

INDEX SEARCH SYSTEM

The present invention relates to a VCR (Video Cassette Recorder) system for recording a video signal and reproducing the recorded video signal
5 with an index search function.

The index search function of a conventional VCR records an index signal at a required position in recording or playing back mode and, if a user wants to find the position where the index signal is recorded, the tape is firstly
10 transported at a maximum speed and then it is played back at normal speed from the position where the index signal is detected.

If two or more index signals are recorded in the VCR with such an index search function, a fast search mode is performed from the starting
15 position of the tape and, if a recorded index signal is detected while performing the fast search mode, the mode is converted to a reproducing mode and then the program of the tape is reproduced for a few seconds, for example, for about 4~5 seconds. If an additional mode conversion signal does not enter during the reproducing mode, the tape is moved fast again until
20 the next index signal is detected. By repeating this operation, the program of the tape is reproduced for a few seconds whenever the index signal is detected. Thus, the user can find the desired program, by watching the screen.

25 In summary, the index signal recorded on the tape is detected in the fast search mode and the program of the tape is reproduced for a few seconds from the position where the index signal is detected, and then the user finds the desired program by watching the screen.

However, in such a prior art VCR system, it takes too much time to find a desired program and another problem is encountered in that programs can not be reproduced in a desired program order.

5 Preferred embodiments of the present invention aim to solve the problems of the prior art and to provide a character-displayed index search system in which a tape program can be easily searched since an index signal and information about each program are displayed on the screen of a character generator in an index search mode after the index signal and the information
10 are recorded in a record mode.

According to a first aspect of the present invention, there is provided a character-displayed index search system for use in video tape systems for recording a video signal and reproducing a recorded video signal to and from
15 a video tape, said index search system comprising:

signal record means comprising a shift register for shifting serial index data which is generated by varying the duty cycle of a control pulse provided from a syscon microprocessor, a converter for receiving the data provided
20 from said shift register and providing a tape recording signal, and a control signal recording circuit for receiving said tape recording signal from said converter and recording it on the tape by a control head to record index data comprising index code and character code;

25 signal reproducing means comprising a control signal reproducing circuit for amplifying an index data signal detected by said control head; and

an index/character converter for converting the output signal of said control signal reproducing circuit to index data by decoding and providing it

to said syscon microprocessor, and a character generator for displaying an index signal and information about a recorded program output from said syscon microprocessor.

5 Preferably, said converter comprises:

 a monostable multivibrator for converting an input control pulse to a pulse of 60 percent duty cycle;

10 a flip-flop for receiving both the output of said monostable multivibrator and the output of said shift register; and

 an AND gate for logic combination of the output of said flip-flop and said input control signal.

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 Preferably, said index-to-character converter comprises:

 a monostable multivibrator for converting a played-back control signal to a control signal of 60 percent duty cycle;

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 an inverter for inverting the output signal of said monostable multivibrator and providing it as a clock signal of said syscon microprocessor;

 a first flip-flop for receiving the output signal of said monostable multivibrator and said played-back control signal through clock and input terminals and providing a character signal;

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 further flip-flops for applying the output signals from each of said flip-flops to the input terminal of the next flip-flop and outputting character

signals, the number of flip-flops including the first and further flip-flops equalling the number of bits in the input signal; and

an AND gate for providing an index signal by the logic combination
5 of the outputs of said flip-flops.

Preferably, said index signal is composed of 10-bit index signal data, 2-bit boundary signal data, and 48-bit character signal data.

10 The invention extends also to a video recorder and player provided with an index search system according to any of the preceding aspects of the invention.

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

Figure 1 is a circuit diagram of a prior art index search system;

20 Figure 2 is a circuit diagram of one example of an index search system embodying the present invention;

Figure 3 shows examples of waveforms of input and output signals of a syscon microprocessor in an embodiment of the present invention;

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Figure 4 shows examples of waveforms showing serial index data in an embodiment of the present invention;

Figure 5 is a circuit diagram of an example of a converter in an embodiment of the present invention;

Figure 6 shows examples of waveforms of signals at parts of the converter shown in Figure 5;

Figure 7 is a circuit diagram of an example of an index or a character converter embodying the present invention;

Figure 8 shows examples of waveforms of signals at parts of the index and character converter shown in Figure 7;

Figure 9 ~ Figure 13 are flowcharts of an example of a program executed in a syscon microprocessor embodying the present invention; and

Figure 14 shows a screen where the index character information is displayed.

In the figures, like reference numerals denote like or corresponding parts.

Figure 1 shows a circuit diagram of a prior art index search system, wherein a syscon microprocessor 2 provides a control signal recording circuit 3 with an input horizontal synchronous signal of 15734Hz and a capstan motor CM control pulse train of 30Hz and 60 percent duty cycle ratio under the control of an input signal from a remote controller (not shown) or a key matrix 1 so as to input tape record signals through a control head H.

If an index key signal is applied from the key matrix 1 or the remote controller, the control pulse train of 30Hz and 60 percent duty cycle ratio provided from the syscon microprocessor 2 is converted to a control signal of 30Hz and 27.5 percent duty cycle ratio and the converted control pulses are recorded.

The control pulses detected from the control head H are amplified by a control signal reproducing circuit 4 and subsequently provided to an index signal detection circuit 5.

The index signal detection circuit 5 provides an index signal to the syscon microprocessor 2, and the system microprocessor 2 performs reproducing (playback) mode for a few seconds.

On the other hand, the signal reproduced by the syscon microprocessor 2 is displayed through a character generator 6.

Figure 2 shows a circuit diagram of an example of a character-displayed index system embodying the present invention. In Figure 2, a shift register 11 receives serial data from a syscon microprocessor 10 which controls the system according to input signals provided from a remote controller (not shown) or a key matrix 1 and shifts the received serial data by a control pulse of 30Hz. A converter 12 is connected to this shift register 11 and generates a record signal by receiving the output data from the shift register 11 and the control pulse of 30Hz provided from the syscon microprocessor 2.

Also, an amplifier 13 amplifies an FG signal which is detected at an FG coil L of a capstan motor CM, and is proportional to the speed of the

capstan motor, and provides the amplified signal to the syscon microprocessor 10.

5 A control signal recording circuit 14 is connected to an output of the converter 12 and records the output signal of the converter 12 through the head H.

10 On the other hand, an index/character converter 16 is connected to a control signal reproducing circuit 15 which plays back the control signal detected by the control output index data from the control signal to the syscon microprocessor 10.

15 Also, a character generator 17 is connected to an output terminal of the syscon microprocessor 10 to display serial data provided from the syscon microprocessor 10 on screen.

20 Here, the key matrix 1 or the remote controller, the syscon microprocessor 10, the control signal recording circuit 14, the control signal reproducing circuit 15, the control head H, the capstan motor CM, and the FG coil L may have similar configurations to conventional parts.

Figure 3 shows the input/output waveforms of the syscon microprocessor 10, and Figure 4 shows the waveforms of the serial data provided from the syscon microprocessor 10.

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Also, Figure 5 is a detailed circuit diagram of the converter 12 in Figure 2, which comprises a monostable multivibrator 20, a flip-flop 21, and an AND gate 22.

Figure 6 shows the output waveforms of each part in Figure 5.

Figure 7 is a detailed circuit diagram of the index and character converter 16, which comprises a monostable multivibrator 30, and an inverter 31, and AND gate 32, and five flip-flops 33 ~ 37. Here, the number of flip-flops is variable depending on the number of bits of an index signal, i.e. the number of flip-flops is equal to that of the bits of the index signal. Figure 8 shows output waveforms of signals at each part in Figure 7.

Figure 9 ~ Figure 13 show examples of flowcharts of a program executed in the syscon microprocessor 10.

Figure 14 shows the case that serial data provided from the syscon microprocessor 10 is displayed on a screen by the character generator 17.

In the embodiment of the invention described as above, while the syscon microprocessor 10 performs record mode in Figure 2, an input horizontal synchronous signal of 15743Hz is divided by a factor of 525 and thus a control pulse of 30Hz and 60 percent duty cycle as shown in Figure 3(b) is provided. A control signal provided from the syscon microprocessor 10 is applied to both the shift register 11 and the converter 12.

An FG signal proportional to the speed of the capstan motor CM is detected by the FG coil L and subsequently amplified by the amplifier 13. The amplified FG signal is applied to the syscon microprocessor 10.

The syscon microprocessor 10 determines the period of a supply reel pulse C and a take-up reel pulse D shown in Figure 3 by counting the FG pulse in the forward mode of the tape.

The supply reel pulse and the take-up reel pulse which are provided to the syscon microprocessor 10 have a 50 percent duty cycle and are proportional to the speed of each reel, i.e. their periods depend on the amount of tape wound to each reel.

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As described above, after calculating the periods of the supply reel pulse and the take-up reel pulse by counting the FG pulse, the progress time of the tape is determined as the functions of the periods T_s and T_t of the supply reel pulse and the take-up reel pulse. That is, the progress time of the

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tape is given by

$$T_P = K \left(\frac{T t^2}{\alpha} - \beta \right)$$

where α is the thickness of the tape and β is the hub diameter of tape.

The hub diameter β generates a difference of $T_s + T_t$ and the progress time T_P is determined by comparing a present value with a previous value.

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In other words, the syscon microprocessor 10 calculates both the period T_s of the supply reel pulse and the period T_t of the take-up reel pulse by counting the FG pulse and, by using these values T_s and T_t , the progress time of the tape is determined, based on SP (Standard Play) mode. Now, the process for recording the index signal and the character signal is described.

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If the character key signal is transmitted from the key matrix 1 or the remote controller, the syscon microprocessor 10 recognizes the character key signal and provides serial data to the character generator 17, thereby making a message identifying character entry mode on the screen of the character generator 17. The manner in which this information is recorded on tape is explained below.

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At this time, the syscon microprocessor 10 is in a standby state for character inputs and recognizes the number input as the character.

That is, if the character key signal is transmitted from the key matrix
5 1 or the remote controller to the syscon microprocessor 10, a message
identifying character entry mode is displayed on the screen of the character
generator 17 and, subsequently, if a number key signal is entered, the syscon
microprocessor 10 recognizes it as a character and displays it accordingly.

10 For example, if '0'-key is pressed, 'A' is displayed, and also, if '1'-
key is pressed, 'B' is displayed.

On the other hand, if the index key signal is transmitted from the key
matrix 1 or the remote controller to the syscon microprocessor 10, the syscon
15 microprocessor 10 performs index signal recording mode.

Next, a signal for selecting the title and index of the program as shown
in Figure 3(g) ~ (j) is provided from the syscon microprocessor 10. Also,
the syscon microprocessor 10 provides the serial index data to the shift
20 register 11. The serial index data is divided into three parts, an index code
part, a boundary code part between an index code and a character code, and
a character code part.

For example, when the index data has a total of 60 bits, the first 10
25 bits are all "L" (low level) for the index code part, the second 2 bits are all
"H" (high level) for the boundary code part, and the last 48 bits are "H" or
"L" for the character code part, depending on the input character signal.

At this time, logic "0" or "1" is determined depending on the duty cycle of the control signal of 30Hz. That is, if the control signal of 30Hz has 27.5 percent duty cycle, it means logic "0", while, if the control signal of 30Hz has 60 percent duty cycle, it means logic "1".

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Thus, in order to generate the serial index data, first, the duty cycle of control signal of 30Hz is converted from 60 percent to 27.5 percent and 10 pulses of this converted control signal are provided as the index code, and next, two pulses of the control signal of 60 percent duty cycle are provided and finally, the combined pulses of 60 percent to 27.5 percent duty cycle of the control signal are output depending on the character signal.

The shift register 11 shifts the index data comprising the index code, the boundary code, and the character code sequentially. The output signal of the shift register 11 and the control signal of 30Hz are applied to the converter 12.

To explain the operation of the converter 12, referring to Figure 5, the index signal in Figure 3h from the shift register 11 is applied to the input terminal of the flip-flop 21 and the control signal of 30Hz in Figure 3b from the syscon microprocessor 10 is applied to the monostable multivibrator 20.

Then the control signal of 30Hz is delayed by 9.16ms, that is, a necessary time interval to convert the duty cycle of the control signal from 60 percent to 27.5 percent, and this delayed control signal K is provided to the clock terminal of the flip-flop 21.

At the same time, the control signal of 30Hz is provided to the input terminal of the flip-flop 21, and then the output waveform, as shown in Figure 6, is provided from the flip-flop 21.

5 Subsequently, the output signal of the flip-flop 21 and the control pulse of 30Hz are applied to an AND gate 22, and then the AND gate 22 provides a signal as shown in Figure 6m.

10 The output signal of the converter 12 comprising the monostable multivibrator 20, the flip-flop 21, and the AND gate 22 shown in Figure 5, is applied to the control signal recording circuit 14 in Figure 2. Then the control signal recording circuit 14 records the data on the tape through the head H, according to the output of the converter 12.

15 As mentioned above, if the user presses the character key at a desired position of the tape, the screen of the character generator 17 is in the standby state to receive the character inputs.

20 If the title of the program is transmitted by using the number keys corresponding to each character input and next the index key is pressed, the index data composed of the 10-bit index code, the 2-bit boundary code, and the 48-bit character code as shown in Figure 4 is applied to the shift register 11.

25 After the shifted signal is applied to the converter 12 and converted to the final recording signal, it is recorded on the tape through the head H by the control signal recording circuit 14.

Now, the process for reproducing the index signal recorded on the tape is described.

In the fast forward mode of the VCR (except when in record mode),
5 the control signal detected at the head H is amplified by the control signal reproducing circuit 15 and the amplified signal 15 applied to the index and character converter 16.

To describe the above process, referring to Figure 7 and Figure 8, the
10 detected control signal in Figure 3j is applied to the monostable multivibrator 30 shown in Figure 7 and delayed by 16.67ms, that is, a necessary time to generate the control pulse with 60 percent duty cycle.

The control signal in Figure 8j and its delayed signal in Figure 8n are
15 applied to the input terminal and the clock terminal of the flip-flop 33 respectively.

Then the flip-flop 33 provides the signal in Figure 8o and, contrarily,
the output signal in Figure 8n of the monostable multivibrator 30 is applied
20 to the inverter 31.

The inverted signal is applied to the syscon microprocessor 10. The
signal in Figure 8o provided from the syscon microprocessor 10 is applied to
the input terminal of the flip-flop 34. Next, the output of the flip-flop 34 in
25 Figure 8p is applied to the next flip-flop 35.

Similarly, flip-flops 36 and 37 are sequentially connected. The
inverted output signals of the flip-flops 33, 34, 35, 36 and 37 are applied to

the five-input AND gate 32, and then the signal as shown in Figure 8y is provided.

5 If the index and character converter 16 comprises five flip-flops as shown in Figure 7, when five control pulses with 27.5 percent duty cycle are applied, the index signal is provided with the pulse of "H".

10 If the index and character converter 16 comprises ten flip-flops, one pulse of index signal is provided only when the ten control pulses are applied.

Also, the control signal in Figure 8j is delayed by the monostable multivibrator 30 and this delayed signal is used as the clock signal. On the other hand, the output signal of the monostable multivibrator 30 is inverted by the inverter 31 and this signal is subsequently applied to the syscon
15 microprocessor 10.

Then the syscon microprocessor 10 abandons the boundary code and receives only the character code. Also, the syscon microprocessor 10 converts the output signal in Figure 8y of the index and character converter
20 16 to the character information and provides serial data to the character generator 17 for display.

Thus, the title of the program is displayed on the screen in the index search mode. If the title number of the program is selected and the index key
25 is pressed again, or the number appearing on the screen is directly pressed in the index search mode, the tape is moved to the index position corresponding to the selected number and the reproducing (playback) mode is automatically carried out.

If two or more numbers are selected, the programs are sequentially reproduced.

Figure 9 ~ Figure 13 show the flowcharts for controlling the recording means comprising the shift register 11 and the converter 12, and the reproducing means comprising the index and character converter 16 respectively.

As shown in Figure 10, the horizontal synchronous signal is counted and subsequently divided by a factor of 525.

After division-by-525, the system is controlled according to the flowchart shown in Figure 9. That is, it is checked that the entry of 60-bit data is completed.

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If it is proven to be completed, the starting address of the stored data is provided to the register A, while, if the entrance of 60-bit data is not completed yet, the number of shifts is checked as to whether or not it is eight.

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If the number of shifts is proven to be eight, the address value stored in the register A is increased. At this time, the input data is composed of the 10-bit index code, the 2-bit boundary code, and the 48-bit character code.

If one data enters, the data at an address assigned by the register B is fetched and the number of times of shift is cleared. Next, the data in the register B is repeatedly shifted to the left, and it is checked whether a carry is generated by the shift operation. If a carry is generated, the duty cycle data corresponds to 60 percent, while, if no carry is generated, the duty cycle data

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corresponds to 27.5 percent. The duty cycle data is provided to a time register to determine the delay time.

Thus, in the case of a 60 percent duty cycle, the control pulse is delayed by 20ms, while, in the 27.5 percent duty cycle case, it is delayed by 9.17ms. The duty cycle data is stored in the timer register as shown in Figure 10, and then the control signal provided from the syscon microprocessor 10 is changed from "L" to "H".

That is, by the control signal of "H", the shift register 11 and the converter 12 are driven, and also, the timer is driven with an initial value, carrying out the index search mode.

After carrying out the index search mode, the control signal provided from the syscon microprocessor 10 is changed from "H" to "L" after 20ms or 9.178ms, completing the recording of the index signal.

Figure 12 shows a flowchart for controlling the index/character converter 12.

Data corresponding to a reference time of 16.7ms is recorded in the timer register by an external interrupt request signal and the timer starts.

After setting the timer, referring to Figure 13, if the input control signal is "L" RAM (Random Access Memory) iD is checked to be either 1 or 0, which is recorded as 1 only when the ten successive pulses of the control signal have 27.5 percent duty cycle.

If the RAM iD is not "1", the index data output port is set to "H" when the input ten pulses of the control signal have 27.5 percent duty cycle. Contrarily, if the input control signal is not "L", another RAM jD is checked to be either "1" or "0", which is recorded as "1" when the RAM iD is "1" and the 2-bit boundary code enters.

If the RAM jD is not "1", the register j which is used to count the number of bits of the boundary code is increased and, if j=2, the RAM jD is set to "1".

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Subsequently, if the input control signal is not "L" and iD=jD="1", the input character code is stored in RAM until the number of received bits of the input character code becomes 48.

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That is, if the 48 bits of character code are all received, the RAM jD is set to D and the index output port is changed from "H" to "L".

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In the above-described embodiment of the present invention, the character-displayed index search system for the VCR, which can record the index signal, can inform the user of the position of a tape with the progress time of the tape and the title of the program by reproducing the program on the tape for about 5 seconds whenever the index signal is detected in the fast forward mode, and repeating this process until the user selects desired programs, and can sequentially play back selected one or more programs after a rapid search by using the index search operation.

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CLAIMS

1. A character-displayed index search system for use in video tape systems for recording a video signal and reproducing a recorded video signal to and
5 from a video tape, said index search system comprising:

signal record means comprising a shift register for shifting serial index data which is generated by varying the duty cycle of a control pulse provided from a syscon microprocessor, a converter for receiving the data provided
10 from said shift register and providing a tape recording signal, and a control signal recording circuit for receiving said tape recording signal from said converter and recording it on the tape by a control head to record index data comprising index code and character code;

15 signal reproducing means comprising a control signal reproducing circuit for amplifying an index data signal detected by said control head; and

an index/character converter for converting the output signal of said control signal reproducing circuit to index data by decoding and providing it
20 to said syscon microprocessor, and a character generator for displaying an index signal and information about a recorded program output from said syscon microprocessor.

2. An index search system according to claim 1, wherein said converter
25 comprises:

a monostable multivibrator for converting an input control pulse to a pulse of 50 percent duty cycle;



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a flip-flop for receiving both the output of said monostable multivibrator and the output of said shift register; and

5 an AND gate for logic combination of the output of said flip-flop and said input control signal.

3. An index search system according to claim 1 or 2, wherein said index-to-character converter comprises:

10 a monostable multivibrator for converting a played-back control signal to a control signal of 60 percent duty cycle;

an inverter for inverting the output signal of said monostable multivibrator and providing it as a clock signal of said syscon microprocessor;

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a first flip-flop for receiving the output signal of said monostable multivibrator and said played-back control signal through clock and input terminals and providing a character signal;

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further flip-flops for applying the output signals from each of said flip-flops to the input terminal of the next flip-flop and outputting character signals, the number of flip-flops including the first and further flip-flops equalling the number of bits in the input signal; and

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an AND gate for providing an index signal by the logic combination of the outputs of said first and further flip-flops.



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4. An index search system according to claim 1, 2 or 3, wherein said index signal is composed of 10-bit index signal data, 2-bit boundary signal data, and 48-bit character signal data.

5. An index search system substantially as hereinbefore described with reference to Figure 2 of the accompanying drawings.

6. An index search system substantially as hereinbefore described with reference to Figures 2 to 13 of the accompanying drawings.

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7. A video recorder and player provided with an index search system according to any one of the preceding claims.