APPENDIX B

OPERATING INSTRUCTIONS: AUTOMATIC MONITOR, AMT/2

The procedure detailed below deals specifically with operations when the monitor is in use with an f.m. transmitter, as described in Section 3. An essential preliminary to these operations is the correct setting-up of audio gain for the transmitter, such that a 1,000-c/s input at zero level produces a carrier-frequency swing of ± 19·2 kc/s. Apparatus needed for making measurements comprises:

Portable Test Meter, PTM/6
High-impedance Amplifier Detector
Avometer (Model 1, 7, 8 or 40)

Before completing the mains supply for the monitor:

(*a*) Ensure that the 12-way socket is correctly wired and connected to the equipment.
(*b*) Set mains-transformer primary connections on tappings suitable for measured mains voltage.
(*c*) Remove V4 (G240/D) from unit.
(*d*) Ascertain that neither the transmitter nor monitor have a.f. inputs.
(*e*) Select the desired transmitter drive, A or B, and make certain that the Test Key on the IAP, if employed, is not operated.

Then power the monitor and transmitter.

After a warming-up delay the lamp LP1 (V1. Cath. Current) should light first, to be followed after a further interval of 80 seconds ± 40 seconds by lighting of LP3 (Demute) and LP5 (Delay). During this period check that the Mon. Normal indication is given at the CIP coincidentally with lighting of LP3 at the monitor.

Connect the feed plug of the PTM/6 in turn to the internal feed sockets of the monitor, to check that each feed-meter reading is mid-scale ± 15 μA. Place the four-pin plug from the PTM/6 in the Bal. Meter socket on the monitor front-panel, and adjust the V3 Bal. control to obtain a mid-scale reading on the left-hand meter. Verify that the control works in the correct sense, to give a meter-pointer movement in a direction corresponding with that in which the knob is being turned. With some valves it is not possible to obtain an exact balance, but a reading within 20 μA of mid-scale is acceptable as a working condition. Failing this the valve should be rejected for use in other equipment types with less stringent requirements. Check that a mid-scale indication is given by the right-hand meter of the PTM/6, which should be left connected to the monitor.

Use the Avometer to measure the operating voltages, which should be inside the following limits:

Voltage across C19a	310 v. ± 25 v.
Voltage across C21	− 50 v. ± 5 v.
Voltage across C20	− 14 v. ± 6 v.

(a) High-level Sensitivity

(i) Place Test Sens. switch at 0 dB setting, and apply 1,000 c/s tone at + 5 dB to a.f. input for transmitter. Take measurements with amplifier detector to ensure that the level at the Ref. Prog. List jack on monitor is + 5 dB, and that at the Comp. Prog. List. jack is the same within ± 0·5 dB.
(ii) Turn Adj. Comp. Prog. control to the position giving a reading of zero on the right-hand meter of PTM/6.
(iii) Increase tone level by 8 dB, and then reduce it gradually to zero level whilst watching that the right-hand meter maintains a balance indication within ± 10 μA.
(iv) Set the Test Sens. switch to a loss of 2 dB and *slowly* increase the input level until a maximum negative deflection is shown on the right-hand meter of PTM/6. This should occur at an input level of + 7·5 dB, otherwise the Increase Lim. Point control should be adjusted until that condition is obtained.
(v) With the input level still at + 7·5 dB, reset the Test Sens. switch to 0 dB position, and then rotate it slowly until the Fault lamp (LP2) lights. This should occur at, but not before, the 2-dB marking. If not, alter the Increase Sens. control until the condition is secured, the *re-testing after each adjustment of the control beginning with the Test Sens. switch at 0.* With the alarm just operating

the right-hand meter of the PTM/6 should show a deflection of 46 μA ± 11·5 μA to *left* of mid-scale.

(vi) Turn Test Sens. switch to 0 dB and reduce input level to + 6 dB.

(vii) Slowly increase the tone frequency, during which the right-hand meter of the PTM/6 should show an increasing deflection to the right while the left-hand meter remains at mid-scale ± 10 μA. Revert to 1,000-c/s tone, and then start slowly reducing frequency to 60 c/s, during which the right-hand meter should deflect increasingly to the right as the left-hand meter remains balanced within ± 10 μA.

(b) Noise Sensitivity

(viii) Set Test Sens. control at 0 dB and disconnect the input from the Ref. Prog. Input position. Adjust the input tone to zero level at 1,000 c/s, for which the left-hand meter of PTM/6 should have a large deflection and relay RLB should be operated.

(ix) Reduce the input level to a value, about − 40 dB, at which the relay opens, and then slowly increase the level until the relay re-operates. This gives the sensitivity to noise at 1,000 c/s. Values at this and other frequencies, to be obtained by repetitions of the method described, should lie within the following limits:

Frequency (*c/s*)	*Noise Sensitivity* (*dB*)	
60	− 22.5	± 5 dB
110	− 26·5	
250	− 26	
1,000	− 24	
5,000	− 16·5	
10,000	− 12	

Check that the left-hand meter of the PTM/6 shows a reading of + 60 μA ± 15 μA for the just-operated condition of relay RLB.

(c) Alarm Delay Time

(x) Reset the frequency to 1,000 c/s and reduce input to − 40 dB.

(xi) Insert V4 and increase the tone input until Fault lamp (LP2) lights. Note the interval between operation of relay RLB, as shown by the Fault indication, and operation of relay RLE, marked by lighting of Alarm lamp (LP4); this should be between 0·5 seconds and 2 seconds. Also check that the Mon. Norm. lamp on the CIP is extinguished as the Alarm lamp lights.

(d) Programme Balance

(xii) Restore the feed to Ref. Prog. Input of monitor and disconnect tone to substitute programme at zero level, peaking well up to 6 on PPM scale.

(xiii) Press Reset switch on monitor and keep it operated until Alarm lamp (LP5) is extinguished.

With programme applied and the Test Sens. switch at 0 dB, the right-hand meter of PTM/6 should show varying deflections to the right, but should not deflect to the left of mid-scale by more than 10 μA. Under these conditions the left-hand meter may show deflections to right or left of centre scale, not exceeding 25 μA. Having observed the balance to be satisfactory:

(xiv) Turn Test Sens. switch to 2½ dB marking.

Then the Fault lamp should light fairly frequently and the right-hand meter of the PTM/6 should swing fairly often to the left of mid-scale to the extent of 25 μA or more. Check that the monitor gives an alarm after three or four successive operations of the Fault lamp.

(xv) Restore the Test Sens. control to the normal 0 setting, reset the monitor and re-check that it shows a satisfactory balance on programme.

SECTION 4

AUTOMATIC MONITORS (TRANSMITTER) AMT/2 AND AMT/2A

4.1 Introduction

These monitors contain two comparators working over different volume ranges as joint means of detecting amplitude inequality between two a.f. inputs, one serving as the reference with which the other is compared. A typical application is the use of the AMT/2 with the r.f. drives of f.m. transmitters, for which the reference signal is taken from the programme circuit feeding the drive and the compared input is obtained, through an external demodulator, from the drive output. In conjunction with external control systems the monitor can be used to initiate either non-executive or executive action, the first simply drawing attention to abnormalities and the second causing substitution of reserve equipment in the monitored zone.

The equipments originated by development from the AMT/1 monitor, dealt with in Instruction T.8. That information, no longer issued, is not generally available and so the next sub-section is substantially a repetition of its preliminary considerations regarding design for this class of monitor.

The parent AMT/2 was intended particularly for f.m. installations and the AMT/2A became available as a counterpart for use with a.m. transmitters. The variant type differs only in having an additional muting facility and is readily adaptable for the f.m. application. For that reason the AMT/2A has superseded the parent version, production of which has ceased.

4.2 Design Considerations

Direct comparison of the two signals is precluded by the extreme difficulty of meeting the requirement that there should be no phase shift between the reference and compared inputs. A second reason is that any constant signal-difference expressed in terms of decibels has a voltage equivalent depending on signal level. For instance with a 1-dB difference at signal amplitudes of 1 volt and 100 volts the respective discrepancies are 0·1 volt and 10 volts approximately. Thus a linear voltage-comparator would vary in sensitivity; adjustment to operate with a given signal difference at large amplitudes would give an insensitive state at small amplitudes and alternatively a satisfactory condition for low levels would provide undue sensitivity at large amplitudes.

The difficulty with phase differences is avoided by rectifying the a.f. inputs before comparing them. The rectifier time-constants are chosen for short charging periods and relatively long discharging periods to enable certain programme peaks to be examined and memorised. The two rectifier outputs are applied to a relay which operates when magnitude differences exceed a predetermined tolerance. The process is one which converts phase differences into time differences between the instants at which the rectifier outputs reach peak values. The relay is incapable of acting quickly enough for operation during charging and the slow rectifier-output decay ensures there is no operation after peaks if both signals attain similar amplitudes.

The problem of sensitivity variation is met by using two comparators to monitor opposite ends of the amplitude range. The low-level comparator is primarily to detect noise discrepancies but, to a limited degree, it functions also for changes in compared-signal amplitude. The high-level comparator monitors for non-linearity and compared-signal reduction from either changes in gain or variations in frequency response.

The high-level comparator is biased to make it responsive only when compared-signal amplitude falls below reference-signal amplitude. This one-way feature is employed because (a) most high-level transmitter faults become evident by reductions and (b) the low-level comparator operates for increases even though its sensitivity in that respect is low. The low-level comparator is unbiased and so tends to duplicate the function of the high-level comparator when a reduction occurs owing to alteration of gain and/or frequency response. For such conditions the high-level comparator has greater sensitivity and therefore takes prior action.

The biased state of the high-level comparator enables weighting to be used for obtaining sensitivity that varies with frequency. This is desirable because the ear is less readily appreciative of volume changes at frequencies in the regions nearing both limits of the audible range. To take that into account the compared-signal amplifier has a gain/frequency response characteristic with a middle-frequency minimum between progressive rises towards both extremes of the audible range. Consequently for high and low frequencies the fall in amplitude can be greater, relative to that at middle frequencies, before compared-signal reduction is sufficient for the high-level comparator to signal a discrepancy.

One difference from the earlier type (AMT/1) is the inclusion of an integrating circuit to which fault signals from the two comparators are applied. This circuit works on a debit/credit basis to exercise discrimination which restricts external action to occasions when fault signals are either continuous or occurring in sufficiently rapid succession. The AMT/2A incorporates a muting facility to permit external action to be cancelled from a remote position and with that exception it is similar to the parent type.

4.3 Mechanical Description

The unit is designed for 19-in. rack-mounting bays and its panel height is 10½ in. All controls, signal lamps, listening jacks for the a.f. inputs and a metering socket for the comparators are on a central sub-panel cleared by a cut-away in the front cover. Beneath the cover and to the left of the sub-panel are anode-current metering sockets, each placed adjacent to the associated valve.

Letter-identified relays in the AMT/2 equipment comprise six in a vertical group on the centre-front of the main panel and one (F) near valve V1 with which it is connected. In the AMT/2A is an extra relay (H) placed near the top-right corner of the main panel.

The monitor is fitted with a 3-pin plugging connector to connect a mains supply for operation at any of the conventional voltages (200 to 250 volts). The mains-fed equipment produces low-voltage d.c. for the comparators and low-voltage a.c. for signalling purposes, in addition to those needed for valve operation. Signal inputs are introduced through a 12-way plugging connector which is used also in establishing external connection with control circuits in systems depending on 50-volt positive-earthed supplies.

4.4 Circuit Description Fig. 4

Fig. 4 is a combined circuit diagram showing by dashed lines the minor changes needed to use the extra relay fitted in AMT/2A units. Apart from late reference to this addition the following description applies to both forms of the equipment type.

The reference and comparison inputs are fed to single-stage amplifiers with V1 and V2 respectively in circuits which are basically similar. Their detail differences include (a) means of adjusting the V2 input only, and (b) the purpose served by negative feedback.

Controls preceding V2 are a tapped and calibrated voltage-divider (*Test Sens.*) in series with a variable resistor R1 (*Adj. Comp. Prog.*). The first control is normally at the 0-dB position as its purpose is to allow checking of sensitivity by noting the input reduction needed to make the monitor issue a fault signal. The second control enables the V2 input to be adjusted to equality with the V1 input.

Negative feedback is taken from the anode circuit to a resistor in series with each input-transformer secondary. For V1 the feedback elements (C2, R9 and R10) have values suited to providing a gain/frequency response characteristic as level as possible. With V2 the desired rises of response towards the limits of the audio range are obtained by progressive reduction of feedback. That occurs at low frequencies owing to the relatively small value of C1 and at high frequencies it results from increasing shunting of R12 by the combination of C9 and R13.

This weighting is needed for the high-level comparator only, as explained under 4.2. Consequently in applying the outputs of both valves to both comparators there is further modification of frequency response in two of the coupling circuits. The low-level comparator requires a V2 feed with a substantially level response characteristic and so the rises produced by V2 feedback have to be eliminated. For this the value of C11 is chosen to give suitable attenuation in the low-frequency region and the voltage-dividing effect of using R20 in series with stray capacitance across the primary of TR4 is the means of offsetting the rise at high frequencies.

The V1 coupling to the high-level comparator includes L3 to attenuate frequencies at the upper end of the a.f. range. This is an indirect means of augmenting the rise by feedback in the V2 stage because it increases the margin by which high-frequency content of the compared signal can fall, relative to the reference signal, before an abnormality is detected.

The two a.f. feeds to the low-level comparator are processed to obtain d.c. signals for application to the grids of double-triode V3. The processing, taking V2 feed for example, is limiting by MR7 and MR8 across the primary of T4 (impedance ratio 1:4) and full-wave rectification with MR9 and MR10 supplied from T4 secondary.

MR7 and MR8 are used in conjunction with

R20 as a variable voltage-divider which determines the input-voltage fraction to be applied to T4. With low signal levels the forward and backward resistances of the rectifiers are much larger than R20 and therefore the fraction is large. Forward resistance decreases progressively with increase of signal level and consequently the useful proportion of the input gradually diminishes. Ultimately with voltages corresponding to high signal level the T4 primary voltage is reduced to about 0·2 of that applied from V2. The other rectifiers, MR9 and MR10, are disposed to provide d.c. in the negative-going sense at V3B grid; charge and discharge time constants in this circuit are approximately 10 ms and 50 ms. The means of converting the V1 feed to a reference d.c. signal for V3A are identical with those described.

V3 operates with the grids of both triodes biased slightly negative from a common cathode resistor. The limiting on the T3 and T4 primaries ensures that grid-signal excursions are restricted to maxima barely exceeding the voltage giving anode current cut-off. The purpose is to obviate prolonged grid-blocking which would occur, owing to the relatively long discharge period of the rectifier circuits, if bursts of high programme volume could drive the grids well beyond cut-off.

Two windings of relay B are connected one each in the anode circuits of V3A and V3B and their magnetically-opposed sensing ensures that a change-over contact (B1) remains unoperated unless the normal anode-current balance is sufficiently disturbed; see subsequent reference to fault signalling.

Metering facilities are suited to use of a Portable Test Meter PTM/6. This instrument has a two-pin plug attachment for connecting a 0/100-μA meter across R34 and R35 to measure V3 anode currents. To check static balance there is a four-pin connector which simultaneously places two centre-zero 100-μA meters across corresponding bridging points in the two comparators. Associated with the *Noise Ind.* portion of the four-pin socket are R29 and R31, to assist in promoting suitable voltage swings for operating the meter. In the anode circuit of V3 is R32, a *V3 Bal.* control for adjustment of static balance, and to give this roughly equal ranges of positive and negative compensation a fixed resistor (R33) of nearly half its value is connected in the V3B anode circuit.

The high-level comparator is simply a high-speed relay (A) with two windings separately energised by d.c. derived through rectification of signal inputs from V1 and V2. Signal comparison is confined to the requisite volume range by operating the comparator with two backing-off voltages from mains-fed bridge rectifiers MR13 and MR14. The first has a 14-volt output, subject to adjustment by a pre-setting resistor (R46) in the load circuit, and the second a 50-volt output with a ±5-volt tolerance.

Fig. 4.1 indicates the essentials in one half of the comparator to show how the bias supplies are applied. Until input-signal amplitude is large enough, the full-wave rectifier MR is held non-conductive by the 50-volt bias and so a lower limit is set to the range of comparison; the rectifier time-constants are approximately 5 ms (charge) and 50 ms (discharge). To impose an upper limit the half-wave rectifier CL is reverse-biased with the effective output voltage (across R45 in Fig. 4) of the 14-volt source. This bias is opposed by the direct voltage developed on the RLA winding by current from MR and therefore its cancellation occurs at some value of signal larger than that determined with 50-volt bias. Above this upper limit there is conduction by CL and the RLA winding is shunted by its forward resistance, neglecting the bias-source resistance. Forward resistance varies inversely with applied voltage and so the action of CL is to limit the relay-winding current to a value not substantially greater than that obtained at the onset of conduction.

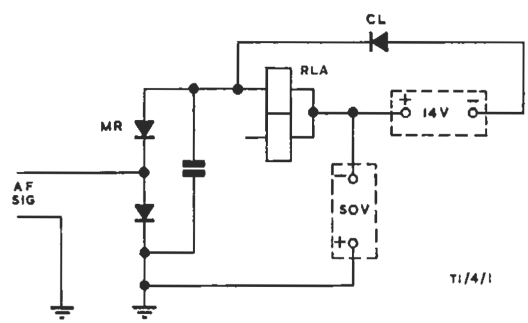

Fig. 4.1 Method of Biasing Rectifiers in High-level Comparator

Relay A issues fault signals by transferring a change-over contact when current through the compared-signal winding drops sufficiently below that in the reference-signal winding.

The high-level comparator is capable of operational adjustment by two pre-setting controls. R46 (*Raise Lim. Point*) is available to alter the loading on MR13 (14-volt source) and so set the upper limit of comparison by determining the bias voltage applied from R45 to CL1 and CL2. The range-limited combination of R26 (*Increase Sens.*) and R27 is a bridging circuit that carries current only when the normal equality of relay-winding currents is disturbed. The control provides for variation of the shunting effect, the degree of which is reflected in the apparent sensitivity of the relay. From points joined by the bridging circuit there are connections to the *High Mod. Ind.* section of the socket which, as already mentioned, enables the static balance of both comparators to be checked with a PTM/6.

Treatment of fault signals from both comparators is most conveniently included in detailing the sequence of events following powering of the equipment. The preparatory stage opens with operation of high-speed relay F provided V1 cathode current reaches approximately normal value. Change-over contact F1 transfers an earth from the anode circuit of cold-cathode diode stabiliser V5 to LP1, which lights to show a satisfactory *V1 Cathode Current* condition. The change allows C17 to begin charging through R41, connected to the junction of voltage divider R37/R38.

When the voltage across C17 has risen sufficiently to make V5 strike, high-speed relay C operates and seals itself on the h.t. supply through contact C1. This sealing causes operation of relay G and consequently:

G1 applies an earth to R42.
G2 makes the supply to LP5 (*Delay*).
G3 makes the circuit from relay-D coil to terminal 11.

The first-mentioned action causes V5 anode voltage to fall to a small value where discharge ceases. If, as usual, the external 50-volt supply is present at terminal 11 there is energising of relay D and:—

D1 shifts an earth from R49 to LP3, which lights to indicate the *De-mute* condition.
D2 and D4 make in external-signalling circuits between terminals 5/6 and 7/8 respectively; the diagram gives their customary functional references.
D3 switches h.t. to the anode of thyratron V4.

The period for this establishment of a working condition, as marked by the interval between lighting of LP1 and LP3/5, should be 80 sec ± 40 sec.

The h.t. for V4 is obtained by an unusual arrangement in which one half (MR12) of the bridge rectifier associated with all other valves is used also for full-wave rectification of the individual supply. This thyratron-anode supply is used also for charging a CR timing combination in the V4 grid circuit, as determined by operation of A and B relay contacts which transmit fault signals from the comparators. Operation of either contact (A1 or B1) causes (a) removal of a short-circuit that otherwise prevents LP2 from a *Fault* indication, and (b) connection of h.t. through R48 to C22 between grid and cathode of V4. Condition (b) has to be maintained for 1·5 to 2 seconds, assuming C22 has no initial charge, before the V4 grid-striking voltage is reached. R50 shunts C22 to provide for a relatively slow cancellation of partial charging in circumstances where fault signals are short and infrequent. With the AMT/2A only it is possible to halt this integrating process by making use of the extra relay (H) for breaking the supply switched by contacts A1 and B1; see Mute circuit shown by dashed-line portion of Fig. 4.

With excessive fault conditions the current flow owing to V4 striking causes operation of relay E, which seals itself on the h.t. supply through contact E4 as:

E1 and E3 break the Mon. Normal and System Normal circuits originally set up by relay-D contacts.
E2 makes a supply for LP4, giving an *Alarm* indication.

To restore relay E to normal a *Reset* switch (SB) is used to temporarily de-energise relay D so that:

D1 transfers an earth to R49 through which C22 undergoes a rapid discharge.
D3 enables relay E to release, by breaking the thyratron supply. Consequently the Mon. Normal and System Normal circuits are again completed.

The interruptions by the E1 and E3 contacts initiate external action which may be either non-executive or executive, as defined in the Introduction. Information sufficiently illustrating the two applications is in Section 3.2.4 of Instruction T.10.

4.5 Test Specification

Following description is based on the production test schedule (D.D. Spec. No. 5.34) and may be used for either fault location or performance testing after repair. Operating instructions referring to use of the equipment in a typical f.m. installation are in Appendix B of Instruction T.10.
Test apparatus comprises:

Avometers (2); Models 1, 7, 8 or 40.
Portable Test Meter PTM/6.

Tone source (60 c/s—10 kc/s) with +20-dB output.
600-ohm Variable Attenuator (0—50 dB in 0·5-dB steps).
600-ohm Variable Attenuator (0—20 dB in 0·1-dB steps).
Repeating Coil.
*Amplifier-detector with high-impedance input.
600-ohm resistor.
Megger (250-volt type).

4.5.1 *Initial Checking*

1. Place the mains voltage selector on the appropriate tapping, remove V4 from its socket and then make the mains supply to the unit.
2. Attach the feed plug of the PTM/6 to each feed socket in turn to check that each feed-meter reading is mid-scale ± 15 μA.
3. Fit the four-pin plug of the PTM/6 to the AMT/2 socket and adjust the *V3 Bal.* control for mid-scale deflection by the l.h. meter of the test instrument. Verify that the directions of movement for the balance control are the same as those of the meter pointer.
4. Check that the r.h. meter of the PTM/6 reads mid-scale.
5. Disconnect the mains supply from the unit, but leave the PTM/6 attached to the equipment.
6. Use an Avometer to check that at the Painton 12-way socket there are open circuits between:

   Pins 10 and 12
   Pins 7 and 8
   Pins 5 and 6

   Leave the meter connected to pins 5 and 6.
7. Connect a 50-volt supply to pins 10 and 12 (earthy side of supply). Restore mains to unit.
8. Again check for open circuits between pins 5 and 6 and pins 7 and 8, *during the interval before the relay contacts become operated.* Check for short-circuits between these pairs of pins after lamps LP3 and LP5 light, which should occur 80 sec. ± 40 sec. after LP1 has lighted.
9. Operate relay E by hand to make it latch through contact E4, checking that lamp LP4 lights and that there are once more open circuits between pins 5 and 6 and pins 7 and 8. Measure the voltage between tag *a* of relay E and chassis; the value should be 135 volts ± 15 volts.
10. Disconnect the 50-volt supply from pins 10 and 12 to check that relay E de-operates and that the voltage between tag *a* of that relay and chassis falls to zero. Check that lamps LP3 and LP4 are extinguished and that the voltage across C18B is 180 volts ± 25 volts.
11. Put V4 into its socket and re-make the 50-volt supply for the purpose of checking that LP3 lights and LP4 does not light. Remove V4 from position; disconnect the mains supply and also the Avometers.
12. With the megger, check that the resistance between pin-5 socket at V4 position and chassis is 50 megohms ± 25 per cent.
13. Restore 50-volt supply to pins 10 and 12 of Painton socket and connect mains supply to unit.
14. After LP5 lights, check with the Avometer for the following results:

Meter across	*Volts*
C19A	310 ± 25
C21	—50 ± 5
C20 (Setting C)	—10 ± 2
C20 (Setting CC)	—18 ± 2

Setting C — With R46 fully clockwise.
Setting CC — With R46 fully counter-clockwise.

4.5.2 *A.F. Test Procedure*

1. Connect test apparatus in the condition-A arrangement of Fig. 4.2.
2. Set the test attenuator and the *Test Sensitivity* control of the AMT/2 to zero loss. Connect the high-impedance amplifier-detector across the repeating-coil secondary winding and adjust the tone-source output at 1 kc/s to obtain a zero-level reading at that point.
3. Plug the amplifier-detector successively into the *Ref. Pro. Listen* and *Comp. Pro. Listen* jacks to check that the levels at these two positions are substantially the same as at the repeater-coil secondary winding.
4. Disconnect the amplifier-detector and reduce the tone input to about —20 dB; note the reading on the l.h. meter of the PTM/6.
5. Set the *Test Sensitivity* switch to $1\frac{1}{2}$ and adjust the test attenuator until the l.h. meter of the

* Should be checked for accuracy of absolute level by means of a lamp bridge or other suitable apparatus.

PTM/6 gives the reading previously noted. The reading of the test attenuator should be 1·5 dB ± 0·1 dB.

Repeat this test on all other settings of the *Test Sensitivity* switch to check that attenuation is correct within 0·1 dB in each instance.

6. Place the *Test Sensitivity* switch at *O* and move the *Adjust Comp. Prog.* control to the fully-clockwise position. By the above procedure, check that turning the *Adjust Comp. Prog.* control fully counter-clockwise gives a loss of about 2 dB. Move the control back to fully clockwise.
7. Alter the test assembly to the condition-B arrangement of Fig. 4.2.
8. Set the test attenuator to zero loss and vary the input level between 0 dB and +10 dB while checking that the r.h. meter of the PTM/6 deflects either to the left by not more than 5 μA or to the right by not more than 25 μA. A leftward deflection exceeding 5 μA may be brought within limits by interchange of valves in the V1 and V2 positions. If deflection is to the right and within the stated limit, adjust the test attenuator to reduce deflections to a minimum. That should be less than 5μA and the required attenuation should be less than 0·5 dB.

Note: Further tests are detailed on the assumption that no attenuation needs to be introduced, and where the contrary applies there must be appropriate allowance with regard to the test-attenuator settings which are quoted.

9. Vary the input level between −30 dB and +10 dB to check that the l.h. meter of the PTM/6 reads:

   0 ± 30 μA at levels between −30 dB and −10 dB.

   0 ± 5 μA at levels between −10 dB and +10 dB.

   V3 should be changed if these requirements are not met.
10. Set the input level at +8 dB and successively make and break the tone-source output. Check that both meters of the PTM/6 are deflected by no more than 20 μA from their initial readings.
11. With an input level of about +6 dB, insert 2-dB loss in the test attenuator. This should cause the r.h. meter to deflect to the left. Vary the input level until the meter is at maximum deflection and observe the input level, which should be +7·5 dB. For a smaller value, shift the *Raise Lim. Point* control in the counter-clockwise direction; if a greater value, make an adjustment in the opposite direction. Repeat test and adjustments until maximum deflection occurs at +7·5 dB.

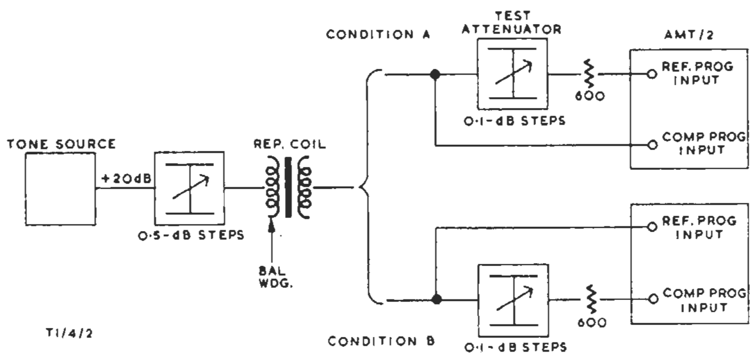

Fig. 4.2 Arrangements of Test Apparatus in Connection with AMT/2 Monitor

12. With the same input level (+7·5 dB), reset the test attenuator to the zero setting and then increase the attenuation in steps of 0·1 dB until the *Fault* lamp (LP2) lights. This should occur at 2-dB loss. Otherwise the *Increase Sens.* control needs adjustment, counter-clockwise if the stipulated loss has been exceeded, until the correct condition is obtained.
13. Place the test attenuator at its zero setting and connect meters in series with the relay-A windings. Raise the tone input to about +17·5 dB to check that currents through the two windings are equal (±0·2 mA) and that the individual currents are 8 mA ± 1 mA.
14. Reduce the input level to +7·5 dB and adjust the test attenuator until relay A just operates, as shown by *Fault* lamp LP2. Note the dif-

ference (Y mA) in current through the two windings, which should be between 0·95 and 1·25 mA. In terms of microamperes the deflection on the r.h. meter of the PTM/6 should be (33 × Y) ± 25 per cent; for example with a difference of 1·1 mA the meter reading should be 36·3 μA ± 9·1 μA.

15. Restore the test attenuator to the zero setting and reduce input until current through each relay winding falls to 1 mA, checking that this occurs with an output level of —3 dB ± 1 dB. Remove meters from the relay-A winding and restore the circuit to normal.
16. Put V4 into its socket and, after adjusting the input level to about +7·5 dB, suddenly introduce 5-dB attenuation in the test attenuator. Note the period that elapses between operation of relay A (per *Fault* lamp LP2) and relay E (per *Alarm* lamp LP4). This delay should be between 1·5 and 2 seconds.
17. Place the test attenuator at its zero-loss setting and press the *Reset* button (SB in Fig. 4) for the short period which should be required to cancel the *Alarm* indication by LP4.
18. Conduct tests with the tone input to the system at various frequencies and levels as in the headings and l.h. column, respectively, of Table 1. Losses should be introduced by adjusting the test attenuator in 0·1-dB steps until the *Fault* lamp signals that either relay A or relay B has *barely* operated. Attenuation inserted should be within limits given in Table 1.
19. Set the test attenuator to its zero-loss position and disconnect the input at the *Ref. Prog. Input* socket. Adjust the input tone to zero level at 1,000 c/s. The l.h. meter of the PTM/6 should have a large deflection to the right and relay B should be operated. Lower the input level to about —40 dB to make relay B de-operate. Then increase the tone level slowly until relay B again operates, and so ascertain the sensitivity to noise at 1,000 c/s. Repeat this test at other frequencies specified, with limits for acceptable sensitivity values, in Table 2.

Table 2

F	*Noise Sensitivity (dB)*
60 c/s	—22·5 ±5
110 c/s	—26 ±5
250 c/s	—26 ±5
1,000 c/s	—24 ±5
5 kc/s	—16·5 ±5
10 kc/s	—12 ±5

Also check that the l.h. meter of the PTM/6 reads +60 ± 15 μA when relay B is barely operated.

20. Restore the connection to the *Ref. Prog. Input* socket and the test attenuator to the zero-loss setting. Disconnect the attenuator in advance of the repeating coil and substitute a source of programme at zero volume. The r.h. meter of the PTM/6 should not deflect appreciably to the left of the centre line, but on loud passages it should swing appreciably to the right. Next insert a 3-dB loss by means of the test attenuator and check that (a) the meter swings well over to the left, and (b) the *Fault* lamp lights fairly frequently, on loud passages.

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Table 1

Input Level (dB)	*Loss (dB) for Alarm at:*				
	60 c/s	*110 c/s*	*1,000 c/s*	*5 kc/s*	*10 kc/s*
+5	9	9 ± 2	3 ± 1	8 ± 2	8
+7·5	—	—	2	—	—
+8	13·5 ± 3	7 ± 1	2·2 ± 3	7·5 ± 1·5	15 ± 3
+10	12·5 ± 3	6·5 ± 2	3·5 ± 1	8 ± 2	16 ± 3
+14	12 ± 3	8 ± 2	7·5 ± 1·5	10 ± 2	17 ± 3

COMPONENT TABLE: FIG. 4

PAGE 1

N.B. Table refers to AMT/2A unit; see supplementary note about components in superseded parent AMT/2.

Comp.	Loc.	Type	Tolerance per cent
C1*	F13	T.C.C. CSM20N	5
C2	F6	T.C.C. CP 35N/PVC	20
C3	H5	Muirhead 234-AT/M	1
C4	F7	T.C.C. CP37N/PVC	20
C5	F8	T.C.C. SCE/79C/PVC	25
C6	H12	Muirhead 234-AT/M	1
C7	F14	T.C.C. CP 37N/PVC	20
C8	G16	Plessey CE17043/1	
C9	F16	T.C.C. CSM20N	20
C10	H6	T.C.C. CP 35N/PVC	20
C11†	H13	T.C.C. SM3N	5
C12	K5	Dubilier B213	20
C13	J8	T.C.C. CP37N/PVC	20
C14	K12	Dubilier B213	20
C15	J16	T.C.C. CP37N/PVC	20
C16	M12	Dubilier B213	20
C17	Q15	Dubilier B213	20
C18A / C18B	R5 / V5	Plessey CE820/1	
C19A / C19B	T4	Plessey CE911/1	
C20	S6	Plessey CE17012/1	
C21	T8	Plessey CE17069/1	
C22	T15	Dubilier B213	20
C23	Y10	Hunt B513K	
C24	J7	T.C.C. CSM20N	
C25	J15	T.C.C. CSM20N	
CL1	N5	G.E.C. GEX45/1	
CL2	N8	G.E.C. GEX45/1	
FS1 / FS2	Y6 / Y5	Belling Lee L562/2.5	
JK1 / JK2	B6 / B13	S.T.C. 4112B	
L1	G5	Partridge C25/60	
L2	G12	Partridge C25/60	
L3	I5	BBC LD10/1	
L4	T3	BBC LD10/1	
LP1 / LP2 / LP3 / LP4 / LP5	R11 / V11 / V16 / W15 / T1	P.O. No. 2(6V)	

Comp.	Loc.	Type	Tolerance per cent
MR1 / MR2	H7	Westinghouse 16MB16	
MR3	J6	G.E.C. GEX/34	
MR4	J8	G.E.C. GEX/34	
MR5	J5	Westinghouse 5D42	
MR6	J12	Westinghouse 5D42	
MR7 / MR8	H14	Westinghouse 16MB16	
MR9	J14	G.E.C. GEX/34	
MR10	J15	G.E.C. GEX/34	
MR11 / MR12	U4	S.T.C. 440SC-18D1-S	
MR13	U6	Westinghouse 5B1019	
MR14	U8	Westinghouse 5D40	
R1	C13	Morganite H/WN linear	
R2	E15	Erie 109	2
R3	D15	Erie 109	2
R4	D15	Erie 109	2
R5	D14	Erie 109	2
R6	D14	Erie 109	2
R7	D14	Erie 109	2
R8	E7	Erie 9	10
R9	E7	Erie 108	2
R10	E8	Erie 108	2
R11	E14	Erie 108	2
R12	E16	Erie 108	2
R13	F15	Erie 108	2
R14	F16	Erie 9	10
R15	G10	Erie 109	2
R16	F12	Erie 9	10
R17	G4	Erie 109	2
R18	F5	Erie 9	10
R19	H6	Erie 109	2
R20	H13	Erie 109	2
R21	K14	Erie 9	10
R22	K8	Erie 9	10
R23	L5	Erie 100	2
R24	L8	Erie 100	2
R25	M7	Erie 108	2
R26	M6	Morganite H/WN log.	
R27	M7	Erie 109	2
R28	M9	Painton P301A	5
R29	L11	Erie 8	10
R30	M11	Erie 109	2
R31	N11	Erie 8	10

* Two (0.0015μF) in parallel

† Two (0.0068 and 0.0082μF) in parallel

COMPONENT TABLE: FIG. 4

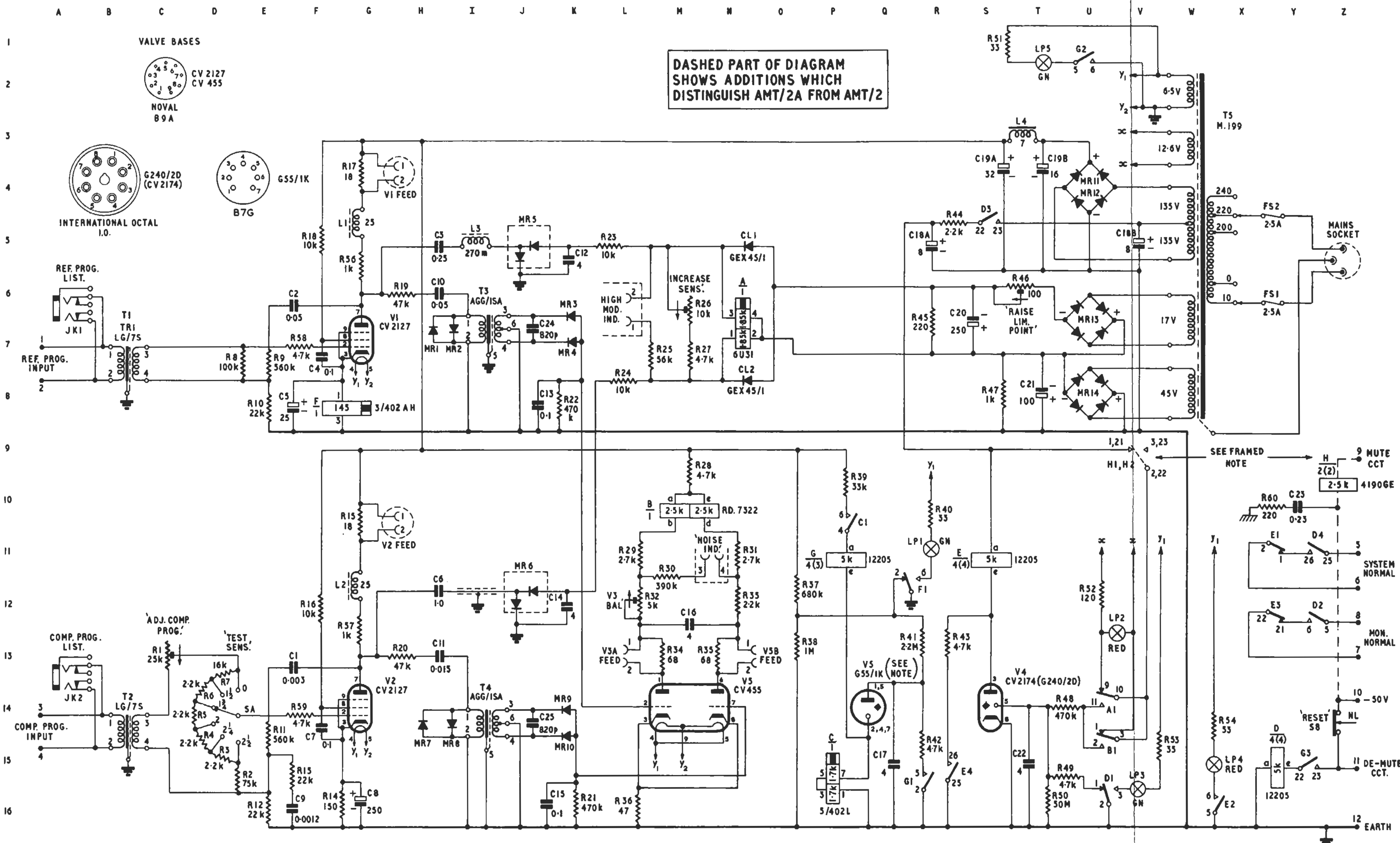
PAGE 2

Comp.	Loc.	Type	Tolerance per cent
R32	L12	Plessey CP/161101/209 linear	
R33	N12	Erie 9	10
R34	M13	Erie 109	2
R35	N13	Erie 109	2
R36	L16	Erie 9	10
R37	O12	Erie 108	2
R38	O13	Erie 108	2
R39	P10	Painton P302A	5
R40	R10	Erie 8	10
R41	R13	Erie 9	20
R42	R15	Erie 9	10
R43	R13	Erie 100	2
R44	R5	Erie 9	10
R45	R5	Painton P306	5
R46	T6	Reliance TW/1/8S/W linear	
R47	S8	Painton P301A	5
R48	U14	Erie 109	2
R49	U15	Erie 109	2
R50	T16	Erie 9	20
R51	S1	Erie 8	10
R52	U10	Erie 100	2
R53	V15	Erie 8	10
R54	W14	Erie 8	10
R56	G5	Erie 100	2
R57	G13	Erie 100	2
R58	F7	Erie 109	2
R59	F14	Erie 109	2
R60	Y10	Erie 9	2
Relays			
A	N7	T.M.C. 6U31	
B	M10	Siemens RD7322	
C	P15	P.O. 3/402L	
D	Y15	P.O. 12205	
E	S11	P.O. 12205	
F	G8	P.O. 3/402AH	
G	P11	P.O. 12205	
H	Z10	S.T.C. 4190GE	
SA	E14	N.S.F. DM 1p 6w shorting	
SB	Z14	Walter 1846	
T1	B7	BBC LG/7SA	
T2	B14	BBC LG/7SA	
T3	I6	BBC AGG/ISA	
T4	I14	BBC AGG/ISA	
T5	W5	BBC M.199	

AMT/2 COMPONENTS

C23, R60 and relay H are not fitted in this parent version of the monitor. Additionally the equipments of earlier production are liable to differ most from the preceding table owing to successive component-type changes that have occurred. Apart from V5 (see Fig. 4 note about maintenance replacements) the items largely affected are the metal rectifiers and relays, although to a very small extent there have been changes in types of capacitors, fixed resistors and variable resistors.

FIG 4



NOTE: EARLY EQUIPMENTS HAVE G120/1B (BRITISH 4-PIN) IN V5 POSITION: THE TYPE IS AVAILABLE AS A MAINTENANCE REPLACEMENT

LAMPS

LP1	V1 CATHODE CURRENT
LP2	FAULT
LP3	DE-MUTE
LP4	ALARM
LP5	DELAY

TRANSFORMER RATIOS (TURNS)

T1 & T2	1: 3.16
T3 & T4	1: 2

AUTOMATIC MONITORS (TRANSMITTER) AMT/2 & AMT/2A: CIRCUIT