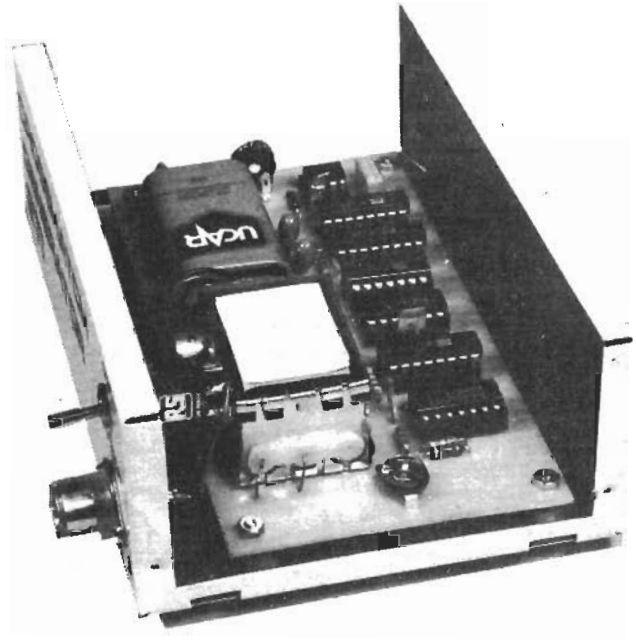
CROSS HATCH GENERATOR

The ETI Project team have hatched up this neat piece of test gear.



THE COLOUR television picture is created in the receiver picture tube by three separate electron guns — one each for red, green and blue. As these guns cannot be in the same physical position they need to be converged into one spot on the screen.

The process of converging at the centre of the screen is called static convergence and is performed by magnets on the yoke assembly.

Green Cross Code

However, the green of the picture tube is not everywhere coincident with the deflection plane and this causes errors when the beam is deflected away from centre. These deflection errors are corrected electronically by 12 or more controls and the process is known as dynamic convergence.

An important part of the process is the use of a crosshatch generator to provide horizontal and vertical lines on the screen. Using the generator, the convergence errors are immediately apparent and the controls on the set are usually labelled with the effect each has on a crosshatch pattern.

In addition to setting up convergence the generator pattern may also be used to set up horizontal and vertical linearity and to orientate the deflection yoke coils on both black and white and colour sets.

Carry Her Power

Most of the inexpensive pattern generators, which are currently available, produce a video waveform, which must be injected into the correct place in the TV, and require a synchronizing signal from the TV set. Such generators are thus fiddly things to use.

The ETI crosshatch generator produces a combined horizontal and vertical sync waveform and this, together with the crosshatch video, is modulated on to a carrier frequency operating on UHF channel 36. Thus to use the generator one simply attaches it to the antenna terminals and selects channel 36.

Construction

Assemble the PCB according to the overlay starting with the links, resistors and diodes. The 555 IC and capacitors next with the CMOS ICs last. Solder the power supply pins of the CMOS (7 and 14 or 8 and 16) first. This allows the internal protection diodes to protect the inputs of these ICs.

We mounted the unit into a small metal case, this prevents drift due to the presence of hands, etc, as it provides good shielding.

Alignment

This is easiest if a frequency counter or oscilloscope is available. Monitor the output on pin 1 of IC4 and adjust RV1 to give 50 Hz.

Connect the unit to the TV set and select channel 36. RV2 should be adjusted to give vertical lines of about the same width as the horizontal.

The cross hatch generator is now ready for use. May we suggest however, that before making any adjustments to your TV you consult the manufacturers' service guide for the set. ETI ▶

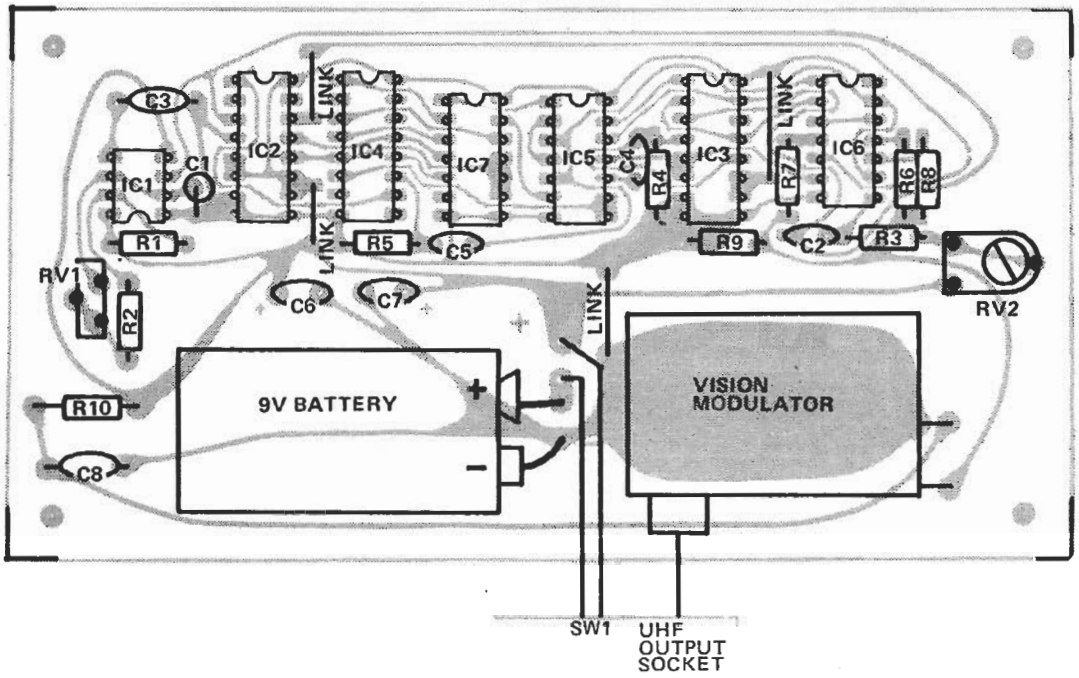


Fig. 1. The cross hatch generator's overlay is shown left.

PARTS LIST

RESISTORS

R1	1kO
R2,7,8,	4k7
R3,4,5,6	10k
R9	330R
R10	110R

POTENTIOMETERS

RV1	5k miniature preset
RV2	25k miniature preset

CAPACITORS

C1	180p ceramic
C2	22p ceramic
C3,8	10n polyester
C4,5	100p ceramic
C6,7	33u 16 V tantalum

SEMICONDUCTORS

IC1	555
IC2,3	4027B
IC4	4040B
IC5	4011B
IC6	4001B
IC7	4012B

MISCELLANEOUS

PCB as pattern, case to suit, output socket, single pole toggle switch, 9 V battery, Astec UMIIIIE 36

BUYLINES

The only component liable to be difficult to obtain is the Astec UHF modulator. These are available from most suppliers of TV game kits, Watford Electronics and Teleplay are examples. Make sure you get a vision modulator, sound modulators look the same but will not work in this application! All the CMOS and other components is widely available. The PCB will be available from usual suppliers who advertise regularly in the magazine.

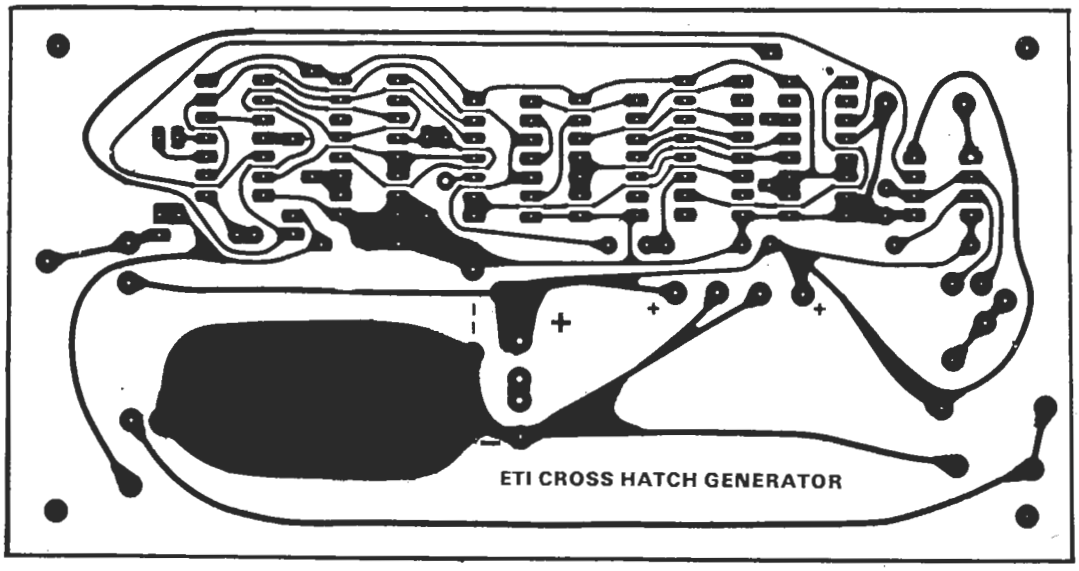


Fig. 2. The foil pattern of the cross hatch generator is shown full size on the right.

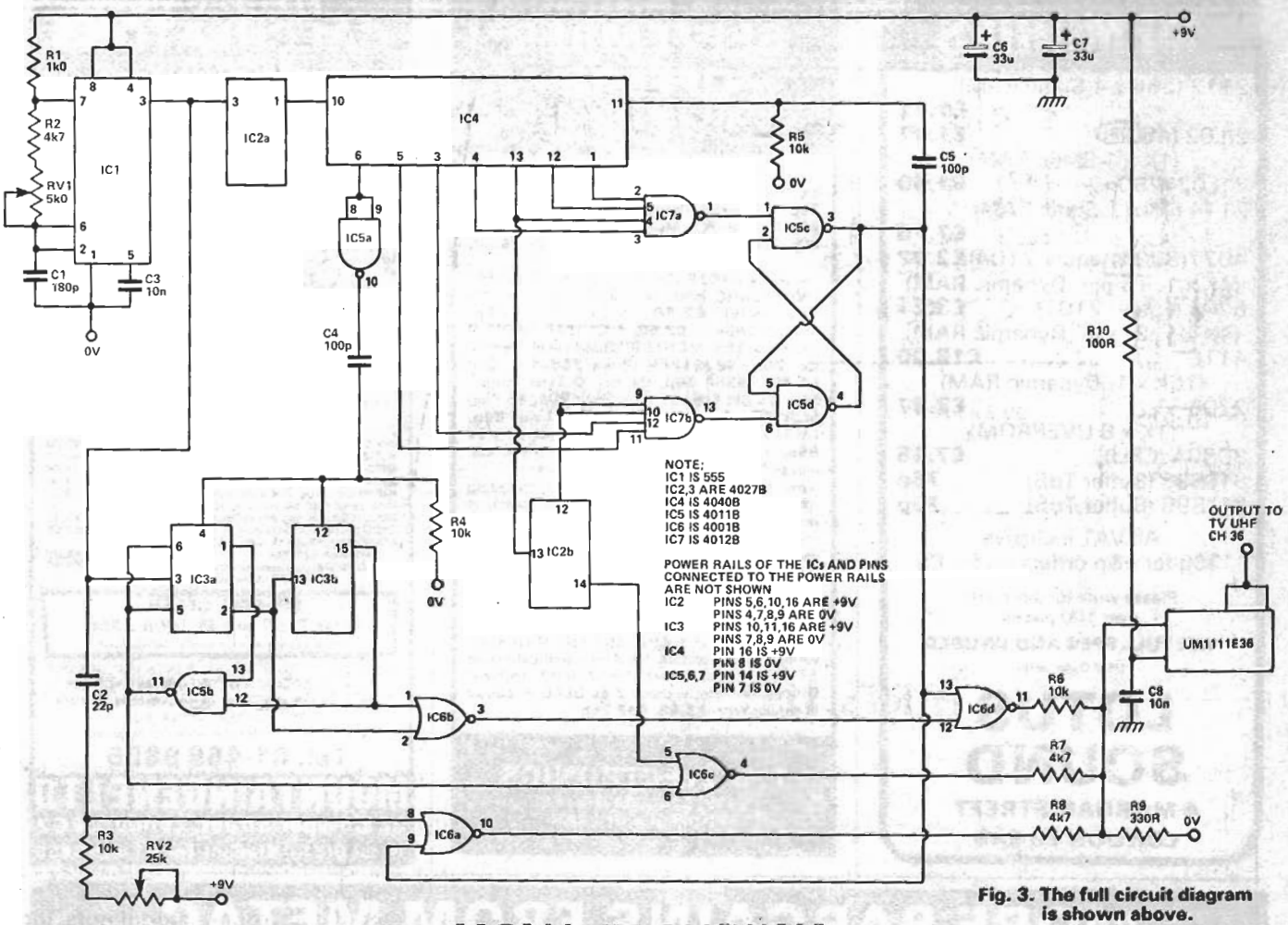


Fig. 3. The full circuit diagram is shown above.

HOW IT WORKS

A TV picture is made up of a series of horizontal lines equally spaced down the screen with the information transmitted in a serial form along with the necessary synchronization pulses. There are 625 lines in each complete picture but these are transmitted as two "frames" each of 312½ lines with the second frame interlaced between the first giving a total of 625 lines. This is to reduce flicker of the picture which would otherwise occur.

To simplify our circuit and prevent a double horizontal line we have used 624 lines which eliminates the interlacing. The TV set automatically accepts this change.

To synchronize the TV set we need a 192μs wide pulse every frame (20ms) and a 4μs wide pulse every line (64μs). All pulses, including the information, are derived from a single 249.6 kHz oscillator IC1. This is divided by 2 in IC2a and then by 2496 by IC4 giving an output of 50 Hz. This IC is a 12 stage ripple counter which, while normally dividing by 4096, can be forced to divide by 2496 by decoding (IC7) the outputs from the 7th, 8th, 9th and 12th stages and reseting IC4 back to zero. The output of IC7 toggles the RS flip flop IC5/c, IC5/d which resets IC4 via C5. This flip flop is reset by the decoded output from the 4th and 5th stages of IC4. This occurs 192μs later; thus the output from IC5/c is the frame sync. pulse.

To generate the line sync. pulse the output from the 3rd stage of IC4 (15,600 Hz) is used to reset both halves of the dual JK flip flop IC3. This IC is then toggled by the 249.6 kHz clock until, after three pulses, both "Q" outputs are '1' when IC5/b detects this and disables IC3/a, IC6/b decodes the second of these clock periods and this becomes the line sync. pulse. These pulses are combined in IC6/4 to give a combined sync. pulse.

The 249.6 kHz is differentiated by C2/R3 and after being quared up by IC6/a is used to generate 16 white spots on each line which results in vertical lines. These pulses are deleted during the frame sync. period to prevent interference to synchronization. Due to variations in the CMOS a trim potentiometer is provided to give equal width to the vertical and horizontal lines.

The horozontal line is generated by IC2/b (JK flip flop) and this IC is toggled by the 8th output (487.5 Hz) of IC4 and is reset by the output of the 4th stage (64μs later). This gives a single white line every 16 lines. To prevent this line interfering with the line sync. pulse the output of IC2/b is combined with that of IC5/b which is high for a period 4μs before the line sync. pulse to 4μs after the pulse. This gives a short black region on both ends of the line (normally off the screen). The outputs of IC6/b, IC6/b and IC/c are combined by R6-R8 to give a composite video signal. Note that the video information gives positive pulses while the synchronization pulses are negative.

The video signal is fed to the UHF modulator. This is a ready built unit that is adjusted at the factory to operate on channel 36. R10 and C15 decouple the supply to the modulator.