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PUBLISHER'S AND EDITOR'S CORNER

Greetings hollow staters and boat anchor lovers wherever you are. For some time we have wanted to do a special issue on test equipment, so here we go. Maybe we can even entice you to share your experiences with test gear by relating some of Dallas' adventures with a pair of AN/URM-25D RF signal generators he got last spring and a TV–2/U tube tester he got at at Ham Com 88 last June. Also, we have asked Joe Bunyard to compare notes with us on the TV–2/U and to provide us with information about the TV–7 tube tester. When all of this is combined with some short reviews of the Eico models 324 and 377 RF and audio signal generators, we should have a good introduction to tube test gear. We don't use VTVM's. Digital multitesters, like the Beckman DM25 with 2% accuracy, are much more convenient and accurate for voltage and resistance measurements. The DM25 also includes a built-in digital capacitance meter with 5 ranges, from 2 nf to 20 mf, which is very useful and accurate except below about 15 pf.

SHORT CONTRIBUTIONS

TUBE TESTERS: I know I have bad-mouthed tube testers in the past because good tubes may test bad and vice versa, but I never denied using them. At the very least, tube testers are useful for identifying dead or nearly dead tubes. It used to be relatively easy to find tube testers, such as at Radio Shack and even at convenience stores. But about two years ago these public tube testers were removed from service. So I purchased a tube tester and have found it indispensable for trouble shooting hollow state gear and for building my tube inventory. Below is a survey of three of the most common military surplus tube testers, any one of which would suffice for a hollow stater's basic tube testing requirements. (Dallas Lankford)

- TV-10A/U
  manual: NAVSHIPS 93069, "Technical Manual For Electron Tube Test Set TV-10A/U," 4 October 1957
  supplementary manual: "Supplementary Test Data For Older Tube Types," Hickok Part No. 3200-96, 11-1-63
  dimensions: 7" by 18.4" by 10.4" (D by W by H)
  weight: 23 pounds
  power required: 105–125 VAC, 50–1,000 Hz, single phase, 100 watts at 60 Hz
  tubes required: 5Y3WGTA, 83 (subsitute 5Z3)
  fuse required: 250 VAC, 1 A, normal instantaneous
  bulbs required: NE-51, 47, 49, 81
  sockets: 7 and 9 pin miniature, loktal, 4, 5, 6, and 7 pin, acorn, 7 and 8 pin subminiature
  meter ranges: 0–3,000, 0–6,000, 0–15,000, 0–30,000 micromhos
  miscellaneous: detachable top (side), built-in roll chart, 829A adapter (E101), 2C39 adapter (E102), test leads (W101 for grid & plate of lighthouse tubes, W102 for plate, W103 for grid)

The TV-10A/U is my primary tube tester. It is small, light weight, and easy to use. I got mine in January 1987 from Fair Radio together with a partial reproduction of the manual, the supplementary data, and, after some whining, a parts list. I don't understand why Fair Radio deleted the parts list from their partial reproduction because some crucial parts values are not listed on the schematic or anywhere else in the manual except in the parts list. My TV-10 was missing all adapters and all but one of the test leads. Because I only test 7 and 9 pin miniature, octal, and a few 4 pin tubes, I did not make a fuss about the missing adapters and test leads. If such adapters are critical to your needs, you should make them a condition of the sale in advance. Like any piece of gear that is 20 to 30 years old, it has required some maintenance and repairs. An immediate problem was an intermittent loss of contact on one or more of the pins of the 9 pin miniature socket. A temporary fix was to bend the contacts closer together with a small dental tool. Eventually I replaced the socket because of recurrence of the problem. Fair Radio sells unused and used mil spec sockets which I recommend for this purpose, especially Eby and Cinch sockets. I recommend against newly manufactured miniature tube sockets. Apparently Americans have forgotten how to manufacture high quality miniature tube sockets, and even used sockets 30 years old are preferrable provided they are in good condition. I elected to redo a poorly done OFF-ON toggle switch replacement which used a toggle switch with binding screw lugs instead of solder lugs as in the original. It turned out that not any toggle switch would do. A small one with lugs which would clear the nearby power transformer was required. The color coded leads of CR101, a fancy little low voltage copper oxide bridge rectifier which determines the calibration of the TV-10, had been unsoldered at some point in the past and resoldered poorly, so I redid that solder work, too. Apparently someone had tested CR101 per the manual in an attempt to determine why the plate voltage measured higher (about 175 VDC) than specified by the manual (150 VDC). The

higher than normal plate voltage, which may be an inherent feature of TV–10's, apparently causes it to indicate erroneous transconductances which are high by as much as 10 to 20% depending on the condition of the 83 (5Z3) tube. The original roll chart window had been replaced with a poorly done homebrewed window, a line scratched on a thin piece of clear plastic and a broad red line drawn above the scratched line with red felt marker. You could hardly read the tube data. So I replaced that with an improved homebrewed roll chart window made with my typesetting software and printed with my laser printer on a sheet of overhead projector transparency. The end result is quite nice, though perhaps not as nice as the original, which was probably a plexiglass window with engraved and painted parallel lines. The TV–10 is moderately difficult to remove from its case because of a continuous metal rim which runs around the inside of the case and to which the front panel is bolted. Some tube socket wiring can easily become pinched between this metal rim and the front panel unless care is used when replacing the TV–10 in its case. The 83 tube is about $15–20, but generally available. The 5Z3 is an acceptable substitute and inexpensive. The 49 and 81 lamps are difficult to find and about $1 each. (Dallas Lankford)

- TV–7( )/U

  manuals: Department of the Army Technical Manual TM 11-6625-274-12, "Operator's And Organizational Maintenance Manual, Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U," Department of the Army Technical Manual TM 11-6625-274-35, "Field And Depot Maintenance Manual, Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U"
  test data manual: Department of the Army Technical Bulletin TB 11-5083-1, Department of the Air Force Technical Order TO 33AA21-5-1, "Test Data For Electron Tube Test Sets TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U," Changes No. 3, 10 February 1960 (and later versions, e.g., TB 11-6625-274-12/1, Jan. 1962)
  dimensions: 6.5" by 15.5" by 8" (D by W by H)
  weight: 18 pounds
  power required: 103.5–126.5 VAC, 50–1,000 Hz, single phase, 45 watts at 50 Hz
  tubes required: 5Y3WGTA, 83 (substitute 5Z3)
  fuse required: none (81 lamp serves as fuse)
  bulbs required: NE–45, 47, 81
  sockets: 7 and 9 pin miniature, loktal, 4, 5, 6, and 7 pin, acorn, 7 and 8 pin subminiature, 7 pin transmitting (for 813, etc.)
  meter range: 0–120% good (can be converted to 0–30,000 micromhos provided rated tube transconductance is known)
  miscellaneous: detachable top (side), built-in 7 and 9 miniature tube pin straighteners, 7 and 8 pin long lead subminiature adapter (E104), 3E29 adapter (E105), 2C39A adapter (E107), test leads (W101 and W102)

The TV–7 is basically a smaller, lighter TV–10, but with a book of tube test data instead of a roll chart, and a meter which reads in % good rather than directly in micromhos. The tube test data manual may be yellowed with age and disintegrating. In any case, you should consider making a Xerox copy of the tube test data manual and storing the original in your files. Because it is small and compact, some TV–7 repairs would be very difficult. The tube, 81 lamp, and chassis replacement comments in the TV–10 discussion above also apply to the TV–7. The NE-45 lamp is expensive and difficult to find. (Joe Bunyard and Dallas Lankford)

- TV–2( )/U

  manuals: Department of the Army Technical Manual TM 11-6625-316-12, "Test Sets Electron Tube TV–2/U, TV–2A/U, and TV–2B/U," March 1961; Department of the Army Technical Manual TM 11-6625-316-35, Department of the Air Force Technical Order TO 33AA21-4-12, "Field And Depot Maintenance Manual, Test Sets, Electron Tube TV–2/U, TV–2A/U, TV–2B/U, and TV–2C/U," Sept. 1961

dimensions: 8.4" by 16.1" by 17.7" (D by W by H)
weight: 37 pounds
power required: 103–126 VAC, 50–1,000 Hz, single phase, 70 watts (no tube under test)
tubes required: (2) 6X4, 83 (substitute 5Z3)
fuses required: (2) 250 VAC, 3 A, normal instantaneous
bulbs required: (2) NE-51
sockets: 7 and 9 pin miniature, loktal, 4, 5, 6, and 7 pin, acorn, 7 and 8 pin subminiature, 7 pin transmitting (for 813, etc.)
meter range: 0–150% good (can be converted to 0–60,000 micromhos provided rated tube transconductance is known)
miscellaneous: detachable top (side), roll chart and 7 and 9 miniature tube pin straighteners built into detachable top, 2% accuracy, filament, grid bias, plate, and screen voltages are individually metered and adjustable, built-in test leads with clips, built-in 7 and 8 pin long lead subminiature adapter, –4 to 125 degrees Fahrenheit operating temperature range

The TV–2 is larger, heavier, and more complicated to set up in order to test a tube than the TV–7 or TV–10. But it is the only one of the three which measures transconductance and other tube parameters accurately, within 2% according to manual specifications. To measure transconductance of a tube you set about the same number of switches as in the TV–7 or TV–10, but, in addition, you fine adjust individually metered filament, grid bias, plate, and screen voltages with rheostats. Consequently, it takes more time to test a tube with the TV–2. Once the controls and adjustments are made, it takes no more time to test several tubes of one fixed type than with a TV–7 or TV–10. Provided you can find exact or nearly exact replacements parts, the TV–2 is the easiest of the three to repair. There is often (but not always) more space between parts, and a tilt-out chassis provides additional access. Some parts, in particular the 250 ohm 50 watt rheostats, are no longer manufactured, but a 225 ohm 50 watt rheostat seems satisfactory in one repair we made. The replacement rheostat was slightly larger than the original, which made it necessary to partly unlace a wiring bundle so that the wires could spread out an allow more space. Meter replacement can also be a problem. Fair Radio currently sells unused ("new" is not an accurate description of a 25 year old meter) screen voltage meters, but it took us four tries to get one which worked correctly. The replacement meters did not have a spherical glass window like the original. The original meter and 3 of the "new" replacement meters were "sticky." The meter needles jumped discontinuously as the voltage was adjusted, and would occasionally hang at some rather high voltage even with the TV–2 turned off. A small amount of discontinuous meter movement is normal because wire wound rheostats are used to adjust the voltages. We were lucky to find an unused 7 pin ceramic transmitting tube socket at Ham Com 88 for $2 to replace a cracked socket in one TV–2. Davilyn sells these sockets for $20, while Surplus Sales of Nebraska wants $90. Some of the electrolytic capacitors and many of the precision resistors in a TV–2 can probably only be obtained from another TV–2. Nevertheless, if you want the best, the TV–2 is it. (Joe Bunyard and Dallas Lankford)

SIGNAL GENERATORS: If you own a hollow state receiver, you really should have a signal generator for occasional alignment and trouble shooting. The Eico models 324 and 377 RF and audio signal generators are adequate for basic signal generator requirements. For precision measurements, any one of the AN/URM–25( ) family of military surplus RF generators offers good performance in a relatively small and light weight package. The Hewlett-Packard 606A, somewhat larger and heavier than the URM–25, appears to be a reasonable alternative, but I have no personal experience with it. Most receivers do not require a precision RF generator. The only receiver I have encountered which does is the 51J4, cf. the 500 kHz IF performance measurements in paragraph 5.3.7 of the manual. (Dallas Lankford)

- Eico Model 324
  manuals: "Instruction Manual, Model 324," "Construction Manual, Model 324, Signal Generator"
  dimensions: 4.8" by 10" by 8" (D by W by H)
  weight: 10 pounds
  power required: 105–125 VAC, 50–60 Hz, 15 watts
  tubes required: 12AU7, 12AV7
  fuses required: none
  bulbs required: 47
  frequency range: 150 kHz to 145 mHz continuously in 6 bands, 111 mHz to 435 mHz on calibrated harmonics
  RF output voltage: not specified
  output impedance: not specified
  types of modulation: none, 400 Hz internal at 0–50% adjustable, 1,000–15,000 Hz external
  miscellaneous: special Amphenol male and female RF output connector and plug (Amphenol type numbers not listed in manual)

I have used the Eico 324 for about 10 years as my main RF signal generator. It is small, light weight, and easy to use. I seem to recall replacing one or two electrolytic capacitors in the power supply at some point in the past, which is not uncommon for an aging piece of equipment that has been seldom used. (Dallas Lankford)

- Eico Model 377
  manuals: "Operating Manual, 377 Sine / Square Wave Audio Generator," "Assembly Manual, 377 Sine / Square Wave Audio Generator"
  dimensions: 7.7" by 11.2" by 7.2" (D by W by H)
  weight: 11 pounds
  power required: 105–125 VAC, 50–60 Hz, 50 watts
  tubes required: 6SJ7, 6AQ5A, 6FQ7, 6BQ5
  fuses required: none
  bulbs required: 47, 3S6-3W (G.E. lamp designation, 130 VAC, 3 watt lamp with small threaded base)
  frequency range: 20–200,000 Hz continuously in 4 bands
  RF output voltage: depends on load impedance, typically 10 volts maximum into 1,000 ohms, continuously adjustable
  output impedance: 1,000 ohms
  types of modulation: none
  miscellaneous: bananna plug / binding post output connectors

I got the Eico 377 for aligning the 60 kHz IF in the HQ–180A. I have never had an opportunity to use it for anything else. It is small, light weight, and easy to use. The 3S6-3W lamp is difficult to find (and essential for operation of the 377 as it apparently functions as a cathode resistor for the 6SJ7 oscillator). I believe I replaced one or two electrolytic capacitors in the power supply at some point in the past. (Dallas Lankford)

- AN/URM–25D
  manuals: Department of the Army Technical Manual TM 11-5551-D, Department of the Air Force Technical Order TO 33A1-8-12-1, "R.F. Signal Generator Set AN/URM–25D," March 1956; Department of the Army Technical Technical Bulletin TB 11-6625-697-35, "Calibration Procedure For Signal Generator AN/URM–25, AN/URM–25A, AN/URM–25B, AN/URM–25C, AN/URM–25D, AN/URM–25F, AN/URM–25G, AN/URM–25H, AN/URM–25J, AN/URM–25K, And AN/URM-25L," 30 July 1976
  dimensions: 10.8" by 14" by 10.3" (D by W by H)
  weight: 37 pounds

power required: 103.5–126.5 VAC, 50–1,000 Hz, single phase, 48 watts
tubes required: (3) 6AH6, 6AG7 (substitute 6AK7), 5726, 5750, 5814, OA2, 6X4W
fuses required: (2) 250 VAC, 1 A, slow blow
bulbs required: (2) 323 (Chicago Miniature brand, 3 V, 0.19 A, base P, bulb T-1$\frac{1}{4}$)
frequency range: 10 kHz to 50 mHz continuously in 8 bands
RF output voltage: 0.1–100,000 microvolts continuously adjustable, metered, better than 10% accuracy when terminated by a 50 ohm load, 2 volts adjustable across a high impedance load
output impedance: 50 ohms, 500 ohms
types of modulation: no modulation, 400 Hz internal at 0–50% metered, 1,000 Hz internal at 0–50% metered, 1,000–15,000 Hz external
adapters and attenuators: CN-223 fixed 5:1 attenuator, CN-224 fixed 10:1 attenuator, CX-1363 test lead adapter, MX-1487 impedance adapter, SM-35 antenna simulator
miscellaneous: detachable top (side), RG–58/U cables terminated in BNC connectors (can be homebrewed)

The 25D has four main disadvantages: the special screw base 323 bulbs which illuminate the dial are difficult to find and expensive; the precision step attenuator often has been damaged by improper use and it is extremely difficult to obtain and to replace the required precision 1/8 watt resistors; there are nine paper capacitors which should (and in some cases may have to) be replaced and it is difficult to obtain and to replace them; some (most or all) of the fixed attenuators and adapters are frequently missing and it is extremely difficult to obtain replacements. The 1 mHz calibrator signal has objectional hum, and some (most or all) will not zero with WWV. There is often (usually or always) considerable backlash in the main tuning, as much as 2 divisions of the 100 division scale, which makes the frequency interpolation scale useless. Manuals, parts, attenuators, and adapters are generally not interchangeable among the URM–25 models. The 25D fixed attenuators and adapters can be rebuilt. Each female BNC screw-in connector is locked in place with an Allen set screw in one of the screw holes used to secure the removable cover. We use a male BNC connector as a wrench to remove or replace a good female BNC connector. Otherwise, a good female connector may be bent out of round during removal or replacement. Some 25D screw-in BNC femals connectors are marked UG–625/U. Apparently there has been a number change since the 1950's because current UG–1094/U's are equivalent to these old style UG–625/U's. Don't be fooled by the superficial good appearance of the paper capacitors with phenolic cases that resemble old style brown colored silver mica capacitor cases (made by Micamold in our 25D's). All are probably leaky, and some may be shorted or open as in one 25D we overhauled. We used 1KV disc ceramics for the 0.01's we replaced, and 600 VDC yellow wrap metalized film tubulars for the larger capacitance values (available from Antique Electronic Supply; see *HSN* **19**). The precision step attenuator can also be rebuilt if you can find the required 1% precision 1/8 watt resistors. We recommend that you try to avoid this exceptionally difficult rebuilding by making a good precision step attenuator a written precondition of your purchase. You should probably include a good meter in the terms of your purchase. One of our 25D's had a sticky meter needle which moved discontinuously as the MICROVOLTS carbon potentiometer was adjusted. We were fortunate to obtain a good used exact replacement from Fair Radio. The meter case rear had some corrosion, but we figured that would not effect performance because the meter was sealed. After sanding and painting with clear exterior varnish, the meter case rear looked fine. In summary, if you are willing and able to do some difficult overhaul work, a URM–25D may be the best compromize with respect to size, weight, price, and availability of the military surplus precision RF signal generators. One of the other URM–25 models would probably be an acceptable substitute for a URM–25D. We like the D model best. (Joe Bunyard and Dallas Lankford)