Chapter 5-1

DETECTOR MAINTENANCE (6511/6512)

CONTENTS

INTRODUCTION

1. This chapter contains information to assist in the repair and test procedures of Wide band detectors, if required. The procedures described in this chapter are of a simplified nature and of restricted range compared with those that relate to the more comprehensive factory test facilities which are necessary to demonstrate complete compliance with the specification.

2. The detector requires careful handling and comprehensive v.s.w.r. and power accuracy checks and because of this it is recommended that repair and re-calibration be carried out only by authorized Marconi Instruments agents or by Marconi Instruments, Microwave Products Division, Stevenage.

Detector servicing ⚠ (Static sensitive device - see Notes & Cautions)

3. If specialized equipment is available to the user or it is accepted that repairs may be carried out without the detector being calibrated to its full specification the following instructions given in this chapter will enable the replacement of three sub-assemblies that may be changed without the use of special tools. A list of available spare parts is shown in Fig. 7 and access to some of these require special tooling. It is therefore recommended that dismantling beyond the sub-assembly stage is not attempted in the course of normal servicing. The three sub-assemblies available are as follows :-

(1) 6511, RF connector assy. N type, Part No. 2716-007
or 6512, RF connector assy. APC-7 type, Part No. 2718-007

(2) Cable assy. (includes 12 pin male connector) Part No. 2716-004, details are also supplied showing wiring details of both p.c.b. and plug interconnections, see Fig. 4.

⚠ (3) Detector module assy. kit Part No. 2716-006
(The kit includes two pre-selected (SIC) resistors, R2 and R6).

4. Two sets of instructions are given in the following paragraphs to enable calibration to be carried out. The first gives a restricted routine using only two items of the test equipment listed in Table 1 : a, 50 MHz, 0 dBm calibrator and h, a 6500 in this procedure. The power accuracy setting is however limited by the uncertainties of the 6500. A second more detailed test procedure provides for greater power accuracy. A limited v.s.w.r. check (8.0 - 12.4 GHz), and a frequency response confidence check may also be carried out in addition if all the items listed in Table 1 are available.

Module replacement ⚠

5. Fig 1 shows the circuit diagram of the detector module, p.c.b. and wiring details. Fig. 2 shows an exploded view of the detector to assist in the dismantling which can be carried out as follows :-

(1) Remove the two rear plate fixing screws and slide the rear plate and casing down the cable towards the plug.

(2) Progressively remove the three socket headed fixing screws securing the module retainer in position, hold the module retainer and with an axial action (i.e. a straight pull) gently detach the r.f. connector assy.

6. The module can now be removed from the retainer, this should also be withdrawn with an axial action and under no circumstances must a twisting action be exerted during withdrawal. It may be necessary to grip the end of the module with pliers or similar, using a suitable amount of padding to ensure that the plated surface is not damaged. The module assembly contains exposed chip devices that are static sensitive, they are also connected with

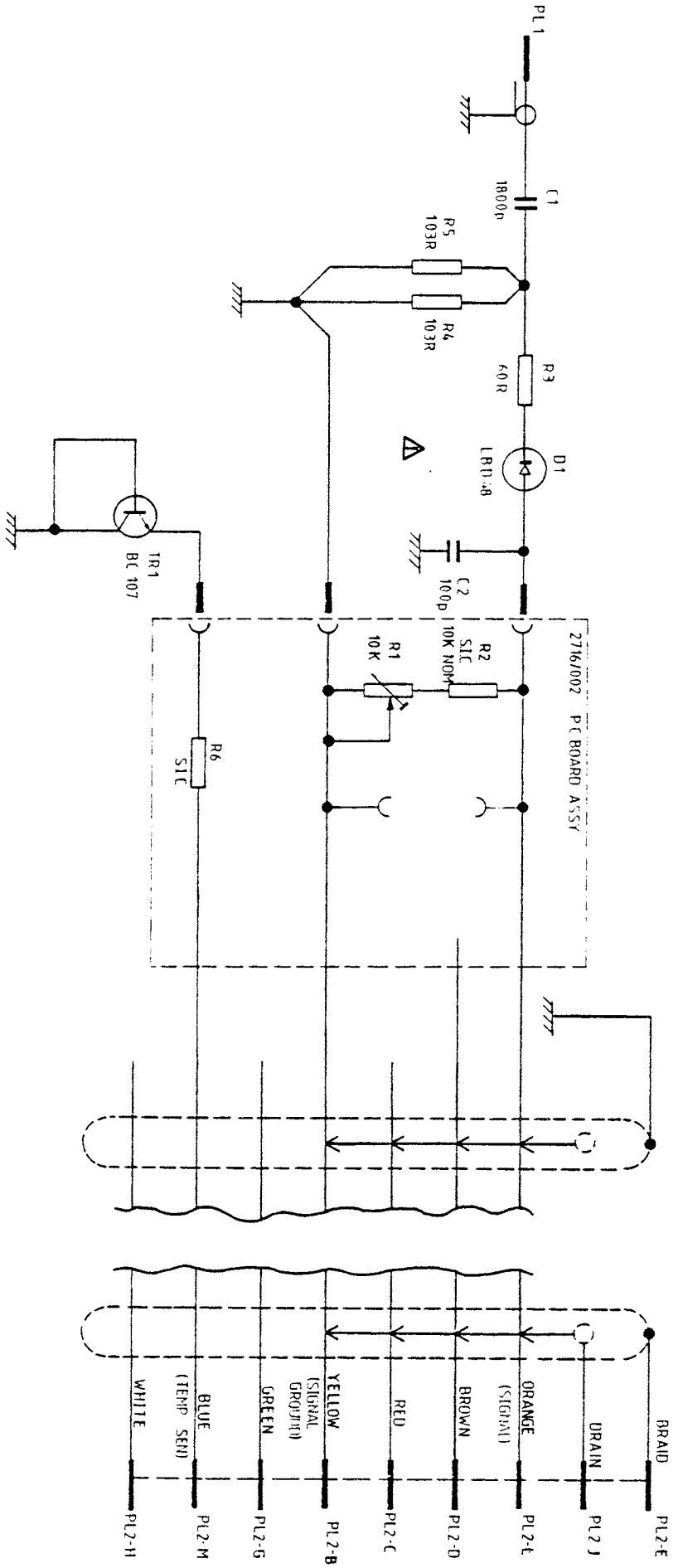

Fig. 1 6511(6512) Detector circuit diagram

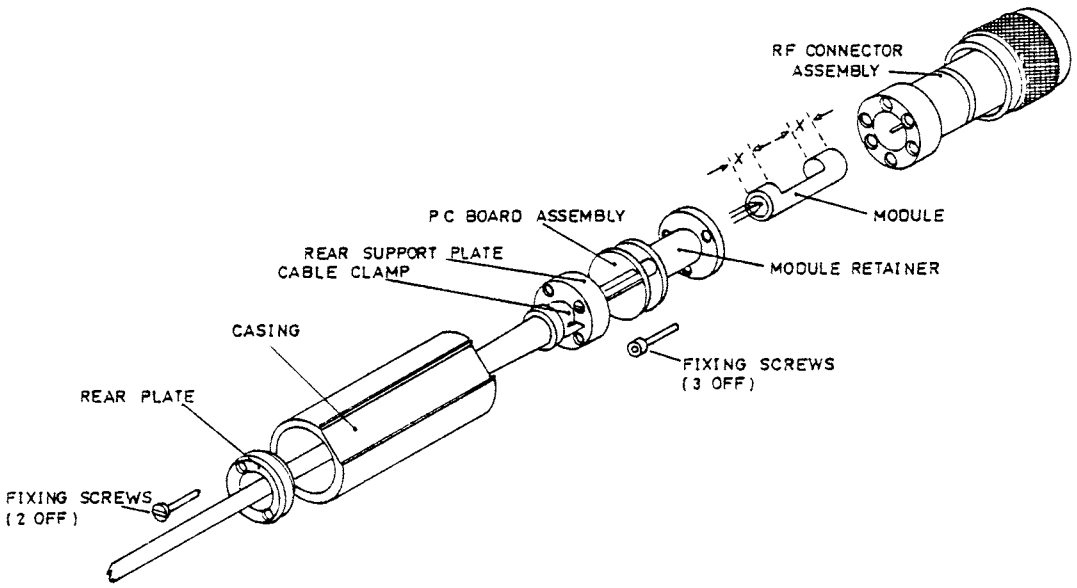

Fig. 2 6511 Detector, exploded view

a fine bond wire and therefore should not be handled directly. Instead hold the module casing across the X dimensions and withdraw the module by purchasing only from the edges.

Note ...

> During withdrawal particular attention should be given to the positioning of the three contact wires so that the replacement item can be inserted into an identical position. Without care it is possible to connect the wires incorrectly.

Module replacement kit

7. Note the value of resistors included with the detector module replacement kit, if either of these differ in value to resistors R6 and or R2 mounted on the p.c.b. and shown in Fig. 3 they must be replaced by those supplied in the kit. Using a fine tip soldering iron remove either or both resistors, (R2) normalization, and (R6) temperature sensor compensation, with the minimum possible heat applied. Solder using flux cored 60/40% tin, lead solder. Remove any locking compound from the adjustment potentiometer (R1) to allow for subsequent re-calibration.

8. Gently push the replacement module into the retainer locating the three connecting wires with the correct module lead sockets of the p.c.b. as shown in Fig. 3. Being careful to retain the axial alignment insert the module into the r.f. connector assy. Replace the three module retainer screws and progressively tighten these, use Locktite 222 or similar to lock the threads of each screw.

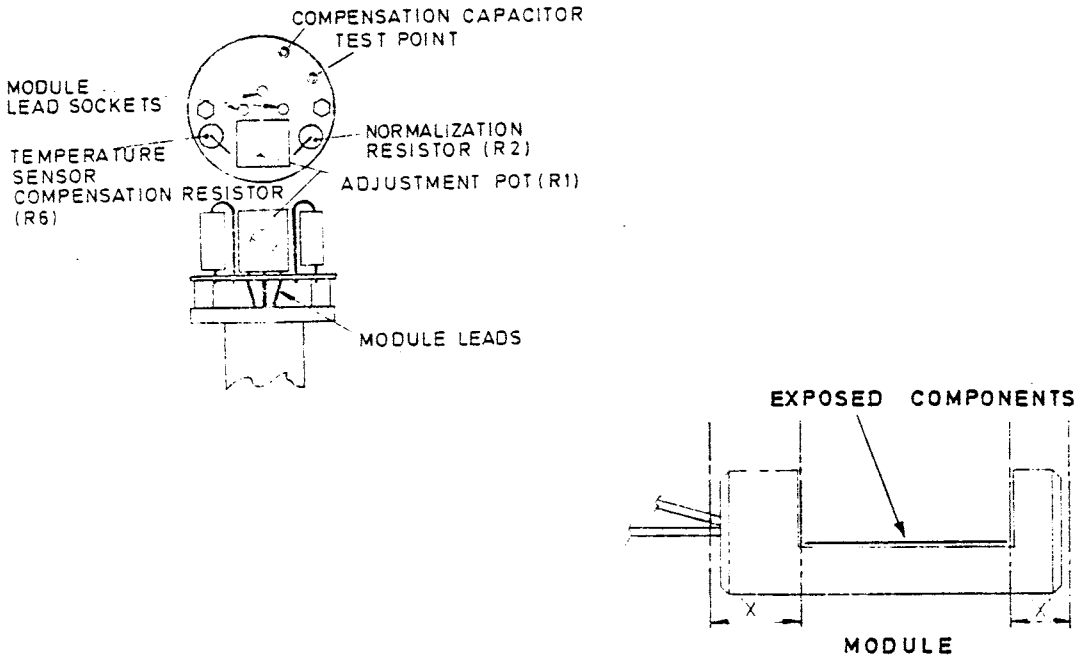

Fig. 3 PCB assy. diagram

TABLE 1 TEST EQUIPMENT

Item	Description	Minimum use specification	Recommended model
a	50 MHz 0 dBm Calibrator	With current calibration certificate 1 mW ±0.7%	Available on Power meters 6950 or 6960
b	Digital voltmeter	DC volts : 0.1 V - 100 V Accuracy : 0.001%	
c	Signal source with Sweeper mode	Freq. range : 8.0 - 12.4 GHz Sweep capability : 0- +10V full sweep	6158A
d	Temperature sensor	±1°C	Comark thermometer (6600)
e	High directivity coupler or bridge		2200/327
f	Power splitter		HP 11667A
g	Detector 6511 (6512)(General purpose)	Specification as laid down in H 6500 Vol. 1, Chap. 1. (2 off)	
h	Automatic amplitude analyser	H 6500 Vol. 1, Chap. 1	6500
		Special tools and alignment aids	
i	Connector socket	12-way female Type 680-09-0330-00-12	MI (Microwave products)

Limited calibration (using only 0 dBm Calibrator and 6500)

Test equipment : items a,h

9. Connect the 6511(6512) Detector to the 50 MHz, 0 dBm calibrator and to Channel A of the 6500. With the r.f. source switched off carry out the AUTO ZERO function then if satisfactory switch on the r.f. source and with the 6500 temperature correction on set the 6511 adjustment potentiometer (R1) to give a reading of 0 dBm ±0.05 dB on the 6500. The adjustment should be carried out after allowing the ambient temperature to stabilize at 22^0C or as near as possible for at least two hours. On completion lock the potentiometer with Silastic 732 silicone adhesive/sealant or similar.

10. Re-assemble the casing and backplate, sliding this over the detector and butting up to the r.f. connector assy. Locate the cable clamp in the slot on the rear support plate and slide the rear plate into position on the casing. Align rear support plate and rear plate screw holes, fit and progressively tighten the two chrome fixing screws locking these with Loctite 222 or similar.

Alternative calibration providing greater accuracy

Test equipment : items a,b,d,h,i

11. Interconnections between the d.c. output of the detector and the d.v.m. can most easily be made via a female 12 contact socket (item i). Wires should be soldered to the following pins of the socket and the free ends connected to the d.v.m. as follows :-

Socket pin no.	DVM terminal
Pin L (signal)	Positive terminal
Pin B (signal ground)	Negative terminal
Pin E (chassis, earth)	Remote guard terminal

12. Two further compensating components are required to carry out the calibration :

(i) 1 µF tantalum bead capacitor Part No. 26486-209F.
This should be inserted into the compensation capacitor test point, the position of which is shown in Fig. 3.

(ii) 39 kΩ 2% 1/4W resistor Part No. 24773-311A.
This should be connected across the d.v.m. +ve and -ve terminals to simulate the 6500 chopper load.

13. Also connect the r.f. input of the detector to the 50 MHz, 0 dBm calibrator in an area where temperature changes can be avoided. Monitor the temperature around the detector unit and leave for two hours for the unit to stabilize. When a stable temperature reading, within the range shown in Table 2 (ideally 22^0C) has been maintained, set adjustment potentiometer (R1) to give a d.v.m. reading corresponding to the temperature reading shown in Table 2. On completion remove the compensating capacitor and lock the potentiometer with a suitable adhesive such as Silastic 732 silicone adhesive/sealant. Reassemble the casing and backplate as previously described in para. 10.

TABLE 2 TEMPERATURE/mV CHART

TEMPERATURE ^{0}C	CALIBRATION mV
17	202.5
18	202.7
19	202.8
20	202.9
21	203.0
22	203.0
23	203.0
24	203.0
25	202.9
26	202.8
27	202.8

CABLE ASSY. AND R.F. CONNECTOR REPLACEMENT

14. To renew either an N type (6511) or an APC-7 (6512) r.f. connector assy. simply remove the casing and the r.f. connector assy. as described in previous paragraphs . It is not advisable to further dismantle the r.f. connector, this requires special tools and the replacement of individual components is difficult.

15. The cable assy. includes the 12 pin male connector and therefore only requires connections to be made at the p.c.b. However Fig. 4 gives details of the interconnections to both p.c.b. and the 12 pin male connector should the user require to change only the plug and not the complete cable assy.

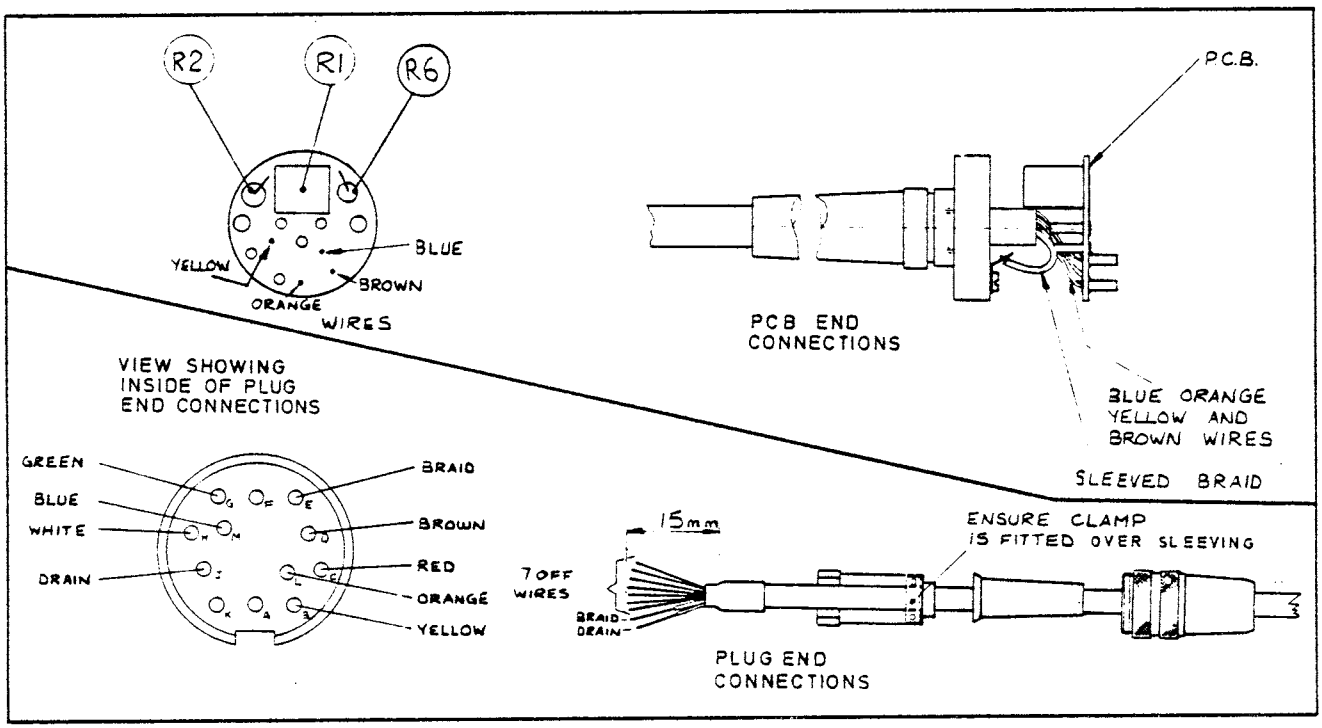

Fig. 4 Cable assy. wiring details.

DETECTOR FUNCTIONAL CHECKS

Temperature sensor check

Test equipment : items d,h

16. On completion of detector calibration the item should be fully cased for all subsequent confidence checks. When handling the detector take care to touch only the cable and not the body of the item. Connect the detector to Channel A of the 6500 and carry out the AUTO ZERO function, if this is satisfactory further select SHIFT and CALAID keys to display the temperature indication. With reference to Table 3 check that the 6500 temperature sensor figure displayed is within $\pm 2^0$C of the figure monitored at the detector by the thermometer.

TABLE 3 TEMPERATURE SENSOR FIGURES

6500 dBt Temp. reading	Temperature ^{0}C
2.2	27.9
2.3	26.9
2.4	26.0
2.5	25.1
2.6	24.2
2.7	23.3
2.8	22.5
2.9	21.7
3.0	20.9
3.1	20.1
3.2	19.3
3.3	18.6
3.4	17.8
3.5	17.1

VSWR confidence check

Test equipment : items c,e,f,g,h

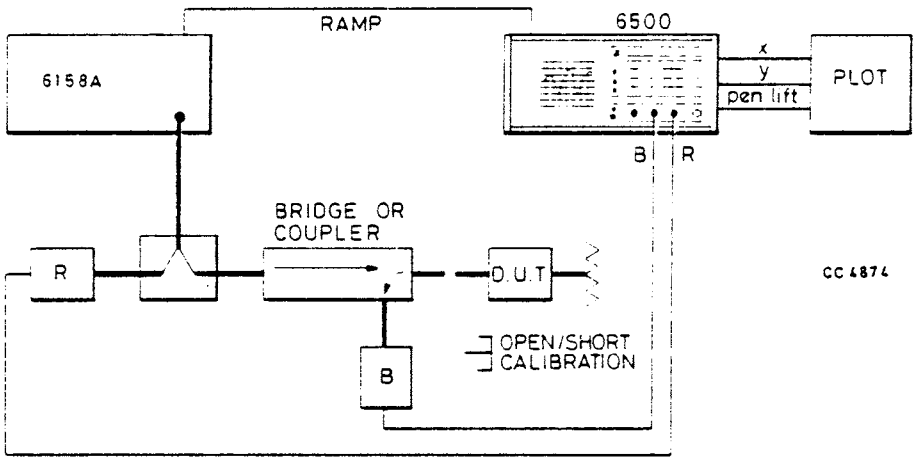

Fig. 5 VSWR measurement, interconnecting diagram

17. Connect the test equipment as shown in Fig. 5 and switch 6158A r.f. level off, and mode to SWEEP. Carry out the AUTO ZERO function on the 6500, if this is satisfactory complete the following :-

(1) Set the 6158A to sweep 8.0 - 12.4 GHz by entries on the 6500 F1 and F2.

(2) Switch 6158A r.f. source on and adjust the level to give an output at the bridge test port of 0 dBm.

(3) With OPEN CIRCUIT termination to the bridge select B, -R, STORE-B, on the 6500. Then fit SHORT CIRCUIT to the bridge and select SHIFT, STORE AV, B, on the 6500 (see Vol. 1, Chap. 3-2, Applications for further details).

(4) Connect the detector to be measured to the bridge test port and select SUB MEM,B and AUTO keys, the display now shows the return loss of the detector, pressing UNITS key will give a v.s.w.r. reading. Check that this does not exceed 1:1.35 across the range 8.0 - 12.4 MHz.

Frequency response check

Test equipment : items c,f,g,h

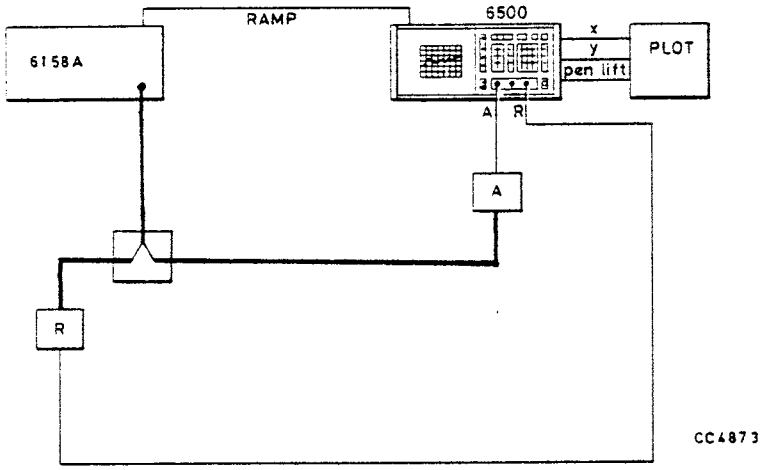

Fig. 6 Frequency response, interconnecting diagram

18. Connect the test equipment as shown in Fig. 6, switch 6158A r.f. source off and mode to SWEEP. Repeat the 6500 AUTO ZERO function, on completion switch 6158A r.f. source on and set the level for an output at the power splitter measurement port of -10 dBm, then carry out the following steps :-

(1) Store trace in memory using a known serviceable detector in Channel A.

(2) Replace Channel A detector by the repaired item and subtract new display from Channel A memory.

(3) Check that any variations in the resultant display do not exceed 1 dB.

SPARES

19. The number of spare items available for maintenance purposes are of necessity limited due to the minute size of some individual items and the difficulties involved in renewal of these. The following list of available spares therefore is not inclusive.

Fig. 7

Item	Description	Mfr./Part number
	Unit 6511/6512 Detector (wide band)	
	Complete item 6511	2716
	Complete item 6512	2718
1	RF connector assy. N type (6511)	2716-007 *
1	RF connector assy. APC-7 type (6512)	2718-007 *
1	Body moulding assy.	2716-001
2	Spring	2717-019
3	Plunger	2717-017
4	Centre contact assy.	2716-003
5	N type plug with 7 mm airline (6511)	131-10003
5	APC-7 type plug with 7 mm airline 6512)	131-1050
6	Sleeve	2716-012
7	Screw Zinc plate, Skt. Hd. M2 x 5 mm	GKN
8	Retainer (Module)	2716-014
9	Detector module assy. kit (includes R2,R6)	2716-006 *
10	Casing	2716-021
11	Screw, Zinc plate, Pan Hd. M2 x 10 mm	21837-241E
12	Spacer (short)	2716-018
13	Spacer (long)	2716-017
14	Printed circuit board assy. (includes Cable assy.)	2716-002
	PCB detail	2716-030
	Single contact connector socket	28488-004E
	Resistor variable (R1) 10K 0.5W ±20%	BOURNS 3329W-1-103 or SPECTRO RELIANCE
15	Plate (retaining cable)	2716-019
16	Screw, Zinc plate, Pan Hd. M2 x 8 mm	21837-239V
17	Screw, Chrome plate, Pan Hd. M2 x 12 mm	21838-243T
18	Cable assy. (Part of Printed circuit board assy.)	2716-004 *
	7 core double braid cable (2 M)	2716-500
	Rear plate	2716-020
	12 pin male connector	680-09-0329-00-12
	'0' clip W.107 1/4"	GRIFLEX

* Recommended
replaceable spare assys.

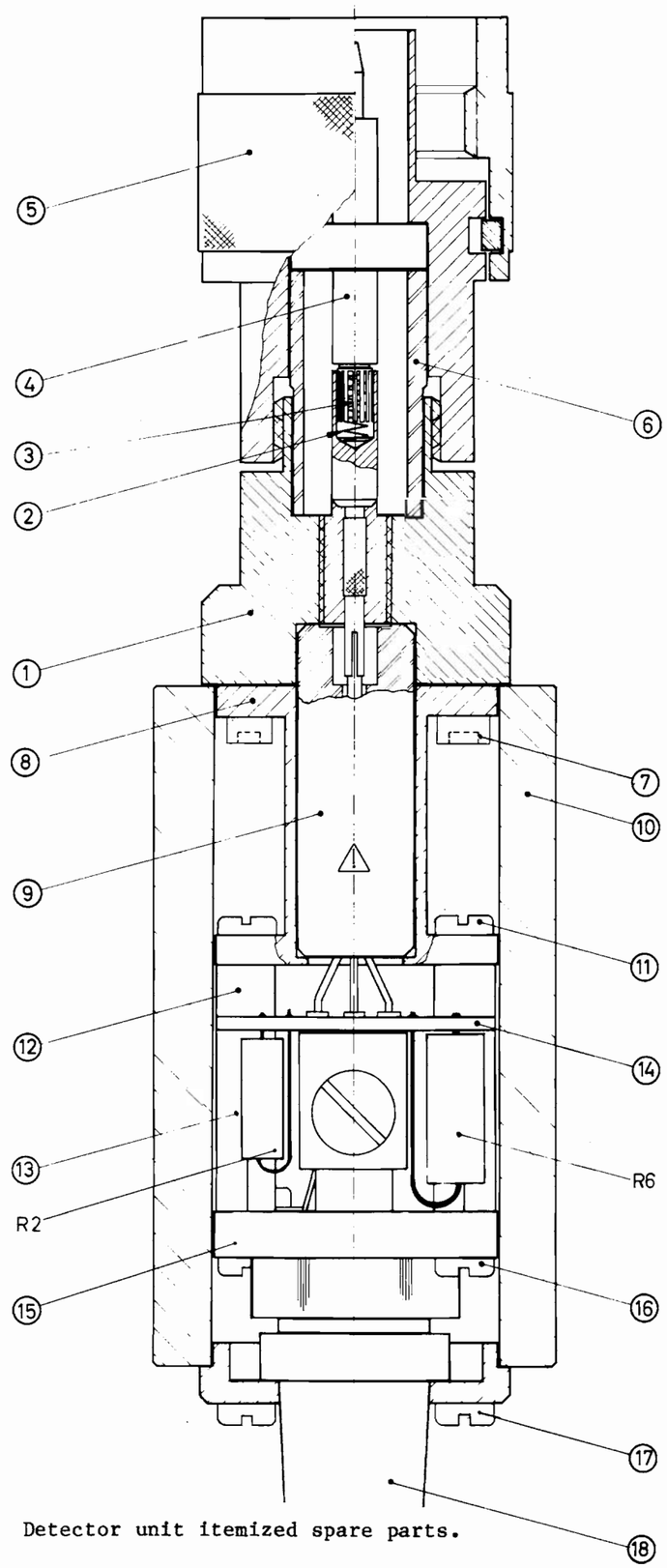

Fig. 7 Detector unit itemized spare parts.

Chapter 5-2

DETECTOR MAINTENANCE (6514)

CONTENTS

INTRODUCTION

1. The RF Detector 6514 is designed for use with 6500 Automatic Amplitude Analyser. The performance of waveguide assemblies may be characterized for transmission loss or gain, power, return loss or VSWR from 26.5 to 40 GHz over a 61 dB range.

OPERATION

2. Each RF Detector comes complete with waveguide attachment for user convenience and to avoid the possibility of damage to detector input face and screw threads through repeated attaching and detaching.

3. The 6514 detected signal is processed by the 6500 to produce a power reading. Powers outside of the square law of the diode are corrected by means of a look-up table in the 6500. The detector type function, DET, is used to select the correction for 6514. (Earlier instruments not having this key fitted can be retrospectively modified if this is required). Details for selecting the 6514 detector, zeroing, and setting of frequency limits are all described in the Vol. 1 Operating Manual.

MAINTENANCE

4. User servicing is not recommended for this detector and no itemized spares are available. If servicing is required the device should be returned to Marconi Instruments Microwave Products, Stevenage with details of any faults encountered.

PERFORMANCE TESTS

5. The following procedure will allow the user to verify the performance of the detector. This procedure is of a simplified nature however and of restricted range compared with tests that relate to the more comprehensive factory test facilities which are necessary to demonstrate complete compliance with the specification.

TABLE 1 TEST EQUIPMENT

Item	Description	Minimum use specification	Recommended model
a	Automatic amplitude analyser	See H6500 Vol. 1 Chap. 1	6500
b	Detector 6514	See H6500 Vol. 1 Chap. 1	6514
c	High directivity couplers	Directivity: >35 dB 26.5-40 GHz	HP R752C 2 off
d	Variable attenuator	26.5-40 GHz	6052/1
e	Signal source	Frequency: 26.5 - 40 GHz Output: 0 dBm	6600A/1
f	Power head/meter	Calibrated at 0 dBm at 33 GHz	6460 & 6428
g	Waveguide short circuit	26.5-40 GHz	Mid-century Microwave MC 22/12
h	Ferrite isolator	26.5-40 GHz isolation >20 dBs VSWR <1.2:1	Trak Microwave Corp. 2571-1810

Initial setting up procedure

6. With the three channels of the 6500 Automatic Amplitude Analyser free of detectors, connect the 6514 under test to channel A. With the RF source switched off carry out the AUTO ZERO function pressing SHIFT and ZERO keys. A status message displayed on the screen should then read

"Ready" for channel A

and "No probe" for channels B and R

No error message should be present.

7. If an error message is present, repeat the test with the 6514 connected in turn to channels B and R to ensure that the fault is confined to the detector under test. The Auto Zero status message displayed should indicate the same fault regardless of channel.

Power accuracy (to be measured at 22° ±2°C)

Test equipment: items a,b,c,d,e,f

8. Connect an RF source capable of producing a levelled output of 0 dBm at 33 GHz, via a variable attenuator, to a high directivity directional coupler as shown in Fig. 1 below. A 6514/6500 or another power head/meter combination can be used as the monitor on the side arm of the directional coupler.

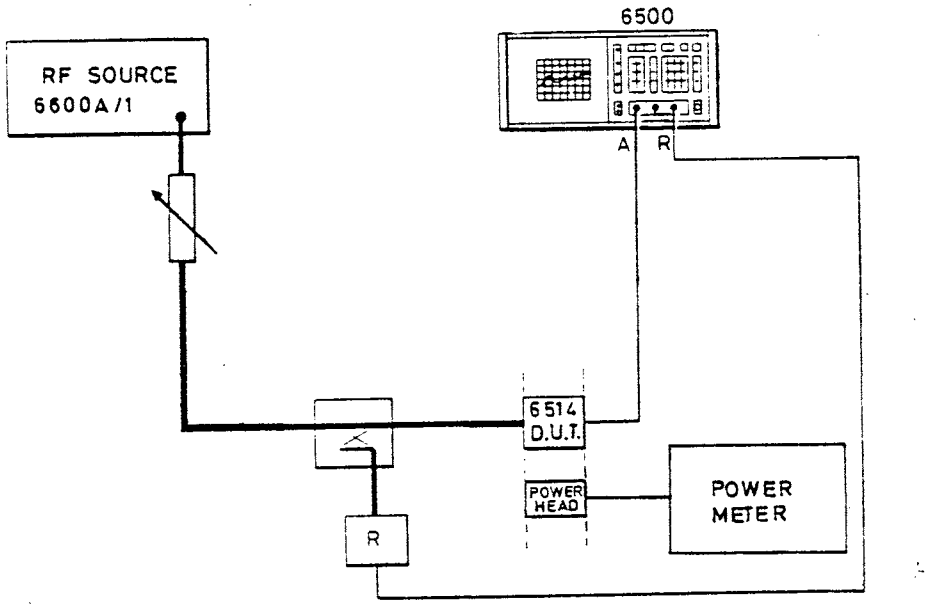

Fig. 1 Power accuracy measurement, interconnecting diagram

9. Connect the 6514 under test to channel A of the 6500 and enter the detector type information by pressing SHIFT, DET, 4 and ENTER keys. Attach the power head to the directional coupler and carry out the following steps:-

(1) With no r.f. power supplied; zero the 6514 under test and also the monitor and power head.

(2) Then with r.f. supplied at 33 GHz adjust the variable attenuator until the power meter reads 0 dBm and note the power reading on the monitor.

(3) Taking care not to handle the detector case, replace the power head with 6514 under test.

(4) Adjust the variable attenuator until the monitor power reading returns to the previous value. Allow the detector to stabilize to ambient temperature ensuring it is not in the air flow of an instrument cooling system or other thermally unstable environment. The 6500 should give a reading of 0.0 ±0.4 dBm.

VSWR confidence check

Test equipment: items a,b,c,e,g,h

10. A v.s.w.r. reading of the 6514 can be obtained by reference to Chap. 3-2, paras. 16 and 17 of the Operating Manual Vol. 1. Connections should be made as shown in Fig. 2 below, and not as illustrated in Vol. 1 Chap. 3-2, Fig. 8. There, detector A is connected so that a transmission loss measurement can also be carried out. VSWR should be better than 2.5:1.

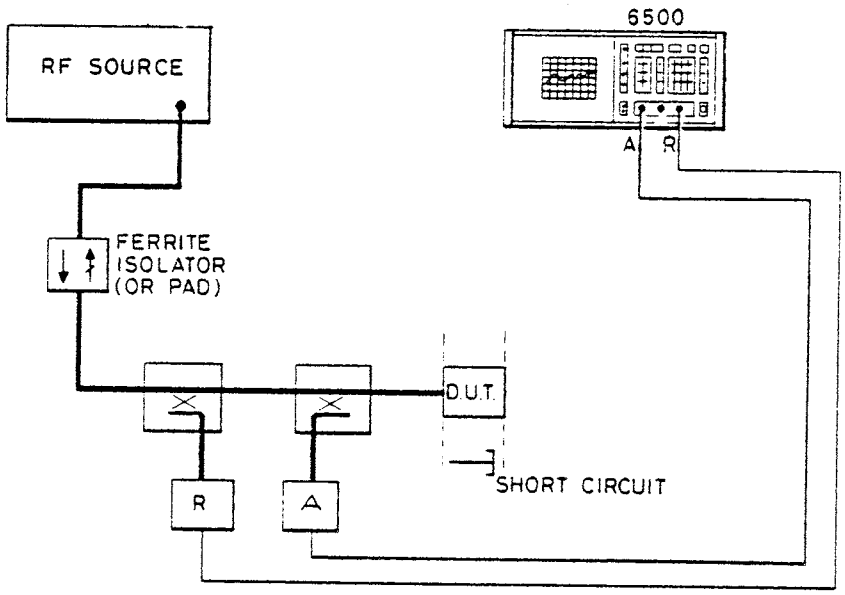

Fig. 2 VSWR measurement, interconnecting diagram