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MARCONI INSTRUMENTS

NEW DESIGN

A.F. and M.F. Signal Sources . *TF 2000 AND TF 2001*

by L. M. SARGENT

A.F. Signal Source TF 2000 provides a maximum level of +15 dBm from 20 c/s to 20 kc/s in balanced or unbalanced loads of 75, 150 or 600 Ω, with distortion over the major part of the range not exceeding 0·1%, or 0·05% in 600 Ω unbalanced loads. An attenuation range of 111 dB is provided, in steps of 0·1 dB, and the attenuator and voltmeter will accept external signals up to 25 V (1 W). M.F. Signal Source TF 2001 has an identical attenuator and meter, and provides a maximum level of +3 dBm from 30 c/s to 550 kc/s in 600 Ω unbalanced loads, or a reduced signal in 75 Ω loads, with distortion not exceeding 0·5% at 0 dBm.

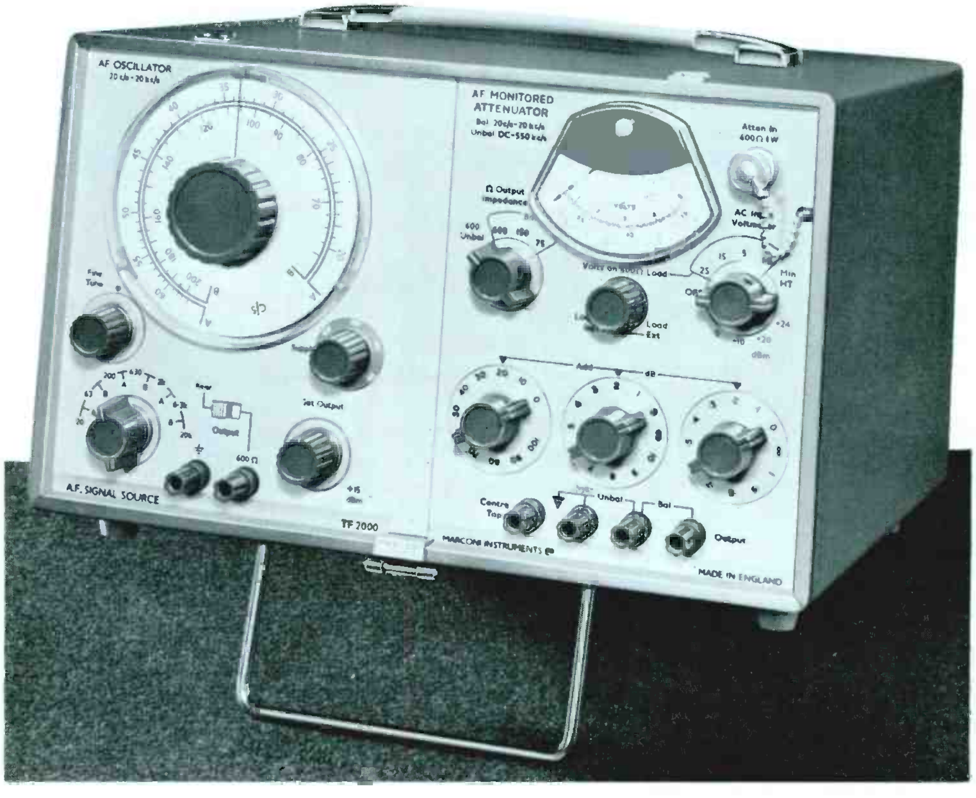

Fig. 1. A.F. Signal Source, TF 2000, consists of A.F. Oscillator, TF 2100, and A.F. Monitored Attenuator, TF 2160, integrated with rear interconnection in a single case

THE PRIMARY PURPOSE of the A.F. Signal Source TF 2000 is the provision of a signal suitable for routine checks on high-fidelity audio transmission apparatus, and particularly for use as a source in tests on distortion, frequency response, operating levels, and gain. The M.F. Signal Source TF 2001 can be used for similar purposes where very low distortion is not necessary, and is useful with other types of transmission apparatus covering the wider bandwidth. The A.F. Signal Source comprises the functioning parts of A.F. Oscillator TF 2100 and A.F. Monitored Attenuator TF 2160, whilst in the M.F. Signal Source are M.F. Oscillator TF 2101 and M.F. Monitored Attenuator TF 2161. These oscillators and attenuators are the subjects of other articles in this issue. The two instruments contained in a Signal Source are mechanically integrated into a single case, the rear signal interconnection being switch-controlled so as to retain optional direct access to the oscillator output or attenuator input, and the rear power interconnection dispensing with the battery for the voltmeter.

There are good reasons for building up the Signal Sources in this way using modules of identical size. Offering these separately or combined provides a greater range to choose from, and at the same time keener prices. Furthermore, there is the simplification of maintenance, which is becoming more of a problem as instruments become smaller and smaller.

The title of 'Signal Source' demands a word of explanation. These instruments are closely akin to signal generators, but they lack modulation facilities, and are not lavishly equipped with screening and filtering devices to avoid pick-up by highly sensitive receivers. Lack of these facilities does not entirely prevent them from being called signal generators, but since by common practice the term is generally reserved for those instruments which possess them, the present title was adopted.

Operational Facilities

The left section of each Signal Source consists of the appropriate Oscillator giving a performance as described in the previous articles. Oscillator output is normally switched to appear at the rear socket, where it is coupled to the rear of the Monitored Attenuator. This permanent connection does not lose the facility of being able to switch the two units to a condition whereby they can be used independently of each other; that is, the Oscillator output can still be switched to appear at the front panel terminals only. This also isolates the Monitored Attenuator allowing an external signal to be fed into the input socket.

When used as a Signal Source the voltmeter will monitor the Oscillator level, which is set with the oscillator SET OUTPUT control. The final signal output is accurately set by the step attenuator at any of the output impedances available from the particular attenuator in use. In the case of the A.F. Signal Source these are chosen for use with the audio equipment at radio and television stations and quad transmission cables, in addition to the normal 600 Ω unbalanced output.

Some Secondary Uses

There are one or two other facilities which are worth noting, resulting from the presence of an external input point, and these may prove useful on occasions.

(*a*) If the attenuation is set to 0 dB, the monitor can measure signals applied at the 600 Ω UNBALANCED outlet, from about 0·1 V on the 1·5 V scale, up to 25 V. Such measurements are restricted to low impedance circuits, the input resistance being 30 kΩ. If the 600 Ω load is switched in, the meter will operate as a level meter, reading power levels in 600 Ω from −6 to +30 dBm. Without the load, the meter will make a bridging measurement instead of matching, when its insertion loss will be less than 0·5 dB. The meter in TF 2000 will also read the same power range in 600, 150 or 75 Ω balanced or unbalanced circuits, if the transformer is switched in.

(*b*) With the attenuation at 0 dB and the meter switched off, the transformer in the A.F. Signal Source TF 2000 is available alone. It then has its uses as a balance-to-unbalance transformer in low impedance circuits over the frequency range of 20 c/s to 20 kc/s, or up to some 50 kc/s if a little more loss can be tolerated. It will transform a 600, 150 or 75 Ω source at the BALANCED terminals to a value of 600 Ω unbalanced at the ATTENUATOR INPUT socket, the voltage step-up ratios being 1 : 1, 1 : 2 or 1 : $\sqrt{8}$. This is convenient for providing a balanced input to a wave analyser or distortion factor meter. If inferior frequency response and distortion are acceptable, it can be used in circuits with impedances up to some 10 kΩ. Direct current must not be allowed to flow in the secondary winding, which is connected to the balanced output terminals. The primary winding is protected by a capacitor at the input socket.

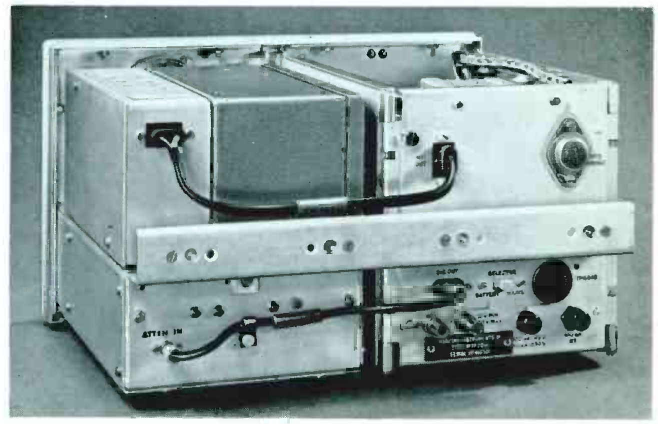

Fig. 2. Rear interior view of Signal Source

(*c*) The same transformer in TF 2000 has been shown to provide impedance and voltage step-up ratios of 1 : 8 and 1 : $\sqrt{8}$ respectively, when switched to 75 Ω. Consider the oscillator output switched to its panel terminals, and the impedance switch set to 75 Ω. Then, if the oscillator terminals are linked across to the BALANCED OUTPUT terminals, an output will appear at the ATTENUATOR INPUT socket; and this signal will have an approximate impedance of 4,800 Ω, with a maximum off-load voltage of some 20 V over most of the frequency range. This signal can be very useful where higher voltages are needed, and the high impedance and a little extra distortion are not important. This applies particularly to the external modulation of many signal generators.

(*d*) With the TF 2000 in use in the normal way, using one of the balanced output impedances, an output can be taken from one balanced terminal and the centre tap terminal. Such an output will have half the normal voltage, and nominally one quarter of the normal impedance. So, on switching to 600, 150 or 75 Ω, the voltages relative to normal connections at 600 Ω will need to be multiplied by 0·5, 0·25 or 0·177, and the nominal output impedance will be 150, 37·5 or 18·75 Ω.

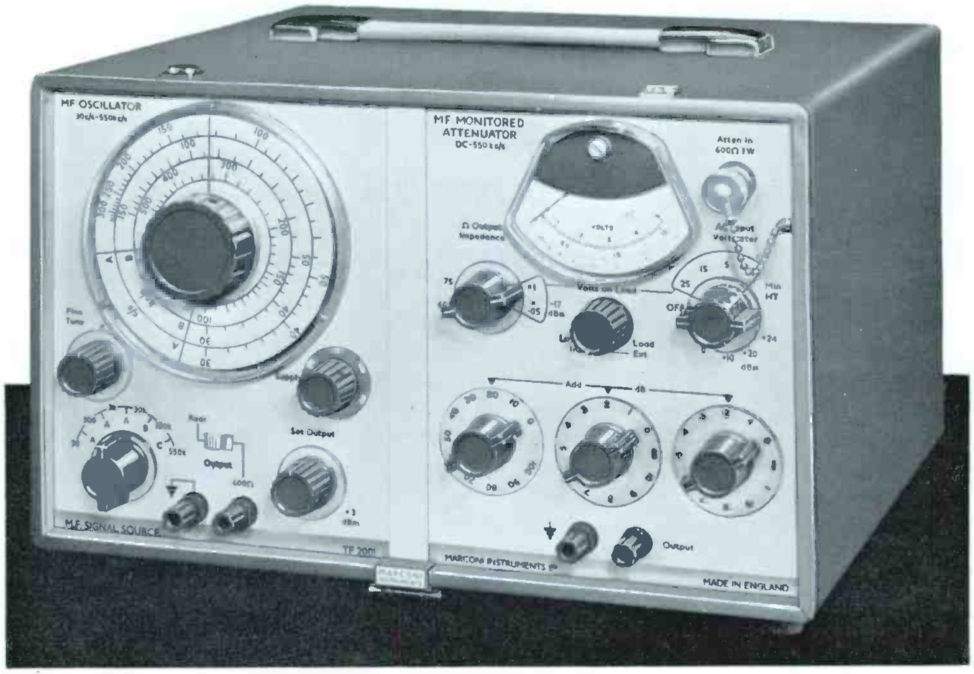

Fig. 3.
TF 2001 is the M.F. counterpart of the TF 2000 shown in Fig. 1

ABRIDGED SPECIFICATION

	TF 2000	TF 2001
Frequency		
RANGE:	20 c/s to 20 kc/s in six bands.	30 c/s to 550 kc/s, in five bands.
ACCURACY:	±1% ±0·2 c/s.	±3%.
Oscillator power	+15 dBm (31·6 mW) to attenuator; over 8·5 V open circuit (600 Ω source impedance). At least 40 dB level control.	+3 dBm (1·1 V) to attenuator, adjustable by continuously variable control.
Attenuator		
RANGE:	0 to 111 dB in 0·1 dB steps.	0 to 111 dB in 0·1 dB steps.
ACCURACY:	±1% of dB setting ±0·2 dB.	±2% of dB setting ±0·2 dB.
OUTPUT IMPEDANCE:	600 Ω unbalanced. 600, 150 and 75 Ω balanced.	600 and 75 Ω unbalanced.
INPUT VOLTMETER:	Ranges: 1·5, 5, 15 and 25 V full-scale.	Ranges: 1·5, 5, 15, and 25 V full-scale.
Frequency response	Output is level within ±0·2 dB, at any attenuator setting, with the indication of the input meter held constant.	Output is level within ±0·2 dB from 30 c/s to 20 kc/s, and within ±1 dB from 30 c/s to 550 kc/s, at any attenuator setting, with the indication of the input meter held constant.
Distortion	Unbalanced output: Less than 0·05% from 63 c/s to 6·3 kc/s; less than 0·1% elsewhere. Balanced output: Less than 0·1% from 50 c/s to 20 kc/s; less than 0·3% from 30 c/s to 50 c/s.	Less than 0·5% at 0 dBm. Less than 0·75% at +3 dBm.
Hum	Less than 0·01% (−80 dB) of output signal, or −90 dBm, whichever is the greater.	Less than −70 dBm. Hum level decreases with output level.