
17	17	17
16	16	16
5	3	1
6	4	2
13	10	7
14	11	8
15	12	9
18	18	18

PLC(33 POLE)

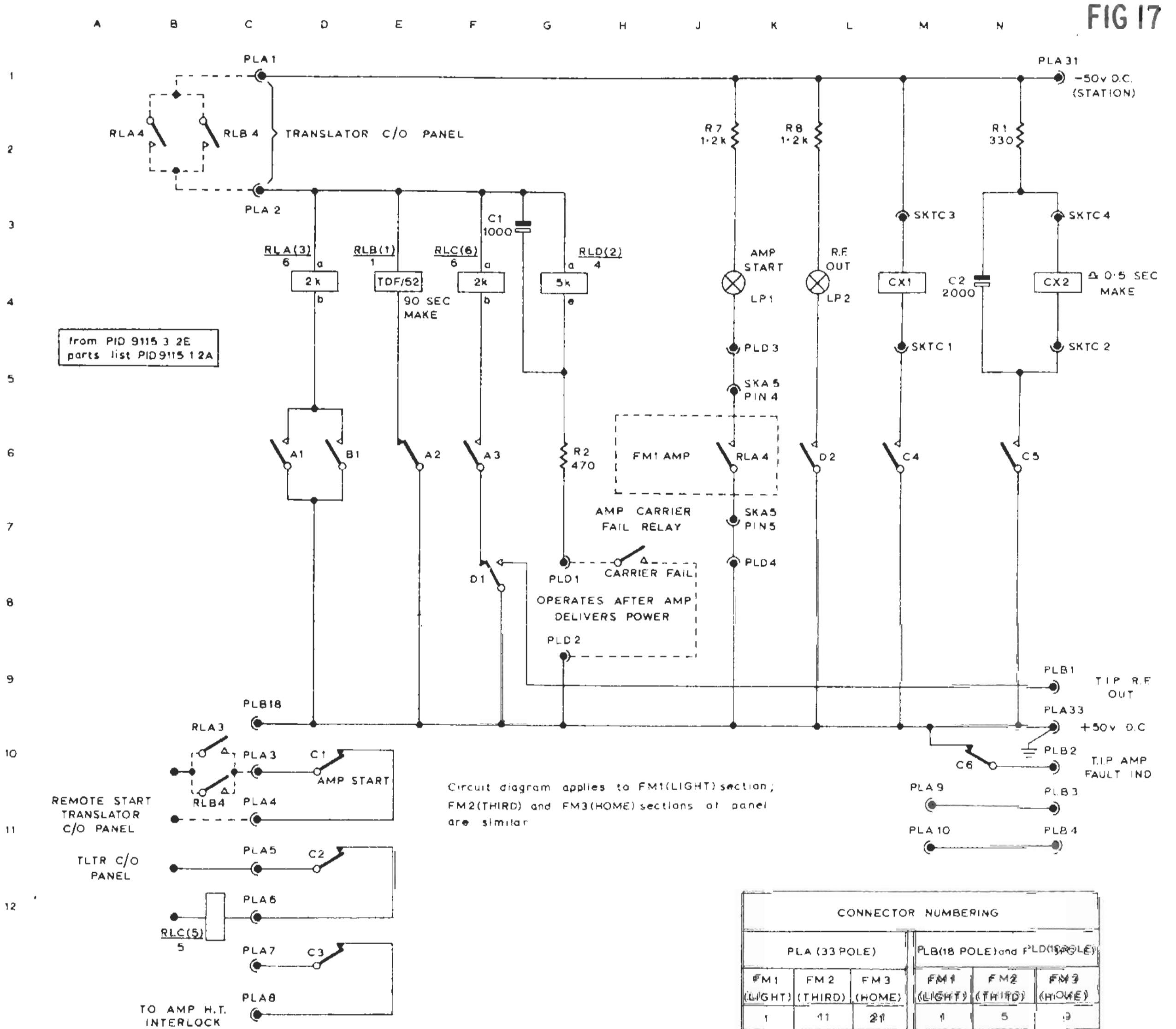
FM1 (LIGHT)	FM2 (THIRD)	FM3 (HOME)
11	20	29
12	21	30
7	16	25
8	17	26
1	2	3
6	15	24
9	18	27
10	19	28
4	13	22
5	14	23
33	33	33

Circuit diagram applies to FM1(LIGHT) section; FM2(THIRD) and FM3(HOME) sections of panel are similar.

TRANSLATOR CHANGE-OVER PANEL: CIRCUIT

The DCC code and title of this equipment are PA17/158 and Translator Change-over Relay Panel

FIG 17



CONNECTOR NUMBERING		
PLA (33 POLE)		
FM 1 (LIGHT)	FM 2 (THIRD)	FM 3 (HOME)
1	11	21
2	12	22
3	13	23
4	14	24
5	15	25
6	16	26
7	17	27
8	18	28
9	19	29
10	20	30
31	31	31
33	33	33

PLB (18 POLE) and PLD (18 POLE)		
FM 1 (LIGHT)	FM 2 (THIRD)	FM 3 (HOME)
1	5	9
2	6	10
3	7	11
4	8	12
18	18	18

SKTC 18 (POLE)		
FM 1 (LIGHT)	FM 2 (THIRD)	FM 3 (HOME)
1	5	9
2	6	10
3	7	11
4	8	12

SKA 5		
1	2	3
4	6	11
5	10	12

COMP FM1(LIGHT)	LOC	TYPE	TOLERANCE PER CENT	EQUIVALENTS FM2(THIRD)	EQUIVALENTS FM3(HOME)
C1	G3	Plessey CE17165/13 50v		C3	C5
C2	N4	Plessey CE17165/13 50v		C4	C6
CX1	M4			CX3	CX5
CX2	N4			CX4	CX6
LP1	J4	BBC 102		LP3	LP5
LP2	L4	BBC 102		LP4	LP6
R1	N2	Painton P301	5	R3	R5
R2	G6	Erie 8	10	R4	R6
R7	J2	Painton MVIA	5	R9	R11
R8	L2	Painton MVIA	5	R10	R12
RLA	D4	P.O. 8281			
RLB	E4	A.E.I. TDF/52			
RLC	F4	P.O. 8281			
RLD	G4	P.O. 12205			

100W/10W CHANGE-OVER PANEL : CIRCUIT

The D.C.C. code and title of this equipment are PA17/157 and Translator Change-over Relay Panel