TAC-TIMER

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ABSTRACT

Although most VCR's can be programmed to record at different times on different channels, the latter capability is lost when the VCR is preceded by a decoder. Channel selection must be done in the decoder and normally cannot be changed when the unit is unattended. The problem is eliminated with a new remote control transmitter. The unit controls the decoder with an IR stream using well-known techniques. Containing a real-time clock, it can be programmed to turn on the decoder, tune it to any channel and then turn it off at a specified time. Multiple events can be programmed, with a different channel for each. An event can be a specific time, as for a special, it can be a specific time once a week, for a series, it can be a specific time each weekday, as for soaps, or it can be a specific time seven days a week, as for the news. The time is displayed when the unit is not being programmed. In the programming mode, the display shows a series of prompts to assist the user. The unit also serves as a hand-held remote control.

THE PROBLEM

The normal configuration for a video cassette recorder (VCR), decoder, and television receiver in a cable system is as shown in Figure 1.

The decoder is tuned to any cable channel and provides a fixed-frequency output, typically channel 2, 3, or 4. For viewing or recording a channel, the receiver or VCR is tuned to the decoder output channel.

For unattended recording of a certain movie or special, the decoder is left on and tuned to the appropriate channel. The VCR is programmed to turn on, tune to the decoder output channel, and record during the designated time slot. This technique can be extended for taping several programs such as the news, a soap opera, or even several movies or specials, provided they are on a single channel; typical VCR's can be programmed to do repeat taping on a daily basis or to tape multiple events. As long as there is no power outage, which would leave the decoder off, the show(s) will be taped for later viewing by the subscriber.

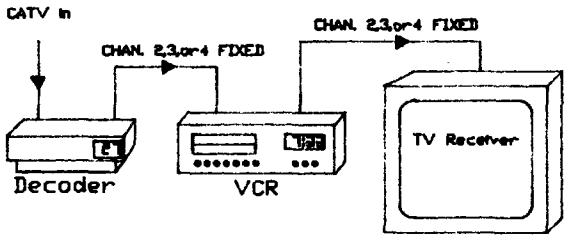

Figure 1 Connection for Decoder, VCR, and Receiver

A problem arises when the subscriber desires to record a program on one channel during a certain time and a program on another channel at a later time with no intervening attention. Although the VCR could be programmed to change channels at a certain time; that is of no use in this situation. Its input channel must still be the decoder output channel. The decoder tuner must select the different channels. If it has no mechanism for changing channels, the subscriber cannot use his VCR to record from multiple channels.

SOLUTIONS

To permit the subscriber to record from different channels, the decoder must in some way be instructed to change channels at specified times. Therefore, the unit which supplies the instructions must contain a real-time clock. It also must have memory to store the start and stop times and channel numbers. Two solutions are evident, as illustrated in Figure 2.

One solution, as in Figure 2(a), is to have the real-time clock and the memory reside in the decoder. Typically, this would be in a microcomputer which would also handle tuning, keyboard scan, display drive, and such. When the time-keeping and memory portions of the program indicate that a new channel is called for, it is a simple matter to branch to the tuning part of the program and tune the new channel.

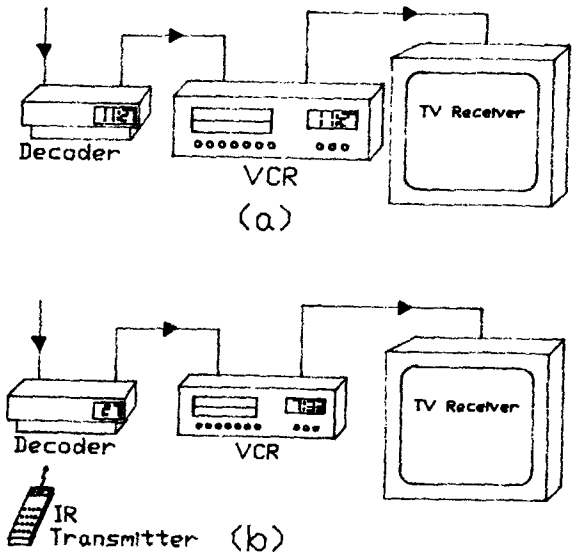

Figure 2 Solutions for the Decoder/VCR Problem

A second approach, as shown in Figure 2(b), has the clock and timing information memory built into an IR Transmitter. The transmitter determines when to turn the decoder on and off and when it is time to change channels. It sends commands to the decoder to cause it to respond appropriately.

With either of these solutions, the decoder can be left off, turned on at the proper time for recording, and then turned off again when recording is done. The user must understand that programming of either the decoder or the timer-transmitter does not remove the need to program the start and stop times into the VCR, as well.

TRANSMITTER APPROACH ADVANTAGES

The transmitter approach is probably the most economical for the parties concerned. This is arguable, depending on several factors, such as whether the cable operator supplies the unit with the built-in timer to all his customers or only to those who specifically request it. In the typical scenario, however, it is felt that the transmitter approach is less expensive.

The IR Transmitter approach also would be expected to have a shorter development cycle. This, too, is conjectural. It depends on the equipment manufacturer's resources, his existing tuning microcomputers and the ability to use left-over ROM or to upgrade to larger units and various other factors.

An unquestionable advantage of the transmitter approach is that it can be installed in a system with an existing decoder base without retrofitting boxes, provided those boxes work with IR transmitters. Thus, a manufacturer need not desert his early customers or force them to change out boxes to allow effective use of VCR's.

TRANSMITTER APPROACH DISADVANTAGES

There are certain disadvantages for the transmitter approach, as well. Some have workable means for minimizing the disadvantage.

The transmitter must be positioned so that its IR bit stream can be received by the decoder. The best solution for this problem is to explain it in the instruction manual. In programming and using the transmitter, the last step in the setup should be to position the transmitter and attempt to turn the decoder on, then off. Accomplishment of this task confirms a satisfactory IR path.

If functions such as "On/Off" and "A/B Cable Select" are toggle functions, it will be necessary to leave the decoder in a certain state, typically off, with A cable selected. This can be overcome, in some cases, by having separate "On", "Off", "A" and "B" functions, provided there are sufficient unused codes in the transmitter reportoire. With the functions separated, it is always possible to put the decoder into a certain state, regardless of its starting state.

A third disadvantage with the transmitter is the reliance on battery power. Although the timer-transmitter unit should require little more power than other transmitters, the consequences of low battery voltage are more serious. If the battery in a normal IR transmitter is low, the user simply uses set top controls until the battery has been replaced. When a timer-transmitter battery is low, the unit can lose memory or have insufficient output power to activate the IR receiver in the decoder. In either case, the user loses programming that he had wished to record, with resultant ill will. To minimize the low battery problem, one approach is to use a microcomputer with a sleep mode; the device uses little power most of the time, but occasionally it goes into the active mode to scan the keyboard, control the display, and such. A second approach is to provide batteries with capacity sufficient to power the unit for a long time, making the low-battery situation a rarity.

CIRCUIT

The transmitter circuit is shown in Figure 3.

The heart of the unit is a CMOS microcomputer. Two crystal oscillators drive the device. One runs at 32.768 KHz for the timekeeping application; it is very accurately adjusted via C3. The other oscillator, running at 3.2 MHz, steps the program counter; its accuracy is less critical.

At power-up, C9 and an internal pullup at Pin 14 combine to generate a reset for initializing the microcomputer. When the battery is removed,

CR4 allows C9 to power the microcomputer until discharged. This relatively quick discharge of C9 guarantees that a reset will be generated and the microcomputer initialized when a new battery is installed.

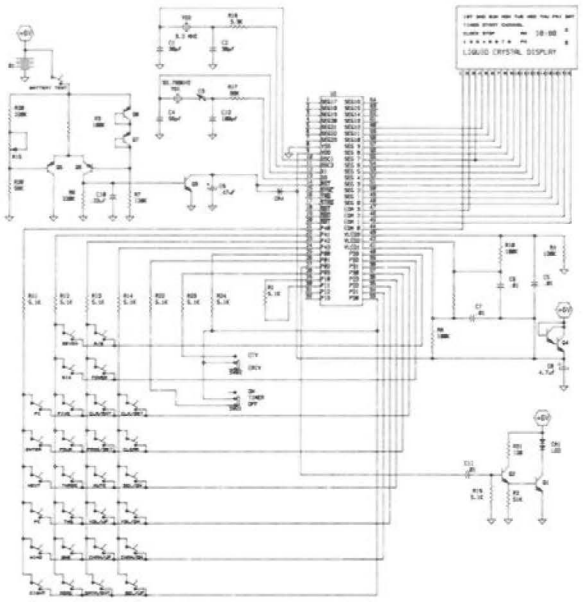

Figure 3 IR Timer-Transmitter Circuit

Because it is so important that programming not be lost, a battery test circuit is provided. Q5 and Q6 comprise a differential amplifier. Q5 is biased by a resistive divider from VDD while Q6 is biased by diodes (Q7, Q8) and a resistor. The voltage at Q6 base drops more rapidly as battery voltage falls. As a result, when the battery voltage drops to a level predetermined by the setting of R15, Q3 discharges C9, resetting the microcomputer. The need for a fresh battery is indicated by the display, which shows dashes in the time display. The test circuit is connected to the supply through a button on the keyboard, drawing power only during an actual battery test.

The microcomputer scans the keyboard for key closures. It also monitors switch positions for the two slide switches that put the unit into the timer mode and indicate whether the IR bit stream should be configured to control the decoder or the television receiver.

A liquid-crystal display is driven by the microcomputer. During a programming operation, the display shows a series of prompts for the operator. When not being programmed, the unit shows the time of day. The display has a wearout mechanism when driven by DC. Accordingly, it is supplied with stairstep voltage waveforms generated by switching various reference voltages. These voltages are generated in a divider comprised of R4, R8, R9, R10, C5, C6, and C7.

The output of the transmitter is a coded IR signal generated by CR1. The IR emission is switched on and off by Q1, Q2 according to the signal from Pin 27 of the microcomputer.

PROGRAMMING

Figure 4 shows the transmitter keyboard, switches, and display. Most of the keys appear on a conventional remote control transmitter, Keys added for programming are "Next," "Program Set," "Clock Set," "Select Up," "Select Down" and "Clear."

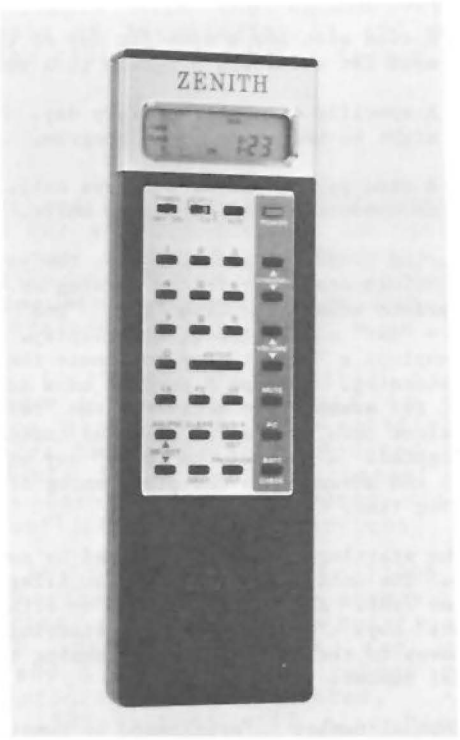

Figure 4 the Timer-Transmitter

Setting the Time

To set the time, the user pushes "Clock Set." The day of the week is indicated at the top of the display. Either "Select" key is used to correct the day, if necessary. When "Next" is pushed, the unit is ready for the time to be programmed. The time is entered by the numeric keys. AM/PM is specified with either "Select" key. With the proper time displayed, "Next" is pushed, starting the clock and stepping the unit out of the time-setting mode.

Programming for Decoder Control

The programming mode is entered by a push of the "Program Set" key. At that time, one of

eight event numbers in the lower left part of the display flashes. This number is for the lowest-numbered vacant event. The user may program that event or use a "Select" key to go to a different event. In any case, the data programmed will overwrite whatever data had been in the memory for that event. To indicate that the event number display is the one to be programmed, the user pushes "Next."

The next item to be programmed is the day(s) for the event to be recorded. An event can be defined as:

- o A time period on a certain day of either the first or second week. This would be used for a movie or a special.
- o A time slot for a specific day of the week, used for recording programs in a series.
- o A specific time period every day. This might be used for a news program.
- o A time period during weekdays only. This accommodates the soap opera buffs.

During programming of the day, the various combinations are indicated by turning on an appropriate selection from "1st," "2nd" and "Sun" - "Sat" at the top of the display. The user employs a "Select" key to choose the day(s) for recording. To tape a program on a daily basis, for example, he activates the "Select Up" or "Select Down" key until all nine indicators are lighted. A push of the "Next" key stores the day(s) and advances to the programming of starting time.

The starting time is programmed by numeric entry. The unit will not accept an illegal time such as 7:86. AM or PM is chosen by either "Select" key. "Next" stores the starting time and moves to the next step, programming the channel number.

Channel number is programmed by numeric entry. The unit will not accept an illegal channel number such as 282. If the system has dual-cable with A/B indicators, A or B is specified, using the A/B key. "Next" stores the channel number and steps to the programming of the stop time.

The time to stop recording or turn off the decoder is specified by numeric entry. Illegal times are not accepted. AM and PM are chosen by either "Select" key. "Next" stores the stop time and the unit exits from the programming mode. If the user has inadvertently programmed the same start and stop times, the unit flashes the event number. If this is ignored, the times are treated as correct entries, that is, it is assumed the user desires to tape for 24 hours.

To clear the memory for an event, the steps are:

1. Push "Program Set."
2. Specify the event to be cleared by using either "Select" key.
3. Push "Clear."

This clears that event memory and takes the unit out of the programming mode.

REVIEWING

To review the data programmed for an event, the user presses "Program Set" and then "Select" to choose the event to be reviewed. He then presses "Program Set" to step through and verify each piece of data programmed. Three more pushes of "Program Set" allow the user to verify the day(s), start time, channel number, and stop time. The last push returns the unit to the clock mode.

OPERATION

Following programming, the user places the "Timer On/Off" switch in the "On" position, which is for attended control of the decoder. He places the unit so that it has a clear line of sight to the decoder and verifies this by operating the "Power" switch to turn the decoder on. He makes sure the unit is on "A" cable, for a dual-cable system and then switches the decoder off. The first event scheduled after the "Timer On/Off" switch is placed into the "On" position starts the two-week timing cycle. At the end of the cycle, it starts over and repeats continuously until the "Timer On/Off" switch is placed at "Off."

The transmitter can be used as a normal decoder remote control, even while in the "Timer On" mode. With the "CATV/TV" switch in the "TV" position, it will also control television receivers made by the same manufacturer.

SUMMARY

The timer-transmitter is a unit that the operator can purchase for use with his existing decoders. It is reasonably easy to program and allows the user to optimize the use of a VCR on his cable system. For these reasons, it should have a substantial appeal to the cable operator for revenue enhancement.

ACKNOWLEDGEMENTS

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