

For Service Manuals  
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# ***RF Signal Generator B4***

*Including B4A, B4B, B4AC and B4BC*

## **Instruction / Manual**

1001

ADVANCE

1-A-2.

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## ***Introduction***

## ***Section 1***

The Advance RF Signal Generator B4 is primarily intended as a laboratory instrument and is available with alternative frequency ranges covering either 100 kHz to 80 MHz or 30 kHz to 30 MHz.

Basically the instrument is a Hartley oscillator with six switched inductors and a variable capacitor directly calibrated to an overall accuracy of  $\pm 1\%$ . Provision of a Logging scale facilitates re-setting. Continuous adjustment of the r.f. output level is provided by means of a non-inductively wound potentiometer and step attenuator. The level can be set by use of a diode voltmeter that monitors the level into the step attenuator.

The output signal can be modulated internally at 400 Hz to a depth between 0 and 80%, or an external modulating source may be used. Both internal and external modulation depths are monitored and an output of 400 Hz is available when the internal modulation is in use. All oscillating circuits are well screened and stray radiation has been kept to a low level.

## Specification

## Section 2

### Frequency Ranges

B4A 100 kHz to 80 MHz in six ranges. Accuracy  $\pm 1\%$ .

Range A: 100 kHz to 300 kHz  
Range B: 300 kHz to 1000 kHz  
Range C: 1 MHz to 3 MHz  
Range D: 3 MHz to 10 MHz  
Range E: 10 MHz to 30 MHz  
Range F: 30 MHz to 80 MHz

B4B 30 kHz to 30 MHz in six ranges. Accuracy  $\pm 1\%$ .

Range A: 30 kHz to 100 kHz  
Range B: 100 kHz to 300 kHz  
Range C: 300 kHz to 1000 kHz  
Range D: 1 MHz to 3 MHz  
Range E: 3 MHz to 10 MHz  
Range F: 10 MHz to 30 MHz

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### RF Output Voltage

Accuracy  $\pm(1 \text{ dB} + 2\% \text{ f.s.d.})$ .

The output voltage from the  $75 \Omega$  attenuator is fed into a  $75 \Omega$  transmission line which is terminated with a  $75 \Omega$  dummy aerial pad TP1D. The output into  $75 \Omega$  is continuously variable from  $1 \mu\text{V}$  to 100 mV by means of a 4-step decade attenuator and a continuously variable control. The signal is monitored after the variable control to ensure accuracy at high frequencies.

### Output Impedance

The output impedance at the end of the unterminated transmission line is  $75 \Omega$ . When terminated by the Termination Pad type TP1D supplied with the instrument, three impedance values are available:

- (1)  $37 \Omega$  (with full output).
- (2)  $10 \Omega$  (with one-tenth indicated output).
- (3) A standard dummy aerial (with one-tenth indicated output).  
 $50 \Omega$  models available on request (B4AC and B4BC).

### Internal Modulation

Frequency 400 Hz  $\pm 10\%$ .

Modulation depth 0 to 80%;  $\pm 1 \text{ dB} \pm 2\% \text{ f.s.d.}$

### External Modulation

B4A 10 Hz to 30 kHz, 0 to 80% for frequencies less than one-thirtieth of the carrier frequency.

## **Specification**

## **Section 2**

B4B 10 Hz to 10 kHz, 0 to 80% for frequencies less than one-thirtieth of the carrier frequency.

Approximately 10% modulation depth per volt input into high impedance is obtained. The modulation depth is monitored. Accuracy  $\pm 1$  dB.  $\pm 2\%$  f.s.d.

### **AF Output**

This is obtained from the internal modulation oscillator at approximately 400 Hz. Output is approximately 0 to 10 V into 600  $\Omega$ .

### **RF Leakage**

Good screening and filtering has reduced stray radiation to approx.  $1\mu\text{V}$ .

### **Accessories Supplied**

- 1 Termination and Dummy Aerial Pad, TP1D.
- 1 Shielded RF Feeder, complete with plugs, PL5B.
- 1 Shielded AF Lead, complete with plug and crocodile clips, PL18B.
- 1 Supply Lead, PL39.

### **Power Supply**

B4A, B4AC, B4B and B4BC: 110, 210, 230, 250V 45 to 65 Hz.  
Consumption approximately 25 W.

### **Weight**

25 lb (11.4 kg) nett.

### **Dimensions**

Width 13 in., height  $12\frac{3}{8}$  in., depth  $7\frac{1}{4}$  in. ( $33 \times 31.4 \times 18.4$  cm).

### **Specification of Termination Pad Type TP1D**

Input impedance 75  $\Omega$ .

Outputs: 37  $\Omega$  at full voltage.

10  $\Omega$  giving one-tenth of input voltage.

A standard dummy aerial giving one-tenth of input voltage.

Details of the TP1D are shown on the circuit diagram.

## 3.1 SUPPLY VOLTAGE

The B4A and B4B are normally despatched with the supply transformer set to operate at 220 to 240V, a.c. (40 to 100 Hz). For other supply voltages, withdraw the instrument from its case by unfastening the fixing screws round the edge of the front panel, unsolder the lead on the 230V tag on the supply transformer, and re-solder it to the appropriate tapping point. With the correct supply voltage applied, the instrument can be switched on. Warming up takes only a few minutes.

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## 3.2 FREQUENCY ADJUSTMENT

Any frequency in the range of the instrument can be selected to an accuracy of  $\pm 1\%$  by means of directly calibrated scales and a band selector switch. A linearly calibrated scale with vernier is also provided to enable high accuracy of re-setting to be obtained. If a given frequency is to be required on a number of occasions, the vernier scale reading should be noted, and when re-setting, the instrument should be set to the reading. Fine frequency adjustment is easily obtained using the double slow motion drive which gives a ratio of 25 : 1. When desired, however, the knob on the main dial may be used to swing from one end of the band to the other.

## 3.3 RF OUTPUT LEVEL

The r.f. output into a  $75\ \Omega$  load, or available at the  $37\ \Omega$  socket of the terminating pad type TP1D, is variable between  $1\ \mu\text{V}$  and 100 mV by means of a continuously variable control and a five position step attenuator, each step representing 20dB. The output voltage is monitored at the input to the attenuator (after the continuously variable control) by a diode voltmeter with an open scale. This method avoids the frequency errors inherent in the continuously variable control.

To read the output voltage, press the switch marked METER-MOD-CW into the CW position. The output voltage available into a  $75\ \Omega$  load or at the  $37\ \Omega$  socket of the TP1D is the product of the reading of the meter, which is calibrated 0 to 15, and the setting of the step attenuator marked  $\times 1\ \mu\text{V}$ ,  $\times 10\ \mu\text{V}$ ,  $\times 100\ \mu\text{V}$ ,  $\times 1\ \text{mV}$ ,  $\times 10\ \text{mV}$ .

For accurate reading at the higher frequencies the output line must be correctly terminated, but up to about 5 MHz the output voltage may be doubled with a slight error by omitting the termination.

When using the  $10\ \Omega$  socket or the dummy aerial socket on the termination pad, the output voltage is one-tenth of the indicated output.

## **3.4 INTERNAL MODULATION**

The signal can be internally modulated from 0 to 80% at 400 Hz. With the modulation switch set to INT MOD, modulation depth is varied by the SET MOD control. The modulation depth is monitored when the MOD-CW switch is set to MOD. Since the modulation depth is determined by the ratio of modulating voltage to h.t. voltage, it is advisable to maintain the a.c. supply voltage to the generator accurately.

## **3.5 EXTERNAL MODULATION**

The external modulating signal is injected into the AF socket with the modulation switch set to EX. MOD. Input impedance is high and a d.c. blocking capacitor is incorporated.

The signal can be modulated from an external source up to 80%, the acceptable modulation frequency being 10 Hz to 30 kHz into B4A and 10 Hz to 10 kHz into B4B. The upper modulation frequency is limited to  $\frac{1}{30}$ th of the carrier frequency. It is desirable that the supply input voltage is accurately maintained so that the metering is accurate.

## **3.6 AUDIO FREQUENCY OUTPUT**

The signal is available at the AF socket from the internal 400 Hz modulating oscillator when the modulating switch is at INT. MOD. Approximately 0 to 10V is available into 600  $\Omega$ , varied by the MOD control. This output is taken from the secondary winding of the modulation transformer and has a low d.c. resistance to earth.

## 4.1 RECALIBRATION OF METER RANGES

The circuits monitoring carrier level and modulation depth are correctly adjusted before leaving the factory. After prolonged service, recalibration may be accomplished using preset potentiometers RV33 and RV18. When the case is removed (para. 3.1), these potentiometers will be found immediately below the supply transformer.

### (a) *Recalibration of Carrier Level*

With the OUTPUT VOLTAGE control RV20 set fully counterclockwise, set the voltage range switch to X10 mV. Connect an external diode voltmeter, calibrated at 100 mV and having an input impedance of 75  $\Omega$ , directly to the ATTEN. RF output socket. Set the Signal Generator to a frequency within the calibration range of the external voltmeter.

Adjust RV20 until the external meter reads exactly 100 mV. Make the built-in meter read 10 on the CARRIER scale by adjustment of preset potentiometer RV33.

### (b) *Alternative Calibration of Carrier Level*

With the Signal Generator set at a low r.f., preferably 1 MHz, connect a valve voltmeter directly to the ATTEN. RF output socket. Set the range switch to X10 mV and adjust the OUTPUT VOLTAGE control to produce a reading of 200 mV on the valve voltmeter. This represents an open circuit voltage reading of the output socket. The built-in meter should be made to read 10 on the CARRIER scale by adjustment of RV33—equivalent to a terminated output level of 100 mV.

### (c) *Recalibration of Modulation Depth*

Obtain a display of the unmodulated output of the Signal Generator on an oscilloscope fitted with a graticule.

Using the OUTPUT VOLTAGE control, adjust the output level to 10 on the meter scale and the output range switch to produce a conveniently large amplitude.

Switch the modulation selector to internal and adjust the SET MOD control until the oscilloscope display indicates 50% modulation. Use the graticule with some care to avoid parallax errors.

Adjust RV18 on the Signal Generator until the MODULATION scale on the meter reads 50%. Check that a visual indication of 75% depth of modulation coincides with a scale reading of 75.

If distortion in the oscilloscope Y amplifier is causing errors, it may be necessary to connect the Signal Generator output direct to the Y deflecting plates.

## 4.2 CLEANING METER FACE

The meter face should only be cleaned using an antistatic cloth or other anti-static material. The use of ordinary cleaning material induces a static charge and hence errors in the meter readings.



# Components List and Circuit Diagram Section 5

## RESISTORS

(10%  $\frac{1}{2}$  W solid carbon insulated unless specified)

Ref.	Value	Description	Part No.
R1	15K		1177
R2	47K	10% $\frac{1}{4}$ W	2933
R3	10K		671
R4	15K	$\frac{1}{2}$ W R.M.A.8	6381
R5	5.6K		1525
R6	10K		671
R7	{ 15K	B4A only	1177
	{ 22K	B4B only	1271
R8	22K	B4B only	1271
R9	22K	B4A only	1271
R10	1K	B4A	1175
	3.3K	B4B	2736
R11	220	B4A	1272
	1K	B4B	1175
R12	220	B4B	1272
	On B4A connection is straight to coil		
R13	22		4419
R14	1K		1175
R15	10K		671
R16	Not used		
R17	330K		4408
R18	250K	Plessey 003/SER Q.C.	11078
R19	1K	5% $\frac{1}{4}$ W R.M.A.9	384
R20	91	Non-inductively wound pot	3754
R21	1K		1175
R22	1.5K		4405
R23	240	1% High Stability	5797
R24-}	743	1% $\frac{1}{8}$ W High Stability	6249
R27			
R28	120	1% $\frac{1}{8}$ W High Stability	5798
R29-}	92	2% $\frac{1}{8}$ W High Stability	6250
R31			
R32	82	2% $\frac{1}{8}$ W High Stability	6251
R33	5K	Pre-set potentiometer	5884
R34	1M		1171
R35	2.2M		1180
R36	5.1K		7496
R37	33K		1183
R38	1M		1171
R39	100K		1270
R40	5.1K		7496
R41	100K	4 W potentiometer	7628
R42	1K	10% $\frac{1}{2}$ W R.M.A.8	6911
R43	270	1% $\frac{1}{8}$ W High Stability	6896
R44	100	1% $\frac{1}{8}$ W High Stability	6106
R45	11	1% $\frac{1}{8}$ W High Stability	6414
R46	390		612

Ref.	Value	Description	Part No.
R47	10K		671
R48	100K		1270
R49	68K		7296

## CAPACITORS

Ref.	Value	Description	Part No.
C1 A-F	3-30p	Concentric Trimmers	1620
C2	13-514p	Variable capacitor	19543
C3	100p	5% Lemco 1106R	2758
C4	200p	5% Silvered Mica on B4A	7493
	750p	5% Silvered Mica on B4B	7577
C5	330p	5% Silvered Mica on B4A	7489
	1200p	5% Silvered Mica on B4B	7579
C6	220p	5% Silvered Mica on B4A	7488
	800p	5% Silvered Mica on B4B	7578
C7	0.5 $\mu$	250 V D.C.W. Paper Tub	10770
C8	Not used		
C9-	0.05 $\mu$	350 V D.C.W. Paper Tub	7491
C11			
C12	8 $\mu$	450 V D.C.W. electrolytic	5921
C13	16 $\mu$	350 V D.C.W. electrolytic	7014
C14	16 $\mu$	350 V D.C.W. elec.	7014
C15-	0.04 $\mu$	Min. Metallized Paper	7485
C17			
C18	0.01 $\mu$	M/M 10% Hunts L6/4 (MLW) H994	5803
C19	0.04 $\mu$	Min. Metallized Paper	7485
C20	0.005 $\mu$	Moulded Mica	1524
C21			
C22	200p	Moulded Mica	7493
C23	300p	Min. Metallized Paper	7850
C24	10p	20%, Ceramic Disc B4A only	4274
C25	10p	20%, Ceramic Disc B4B only	4274

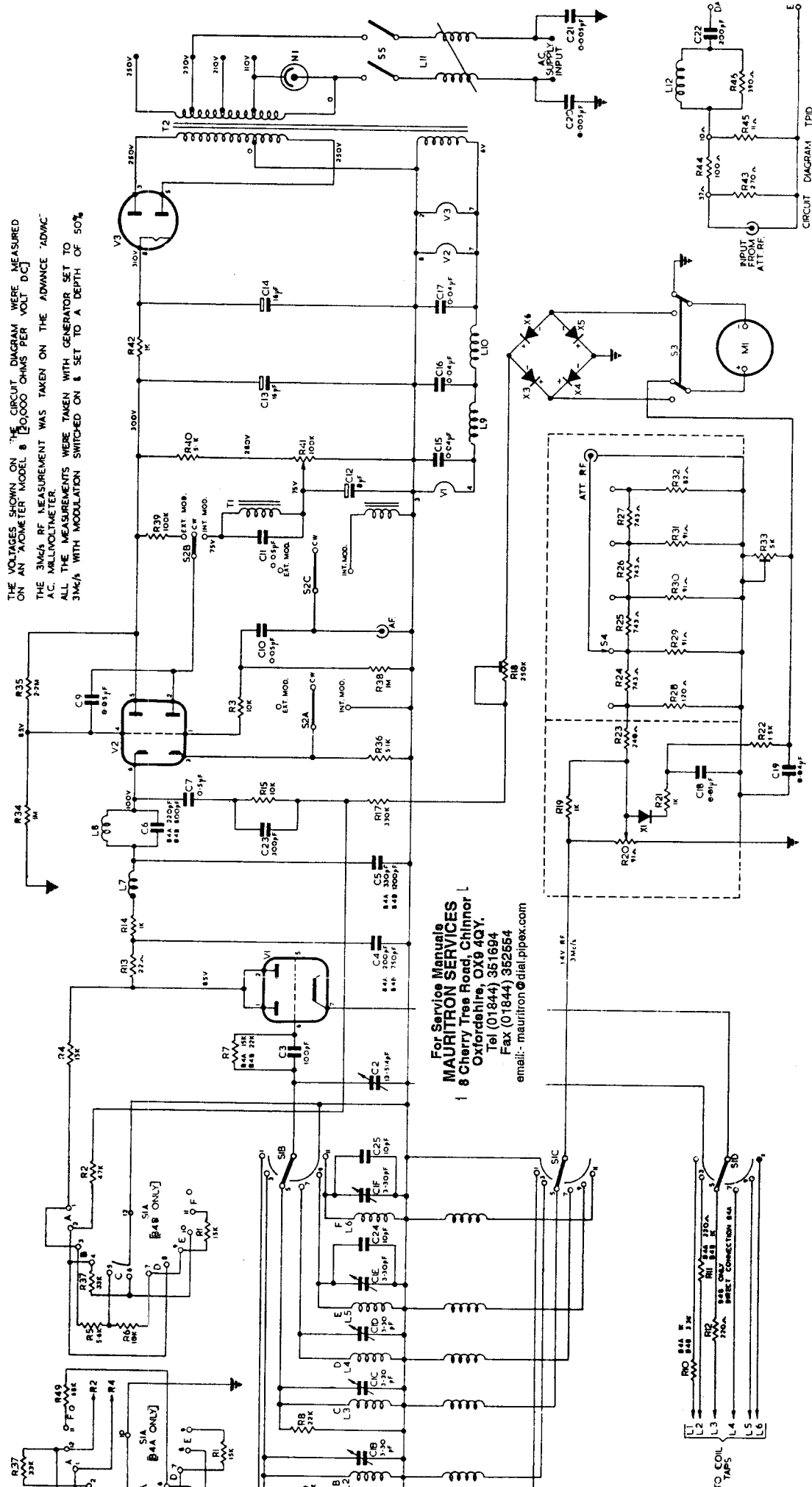
# Components List and Circuit Diagram Section 5

## MISCELLANEOUS

Ref.	Description	Part No.	Ref.	Description	Part No.
L1	Oscillator Coil. 100-300 kHz	B4A RF 541	L10	LT RF choke	C95
	30-100 kHz	B4B RF 551	L11	RF Choke for a.c. supply	C83
L2	Oscillator Coil. 300-1000 kHz	B4A RF 542	L12	Dummy aerial inductance	
	100-300 kHz	B4B RF 541	N1	Neon indicator 100 to 125 V	1165
L3	Oscillator Coil. 1-3 MHz	B4A RF 543	M1	100 $\mu$ A Meter Sifam	A17866
	300-1000 kHz	B4B RF 542	SIA/D	RF switch	8332
L4	Oscillator Coil. 3-10 MHz	B4A RF 544	S2	Modulation switch	7382
	1-3 MHz	B4B RF 543	S3	Meter switch DP/DT. Bulgin S270 CHR/P	6846
L5	Oscillator Coil. 10-30 MHz	B4A RF 545	S4	Attenuator switch	A29
	3-10 MHz	B4B RF 544	S5	Supply switch	6718
L6	Oscillator Coil. 30-80 MHz	B4A	T1	Modulation transformer	MT310
	10-30 MHz	B4B RF 545	T2	Supply transformer Input 110-210-230-250 V 40-100 Hz on B4A, B4AC, B4B, B4BC	MT309
L7	RF Filter Inductance	B4A C123	V1	ECC91 (6J6)	7034
		B4B C124	V2	6SN7 GT	5873
L8	RF Filter Inductance	B4A C121	V3	6X5GT	3150
		B4B C123	X1	Silicon Crystal Rectifier. B.T.H. type CS2A.	7110
L9	LT RF choke	C95	X3-6	Crystal Diode GE. Westinghouse WG5B	11538
			75 $\Omega$	BNC fixed connector	2121

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THE VOLTAGES SHOWN ON THE CIRCUIT DIAGRAM WERE MEASURED ON AN ANOMETER MODEL 8 [20000 OHMS PER VOLT D.C.] THE 3M $\mu$ S RF MEASUREMENTS WERE TAKEN ON THE ADVANCE ADVAC A.C. MILLIVOLTMETER. ALL THE MEASUREMENTS WERE TAKEN WITH GENERATOR SET TO 3M $\mu$ S WITH MODULATION SWITCHED ON & SET TO A DEPTH OF 50%



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Fig. 1 Circuit diagram B4

## **Amendments for 50 $\Omega$ Models** **Section 6** **B4AC and B4BC**

Reference to 75  $\Omega$  impedance should read 50  $\Omega$ .

Reference to 37  $\Omega$  impedance should read 25  $\Omega$ .

Termination Pad TP1D is replaced by TP1C.

RF lead PL5B is replaced by PL43.

AF lead PL18B is replaced by PL18A.

### *Circuit Diagram*

R23 is 162  $\Omega$  Part No. 362  
R24 is 490  $\Omega$  Part No. 365  
R25 is 490  $\Omega$  Part No. 365  
R26 is 490  $\Omega$  Part No. 365  
R27 is 490  $\Omega$  Part No. 365  
R28 is 82.5  $\Omega$  Part No. 6251  
R29 is 62  $\Omega$  Part No. 363  
R30 is 62  $\Omega$  Part No. 363  
R31 is 62  $\Omega$  Part No. 363  
R32 is 56  $\Omega$  Part No. 364  
R43 is 91  $\Omega$  Part No. 372

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NOTE. Changes from 75  $\Omega$  to 50  $\Omega$  models also require changes of BNC connectors :  
50  $\Omega$  fixed BNC connector, Part No. 1164.