

Heathkit of the Month:
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**Heath IT-12
Visual - Aural Signal Tracer**

Introduction:

This month we're going to look at a piece of inexpensive Heathkit test equipment. If you ever worked on a ham receiver or even an old AC-DC radio, stereo or phonograph, the signal tracer is second only to the voltmeter as a tool for troubleshooting, especially if you don't own a quality oscilloscope.



Heathkit IT-12 Signal Tracer

The Signal Tracer:

A signal tracer is a high-gain audio amplifier, with a built-in speaker and visual signal indicator. Two probes provide input to the signal tracer. One probe directly connects the input for troubleshooting audio signals. The second probe includes a crystal diode for troubleshooting modulated R.F. signals. Often the probes are combined into one probe with a two-position switch for selecting the probe's function.

Using a Signal Tracer:

Using a signal tracer is quite simple. A signal source is input to the 'device under test' (DUT). For a receiver, a modulated RF signal generator, or even a local radio station will work. For an audio device, a record, tape, or other audio signal is used. The DUT is then probed one stage at a time. Thus it is easy to find which stage is malfunctioning, whether it is a total loss of signal, distortion, noise or low gain. For example, to troubleshoot a super-heterodyne shortwave receiver, first apply a known RF signal. When the RF probe is placed on the grid (or base) of the RF amplifier stage you should hear the signal. The probe is then moved to the plate (or collector) of the RF stage and the signal checked again. If the stage has gain you should notice it by the indicator and the increase in signal volume. This procedure is repeated in the mixer stage(s) and subsequent IF stages. At the detector stage the audio probe is used instead of the RF probe and tracing continues. A sudden loss of signal or other problem tells which stage or interstage coupling is at fault. From there it's usually a simple matter to measure voltages and find the component that is faulty.

Heathkit IT-12 Features:

The Heathkit IT-12 has a few additional features that add to its capability. External terminals are available for the speaker and the primary output transformer. Front panel switches isolate the speaker and transformer so they can be used for substitution in the device under test. The speaker is handy for radios that don't have built-in speakers.

A second feature that is very handy is the NOISE feature. Sometimes components get noisy and this can be very difficult to trace. After you determine the stage where the noise is originating using regular tracing techniques, the DUT is turned off and the noise feature on the IT-12 is turned on. This puts about 140 VDC (current limited) on the probe. When touched to a component in the DUT a single click is heard in the speaker of the IT-12. If the

component being probed is intermittent or breaking down, the noise is continuous and that component needs to be replaced. This method can even detect cold soldered joints.

Heath Signal Tracer History:

To get an idea of what a valuable troubleshooting device the signal tracer is, Heathkit introduced their first model, the T-1 in May of 1948, and continued to manufacture updated models until Heath went out of the kit business in the early nineties.

Heathkit T-1:

The original Heathkit T-1 uses three octal tubes: a 6SJ7 audio amplifier, a 6K6 audio output and a 6X5 power supply rectifier. The RF probe contains a crystal diode and connects to the T-1 by banana plugs. The original T-1 cost \$19.50 and remained in production for eleven months until April of 1949, when it was replaced by the T-2.



Heathkit
SIGNAL TRACER KIT

Shipping wt. 10 pounds.

Let a Heathkit Signal Tracer do the tedious watching of intermittents while you go on to other profitable jobs. Follow the signal from the antenna to the defective part in a matter of seconds. Triples the repairs per man in many shops. A Heathkit Signal Tracer Kit pays for itself in a matter of days of operation. Locates faults immediately. External amplifier available for speaker testing and internal speaker available for amplifier testing. Connection for VTVM on panel allows visual tracing and gain measurements. Also tests phonograph pickups, microphones, PA systems, etc. Frequency range to 200 Mc. Complete ready to assemble. 110V 60 cycle transformer operated. Supplied with 3 tubes, diode probe, 2 color panel, all other parts. Easy to assemble, detailed blueprint and instructions.

\$19.50
Nothing ELSE TO BUY

Ad for the Heathkit T-1 from an October 1948 Heath flyer

Heathkit T-2:

The T-2 is similar to the T-1 except it uses a 6SH7 audio amplifier tube and has a multi-position switch that allows numerous different matching impedances when using the speaker output transformer externally. The cost remained \$19.50. It remained in production until October of 1952 when it was replaced by the T-3.

Heathkit T-3:

When Heathkit introduced the T-3 Signal Tracer in 1952 they made many significant changes that brought the tube count up to five. The 6X5 remains as the power supply rectifier. The rest of the tubes were changed to 12-volt filament types. The 6K6 audio output tube was changed to a 12A6 and the 6SH7 audio amplifier to a 12SH7. The T-3 has separate inputs (and probes) for audio and RF. The RF section has an additional stage of gain using a 12C8 tube. On the T-1 and T-2 there is no visual indication of signal level; however they have jacks where you may connect a VTVM. This changed on the T-3 with the addition of a 1629 "Magic Eye" tube. The 1629 was used in the WW-II Command Set transmitters and was very common and inexpensive on the surplus market at that time. The eye-tube provides indication of relative signal strength. The T-3 also has an unusual feature. It can measure the power consumption of the DUT. The device is plugged into a special AC outlet on the T-3 and turned on. Once the device warms up, a control on the T-3 is adjusted until the eye just closes but does not overlap. The power consumption of the DUT can then be read on the scale of the control. The 12C8 RF amplifier doubles as a diode for the wattmeter function. The added features of the T-3 raised its original price to \$22.50. The T-3 remained in production until the end of 1957 when it was replaced by the T-4.

Heathkit T-4:

The T-4 was a totally new design. The price of the T-4 dropped back below \$20 and it remained in production until 1962 when it was given a new cabinet color scheme and renamed the IT-12. Other than the new case the two circuits are identical.

Heathkit IT-5283:

In Early 1978 Heathkit stopped production of the IT-12. In its place they introduced a line of five solid-state low-cost test equipment pieces that run on batteries or a common power supply. This is the 5280 line and includes the IG-5280 RF Oscillator, IB-5281 RCL Bridge, IG-

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5282 Audio Oscillator, IT-5283 Signal Tracer, and IM-5284 Multimeter. When Heathkit went out of the kit business only two of these kits were still being made, the audio oscillator and, showing its versatility, the signal tracer. Near the end the IT-5283 sold for \$59.95. up some from its original \$42.95 price.

The Heathkit IT-12:

The IT-12, and its electrically identical predecessor the T-4, was the first in the signal tracer line to use miniature seven and nine pin tubes (except for the 1629 eye-tube). A 50 ma selenium solid-state rectifier replaces the rectifier tube. The IT-12 uses a single probe with an RF - AF switch. As in the T-3, 12-volt filament tubes are used. This is driven by the 1629 having a 12-volt filament. The IT-12 uses three tubes, the 1629, a 12AX7 dual triode that performs as two stages of cascaded audio amplification, and a 12CA5 audio output tube.

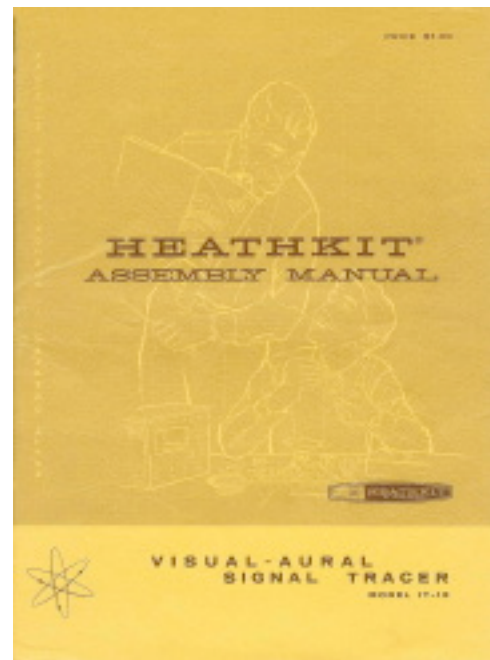
Front panel controls are few and simple. A two position rotary switch selects OFF/ON. In the OFF position the primary of the output transformer is isolated from the power supply so the transformer may be used as a substitute transformer. (Many older consumer devices have their speaker and occasionally their output transformer mounted to the cabinet so when the chassis is removed from the case they are not present on the chassis). A LEVEL control adjusts the gain of the audio amplifier. A SPKR slide switch disconnects the speaker from the internal transformer so it can be used as a substitute speaker. A NOISE slide switch places DC voltage on the Probe tip (Audio Position only) for checking components. Another slide switch on the probe, AUDIO/R.F. switches in or out the crystal detector circuit in the probe. Five binding posts are located on the front panel. Two connect directly to the speaker, and three, marked B+ CT and P, connect to the three primary leads of the audio output transformer. Other front panel items are the 3-1/2 inch speaker and "Magic Eye" display tube.

The IT-12 may be used with transistor circuits

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with one warning. The noise circuit can damage solid state and low-voltage components if used indiscriminately. However many components may be checked if one end is disconnected from the circuitry prior to the check. The manual gives recommendations for doing this.

The IT-12 originally sold for \$19.95. When discontinued at the end of 1977 the price had risen to \$34.95.



Summary:

This is a very versatile piece of test equipment for people troubleshooting receivers and audio electronics. Long after Heathkit became history, its simple signal tracers remain a common tool for repairing communications receivers and audio circuits and devices.

73, from AF6C



Remember if you come across any old Heathkit Manuals or Catalogs that you do not need, please pass them along to me.

Thanks - AF6C

This article originally appeared in the October 2008 issue of RF, the newsletter of the Orange County Amateur Radio Club - W6ZE.