THE

HICKOK

ELECTRICAL

INSTRUMENT

COMPANY

OPERATING INSTRUCTIONS

for

HICKOK UHF-VHF PORTABLE FIELD STRENGTH METER MODEL 235

CHOICE OF THE EXPERTS FOR SPEED, ACCURACY and DEPENDABILITY...

OPERATING INSTRUCTIONS

for

HICKOK UHF-VHF PORTABLE FIELD STRENGTH METER MODEL 235

THE HICKOK ELECTRICAL INSTRUMENT COMPANY
10514 Dupont Avenue • Cleveland 8, Ohio

STANDARD RETMA GUARANTEE

The Hickok Electrical Instrument Company warrants instruments manufactured by it to be free from defective material or factory workmanship and agrees to repair such instruments which under normal use and service, discloses the defect to be the fault of our manufacturing. Our obligation under this warranty is limited to repairing any instrument or test equipment which proves to be defective, when returned to us, transportation prepaid, within ninety (90) days from the date of original purchase and provided the serial number has been made known to us promptly for our records.

This warranty does not apply to any of our products which have been repaired or altered by unauthorized persons or service stations in any way so as, in our judgment, to injure their stability or reliability or which have been subject to misuse, negligence, or accident, or which have had the serial number altered, effaced, or removed. Neither does this warranty apply to any of our products which have been connected, installed, or adjusted otherwise than in accordance with the instructions furnished by us. Accessories including all vacuum tubes not of our manufacture used in this product are not covered by this warranty.

This warranty is in lieu of all other warranties expressed or implied and no representatives or person is authorized to assume for us any other liability in connection with the sale of our products.

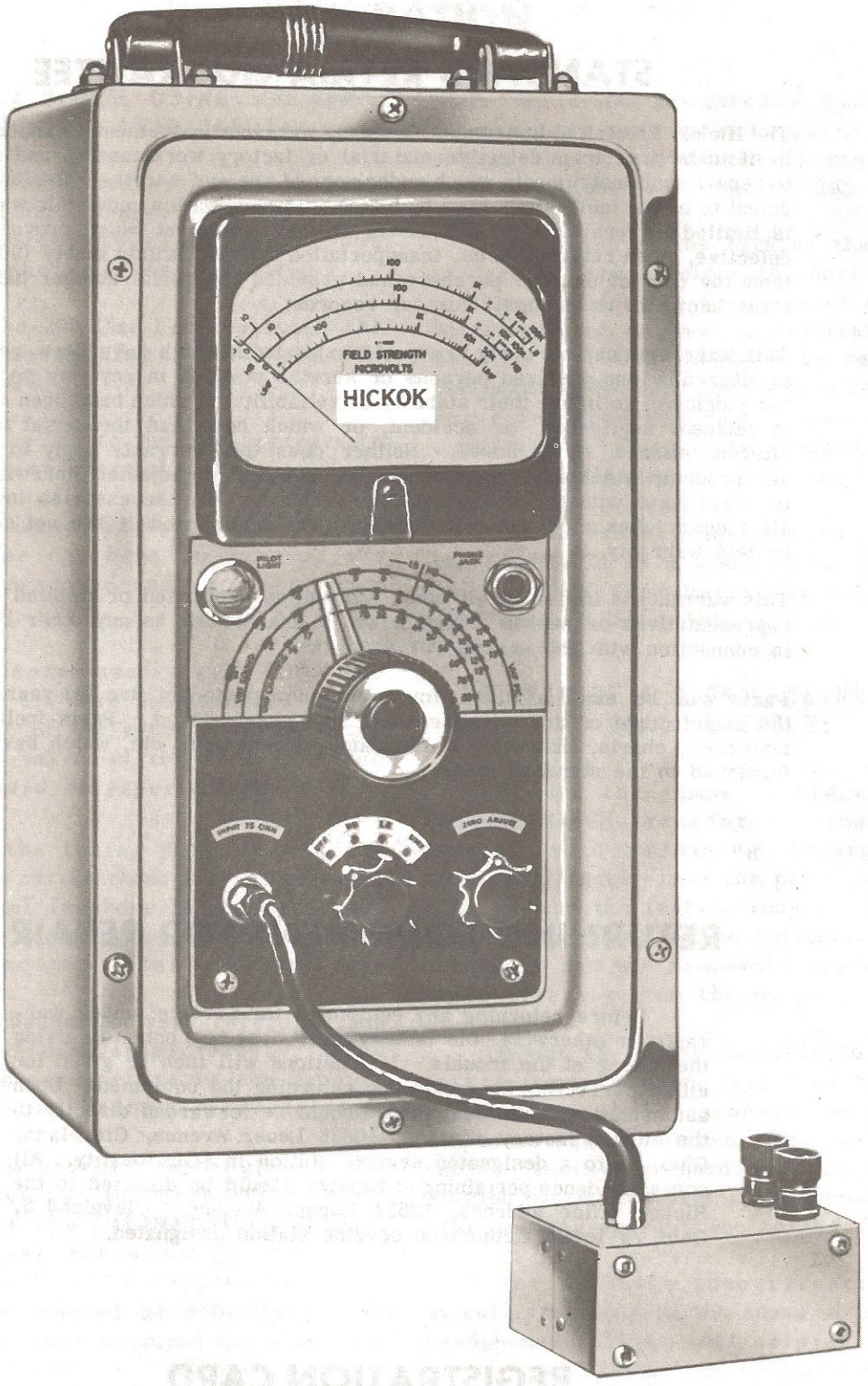
Parts will be made available for a minimum period of five (5) years after the manufacture of this equipment has been discontinued. Parts include all materials, charts, instructions, diagrams, accessories, etc, which have been furnished in the standard model.

RETURNING EQUIPMENT FOR REPAIR

Before returning any equipment for service, under warranty or otherwise, the factory must first be contacted giving the nature of the trouble. Instructions will then be given for either correcting the trouble or returning the equipment. Upon authorization, this equipment should be forwarded directly to the Hickok factory address, 10636 Leuer Avenue, Cleveland, Ohio, or to a designated service station in your locality. All correspondence pertaining to repairs should be directed to the Hickok office address, 10514 Dupont Avenue. Cleveland 8, Ohio, or to the authorized service station designated.

REGISTRATION CARD

The above guarantee is contingent upon the attached registration card being returned to the factory immediately receipt of the equipment.



HICKOK UHF-VHF PORTABLE FIELD STRENGTH METER MODEL 235

DESCRIPTION

The Hickok Model 235 is a portable battery operated instrument designed to receive and measure orally or visually the strength in microvolts of a signal within the bands of 54-88 mc/s, 174-216 mc/s and 450-900 mc/s.

The instrument will measure from 10 to 100,000 microvolts with an accuracy of plus or minus 3DB on the two VHF bands with 75 ohms input. On the UHF band the instrument will measure from 30 to 50,000 microvolts with an accuracy of plus 6DB, minus 2DB with 75 ohms input. As an example of what these figures mean in regard to accuracy, if a UHF Channel were being measured and the 235 indicated a signal strength of 100 microvolts this figure could be plus 6DB or minus 2DB. Now plus 6DB is a ratio of 2 to 1, therefore, the signal strength could be 200 microvolts. Similarly, minus 2DB is a ratio of 0.8 and the signal could be 80 microvolts. From the above simple calculation it can be seen that if the 235 indicates 100 microvolts on UHF, the actual value of the signal could be anywhere between 80 and 200 microvolts. However, plus 6DB is the worst possible condition of error and may occur only on the high end of the UHF Range.

The meter is designed for 75 Ohm Coaxial Cable input, but the Hickok Type CM-1 CALI-MATCH matching transformer should be used when measurements on 300 Ohm balanced lead are made.

The separate matching transformer ensures maximum accuracy since there are no losses due to switch contacts. This is especially important on the UHF band.

Two safeguards are built into the Unit to ensure that the designed accuracy is maintained throughout the life of the instrument:

1. A neon indicator is located on the panel which also acts as a voltage regulator. This ensures that provided the battery voltage is high enough to cause the neon lamp to light, the voltage applied to the circuits in the instrument will be constant.

   If at any time when the instrument is switched on, the neon indicator fails to light, this is an indication that the B battery is worn out and should be replaced. The two A batteries should be replaced at the same time.

   On no account should the neon indicator be changed unless our instructions on page 3 are adhered to since the neon operating voltage is part of the calibration procedure of the instrument.

2. A sensitivity adjustment is provided so that when a tube is changed the instrument can correct for tube tolerances to maintain its calibration accuracy. This adjustment should be made as follows:

   Remove the six mounting screws from front of panel. Remove instrument panel carefully from case as far as battery leads permit.

   Switch on instrument to Low Band and tune to approximately Channel four.

   Turn zero adjustment control on panel to the center of its range of travel.

   Using an insulated screw driver, adjust the iron core slug, which is located just behind the positive terminal of the microammeter, until the meter reads zero. Make sure while this adjustment is being made that no outside sources of interference are causing the meter to deflect. This can be checked by plugging a pair of headphones into the jack provided on the panel.

   Replace the instrument panel in its case.

   NOTE: The above adjustment should be checked from time to time in order to correct for unavoidable tube ageing and mechanical shock that the instrument may receive. The vital circuits of the 235 are provided with a built-in temperature compensation to ensure accuracy when used out-of-doors and under various climatic conditions.

OPERATION

TO MEASURE A SIGNAL USING 300 OHM BALANCED TWIN LEAD INPUT:

Using the short length of coaxial jumper cable supplied, connect the CALIMATCH (CM-1) transformer to the 75 Ohm input jack on the panel of the instrument.

Connect the 300 Ohm lead carrying the signal to be measured to the CALIMATCH 300 Ohm terminals.

Switch on the 235 to the band appropriate to the television channel to be measured.

Tune the tuning dial until the pointer is just off the calibration line of the channel to be measured and zero the meter carefully.

NOTE: The meter needle will fluctuate slightly around the zero point due to random noise, etc., but if the average of the meter fluctuation is taken as the zero point no difficulty should be experienced.

Now turn the tuning dial towards the calibration line of the channel to be measured and if the signal is above 10 microvolts on the High and Low Bands and above 30 microvolts on the UHF band the meter will deflect.

Tune the channel in very carefully for maximum meter reading in microvolts, using the meter scale appropriate to the band in which the channel being measured lies.

Note the microvolt reading, and for maximum accuracy use the correction chart on the back of the CALIMATCH to obtain the voltage loss ratio.

Thus if a channel at 650 megacycles (Channel 43) was being measured and a reading of 200 microvolts was obtained from the meter, this figure must be multiplied by 1.2 to obtain the actual microvolt reading. The corrected figure is therefore 240 microvolts.

The chart on the back of the CALIMATCH is used by looking along the horizontal axis of the graph for the frequency of the channel being measured and reading vertically up from that point until the curve is reached. At the point where the frequency of the channel being measured and the curve intersect, a horizontal line to the vertical axis of the graph will give the voltage loss ratio.

If the correction chart on the back of the CALIMATCH is not used then the maximum error on 300 Ohms may be as high as: plus 4 DB minus 3 DB on VHF, and plus 8 DB minus 2 DB on UHF.

TO MEASURE A SIGNAL USING 75 OHM COAXIAL CABLE:

Remove the jumper cable connecting the CALIMATCH transformer, and plug the coaxial cable containing the signal to be measured directly into the panel jack of the 235. Follow the instructions outlined above for 300 Ohm ribbon but no correction chart is necessary and the microvolt reading can be taken directly from the meter.

On UHF it is not possible to obtain as satisfactory an image rejection ratio as on VHF and for this reason various spurious responses may be noticed. However, they can easily be distinguished from the desired TV station since they will not coincide with the dial reading appropriate to the TV station.

For definite identification of any signal, listening to the sound with a pair of headphones will be most helpful.

CIRCUIT DESCRIPTION

The signal to be measured is first switched through a filter network which helps to eliminate spurious responses and then applied to a crystal diode mixer (1N147).

The crystal mixer also receives a voltage from the local oscillator which may be tuned from 92-188 megacycles.

On the low band VHF channels, the local oscillator will tune on the high side of the signal frequency and produce a 40 megacycle I. F. frequency.

On the high band VHF channels, the local oscillator will tune on the low side of the signal frequency and produce a 40 megacycle I. F. frequency.

On the UHF channels, the 5th harmonic of the local oscillator tunes 40 megacycles higher than the signal frequency to be measured and produces a 40 megacycles I. F. frequency.

Thus it will be seen that all television channels are made to produce a 40 megacycles I. F. frequency and this is applied to a superegenerative I. F. amplifier working in the logarithmic mode.

The plate current of the superegenerative I. F. amplifier will therefore vary logarithmically with the voltage applied to the grid and this property is used to give a logarithmic scale. In addition to the logarithmic property of the superegenerative amplifier mentioned above, a germanium diode is connected across the meter circuit in order to give additional correction and allow circuit variations to be corrected in production.

The microammeter is connected in a balanced bridge circuit to the plate of the superegenerative I. F. amplifier.

In order to correct any zero variations of the meter circuit with no signal input to the instrument, the strength of superegenerative oscillations is varied by means of an inductance in the plate of the superegenerative amplifier. This inductance is in two parts: one coarse setting is inside the instrument and the fine setting is on the panel.

Since the meter is always zeroed each time the instrument is used, this means that the strength of the oscillations of the superegenerative amplifier is always the same and the sensitivity remains constant.

It should be noted that a high capacity condenser is included in the voltage regulation circuit and the charge held by this condenser will cause the meter to deflect upwards for some time <u>after</u> the instrument is switched off. This will not cause any inconvenience but is mentioned here in case the user feels that there may be something wrong with the meter movement.

TUBE COMPLEMENT

1 - 3A5

1 - Germanium Diode 1N87

1 - Crystal Diode Mixer 1N147

1 - NE52 Neon Indicator and Voltage Regulator

NOTE: If at any time it is absolutely certain that the Neon Indicator is faulty then it must be replaced with an NE51 Neon having exactly the same operating voltage as the original. This operating voltage is stamped inside the 235 near the Neon socket.

NE51 Neons may have an operating voltage of anywhere from 60 to 70 volts. (Due to production tolerance). It is therefore likely that several Neons may have to be tried until one that is within one volt of your Units Specification has been found.

For the user's convenience, Hickok will supply a correct Neon replacement on written request, free of charge. The serial number of the 235 must be given in order to find your particular Neon operating voltage from our records.

Needless to say that under normal conditions, NE51 Neons will last for a considerable length of time.

<u>B BATTERY</u>

1 - Burgess N60 (Canada & USA)

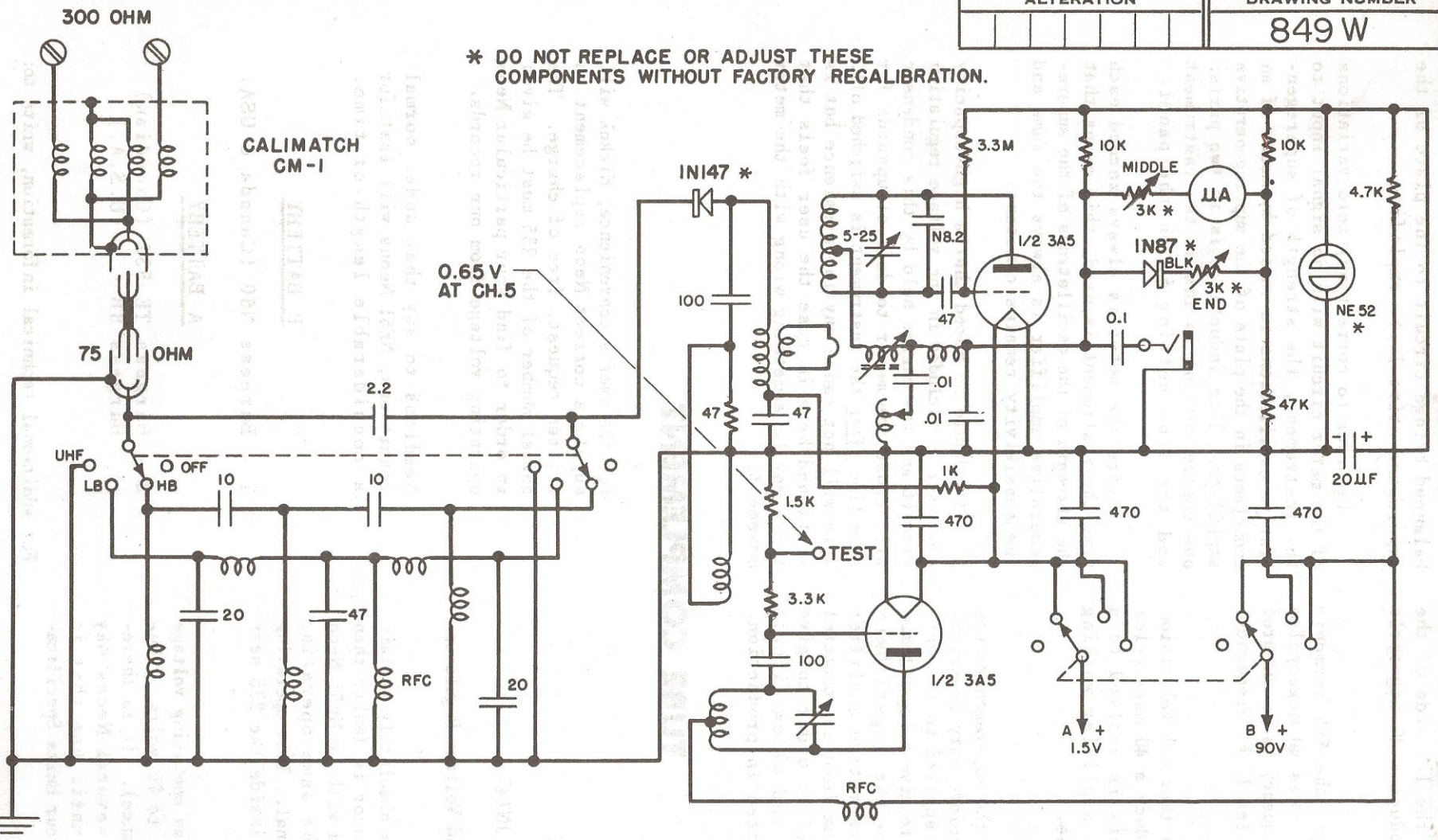
<u>A BATTERY</u>

2 - Burgess TE 532 (Canadian)
Burgess 8R (U.S.A.)

For additional technical information, write to:

The Hickok Electrical Instrument Company
10514 DUPONT AVENUE
CLEVELAND 8, OHIO

ALTERATION	DRAWING NUMBER
	849 W



NO.	ALTERATION	BY	APP'D	DATE

THE HICKOK ELECTRICAL INSTRUMENT CO.
CLEVELAND, OHIO, U.S.A. A-8½X11

TITLE SCHEMATIC WIRING DIAGRAM

USED ON MODEL 235 FIELD STRENGTH IND.	SCALE	X SIZE
MATERIAL		
FINISH	DATE 9-15 1954	

DRAWN	CHECKED	APPROVED	PART NUMBER
E.J.T.	B.J.K.		

MODEL 235 SCHEMATIC

HICKOK

ELECTRICAL
INSTRUMENT
COMPANY

10514 DUPONT AVE., CLEVELAND 8, OHIO

500-235-954-KARG