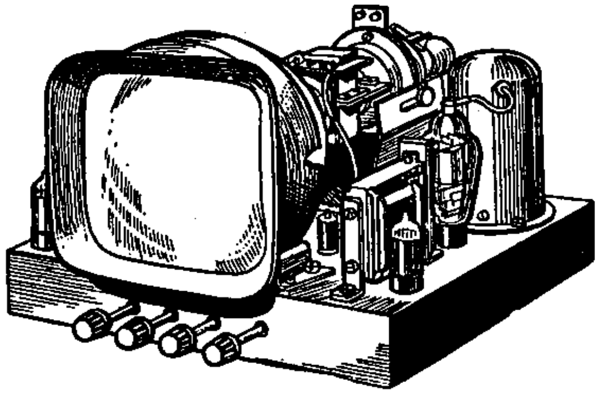
9 April 1955 WIRELESS AND ELECTRICAL TRADER 91

TV TECHNICAL FORUM



TeleVet Comprehensive TV Tester

THE suggestion of combining in a single instrument a crystal calibrated signal generator with a finely graded vernier scale, a wobbulated signal generator with crystal-controlled 5 Mc/s marker pips, a television pattern generator, an audio frequency oscillator, an oscilloscope, a D.C. valve voltmeter for H.T. and E.H.T. measurements, an A.C. valve voltmeter reading from 0.2 V to 400 V at frequencies of 50 c/s to 10 kc/s, and an output meter, conjures up a massive and elaborate piece of equipment suitable only for permanent installation in a workshop or laboratory and costing perhaps several hundred pounds.

Comprehensive Tester

Yet all these facilities are present in the TeleVet type 877 television tester, a portable instrument costing only 57 guineas (£59 17s). In addition, all connecting leads, with their associated terminations, attenuators, and matching pad, are permanently attached so that they cannot be lost, and they all fold away neatly into pockets provided for them in the end faces of the case.

It might be wondered how it is possible to provide so many very exacting facilities at the price, and whether the quality of the materials must be of a low standard and will not stand up to wear and tear. This question occurred to us, and we invited the makers to let us test one of these instruments in our laboratory.

The answer, we find, is that by singular ingenuity and improvisation, in which each section of the instrument is made to perform more than one operation, coupled with a low margin of profit, Airmec, Ltd., have found it possible to produce an instrument at the price which justifies their claims. It does all they claim for it and is well made.

The foundation of the instrument rests on an internal 2¾in oscilloscope and a standard type of signal generator. The latter covers two ranges of 8-70 Mc/s and 168-230 Mc/s. There is, however, no band-switching, the two bands being produced simultaneously by beating a variable oscillator against a fixed one. The frequency range of the variable oscillator is 88-150 Mc/s, and the fixed one operates at exactly 80 Mc/s. The sum and difference of the resulting beats produces the two ranges quoted.

The oscilloscope acts as the indicator for all measurements, A.C. volts, D.C. volts, output and wobbulation, and it can also be used as a conventional C.R.O. for a limited range of applications which are of particular use in TV servicing, having two time-base velocity ranges suitable for line frequency and frame frequency waveforms. It has a Y (vertical) amplifier with a gain of 50 times (maximum) handling D.C. and going up to 10 kc/s A.C.

Voltage Measurements

Voltage readings are obtained by using a calibrated Y shift control and "backing-off" the deflection of the trace. The control consists of a stepped Y gain amplifier control and a variable Y shift control. The trace is first pre-set to a calibration line, and then deflected by the application of a test voltage; the reading is derived from movement of the controls necessary to bring the trace back to the calibration line. Polarity is indicated by the deflection, which is upwards for positive and downwards for negative.

For A.C. voltages the trace, which is a horizontal line, broadens vertically into a band of light. It is measured by using the shift control to level first the bottom of the band, then the top of the band, with the

(Continued overleaf)

calibration line, the movement of the calibrated controls again providing the reading, which is, of course, the peak-to-peak value and must usually be converted by calculation to R.M.S.

Signal Generator

As a signal generator, the frequency ranges cover Band I and Band III and all associated intermediate frequencies. Three oscillators are used: the variable oscillator, which is controlled directly by the calibrated tuning scale and tuning knob; the fixed 80 Mc/s oscillator with which the variable oscillator beats to produce the two ranges covered; and the crystal oscillator which provides 5 Mc/s beats with both of the others. In addition there is a square wave generator which is used for the test pattern and A.M. sound for A.F., and a time-base generator for the C.R.O.

The calibration of the main tuning scale, which is marked off in Mc/s, is only approximate, and it is supplemented by a 360 degree vernier scale, divided into 180 divisions, with a gearing ratio of 6:1. With this and the crystal oscillator the calibration can be set with a very high degree of accuracy, although the process involved is rather tedious and must be repeated each time the signal generator is used or tuned to a new frequency.

The wobbulator system employs the same signal generator oscillators, but a vibrating reed attached to a capacitor vane wobbulates the frequency of the fixed 80 Mc/s oscillator by approximately ± 6 Mc/s giving a 12 Mc/s sweep, which can be adjusted if required to a smaller frequency sweep by restricting the amplitude of the vibration. The reed is driven magnetically from the mains, and the C.R.O. time-base is mains driven, so they both operate from 50c/s A.C.

Calibrating Crystal

Accuracy of calibration of the signal generator depends upon the crystal oscillator and the accuracy of the setting of the fixed 80 Mc/s oscillator. The fixed oscillator frequency is first reset by beating it against the sixteenth harmonic of the 5 Mc/s crystal, and the setting is very critical, often becoming off-set as the fingers leave the "Calibrate" control knob. Output leads from the TeleVet are connected to the volume control of the receiver, and the set speaker acts as the beat detector, producing a kind of whistle from the beat.

The variable oscillator is then calibrated against the crystal, the beat again being heard in the speaker of the set. This operation can be rather tedious, and it holds only over a small section of the tuning scale. The procedure is to find two 5 Mc/s beats, one either side of the required frequency as read off on the calibrated tuning scale, and note the reading for each on the 180-division vernier scale.

If the difference between the two vernier readings is, for the sake of example, 35 divisions, then 35 is divided by 50 (because there are 50 100 kc/s steps in 5 Mc/s) and the vernier is thus calibrated in 100 k/cs steps, 100 kc/s equalling $\frac{35}{50}$. The required frequency is then regarded in terms of 100 kc/s steps from the nearest 5 Mc/s beat. Suppose the required frequency to be 41.5 Mc/s, then the 5 Mc/s beats will be at 40 Mc/s and 45 Mc/s, and 40 Mc/s will be the nearer. $40 + 1.5$ Mc/s $= 41.5$ Mc/s, and 1.5 Mc/s $= 15$ 100 kc/s steps.

Each 100 kc/s $= \frac{35}{50}$ vernier divisions, so that the vernier reading for 40 Mc/s, plus $\frac{35}{50} \times 15$ divisions must be the vernier setting for 41.5 Mc/s within very fine limits, which the makers claim to be better than 0.05 per cent. At a frequency that is an exact multiple of 5 Mc/s the accuracy is claimed to be as high as 0.02 per cent, provided that the fixed oscillator has not drifted.

Calibration Accuracy

The process just described is not difficult in any way, but it is irksome in the opinion of the writer in that it must be carried out separately for each section of the scale if the accuracy required is high, because the calibration accuracy of the direct tuning scale is claimed only to be ±1.5 Mc/s. It is inadvisable to calibrate several frequencies in advance in case any drift should occur in the 80 Mc/s oscillator before the later ones are used, so that apart from the need to recalibrate the scale each time the instrument is used as a signal generator, the alignment process itself might have to be interrupted while the calibration is checked again.

Nevertheless, the attainment of such a high order of accuracy is a facility that is not available in any commercial servicing signal generator not fitted with a crystal. In order to avoid spurious whistles the 80 Mc/s oscillator is muted during the calibration procedure, so that the frequencies at which the vernier divisions are read are actually in the 88-150 Mc/s range, but they remain equally correct when the 80 Mc/s oscillator is introduced again provided that its frequency remains constant.

We found in our tests that the number of vernier scale divisions for 5 Mc/s varied in different parts of the tuning scale in our instrument from approximately 30 to 50, which explains why a separate check must be made at each part of the scale that is used.

(*Continued on page* 94)

TV Technical Forum

(*Continued from page* 92)

Our sample actually covered 5 Mc/s in 31 divisions at 40-45 Mc/s, and 52 divisions at 60-65 Mc/s, to quote the scale readings. We could change the frequency by approximately one vernier division (about 60-100 kc/s) by adjusting the output attenuator setting.

The Wobbulator

When the wobbulator facility is used the reed vibrates and frequency-modulates the 80 Mc/s oscillator. Three marker pips appear on the horizontal trace on the C.R.O. screen, one at the centre and one near each end, generated from the beats of the 5 Mc/s crystal with the 80 Mc/s oscillator, the centre one representing the frequency of the signal generator output.

Unfortunately these are visible only while the C.R.O. trace is set up, and they form calibration points which can be set against a vertical marker line on the tube mask, but they disappear when the response curve is present. They are used by synchronizing the central pip with the vertical line, and any point on the response curve can be identified by changing the signal generator frequency so that the response curve moves across the screen.

When the point under inspection and the frequency of the signal generator coincide, the point in question is in line with the vertical line and, therefore, with the central marker pip. The two outer pips indicate accurately points 5 Mc/s either side of the central frequency. Our time-base was not quite linear, and our end marker pips were not equally spaced physically from the centre. Further, if the deviation control was altered, the central marker pip moved away from the vertical marker line.

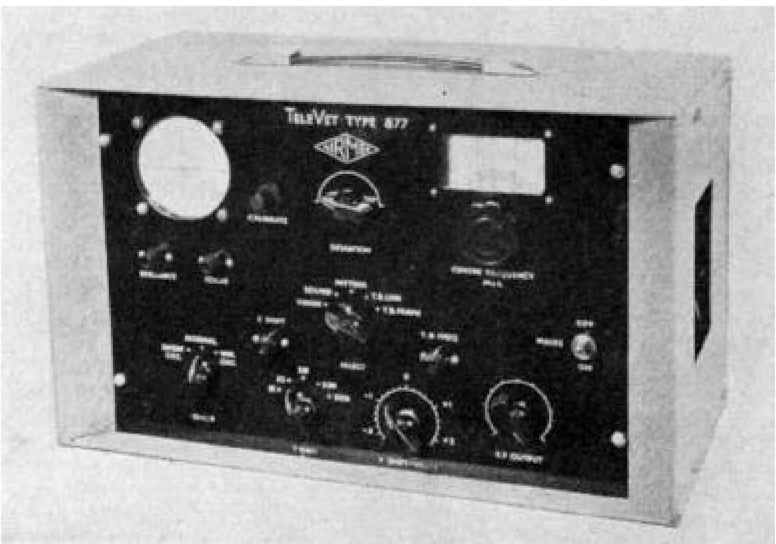
One slight drawback to the vibrating reed method is that it remains in circuit in the 80Mc/s oscillator tuning circuit when it is not being vibrated, and any vibration of the bench such as the dropping of a pair of pliers or a hammer, or even of anybody walking by on a wooden floor that has a loose board or is not thoroughly firm, sets it vibrating slightly and wobbulates the signal. Another small disadvantage is that it produces an unpleasant audible buzz.

The pattern generator facility operates on the principle of interrupting the R.F. carrier to produce a pattern of black and white bars. There are no front and back porches, but there is a modulation suppression of 14 lines at 100 c/s intervals to provide frame sync and a black horizontal line at the centre. This is synchronized with the mains frequency and permits approximate adjustments of line hold, frame hold, height and width to be performed. It can be applied to the receiver only on a carrier, and not as a video signal.

Accessibility

We found some difficulty in getting the input and output leads from the instrument to their connecting points in the receiver. They emerge from opposite ends of the instrument, and when one end is near the set the other faces away from it. The best position for the instrument, we found, was over the set, and this had the advantage of lifting it up to eye-level, where the scale is easier to read.

(*Continued on page* 96)



The appearance of the Airmec TeleVet television tester is seen in this photograph, which was taken from our sample instrument. Its many facilities result from ingenious multi-circuit switching, controlled by a 5-position knob seen at the centre of the panel and a 3-position knob seen at the bottom left-hand corner. At top left is the C.R.O. screen, and at top right the tuning scale, which is illuminated. The "Calibrate" knob just on the right of the C.R.O. screen is the 80 Mc/s tuning control. The size of the case is 15½ x 9¾ x 8¼ deep, and the weight is approximately 25 lb.

TV Technical Forum

(*Continued from page* 94)

The tuning scale is set rather far back, and at bench level it disappears beneath its escutcheon so that it is necessary to stoop fairly low and then look upwards to read it, but we understand that something is being done to improve this.

Practice Necessary

Despite certain criticisms we have voiced here concerning the operation of this instrument, there can be no doubt that it will do most of the things that are necessary in television service work provided that its user is prepared to go to a little trouble to familiarize himself with it. The greatest drawback we found was that practically all of its indications or readings are obtained indirectly.

Voltage readings are obtained only after adjusting two or three range-setting controls, and the value indicated is then calculated by multiplying the Y shift reading by the Y gain reading and then multiplying that by the probe setting (if necessary), with still another factor of 2.83 : 1 to convert peak-to-peak readings to an R.M.S. value if the reading is A.C. The frequency range is very wide, however, and D.C. readings can be made up to 20 kV. The accuracy falls off above 5 kc/s.

As an output meter the C.R.O. trace again acts as the indicator, and in addition to wobbulator alignment, the conventional spot frequency method can be used, the height of the deflection of the trace providing the output indication. We found only one essential alignment operation that cannot be carried out with this instrument, and that was the accurate adjustment of the rejector circuits. It might be possible, but we could not do it.

Sound Rejection

This cannot be performed properly by the wobbulator method, and it requires a very accurate I.F. signal of good strength and a sensitive indicator, so that the point of maximum rejection can be determined without ambiguity at the rejection frequency, where the signal output is almost completely suppressed. With the TeleVet, which is undoubtedly the lowest priced instrument in which such an accurate I.F. signal is provided for the rejection frequency, we could not obtain a sufficiently sensitive output indication to detect a response at the rejection frequency, although this could be overcome probably by using a sensitive meter externally.

When you are in the fortunate position of having at your disposal a direct-reading meter for A.C. and D.C. voltages, E.H.T. voltages, a separate signal generator for spot frequencies, a separate one for wobbulation, another giving B.B.C. waveform for a test pattern and an oscilloscope that costs perhaps £100 by itself, the indirect methods used on the TeleVet to obtain readings appear a little irksome, but the fact remains that they can be obtained with it, and probably quite rapidly after a little practice, all with a single instrument of quite reasonable cost, and that must appeal to many dealers whose business does not warrant a large expenditure on servicing equipment.

Good Instruction Manual

The TeleVet is made by Airmec, Ltd., of High Wycombe, Buckinghamshire, and with it is included a most comprehensive and perfectly frank instruction manual of 65 pages which gives thoroughly detailed step-by-step instructions for every application. There is a full circuit description, a complete diagram and a list of components for servicing the instrument itself. About one-third of it is devoted to practical fault hints, explaining how the TeleVet should be applied to investigate given symptoms.