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Oscilloscope Line-Analyzer Accessory

The unit to be described enables the selection and display of any single line on a standard oscilloscope. The circuit is designed for video sources having the standard output level.

1. INTRODUCTION

The last 10 years in the development of data processing, the emerging media has left its effect upon the video signal. The transmission of additional information signals, which are not intended for visible display, is evermore increasing.

Broadcast television offers its viewers VIDEO-TEXT and other similar services and VHS rent-films add signals according to the MACRO-VISIONS (2) technique. The SIS technique (Sound-in-Sync) has been decided upon for the transmission of high-fidelity sound, also data and marker signals can be encountered.

All these non-displayed signals are carried in the blanking and synchronizing portions of the video signal and cannot reliably be evaluated on a normal oscilloscope's trace. For this facility, a synchronizing frame must be prepared which is

able to be triggered in a definite and programmable manner from an external source.

2. PRINCIPLE

A synchronizing pulse circuit, which has been to the desired video input signal (level pos./neg.), primes the line and frame pulses. A counting circuit is started from the half frame picture which counts the horizontal pulses and produces, at a preselected point in time, an impulse for the external trigger input of an oscilloscope. This enables the presentation of a single line or series of lines to occur always at the same point in time (e.g. after the 10th line).

The number of displayed lines is selected on the oscilloscope by the horizontal speed control. The displayed time duration for only one line (64 μ s) is too short for the trace to have the required brilliance and therefore the brilliance control of the oscilloscope must be increased to maximum and/or the ambient lighting reduced. An oscilloscope hood would also be an advantage.

Should several lines be displayed at the same time, the trace brilliance increases propor-



tionally. Using a proprietary small service oscilloscope, a single, complete line can be made clearly visible; groups of about 10 to 15 lines are distinct even with a small screen size. The principle is shown clearly in **fig. 1**.

3. THE CIRCUIT

There have already been several circuits published (3), (4), which may also be classified into video, synchronizing or digital portions.

There are various possible solutions. The TBA 920, used here, and the TTL series ICs are not

state-of-the-art components but they are unproblematical in their employment and are probably already in the amateur's junk-box waiting for something useful to do (**fig. 2**).

Highly integrated solutions may be more elegant but do not allow the same sort of control over all the individual parameters. For signal sources which do not possess the normal synchronizing pulses (satellite television), an external re-constitution would be indispensable.

3.1. Video Amplifier

The video amplifier must match the input signal to the following sync.-pulse circuits. Standard video signals, e.g. from a video recorder (1 V_{pp}/75 Ω FBAS pos.), can be processed directly by

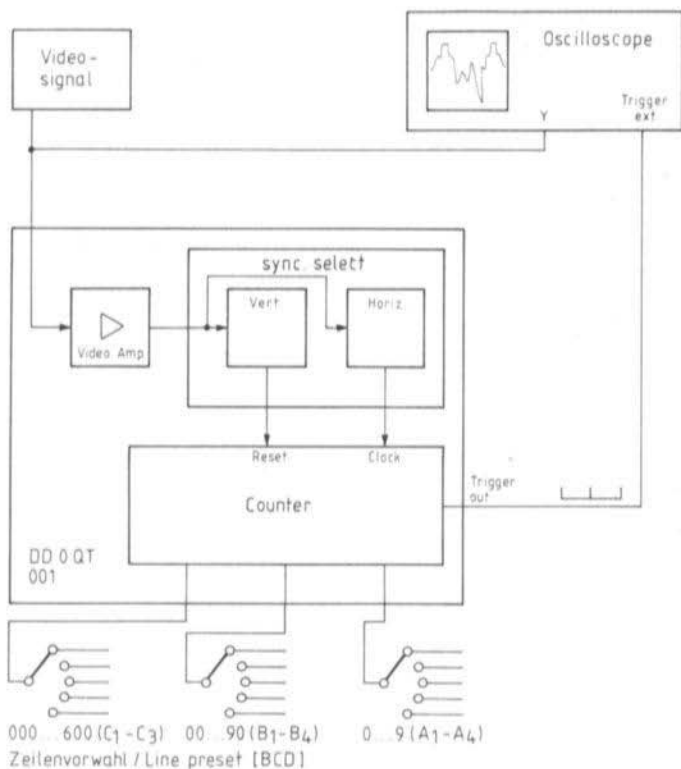


Fig. 1:
Principle of a video
line analyzer

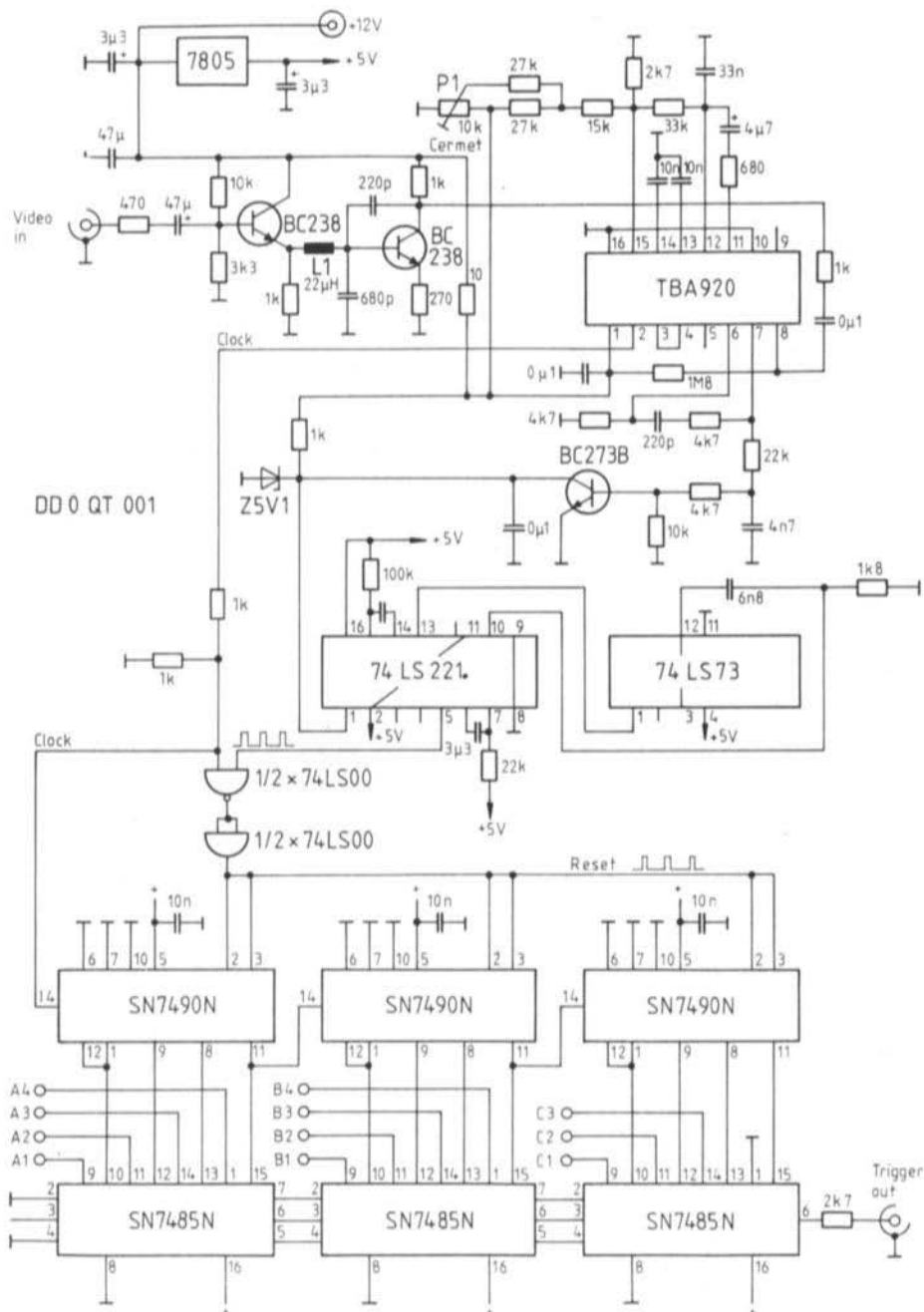


Fig. 2: Circuit schematic of the video line analyzer



a television LSI-IC (e.g. TDA 3701 (4) or TDA 2595 (5)).

The TBA 920 has been designed to work with positive sync. pulses from an input signal of at least 1 V and a pre-amplifier is therefore necessary. This was taken from (6).

When other video signals are to be displayed a suitable amplifier must be provided. Maybe several inputs with switchable signal processing would be the most convenient solution.

3.2. Sync. Separation

The composition of a typical television picture signal complete with sync. pulses will be assumed to be familiar to the reader.

The TV-IC TBA 920 is used in a standard circuit and connected in the video-record mode (pin 16 to ground). The capacitor at pin 14 (10 nF MKH) must have a very close tolerance as it is in a frequency-determining part of the circuit. It may be better to construct it from several smaller parallel capacitors to achieve the exact value. If this point is not observed, the horizontal oscillator will have a very limited capture range, or indeed, none at all! The half-frame impulses are extracted passively by means of an RC-network. The disadvantage of this simple circuit is manifest when parasitic pulses (e.g. MACROVISION) occur in the signal. This causes the irregular generation of spurious vertical pulses immediately after the half-frame impulse. In order to suppress these signals, the vertical signal is taken via an inverter stage to the first mono-

stable in the 74LS221 which generates a square-wave pulse whose width equals the duration of about 100 (uncritical) lines. It is triggered only from a genuine half-frame pulse and its leading edge flips the next bi-stable (74LS73).

This bi-stable is connected as a divide-by-two scaler and it suppresses every second half-frame impulse. Only by these means can the following counter be pre-adjusted to operate over the full number of lines (625).

In order to achieve a fixed relationship between the line sync. pulse, trigger signal, the counter is not reset by the half-frame pulse but by a horizontal sync. pulse. The relevant signal sequence is shown in **fig. 3**.

Following the suppression of any spurious half-frame pulse by MF 1 and every second half-frame pulse by the flip-flop, MF 2 produces an output pulse of the same width as a line length and which is used as a gate for the AND gates (2 x 74LS00).

At this time, the arriving pulse from the TBA 920 horizontal oscillator appears at the output of the inverter as a positive reset pulse for the following counter.

This manner of recovering the impulse has the following two disadvantages: —

- By using the horizontal pulse as a reset, the line following the selected line will be displayed on the screen.
- Since no account has been taken in the suppression of every second half-frame pulse in

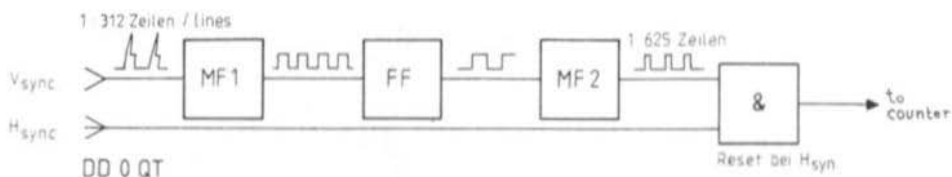


Fig. 3: Producing the counter reset input system

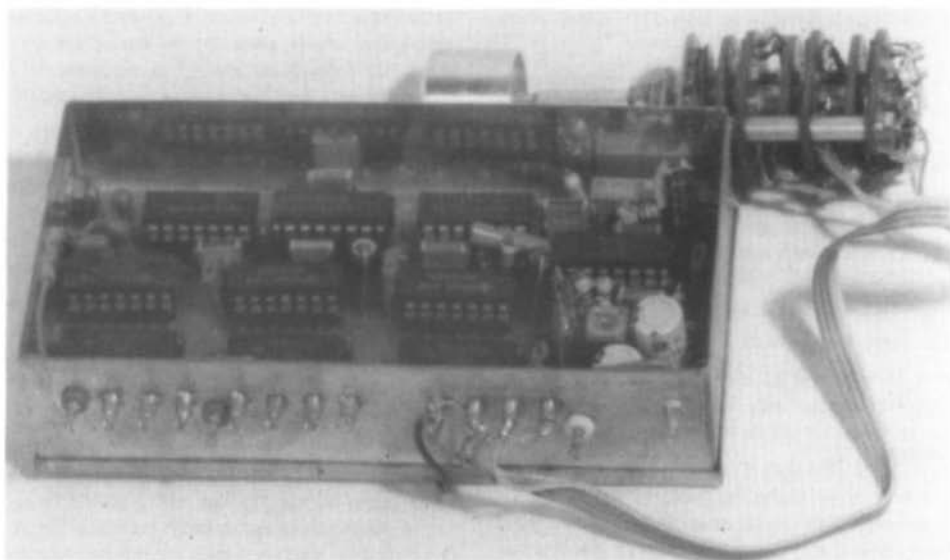


Fig. 4: The photograph shows an analyzer in a tin-plate frame, before it was built in a case. The unit is only provisionally wired for test purposes.

which half of the frame it is, it can occur that, when say, line 10 has been selected, line 323 is displayed.

For amateur purposes, both these disadvantages are largely irrelevant. A systematic displayed error of + 1 is very easily accommodated by the user.

The question of the half-frame can be settled quite quickly by observing the successive pulses, 5 = first half-frame, 4 = second half-frame.

3.3. The Counter

The processed sync. pulses are taken to a pre-adjustable counter. BCD types with negative outputs can be used for the switches or simple step switches with a suitable diode matrix. When the selected number has been reached, an impulse appears at the last 74 LS 85 which is used to trigger the oscilloscope.

4. CONSTRUCTION

Although a small number of working units have been constructed, this circuit was only intended as a basis for design. A reproducible PCB layout has therefore not been provided. A suitable PCB for the counter would be that of DK 1 OF 002 (7). The construction should be effected by equipping one circuit at a time and operationally testing it. Particular care should be taken with the adjustment of the TBA 920.

It is also possible to work with video sources having 525 lines at 60 Hertz. A very versatile measurement accessory for the oscilloscope can be built with switchable inputs to various pre-amplifiers polarities and external clock and reset inputs.



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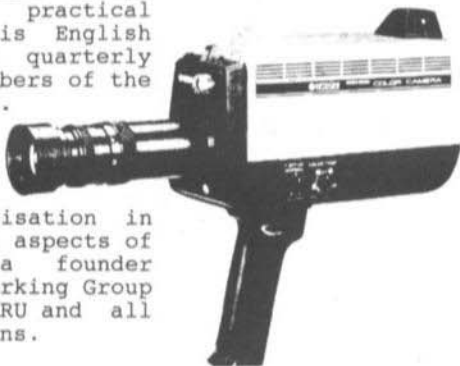
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