INSTRUCTION MANUAL

Taylor

Model 171A
ELECTRONIC TEST METER

IMPROVED TYPE

TAYLOR ELECTRICAL INSTRUMENTS LTD

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Instruction Manual

TAYLOR MODEL 171A

Electronic Test Meter

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1. GENERAL

1/1. DESCRIPTION

This is essentially a stable and sensitive Valve Voltmeter of very wide range, designed to meet the special requirements of the Radio and T.V. Engineer. It has the advantages of an extremely wide frequency coverage and very high input impedance, together with good accuracy and reliability. Rapid and simple operation is a feature of the instrument. The 171A is highly versatile, covering in addition to D.C. and A.C. voltage measurement, a wide range of resistance measurement. It can also be used as a direct reading wide range output meter, scaled direct in decibels. 30 useful ranges are available. The high input impedance allows much more accurate results than are possible with any other type of test meter when measuring in high impedance circuits, such as resistance coupled amplifiers, A.V.C. networks, etc. A centre zero facility is provided on the IV and 2.5V D.C. ranges to enable T.V. and F.M. discriminator alignment to be carried out. The 171A can measure up to 25 KV D.C. with an additional adaptor. The instrument is of quite exceptional utility, and forms a valuable acquisition in any workshop or laboratory.

Basically the 171A consists of a balanced double triode twin cathode follower bridge network, and a miniature shunt-connected double diode R.F./A.F. probe, both compensated against drift. The removable fully screened probe allows connection to be made very close up to the circuit under test, and has a frequency response of ± 2dB from 6 c/s up to about 200 Mc/s. The D.C. or rectified A.C. out-of-balance voltage appearing across the valve bridge network is proportional to the input voltage to the instrument, and is applied via the range multipliers to the robust microammeter with 5″ scale. The instrument is almost completely free from drift after a brief warming-up period. Accurate readings may be taken on the upper four voltage ranges only 20 secs. after switching on. A special heater balance compensation circuit ensures that zero and reading accuracy are virtually unaffected by mains voltage variations. All components are conservatively rated, and the meter movement is fully protected against any possibility of damage by overload.

A complete circuit diagram with component valves is given at the end of this Instruction Manual.

1/2. MAINS ADJUSTMENT

The instrument is designed to operate from mains of 105-125 volts or 200-250 volts, 40-100 cycles. The adjustment panel is fitted internally and is adjusted to 240V at the Factory.

Before the instrument is put into use, the Mains voltage and frequency must be ascertained, and, if necessary, the instrument should be removed from the case for adjustment. To change to another voltage, the bakelite screw should be screwed firmly into the socket most nearly corresponding with the actual voltage, i.e.:

for 105-125 volts use the 115V socket
for 200-229 volts use the 210V socket
for 230-250 volts use the 240V socket

The power consumption is approximately 25 watts.

For proper operation on the A.C. ranges with "Common" isolated from "Earth", it is essential that the instrument case be earthed, preferably through the third (green) core in the mains lead.

Mains Fuse Protection. Each instrument is fitted with a 250mA fuse connected in series with the transformer. This will disconnect the instrument from the supply almost immediately if for any reason an excessive overload is applied to the transformer. If the instrument has been properly connected to the Mains supply, but no reading can be obtained on the meter after switching on, the fuse should be checked to see if it has blown.

1/3. CONTROLS

(a) Function Switch: This is on the left-hand side of the front panel and selects the class of measurement desired; Resistance, D.C. voltage or A.C. voltage, the first position being "Mains off".

(b) Range Switch: This is on the right-hand side and selects the required full-scale reading of volts, and the multiplying factor on resistance ranges.

(c) Reverse Meter Switch: This is located at the centre; it is set to the left for +D.C. and ohms; to the right for −D.C., A.C. and decibels.

(d) Zero Adjustment: This is at bottom left of panel and adjusts the electrical zero of the circuit.

(e) Ohms Adjustment: This is at bottom right of panel and is used on resistance ranges to set full-scale deflection with the test leads shorted, to give the correct zero setting on the particular range in use.

1/4. SOCKETS

The sockets marked "Common" and "Earth" are normally linked together by the shorting plug.

Sockets marked "250V" and "Common" (or "Earth", if "Common" is strapped to "Earth") are used for D.C. and resistance measurements. If it is required to isolate the instrument from Earth, the shorting plug should be plugged into the two Earth sockets, leaving the "Common" socket free for the low-potential test lead.

WARNING : If the common and earth terminals are separated, care must be taken to ensure that any voltage applied between them does not exceed 500 volts D.C., and that the probe insulation has not been damaged by misuse.

Caution : If the measurements are being made on a T.V. or Radio chassis of the Universal A.C./D.C. type, where the chassis is connected to one side of the Mains supply, it is essential to ensure that the chassis is connected to the **Neutral** supply line. The connection between the chassis and the Test Meter must be plugged into the socket marked "Common", and the shorting link on the front panel plugged between the sockets marked "Earth — Earth". **It must be borne in mind that the chassis under test is isolated from Earth, and accidental contact with the operator may result in serious shock.** This is, of course, inherent in the design of A.C./D.C. receivers, and applies whenever measurements are being made on them, with any type of test equipment.

The Centre red socket is used for the 25KV D.C. probe, and is internally connected directly to the 1000V D.C. socket.

1/5. RANGES

The following 30 ranges are available :—

D.C. Volts	A.C. Volts (R.M.S.)	A.C. Volts (Peak)	Resistance	Decibels
1.0	1	1.4	1.0-100-10K	—
2.5	2.5	3.5	10-1000-100K	−15 to +3
10	10	14	100-10K-1M	−13 to +15
25	½ 25	35	1K-100-10M	−5 to +23
100	100	140	10K-11M-100M	+7 to +35
250	250	350	100K-10M-1000M	+15 to +43
1000				

also 25KV (by means of external adaptor Model 471).

Resistance ranges are listed giving the lowest useful, mid-scale, and highest useful measurements respectively.

1/6. SCALES

The top scale is used for D.C. Volts 1, 10, 100 and 1000; A.C. Volts 10, 100. The second scale gives the corresponding A.C. peak values.

The third scale is used for D.C. Volts 2.5, 25, 250 and 25KV. A.C. Volts 25 and 250. The fourth scale gives the corresponding A.C. peak values.

The fifth scale is used for A.C. 2.5 Volts only. The sixth scale gives the corresponding A/C peak values. The seventh scale is used for A.C. 0-1 Volt only and the eighth scale gives the corresponding A.C. peak values.

The ninth scale is calibrated OHMS.

The tenth scale is calibrated in DECIBELS.

The − + Centre Zero Mark is used for F.M. discriminator alignmet purposes.

1/7. ACCURACY

The instrument's accuracy is as follows :—

D.C. ranges ± 2% of full scale; except 25KV ± 10%.
A.C. ranges ± 3% of full scale on 50 c/s sinusoidal waveform.
Resistance ranges ± 7% of indication at mid-scale.
Decibels ± 0.3 dB between O dB and +43 dB, from 15 c/s to about 70 Mc/s.

1/8. FREQUENCY RESPONSE

± 2 dB from 6 c/s to approx. 200 Mc/s with probe withdrawn (using A.F. socket below 20 Kc/s, and R.F. socket above). (50 ohms source). ± 2 dB from 6 c/s to approx. 10 Mc/s with probe inside instrument (1,000 ohms source). (3% down at 2 Mc/s).

± 2 dB from 6 c/s to approx. 1 Mc/s with probe inside instrument (10,000 ohms source). (3% down at 200 Kc/s). −0.1 dB at 20 c/s; −0.5 dB at 12 c/s.

Below 50 c/s the response falls off very slightly owing to the increasing impedance of the probe A.F. socket blocking condenser. In the V.H.F. region there is a broad peak due to diode resonance. Above this peak the response falls off considerably.

1/9. INPUT IMPEDANCE :

On 1-250V D.C. ranges	25 Megohms.
On D.C. 1000V range	100 Megohms.
On D.C. 25KV range	2500 Megohms.

On A.C. volt ranges: 5 Megs. at 50 c/s shunted by about 18 pF (A.C. socket).

On A.C. volt ranges :

5 Megohms at 50 c/s shunted by about 10pF (A.F. & R.F. sockets).
4 Megohms at 10 Kc/s shunted by about 10pF (A.F. & R.F. sockets).
3 Megohms at 100 Kc/s shunted by about 10pF (A.F. & R.F. sockets).
1 Megohms at 1 Mc/s shunted by about 10pF (A.F. & R.F. sockets).
0.1 Megohms at 10 Mc/s shunted by about 10pF (A.F. & R.F. sockets).

Where still higher input impedance is required, these input resistance and capacitance figures can be considerably improved at frequencies over 20 Kc/s by using an external 5pF or 10pF capacitor in series with the R.F. socket. This entails a corresponding loss of sensitivity, due to the capacity potential divider effect. The correction factor is largely independent of frequency above 20 Kc/s, and may easily be determined by measuring a low impedance source voltage, both directly and through the external capacitor.

1/10. ZERO STABILITY :

This is of a high order for an inexpensive instrument. A drop of mains voltage from 240 to 220V results in a maximum change in zero on the most sensitive 1V range of less than 2½% of full scale deflection, and proportionately less on higher ranges. Zero adjustment is smooth, and the zero position is not affected by the setting of the Range Switch.

OPERATION

/1. ZERO ADJUSTMENT

Before switching on, check the meter mechanical zero and adjust it if necessary by means of the bakelite screw in the meter moulding. Then, after a suitable warm-up period (30 secs o 1 minute when using the upper 5 ranges, and 2 or 3 minutes when using the 1V range) set he electrical zero by the Adjust zero control with the instrument switched to the 1 volt D.C. ange. The adjustment will hold closely on all other ranges. Alternatively, to check the etting of the meter zero adjusting screw, disconnect any test leads, switch to 250V. D.C. or A.C., nd adjust as necessary. When the greatest possible accuracy is desired, the electrical zero hould be adjusted with the range and function switches set as required, preferably checking efore and after the reading is taken. On the 1 and 2.5V A.C. ranges, short circuit the probe while setting zero to avoid possibility of errors due to pickup from stray fields. On the D.C. anges the zero may be set with leads disconnected and input open-circuited, except as specified n PRECAUTIONS FOR MAXIMUM ACCURACY on page 11, ref. No. 2/9. If it is found hat the Adjust Zero control does not bring the points to zero, the coarse zero pre-set control hould be reset (see Section 3/8 on page 14) .

/2. RESISTANCE MEASUREMENTS

Switch to "Ohms", and check the setting of the Adjust Zero Control. Then short the est Leads together, and check that the pointer gives full-scale deflection. If necessary, adjust he deflection by means of the "Adjust Ohms" control. It will be found that this instrument vill hold on all Ohms ranges except perhaps on the lowest range, where slight re-adjustment nay be required.

Now connect the Test Leads to the unknown resistor. If this forms part of a circuit see hat its Mains or battery supply is switched off, as any voltage on the unknown resistor will ender ohmmeter readings meaningless.

Set the range switch to the position where the deflection is most nearly mid-scale, then ead resistance on the Ohms scale and multiply by the multiplier for that range. Below 0 ohms and over 10 megohms the readings are necessarily near one end of the scale and care nust be taken to avoid excessive error, since the ohms reading accuracy is highest at mid-scale nd least towards the scale extremes.

The voltage applied by the instrument to the unknown resistor is not over 1½ volts, and it nay be useful to remember that the polarity of the 250V/ohms terminal is negative with espect to Common.

In order to avoid running down the dry cell unnecessarily, the ohmmeter should not be eft connected to a resistor under 5,000 ohms indefinitely, nor to resistors under 100 ohms for onger than is necessary. This precaution applies particularly when setting full scale deflection n the X10 ohms range.

/3. D.C. VOLTAGE MEASUREMENTS

Switch to "V.D.C." and select the range giving the highest useful pointer deflection. Then et zero (as above) and take reading. The polarity of the voltage can readily be determined; if he lead connected to the 250V D.C. socket is positive, the meter will read normally; if its olarity is opposite to the above, the pointer will move to the left of zero and can be corrected y switching over the Reverse Meter Switch from + D.C. to A.C.

In the interests of safety, when dealing with voltages over 100, connect the lead to the arthy side first, then that to the live side.

When ripple is superimposed on the D.C. voltage, the value indicated is the mean value, ot the peak.

2/4. A.C. VOLTAGE MEASUREMENTS

Switch the Function Switch to V.A.C. and the Reverse Meter Switch to A.C. Select a suitable voltage range, and check meter zero. Connect the leads from the voltage under test as follows.

(a) For frequencies from 6 c/s up to about 200 Kc/s to 20 Mc/s (depending on the source impedance as specified in Section 1/8 above), the A.C. probe may either be left plugged into the compartment on the front panel, standard test leads being taken to the "Common" or "Earth" socket and to the A.C. socket, or it may be withdrawn from its housing should this be more convenient. If withdrawn, the probe socket marked "A.F." should be used for measurements below 20 Kc/s. The unmarked socket of the probe is connected to "Common" internally, and is used for the low-potential return lead.

(b) For higher frequencies than about 200 Kc/s, especially in circuits of greater impedance than 10,000 ohms, the probe must be removed from its compartment, and its "R.F." and Common (unmarked) sockets connected by short leads to the voltage under test. In this way accurate measurements can be taken up to about 200 Mc/s. The probe may be used at frequencies up to approximately 400 Mc/s for comparative purposes with reduced accuracy due to resonance effects.

Not more than 250V R.M.S. should be applied to the probe or A.C. socket. The maximum safe D.C. voltage with 20V A.C. superimposed is 600 volts.

The meter deflection is proportional to the **positive peak value** of the alternating voltage, and the scale is calibrated in R.M.S. values for sine wave form and in Peak values. Some error in both R.M.S. and Peak indications will therefore arise in reading voltages with distorted wave forms. Where the distortion is not readily visible on an oscilloscope, this error should not exceed 5%. In general, the percentage error will be rather less than the total harmonic distortion percentage, and except for definitely non-sinusoidal wavforms may be neglected.

With unsymmetrical voltages there may be "turnover error", and the average should be taken of the readings before and after reversing the probe connections. For this test, the Common/Earth link must be removed .

2/5. T.V. PULSE VOLTAGE MEASUREMENTS

Positive-going peak voltages with respect to earth, as encountered in T.V. circuits, may be measured directly, using the probe with the Peak reading scales and multiplying the reading by :

1.02 for frame sync. pulses (with source impedances up to 50K)
1.1 for line sync. pulses (with source impedances up to 50K)
1.0 for video signals (with source impedances up to 10K)

Negative-going peak voltages must be converted to equal positive-going pulses before measurement.

2/6. DECIBEL MEASUREMENTS

These are carried out in the same way as for A.C. voltage measurements above. Rapid output, gain, level and frequency response measurements can be carried out from 6 c/s to 200 Mc/s. Comparative measurements may be made at up to about 400 Mc/s. The decibel ranges are based on a reference level of 1.732 volts.

When this voltage is impressed on an external 500 ohm load, the power dissipated is 6 milliwatts. This is defined as 0 dB and the is direct reading on the 2.5 volt A.C. range. On other ranges the corrections are :—

10 volt range	add 12 dB
25 volt range	add 20 dB
100 volt range	add 32 dB
250 volt range	add 40 dB

If it is desired to use a reference level of 1 milliwatt in 600 ohms, 7 dB should be added to the reading on any range. The accuracy of the decibel scale drops off at levels below 1V R.M.S. due to the diode bottom bend. If it is desired to measure at low levels, voltages should be measured, and converted to dB by means of tables. Relative dB measurements may of course be taken at any power level or across any impedance desired, provided that the voltage does not drop below about 1V R.M.S. If lower levels are required the R.M.S. voltages should be measured, and converted to dB by means of tables.

2/7. SUPERIMPOSED VOLTAGES:

When the instrument is set to measure D.C. voltage, the reading (mean value) will be unaffected by the presence of a large amount of ripple or superimposed A.C. voltage, even with A.C. of the same magnitude as the D.C. For example, it will accurately measure the mean D.C. voltage on a reservoir condenser, or on the anode of a driven output stage. Ripple elimination is effected by a two-stage R - C low pass input filter with an attenuation of 48 dB at 50 c/s 1000V R.M.S. 50 c/s A.C. superimposed on a D.C. voltage under measurement produces an error of only approximately 1/4 volt. (Errors for other 50 c/s A.C. voltages are proportional, i.e. 2.5 mV D.C. per volt R.M.S. at 50 c/s, or 0.5 mV D.C. per volt R.M.S. at 100 c/s.)

When measuring standing D.C. voltages with superimposed R.F. (e.g. on the grid pin of an oscillator valve), the test lead should be applied through a 1 megohm 1/4 W. series resistor, to avoid the introduction of stray capacitance. The reading will then be about 4% low.

When the instrument is set to measure A.C. voltage, the presence of a comparatively high D.C. voltage will not affect the reading, except for an initial kick when the condenser in the probe charges to the D.C. voltage. This kick can do no harm to the measurement: the pointer will return to the correct reading after a short interval.

When measuring A.C. volts with superimposed D.C. present, care should be taken that the peak voltage ratings of the probe blocking condensers are not exceeded. This is of the order of 600 volts, so that it is not wise to exceed a superimposed D.C. or 500 volts.

When maximum accuracy is required on the 1V and 2.5V D.C. ranges, it will be necessary to zero the instrument in such a way that the small effect of grid current is allowed for. It will be noticed that short-circuiting the input produces a negative deflection of from 0 to 0.03 volts on the 1V range (proportionately less on higher ranges), dependent on the particular 12AU7 valve employed. This is due to the change in the effective value of grid leak when connecting the circuit under test. To avoid small errors due to this cause, proceed as follows :—

When measuring circuits with a resistance of 7 Megohms or less, before taking the reading, zero the meter with the input **short-circuited** (neglecting the slight change of zero on removal of the short). When measuring circuits of resistance greater than 50 Megohms, zero as usual with **open circuited** input. If the circuit resistance is between 7 and 50 Megohms, zero with the input sockets directly connected by a resistance of the same value (within say ± 25%). Care must be taken in high impedance circuits to avoid picking up hum voltages exceeding 50V R.M.S. in the test leads. If long leads are necessary, screened cable must be used, or the leads should be shunted by a 0.1uF condenser of good insulation.

If two superimposed A.C. voltages of different frequencies are applied to the instrument, it will tend to read their sum unless the frequency of one is below 20 c/s when the reading will be slightly less. When measuring modulated R.F. voltages, the reading will correspond to the peak of the modulation envelope.

2/8. OVERLOAD PROTECTION

The sensitive meter movement cannot be damaged by overload on any range, due to the overload rectifiers across the meter and the limiting effect of the valve circuit. The overload rectifiers affect scale linearity by less than ½% at and near to full scale.

It is, of course, not possible to cause an appreciable overload on the ohms range, unless external A.C. or D.C. voltages are applied in error due to incorrect switching when the meter is still fully protected by the rectifiers.

2/9. EARTHING OF CASE

WARNING : In the use of this instrument, if the Common and Earth terminals are separated, care must be taken to ensure that the voltage applied between them does not exceed 500 volts D.C., and that the probe insulation has not been damaged by misuse.
The instrument case must be earthed, preferably through the third (green) core in the mains lead.

2/10. PRECAUTIONS FOR MAXIMUM ACCURACY

Where very accurate measurements are required, care should be taken to see that the meter mechanical zero is correctly set. This can be checked while the instrument is working by first ensuring that no external voltage is being applied, then turning to the 250 volt A.C. or D.C. range, and adjusting the meter zero adjusting screw until the meter pointer exactly corresponds with the zero scale mark.

Additional improvement in accuracy may be obtained by calibrating and using the instrument horizontally, so improving scale linearity by eliminating balance errors in the meter movement; also by allowing from 15 mins. to 1 hour for warming up.

APPLICATIONS

3/1. GENERAL

One great difference between the Electronic Test Meter and an ordinary universal Test Meter is its very high input impedance. Thus ordinary test meters have D.C. sensitivities from 1,000 ohms per volt up to 20,000 ohms per volt, whereas the Electronic Test Meter on the 1 volt D.C. range has a sensitivity of no less than 25 megohms per volt, and on the 2.5 volt range has a sensitivity of 10 megohms per volt. The benefit of this is that the negligible meter loading hardly affects the voltage being measured, even in a high impedance circuit. Thus a much higher accuracy of measurement is obtained as the operating conditions of the circuit under test are practically undisturbed.

On A.C. it will be noticed that the probe is extremely sensitive to "pickup" due to the very high impedance, and with an inch or two of wire can be used as a small aerial to investigate A.C. fields. On the 1 volt A.C. range, full-scale deflection is obtained with an absorption of only 0.2 microwatts from the external circuit. Also, unlike an ordinary test meter, the Electronic Test Meter is sensitive to radio frequency voltages up to the U.H.F. region.

3/2. A.V.C. VOLTAGE

Because of its high input impedance the instrument can measure A.V.C. voltages at any point in a receiver. This facility, which is not afforded by ordinary test meters, is particularly useful in fault location, as a leaky bypass condenser, a leaky grid coupling condenser, faulty insulation, or an open-circuit resistor can quickly be identified.

3/3. SIGNAL TRACING

The probe may be used to measure signal voltages, R.F. or A.F., in any stage of a receiver, except the first one or two stages where the level is very low. This renders easy the measurement of stage gain, the plotting of selectivity curves stage-by-stage if desired, and many other useful measurements including the tracing of intermittency. The small capacitance of the probe should, however, be borne in mind as this will de-tune R.F. circuits slightly. This effect may be nullified by temporarily re-peaking the trimmer while the probe is held in position. Afterwards the trimmer should, of course, be restored to its correct setting.

Also the hum or signal voltage on H.T. positive, or other points such as cathode and screen grids, can usefully be measured directly by the probe. This enables bypass condensers to be checked for effectiveness very rapidly.

3/4. OSCILLATOR VOLTAGE

Frequency changer valves have optimum oscillator voltages which are usually specified by the makers. With the Electronic Test Meter it is a simple matter to measure the oscillator voltage using the probe. Readings on all wavebands will, of course, be equally accurate. Also the constancy of the voltage over each band can be checked and weak spots, due to absorption easily traced.

If the oscillator is modulated either intentionally or unintentionally, e.g. by hum, the meter will read the peak value of the modulation envelope, hot the amplitude of the R.F. voltage alone.

3/5. POWER OUTPUT

A resistor of suitable power rating and equal in value to the specified load impedance should be connected to the output of the receiver or amplifier in place of the loudspeaker. After connecting the probe across this resistor, the equipment under test is supplied with a suitable steady sinusoidal signal voltage. The power output is then V/R watts, where R is the load resistance in ohms and V is the A.C. voltage indicated on the meter.

3/6. D.C. & A.C. CURRENT MEASUREMENTS

D.C. and A.C. current can be measured by connecting a resistor of convenient value to give, say, a voltage drop of 1 volt (or 2.5 volts) in series with the load, and measuring the voltage across it. The current will then be V/R amperes, where R is the value of the resistor used. The resistor should be connected in the earthy or neutral side of the A.C. circuit, and should, of course, be a non-inductive type. The instrument can be made direct-reading by selecting a resistance with a suitable value.

3/7. INSULATION MEASUREMENTS

The exceptional range of resistance measurements afforded by the Electronic Test Meter enables many insulation tests to be carried out with ease, up to a maximum value of 1000 megohms. When measuring condenser insulation a short period must be allowed for the condenser to charge, after which the steady minimum deflection indicates the leakage resistance.

3/8. OFFSET ZERO FOR F.M. DISTRIMINATOR ALIGNMENT

A coarse zero preset control (VR9), accessible through a small hole in the top of the case, is provided. This is normally set so that, with zero volts applied to the instrument, and with the Adjust Zero Control central, the meter reads zero on the 1V range. It may, however, be adjusted to bring the meter pointer to the central −|+ mark under the bottom scale for convenience in discriminator alignment. Sufficient range of control is provided for central setting on both the 1 and 2.5V D.C. ranges.

MAINTENANCE

4/1. BATTERY REPLACEMENT

When the "Ohms" adjustment can no longer be carried out on the X10 ohms range, the battery should be replaced. Unscrew the small cover plate, withdraw the old cell and replace with a new one of the correct type (British Ever-Ready, Type U11; U.S.A. Ever-Ready, Type 935; Burgess, Type 1; or equivalent). It is important that the paper tube be removed from the new cell, which should be inserted cap first.

4/2. VALVE REPLACEMENT

This is unlikely to be necessary for a very long time due to the low emission conditions under which the valves operate. Before leaving the Works every instrument is given a thorough soak test to ensure that it is in a thoroughly reliable condition. This also serves to "age" the valves and other components and results in a more reliable and consistent performance. It is strongly recommended that any valve replacements which may become necessary are thoroughly aged before use, either by running them continuously for at least 24 hours in the instrument, or by operating them under full load conditions for at least 12 hours before fitting to the instrument.

The diode in the probe is type 6AL5, and may need replacement if the zero adjustment is normal on D.C. volts but alters beyond the range of the V.R.2 preset control on switching to A.C. volts. The diode may also need replacement if no readings can be obtained on A.C. volts.

The double triode inside the instrument is type 12AU7, and may need replacement if it becomes impossible to set up the instrument correctly, or to adjust zero on all ranges.

Failure of the 6X4 rectifier will usually be self-evident and easily traced. Failure of the mains fuse will normally be due to failure of the 6X4, or of the reservoir condenser, a fault in the mains transformer, or to repeatedly switching the instrument on and off at very frequent intervals.

After the fault has been cleared, the fuse should be replaced with a standard 250 mA type, which is suitable for mains voltages from 250 to 105V.

4/3. CALIBRATION

Due to valve manufacturers' tolerances it is advisable to check calibration after fitting of replacement valves to ensure that the standard of accuracy is maintained. The valves should first be well aged as described above. Before calibration, the instrument should be allowed to warm up for an hour with the cover removed in a warm room (70° F. approx.).

6X4. After change of the 6X4 valve the voltage on the H.T.+ and H.T.− rails should be checked at + 215V and − 160V respectively. The H.T.+ voltage must not be less than 21/V or over 230V; if so, R26 should be increased by some 3000 ohms. Low H.T.+ voltage may cause the meter to limit for inputs greater than about + 240V.

6AL5. Change of the 6AL5 in the R.F. probe may necessitate adjustment of VR.2, which serves to balance the standing current in the two diode sections. VR.2 will be found on the amplifier chassis at the bottom of the instrument. When the meter zero has been set on the 1V D.C. range by operation of the Adjust Zero and Coarse Zero Controls, the Function switch and Reverse Meter switch should be set to "A.C." and VR.2 adjusted so that no change of zero occurs on switching over from D.C. to A.C. (resetting the D.C. zero by the Adjust Zero knob if required after each adjustment of VR.2).

Accuracy on the 1V A.C. range should now be checked. First zero as above; then apply 1V R.M.S., 50 c/s, of good sine waveform to the A.C. socket on the front panel with the probe inserted into its housing. If adjustment is required, the meter should be set to the 1V full scale mark by alteration of VR.3, the upper left-hand pre-set potentiometer inside the instrument, located over the Function Switch.

It is desirable that the applied A.C. test volts should be monitored by a sub-standard meter having an accuracy within ± 0.5% and this adjustment will then automatically bring all the A.C. volts ranges within the specified tolerances.

12AU7. If it becomes necessary to change the 12AU7 amplifier valve, a check should be made on the volts across C4 to ensure these are still within 210-230 volts. The calibration should then be checked on both A.C. and D.C.

First check the setting of VR.8 (the heater balance pre-set pot., located at the top of the amplifier chassis) to make the meter zero independent of slow mains voltage changes. This may be done as follows.

Connect a resistance in series with the Neutral mains lead to the instrument (roughly 200 ohms, 1.5W for 240V mains, 180 ohms, 1.5W for 210V, and 50 ohms 1.5W for 115V mains), and wire a short-circuiting switch across it, carefully observing the usual safety precautions. Remove the instrument from its case, allow 3-5 mins. warm up, and zero on the 1V D.C. range. Then open the switch, wait half a minute for the pointer to settle, and observe the amount and direction of the pointer movement due to the drop in mains voltage. Rotate VR.8 by about 45 degrees, reset zero, and repeat, until a setting is found where the pointer movement is negligible. A high degree of zero stability is attainable by this means. See section 1/10.

A check should now be made to ensure that the valve does not have excessive grid current, by noting the shift of zero on shorting the input on the 1V D.C. range. This shift should not exceed about 3% of full scale.

Next apply 25, 100 or 250V R.M.S. (Accurately metered) of good waveform at about 50 c/s to the appropriate A.C. range, and adjust VR7 (the third pot. on the amplifier chassis, counting downwards) to give full scale deflection. Then switch to 1V A.C., allow the pointer to return to a steady zero (this may take up to 1 minute after the application of 250V, due to thermionic effects), reset the zero and check the 1V A.C. range as above (setting full scale deflection if necessary by adjustment of VR.3).

The D.C. ranges should be checked similarly against a sub-standard D.C. voltmeter. First check the 25, 100 or 250V range, adjusting VR5 (the second pot. counting downwards) if necessary to give full scale deflection. Then zero and check the 1V D.C. range, adjusting VR6 accordingly (the upper right hand preset pot. inside the instrument, located over the Range Switch).

MODEL 471, 25KV PROBE ADAPTOR FOR HIGH VOLTAGES

This adaptor is specially designed for use in conjunction with the "Taylor" Model 171A Electronic Test Meter for measurements of E.H.T. voltages up to 25KV, such as are used in modern T.V. sets. The total current drawn from the circuit under test is only 10 microamps at 25KV or 4 microamps at 10KV, so that supplies with poor regulation such as "Flyback" E.H.T. systems can be measured without introducing any appreciable error due to the Test Meter.

Special resistors, carbon deposited on glass rod, recently developed for high voltage measurement work, are used in the probe. These have an extremely good voltage coefficient, and are rated for working at 30KV.

Corona and tracking effects, and leakage across the resistors, have been practically eliminated by careful design and the use of materials with very high insulating properties for the probe body construction. A liberal coating of silicone grease over the whole surface of the resistors protects the unit against the effects of moisture and further reduces any tendency to corona and tracking, so that the adaptor may be handled with safety and confidence in use. The outer surface of the probe body is also silicone treated, and an insulating hand-guard prevents the operator from approaching too near to the high potential point when taking readings.

The usual precautions necessary when handling very high potentials must be observed, and particular care should be taken that the probe lead is properly and firmly connected to the Test Meter, that the Test Meter is bonded to the low potential supply under test, and that the case of the instrument is earthed.

CAUTION: If the measurements are being made on a T.V. or Radio chassis of the Universal A.C./D.C. type, where the chassis is connected to one side of the Mains supply, it is essential to ensure that the chassis is connected to the **neutral** supply line. The connection between the chassis and the Test Meter must be plugged into the socket marked "Common", and the shorting link on the front panel plugged between the sockets marked "Earth-Earth". **It must be borne in mind that the chassis under test is isolated from Earth, and accidental contact with the operator may result in serious shock.** This is, of course, inherent in the design of A.C./D.C. receivers, and applies whenever measurements are being made on them, with any type of test equipment.

IMPORTANT

Read before using

MODEL 471 HIGH VOLTAGE ADAPTOR INSTRUCTIONS FOR USE

The Adaptor is suitable only for D.C. voltages not exceeding 25 Kilovolts.

To measure high voltages with negative pole earthed.

1. Switch meter to 250V D.C. range, and set Reverse Meter switch to D.C.
2. Connect the "Common" socket on the Model 171A meter to the earthed negative high voltage supply terminal.
3. Plug the red plug on the high voltage probe lead into the red socket marked "25 K.V. Probe" on the front panel.
4. Then grasp the high voltage probe by the cable end **behind the guard,** and apply the metal

To measure high voltages with positive pole earthed.

1. Switch meter to 250V D.C. range, and set Reverse Meter switch to "A.C.".
2. Connect the socket marked "Common" to the earthed positive supply terminal.
3. Plug the red plug on the high voltage probe lead into the red socket marked "25 K.V. Probe" on the Model 171A meter.
4. Then grasp the high voltage probe by the cable end **behind the guard** and apply the metal spike to the High Voltage positive test point.

Great care must be taken to avoid bringing any part of the hand or body within **four inches** of any High Voltage point.

Care must be taken that no more than 500 volts D.C. is applied between the 171A "Common" and "Earth" sockets. When used in accordance with the above instructions, the voltage difference will be negligible.

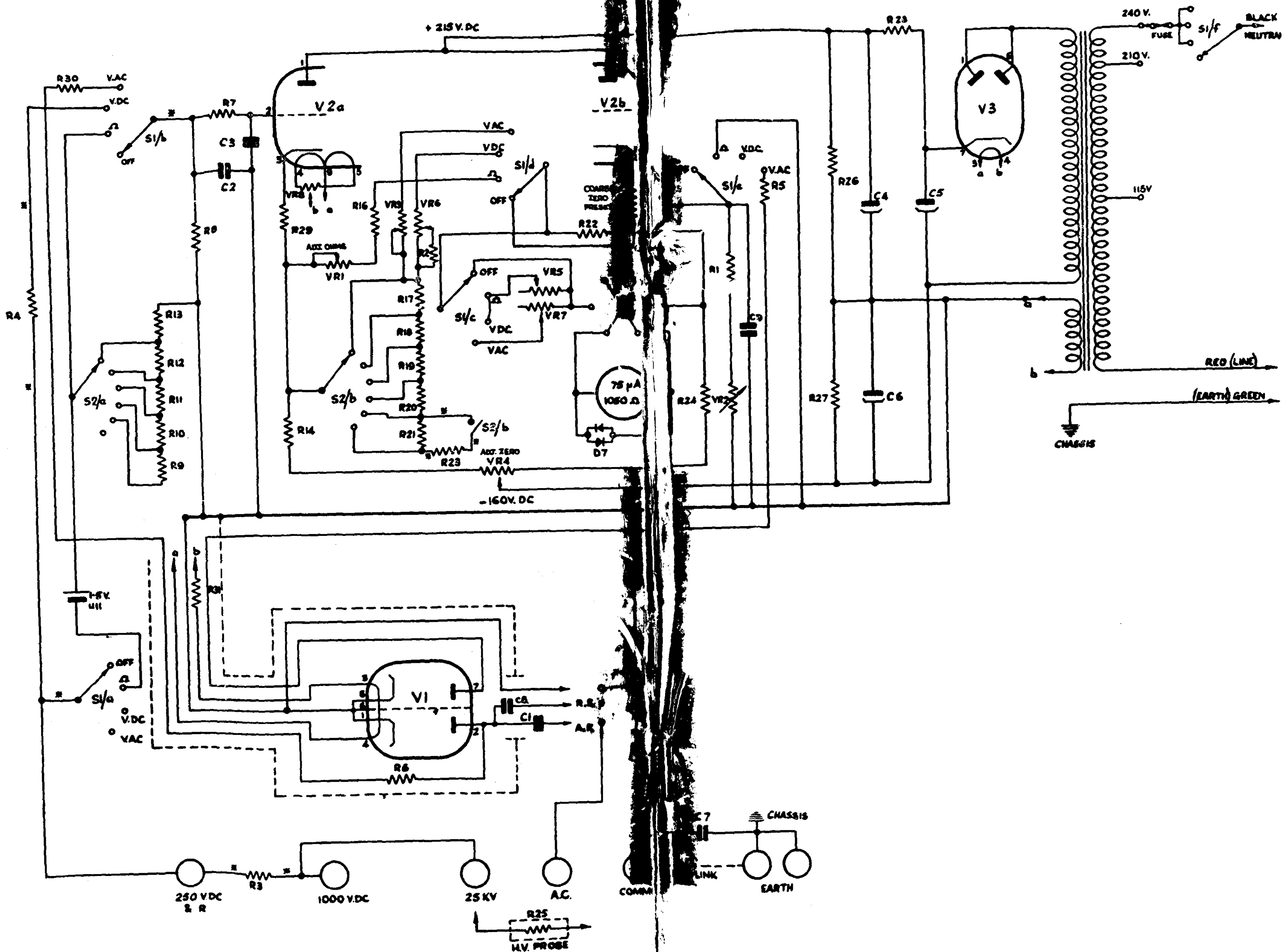
Service Guarantee

We hereby guarantee each new instrument manufactured by us to be free from defective materials and workmanship and agree to rectify any such defects free of charge for a period of six months from date of registered purchase. This guarantee is subject to the following conditions:—

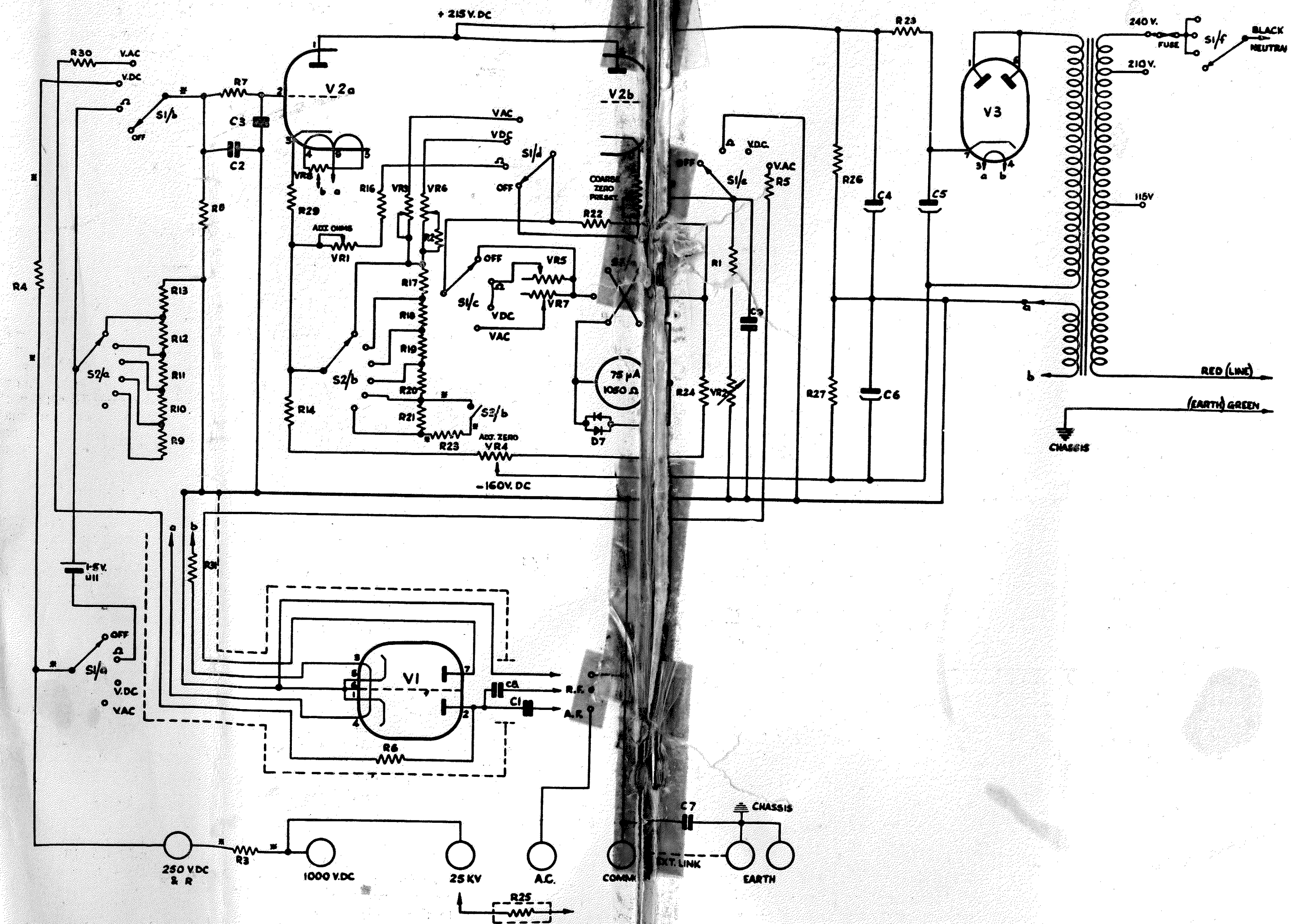
1. That the instrument has had, at all times, normal use and has not been tampered with.
2. That the registration card has been correctly completed and returned to us within seven days of purchase.
3. That in cases of complaint the instrument is returned to us with seals intact, securely packed and carriage paid.
4. That any faulty parts of our manufacture are returned to us for inspection if required.
5. That any Valves, Rectifiers or other components of proprietary make are definitely excluded and are covered by the respective manufacturers' guarantee.
6. In the event of repairs being carried out by the purchaser, the Company cannot be held liable for any expenses incurred.
7. Under no circumstances can the Company be held responsible for indirect damage caused by any defect. Our liability in all cases is limited to making good any defective part.
8. In the event of any dispute arising as to the interpretation of this guarantee, the decision of the Company must be accepted as final.

TAYLOR ELECTRICAL INSTRUMENTS LIMITED

419/424 MONTROSE AVENUE · SLOUGH · BUCKS · ENGLAND



NOTE LEADS MARKED ✻ ARE NOT TO BE INCLUDED IN MAIN CABLE FORM.



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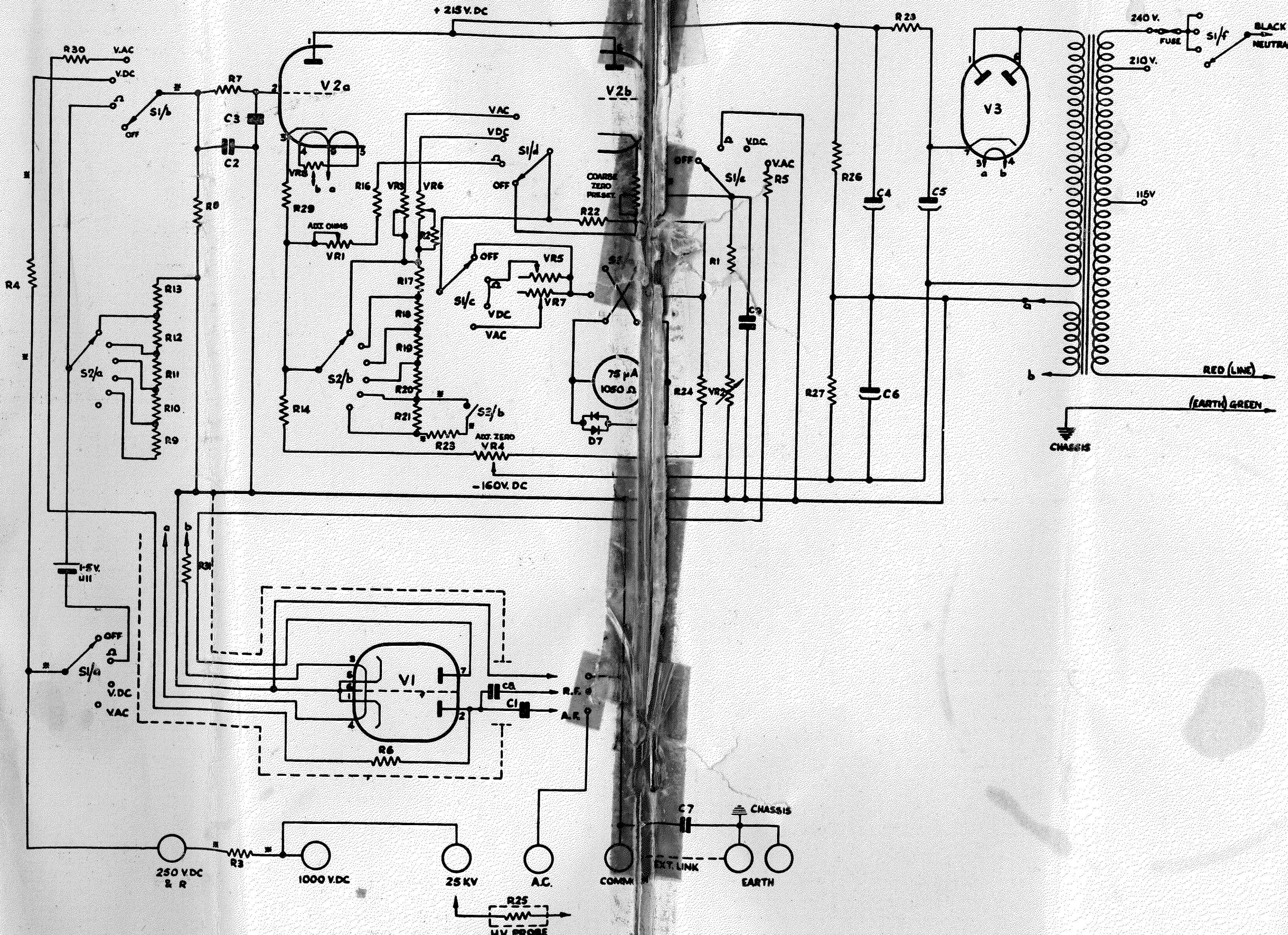

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