UNIVERSITY

Model AST Supertracer

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MODEL AST "SUPERTRACER"

PURPOSE: This instrument has been designed to facilitate the rapid location of faults when servicing radio receivers, amplifiers and similar equipment. It's function is to trace the signals throughout the receiver from the aerial terminal right to the loudspeaker. Any fault which renders a receiver inoperative is then easily detected as being between the point at which it is inaudible. In a similar fashion, the point at which hum or distortion is introduced is indicated. Thus it is possible in a very short time to determine the stage or group of parts in which a fault exists. Once this has been done, it is a simple matter, with the aid of the V.T.V.M. section of the instrument, to locate the faulty component.

The V.T.V.M. section of the instrument may be used quite independently of the tracer section for A.C. and D.C. voltage measurements in all types of electronic equipment. In addition, the provision of a calibrated attenuator in the tracer, in conjunction with the V.T.V.M. makes possible the measurement of the gain of individual stages in a receiver.

GENERAL DESCRIPTION: The "University" Supertracer comprises a two stage, plate tuned, radio frequency amplifier followed by a diode detector and then a two stage audio amplifier driving a 5 inch loud speaker. An A.C./D.C. electronic voltmeter is included to measure the relative strengths of the signals being traced in the R.F.-I.F. and audio sections of a receiver under test. The voltmeter also has a separate input jack to permit it to use a general purpose A.C. or D.C. voltmeter. Three separate test leads are provided for various applications. *The lead with the red prod is for R.F. use only;* it has an extremely small condenser built into the tip and thus will not appreciably upset the tuning of any resonant circuit to which it is applied. *The lead with the black prod is for use on direct voltage measurement only.* This lead has a high resistance to the tip. and can also be applied to tuned circuits of all types without appreciable detuning.

The remaining control is a switch to silence the speaker. When the speaker is turned off, a resistive load is connected in it's place so that the characteristics of the audio amplifier are not disturbed. The A.F. amplifier and V.T.V.M. may thus be used to indicate small A.F. or hum voltages of the order of a few millivolts by feeding the voltage into the "Low Audio" jack and turning the V.T.V.M. selector to A.F. output, obtained from the "High Audio" jack, by operating the tracer from an aerial or oscillator, to be used to testing loudspeakers. *The green test lead should be used to convey signals from the "High Audio" jack to one end of the primary winding of the loudspeaker's input transformer,* while *the other end of the primary is connected to the earth terminal of the tracer.* Of course, if the speaker being tested is of electrodynamic type, it's field coil must be energised.
At the bottom left is an earth terminal, - this should be connected by means of the lead provided to the chassis of the receiver under test.
The four input jacks are in line with the earth terminal and from left to right are R.F. input, V.T.V.M. input, Low Audio and High Audio. *The "Low Audio" jack is the normal input channel to the audio amplifier* and *the "High Audio" jack provides output for testing speaker, headphones, etc.*

Valve Types: The valve types and positions are as follows:

1st R.F. Amplifier:	6SK7GT/G left rear of chassis
2nd R.F. Amplifier:	6SK/7GT/G right rear of tuning condenser
Detector & 1st Audio Amplifier	6SQ7GT/G rear of meter
V.T.V.M. tube	6B6/G right front
Audio power tube	Right centre of chassis 6V6GT/G
Rectifier	5Y3GT/G right rear of chassis

V.T.V.M. ADJUSTMENTS:

There are three screwdriver adjustments in the meter circuit, which may require to be changed if ever the 6B6/G V.T.V.M. tube is replaced. Their location and purpose is as follows:

The one closest to the first 6SK7GT/G tube is to adjust the sensitivity of the meter on D.C. The adjustment is made by first adjusting the pointer to zero, at the centre of the scale, by means of the control on the front panel and then applying an accurately known voltage of 5 volts between the tip of the black probe and the earth terminal. The sensitivity control is then adjusted until the meter pointer registers correctly at the right hand end of the scale. The zero adjustment should then be checked and re-adjusted if necessary. The known voltage is applied again and a further slight adjustment made if necessary.

The potentiometer nearest to the 5Y3G tube may be used to correct the sensitivity of the alternating voltage ranges by the application of an accurately known alternating voltage of 5 volts at any frequency between 30 and 1000 cycles per second, employing a technique similar to that described above for direct voltage adjustment, excepting that the *green* probe is used.

The potentiometer in front of the alternating voltage sensitivity control is for the purpose of adjusting the pointer to the zero position on the alternating voltage scale. After having previously adjusted the D.C. zero position, by means of the zero adjuster on the front panel, with the V.T.V.M. selector switch on D.C., the selector switch is turned to A.C. and the control employed to bring the pointer to the A.C. zero. During this adjustment, the test prod should be connected directly to the earth terminal. As a result of this adjustment, the pointer should move directly from the D.C. zero to the A.C. zero position when the selector switch is turned from D.C. to A.C. without any re-adjustment of the zero control on the front panel.

Due to the fact that the D.C. voltmeter is of the centre zero type, no reversal of leads is necessary to measure voltages that are negative with respect to earth, such as A.V.C. and back bias voltages.

OPERATION:

Before commencing to trace signals through a receiver of any type, there is one important test that should be made. This is to switch both receiver and "Supertracer" on and check the H.T. voltage of the receiver with the V.T.V.M. If there is no H.T. voltage in the receiver, this may indicate a short circuit which will overload and damage some of the components in the power supply section. Any attempt to trace signals in a receiver with a fault of this nature is, of course, useless.

Presuming that the H.T. voltage is present, and reasonably close to the correct value, tracing can be proceeded with in the normal manner. With the receiver connected to an aerial which is known to give fairly good signals, start at the aerial terminal with the tracer as follows. Set the receiver dial to the frequency of a local station of good strength. Set the "Supertracer" to the same frequency, and the R.F. multiplier to X1000, with the A.F. gain control well advanced. When the probe is placed on the aerial terminal, the station should be heard in the loudspeaker. Next move the probe to the control grid of the converter tube in the receiver where the signal should be stronger. At this point, retune the receiver dial. Any large variation here will indicate that the receiver needs re-alignment of it's tuned circuits.

Next tune the tracer to the intermediate frequency of the receiver, and apply the probe to the plate of the converter tube. The signal now should be somewhat increased in strength. Also, by tuning the receiver other signals should be audible at the correct points on the dial. If the signal should now be too strong it may be reduced by tuning the R.F. multiplier back to X1000. This means that a signal ten times the strength will now give the same indication on the tracer.

The R.F. probe should now be applied to the grid of the I.F. amplifier tube. The signal here should be somewhat weaker than at the previous plate due to the slight loss that takes place in the I.F. transformer. The next point to test is the plate of the I.F. amplifier tube where the signal will be greatly increased in strength and a further decrease in sensitivity, by turning back the "R.F. Multiplier", may be necessary. The only other point to test with the R.F. probe is the diode plate of the detector tube. At this point, the signals will be somewhat weaker than at the I.F. tube's plate. In continuing to trace the signals through the A.F. stages of a low receiver the A.F. – A.C. (green) probe plugged into the "Low Audio" jack should be used, and the volume control of the receiver advanced slightly so that some audio will be fed from the R.F. end of the set into the audio amplifier. The same procedure should be adopted in the audio end of the receiver as in the R.F. – I.F. section. The A.F. gain control will now allow the reduction of the signal strength to a suitable value.

The above procedure applies to a receiver with A.V.C.. If the receiver is without A.V.C. the manual control should be advanced to a point where satisfactory signal strengths are obtained in the receiver with the tracer applied.

MEASURING STAGE GAIN:

In addition to judging the performance of the receiver by means of the sounds produced by the tracer's speaker, the V.T.V.M. will provide an indication of signal strength by turning the V.T.V.M. Selector to "R.F." for R.F. tests and to "A.F" for audio frequency tests. A little experience will soon enable one to judge whether the receiver's stage gain is normal or not. The gain of a stage may be measured by measuring the strength of signal at the grid of one tube and then applying the probe to the grid of the following tube. The R.F. multiplier should then be operated to reduce the voltage applied to the V.T.V.M. to approximately the same order, and the ratio of the voltage readings multiplied by the factor introduced by the R.F. multiplier will correspond to the stage gain.

LOCATION OF FAULT:

If signals appear, as expected, up to a certain point in a receiver, and then are absent, or extremely weakened at the next point tested, a fault must exist between the two points. If signals are detected at the grid of the converter tube and no signals at intermediate frequency exist at it's plate, the oscillator action should be tested at the oscillator grid by tuning the tracer to a frequency higher than the signal frequency by the amount of the I.F. and observing the strength of the oscillator frequency by means of the R.F. multiplier setting and the voltmeter reading.

Alternatively, the V.T.V.M. alone may be used to measure the rectified oscillator signal at the grid of the oscillator tube by turning it's selector switch to "D.C." and employing the black probe inserted in the V.T.V.M. input jack. The meter reading will correspond almost exactly to the peak value of the oscillator voltage. A.V.C. or A.F.C. voltages are also measured on the D.C. ranges of the V.T.V.M.

MISCELLANEOUS USES:

Many uses for the "Supertracer" will suggest themselves after a little experience. A few are listed below. Suspected by-pass condensers will have a signal appearing across them, and in cases where the receiver is oscillating, large R.F. signal voltages will appear across faulty condensers. Electrolytic condensers in cathode circuits of A.F. amplifiers may be tested in the same manner.

The point at which distortion or hum occurs in an audio amplifier is, of course, easily determined by tracing the signal along to the point where it becomes distorted or where the hum is detected.

A.F. signal voltages may be obtained from the tracer for the purpose of testing A.F. amplifiers, headphones or loudspeakers by applying an aerial to the R.F. input jack, tuning the tracer to a station, switching off the tracer speaker and taking either a weak A.F. voltage from the "Low Audio" jack or a stronger voltage from the "High Audio" jack.

RAPID FAULT LOCATION:

Under normal circumstances, the red, black and green test leads will be left plugged into the R.F., V.T.V.M. and Low A.F. jacks respectively and left lying on the bench ready to be quickly picked up and applied to appropriate points in a receiver. Thus the signals may be traced through a normal set, and the various plate, screen grid, bias and A.V.C. voltages checked in a period of a few minutes.

The V.T.V.M. is ideal for use as an output meter, during alignment of a receiver, because it is overload-proof and cannot be damaged by the accidental application of excessively strong voltages. This feature applies to all V.T.V.M. applications. The V.T.V.M. may be used for voltage measurement at the same time as the R.F. or A.F. section is being used to trace signals. Thus checks may be made simultaneously at two separate points in a receiver. This will be found to considerably facilitate the location of intermittent faults found.