

A grey scale test pattern generator for testing APT recorders

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सार — यहां एल्डन ए.पी.टी. अभिलेखों के परीक्षण के लिए एक सरल परीक्षण पैटर्न संकेत जनित का वर्णन किया गया है और उससे प्राप्त परिणामों को दिखाया गया है।

ABSTRACT. A simple test pattern signal generator for testing ALDEN APT recorders, is described and the results obtained are shown.

1. Introduction

TIROS-N series orbiting weather satellites transmit the earth imagery data to APT receiving centres at the rate of 120 lines per minute in serial format, the IR data first, followed by the visible data; the complete scan cycle lasts for 0.5 seconds.

The ALDEN facsimile recorder (Model 9273R) with its associated signal processor (Model 9310D) has the facility to reproduce the IR and visible portions of the weather picture (labelled as CH. A and CH. B respectively) side by side in a reduced size picture format or either of them as selected by the operator, as a full width picture.

A mosaic grey scale generator is a useful instrument for assessing the marking and signal-to-image transfer characteristics of the APT recorder. A simple unit designed by the authors when used with the ALDEN APT recorders generates 8 shades of grey between full white and full black, twice during each scan line. The test instrument and its functioning are described below.

2. Test pattern generator

2.1. Design logic

The objective was to design a grey scale pattern generator with a convenient number of shades of grey from white to black. As it is the amplitude modulation on the subcarrier of the APT signal (2400 Hz) which causes different shades of grey in the recorder, it stands to reason that any test generator to achieve the objective stated above, should provide a 2400 Hz sine wave signal whose amplitude is sequentially stepped up from near zero (white level) to a defined level (black level) at precisely defined time intervals, the whole cycle lasting for the duration of half a scanline, i.e., 0.25 sec. This cycle repeats not only during the second half of the scanline but for the successive lines as well. In order that the final pattern which emerges, displays 8 sharp

vertical strips of the grey scale with the dividing edges between different shades sharply defined and straight, as well as at the commencement of the cycle, the amplitude stepping sequence has to be precisely timed and also synchronized to the commencement of each scanline in the recorder.

2.2. Description of the instrument

Fig. 1 shows the simplified block diagram of the test pattern generator. A stable 2400 Hz square wave signal is utilised as a precision time reference by dividing it successively by 15 & 5 and operating a 4-bit binary counter. The binary counter is operated as a 3-stage counter, giving a count cycle length of 'divide by eight', time duration of the cycle working out to 0.25 sec. It will be noted that this is the length of the IR or visible scan. The "B.C.D. outputs" of the binary counter are used as switching inputs to a CMOS analogue switch which controls the value of a feedback resistance of an operational amplifier IC 1. The binary count, the value of the feedback resistance in the circuit of IC 1 and the gain of the latter are given below :

Binary/count	R_f in K Ohms	Signal gain
000	80	8
001	70	7
010	60	6
011	50	5
100	40	4
101	30	3
110	20	2
111	10	1

The 2400 Hz square wave signal is also converted to a pure sine wave by means of an active low pass filter. The 2400 Hz sine wave signal simulates the APT sub-carrier.

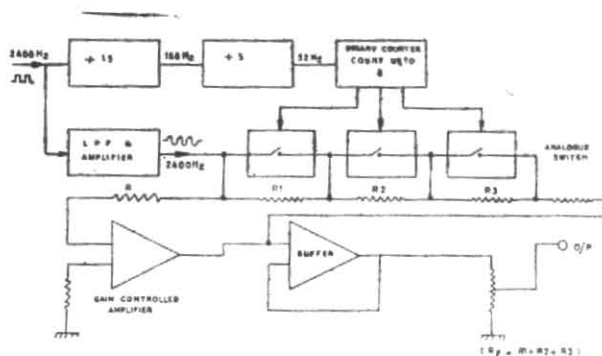


Fig. 1. 8-step grey pattern generator

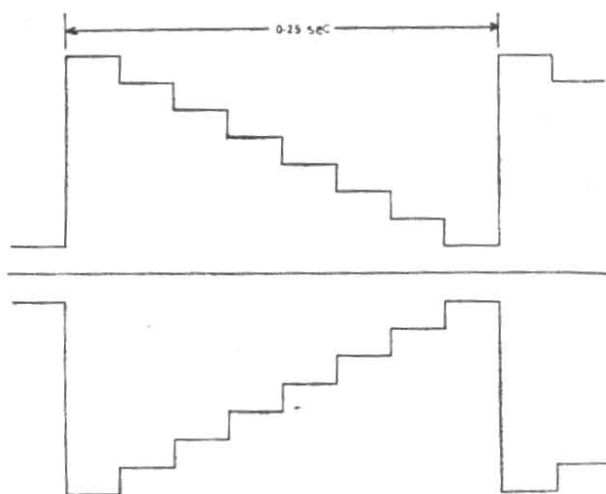


Fig. 2. Envelop of the 2400 Hz test signal

A fraction of this signal is fed to the operation amplifier IC1 whose gain is controlled in the manner described in the earlier para. The output of this amplifier after passing through an unity gain buffer amplifier, is used as the test input signal to the APT recorder. The potentiometer at the output of the buffer is used to set the black level.

In practice, a stable 2400 Hz square wave signal readily available in the ALDEN recorder chassis may be utilised as the input to the test instrument described, as this signal is also used as the synchronizing signal for the scanline.

The test instrument operates on a self contained regulated power supply with the various D.C. voltages required for the circuit.

2.3. Results

The output wave-form from the test unit described above is shown in Fig. 2. The wave form is a 'Stepped wave-form' and each step corresponds to different intensity in the grey scale. The maximum amplitude produces black level which successively becomes lighter in blackness at each step and finally becomes white at minimum amplitude. The test pattern produced by the "Pattern Generator" with ALDEN APT recorder on 120 r.p.m. is shown in Fig. 3. When the recorder is switched to 240 r.p.m. the signal processor selects only

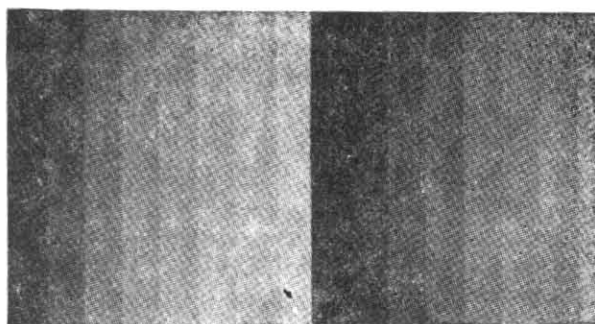


Fig. 3. Photograph showing the grey pattern obtained from ALDEN APT recorder at 120 rpm

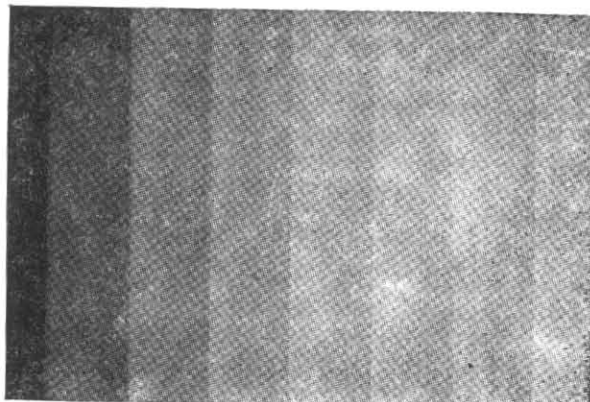


Fig. 4. Photograph showing the grey pattern obtained from ALDEN APT recorder at 240 rpm

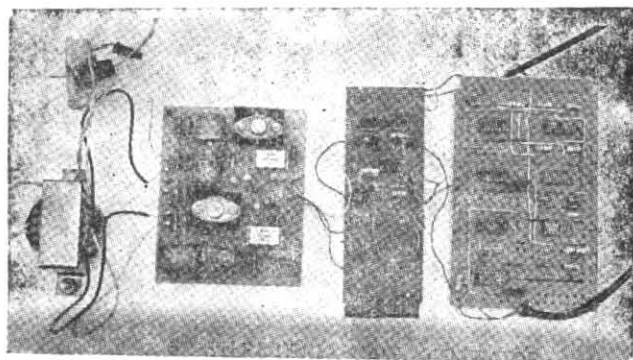


Fig. 5. 8-step grey scale generator

half of the scanline and, therefore, only one set of 8 shades are obtained across the full width of the scan for obvious reasons. This is shown in Fig. 4. Figs. 3 and 4 are the reduced form of actual test patterns obtained from APT recorder.

3. The grey scale pattern generator besides being useful for adjustment of the recorder controls for best picture reproduction, can also be used as a servicing instrument to check faults such as instability in the rotation speed of the recorder which manifests as a skewed test pattern, sloping to the right or left. The assembled instrument (Fig.5) costs less than Rs. 1000.