

The invention is based on a video recorder according to the preamble of Claim 1. Such a video recorder has been disclosed by DE-A 35 33 707.

For the recording of a teletext signal with a video recorder it is also known (DE-C 33 15 687) to record the analogue text signal which has been obtained in a teletext decoder and which for example is in the form of the R,G,B signals, as frequency modulation of the video carrier. As in this case only an analogue signal is ever recorded, likewise only black/white reproduction is possible.

The aim of the invention is to further develop a video recorder with recording of a teletext signal in such manner that in spite of the recording only of an analogue signal, playback in a plurality of grey levels and also in the colours of the original teletext signal is possible.

This aim is fulfilled by the invention described in Claim 1.

In accordance with the invention, the three R,G,B signals are not recorded with full amplitude via an OR circuit. Instead, a grey scale signal is produced from the R,G,B signals in a matrix serving as linear adder in accordance with the standard matrixing rule

$$Y = 0.59G + 0.30R + 0.11B$$

This grey scale signal, which represents a luminance signal, is then recorded as frequency modulation of the video carrier. It can be advantageous, in order to improve the legibility of the text on playback, to carry out the aforementioned matrixing somewhat differently from the standard rule.

The recorded grey scale signal, which represents a text signal or a graphics signal, can extend for example over a plurality of lines during the image and represent one or

more lines of text. The grey scale signal can also extend only over a part of the lines when the lines of text are not to reach from the left to the right-hand edge of the image. The grey scale signal can also extend over the entire image. Then only text reproduction, also referred to as "full-page" text reproduction, takes place over the entire surface of the image. In the recording, the text signal is "punched" into the signal representing the actual moving image in that the actual video signal is replaced by the text signal and thus the actual video signal is suppressed. If the text- or graphics playback extends over the entire surface of the image, thus in the case of so-called "full-page" operation, the entire signal representing the image is replaced by the text signal. Therefore on playback, the grey scale signal allows representation of the text in a plurality of grey levels, with the result that an improvement in legibility and differentiation is achieved compared to pure black/white representation of the text.

In accordance with the invention, in spite of the recording only of one grey scale signal, playback in the original colours of the teletext signal is obtained. Here the following facts and recognitions are utilized. The amplitude of the R,G,B- text signals is either zero or equal to the maximum value corresponding to the full colour saturation. Thus these signals have no amplitude intermediate values with reduced colour saturation. The grey scale signal produced in accordance with the aforementioned rule then has an amplitude which is dependent upon the respective composition of the R,G,B signals. The resultant amplitude for the grey scale signal here is different for all eight conceivable combinations of R,G,B including black and white. Therefore this fact can be utilized to deduce, from the respective amplitude of the recorded grey scale signal, the combination of R,G,B and to restore the original signals R,G,B of the teletext signal.

Then in spite of the recording of only one luminance signal, surprisingly colour reproduction is possible, and this precisely in the colour of the original teletext signal. Accordingly a colour video signal can also be produced from the obtained R,G,B signals on playback.

The outlay for the solution according to the invention is extremely low as essentially only a simple matrix is required, in which the signals R,G,B are added via differently dimensioned resistors with the corresponding weighting factors. The actual recording gives rise to no additional outlay as only one luminance signal in the form of the aforementioned grey scale signal is recorded.

The invention can basically be applied to any type of text transmission, thus for example ⁽¹⁾"Videotext" or ⁽²⁾"Antiope" and other known or future systems for the additional transmission of a signal which represents text or graphics. The text signals can represent letters, graphics or other character symbols.

The invention will be explained making reference to the drawing wherein:

Fig. 1 is a simplified block circuit diagram of the video recorder with recording of teletext,

Fig. 2 illustrates a modification of the circuit according to Fig. 1,

Fig. 3 shows the amplitude curve of the R,G,B signals,

Fig. 4 illustrates the relationship between the respective colour of the teletext signal and the amplitude of the recorded grey scale signal and

Fig. 5 is a block circuit diagram for the signal processing on playback.

In Fig. 1 the video recorder comprises an input terminal 1 for a colour video signal, an input terminal 2 for an

antenna signal, an output 3 for a R,G,B signal with a keying signal BL, an output 4 for a colour video signal and an output 5 for a carrier modulated with the signals, in the channel 36, for the connection of a television receiver. The drawing shows the antenna A, the tuner 6, three switches S1, S2, S3, a signal processor 7 containing an automatic gain control for the processing of the luminance signal, on recording and playback, the actual recording unit 8 as well as a signal processing circuit 9. The circuit 9 comprises a teletext decoder 10 and a matrix 11 serving as linear adder. The output 12 of the circuit 9 is connected to the input of the modulator 13 which at the output 5 supplies a carrier, modulated with the signals, in the channel 36.

By appropriate control of the switches S1, S2, S3, the circuit according to Fig. 1 facilitates the following functions. The input 1 can be supplied with a colour video signal which is recorded via the processor 7. The input 2 is supplied with the signal of an antenna 6 and converted in the tuner 6 into a colour video signal. For recording, this colour video signal is fed via the switches S1, S2 in position b to the processor 7 and simultaneously or alternatively via the switch S3 in position a to the circuit 9. A R,G,B signal can be tapped from the output 3. This signal can be derived from the colour video signal from the tuner 6 in so-called EE (electric/electric) operation. In playback operation it can also emanate from the processor 7 via the switch S3 in position b. The signal at the output 3 can additionally contain a text signal which can emanate from the tuner 6 or also from the processor 7 in the case of playback. At the output 4 a colour video signal can be tapped which either emanates from the tuner 6 or, in the case of playback operation, from the processor 7. This signal contains no teletext signal. At the output 5 it is possible to tap a modulated carrier in the channel 36 which is modulated with the colour video signal and additionally

with a teletext signal. The same colour video signal is present at the output 12 of the circuit 9 as at the output 4, but optionally combined with the teletext signal. The colour video signal at the output 12 can likewise emanate from the tuner 6 or, in the case of playback operation, from the processor 7. The teletext signal within the colour video signal at the output 12 always also appears correspondingly in the R,G,B signal at the output 3.

The recording of a teletext signal received with the antenna A is carried out by the circuit according to Fig. 1 in the following manner: The signal is fed from the antenna A via the input 2 to the tuner 6. The tuner 6 produces the colour video signal which contains the teletext signal during the vertical blanking interval in each case in a plurality of lines. This signal is fed via the switch S3 in position a to the input of the circuit 9 and from here to the input of the teletext decoder 10. The decoder 10 produces the analogue text signal R,G,B and a synchronising signal S in each case in the lines with text reproduction. These signals are fed to the matrix 11 where they are matrixed in accordance with the matrixing rule

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to form a grey scale signal Yg. This grey scale signal, together with the colour video signal representing the actual moving image, is fed to the output 12 and from there to the input of the modulator 13. The input of the modulator 13, which actually represents an output of the recorder, is connected via the line 14 to the switch S2. This ensures that the signal is fed from the input of the modulator 13 via the switch S2 in position b to the input of the circuit 7 switched to recording operation, and thus is recorded in the recording unit 8. The grey scale signal Yg present in practice at the output of the recorder is thus fed back from an output terminal, for example the terminal of a scart socket, and is forwarded to the recording path of

the recorder of the purpose of recording. Thus here a combined signal is recorded, which in itself represents the signal of the moving television image but also represents the text signal during the parts of the image with text reproduction. The signal can also represent only the text signal if, in accordance with "full page" operation, only text is reproduced over the entire surface of the image.

Fig. 2 illustrates a modification of the lower part of the circuit shown in Fig. 1. The circuit 9 contains the complete colour video encoder 16 instead of the matrix 11. Thus a colour video signal, into which the text signal is inserted as colour video signal, is present at the output 12. This signal is likewise fed to the input of the modulator 13 and to the output 4. The outputs 4, 5 thus supply the same signal, where only the signal at the output 5 is modulated onto a carrier. The remainder of the circuit is unchanged compared to Fig. 1.

Fig. 3 shows the amplitude curve of the signals R,G,B of the teletext signal which can occur in arbitrary combinations. The amplitude of the signals R,G,B is either zero, and thus corresponds to the black value, or is equal to the maximum value 1 corresponding to the full colour saturation. Intermediate amplitude values do not occur in the R,G,B signals.

Fig. 4 shows the total of eight conceivable combinations of the signals R,G,B in the teletext signal including the two values black and white and the associated colour corresponding to the combination of R,G,B. It will be apparent that the amplitude of the grey scale signal Y_g produced in accordance with the matrixing rule is different for these eight combinations. Thus there is a clearly defined co-ordination between the respective colour and the amplitude of Y_g . When for example Y_g has a value of 0.59

relative to the maximum amplitude of 1, this amplitude can emanate only from the text signal G. Thus, in accordance with the co-ordination shown in Fig. 4, it is possible to deduce the combination of R,G,B from the amplitude of Yg. This means that by analysing the amplitude of Yg it is possible to restore the colour signals R,G, B in each case with the amplitude 0 or 1 and that thus playback in the original colours of the teletext signal is possible.

Fig. 5 shows a circuit for playback operating on the basis of the relationships illustrated in Fig. 3. The grey scale signal Yg scanned from the tape is fed to the amplitude discriminator 17 which effects a differentiation of the amplitude stages of Yg in accordance with Fig. 3. In accordance with this amplitude analysis, a signal Us is fed to the generator 15. On the basis of the clearly defined relationship between the combination of R,G,B and the amplitude of Yg, the generator 15 again produces the signals R,G,B which represent the teletext signal and which in each case have the amplitude 0 or the full amplitude 1. These signals R,G,B can thus be used for the colour representation of the teletext signal on a picture tube. Alternatively or additively, these signals can be fed to the encoder 16 which produces a colour video signal representing the respective teletext signal. This signal can then be inserted, during the presence of text, into the colour video signal representing the actual moving image and on playback in a television receiver can effect the corresponding text reproduction. The quadrature-modulated colour carrier generated in the encoder 16 can be coupled in its frequency with the line frequency of the recorded signal or, independently thereof, can be at a fixed frequency.

The recorder according to the invention also facilitates the recording of title pages created by the customer himself by means of a character generator. In this way for example

title pages or other additions to a video recording can be recorded on the recorder.

Claims

1. A video recorder with a built in text decoder (10), where analogue text signals (R, G, B), which represent text or graphics and the amplitude of which is either equal to zero or equal to 100% of the full colour saturation, occur at the outputs of the text decoder, characterised in that a matrix (11) fed with the R, G, B- text signals is located in the recording path, which matrix (11) effects a matrixing according to the equation

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in accordance with the PAL standard, and that the grey scale signal (Yg) thus obtained is applied via a switch (S2) to the recording path (14), and that on playback the grey scale signal (Yg) is fed to a circuit (17, 15) in which the text signals R, G, B are recovered from the clearly defined co-ordination between the composition of the respective colour signal from the text signals R, G, B and the amplitude of the grey scale signal (Yg).