

## MODULATOR MD1/503A and B

**Introduction**

The MD1/503A is a modulator for sound or vision use and consists of an oscillator feeding a Cowan type bridge modulator. The frequency range covered is normally 30 to 90 MHz, but frequencies above 100 MHz can be accommodated by adding an additional multiplier stage. The units are not directly tunable between channels and so pre-aligned units are required for channel changes.

The MD1/503B is similar to the 'A' version but has no oscillator and requires r.f. drive from an associated 'A' unit.

An external power source is required.

The units form part of the MD1/502 or MD1M/507 Wide Band Sound and Vision Modulator and are built on to CH1/12A chassis with index pegs 9 and 12.

**General Specification***MD1/503A*

Video input	0.708 V p-p with bottom of syncs at 0 V
Output (R.F. Vision or Sound)	0.35 V to 0.55 V p-p
Sound Input for 100% Modulation	approximately zero level
Input Impedance (modulation)	75 ohms
Carrier Leak	less than 2 mV p-p
Non-linearity Distortion	less than 3%
<i>k</i> rating (625-line 2T pulse and bar signal)	less than 0.5%
Differential Gain Error	less than 2%
Differential Phase Error	less than 0.5°

*MD1/503B*

Input (6 MHz f.m. sound)	0.7 V to 1 V p-p
Output	160 mV to 250 mV p-p
Output Impedance	75 ohms
Carrier Leak	less than 2 mV p-p

**Circuit Description**

The circuit diagram for the MD1/503A is given in Fig. 1. TR1 is a crystal controlled oscillator with the crystal in the feedback path. L2 and C5 suppress spurious oscillatory modes in the crystal. TR2, an emitter follower, drives the modulator amplifier TR3 and provides an output for feeding an associated 'B' unit. The circuit of the MD1/503B is given in Fig. 2 in which TR1 operates as a buffer amplifier. The bridge is fed at r.f. by an emitter follower TR4; the output at the emitter of this transistor is 2 volts across 75 ohms, the nominal impedance of the bridge.

The oscillator and amplifier are tuned and the values of certain components depend on the frequency range being used; these values are tabulated on Fig. 1.

The modulator, a four diode bridge circuit, offers the following advantages:

- It is simple, robust and suitable for unbalanced operation.
- When balanced there is no r.f. output in the absence of modulation. By mixing d.c. with the input modulation a normal full-carrier a.m. signal can be produced.
- When the r.f. drive is sufficiently large, the output amplitude is reasonably independent of drive amplitude.

The differential capacitor C23, with resistor R19, adjusts the balance of the bridge. C23 is set for minimum carrier leakage. The bias required by the bridge is supplied by an associated unit<sup>2</sup> via the isolating choke L4, and its value depends on the conditions. For the 625-line system with negative vision modulation, a negative bias is

required; for the 405-line positive modulation system with the bottoms of syncs at or near zero carrier, the d.c. component of the signal itself provides the necessary bias and an external source is not required; for a.m. sound, bias is required but the polarity is not important; bias is not required for frequency changing.

L5 and L6 with C25 form an r.f. filter to isolate the modulation input from the r.f. circuits. The filter in the r.f. output lead removes unwanted products of the modulation process. The type of filter depends on circumstances; for example:

- (a) 625-lines, sound carrier 31.5 MHz vision carrier 37.5 MHz (i.e. parent unit operating in channel IV or V) MD1/503A-FL4/520 and MD1/503B-FL2/536.
- (b) 405-lines, MD1/503A-FL4/15. The FL3/507 high pass filter is used for the sound modulator when the vision is below the sound carrier.

### Maintenance

Routine maintenance is not required but the following tests can be made occasionally or when the frequency is changed (in which case see table of component values given on Fig. 1).

#### MD1/503A

1. The low pass filter in the modulation lead should cause no deterioration of a pulse and bar signal. This may be monitored with an oscilloscope and high impedance probe at the junction R16 and R17.
2. Oscillator Adjustment.  
The circuit should not oscillate if the crystal is removed. If it does oscillate, screw in the core of L2 until oscillation just ceases.  
With the crystal in position, check the frequency with a counter connected to SKT A. The core of L1 is set just off the point of peak output on the 'Slow' side, the frequency should then be correct. If not, the value of C4 should be adjusted. The maximum value of this capacitor should not exceed 33 pF. (N.B. the frequency is reduced as C4 is increased.)  
A final check of the frequency should be made after the unit has been run for 30 minutes and with all screening in position. Any readjustment of L1 must be made with an insulated

trimming tool.

3. R.F. Amplifier Alignment.  
With trimmers C10, C17 and C19 at mid position and with the oscilloscope and high impedance probe monitoring the junction of T1 and C22, adjust L3 for peak output. The signal level at this point should be between 5 volts and 6 volts p-p. To obtain this C10 and C19 are reduced or increased equally at the same time adjusting C17 for maximum output.
4. Modulator Bridge Adjustment.  
Connect the oscilloscope, terminated with 75 ohms, to *R.F. Out (mod)* PLA12. Terminate *mod Input* PLA4 with 75 ohms and adjust C23 for minimum output, which should be less than 2 mV. If the minimum signal is greater than this, R19 should be connected to point A or C on the secondary of T1. The value of R19 should lie between 600 ohms and 6.8 kilohms.

Final tests of the unit are made when in position in the parent unit, MD1/502.

#### MD1/503B

A properly aligned A unit is required to provide r.f. drive for the B unit.

1. The low pass input filter should be checked as described above.
2. R.F. Amplifier Alignment.  
Set C10 to its mid position, monitor the junction of C10/C14 with the oscilloscope and probe and adjust the core of L1 for maximum output. Now set C17 and C19 to mid position, move the monitoring oscilloscope to the junction of T1 and C22 and proceed as in 3 above.
3. Modulator Bridge Alignment.  
Disconnect the r.f. output filter; link C24 to PLA12. Connect the oscilloscope, terminated in 75 ohms, to PLA12. Terminate *mod. input* PLA4 with 75 ohms and adjust C23 for minimum output which should be less than 20 mV. Now proceed as in 4 above.

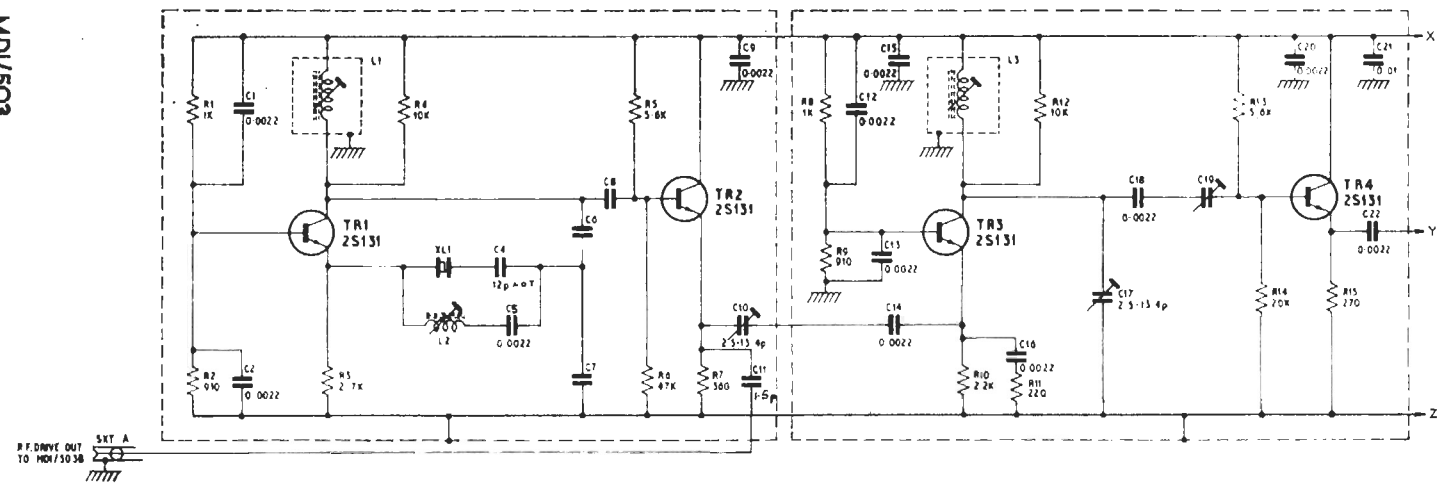
A final check of the balance must be made with the unit in position in the parent unit and with all associated units in circuit.

### Reference

1. Designs Department Specification No. 4.18(65).
2. UNI/546 Bias Unit.

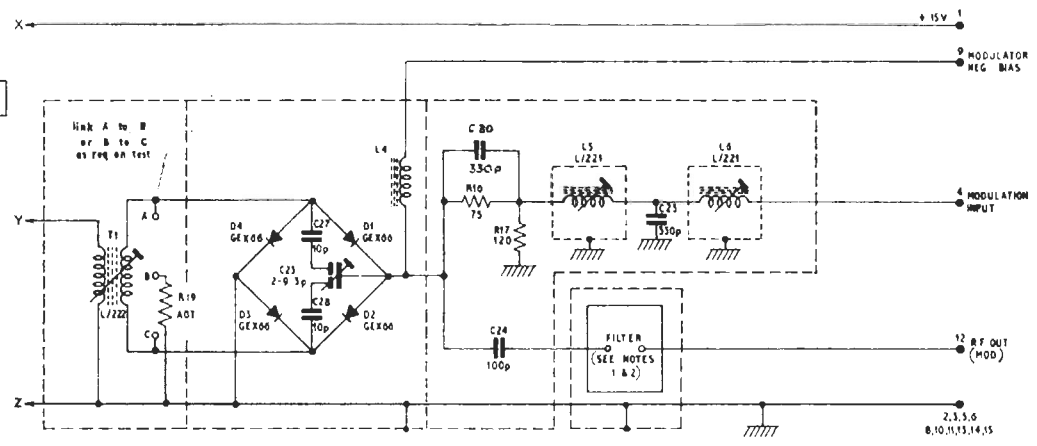
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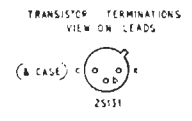
Fig 1 Circuit of the MDI/503A

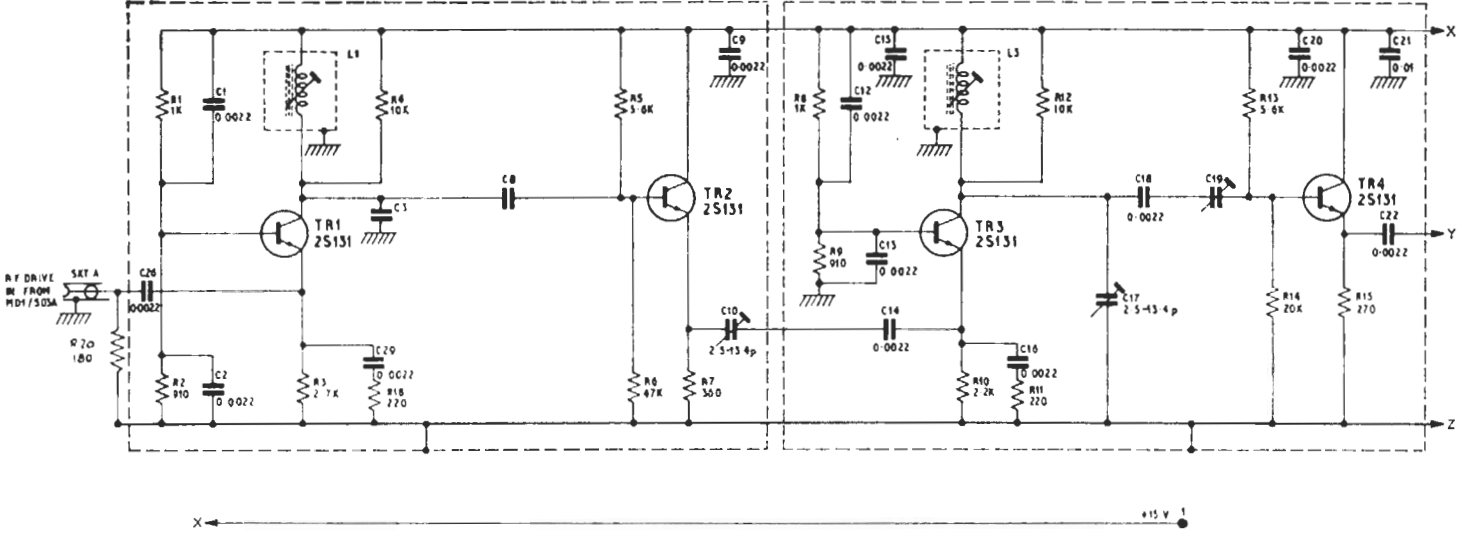


CARRIER FREQ RANGE MHZ	C8	C19	L1 & L3	L2	C6 & C7
30 - 35	10p	2.5-1340	L/315	L/316	22p
35 - 40	82p	---	L/315	L/316	18p
40 - 45	68p	---	L/285	L/317	15p
45 - 55	5.6p	---	L/284	L/318	15p
55 - 65	4.7p	---	L/314	L/319	12p
65 - 75	4.7p	2-9 3p	L/313	L/320	8.2p
75 - 85	4.7p	---	L/286	L/283	8.2p
85 - 95	4.7p	---	L/312	L/283	6.8p

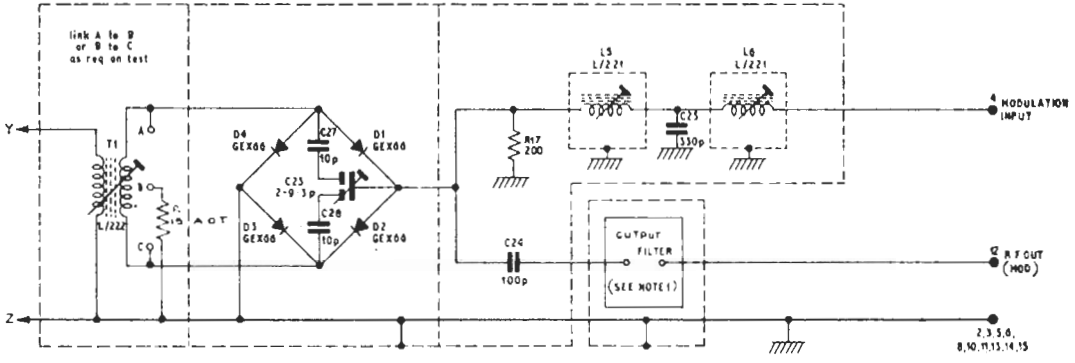
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NOTES -  
 1) FOR 405 VIS/OK OR AM SOUND USE FILTER FL4/15 TO SUIT CHANNEL IN USE  
 2) FOR 825 VIS/OK (WHEN USED WITH FM SOUND) USE FILTER FL4/320 TO SUIT FREQ IN USE.



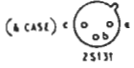


from DD13542 Iss 3  
parts list DA13543



CARRIER FREQ RANGE MHz	C5	C8	C19	L1 & L3
30 - 35	10 p	10 p	2.5-13.4 p	L/315
35 - 40	8.2 p	8.2 p	-	L/315
40 - 45	6.8 p	6.8 p	-	L/285
45 - 55	5.6 p	5.6 p	-	L/284
55 - 65	4.7 p	4.7 p	-	L/314
65 - 75	3.3 p	4.7 p	2.9-3 p	L/313
75 - 85	3.3 p	-	4.7 p	L/286
85 - 95	2.2 p	4.7 p	-	L/312

TRANSISTOR TERMINATIONS  
VIEW ON LEADS



NOTE  
1 OUTPUT FILTER FL2/534, FL3/507 OR  
FL4/15 TO SUIT APPLICATION

Fig.2 Circuit of the MDI/503B