SWITCHING OF TELEVISION BROADCAST MODES

The present invention relates to devices for switching between television broadcasting modes such as, for example, NTSC, PAL, SECAM, M-PAL, N-PAL and the like.

Generally, well-known television broadcast signal standards include, for example, NTSC, PAL, SECAM, M-PAL and N-PAL. Various techniques have been proposed to switch between such television broadcast standards whilst substantially conforming to the characteristics corresponding to the visual and aural areas.

For example, a technique proposed by SONY Co. Ltd employs several field memories to reduce deterioration of picture quality. According to such a technique, the construction of a system embodying the technique tends to be very complicated with the result that cost is increased undesirably.

Japanese patent laid-open publication No. Heisei 3-208484, for instance, discloses a technique wherein the television broadcasting modes such as NTSC, PAL, SECAM and et el., can be compatibly switched. Figure 1 of the accompanying diagrammatic drawings shows a block diagram of a television broadcasting mode switching device embodying such a technique disclosed in the publication No. Heisei 3-208484.

As shown in Figure 1, the device includes a horizontal scanning line number converting circuit 3 for converting a number of horizontal scanning lines of an input image signal into a number of horizontal scanning lines of

a different television broadcasting mode, a field frequency converting circuit 11 for converting a field frequency of an output signal of the horizontal scanning line number converting circuit 3 into a field frequency of the different television mode and a vertical edge emphasizing circuit 20 disposed at a front stage or rear stage of the horizontal scanning line converting circuit 3 for emphasizing an edge of the image signal in a vertical direction to correct the vertical resolution which deteriorates due to the change of number of the horizontal scanning lines. Such a conventional technique, therefore, provides a switching device of television broadcasting mode having a reduced deterioration of an image signal, but doesn't provide a potential of a line or field conversion of the image signal.

Preferred embodiments of the present invention aim to provide an automatic switching device of television broadcast mode which employs a video memory capable of storing two field image signals instead of the previously proposed field memory so as to compatibly switch standard television broadcast signals by way of a simplified construction and an inexpensive cost.

According to one aspect of the present invention, there is provided a device for automatic switching of television broadcast modes, the device comprising:

a low pass filter for extracting a luminance signal from an input television video signal;

an analog to digital converter connected to the low pass filter, for converting the luminance signal to a digital signal;

a synchronizing signal separator for separating synchronizing signals from the input video signal;

a colour difference signal generator connected to the synchronizing signal separator, for generating colour difference signals from the video signal;

a synchronizing signal generator connected to the synchronizing signal separator, for supplying a 4fsc generating signal proper to a selected broadcast mode and for generating a synchronizing signal;

a multiplexer connected to the colour difference signal generator, for mixing the colour difference signals;

an analog to digital converter connected to the multiplexer, for converting the mixed colour difference signal to a digital signal to produce colour signal data;

a controller for generating control signals to control operation of the device;

a luminance line memory connected to the controller, for delaying the luminance signal by 1 horizontal period;

a colour line memory connected to the controller, for delaying the colour signal by 1 horizontal period;

a basic clock generator connected to the controller, for generating a basic clock signal;

a video memory connected to the controller, for storing field image signals from said luminance line memory and said colour line memory, or from said analogue to digital converters, according to a chosen conversion sequence,

a digital to analog converter connected to the controller, for converting digital image data into an analog luminance signal and colour difference signals; and

an encoder connected to the digital to analog converter, for encoding the analog signals to a selected broadcast mode.

Preferably, there are provided a plurality of said encoders each for encoding received analog signals to a respective broadcasting signal standard, and a switch connected to the controller and encoders, for selectively providing any one of the signals from the encoders under control of the controller.

A device as above may comprise a first said encoder for encoding received analog signals to an NTSC, PAL, N-PAL or M-PAL standard, and a second said encoder for encoding received analog signals to a SECAM standard.

According to another aspect of the present invention, there is provided a device for converting television broadcast standards, the device comprising

a luminance line memory, a colour line memory, a video memory, writing means for writing video signal data into the video memory, reading means for reading video data out of the video memory, and control means for selectively passing data through said colour and luminance line memories either before writing or after reading of the data into or out of the video memory, in dependence upon a selection of standards between which conversion is effected.

A device as above may further comprise any one or more of the features disclosed in the accompanying specification, claims, abstract and/or drawings, in any combination.

The invention extends to a video recorder or reproducer (e.g. a video tape recorder or reproducer, especially a video cassette recorder or reproducer) provided with a switching or converting device, or adapted to operate in accordance with a method, according to any of the preceding aspects of the invention.

For a better understanding of the invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to Figures 2 to 4 of the accompanying diagrammatic drawings, in which:

Figure 2 is a block diagram of one example of a switching device of television broadcasting mode according to the present invention;

Figure 3 shows examples of waveforms generated from principal parts of the device of Figure 2; and,

Figure 4 shows an example of a waveform of a writing enable signal.

In Figure 2, a low pass filter 150 separates a luminance signal from an input television image signal and is connected to an analog to digital converter 160 which converts the luminance signal into a digital signal.

A synchronizing signal separator 110 for separating a synchronizing signal from the image signal is connected to a colour difference generator 120 for generating colour signals R-Y and B-Y from the image signal.

A multiplexer 170 for mixing the colour difference signals is connected to the colour difference generator 120. A synchronizing signal generator 130 for generating a 4fsc generating signal (fsc denotes a colour subcarrier frequency and is set to 3.5795 MHz when in NTSC mode) relative to a broadcasting mode is connected to the synchronizing signal separator 110.

A controller 100 for controlling the entire system is connected to a luminance line memory 190 and a colour line memory 200 for respectively 1H delaying the luminance and colour signals and is also connected to a basic clock generator 250 for generating a basic clock signal and a video memory 210 for compatibly converting different fields.

Several digital to analog converters 220, 230 and 240 for converting digital image data into an analog luminance signal and colour difference signals are connected to the controller 100 and encoders 140 and 270 for encoding the broadcast signals into NTSC, PAL, N-PAL, M-PAL and SECAM mode. A switch 260 is connected to the encoders 140 and 270 and

the controller 100 for selectively providing the signals from the encoders 140 and 270 under control of the controller 100.

An example of operation of the illustrated example of the present invention is initiated according to commands externally supplied through an input side thereof. The commands are transferred through a reset line RST, a data line DATA, a clock line CK and strobe line STB and include those which will be listed below. That is:

1) input NTSC
2) input PAL
3) input SECAM
4) input N-PAL
5) output M-PAL
6) output NTSC
7) output PAL
8) output SECAM
9) output N-PAL
10) output M-PAL
11) output TV-still (general still)
12) special playback (SLOW)
13) STROBO

The illustrated device is operated as the commands representing the present input and output are entered thereto.

If a PAL mode output for an NTSC input is required, then the commands denoting the input NTSC and the output PAL must be input to the device.

In digital effects such as TV-still, strobo etc., the TV-still is achieved by performing it with the input and output previously defined, and the strobo is effected by inputting the strobo command STROBO. And, a special playback such as a digital slow is effected by receiving a special playback command and a writing enable signal WE while defining the input and output. The writing enable signal WE has a format as shown in Figure 4 and is a synchronized with the writing enable signal WE when in the special playback (SLOW).

More specifically, the writing enable signal WE is at a high level (H) at a portion where the picture quality is excellent, while it is at a low level (L) at a portion where noise is presented, as shown in Figure 4.

In fact, the device is in a special playback waiting state by receiving the input and output commands and then receiving the special playback command. At this time, if the writing enable signal WE goes to the high level, one field data is stored into the video memory 210 on the basis of a vertical synchronizing signal V-sync and a horizontal synchronizing signal H-sync and a reading operation is then continued.

If the writing enable signal WE goes to the high level again, then the previously described operation will be continuously effected by the device. Accordingly, a writing operation is effected with respect to the excellent picture image and the image having noise therein is substituted by the image

having an excellent picture quality, thereby obtaining a slow image of an excellent picture quality.

An example of a mode switching method will now be described, referring to Figure 2.

First, when receiving the video input and output commands, the controller 100 produces an input mode selecting signal IN-SEL to control the synchronizing signal separator 110 and the colour difference signal generator 120 so as to select the input signal. The controller 100 produces an output mode selecting signal OUT-SEL to control the synchronizing signal generator 130 and the NTSC, PAL, N-PAL, M-PAL signal encoder 140, thereby selecting a broadcasting mode proper to the output signal.

Next, the video signal is entered through the video input terminal Vin. The synchronizing signal separator 2 separates the vertical synchronizing signal V-sync and horizontal synchronizing signal H-sync which, in turn, are supplied to the controller 100. The low pass filter 150 extracts the analog luminance signal Y-IN and supplies the luminance signal Y-IN to the controller 100 through the analog to digital converter 160.

The colour difference signal generator 120 separates the colour difference signals R-Y and B-Y from the video signal input. The colour difference signals are supplied to the multiplexer 170.

The composite video signal is subjected to a colour difference separation; a colour system such as NTSC, PAL, SECAM is removed but synchronizing systems V-sync and H-sync exist. In this case, the luminance

signal is converted into the digital signal in accordance with the luminance clock signal Y-CLK generated by the controller 100 and the digitally converted signal is supplied to the controller 100. The colour difference signals R-Y and B-Y are input to the analog to digital converter 180 through the multiplexer 170 operating in accordance with a control signal CTL transferred from the controller 100. At this time, the colour analog to digital converter 180 receives the colour clock signal C-CLK and then supplies the colour signal data C-DATA to the controller 100.

The conversion sequence of the luminance signal Y-DATA and the colour signal C-DATA, digitally effected by the analog to digital converters 160 and 180, are differently determined depending upon the scanning lines, for example, 525 lines or 625 lines.

More specifically, if PAL, SECAM or N-PAL signals having 625 scanning lines at 50 Hz frequency are converted into an NTSC or M-PAL signal having 525 scanning lines at 60 Hz frequency, the signals from the analog to digital converters 160 and 180 are entered to the luminance line memory 190 and colour line memory 200 through the controller 100 and then are stored into the video memory 210 under control of the controller 100. The signals stored in the video memory 210 are supplied through the controller 100 to digital to analog converters 220, 230 and 240.

Alternatively, if a signal having 525 scanning lines is converted into a signal of 625 scanning lines, then the signal input from the analog to digital converters 160 and 180 is directly supplied to the video memory 210 and is entered to the digital to analog converters 220, 230 and 240 through the line memories 190 and 200.

The change of the conversion sequence allows the memory to be reduced in capacity because the video memory 210 always stores a signal of 525 lines. Generally, a signal of a larger number of scanning lines can be easily converted into a signal of a smaller number of lines.

In order to convert a 50 Hz signal (50 fields) into a 60 Hz signal (60 fields), this can be preferably achieved by compatibly converting a signal of five fields to a signal of six fields. That is, as shown in Figure 3, when converting the 50 field signal to 60 field signal, 625 lines of the signal are converted into 525 lines by way of the line memories 190 and 200, and the 525 lines thus converted are written into the video memory 210 (the vertical synchronizing signal is equal to a synchronizing signal of an original video signal). On the contrary, the 60 field signal from the memories 190 and 200 is read in a synchronous relation with the synchronizing signal generator 130 which produces the 60 field synchronizing signals V-sync and H-sync. In a procedure of converting a signal of five fields into a signal of six fields, any one of the five fields is repeatedly read to obtain the six fields.

When converting the 60 field signals into 50 field signals, the last one of six fields of the original signal is skipped to produce the desired signal of five fields. The five field signal from the video memory 210 is read in synchronism with the synchronizing signal generator 130 which produces the synchronizing signal in 50 fields. The signal thus read is converted into a signal having 625 lines by way of the line memories 190 and 200. The common applications in the previously described detail are that the six field periods of 60 field signal are substantially synchronized with the five field periods of 50 field signal and the video memory 210 is first written and then is read.

In the line conversion described above, to convert the signal of 625 lines into the signal of 525 lines, the signal is converted in a ratio of 6:5 by way of a method as is described below.

6/5 = 1.2

525 lines	626 lines	<1H delay>				<present>		
1	(1)			0	+	1		
2	(2)	1	X	0.2	+	2	X	0.8
3	(3)	2	X	0.4	+	3	X	0.6
4	(4)	3	X	0.6	+	4	X	0.4
5	(5)	4	X	0.8	+	5	X	0.2
	(6)	5			+	0		
6	(7)	0			+	6		
7	(8)	6	X	0.2	+	6		
8								

video memory address — horizontal synchronising signal of the synchronising signal generator

5/6 - 0.833...

625 lines		525 lines						
			<1-H delay>			<present>		
1								
2	(1)	1	X	0.833 . .	+	2	X	0.166
3	(2)	2	X	0.66 . . .	+	3	X	0.33 .
4	(3)	3	X	0.49 . . .	+	4	X	0.5 . .
5	(4)	4	X	0.33 . . .	+	5	X	0.66 .
6	(5)	5	X	0.166 . .	+	6	X	0.833
7								
8	(6)	7	X	0.833 . .	+	8	X	0.166
9	(7)	8	X	0.66 . . .	+	9	X	0.33 .
.	.							
.	.							
1								

synchronising signal of the original video signal.

According to the line converting method as described above, the signal of 525 lines can be converted into a signal of 625 lines by way of an algorithm which applies a weighting value of 1.2 to any one of 525 lines and applies a percentage to the present signal and the signal 1H delayed by the line memories 190 and 200 in the signal 625 lines to be converted, thereby producing one line. the signal of 525 lines is first stored and then is converted into a signal of 626 lines. Substantially, a portion changed from a

fifth field to sixth field is discrete but a reading address for the memory 210 is 1H delayed so that the line conversion may be achieved effectively.

Alternatively, a signal of 625 lines can be converted into a signal of 525 lines by way of an algorithm in which a weighting value of 0.8333 is applied to any one of the 626 lines and a percentage is applied to the present signal and 1H delayed signal of 525 lines, thereby producing one line.

When converting the signal of 626 lines into a signal of 525 lines, the original signal is immediately converted in line. The fifth line and sixth line are discrete, but it can be considered that the signal is continuously written in the video memory 210 by 1H delaying a writing address for the video memory 210.

The basic clock generator 250 supplies a basic clock EX-CLK to the controller 100 and the synchronizing signal generator 130 generates the 4fsc signal conforming to the broadcasting mode to produce a synchronizing signal corresponding to the mode. The digital to analog converters 220, 230 and 240 supply the luminance signal Y and colour difference signals R-Y and B-Y through data bus lines. The digital to analog converters 220, 230 and 240 separately employ the clock signals so as to reduce the number of signal I/O pins of the controller 100. The encoder 140 codes the luminance signal Y and colour difference signals R-Y and B-Y of the NTSC, PAL, N-PAL, M-PAL broadcasting modes and supplies the coded results to the output switch 260. The encoder 270 codes the luminance and colour difference signals of SECAM broadcasting mode and supplies the coded signals to the output switch 260 to obtain the video output Vout selected by the switch 260.

In the above-described example of the present invention, since the television broadcasting modes can be compatibly switched, a video tape can be reproduced regardless of the tape recording mode. Furthermore, this embodiment of the invention may be applied to all types of television mode software. A video memory capable of storing two fields is employed for standard television signal conversion without using a large number of field memories. Accordingly, the device can be simply constructed and the cost of manufacturing the device can be decreased.

Although a specific example of present invention has been described, it will be understood that various changes and modifications will be made therein without departing from the scope of the invention.

CLAIMS:

1. A device for automatic switching of television broadcast modes, the device comprising:

a low pass filter for extracting a luminance signal from an input television video signal;

an analog to digital converter connected to the low pass filter, for converting the luminance signal to a digital signal;

a synchronizing signal separator for separating synchronizing signals from the input video signal;

a colour difference signal generator connected to the synchronizing signal separator, for generating colour difference signals from the video signal;

a synchronizing signal generator connected to the synchronizing signal separator, for supplying a 4fsc generating signal proper to a selected broadcast mode and for generating a synchronizing signal;

a multiplexer connected to the colour difference signal generator, for mixing the colour difference signals;

an analog to digital converter connected to the multiplexer, for converting the mixed colour difference signal to a digital signal to produce colour signal data;

a controller for generating control signals to control operation of the device;

a luminance line memory connected to the controller, for delaying the luminance signal by 1 horizontal period;

a colour line memory connected to the controller, for delaying the colour signal by 1 horizontal period;

a basic clock generator connected to the controller, for generating a basic clock signal;

a video memory connected to the controller, for storing field image signals from said luminance line memory and said colour line memory, or from said analogue to digital converters, according to a chosen conversion sequence,

a digital to analog converter connected to the controller, for converting digital image data into an analog luminance signal and colour difference signals; and

an encoder connected to the digital to analog converter, for encoding the analog signals to a selected broadcast mode.

2. A device according to claim 1, wherein there are provided a plurality of said encoders each for encoding received analog signals to a respective broadcasting signal standard, and a switch connected to the controller and

encoders, for selectively providing any one of the signals from the encoders under control of the controller.

3. A device according to claim 2, comprising a first said encoder for encoding received analog signals to an NTSC, PAL, N-PAL or M-PAL standard, and a second said encoder for encoding received analog signals to a SECAM standard.

4. A device for converting television broadcast standards, the device comprising a luminance line memory, a colour line memory, a video memory, writing means for writing video signal data into the video memory, reading means for reading video data out of the video memory, and control means for selectively passing data through said colour and luminance line memories either before writing or after reading of the data into or out of the video memory, in dependence upon a selection of standards between which conversion is effected.

5. A device according to claim 4, further comprising any one or more of the features disclosed in the accompanying specification, claims, abstract and/or drawings, in any combination.

6. A device for switching or converting television broadcast standards, the device being substantially as hereinbefore described with reference to Figure 2 or Figures 2 to 4 of the accompanying drawings.

7. A method of switching or converting television broadcast standards, the method being substantially as hereinbefore described with reference to Figure 2 or Figures 2 to 4 of the accompanying drawings.

* C L M S *

8. A video recorder or reproducer provided with a switching or converting device according to any of claims 1 to 6, or adapted to operate in accordance with a method according to claim 7.

9. A video recorder or reproducer according to claim 8, being a video tape recorder or reproducer.