SECTION 3

CARRIER FAILURE MONITOR MN1/503

Introduction

The MN1/503 is designed to monitor, by radio reception, both sound and vision carriers from Band-I transmitting stations and to give an alarm signal should either or both fail. It could also be used to monitor the actual outputs at a transmitter or the i.f. signals inside Band-I translators. It has its own inbuilt power supply.

Mechanical Details

The monitor is built into three small Eddystone boxes bolted together, the overall dimensions being about 5 in. by 4½ in. by 2½ in. One box contains a wideband amplifier and the opposite box contains a 3·5-Mc/s and d.c. amplifier, while the cover of an otherwise empty box at right-angles forms a faceplate which carries a power unit on its reverse side. The monitor was designed primarily for use in the homes of T.As.-in-Attendance and to be mounted inside a monitoring receiver, with an associated buzzer alarm unit as a separate item. In future, however, it is intended to mount the monitor and the alarm unit in a separate metal container because there is no longer sufficient room in modern receivers.

Fig. 3.1 shows the faceplate and the wideband amplifier layout while Fig. 3.2 shows the 3·5-Mc/s

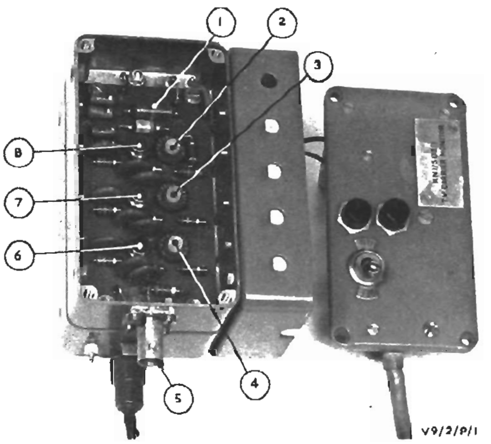

Fig. 3.1 Faceplate and Wideband-amplifier Layout

1. L4
2. L3
3. L2
4. L1
5. H.F. Input
6. VT1
7. VT2
8. VT3

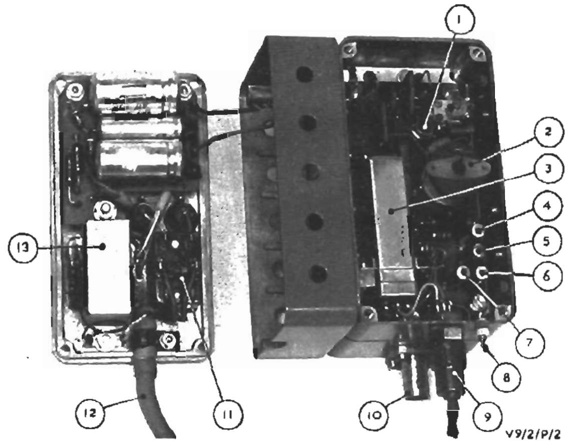

Fig. 3.2 Power Unit (left) and 3·5-Mc/s and D.C. Amplifier (right)

1. VT4
2. L5
3. RLA
4. VT5
5. VT6
6. ZD1
7. VT7
8. D.C. Output
9. Alarm Output
10. H.F. Input
11. Switch SA
12. Mains Input
13. T1

General Specification

Input Required	500 μV r.m.s., corresponding to a peak white vision carrier together with 250 μV r.m.s. of sound carrier
Input Impedance	Approximately 600 ohms
Frequency Coverage	34·5 Mc/s to 66·75 Mc/s

and d.c. amplifier and also the power unit assembled on the reverse of the faceplate.

General Description

The wideband amplifier accepts the sound and vision carriers of any Band-I television transmission or i.f. source, and applies them, after amplification, to a mixer circuit. The frequency difference between the carriers is 3·5 Mc/s and this frequency appears in the output of the mixer. After amplification the 3·5-Mc/s signal is applied to a rectifier followed by a d.c. amplifier which operates the alarm relay.

When the MN1/503 is used with a monitoring receiver, the r.f. input is taken in parallel with the input to the receiver, the bridging loss being small due to the relatively higher input impedance.

Circuit Description

A circuit diagram of the monitor is shown in Fig. 3.3'

The input signal consisting of both vision and sound carriers is connected to PLA and then, via R8 and C4, to the base of VT1. VT1, VT2 and VT3 are three similar common-emitter stages, and together they comprise a wideband amplifier covering the frequency range from 34·65 Mc/s to 66·75 Mc/s; thus, signals from all stations in Band I can be accepted and also the i.f. signals from Band-I translators. The three stages, which are individually decoupled by a 0·01-μF capacitor and a 180-ohm resistor, are identical up to the collector of VT3. The output from VT3 appears across L3 and consists of both sound and vision carriers. These are applied to the mixer MR1, in the output circuit of which various intermodulation products appear, and in particular the difference beat of 3·5 Mc/s. The other components of higher frequency are filtered out by C10 and L4 and C11 and C12, which comprise a low-pass filter and matching circuit, and so do not appear across the rectifier load R7.

The 3·5-Mc/s signal is now taken to the base of VT4 via C17. VT4 is a high-grain common-emitter amplifier, its collector feeding a tuned transformer. The secondary winding of this transformer feeds a rectifier MR2, the load for which is R23 in parallel with the 30-μF capacitor C21. The impedance of this load is very low at 3·5 Mc/s, hence the output applied to the base of VT5 is almost entirely d.c. R20 prevents the comparatively low input resistance of VT5 from appearing across R23. C18 and C19 provide a neutralising circuit for VT4.

VT5, VT6 and VT7 together form a current amplifier in the output of which is the alarm relay RLA.

In the absence of a signal input to the monitor, the base of VT5 is at earth potential and the transistor is cut off. The base current of VT6, flowing in the high resistance R17, sets the base and the collector of VT5 to a potential a fraction of a volt negative, and VT6 is conductive causing a low collector potential. VT7, having the very high resistance of the unbiased Zener diode ZD1 in its emitter circuit, is non-conductive and therefore relay RLA is not operated.

On the arrival of the signal, the negative voltage across R23 causes current to flow in VT5 base/emitter circuit. The collector of VT5 now approaches earth potential, carrying the base of VT6 with it. The current through VT6 is reduced and the potential of its collector and the base of VT7 rises negatively. As soon as the potential across VT7 has risen sufficiently for the working voltage of the Zener diode to be reached, its resistance falls extremely rapidly to a low value. VT7 now takes current and the relay RLA operates. R19 and C16 form a surge suppressor which prevents damage to VT7 by the back e.m.f. across the relay. Since the Zener diode changes very rapidly from its non-conducting to its conducting condition, the operating point of the relay is well defined. ZD1 holds the emitter potential of VT7 at 4·7 volts, the current in the collector circuit being limited by the resistance of the relay to a maximum of about 12 mA.

Should either of the input carriers fail, the 3·5-Mc/s beat disappears and the input to the current amplifier ceases. The relay therefore releases and gives the alarm as already described.

The power circuit is a normal voltage doubling arrangement, with R24 and C24 as smoothing. The output voltage is stabilised by the two Zener diodes ZD2 and ZD3, in conjunction with R24 and R25.

General Data

With no input signal, the voltages and currents listed below are typical, all being measured with an Avometer Model 8.

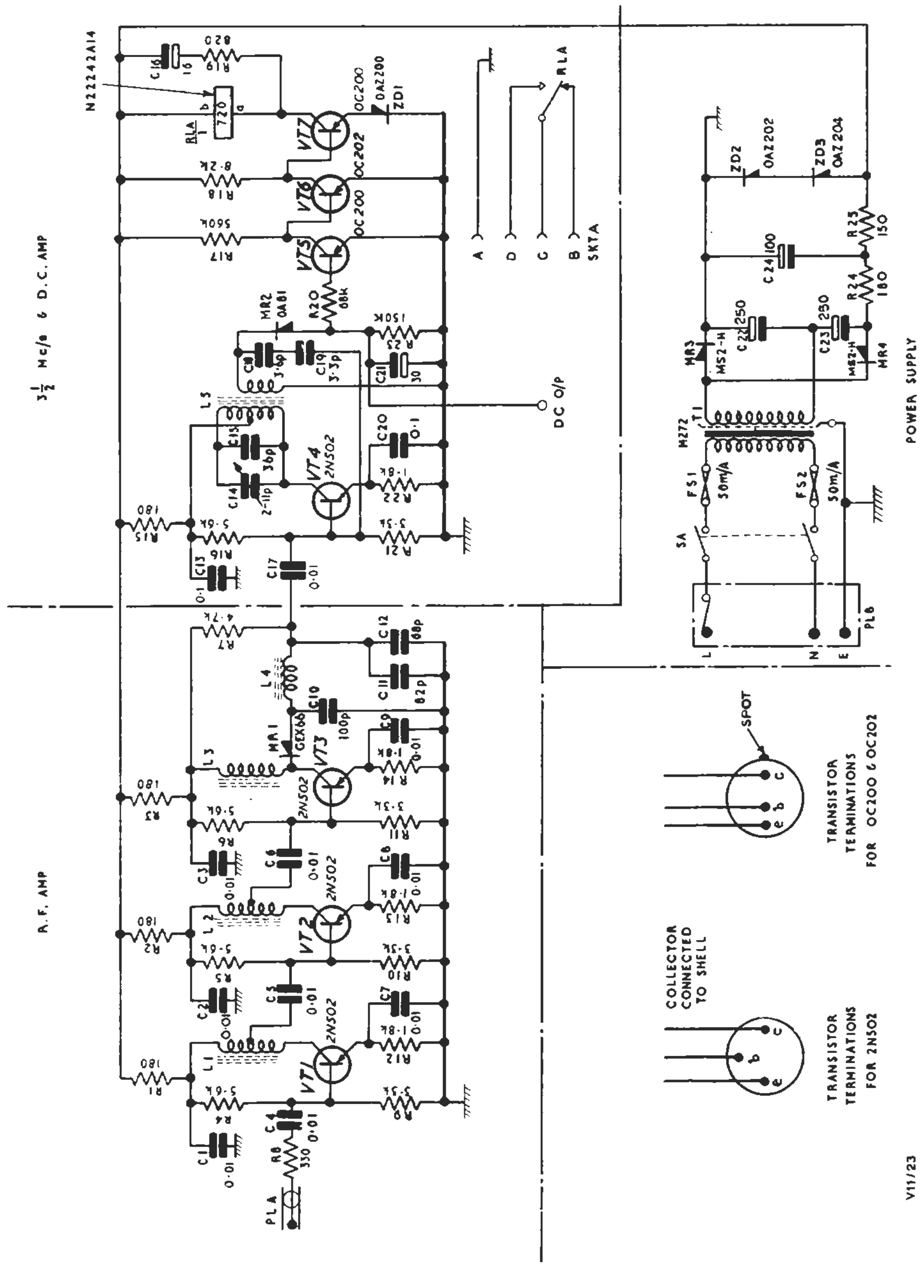

Fig. 3.3. Circuit of the MN1/503

Measuring Point	*Voltage*
T1 Secondary	12·7
Across C22 + C23	30·0
Across ZD2 + ZD3	13·5
Base VT1, VT2, VT3, VT4	4·8
Emitter VT1, VT2, VT3, VT4	4·5
Collector VT1, VT2, VT3, VT4	12·7
Collector VT5	0·5
Collector VT6	3·9
Collector VT7	13·5

Current to r.f. amplifier, 12 mA.
Current to 3·5-Mc/s and d.c. amplifier, 5 mA.
Current through ZD2 and ZD3, 33 mA.

2.7 Test Specification

2.7.1. *Apparatus Required*

2 F.M. Signal Generators, Marconi TF 995/A1 or A2
2 Avometers Model 8
S.T. & C. Attenuator, 0—0·9 dB, Type 74600
S.T. & C. Attenuator, 0—9 dB, Type 74600
S.T. & C. Attenuator, 0—90 dB, Type 74600
Heterodyne Frequency Meter BC221
Valve Voltmeter, Marconi TF 1041
75-ohm T Connector
75-ohm Termination
Variac, output voltage variable up to 240 volts
Combining Unit, consisting of three 75-ohm resistors connected in delta and mounted in a small Eddystone Box with suitable sockets

2.7.2. *Alarm Relay Operation*

Connect the Avometer, set on the *Ohms* range, across tags C and D of socket A of the monitor to observe the operation of relay RLA. Connect the T connector directly to the input socket of the monitor and terminate one side with the 75-ohm termination.

Set one signal generator to channel 1 sound frequency, 41·5 Mc/s, and set its attenuator to give 1·6 mV out. Set the other signal generator to channel 1 vision frequency, 45 Mc/s, and set its attenuator to give 1·0 mV out. Connect the outputs of the two generators together via the combining unit. Feed the output of the combining unit through the S.T. & C. attenuators to the vacant side of the T connector. Set the S.T. & C. attenuators to zero attenuation. Connect the heterodyne frequency meter to the *D.C. O/P* terminals of the monitor and trim the frequency of one generator to give an exact difference frequency of 3·5 Mc/s. Disconnect the heterodyne meter, replacing it with the valve voltmeter, and proceed as follows.

1. Adjust C14 for maximum deflection on the valve voltmeter, at the same time altering the setting of the S.T. & C. attenuators to keep the voltage at the *D.C. O/P* point at 0·5 volt. This adjustment must be made slowly to avoid errors due to the time-constant of C21 and R23.
2. Set the S.T. & C. attenuators to give maximum loss, then slowly decrease the attenuation until the relay operates. Note the setting, which should not be less than 10 dB, and check that the valve voltmeter reading is 0·5 ±0·2 volt. Now slowly increase the attenuation and note the setting when the relay releases. The difference between the two settings should not be greater than 0·5 dB. Repeat for all channels.
3. Vary mains input voltage to the monitor between 200 and 240 volts. The setting of the attenuator at which the relay operates should not vary more than ±0·2 dB. Reset mains input voltage to 240 volts.
4. Repeat the test, detailed in paragraph 2 above, on one channel, but with either one of the signal generators set to give a difference frequency of 3·5 Mc/s ±40 kc/s. The attenuator setting at which the relay operates should not be reduced by more than 4 dB.

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