LEAFLET BC51. NOV. 74.

INSTRUMENTS

TECHNICAL INSTRUCTIONS

INSTALLATION AND ADVANCED MAINTENANCE

DISTORTION MEASURING SET Series 3

For equipment Serial No:

1. GENERAL

The instrument is despatched from the factory fitted with its internal battery connected and ready for use. Two screened cables are provided fitted with connectors to mate with those fitted to the instrument. A description of the controls, functions and facilities is described below, followed by operating details of setting up and measurement.

2. CONTROLS, FUNCTIONS AND FACILITIES

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

2.1 Distortion Output Socket (B.N.C.)

This socket provides the out-of-balance waveform indicated and measured by the meter. By displaying this output on an oscilloscope it is possible to assess the harmonic structure and to indicate the presence and relative amplitude of spikes produced by crossover non-linearity in audio amplifiers. It is an advantage to display the fundamental waveform on one beam for frequency reference if a double beam oscilloscope is available.

2.2 Signal Input Socket (B.N.C.)

The input impedance at this socket presented to the equipment under test is approximately 47K ohms on all ranges. The input voltage signal should not greatly exceed the maximum shown for the range in operation on input voltage range switch.

2.3 Input Voltage Range Switch

This is a three position switched attenuator which adjusts the input voltage to within suitable limits for 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 which is concentric with it.

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 deflection 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.

Note that when the input range switch is in the most sensitive range (0.05V - 0.5V) the two lowest ranges of distortion measurement (0.01% f.s.d. and 0.03% f.s.d.) are inoperative.

2.4 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.

2.5 Distortion Percent Range Switch

The principle of operation employed in this instrument is to use a stable fixed gain amplifier (with a gain control to adjust 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 when the 'Set f.s.d.' control is at maximum, the amplifier will be at maximum gain, and consequently the noise generated will also be at maximum. This is equivalent to a reading of approximately 0.002% distortion. If it is required to read distortion of this order, a high level of signal input is desirable within the permitted range of the Input Voltage Range switch. This permits the 'Set f.s.d.' control to be reduced, and so reducing inherent noise.

2.6 Rejection Frequency Range Switch

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

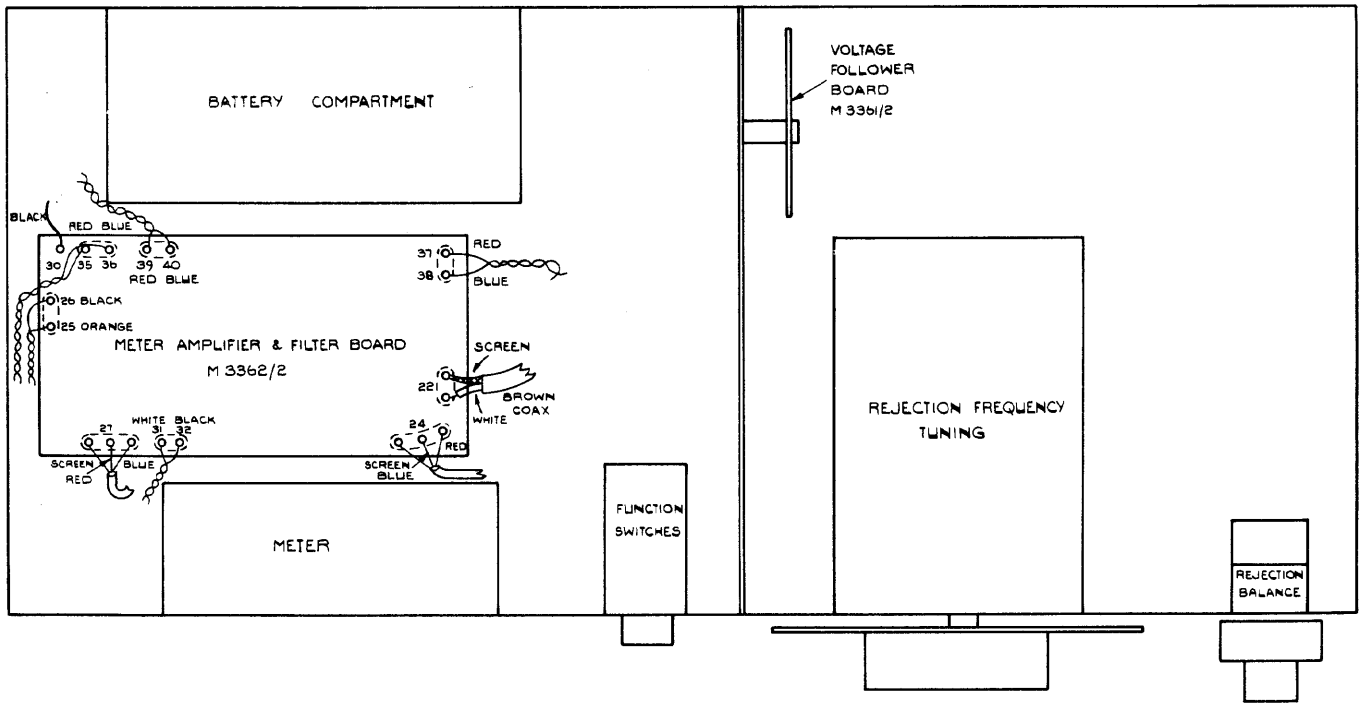
2.7 Rejection Frequency Tuning Control

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

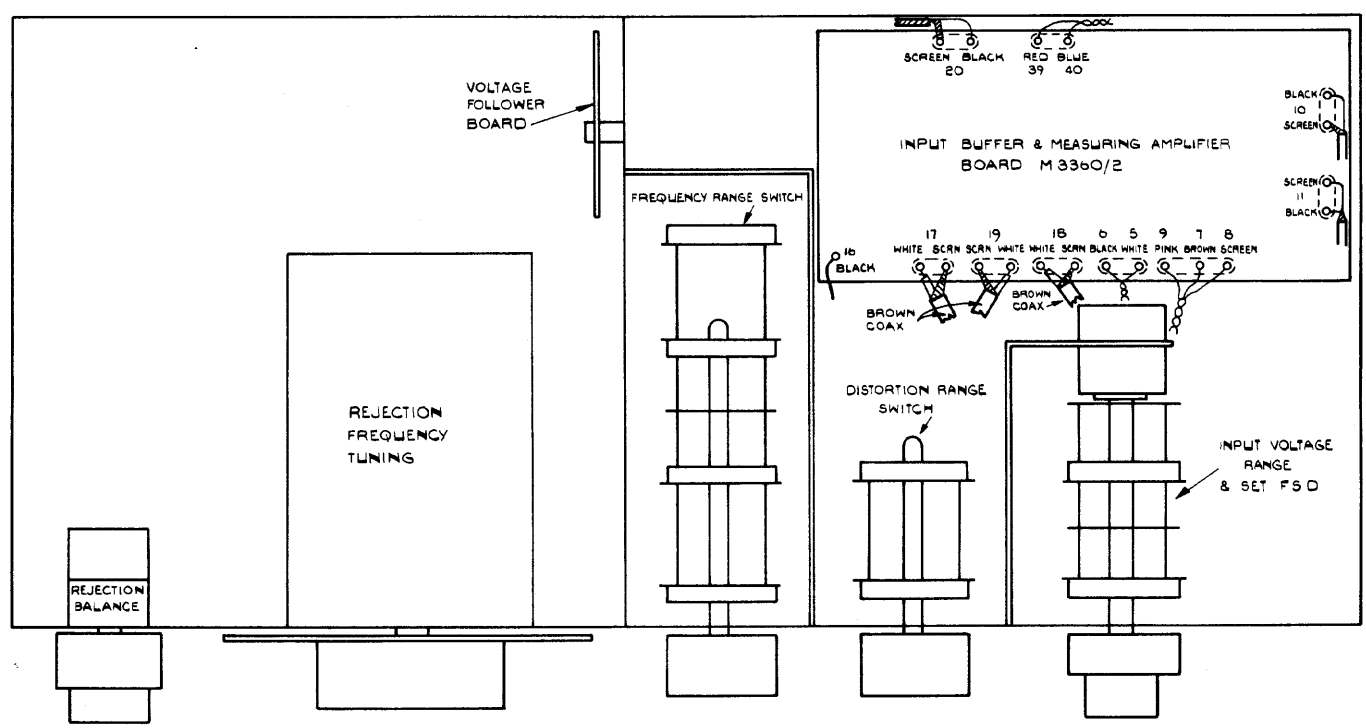
2.8 Rejection Frequency Balance Controls

The rejection frequency balance controls are to permit progressive rejection of the fundamental frequency. Three twin potentiometers are used and classified as coarse, medium and fine. The method of adjustment of these controls is described under the Section 3.2.

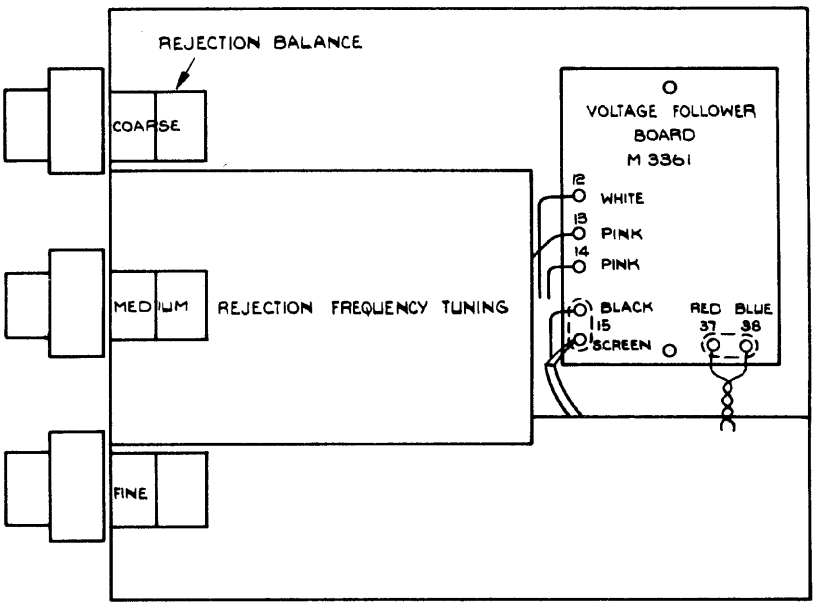
TOP VIEW



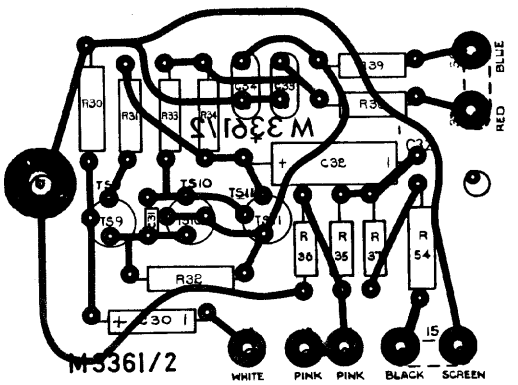
BOTTOM VIEW

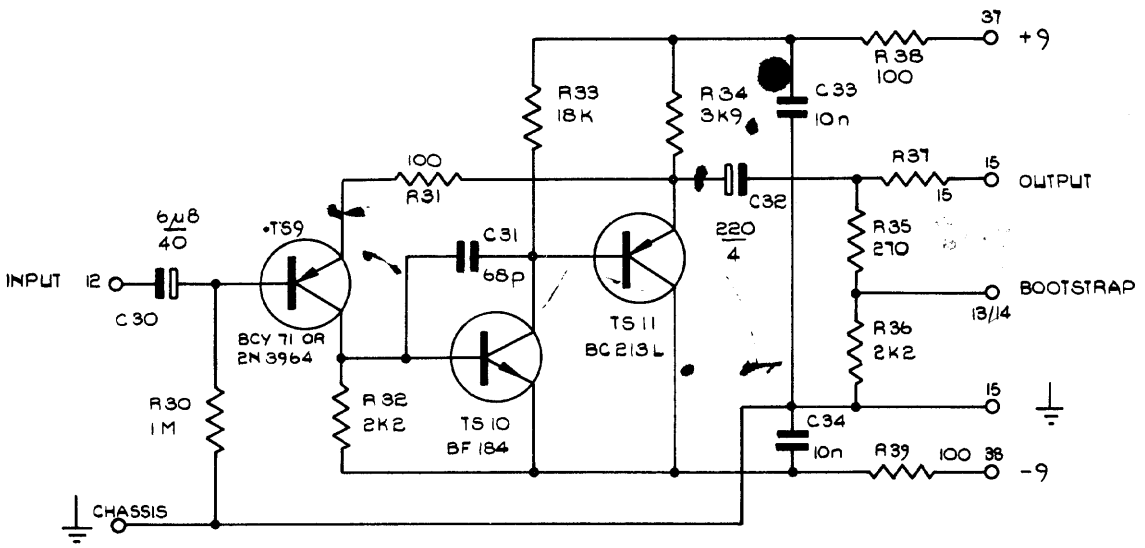


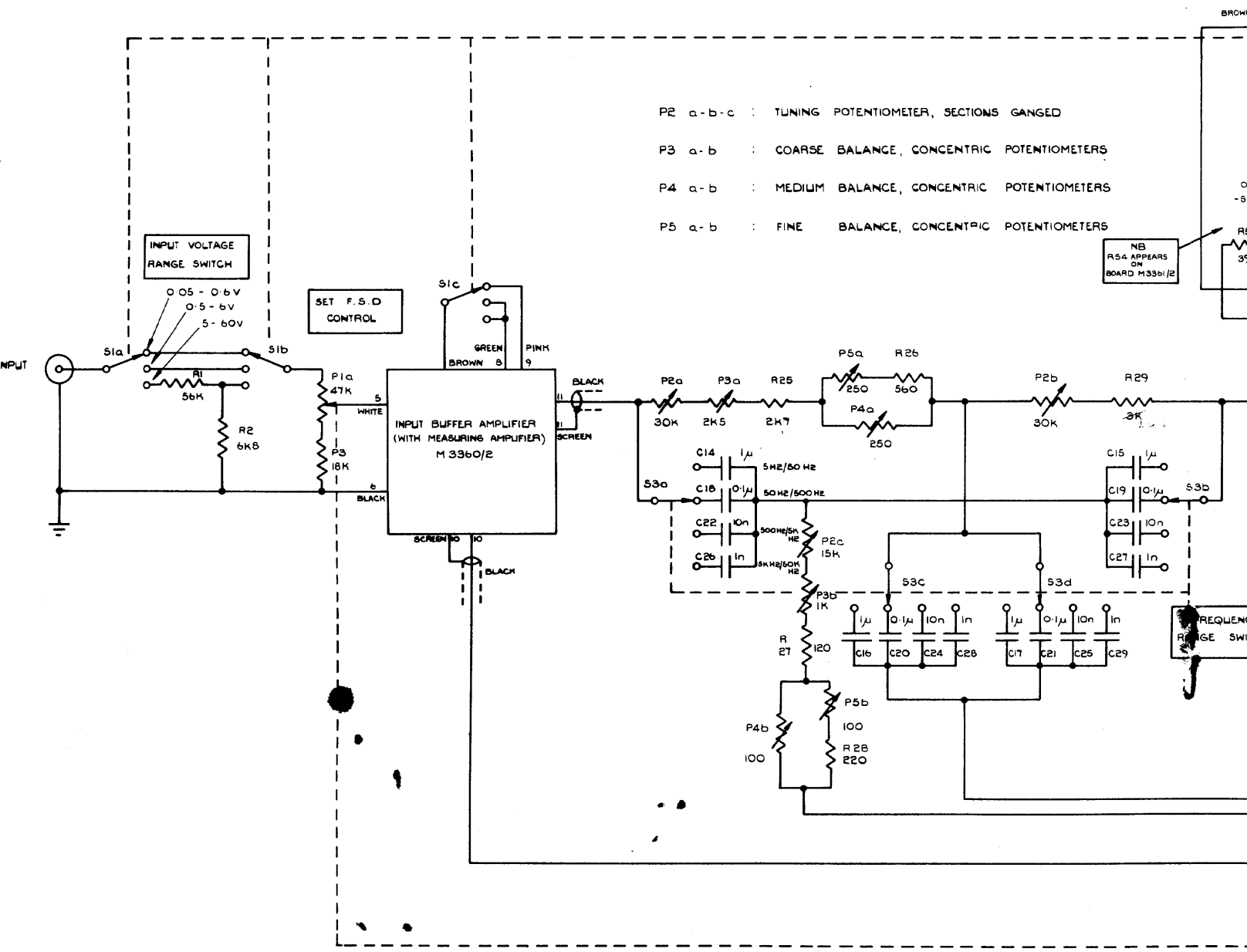
SIDE VIEW



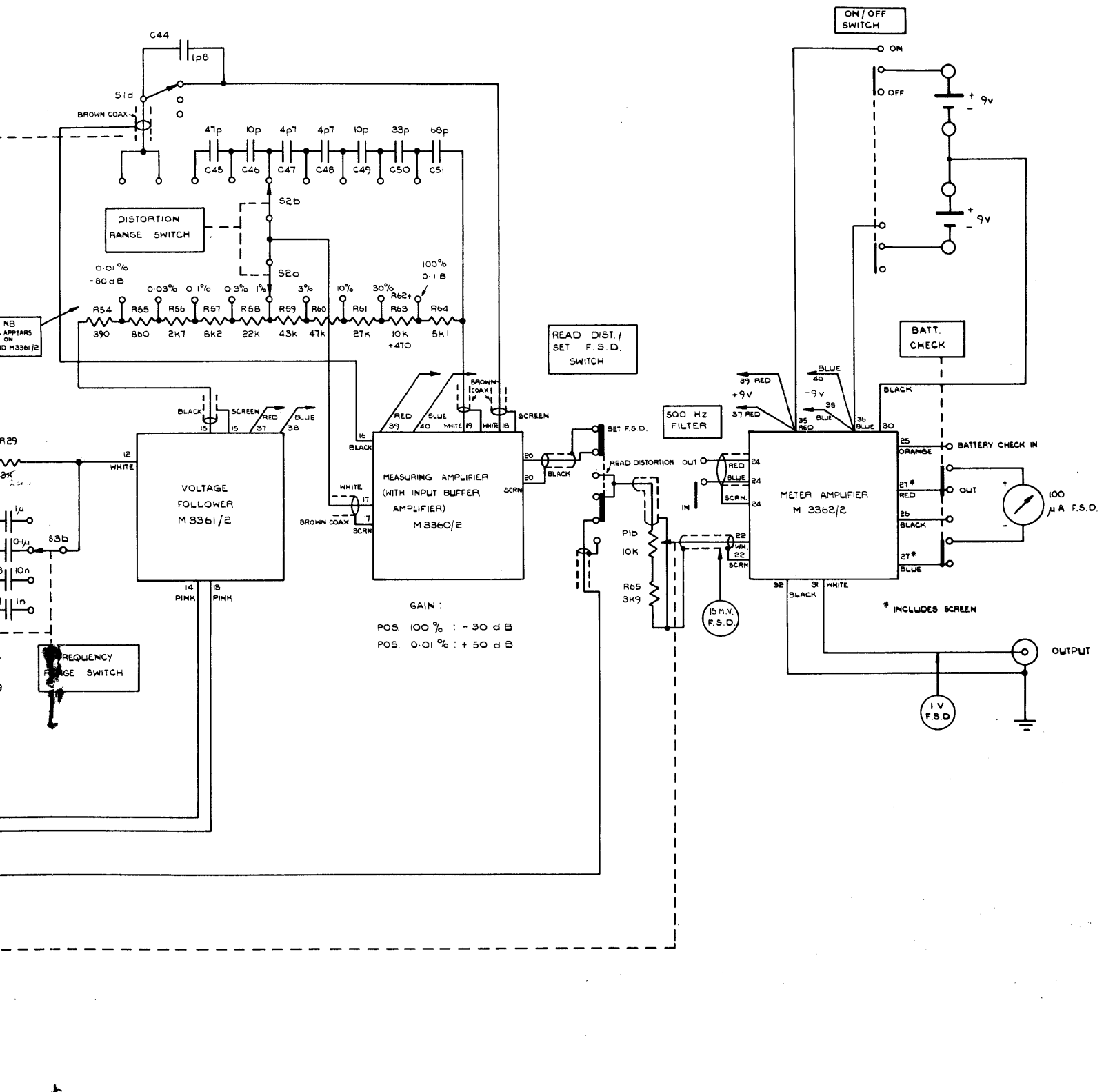
VOLTAGE FOLLOWER M3361



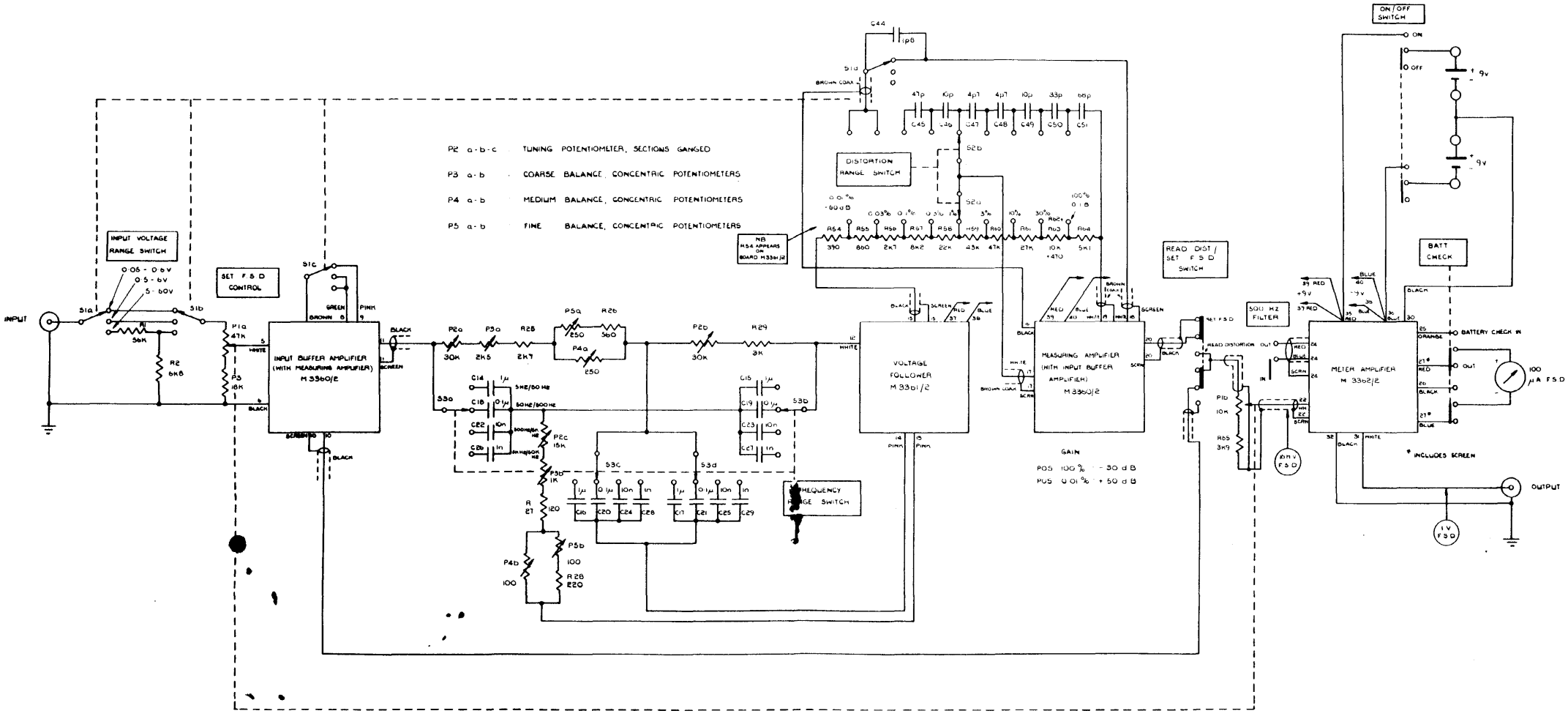



P2 a-b-c : TUNING POTENTIOMETER, SECTIONS GANGED
P3 a-b : COARSE BALANCE, CONCENTRIC POTENTIOMETERS
P4 a-b : MEDIUM BALANCE, CONCENTRIC POTENTIOMETERS
P5 a-b : FINE BALANCE, CONCENTRIC POTENTIOMETERS
INPUT VOLTAGE RANGE SWITCH
0·05 - 0·6V
0·5 - 6V
5 - 60V
S1a
S1b
S1c
SET F.S.D CONTROL
R1 56K
R2 6K8
P1a 47K
P3 18K
WHITE
BLACK
INPUT BUFFER AMPLIFIER (WITH MEASURING AMPLIFIER) M 3360/2
GREEN
BROWN
PINK
SCREEN
P2a 30K
P3a 2K5
R25 2K7
P5a 250
R26 560
P4a 250
P2b 30K
R29 3K
C14 1µ 5Hz/50 Hz
C18 0·1µ 50 Hz/500 Hz
C22 10n 500Hz/5K Hz
C26 1n 5K Hz/50K Hz
P2c 15K
S3a
S3b
S3c
S3d
C15 1µ
C19 0·1µ
C23 10n
C27 1n
P3b 1K
R 27 120
C16 1µ
C20 0·1µ
C24 10n
C28 1n
C17 1µ
C21 0·1µ
C25 10n
C29 1n
P5b 100
P4b 100
R28 220
NB R54 APPEARS ON BOARD M 3361/2

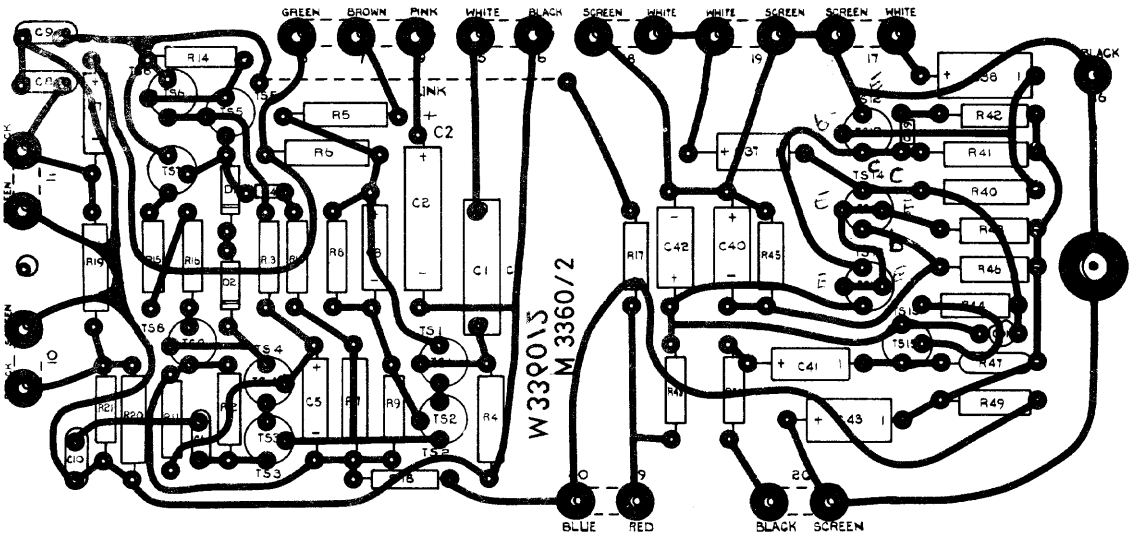
EMATIC DIAGRAM



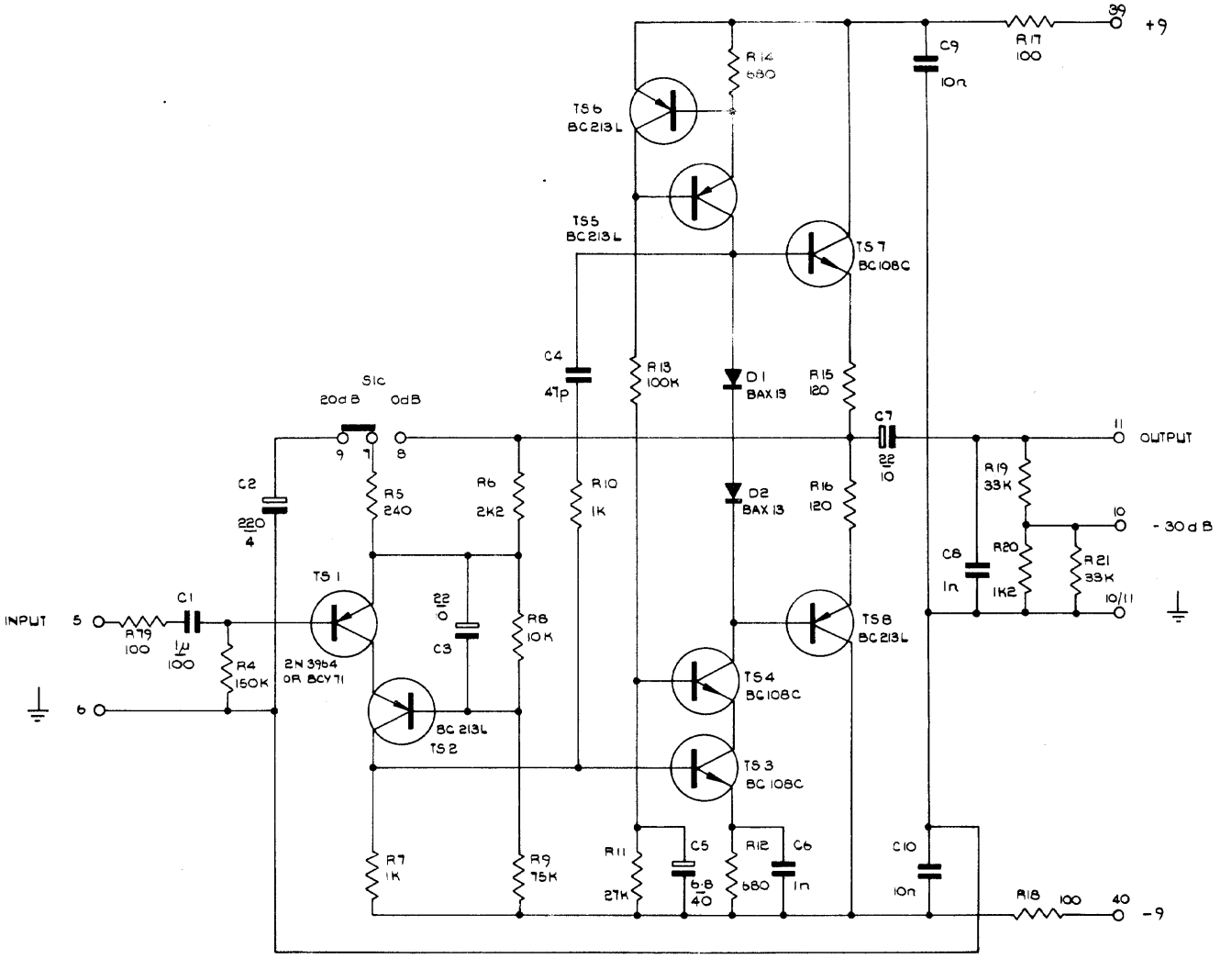
SCHEMATIC DIAGRAM



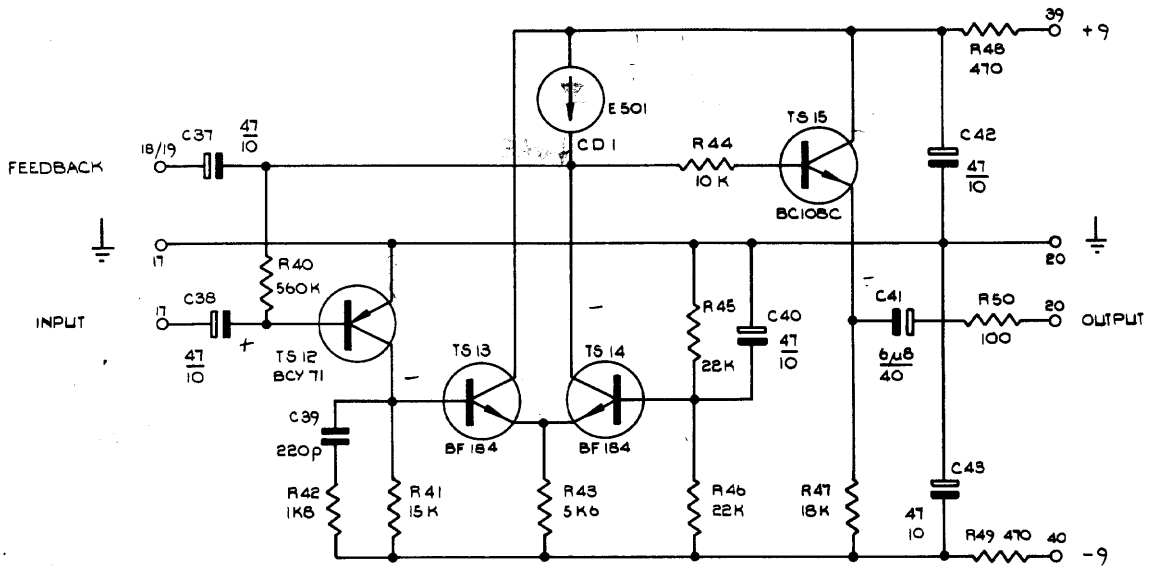
INPUT BUFFER AND MEASURING AMPLIFIER M3360



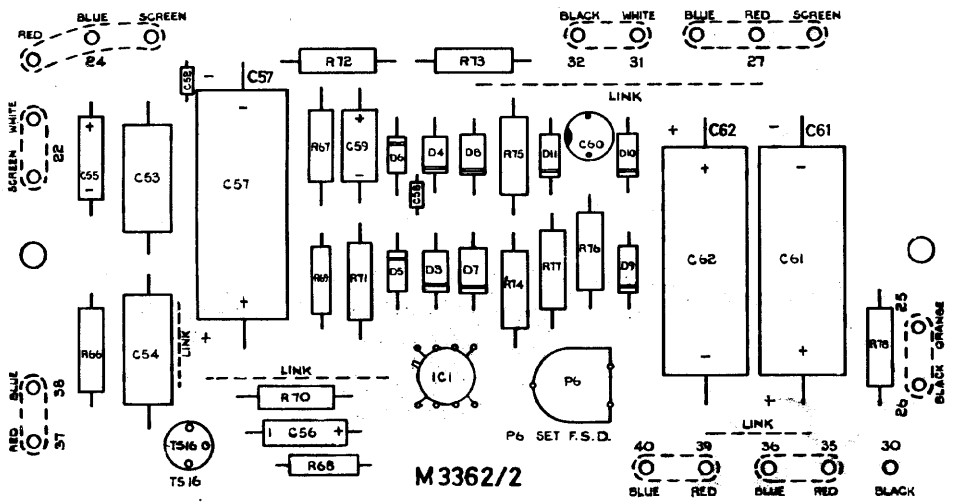
INPUT BUFFER AMPLIFIER

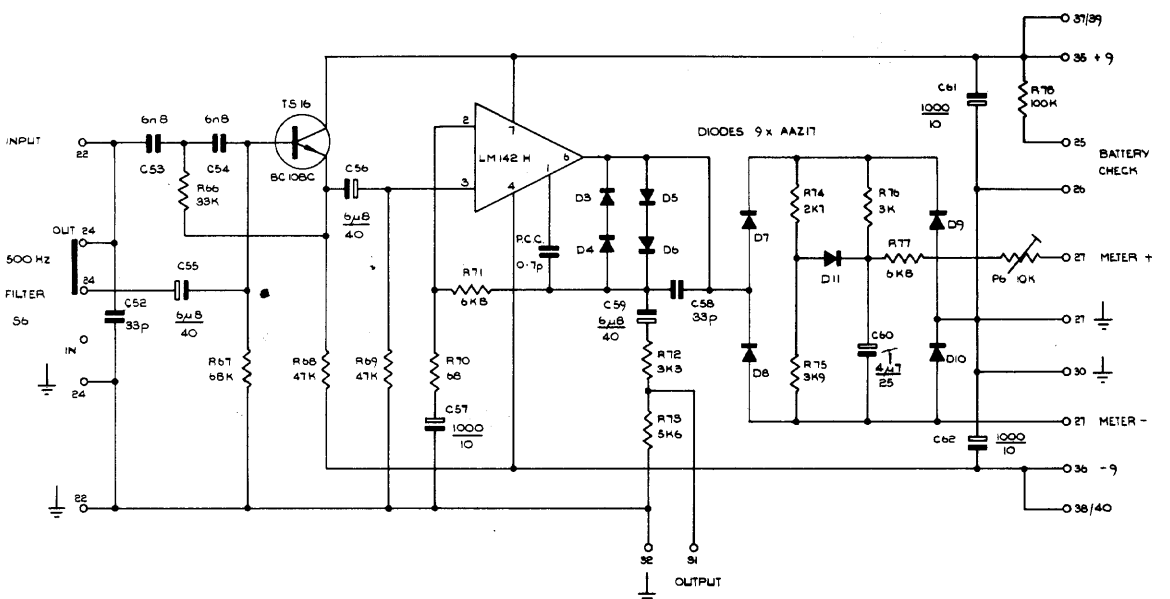


MEASURING AMPLIFIER

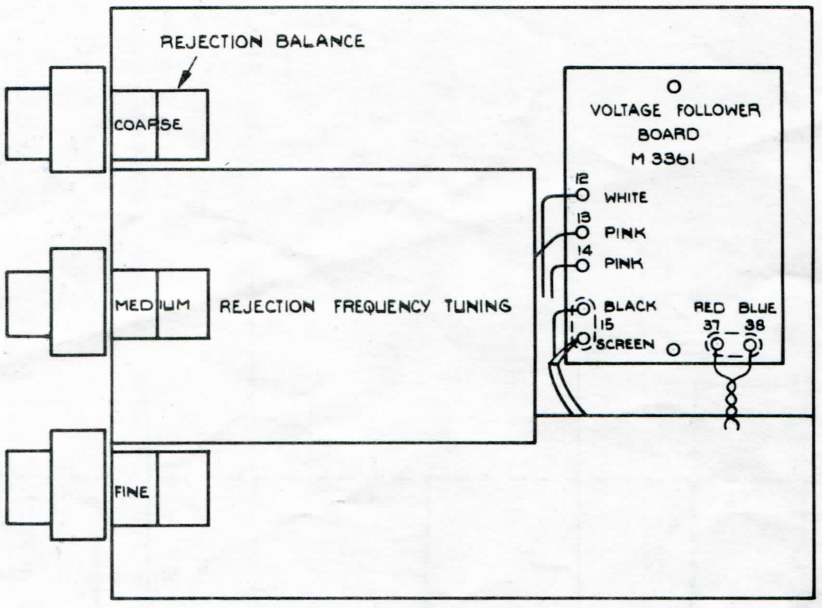


METER AMPLIFIER M3362

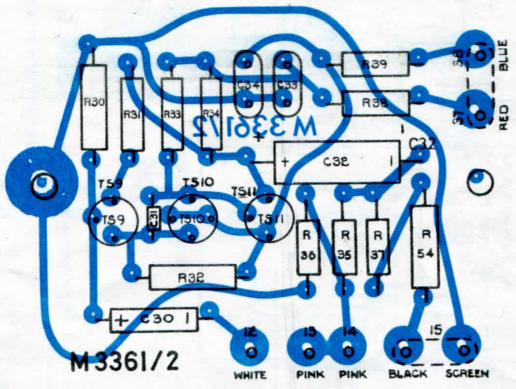


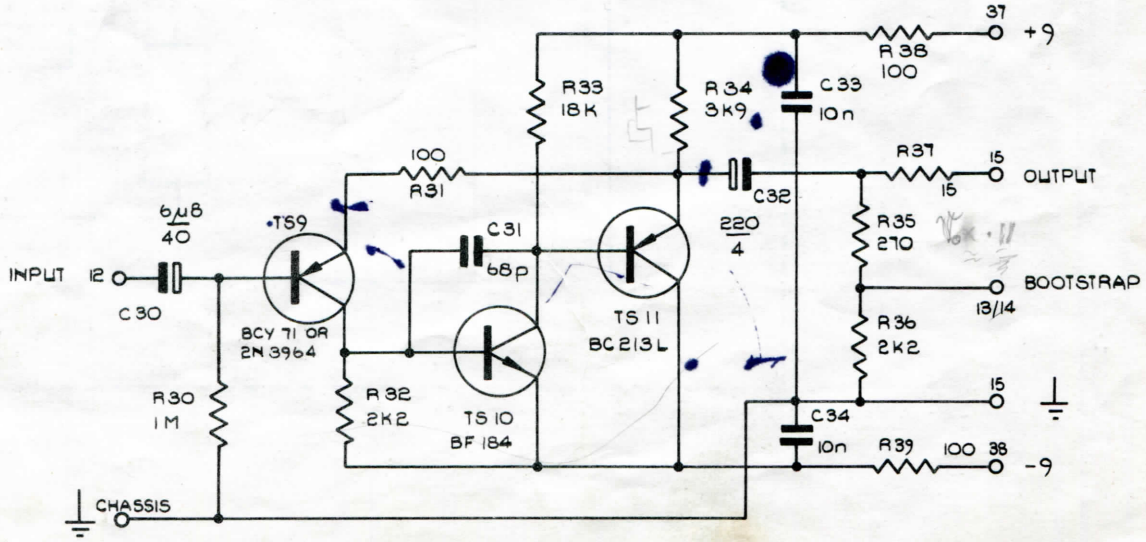


SIDE VIEW

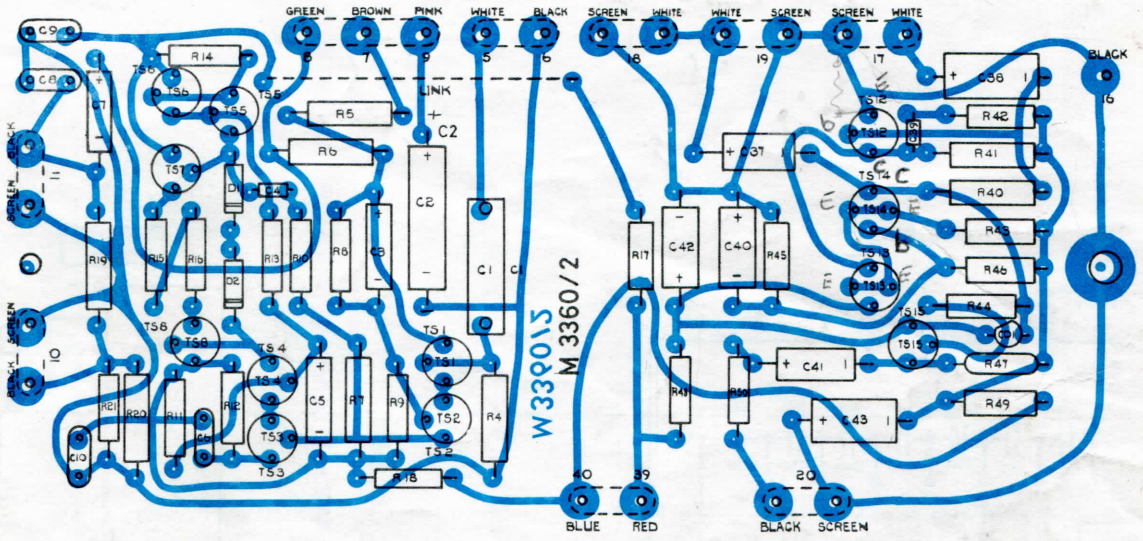


VOLTAGE FOLLOWER M3361

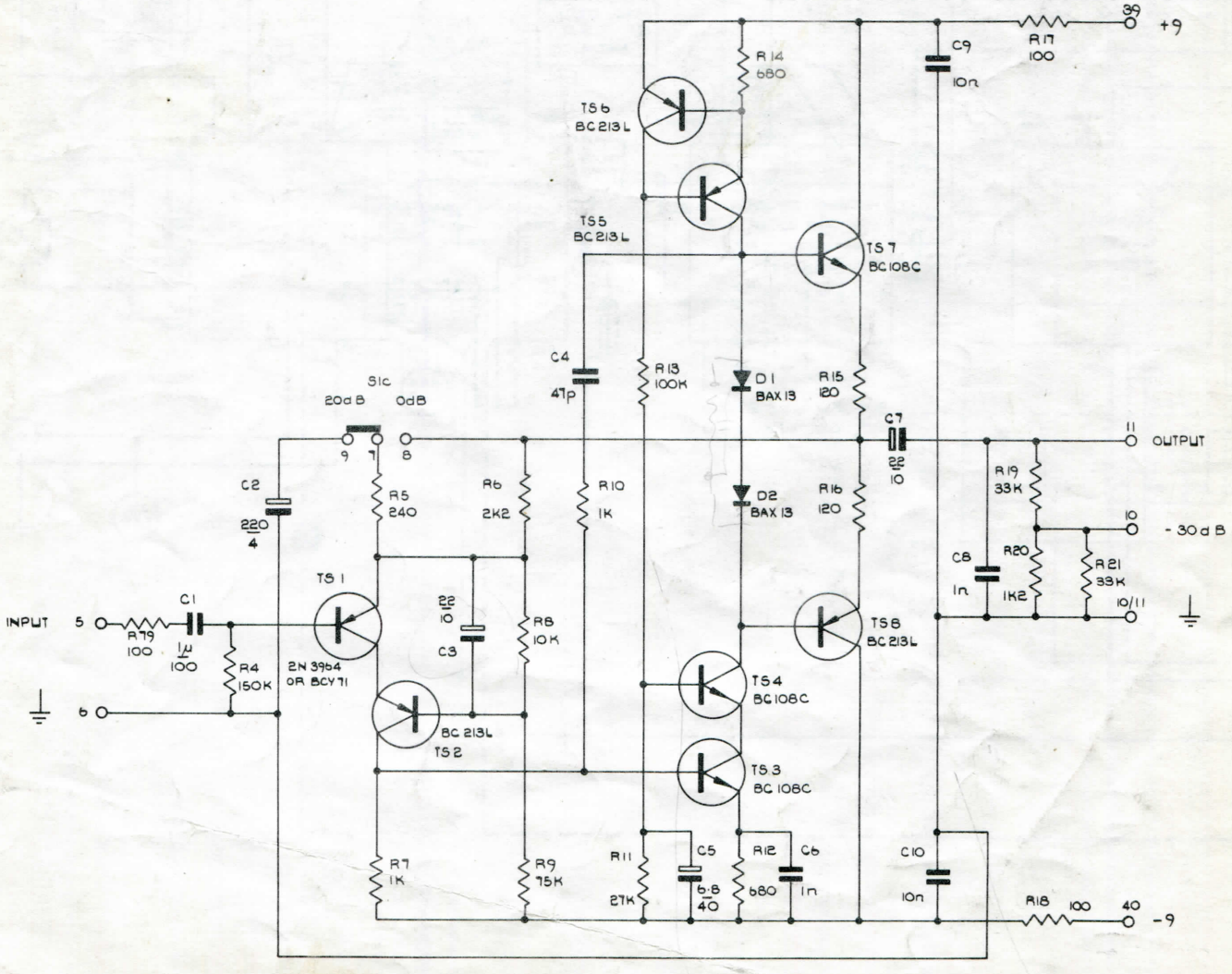




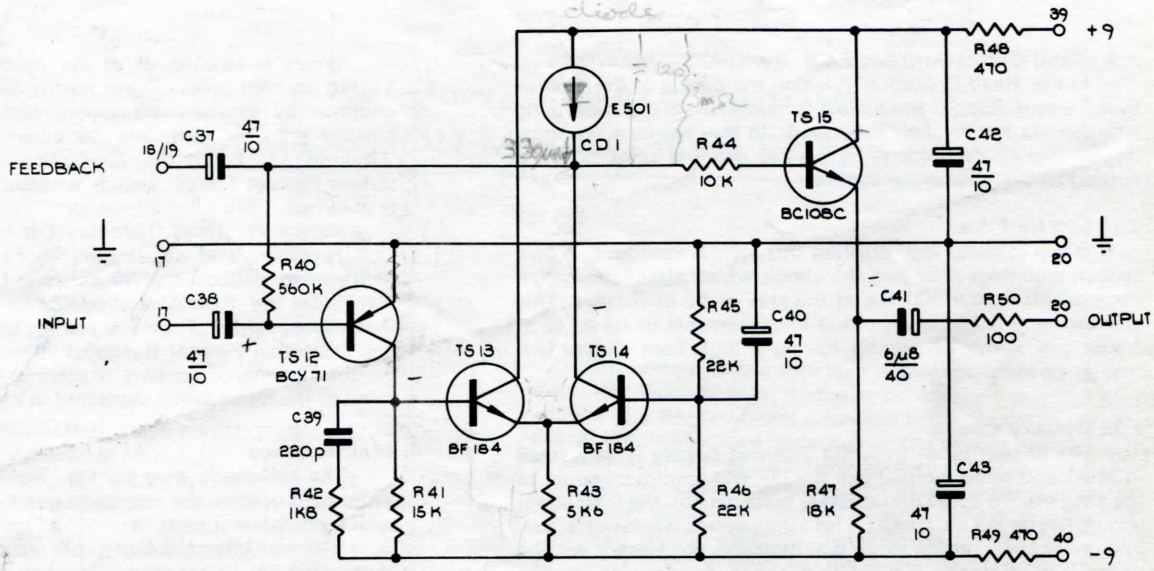
INPUT BUFFER AND MEASURING AMPLIFIER M3360



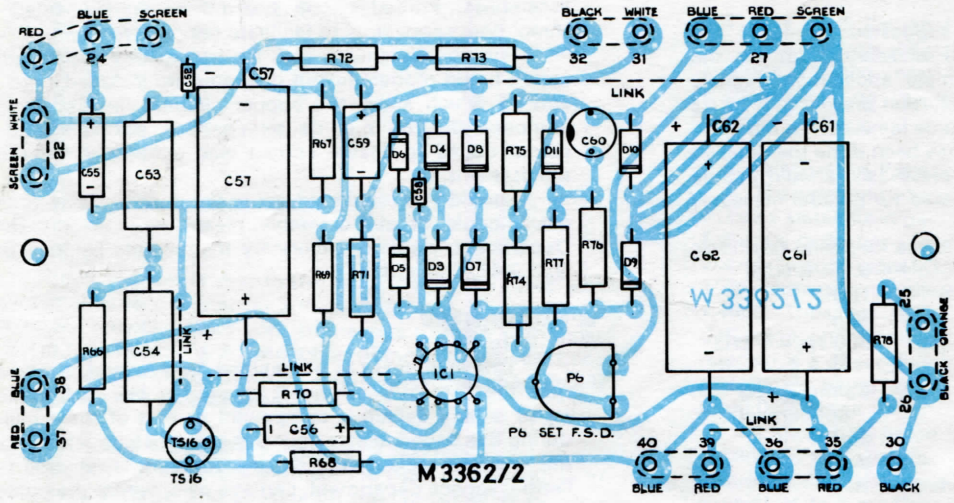
INPUT BUFFER AMPLIFIER

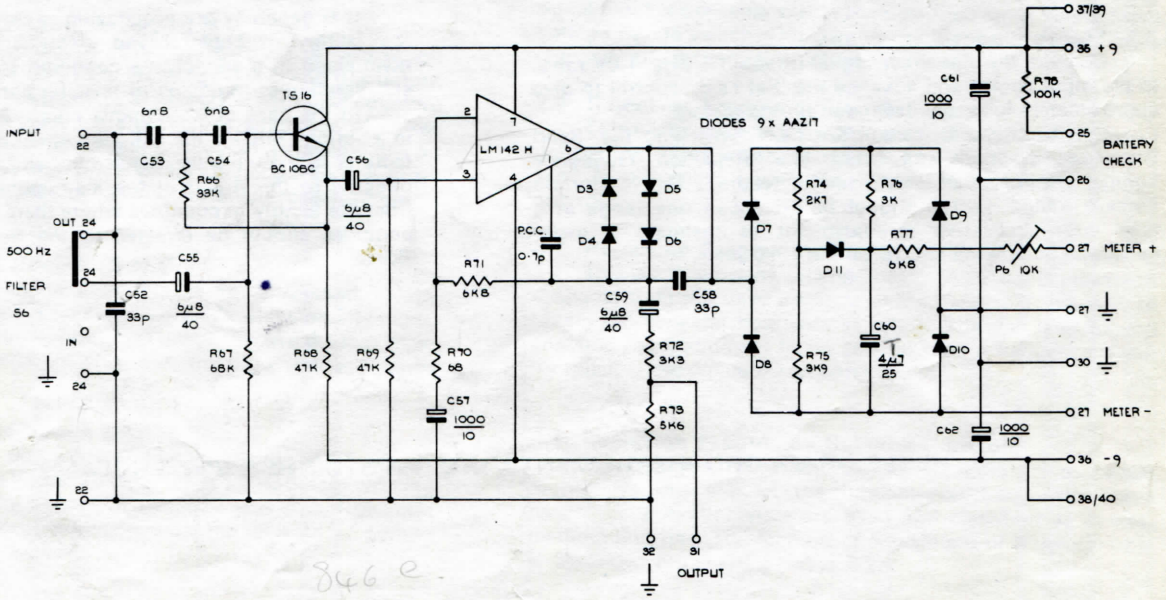


MEASURING AMPLIFIER



METER AMPLIFIER M3362





2.9 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. In the 'Set f.s.d.' position the parallel 'T' network is by-passed and the total signal is applied to the measuring circuit.

2.10 500 Hz Filter

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.

2.11 Battery Check

The current taken from the included battery is very small (13mA) 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. The green band on the meter dial indicates the battery voltage under load. Replace the batteries when voltage approaches the low end of the green band.

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	0.5 – 6 volts
Distortion Percent Range Switch	100%
Set f.s.d. Variable Control	Min.
Rejection Frequency Range Switch	500 Hz – 5 kHz
Rejection Frequency Balance Controls:	
Coarse	Centre (knob dot 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 the 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 concentric '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.

4. Maintenance

The schematic diagram Fig. 1 shows the wiring of the instrument outside the printed circuit board modules together with a component parts list.

It is not intended that p.c.b. modules in the Distortion Measuring Set be repaired by component replacement. They should be replaced by factory tested modules should a fault occur. Physical layout diagrams of the instrument, Figs. 2, 3 and 4, provide identification of modules and other components assemblies. Printed circuit board modules are fitted with 'Amp' type connectors to facilitate easy replacement.

For completeness, and for emergency repair, printed circuit board module layout diagrams are included (Figs. 5, 6 and 7) which show the copper circuitry in relation to the components. The module terminations are numbered and colour coded to ensure correct lead connection after board replacement.

Should you require advice or the supply of any component, module or sub-assembly please write to the Service Department, Radford Laboratory Instruments Limited, Bristol BS3 2HZ, England.

5. GUARANTEE

Home

This instrument is guaranteed for a period of one year from the date of purchase. It covers the free replacement or repair of any defective component or part of the equipment during this period. It also covers the cost of labour in executing the repair or replacement if the instrument is returned to the factory service department, carriage paid, within the guarantee period.

Overseas

It is generally not practicable to return the instrument to the factory in England and instruments will normally be maintained in a serviceable condition by the replacement of sub-assemblies, modules or specific component parts.

In the case of instruments purchased through an Agent in a country outside the U.K., the agent will act for the manufacturer in that country. Service enquiries should therefore be directed to the Agent. If the instrument is purchased direct from the factory in countries where there is no Radford Agent, enquiries should be directed to the Service Department in Bristol.