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ADDRESSABLE CABLE TELEVISION CONTROL SYSTEM WITH VERTICAL INTERVAL DATA TRANSMISSION

BACKGROUND OF THE INVENTION

This invention relates to an addressable cable television control system. More particularly, the present invention relates to a cable television system having a multiple-function addressable converter and

5 including data transmission during the vertical interval of the video data.

In recent years, the availability of cable television programs and services for the general public has expanded rapidly. Communication satellites have enabled nationwide programming for a

10 number of "super stations". Sophisticated two-way interactive cable communication systems have laid the groundwork for a wide spectrum of cable television and data communication services for the consuming public. After years of development, cable television systems have been or are now being installed in many major cities to provide the

15 television consumer with a vast array of programming choices as well as many other services which can be utilized at home, such as shopping, banking and schooling. Other services provided by such systems include home security monitoring, medical and emergency alert signaling and information retrieval.

20 In order to provide these new services and programs in a systematic and efficient manner, generalized control systems are required which can supervise access to both one-way and two-way sophisticated cable communication systems having different degrees of complexity. Control is required to differentiate and limit access on

25 several bases, including different levels or tiers of subscribers to different television channels, and different programs and events on a given channel. In addition, for many subscribers it is desirable to be

able to limit access to certain programs because of the program subject matter. Presently, there are no cable systems having this degree of sophistication in controlling program access. Even simpler conventional cable systems which provide for limiting program access
5   must be two-way interactive systems requiring more complex and expensive equipment than one-way systems.

Besides this problem of coordinating cable communications, the need for efficiency in the transmission of data has become increasingly apparent. Athough approximately 55 video and sound
10   channels are presently available between the allocated television frequencies of 50 and 400 megahertz, the varied types of possible cable television programming and data transmission services require the efficient utilization of these frequencies. For example, cable television programming includes movies, special events, news, con-
15   sumer programming, community access and religious programming. An almost limitless range of data can be provided, including reports on stock and money markets, weather reports, airline schedules, shopping directories, entertainment schedules, traffic reports, home security data emergency and first aid information and unlimited library textual
20   information. The possibility for cable system operators to lease available cable channels to private concerns for these and other services makes it imperative that cable transmission control be efficient and flexible. In order to effectively utilize the available portion of the electromagnetic spectrum for such a wide variety of
25   programming and data transmission, the cable system should be able to process the data quickly and efficiently while using relatively simple and inexpensive equipment which is affordable to the general consuming public.

In the last few years, various experiments have been conducted
30   regarding the transmission of data over the vertical blanking interval of a normal television signal. This interval in the video signal occurs 60 times each second as the cathode ray tube beam sweeps from the bottom to the top of the TV screen and is relatively unused for the transmission of data. Some early systems such as that shown in U.S.
35   Patent 3,769,579 issued on October 30, 1973, utilized the vertical interval for transmitting control signals to individual transponders at the subscriber locations. More recently, there has been experimentation with television broadcasting systems which transmit visual

data on the vertical blanking interval, referred to as teletext transmission, for display as pages of text on suitably equipped television receivers. These experimental systems have generally been limited to over-the-air broadcasting of teletext transmissions for a

5   single channel, and the necessary apparatus for cable television systems has been regarded as too complicated and expensive to be practical when compared to the high-speed transmission of compact data over a dedicated channel.

SUMMARY OF THE INVENTION

10   The present invention provides a relatively inexpensive and simple one-way cable television system having the capability of controlling access to a wide range of television program and data signals while efficiently transmitting data signals in the vertical interval (VI) of each television program channel. This VI data not only

15   provides control data for an intelligent converter unit, but also provides a substantial amount of textual data per channel for use either to provide additional data to supplement a channel television program or as a separate all textual and graphic channel.

The present invention includes an intelligent addressable con-

20   verter designed to convert and descramble video for up to 55 CATV channels. For dual cable systems, an optional cable switch on the converter doubles the available number to 110 channels. The converter of the present invention receives control data which allows the system operator to control subscription television services on a per channel,

25   per service tier, and per event basis. In addition, the system and converter of the present invention enables each subscriber to define his own level of required eligibility based on program subject matter.

The system of the present invention also enables a com- plementary text channel to be transmitted on the vertical interval of

30   each of the incoming video signals and to be decoded and displayed as an alternate channel to the video programming. The data for the complementary text channel is preferably displayed in a combination of text and graphics. This capability effectively adds 55 additional text channels for a wide spectrum of data-type information for the

35   consumer. Thus, the present system provides 110 independent channels of television program and text viewing in a one cable system and 220 channels in two cable systems. Moreover the control system of the present invention, when used in conjunction with appropriate two-way

interactive apparatus, provides a complete two-way interactive communication system including pay-per-view, home security, opinion polling, channel monitoring, information retrieval, and with additional equipment, energy management.

5   For a better understanding of the present invention, together with other and further objects and features thereof, reference is made to the following description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

10   FIGURE 1 is a simplified block diagram of a preferred embodiment of the addressable cable television control system of the present invention;

FIGURE 2 is a block diagram of a preferred embodiment of the head end portion of the system shown in Figure 1;

15   FIGURE 3 is a block diagram of the programming control system shown in Figure 2;

FIGURE 4 is a block diagram of the head end video processor shown in Figure 2;

FIGURE 5 is a more detailed block diagram of the head end

20 video processor of Figure 4;

FIGURE 6 is a block diagram of a preferred embodiment of the addressable converter of the present invention shown in Figure 1;

FIGURE 7 is a block diagram of the converter control logic shown in Figure 6;

25   FIGURE 8 is a block diagram of the VI data extractor unit shown in Figure 5;

FIGURES 9 and 10 are schematic diagrams showing two preferred methods of connecting the converter of Figure 6 in a CATV system;

30   FIGURE 11 is a schematic diagram showing the data format for the system of the present invention;

FIGURE 12 is a flow diagram showing the operation of the converter shown in Figure 6; and

FIGURE 13 is a top plan view of the keyboard of the converter

35 of Figure 6.

DETAILED DESCRIPTION

FIGURE 1 shows a simplified block diagram of a one-way cable television system 10 in accordance with the present invention. A head end station 11 includes a central data system 12 utilizing a control
5   computer which gathers data from a wide variety of sources and formats the data for transmission on video frequency channels. The central data control system preferably has a two-way interface link 13 with a remote computer which may be used for central control and billing functions. The formatted data is then transmitted by
10   communications link 14 to a television program processor 16 where it is incorporated into the vertical blanking intervals of video signals generated by a variety of television program sources. In addition, the data may be formatted for transmission in a separate channel dedicated only for the transmission of data. The dedicated data
15   channel transmissions are connected over link 18 to a head end signal combiner 20 where they are combined with a plurality of video signals transmitted from television program systems 16 along transmission link 22. The head end unit then transmits the combined cable television and data signal to remote subscribers. Normally, the signals are then
20   transmitted through a cable network, referred to as a cable plant to a plurality of subscribers.

FIGURE 1 shows a single cable plant 30 servicing a plurality of cable television subscribers by way of a one-way data link 32. The transmitted signals are received by an addressable converter 40 on a
25   one-way data bus 32. Converter 40 then processes the data on line 38 as determined by subscriber input 34 for desired viewing on one or more television sets 36.

Referring now to FIGURE 2, the data control system 12 and television program processor 16 are shown in greater detail. A
30   programming control system (PCS) 50 generates a continuous stream of data that contains a mixture of subscriber addressing signals and channel control signals. This data is transmitted to a plurality of head end video processors (HVP) 52 and 53 for combining with video signals in a plurality of different channel frequencies. PCS 50 is also
35   preferably connected by a two-way data link to a remote computer for use in various control functions.

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