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# video pattern generator

**TV technicians often make use of a video pattern generator to help set up television sets quickly and simply. Pattern generators (normally) produce a video signal which complies with CCIR standards. The video information itself is usually quite simple. The patterns consist of lines, dots and bars, or a combination of them. Design and construction of high quality video pattern generators is not an easy task for the amateur, but if 'reasonable' quality is acceptable there is no need for the TV enthusiast to go without.**

The original circuit of the video pattern generator (see Summer Circuits issue 1979) has been slightly modified and a printed circuit board has been designed for it. The pin numbering of the various gates has been altered, mainly to simplify the layout on the board, and of course the modifications published in October 1979 have been incorporated.
To give a clearer indication of how the unit works, the circuit diagram has been divided into four sections which each carry out a certain function. Block A takes care of the synchronisation pulses. Block B provides the sound output and grey scale circuitry. Block C contains the logic required to produce the various patterns and block D comprises the video stage.

## Sync generator

The crystal oscillator formed around N3 provides a 1 MHz signal which is divided by IC14 to produce the required 250 kHz input signal. This is then further divided by IC1a to obtain the line frequency (15,625 Hz). The field frequency is produced from the counters IC1b, IC2a and IC2b which twice divide the line frequency (31250 Hz) by 625 to give the required 50 Hz. These counters also control three timers (IC3b, IC4a and IC4b) which, after being triggered by IC3a (the front porch delay), provide the line sync pulse, the field sync pulse and the equalisation pulses. The enable signal for IC3b is also gated with the 12 $\mu$s line blanking pulse (from N4) to ensure correct synchronisation with the line frequency. The flipflop N11/N12 produces the field blanking interval and is reset after every 25 lines. The blanking pulses and the output from the pattern generator are gated by N9 to provide a blanked video drive to the mixer stage.

## Sound output

The sound output circuitry consists of little more than a divide-by-sixteen counter, IC12a. This produces a tone of 977 Hz from the line frequency. The amplitude of the output signal is attenuated by R12 and P1 and filtered by C7 to produce a more pleasant sound.

## Grey scale

The grey scale is produced by a gated oscillator constructed around N2/N9 and a binary counter IC12b. During line and field blanking intervals the oscillator is inhibited and the counter is reset to zero to ensure that each new line is correctly positioned. The outputs of the counter are inverted by N30 . . . N32 to give a descending grey scale. The grey scale is selected by taking the other inputs of these gates high, in other words by operating switch S1.

## Pattern generator

The pattern generator (section C) produces eight basic black and white patterns from which a choice can be made with the aid of a rotary switch.

### Vertical lines

The Q1 output of the grey scale counter (IC12b) is connected to N19 which generates a short output pulse at each transition of the input signal. In this way, fifteen vertical lines are produced.

### Horizontal lines

A horizontal line is produced after every 20 TV lines at the output of the flipflop N15/16. The gating on the input ensures that it is one TV line long between the line sync pulses. Fourteen horizontal lines are thus produced.

### Crosshatch

For this signal the horizontal and vertical lines are simply ORed together.

### Dots

These are produced by ANDing the horizontal and vertical lines together.

### Vertical bars

This is the output of the grey scale oscillator (N2 and N29) and gives sixteen vertical bars.

### Horizontal bars

The Q3 output of the field counter (IC12a) gives thirteen horizontal bars.

### Chessboard

By connecting the horizontal and vertical bar signals to the EXclusive NOR gate N20 a chessboard effect is produced.

1

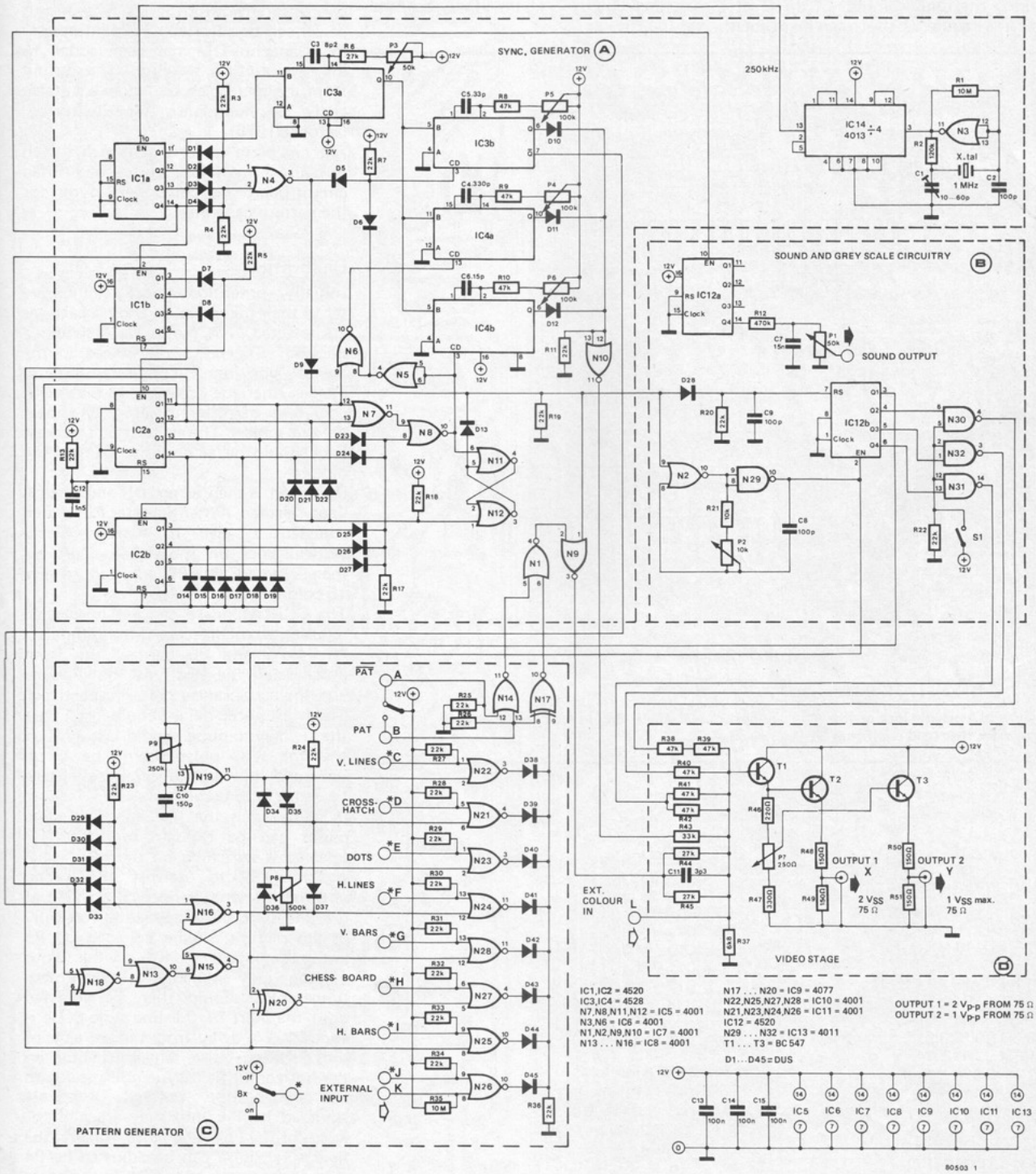


**Figure 1. The complete circuit diagram of the video pattern. It is divided into four sections for clarity. A UHF/VHF modulator can be connected directly to the output of the video stage.**

**External**

Provision has been made so that an external pattern signal can be connected to the system via gate N26.

As can be seen, the eight patterns are connected to gates N21 . . . N28. By taking the unused inputs of these gates low the required pattern can be selected.

Gates N14 and N17 allow the choice between 'normal' and 'inverted' patterns. The number of patterns can be extended by selecting several basic patterns together (vertical lines with horizontal bars) or more complex patterns can be produced by utilising the binary outputs of IC12b.

2

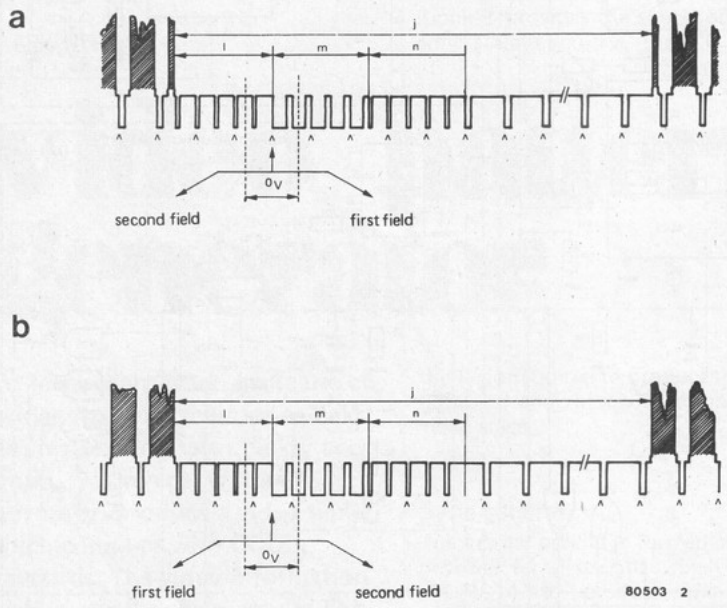


**Figure 2. A general idea of what the composite video signal should look like. Figure 2a shows the first field and figure 2b the second.**

**Parts list:**

Resistors:
R1,R35 = 10 M
R2 = 120 k
R3,R4,R5,R7,R11,R13, R17 . . . R20, R22 . . . R34, R36 = 22 k
R6,R8,R9,R10, R38 . . . R42 = 47 k
R12 = 470 k
R37 = 6k8
R43 = 33 k
R44,R45 = 27 k
R46 = 220 Ω
R47 = 330 Ω
R48 . . . R51 = 150 Ω
(R14,R15 and R16 have not been used)

Capacitors:
C1 = 10 . . . 60 p
C2,C8,C9 = 100 p
C3 = 8p2
C4 = 330 p
C5 = 33 p
C6 = 15 p
C7 = 15 n
C10 = 150 p
C11 = 3p3
C12 = 1n5
C13 . . . C15 = 100 n

Semiconductors:
T1 . . . T3 = BC 547
D1 . . . D45 = DUS
IC1,IC2,IC12 = 4520
IC3,IC4 = 4528
IC5 . . . IC8,IC10,IC11 = 4001
IC9 = 4077
IC13 = 4011
IC14 = 4013

Miscellaneous:
S1 = single pole switch
S2,S10 = single pole toggle switch

## Video stage

In section D the digital input signals are mixed together by the resistor network R37 . . . R45. The composite video signal is then buffered by T1 which drives transistors T2 and T3 to provide two different output levels. The output of T3 can be adjusted by potentiometer P7. Capacitor C11 has been added to improve picture stability. The output from the mixer can be fed to a suitable UHF TV modulator (see Elektor 42, October 1978).

The complete video waveform is shown in figure 2 and figure 3 gives the printed circuit board and component layout for the pattern generator.

## Calibration

Initially, potentiometers P3 . . . P6 are set to their mid position and no patterns are selected. The grey scale is switched on with S1 and S2 is placed in the 'invert' position ($\overline{PAT}$). Potentiometer P2 can then be adjusted so that eight grey bars of different intensity appear on the screen. The lightest and darkest bars should be at opposite sides of the picture.

Switch S1 is then turned off and vertical lines selected. Potentiometer P9 is then adjusted to give 15 narrow, black, vertical lines on the screen. Dots are then selected and P8 adjusted to give 15 columns.

The CCIR standard can be approached by using an oscilloscope. Potentiometers P3, P4, P5 and P6 control the front porch delay, the field sync, the line sync and the equalisation pulses respectively. The front porch delay should last 1.5 $\mu$s, the field sync pulse should last 27.3 $\mu$s, the line sync pulse should be 4.7 $\mu$s wide and the equalisation pulses should be about 2.35 $\mu$s wide.

In some cases the line and field sync pulses can be brought onto the TV screen by switching on the grey scale, switching S2 to 'normal' (PAT) and selecting horizontal lines. The width of the line sync pulse appearing vertically in the picture can be adjusted by P5 until it amounts to 40% of the width of the grey blanking pulse. Potentiometer P3 should then be adjusted until the start of the line sync pulse is about 12.5% away from the left edge of the blanking pulse. The thickening on the horizontal field sync pulse is due to the equalisation pulses. These are adjusted by P6 until they are half the width of the line sync pulse. Finally, the field sync pulse can be adjusted by P4 so that the width of the gap in the beam is equal to the width of the line sync pulse.

The pattern generator produces interlaced pictures only. By removing D19 the interlacing disappears. The representation of an even or uneven field depends on random switch-on phenomena. This may be noticed by the occurence of half lines in the horizontal bar pattern.

3

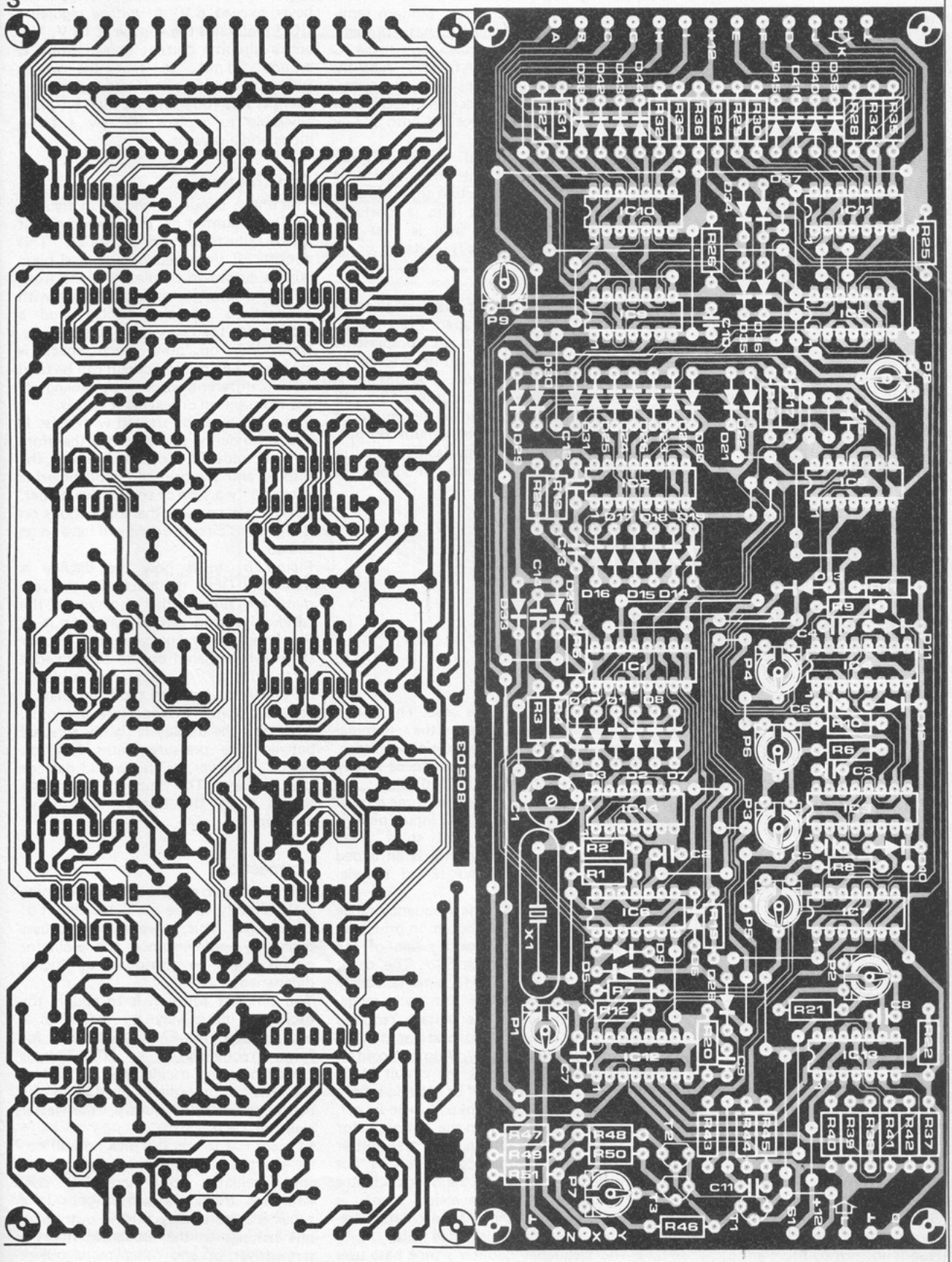


Figure 3. The printed circuit board and component layout for the video pattern generator.