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A DIGITAL RECEIVER TESTER

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General Description

The purpose of this instrument was initially to measure digitally the output of the lunar occultation receivers, although the tester may be used for any receiver, punch, or printer. The punched-tape output may also be used to Fourier analyze receiver fluctuations.

A block diagram of the instrument is shown in figure 1.

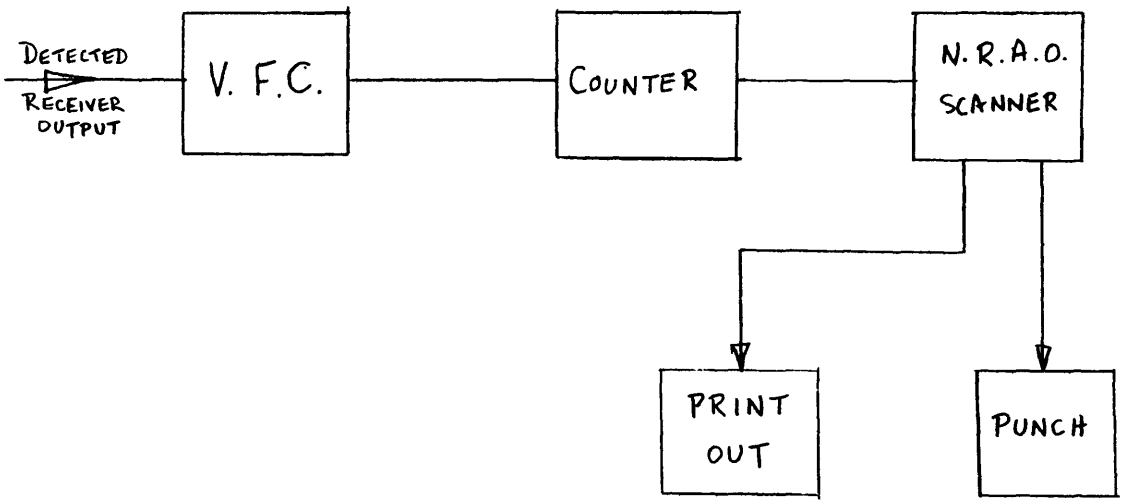

Figure 1

The detected total power output of a receiver is passed to a Dymec voltage-to-frequency converter, whose maximum output (for 1 V rms) is 10,000 pulses per second. To reduce sensitivity if the input rms voltage is too great on the 1 V range (> 200 mV, say) the 10 V or 100 V ranges on the VFC may be used, as appropriate.

The output pulses from the VFC are passed to a Beckman counter. This counter has been modified to give a maximum counting time of 199,999 seconds. The pulses will be counted for whatever time is indicated on the counter-set to the left of the counter front panel.

The output of the counter goes to a NRAO scanner 2, slightly modified for this purpose. The output from the scanner is in the form of punched paper tape or print-out.

Operating Instructions

Switch on power for VFC, counter punch and scanner power supplies. Switches 8 and 2 at the rear of the scanner should be down, while switches 4 and 1 should be up. Set "FUNCTION" switch on counter to "TEST". Set "DISPLAY" to approximately half-setting. Set N to 010000. The counter should now read 10000 at the end of each count, reset, and repeat its count to 10000 automatically.

The VFC selector switch should now be set to "CAL+", and the counter "FUNCTION" switch is set to "E/UTXN". With N set to (say) 009847 (or any number slightly less than 010000), the counter should display 98470. This is the number of 10 kHz pulses counted in 9.847 seconds when a 1 V DC level (CAL+) is applied to the VFC. If the displayed count is different from that expected, the "SENSITIVITY" control should be adjusted. When the correct display has been obtained the tester is ready for operation.

With the detected output of the receiver to the input of the VFC, set the right-hand switch on the scanner to "OPERATE", and the VFC selector switch to 100 V. If two (or more) zeros are the most significant figures punched and printed, set the VFC selector to "1 V"; if one zero occurs, set to "10 V". Adjust N for the counting (integrating) interval required.

The output punched and pointed represents

$$\left[\frac{P}{100\ N.S}\right] \quad \text{volts rms}$$

where P ≡ number punched and printed,

N ≡ setting on counter, in seconds (100000 represents 100 seconds), and

S ≡ setting of VFC switch.

Example: A count of 24138 on the tape, with the VFC set to 10 V (S = 10) and the integrating time of 100 seconds (N = 100), represents 0.24138 volts rms.

Important Note

Four precautions should be observed when using this tester:

1. The inherent input time constant of the VFC is very low, so a short CR should be used as pre-integrator for the VFC. This prevents the excessive voltage excursions from being too frequently limited by the VFC.

2. The correct input voltage range should be chosen. For example, rms voltages much above 0.2 V on the 1 V scale (or $> \frac{1}{5}$ of chosen voltage range) will overdrive the VFC frequently, and hence be limited at the VFC input. This in turn will give significant digital errors, although the amount of these errors will depend on the pre-integrator CR.

3. Care should be taken to avoid counter overflow. Since it is advisable to operate the counter slightly below its maximum count, this should only be a problem when large, slow total power fluctuations occur.

4. Since the maximum punch speed is 20 lines per second, five significant figures (and an end-of-line marker) may be punched approximately 3 times per second, permitting frequency components below 1.5 cycles per second to be obtained. The use of less digits entails slight modifications to the scanner.