Review of Heathkit IT-28 Capacitor Checker

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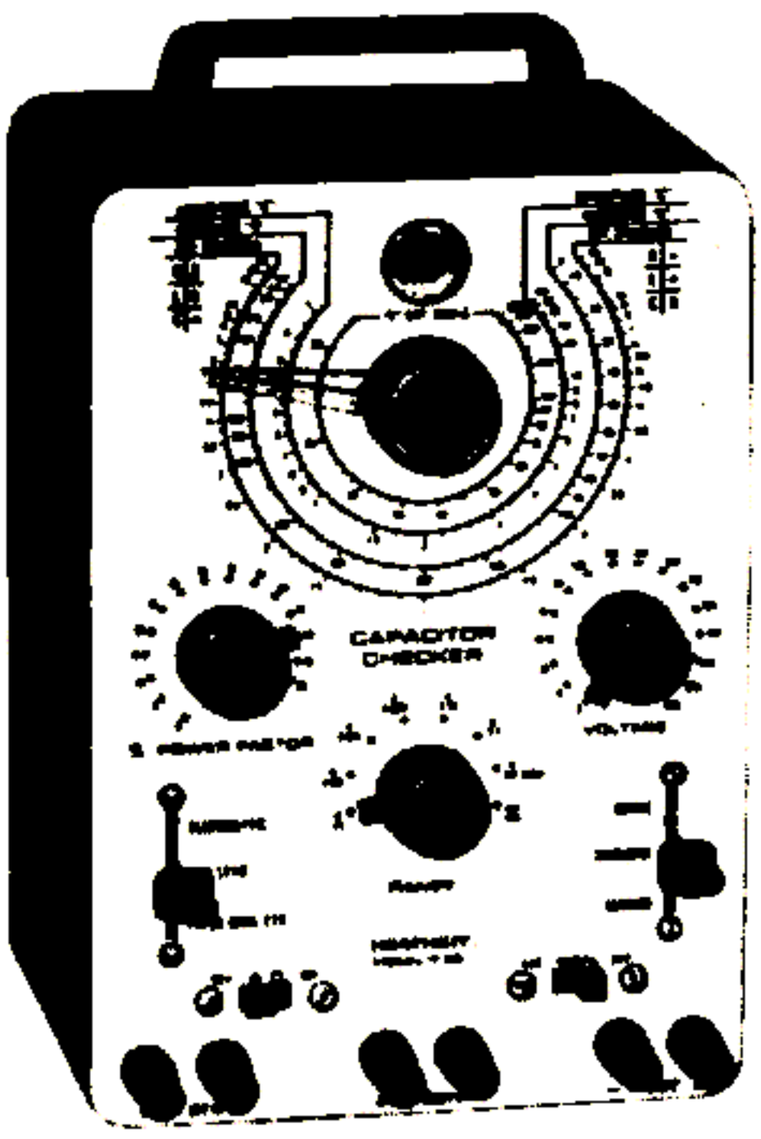

A careful scanning of most of the electronics magazines from the early '50s to the present has brought to light some interesting capacitor checker circuits, but none of the construction articles on these instruments boasted a range from picofarads to hundreds of microfarads.[1,2] This is the range encountered by even a casual builder.

Examination of the specs. of commercially available capacitor checkers revealed that most of them do not cover the wide range of values needed by the experimenter and builder. The one that is satisfactory has a price tag that disqualifies it.

When the announcement of the revised Heathkit Capacitor Checker IT-28 recently appeared, I immediately began to devise means to get the XYL out of the house long enough for me to pick the lock on the piggy bank.

Manual

An outstanding feature of the kit is the three page circuit description included in the construction manual. Simplified schematics are used to clarify the theory of operation. Any ham with elementary knowledge of test instrument circuits will find these pages enlightening reading even if he has no intention of building the tester.

In addition to the standard Heathkit step by step instruction and pictorials, there is an easy to read two page schematic of the instrument at the back of the manual. Included on the schematic are operating voltages expected at the tube sockets, which are indispensable for trouble shooting.

Circuit

The big surprise came when the power supply schematic was examined. The half wave vacuum tube rectifier is unusual for new equipment in this time of semiconductors. A little reflection indicates that there is about 1500 PIV in the circuit, which inexpensive diodes do not handle.

The heart of the IT-28 is the bridge circuit, which uses the 6E5 "eye tube" as an amplifier and null indicator. Three resistance and three capacitance standards are included in the instrument. Driving voltage for the bridge is provided by a transformer which supplies 60 Hz ac. Provision is made for use of external driving voltage of up to 10 kHz. There is also provision for connection of standard resistance, capacitance, or inductance for comparison with a component of unknown value connected to the "Test" posts.

Construction

Construction time for a nearsighted, butterfingered technician was approximately 9 hours.

Wiring is greatly simplified by a ready-made harness that already has the insulation stripped from the ends of the wires. Components are uncrowded for the most part.

Most of the electronic components are mounted on a conventional chassis using

tube sockets and terminal strips. Controls are bolted to the front panel. A sizable portion of the construction time is consumed in the interconnection of the panel and chassis.

The hardest part of the whole operation is mounting the line cord strain relief insulator.

Even the beginner should have little difficulty getting this instrument to operate, for construction is straightforward.

Operation

With 8 front panel controls, this instrument might at first glance appear a complicated knob twirler's delight. It does not turn out to be nearly as complicated as it looks. Care is required to be sure the range, bridge-leakage, type, and power factor controls are properly set before beginning to try to get the eye tube to open.

Anyone with vtvm available will find resistance measurement easier with it than use of resistance ranges on the IT-28, even though these ranges are quite usable. The 200 ohm, 1% resistor included for calibration of the instrument also comes in handy for calibrating the vtvm.

The capacitance ranges are a real delight to those who salvage parts from defunct equipment, but who do not want the "junk box" cluttered with components in doubtful condition. These ranges will serve the builder or repairman well as a tool in positively indicating a capacitor's condition.

For best results in checking capacitors of a few tens of pf, it is best to use an external generator connected to the posts supplied for the purpose. A check indicated the frequency of the external signal is not as important as the ability of the generator to supply adequate voltage to the low impedance of the input. A 1000 Hz tone taken from the 16 ohm output of an amplifier running at high gain made the null much sharper than did the internal 60 Hz. It was possible to measure capacitance of a pair of twisted wires.

The "Mini-lytic" function of the "Type" switch will be most useful to those who work with transistor circuits. Who doesn't, these days?

The "Electrolytic" function also provides a test of "power factor" of the capacitor. "Power factor" is the cosine of the angle by which the applied current leads the voltage in a capacitor. Use of a capacitor with a high power factor can seriously degrade the performance of filter, bypass, or coupling circuits.[3]

The "Leakage" position of the "Bridge-Leakage" switch will test quickly the condition of all three types of capacitors, with differences in type taken care of by proper setting of the "Type" switch.

Since the instructions specify that the upper operating frequency of the IT-28 is 10 kHz, it is inconceivable that the comparator range is useful for checking any inductance other than those used at audio frequencies. If much work using this range is anticipated, precision inductances of 1 henry and 100 milahenries should be acquired. Turns ratios of those old transformers cluttering up the "junk box" can also be determined.

Conclusion

For the ham builder who has a vom or vtvm, a grid dip meter and access (maybe at the corner drug) to a tube checker, the IT-28 is recommended highly as the next piece of test equipment.

...WØHMK

References:

[1] R.L. Waters. "Direct Reading Capacitance Meter," *Radio-Electronics*; Vol. XXXIV, No. 8 (Aug., 1963), pp. 32-33.

[2] Eugene Fleming, "Electrolytic Saver," 73; Nov., 1964, pp. 31-32.

[3] H.P. Manly, "Power Factor...What It Means," *Radio-Electronics*; Vol. XXVIII, No. 7, p. 82 ff. (Aug., 1963).

Specifications:

Test Circuit

AC bridge powered from internal 60 hz or external source.

Ranges:

Capacitance–10 picofarad to 1000 microfarad in 4 overlapping ranges, one range for comparison with external standard.

Resistance–5 ohms to 50 megohms in 3 ranges. One range for comparison with external standard.

Inductance–One range for comparison with external standard only.

Power requirements

115 or 230 (nominal) volts ac 50/60 hz. 30 watts.

Internal power supply

Half-wave rectifier.

Tube complement

6E5, 6AX4, 6BN8.

Controls

Bridge balance, power factor, test voltage, range switch, type switch, bridge-discharge-leakage switch, on-off, int.-ext. bridge power.

Size

9-5/8"x6-5/8"x5"

Weight

5 pounds.