DISTORTION MEASURING SET

1. INSTALLATION

The instrument is despatched from the factory fitted with its internal battery connected and ready for use. To test the battery, depress the switch marked 'Battery Check' after switching on the instrument. A correct voltage battery will read 10 on the 0–10 scale and it should be discarded when the reading drops to 9. A new battery will sometimes read more than 10.

2. CONTROLS AND FACILITIES

This section describes in detail the uses and functions of the various controls and sockets on the Distortion Measuring Set.

2:1 Input Socket (BNC)

The input impedance at this socket is a function of the setting of the 'Input Voltage Range' and 'Distortion Percent Range' switches, and is detailed in the specification. The maximum permissible input is 150V. peak. A suitable blocking capacitor should be used if connection is made to a point of d.c. potential, e.g. a valve anode.

2:2 Input Voltage Range Switch

This is a three position switched attenuator which adjusts the input voltage to within suitable limits for the optimum working of the instrument in respect of overload and signal-to-noise ratio. It operates in conjunction with the 'Set f.s.d.' control.

The voltage ranges specified are nominal, but for accurate distortion measurement it should be checked that the actual voltage of the signal being measured is not greatly in excess of the maximum specified range value. The factors controlling the required input voltage on any range are :—

a) That a full scale deflation on the meter is obtainable by suitable adjustment of the 'Set f.s.d.' control.
b) That an adequate signal-to-noise ratio is obtained without overloading the amplifier.

2:3 Set f.s.d. Control

This controls the gain of the amplifier and is used in conjunction with the 'Input Voltage Range' switch to obtain a full scale reading on the meter when setting up for distortion measurement

2:4 Distortion Percent Range Switch

The principle of operation employed in this instrument is to use a stable fixed gain amplifier (with a gain control purely to adjust the full scale deflection) capable of measuring the smallest desired out-of-balance signal, and to attenuate all larger signals up to 100% distortion by means of the 'Distortion Percent Range' switch. Thus the attenuation necessary to obtain a suitable deflection on the meter when the fundamental is completely rejected is a direct function of the harmonic content; maximum attenuation being used on the 100% range and minimum on the 0.01% range. It should be noted that the 0.01% and 0.03% distortion ranges are inoperative when the 'Input Voltage Range' switch is set to 0.1–1.0V.

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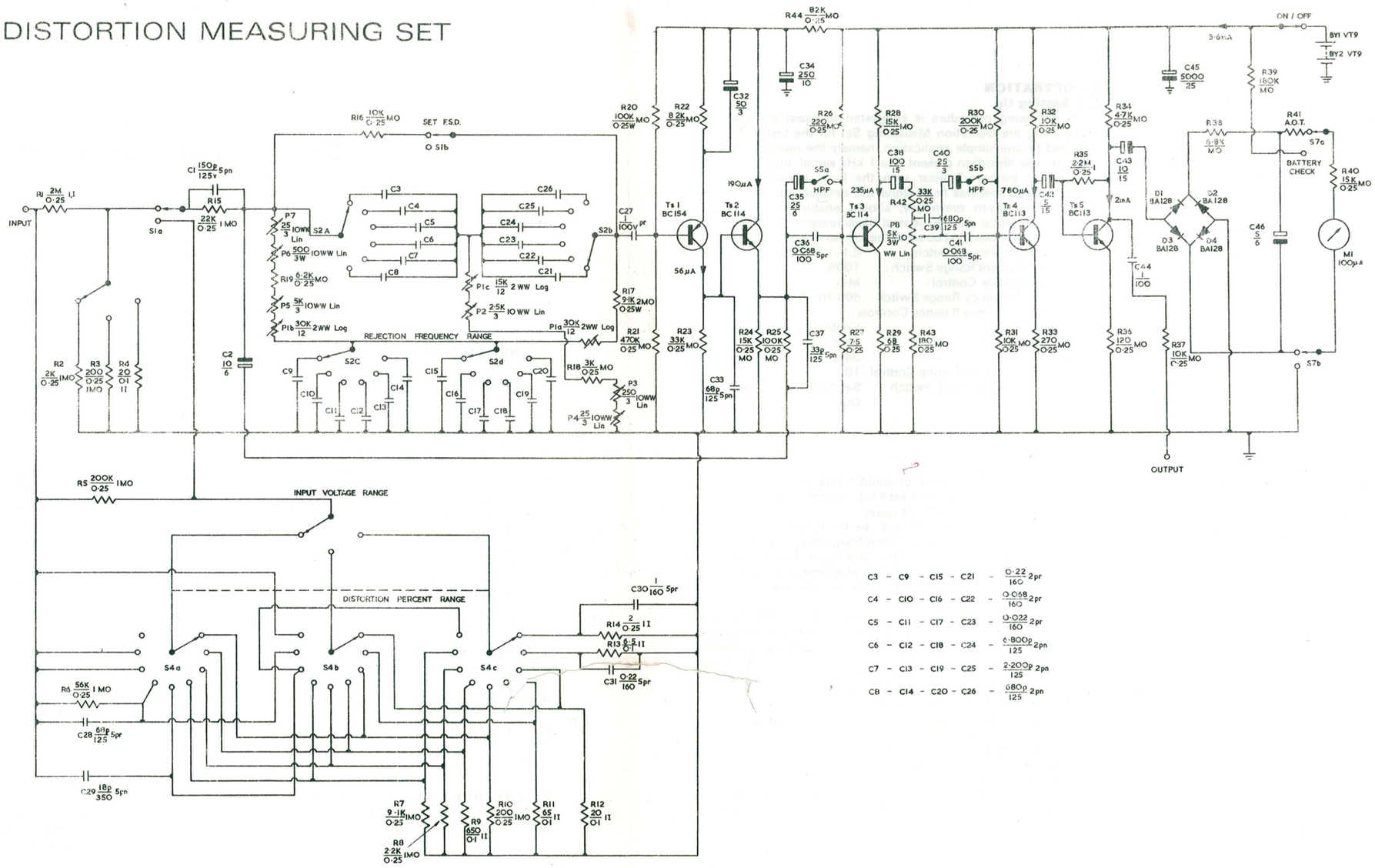

C3 - C9 - C15 - C21 - 0·22/160 2pr

C4 - C10 - C16 - C22 - 0·068/160 2pr

C5 - C11 - C17 - C23 - 0·022/160 2pr

C6 - C12 - C18 - C24 - 6·800p/125 2pn

C7 - C13 - C19 - C25 - 2·200p/125 2pn

C8 - C14 - C20 - C26 - 680p/125 2pn

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2:5 Rejection Frequency Range Switch

This switch selects the appropriate capacitive elements of the parallel 'T' network for the frequency range in use and is used in conjunction with the 'Rejection Frequency Tuning' control.

2:6 Rejection Frequency Tuning Control

This is a three-gang potentiometer. The variable resistance elements form the three sections of the parallel 'T' network to obtain fundamental balance. The dial is calibrated enabling the instrument to be used also as a frequency meter for quick approximate measurement is desired.

2:7 Read Distortion/Set f.s.d. Switch

In the 'Read Distortion' position the output of the 'Distortion Percent Range' attenuator is coupled to the measuring amplifier via the parallel 'T' network and feedback amplifier. In the 'Set f.s.d.' position the parallel 'T' network is by-passed and the total signal is applied to the measuring circuit.

2:8 500 Hz Filter Switch

When in the 'Filter' position this switch introduces a two section high pass filter into the circuit which attenuates signal components below 500 Hz at the rate of 12 dB/octave. This enables more accurate distortion measurements to be made at 1 kHz and above on signals having a high hum and/or low frequency noise content.

2:9 Output Socket (BNC)

This socket is provided in order that the out-of-balance components being measured may be observed on an oscilloscope and/or connected to an external r.m.s. reading instrument. The output signal is approximately 3 Volts from a source impedance of about 10 kOhms.

2:10 Battery

The current taken from the included battery is very small (4mA) and under normal use the life will be almost equal to the shelf life. To avoid unnecessary replacement, the instrument should not be left switched on for long periods when not in use.

3. OPERATION

3:1 Setting Up

The following procedure is suggested to assist the operator when using the Distortion Measuring Set for the first time. It is confined to one simple application, namely the measurement of the harmonic distortion present in a 1 kHz signal, but it will help the user to become familiar with the basic operation of the controls. Once this has been done the detailed information on each control, given previously, should enable the Distortion Measuring Set to be used for general measurement.

The controls should first be set to the following positions:

Input Voltage Range Switch:	0.1–1.0 Volts
Distortion Percent Range Switch:	100%
Set f.s.d. Variable Control:	Min.
Rejection Frequency Range Switch:	600 Hz–2 kHz.
Rejection Frequency Balance Controls:	
Coarse:	Centre (knob line vertical)
Medium	ditto
Fine:	ditto
Rejection Frequency Tuning Control:	10
Read Distortion/Set f.s.d. Switch:	Set f.s.d.
500 Hz Filter Switch:	Out

3:2 Measurement

Connect a sine wave signal of about 1 kHz, 1.0V. r.m.s. to the input socket and advance the 'Set f.s.d.' control to give approximately full scale deflection on the meter.

Set the 'Read Distortion/Set f.s.d.' switch to the 'Read Distortion' position and rotate the 'Rejection Frequency Tuning' control to obtain minimum reading. The 'Distortion Percent Range' switch should be advanced one range at a time with successive re-adjustment to maintain a meter deflection between 3 and 10 on the 1–10 scale.

When re-adjustment of the main 'Rejection Frequency Tuning' control produces no further improvement in balance, continue by alternate adjustment of the two 'Coarse' balance controls. Complete the balance procedure using the 'Medium' and finally the 'Fine' controls, advancing the 'Distortion Percent Range' switch successively until final balance is obtained.

Return the 'Read Distortion/Set f.s.d.' switch to the 'Set f.s.d.' position, and adjust the 'Set f.s.d.' variable control to give a meter deflection of 10 on the 0–10 scale.

Reset the 'Read Distortion/Set f.s.d.' switch to the 'Read Distortion' position. The meter reading taken in conjunction with the 'Distortion Percent Range' switch position, then indicates the total harmonic content, expressed as a percentage of the value of the input signal measured in r.m.s. values.