S.N. 12583. Condition: pretty good – unmodified. eBay June 2012.
Article in 1957 December Wireless World.
0 to 1kVdc test voltage. Delay on meter connection for capacitor charging when measuring.

T1		KB883; resonant autotransformer; 0, 44.7%, 67%, 100% turns.
T2		KB881; 4.66:1 turns ratio
T3		KB1017: 0-245V, 0-1050V.
T4		KB1016: 0-250V, 230-0-230V, 6.3V at least 2A.
Caps		Dubilier Nitrogel B255 VG , 0.5uF 1250VDC ;
		Static 4uF 800V SD 4 C
		Static 2uF 400V SB 2 C
		DALY 8uF 500V J7 4/15 WE
		ERO
Pots		Colvern WW XG
		Bercostat L75
Resistors		Welwyn AW3111 WH
Relay		AK8207 198 H44/4
		?
Diode		Senter K3/45 A66
		BYY34 zener K28
Valves	V2	EZ80 Mullard kC5 ±6E3 (kC=EZ80, 5=change symbol; Chartres, 1966, May)
	V3	12AU7 USA 23C 56-43 ; relay RL1 driver
	V4,5	EF37A (x2) Mullard EP2 B6C2 red coated
		(EP=EF37A, 2=change code; B=Blackburn, 1966, March)
Meter M1		100uA FSD Res: 86.6ΩS.N. 8219/A/6

Other functional uses:

1. High voltage DC supply between '+' and Guard terminals, with metering (keyswitch set to "Test Voltage"). Current limited droop from series 25k (ie. about 52mA short circuit). Instant current limit from series 10k (ie. about 100mA short circuit).
2. uA/pA FS meter between '–' and Guard terminals, with metering (keyswitch set to "Measure").
   Multiply x0.1: 555uA FS; 250mV drop; 444ohm sense;
   Multiply x1: 55.5uA FS; 250mV drop; 4.44kohm sense;
   Multiply x10: 5.55uA FS; 250mV drop; 44.4kohm sense;
   Multiply x100: 0.555uA FS; 250mV drop; 444kohm sense;
   Multiply x1000: 55.5pA FS; 250mV drop; 4.44Mohm sense;
   Multiply x10,000: 5.55pA FS; 250mV drop; 44.4Mohm sense;

Notes:
Top panel provides access to valves, and sensitivity pot. Rear and base wrap-around panel provides access to underneath chassis – the rear mains socket connects to top of chassis via an octal plug.
C1 4uF cap disconnected and missing – needs to be at least 400VAC rated due to T1 2:1 step-up.
Trim resistor goes to T4 primary, not to R1 front panel pot.
R22 (10k) in Rx BLK terminal feed to HT (schematic error).
Rx RED terminal in grounded/range feed – shown on schematic as HIGH.
T3 secondary 0V taken direct to chassis mounting bolt.
V1 uses BYY34 zener.
Meter M1 missing side mount.
Schematic switch S3H not connected.

Dating:
Schematic dated 1959 for Issue 2.
Parts appear to be 1966 (not 1956).

Initials and date written on chassis: C.A. 16-11-66

Issues:

- Mains socket and connection to chassis via octal plug.
- mains side control parts: panel pot (set volts); trim pot; 4uF oilcan cap.
- No mains fuse, or power supply secondary fuse, or HV secondary fuse
- Electrolytic filter cap C5 - old.
- R31 self-discharge is a 1/2W resistor and has to withstand 1kV.
- Stability of R15.
- R4 = 4k (not 15k)

Modifications

- Installed IEC socket and 0.8A IEC T fuse on chassis rear panel.
- Separated AC primary wiring from secondary side wiring.
- Series UF4007 with each EZ80 anode.
- Added 100mA fuse in T4 secondary CT, and star the first filter cap points.
- Replaced C5 electrolytic with 10uF 250VAC poly.
- Made a side mounting bracket for meter.
- Replaced R31, and R4.
- Added 1N4004 across RL1 coil.
- Installed 6x 2u2F 250VAC ERO MKT 1822S9 for C1 (as 6.6uF in series with 6.6uF, and 180k PRO2 across each for balancing). Working voltage is about 400Vac.
- Megger tested all primary side parts and secondary side B+ parts.
- Fail-safe wiper on Adjust to infinity.
- Replaced 10MΩ for voltage measurement (made from 5 series high stability resistors, but prone to soldering cracks due to very short terminals) – 10.3MΩ made from 6 series 1% resistors.

To do:

- Add switch to turn HV supply off (ie. just use to measure for uA/pA measurement).
- The schematic shows how the keyswitch was modified to “give a check voltage position, as well as earth and test.”
- Replace 3.3uF 500Vac cap with 4uF 450Vac when in (then check for 6.3V heater).
- Check that “measure” voltage is same as reported during voltage test.

Design

Heater current: 0.6+0.6+0.2+0.2+0.2+0.2 = 2A

B+ supply
T4 primary ESR=83Ω; secondary ESR 240+260Ω
EZ80 can cope with lots of first filter capacitance, as load is low even with relay RL1 energised.
Best to insert another RC filter between V3 and V4,5 with cap going direct to R19.

Resonant reactor voltage regulator
Reference is Lee 1955.
Inductance of T1 and C1 are parallel-resonant at mains AC frequency. So reactive voltage across inductance of T2 primary is lowish as LC tank doesn't draw much current, and T1 is partially saturated. If AC mains voltage falls, then tank becomes untuned and current drawn through T2 becomes more capacitive, and increases T2 primary voltage. Conversely, a more inductive current in the tank occurs with higher AC mains voltage, which reduces voltage across T2 primary.

T2 primary voltage is about 156V, and secondary about 34V. T1 tap voltages are about 173V, 260V and 390V. Regulated voltage to T3 and T4 is about 267V to 264V, over mains AC range of 180V to 240V. Heater voltage was kept to 1% for mains AC variation from 180-240V. Heater voltage was 6.4V for C1=4.4uF, and 6.0V for C1=3.3uF. T1 gets warm.

Performance

Voltage measurement is within parallax error across range.
Resistance measurement sensitivity pot calibrated with 1MΩ PRO2 at 500V on 1/10 multiplier. 68MΩ VR68 measures accurately on x1 multiplier.
No need to adjust Set Infinity pot, as Adjust to Infinity was fine.

BPL RM 175-LZ II Megohmeter
1956

1—DESCRIPTION

1.1 This instrument is capable of measuring, to a high degree of accuracy, the value of insulation resistances from under one megohm up to five million megohms. In operation it is exceptionally stable and its simplicity of control, together with the very thorough character of the incorporated protective devices, renders it entirely suitable for use by unskilled operators.

1.2 The circuit used combines the advantages, such as stability and accuracy, of the bridge with the direct indication of the ohmmeter; this is a feature of exceptional value, in that the effect of physical treatment of test samples (e.g., changes in ambient temperature, pressure, humidity, configuration, etc.) can be observed immediately without the readjustment delay inevitable in a simple null bridge system. In effect, the operation of this instrument is equivalent to that of a self-balancing bridge.

1.3 Two other valuable features are the complete protection of the indicator circuit—the meter will not be damaged even shou'd the test terminals be short-circuited—and the fact that the polarizing voltage is substantially independent of the resistance of the circuit or component under test.

1.4 The RM-175 Megohmmeter is made in three standard types; all have the same resistance ranges but see paragraphs 3.1 and 3.2.

1.41 The RM-175-CX is the basic model, with a test pressure of 500 volts D.C. and includes an adjustable automatic delay circuit which does not insert the indicating circuit until a pre-determined charging period has elapsed; it is, therefore, particularly suitable for measuring the insulation resistance of large capacitors.

1.42 The RM-175-LZ includes this feature, and in addition the test voltage can be continuously varied from zero up to 1000 volts D.C.; the actual voltage is directly indicated by an additional meter. The measuring range is increased to 10×10^{12} ohms.

1.43 Instruments with the suffix S have the low terminal connected to chassis and earth.

2—INSTALLATION

2.1 This instrument is suitable for 200 to 250 volts A.C. at 50 cycles per second; within this range no other mains adjustment is necessary. No mains fuses are provided; power consumption is of the order of 70 watts.

2.2 It is most desirable that the instrument should be earthed and a third core (not red or black) is provided in the mains lead for this purpose.

2.21 For notes on guarding see paragraph 6.

2.3 The exact valve arrangement varies with each model; the appropriate holders are clearly indicated by labels on the chassis. It is essential that the correct replacement types be used.

	RM-175-CZ	RM-175-LZ	RM175-LZ MkII
V.1 ...	6X5-G	6X5-G	EZ80
V.2 ...	U50	HVR2	K3-45 2.9
V.3 ...	6SN7	6SN7	ECC82
V.4 ...	ME 1400	ME 1400	EF37A
V.5 ...	ME 1400	ME 1400	EF37A
V6		CA50	8vy3t

2.33 In all cases the ME 1400 can be used as a replacement for the EF 37, used previously.

3—RANGES

3.1 On all instruments the same six ranges are provided; selection is made by use of the " MULTIPLY BY " Switch.

Range 1 x 1/10	0.9 to 50	megohms
Range 2 x 1	9 to 500	megohms
Range 3 x 10	90 to 5000	megohms
Range 4 x 100	900 to 50000	megohms
Range 5 x 1000	9000 to 5000000	megohms
Range 6 x 10000	90000 to 5000000	megohms

3.2 Since the range is a function of the test voltage, on the RM-175-LZ model, for any voltage other than 500 a very simple correction must be applied, i.e. Reading x $\frac{\text{Test Pressure}}{500}$. For example, if the test voltage is adjusted to 1000 each of the above ranges is doubled.

3.3 On models which incorporate a charging delay circuit, four time ranges are provided, 0, 1, 3 and 10 seconds. The most suitable range varies both with the capacitance of the condenser and with its expected leakage resistance.

4—ACCURACY

4.2 On the RM-175-LZ model the voltage under test is correctly indicated within 2%, unaffected by the resistance of the circuit under test.

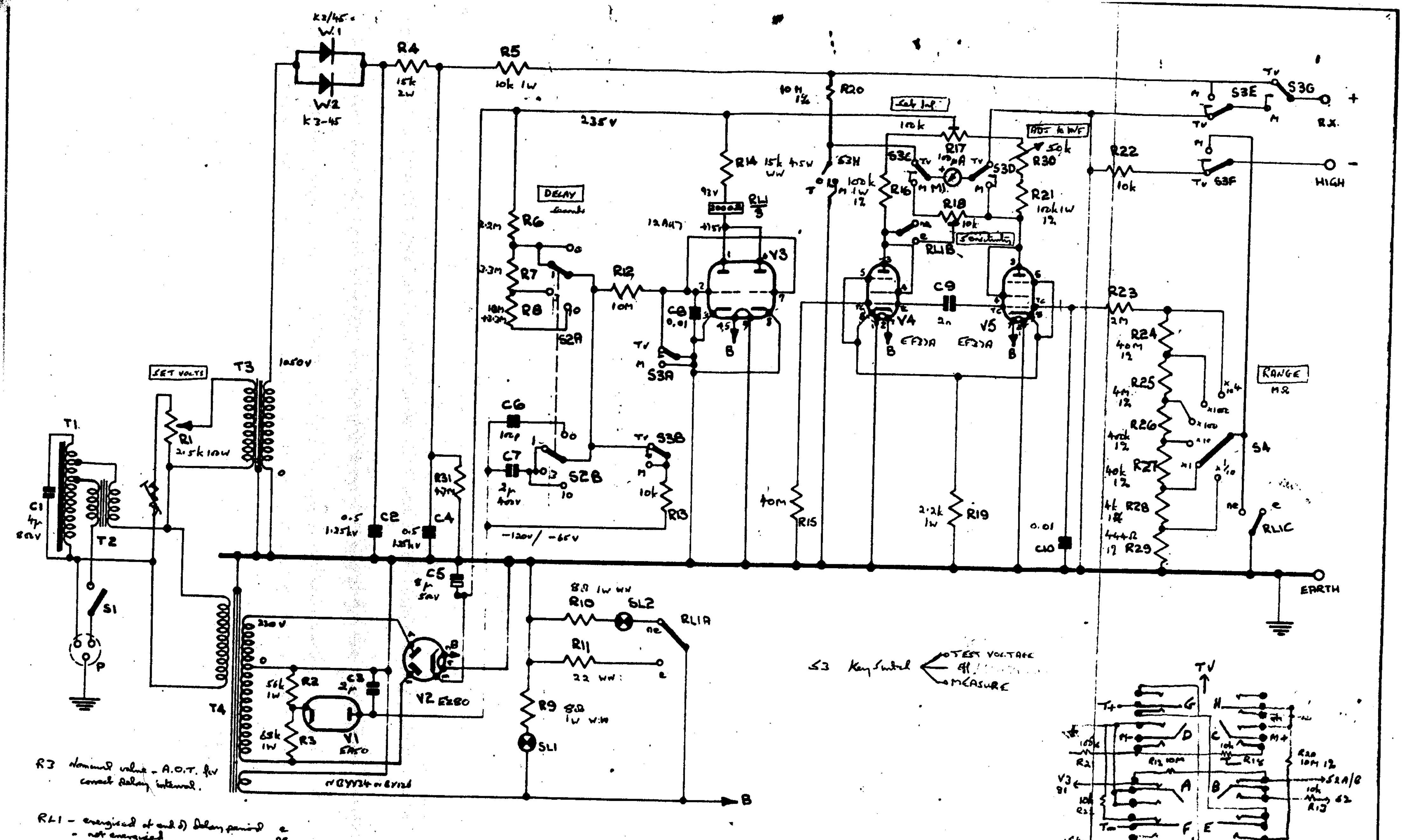
4.3 The time delay circuit is adjusted to within − 0, + 1 sec. of the indicated time.

5—OPERATION

5.1 If possible the instrument should be allowed to warm up for about 20 minutes before use.

5.2 The component or circuit, the resistance of which is to be measured should be connected to the terminals marked Rx.

5.3 Using the ADJ. TO INFINITY control, set the MEGOHMS meter to read infinity.



ISSUE 2 TRANSFORMER WIRING CHANGED A.H. 15-5-59

DRN:	PRK.	PARTS LIST No. D950GB.	BRITISH PHYSICAL LABORATORIES, RADLETT, HERTS.
TCD:			
CKD:		TITLE	DIAGRAM No
DATE	16-10-56	RM 175 - L7. MK II MEGOHMMETER	D. 143 SHEET 2

INSTRUCTION BOOK

for

MEGOHMMETER

Model RM-175-LZ

BRITISH PHYSICAL LABORATORIES

HOUSEBOAT WORKS . RADLETT . HERTS . ENGLAND

BRITISH PHYSICAL LABORATORIES

Designers and Manufacturers of Electrical Laboratory and Production Testing Equipment

INSTRUCTION BOOK

for

MEGOHMMETER

Model RM-175-LZ

1. Description
2. Installation
3. Ranges
4. Accuracy
5. Operation
6. Guarding
7. Service
8. Circuit Diagram
9. Schedule of Components

HOUSEBOAT WORKS . RADLETT . HERTS.

Telephones: RADLETT 5674-5-6 Cables: BEEPEELLE, RADLETT

Telegrams: BEEPEELLE, PHONE, RADLETT

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5.4 With the RM-175-LZ model, adjust the TEST VOLTAGE to the desired value, using the TEST VOLTAGE CONTROL.

5.5 Set the range switch (MULTIPLY BY) to the appropriate range.

5.6 With models with a delay circuit (RM-175-CZ and RM-175-LZ), set the delay time to an appropriate value. In practice, use of this delay circuit is confined to the testing of large condensers of high leakage resistance; the selected time should be a direct function of both capacitance and expected leakage resistance.

5.7 Operate the PRESS TO READ key and the insulation resistance is indicated directly by the MEGOHMS meter; in the case of the RM-175-LZ this reading is subject to correction according to the test pressure. In such a case the reading should be multiplied by test pressure divided by 500.

5.8 The DELAY INDICATOR lamp will indicate the expiration of the delay period, and must light up after the pre-set period. During this period any capacitance across the test sample is charged directly from a low impedance source and the indicating circuit is not in operation.

6—GUARDING

6.1 When testing an insulation resistance which forms part of a multi-terminal network it is frequently desirable to make use of the principle of guarding. For example, a paper condenser in a metal case may be considered as a three terminal network in that both electrodes will have some leakage resistance to the case. If this case be connected to the GUARD terminal, even should these two leakages be comparable in value with the direct electrode to electrode leakage, their presence will in no way affect the accuracy of measurement.

6.2 Guarding has been loosely described as " insulation by conduction "; more accurately, it confines stray leakages to paths where their effect is unimportant. It is not possible to deal more fully with the subject here and reference should be made to any standard text-book dealing with high resistance measurement.

7—SERVICE

7.1 In case of any difficulty, before returning the instrument the customer should communicate with the manufacturers, who will be pleased to render every possible assistance.

7.2 Should it be necessary to change either V4 or V5, it may also be necessary to re-adjust the sensitivity of the indicator circuit. This may be conveniently done by connecting a known resistance to the test terminals, a value of the order of one or two megohms is suitable. After having carefully adjusted the MEGOHMS meter to infinity, press the key and adjust the internal SENSITIVITY control (on the chassis) until the meter reads correctly. This correction holds good for all ranges.