MULTICHANNEL TELEVISION SYSTEM

This invention relates to a multi-channel television system which has the facility for displaying more than one channel at once.

One type of existing multi-channel system displays only one sub-screen in the corner of a main screen. The present invention is concerned with displaying more than one sub-screen in a main screen. It is particularly, but not exclusively, concerned with a menu-type multi-channel system in which a main screen provides a multi-channel display by the existing picture in picture (PIP) function of video tape recorders (VTR) and television (TV), and from which a user can easily select his favourite channels.

According to the present invention there is provided a multi-channel television system comprising: a channel memory for storing channel information relating to a plurality of television channels for display, the memory having a plurality of memory locations with respective channel selection data stored therein for identifying respective television channels; means for displaying a plurality of channels simultaneously on a main screen; and means for recalling said channel selection information to display a first plurality of channels on said main-screen corresponding to a first group of channel data and, responsive to a user command, a second plurality of channels on said main-screen corresponding to a second group of channel data.

The invention also provides a method of operating such a system.

In the preferred embodiment of the invention a sub-screen assigned to a channel which was stored in the channel memory is displayed in a main screen in PIP mode, when a

multi-channel key on a remote control transmitter is pushed. The channel which is stored in a next page of the memory can be displayed in a multi-channel mode by a page up/down facility. In the multi-channel mode, the sub-screens are sequentially tuned to different channels to provide a "menu" type display. A user can easily select his favourite channel from the "menu" type display.

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

Figures 1-(A) and (B) are the tuning waveforms for the PIP signals in an exemplary multi-channel embodiment of the present invention;

Figure 1-(C) is a diagram of the positions of channel display information in the channel memory;

Figures 1-(D) and (E) are diagrams of a multi-channel display on a main screen;

Figures 2-(A) and (B) are timing diagrams of multi-channel tuning and reference times;

Figures 3-(A),(B),(C) and (D) are diagrams relating the PIP sub-screen displays to the channel information in the channel memory;

Figures 4-(A-1),(A-2),(B-1) and (B-2) are diagrams showing the main screen and sub-screen relating to first and second tuners;

Figures 5-(A),(A-1),(B) and (B-1) are hardware block diagrams and state diagrams of the first and second tuners respectively;

Figure 6 is a block diagram of a multi-channel television apparatus; and

Figure 7 is a flow chart for multi-channel operation of the apparatus.

In the following description, multi-channel mode is defined as n PIP sub-screens within a main-screen, where channel data for each sub-screen is fetched from a channel memory and displayed on said n PIP sub-screen at the same time.

Multi-channel mode can work on the PIP system regardless of only having two tuners (650,660 in Figure 6). In the case of the multi-channel mode, the procedure of PIP control is as follows. When a multi-channel key is on, the multi-channel mode begins to operate.

Assume that the channels K,L,M,N are stored in the channel memory in that order. The channels stored in the channel memory are termed herein "scanning channels". If ther is a synchronised signal on a scanning channel during a multi-channel mode, the channel becomes an effective channel as shown in Figure 1-(A).

In Figure 1-(A), (٢٢) is a rotate data output signal for the PIP screen which starts the scanning process.

(١) is a first still data output of the PIP, which causes the picture displayed at the currently tuned PIP location to stop moving,
(2) is a rotated data output signal which causes the tuner to tune the next display location,
(3) is an output starting on channel selection of the tuner to tune the selected display location to the next stored channel (L),
(4) is AFT (Auto Fine Tuning) which completes operation of the tuning procedure, and
(5) is a second still data output (the same as (1)) which cancels the still state and allows the displayed picture to move.

Therefore the first still causes a still state and the second still cancels the still state.

If there is not a synchronised signal at the stored channel in the multi-channel mode, the channel is designated as an ineffective channel. This is described in Figure 1-(B). In Figure 1-(B), signals 1' to 3' do the same function as 1 to 3 of Figure 1-(A). The signal 3' is seeking to tune the selected display location to channel M, which has no synchronised signal. 4' is an output signal indicating a decision of no synchronised signal, 5' is an output signal jumping to a channel having a wavelength close to the sought channel (channel M), 6' is an output signal for repeating said processes of 1' to 5' until finding the next channel position in memory having a synchronised signal (in this case channel N), and 7' executes the process of Figure 1-(A) when a synchronised signal is found, to fine tune the channel signal and cancel the still state.

Thus, the channel information stored in the channel memory becomes as shown in Figure 1-(C), where it is assumed that a NON-ADDED channel exists on position 4 and an ineffective channel is on position 3.

The NON-ADDED channel is defined as a channel not memorised in the channel memory before.

The whole screen obtained by the operation of Figure 1-(B) represents the display of channels K,L,N and O as shown in Figure 1-(D), where the channel (M channel) not having synchronised signal of Figure 1-(A) is skipped.

If a specific channel key is pressed in the operating mode of Figure 1-(E), is pressed, the pressed channel mode works.

Figure 2 shows a waveform providing the display time Δt in the multi-channel mode between tuning steps.

Figure 2-(A) indicates the time increment Δt which can be adjusted by use of a (+) key and a (-) key to control the time between changing from one channel to another channel.

Figure 2-(B) shows how the time Δt can be increased or decreased in 0.2 second increments when the reference time is 1 second.

Figure 3 illustrates a page up/down operation when the multi-channel key is on.

Figure 3-(A) shows a channel memory consisting of 32 positions.

Figure 3-(B) shows one page of a TV screen on which four channels corresponding to four positions of the channel memory are displayed when the multi-channel mode is operated.

Therefore, if one page is defined to display 4 positions per page, it is possible to hold P pages in the channel memory where $4P = 32$.

It is assumed in Figure 3-(A) that position 4 and position 6 are non-added channels, and positions 3, 5 and 10 are ineffective channels without a synchronised signal. In the case of Figure 3-(B), each of four channels corresponding to four positions of the channel memory is displayed on one page of one TV screen, and it is possible to alter the display by moving a channel selector up or down the channel memory by a page.

If there are channels which do not have synchronous signals, the channel selector jumps over the channels as explained with reference to Figure 1-(B). Thus, a multi-channel mode is

accomplished only using the positions having symchronous signals. As an example, if position 3 (channel M) is an ineffective channel not having a sychronous signal, the channel is skipped over and the next effective channel previously stored in the memory becomes active. In this case, the next effective channel is channel O. Thus, the first page displays channels K,L,O and P as shown in Figure 3-(B).

The arrow of Figure 3-(B) indicates the direction of the progress of sequential tuning of the respective channels to display moving pictures in rotation as described with reference to Figure 1-(A). Figure 3-(B) also shows the result of executing a page up or down command. The next page for display has channels Q,S,T and U, bearing in mind that position 10 (Channel R) is ineffective. Figure 3-(D) indicates the channel memory with the defective and non-added channels having been removed.

Figure 3-(D) shows a skip memory having channels K,L,M and N which are all effective channels and the corresponding display.

Figure 4 shows that multi-channels are displayed on signal screen.

Figure 4-(A-1) illustrates the case where a main-screen is a play back screen when the first tuner 650 is in playback mode and the sub-screen is in multi-channel mode.

Figure 4-(A-2) describes the TV screen on which the main screen is a blue screen not receiving a broadcasting signal and the sub-screens are multi-channel screens when TV is turned on but is not in playback mode.

Figure 4-(B-1) shows that the main screen is the playback mode and the sub-screens are in the multi-channel mode when the second tuner is in a playback mode.

Figure 4-(B-2) shows that, when there is a synchronising signal in a main screen but it is not in the playback mode, the main screen displays the signal from the first tuner or a single line and the sub-screen displays the signal from the second tuner.

Figure 5-(A) shows the first tuner system and Figure 5-(B) shows the second tuner system.

The first tuner system consists of a television tuner circuit 501, a signal processing circuit 502 for a video tape recorder (VTR, a switching part 503 which can select a blue screen signal whose channel does not receive any broadcasting signal and which is controlled by respective control signals for the main screen (Q7) and sub-screens (Q6), and a PIP (picture-in-picture) block 504 for controlling the picture in picture (PIP) function.

The second. tuner system consists of a main screen input selector 510, a sub-screen output selector 511, a VTR signal processing block 512, a switching part 513 which can select a blue screen and which is controlled by respective control signals for main screen (Q7) and sub-screens (Q6), and a PIP block 514 for processing the signals in PIP mode.

Figures 5-(A-1) and 5-(B-1) are state diagrams for the operation of the first and second tuner systems. "X" denotes a NORMAL state which has a synchronous signal and "Y" is to indicate the ineffective channel which does not have a synchronous signal.

In the example of Figure 5-(B-1), for the first time Q6 becomes L (low) and selects playback (PB) screen as a main screen in playback mode.

Q7 sets "X" to L by a synchronous signal and selects the received channel as a sub-screen. If there is not a synchronous signal, then Q7 sets "Y" to H (high) and selects blue screen as a sub-screen.

Next, at NON PB mode, Q6 and Q7 select either received channel or blue screen as main screen or sub-screen according to the existence of a synchronous signal. Figure 6 shows a whole system comprising the first and second tuner systems of Figure 5 and using a microcomputer 600 as a controller.

Figure 7 is a flow chart for the system of Figure 6.

If the microcomputer 600 receives a channel input (step 701), it makes a decision whether the channel is selected by the first or second tuner system (step 704). If the channel is from the first tuner, it will determine whether the channel is a PB mode or not (step 705). If it is a PB mode, it selects the PB screen as a main screen (step 706). If it is not a PB mode, it selects the blue screen as a main screen (step 707). If the tuner system is the second tuner, it will determine whether the present mode is a PB mode or not (step 708). If it is a PB mode, it selects the PB screen as a main screen (step 706). If it is not a PB mode, it will determine whether it is main screen or sub-screen (step 710).

If it is a main screen, it will check the existence of a synchronous signal (step 711). If there is not a synchronous signal, it selects the blue screen as a main screen (712). If said signal is a sub-screen (step 710), it reverses the mode of main/sub again (step 713) and selects a main screen according to the kind of input; first tuner, second tuner or LINE (step 714).

If the input is the first tuner, the controller 600 sets a select signal Q2 to H (step 715) which is fed to a multiplexor 640 to control the first tuner 650 (step 716).

If the input is the second tuner, the controller sets Q2 to low (step 717) and controls the second tuner (step 718 through the multiplexor 640.

If the input is LINE, the controller keeps the previous state of Q2 (step 719) and does not control either tuner (step 720).

When a main screen is selected according to the above process, the controller 600 selects the blue screen as a main screen (step 722) according to the existence of a synchronous signal (step 721).

On the other hand, a selection of sub-screen is determined according to whether the output selector is the first or second tuner or LINE (step 725).

If the output selector is the first tuner, the controller 600 sets the signal Q2 to high (step 726), and controls the first tuner 650 (step 727). If it is the second tuner 660, the controller sets the signal Q2 low (step 728), and controls the second tuner 660 (step 729).

If it is LINE, the controller keeps the previous state of Q2 (step 730) and does nothing for control (step 731).

The selection of sub-screen is completed according to the above process.

The microcomputer 600 executes the multi-channel mode according to each sub-screen 1, 2 or n (step (732), as described with reference to Figure 1, that is, it outputs the PIP still and ROTATE key data (step 733), begins the channel selection, performs the AFT action, and then outputs the PIP cancel still data again (step 734).

The microcomputer makes a decision on the presence of a synchronous signal on the current sub-screen (step 735).

If there is no synchronous signal, the controller 600 jumps to the next position in the channel memory (step 736). If there is a synchronous signal, a decision is made as to whether the sequential tuning of the channels on one page of memory is finished or not (step 736-1). If it is not finished, the controller executes the sequential tuning in progress (step 737), then checks for a page up (step 738) and page down (step 740) condition. When page is up (step 738), the content of page counter is increased (step 739). When page is down (step 740) the content of page counter is decreased (step 741). The counter then makes a decision on whether multi-channel key input (step 742) has been made again. If the input has been made, multi-channel mode is turned off (step 743) and is set to the state prior to ON (step 745).

If there is not a multi-channel key input but there is a remocon channel key input (step 746), the corresponding channel is displayed on the corresponding screen (step 747). Thus, according to this invention, TV screen is changed to the state of a multi-channel display by using an existing PIP or multiscreen function with the effect of improving the convenience and reliability when using TV system is obtained so that a user easily selects his favourite channel by making it possible to select a channel by menu type selection.

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CLAIMS:

1. A multi-channel television system comprising:

a channel memory for storing channel information relating to a plurality of television channels for display, the memory having a plurality of memory locations with respective channel selection data stored therein for identifying respective television channels;

means for displaying a plurality of channels simultaneously on a main screen; and

means for recalling said channel selection information to display a first plurality of channels on said main-screen corresponding to a first group of channel data and, responsive to a user command, a second plurality of channels on said main-screen corresponding to a second group of channel data.

2. A multi-channel television system as claimed in claim 1 in which the means for recalling said channel selection information comprises:

means for recalling channel data from a first memory location, determining whether or not there is a synchronised signal for the television channel identified by that channel data, wherein, if there is a synchronised signal, that television channel is displayed and, if there is no synchronised signal, channel data from the next memory location is recalled whereby said respective pluralities of channels are selected for display.

3. Apparatus according to claim 2 in which the channel data in the memory is organised as respective pages of channel data, each page comprising a plurality of memory locations containing channel data for synchronised channels, the number of memory locations in each page being the same and the first and second groups of channel data corresponding respectively to first and second pages.

4. Apparatus according to claim 3 wherein said pages are selectable in response to a page up/down user command to determine whether a next page or an earlier page of channel data is to be displayed.

5. Apparatus according to any preceding claim further comprising:

first and second tuner means for receiving broadcasting signals and for outputting television channel signals for display corresponding to the broadcasting signals;

main-screen selecting means for selecting an output signal from one of the first and second tuner means or a line input signal as a main-screen signal;

sub-screen selecting means for selecting a signal different from the signal selected by the main-screen selecting means for use as a subscreen signal;

signal processing means for processing a video tape recorder reproduction signal applied from a video tape recorder system with said main-screen signal;

picture-in-picture processing means for receiving signals from the signal processing means and the sub-screen selecting means for producing multi-channel television display signals; and

control means for controlling the display of said signals.

6. Apparatus according to claim 5 wherein the picture-in-picture processing means is operable to reverse the signals supplied respectively to the main-screen and a sub-screen in response to a main/sub control signal from the control means.

7. A method of controlling a multi-channel television system having a channel memory in which there is stored channel information relating to a plurality of television channels for display, the memory having a plurality of memory locations

with respective channel selection data stored therein for identifying respective television channels, the method comprising:

recalling channel data from a first memory location and determining whether or not there is a synchronised television signal associated with the channel data in that memory location;

if there is a synchronised signal, displaying said television channel at a display location on the main-screen and, if there is no synchronised signal, recalling channel data from the next memory location;

repeating the above steps to display a plurality of television channels comprising a first group at a plurality of display locations on a main-screen;

determining whether a user command signal has been input for changing the displayed television channels;

on receipt of a user command input, recalling channel data from a new memory location and repeating said above steps to display a next group of television channels at the display locations.

8. A multi-channel television system substantially as hereinbefore described with reference to or as shown in the accompanying drawings.

9. A method of controlling a multi-channel television system substantially as hereinbefore described with reference to the accompanying drawings.