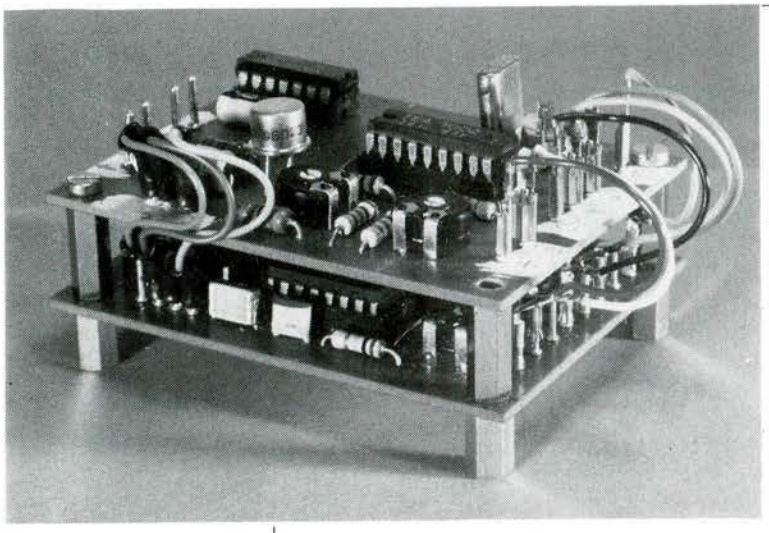


**The video combiner is a circuit which 'welds' the various components of a video signal, such as the synchronizing pulses, blanking signal, colour information, and so on, into a composite video signal. Although this is a fairly complex matter, a recently introduced integrated circuit, the TEA 1002, makes it possible to keep the combiner reasonably simple.**

# video combiner

PAL (Phase Alternation Line) is a colour TV system developed in Germany and generally adopted in Europe. In France, however, the SECAM (SEquential Couleur A Memoire) system is used.

The colour burst signal is a phase and amplitude reference signal which is used to demodulate the chrominance signal.

The luminance signal contains brightness information; it is obtained by combining the outputs of the three colour channels and then used for amplitude modulation of the main picture carrier frequency.

The chrominance signal is obtained by combining, in the logic decoder and chroma encoder, portions of the separate colour logic levels into sum and difference signals. Two quadrature components of the chrominance signal are produced and used for amplitude modulation of the chrominance subcarriers.

The TEA 1002 is a PAL colour encoder with video combining stages. It converts a number of appropriate input signals into a complete video signal, that is, one containing synchronizing pulses for the line and field scans, luminance and chrominance signals, blanking pulses, and a colour burst signal.
The required input signals are derived from the 'video sync box' described elsewhere in this issue. The printed-circuit boards for that box and the present circuit are of the same dimensions so that they can be built conveniently into one unit.

## The TEA 1002

The 'innards' of the TEA 1002 are shown in schematic form in figure 1. The logic decoder generates colours according to the logic levels at pins 1... 4 (see table 1). If only black and white signals are required, pins 2...4 are simply strapped together. In that case, neither the chrominance subcarrier oscillator (pins 13, 14) nor a signal at the CBF (colour burst flag) input (pin 15) is required.

## The circuit diagram

The circuit may be divided into three parts (see figure 2): the PAL switch (FF1), the combiner proper (IC2), and a buffer stage (T1).
The PAL switch, flip-flop FF1, is controlled by the line synchronizing pulses at its clock input (pin 3). (See also 'video sync box' elsewhere in this issue.)
The TEA 1002 (IC2) contains a chrominance (chroma) and a luminance encoder. The luminance is dependent on the voltage level at pin 9, which is preset by P1. If this voltage is greater than 4 volts, a 75 per cent colour signal (as defined by the EBU — European Broadcasting Union) is generated. When the voltage falls below 3 volts, the brightness is increased to 95 per cent, which, no doubt, will normally be preferred as it gives a clearer picture. It should be noted that the voltage at pin 9 should not rise above 5 volts to prevent saturation of the buffer, T1.
The TEA 1002 also contains a divider which produces a 3.54 MHz clock signal from the 8.86 MHz subcarrier oscillator. The clock (pin 17) may be used to synchronize other circuits. The oscillator can

1

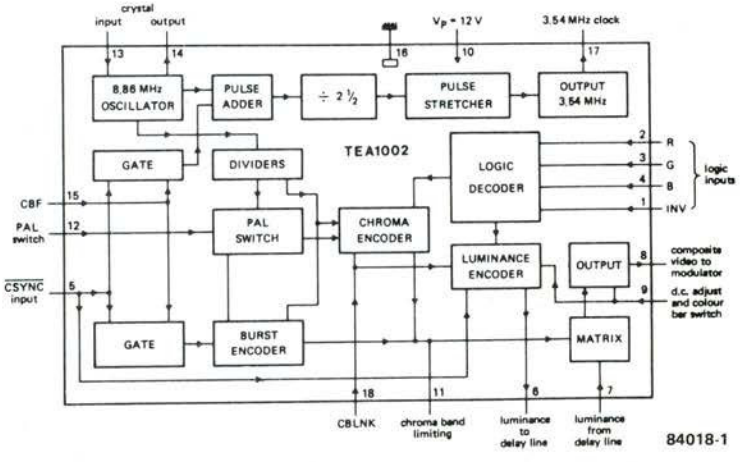



**Figure 1. This block schematic of the TEA 1002 clearly shows the complexity of the circuitry required to produce a composite colour video signal.**

be pulled to its correct frequency by adjusting capacitor C1 for minimum interference (least ragged image fringe). Setting C1 to its mid-position will in practice normally be sufficient.
The output level of the buffer stage, emitter follower T1, is preset by means of P2. With values shown, the output impedance is around 75 ohms. The output level is normally adjusted to give 1 $V_{pp}$ across 75 Ω, that is, 2 $V_{pp}$ emf.

## Construction and application

The printed-circuit board, shown in figure 3, has the same dimensions as that for the video sync box, so that the two boards can conveniently be built into one compact unit. The various terminals on the boards are located such that the length of the interconnecting wires is kept to a minimum. The circuits should, of course, be preset before making the interconnections.
The board has provision for an optional wire bridge. If this is used, the logic levels at pins 2...4 ('0') produce standard colours and the chrominance signal is at normal level. If the wire bridge is omitted, the colours are inverted (see table 1) and the chrominance signal is reduced by 6 dB.
Power supply requirements are 12 V at 100 mA maximum.
The combiner lends itself to a variety of applications. For example, when used with a personal computer with video interface which has colour information available (in the form of Red, Green, and Blue signals) it makes possible the production of a composite video signal.
In combination with the video sync box, the combiner can produce a colour bar which is suitable for use as a test signal, as a space marker for video recorders, or with local cable systems. For these uses, the R, G, and B pins on one printed-circuit board must be linked to the corresponding ones on the other board.
Finally, the combination may in appropriate cases form the link between electronic equipment and a colour TV.

2

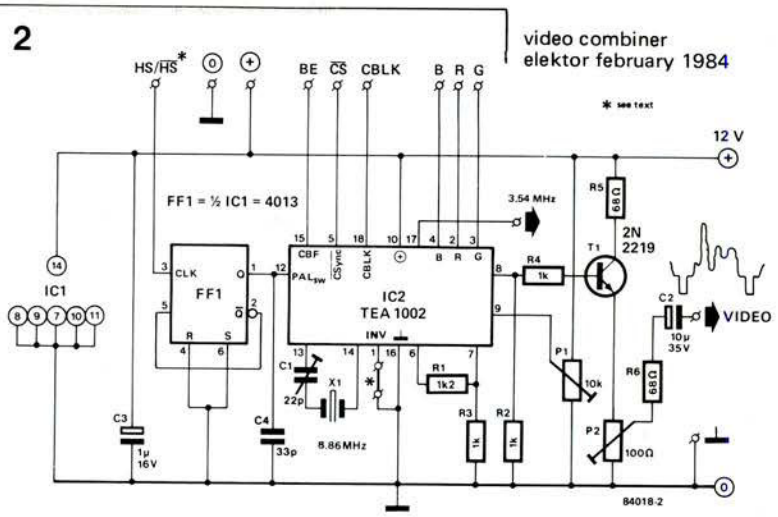



Figure 2. From this circuit diagram it is evident that once all the complex functions are performed by the TEA 1002, the remainder of the design becomes relatively simple.

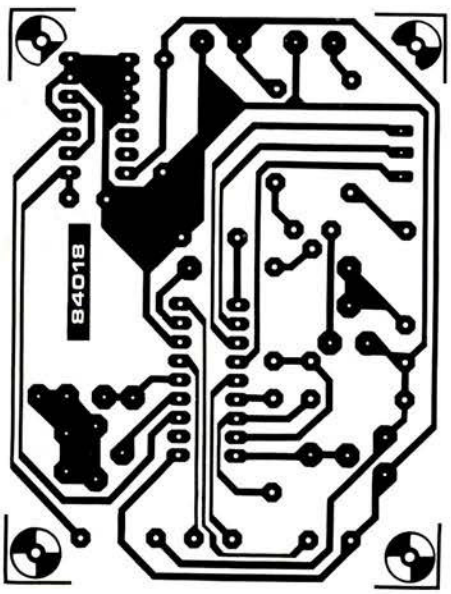
Table 1.

| inputs | | | | |
|---|---|---|---|---|
| pin 2 R | pin 3 G | pin 4 B | pin 1 INV | colour |
| 0 | 0 | 0 | 0 | black |
| 1 | 0 | 0 | 0 | red |
| 0 | 1 | 0 | 0 | green |
| 1 | 1 | 0 | 0 | yellow |
| 0 | 0 | 1 | 0 | blue |
| 1 | 0 | 1 | 0 | magenta[1] |
| 0 | 1 | 1 | 0 | cyan[2] |
| 1 | 1 | 1 | 0 | white |
| 0 | 0 | 0 | 1 | grey |
| 1 | 0 | 0 | 1 | cyan[2] |
| 0 | 1 | 0 | 1 | magenta[1] |
| 1 | 1 | 0 | 1 | blue |
| 0 | 0 | 1 | 1 | yellow |
| 1 | 0 | 1 | 1 | green |
| 0 | 1 | 1 | 1 | red |
| 1 | 1 | 1 | 1 | black |

[1] red-blue
[2] blue-green

Table 1. Correlation between logic levels at pins 1...4 and the colour produced.

3



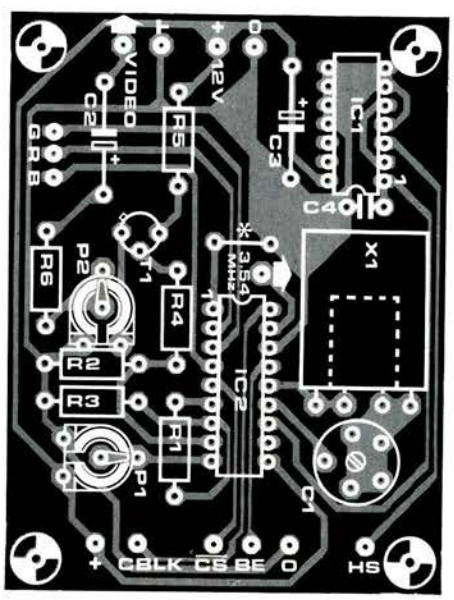




Figure 3. The printed-circuit board for the video combiner. Note the wire bridge described in the text near the centre of the board.

**Parts list**

Resistors:
R1 = 1k2
R2,R3,R4 = 1 k
R5,R6 = 68 Ω
P1 = 10 k preset
P2 = 100 Ω preset

Capacitors:
C1 = 22 p trimmer
C2 = 10 μ/35 V
C3 = 1 μ/16 V
C4 = 33 p

Semiconductors:
IC1 = 4013
IC2 = TEA 1002 *(available from Technomatic Ltd)*

Miscellaneous:
X = crystal, 8.867237 MHz