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## CABLE CONVERTER UNIT CONTROL BY VCR

The subject application concerns the field of videocassette recorders (VCRs) and apparatus for programming them.

5 The subject application is related to U.K. Patent applications entitled "VCR Control of a Cable Converter Unit", "An IR LED Assembly for VCR Control of a Cable Converter Unit", "ON/OFF Control of a Cable Converter Unit by a VCR", "Automatic Detection of Kind of Cable Converter Unit Coupled to a VCR", and "VCR Control of Cable Converter Unit", all filed on even date claiming  
10 priority from U.S. Patent applications Nos: 807,472; 806,916; 806,551; 806,918; and 807,068 respectively.

When a television set owner is a subscriber to a cable television system and also possesses a videocassette recorder  
15 (VCR), he may be required to connect to the cable system via a cable decoder box (also called a CATV converter, or a set-top converter). This connection may be required, because in these systems, many cable channels (i.e., the so-called premium channels) are scrambled (i.e., encoded or encrypted) and must be descrambled (i.e., decoded or decrypted) in the cable box. The  
20 cable box descrambles the premium channel and converts its RF carrier frequency from its assigned cable channel frequency to a cable box output frequency, normally that of channel 2, 3, 4, or 5 for reception and recording by the VCR, or display by the television receiver. In such an arrangement the viewer may have as many as three remote control units for controlling the video  
25 equipment (i.e., one each for a television set, a VCR, and the cable box). If a user wants to change channels via the tuner of his cable box but inadvertently operates the remote control for the VCR, the VCR will tune away from the output channel of the cable box, causing loss of signal to the VCR, and most probably, also causing a great deal of confusion, especially to a non-technically-trained  
30 user.

A second problem arises in connection with lists of preferred channels. It is common practice to include lists of preferred channels in television receivers (TVs) and VCRs. In response to a CHANNEL UP or CHANNEL DOWN command, the TV or VCR skips non-preferred channels and tunes a preferred

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channel which is next higher or next lower in frequency from the currently-tuned channel. Many skip lists are automatically programmed via an autoprogram feature which steps through all possible channels and programs the skip list with information concerning whether or not each channel is active. Channels not detected in the autoprogram operation may be added by a user via operation of an ADD key. Channels which were detected and stored in the skip list but which nevertheless are not preferred by a user may be deleted from the skip list by operation of a DELETE key. Unfortunately, cable boxes normally do not perform an autoprogramming operation, and do not include skip lists. Thus, confusion arises because, a CHANNEL UP command sent to a VCR will cause the tuning of the next active or preferred channel, while a CHANNEL UP command sent to a cable box will cause the selection of the next higher channel whether that channel is active or not.

It is herein recognized that a further problem arises in that a viewer may not want to leave his VCR powered-up whenever he is watching television shows from his cable system. That is, most viewers only turn on the VCR when they are about to record or play back a videotape. Thus, locating the autoprogramming skip list in a conventional VCR would force the user to turn on the VCR in order to access the feature of skipping undesired channels during channel scans.

A VCR includes means for controlling a cable converter unit, means for detecting the presence of a television signal, and control code transmission means for remotely controlling a cable converter unit. Advantageously, because the VCR is coupled to the output of the cable converter unit, the VCR can monitor the television signals received from the cable converter unit to ensure that commands sent to the cable converter unit from the VCR are executed. It is herein recognized that a skip list programmed into a VCR may be used by the VCR to control a cable box. That is, in response to a channel up command received by the VCR, the tuner of the VCR would not change channels itself, but rather the VCR controller controls the cable box to select the next preferred channel entered in the skip list of the VCR. In this mode of

operation, the channel tuning keys (e.g., CHAN UP; CHAN DN) of the VCR remote control are used to control an external source of signals, while the VCR mechanism control keys (e.g., PLAY, RECORD, FAST FORWARD) control the operation of the VCR. It is

5 further recognized that those portions of the VCR concerned with channel tuning should receive power from the standby power supply normally provided for powering the IR receiver.

An exemplary embodiment of the invention will now be described with reference to the following figures:

10 Referring to FIGURE 1, radio frequency (RF) signals are applied to an RF input terminal of a tuner assembly 102. Tuner assembly 102 selects a particular RF signal under control of a tuner control unit 104 which applies a tuning control signal to tuner assembly 102 via a wire 103, and applies bandswitching  
15 signals via a control bus 103'. Tuner control unit 104 is controlled by a controller 110. Controller 110, which may be a microprocessor or microcomputer, includes a central processing unit (CPU) 112, a read-only memory (ROM) 114, a random access memory 116, and an external electrically-erasable read only  
20 memory (EEPROM) 117. Controller 110 generates a control signal for causing tuner control unit 104 to control tuner 102 to select a particular RF signal, in response to user-entered control signals from a local keyboard 120 and from an infrared (IR) receiver 122. IR receiver 122 receives and decodes remote control  
25 signals transmitted by a remote control unit 125.

Tuner 102 produces a signal at an intermediate frequency (IF) and applies it to a processing unit 130 comprising a video IF (VIF) amplifying stage, an AFT circuit, a video detector, and a sound IF (SIF) amplifying stage. Processing unit  
30 130 produces a first baseband composite video signal (TV), and a sound carrier signal. The sound carrier signal is applied to an audio signal processor unit 135 which includes an audio detector and may include a stereo decoder. Audio signal processor unit 135 produces a first baseband audio signal and applies it to a





signal switch unit 137. Second baseband composite video signals and second baseband audio signals may be applied to VIDEO IN and AUDIO IN terminals from an external source.

5 The first and second baseband video signals (TV) are coupled to a video processor unit 155 (having a selection circuit not shown) and is also applied to signal switch unit 137. Video and audio signals are also applied to a tape recorder unit 165 which causes the signals to be recorded onto video tape. Tape recorder unit 165 has a control input and operates under control  
10 of a tape recorder unit controller 160, which may be a microprocessor. Tape recorder unit controller 160 is in turn controlled by control signals from controller 110. Under control of controller 110, an on-screen display processor 140 generates character signals, and applies them to a second input of video  
15 signal processor 155, for inclusion in the processed video signal. Signal switch unit 137 is controlled by controller 110 via a control input terminal C to select audio and video signals from audio signal processor 135 and video signal processor 155, or from the output terminals of tape recording unit 165 in the  
20 playback mode, and to apply the selected signals to a modulator 139 for modulation onto a particular channel frequency carrier, typically that of channel 3 or channel 4. The circuitry described thus far is known from RCA videocassette recorder model VR520.

25 Unlike the RCA VR520, which has as its main programming feature a TIMER PROGRAM mode of operation, apparatus according to the subject invention may include both a TIMER PROGRAM programming feature and a VCR PLUS™ programming feature. The control program for the above-mentioned features resides in ROM 114 of controller 110.  
30 Electrically-erasable programmable read only memory (EEPROM) 117 is coupled to controller 110, and serves as a non-volatile storage element for storing autoprogramming channel data, user-entered channel data, and VCR PLUS™ channel mapping data.

35 An IR LED driver circuit, generally, designated 100, is coupled to controller 110, for providing IR signals to external units, such as a cable box for a cable TV service. IR LED driver circuit comprises a filter capacitor C102, a current-limiting

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resistor R102, three series-connected IR LEDs (infrared light emitting diodes) D101, D102, and D103, a darlington-connected transistor switch Q101, a base resistor R101, and a speed-up capacitor C101.

- 5                    Processing unit 130 also produces an IF AGC signal which is coupled to controller 110 via a wire 131, for detection of variation of the signal strength of signals of currently-tuned channels, the changes being indicative of channel changes. Alternatively, video signal processor 155 produces a valid sync  
10 detection signal or a video AGC signal which is coupled to controller 110 via a wire 151, for detection of channel changes.

- It is herein recognized that in a system in which the VCR relays commands to the cable box, user confusion caused by operating the wrong remote control can be greatly reduced.
- 15    U.K. Patent Application entitled "VCR Control of a Cable Converter Unit" describes a VCR which controls a cable box and monitors an internal VCR signal to ensure that the commands sent to the cable box were received and executed. It is herein recognized that in such a system, an autoprogramming function  
20 can be implemented in which the cable box is controlled to select each channel in sequence, and the VCR examines the received signal to determine if the channel to which the cable box is tuned is an active channel. If so, the VCR enters it in its list of preferred channels, if not, the cable box is directed to tune the next channel  
25 in sequence. It is herein recognized that for three reasons, it is a clear advantage for a unit which contains a channel skip list (i.e., the VCR) to control the cable box. First, in general, cable boxes do not include lists of preferred channels (sometimes known as skip lists), and this would add the feature without modifying the cable  
30 box. Second, uniformity of operation would be introduced in that a CHANNEL UP or CHANNEL DN command would have the same effect whether the cable box (via the VCR) or VCR were being controlled. Third, if the user were to attempt to change channels via the remote control unit of the VCR, the cable box channel  
35 would be changed to the next active channel, and no confusion would result (i.e, the VCR would not tune away from the cable box output channel, as is the case with conventional VCRs)..



Apparatus in accordance with the subject invention controls the cable box (i.e., the source of its own video input signals), and monitors the television signals received from the cable box, in a "closed loop" manner. By monitoring the IF AGC

5 signal on line 131 of FIGURE 1, controller 110 can detect perturbations of the signal level which indicate that the cable box has changed channels. That is, the output signal of the cable box remodulated on, for example, the RF carrier frequency of channel 3, will be momentarily lost during the period in which the cable  
10 box changes channels. Thus, the subject apparatus can determine if a channel change has occurred. It is also recognized that other signals (such as a "Valid Sync Detect" signal or a video AGC signal on line 151 of FIGURE 1) can also be monitored to provide this feedback information as to whether commands transmitted to the  
15 cable box have actually been received and executed.

Advantageously, if a signal which tracks a characteristic of the baseband video signal (such as Valid Sync Detect or video AGC) is used for detecting loss of signal during channel change, then the subject invention is applicable to use with cable boxes which  
20 produce decoded cable television signals at baseband rather than remodulating them to a particular television channel frequency.

It is herein recognized that It would be desirable to control the cable box via the VCR remote control circuitry, and thus gain the benefits of autoprogramming associated with use of  
25 the VCR skip list, even when the VCR is "turned off". In this way, a user who operates his VCR remote control unit, would have the proper command passed to the cable box, even though the VCR is "off", without having to perform the separate step of turning the VCR "on".

30 Note from FIGURE 1, that TUNER ASSEMBLY 102, TUNER CONTROL UNIT 104, CONTROLLER 110, EEPROM 117, VIF AND SIF AMPLIFIERS AND DETECTOR UNIT 130, VIDEO SIGNAL PROCESSOR 155, IR RECEIVER 122, AND IR TRANSMITTER CIRCUIT 100, are all powered from a standby power supply, not shown.

35 All the units mentioned above are concerned with channel selection or transmission of IR commands to the cable box. Powering those units from the standby power supply will enable those units to remain active even when the VCR appears to be



"off". Thus, channel-related commands received by the IR receiver will be translated to the proper remote control command code format by controller 110, and transmitted to the cable box via IR transmitter circuit 100.

5           FIGURE 2a is a perspective view of a cable box 210 placed VCR 200 having a . In FIGURE 2b, VCR 200 is shown coupled to the RF input via cable box 210. Tuner 102 of FIGURE 2b is the same tuner unit 102 previously described with respect to FIGURE 1. Tuner 102 of FIGURE 2b is the same tuner unit 102  
10 previously described with respect to FIGURE 1. It is common practice for cable television services to encode (i.e., scramble) at least their "Premium" channels. FIGURE 2b is a configuration which may be used when some or all of the television channels provided by the cable television service are encoded in some  
15 fashion (i.e., a cable box is required for decoding). In such a configuration, the VCR will be set to record all television programs on the cable box output channel (typically, channel 2, 3, or 4). Cable box 210 of FIGURES 2a and 2b includes a window 212 for admitting an IR (infrared) remote control signal for turning the  
20 cable box on and off, and for causing the tuner of the cable box to change channels. VCR 200 of FIGURE 2a includes a window 204 for admitting an IR (infrared) remote control signal for turning the VCR on and off, for causing the tuner 102 of the VCR to change channels, and for controlling the recording and playback of  
25 videotapes. VCR 200 also includes a window 214 through which IR signals generated by the VCR are transmitted to external units such as cable box 210. Note from FIGURE 2b that cable box 210 preferably receives IR signals from window 214 of VCR 200 along a rearward directed path 216, and from a "bounce" path 218 in  
30 which the IR signals may be reflected from a wall or other object 220. The "bounce" path is provided for the case in which the user chooses not to place the cable box on top of the VCR.

U.K. Patent Application entitled  
"VCR Control of Cable Converter Unit"  
35 describes a system in which whenever the VCR is coupled to a cable box, and programmed for controlling the cable box, VCR remote control unit 125 is treated as if the VCR mechanism keys (e.g., FAST FORWARD, REWIND, STOP, PLAY, RECORD) were to



control the VCR, but the tuner control keys (CHAN UP, CHAN DN, and NUMBER KEYS) were to control the cable box. Copending U.S. patent application bearing attorney docket number RCA 86,660, also herein incorporated by reference, describes a system in  
5 which the specific kind of cable box connected to the VCR is automatically determined, in order that the proper control code format may be used to send channel change commands from the VCR to the cable box.

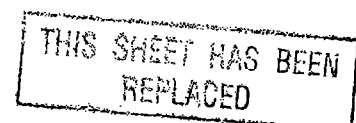
Although the VCR PLUS™ system is referred to in the  
10 subject specification, it is herein recognized that the subject invention does not require the use of the VCR PLUS™ system and is extremely useful with standard timer recording.

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CLAIMS

1. A videocassette recorder, comprising:  
a first power supply subject to being turned on and off;  
a second power supply for providing power so long as  
said videocassette recorder is connected to an external AC power  
5 line;  
a radio frequency (RF) signal input terminal, for  
receiving a group of RF signals;  
tuner means coupled to said RF signal input terminal for  
receiving said group of RF signals, said tuner means selecting a  
10 particular RF signal from said group of RF signals in response to a  
control signal, said tuner means being capable of tuning to a  
predetermined number of channels;  
control means for generating said control signal for  
causing said tuner means to select said particular RF signal;  
15 means, coupled to said control means, for entering data  
in response to operation by a user; and  
means coupled to said control means for transmitting a  
remote control signal for controlling an external source of said  
particular RF signal;  
20 said control means in response to data entered by said  
user generates said remote control signals and applies said remote  
control signals to said remote control signal transmitting means;  
and  
means for detecting an active television signal, said  
25 detecting means being coupled to said tuner means for receiving said  
selected signal, and in response to the detection of a predetermined  
characteristic of said selected signal generates a signal indicative  
of an active television signal and applies said indicative signal to  
said control means;  
30 wherein said control means transmits said remote  
control signals and monitors said indicative signal as a feedback  
signal to ensure that commands corresponding to said remote  
control signals are executed; and wherein

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said tuner means, said control means, said transmitting means, and said means for entering data, and said detecting means all receive power from said second power supply.

5           2. The videocassette recorder of claim 1, wherein said means for transmitting is an IR LED assembly, and said remote control signals are IR signals.

3. The videocassette recorder of claims 1 or 2, wherein said  
10 means for detecting is an automatic gain control (AGC) circuit, and said signal indicative of an active television signal is an AGC signal.

4. The videocassette recorder of claims 1 or 2, wherein said means for detecting is a valid television synchronizing signal  
15 detection circuit, and said signal indicative of an active television signal is a signal indicative of the detection of a valid television synchronizing signal.

5. The videocassette recorder of any preceding claim, further  
20 comprising:

means for storing data corresponding to said commands for controlling said particular RF signal source, said storing means being coupled to said control means.

6. The videocassette recorder of any preceding claim, further  
25 comprising:

a baseband video signal input terminal, for receiving a baseband video signal;

said means for transmitting a remote control signal controlling an external source of said baseband video signal.

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7. A videocassette recorder, comprising:

means for receiving a remote control signal from a remote control unit, said remote control unit having means for controlling the mechanism of said videocassette recorder, and

5 means for controlling the selection of television signals;

first means for selecting television signals for recording in response to control signals of said remote control unit;

control means coupled to said receiving means for receiving control signals entered by a user; and

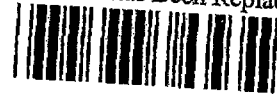
10 means for transmitting control signals to an external source of television signals having a second television signal selection means;

said control means operating in first and second modes, said first mode being one in which said control means controls first

15 means for selecting television signals in response to signals generated by said means for controlling the selection of television signals of said remote control unit, and said second mode being one in which said control means controls second means for selecting television signals in response to signals generated by said means for  
20 controlling the selection of television signals of said remote control unit.

8. A videocassette recorder substantially as herein described, with reference to the accompanying drawings.

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