TR100 Tracking Receiver Unit

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FEATURES

- Synchronizes to Both the Digital and Video Inputs
- Supports Single, 4-Channel, or 8-Channel Operation
- Retrieves and Displays the Status of the MT100 Outputs
  - 8-Channel Alarm Status
  - 8-Channel Self-Test Status
- Displays Channel Number Selected
- Displays Selected Channel on Video Monitor
- Manual or Alarm Condition Selection
- For Multiple Alarm Conditions, Priority Selection
- Either Video or Tracking Data
- Conforms to NTSC or PAL format
- Display resolution is 640+ Pixels/Scan-Line
- Eliminates Blur During Motion
- Provides Operational Controls
- Video or Tracking Display Selection
- Manual or Automatic Control of Channel Selection
- Refreshes Video Monitor Every Field during Multiplexed Operation
- Functions over 3-Scan-Line Video Camera Synchronization Range

APPLICATIONS

- Provides Receiver-Decoder for MT100 Outputs
- Provides Playback Capabilities for a Recording Device

PROJECTED COMPUTER-BASED RECEIVER

- Supports up to Four MT100 Units (32 Channels)
- Provides Identification of Intrusion
- Creates Intrusion Motion Vectors
- Controls Pan and Tilt of All Video Cameras
- Provides Extensive Treat Evaluation

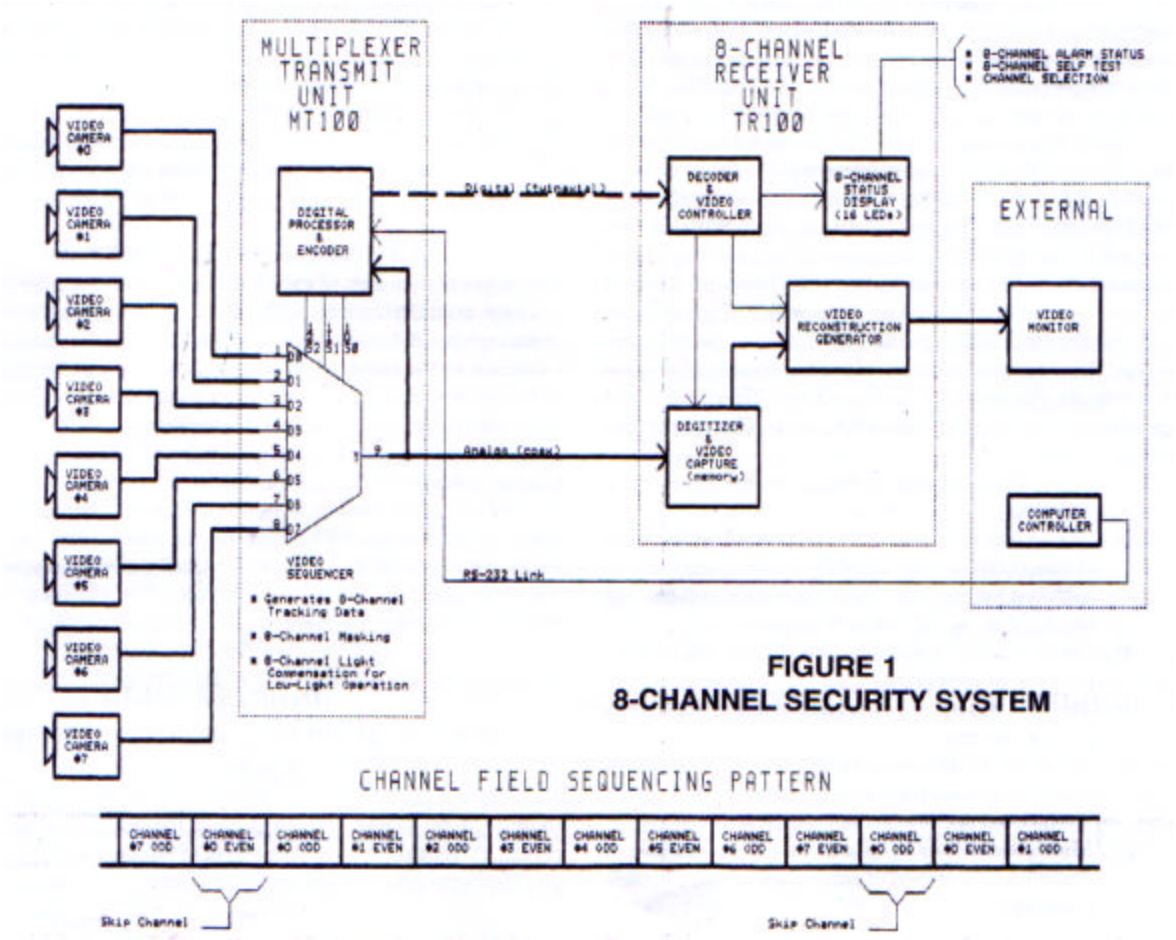

FIGURE 1
8-CHANNEL SECURITY SYSTEM

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SYSTEM DESCRIPTION

The TR100 Receiver-Decoder unit is designed to receive the data transmitted by the MT100 Multi-Tracker unit. Figure 1 is a block diagram of the MT100 and the TR100 equipment pair in an operating system. The MT100 supplies two outputs that are received by the TR100 unit. The first is a field sequence of the multiplexed video channels; this sequence is shown in Figure 1. The second is a serial digital signal containing encoded data of the vertical and line synchronization timing of the current field, special data required by the receiver, and tracking data of the profile of an image in motion. The transmission end (MT100) utilizes video cameras that are coarsely synchronized by the power line timing. The multiplexed channels are vertically synchronized within three scan lines; the scan lines of each channel are asynchronous. The TR100 unit maintains display and data reception synchronization control under these conditions.

OPERATING DESCRIPTION

Figure 1 illustrates the functions of the TR100 unit.

1) **DECODER AND VIDEO CONTROLLER -** The MT100 transmits a correlation pattern for each of the vertical and line synchronization. These patterns are decoded and supplied to other receiver circuitry for timing control. They also synchronize the video controller to produce memory addressing. The timing of the vertical and horizontal blanking intervals are determined. It also detects the line timing (during the blanking interval) that the special data are transmitted.
2) **STATUS DISPLAY -** The special data are control information transmitted by the MT100; their sources are the controlling computer of the MT100 and the MT100. These are detected for each channel during the transmission of the special data line. The channel selection is displayed on a single character display. The motion alarm and self-test status of eight video channels are displayed on LED displays. These and other special data are used by the internal circuitry. The special data are the following:
    a) **Channel Selection -** The selected channel is displayed.
    b) **Alarm Status -** The motion alarm status for each channel (detected by the MT100) are displayed.
    c) **Self-Test Status -** The self-test status for each channel (detected by the MT100) are displayed.
    d) **Odd/Even Field Status -** The current odd or even field status is reported.
    e) **Test Interval Status -** The interval that self-test takes place is reported.
    f) **Single or Multiplexed Operation -** The mode of operation selecting either single channel or multiplexed operation is reported.
    g) **Multiplexed 8 or 4 Channels -** The selection of multiplexed operation of either eight or four channels is reported.
3) **DIGITIZER AND VIDEO CAPTURE -** The sequenced channel video signal is digitized at a rate of 640 samples-per-scan-line. It is digitized at an eight-bit resolution. These data are then stored into RAM. The least significant bit is replaced for the storage of tracking data for 1/16th of the digitized samples; tracking data volume is one bit per 4 x 4 pixel cell. The digitized video data are stored in RAM under the addressing control previously described. The RAM is organized to provide write capability to one memory chip while reading from another. This is true for both the odd and even fields. The read process is available for the following field interval from the freshly written field storage data. Because of the multiplexed operation, the channel selected has both its odd and even fields displayed on the output video monitor for multiple fields until the next update. The number of field display repeats is nine for eight-channel operation; it is five for four-channel operation. The odd field updates are mid-way between the even field updates. There is no repeat for single channel operation.
4) **VIDEO RECONSTRUCTION -** The digitized video data are retrieved from memory in their normal scanning pattern, converted to analog (RS-170 level) and combined with a composite sync signal (manufactured by the TR100). The unit has the capability to restore the signal in either NTSC or PAL format. When the tracking data display mode is selected, the unit outputs one pixel (white or black) to the video monitor per each 4 x 4 pixel cell.

PHYSICAL DESCRIPTION

The physical enclosure of the TR100 is 8" x 6 1/2" x 2 3/4". There is a twin-axial BNC connector for the digital input. There is a BNC connector for the video input (sequential channels) and a BNC connector for the video output (single channel). There is a connector to accept 9 VDC power. There is a power-on switch; there is an associated LED power indicator. There are toggle switches to select video or tracking data display and to select manual or automatic channel selection. There is a push-button switch to increment the channel selection number when in the manual channel selection mode. There are eight red LED displays to indicate the alarm status of the eight (maximum) operating channels; an alarm is indicated when the LED is on. There are eight green LED displays to indicate the self-test status of the eight operating channels; a pass condition is indicated when the LED is on. There is a single character display to indicate the selected channel (to the video monitor output).

FORMAT OF DIGITAL DATA FROM MT100

The digital data are serially transmitted to the TR100 at a 3.0 megabit/second rate on a twin-axial line. At the receiving end, the sampling time of each bit of data is at the last quarter of the bit period. Correlation patterns permit synchronization with the sending end. Tracking data are only sent every fourth scan-line.

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SYNCHRONIZATION DECODER

The MT100 uses unique patterns (ones that cannot be present in the tracking data) to indicate the presence of either a line sync or a vertical sync condition. These were detected in the MT100 and transmitted to the TR100. The TR100 recognizes these signals after decoding a serial bit stream pattern; the recognition time occurs after the actual event. A free-running sync generator is locked to this event detection with timing compensation for the recognition time. The sync timing is the same as the incoming sync timing when the selected channel matches the incoming channel of the sequentially changing channels. When the incoming channel does not match the selected channel, the timing of the video output is made equal to the sync timing of the free-running sync generator; it is no longer locked to the incoming signal timing until the next match.

SPECIAL DATA RETRIEVAL

Special data are sent every field to correspond to the transmitted channel (could be up to eight). These data are sent on the sixth scan line following a vertical sync transmission (during the blanking interval). There is a special transmission pattern that indicates this line is to be sent. The TR100 latches these data bits; they are used for display or other purposes. If one or more cameras were not connected on the MT100 end during multiple operation, the TR100 will indicate that these channels failed the self-test. The TR100 will operate properly with missing channels.

TRACKING DATA RETRIEVAL

Tracking data are received (every fourth scan line) during the non-blanking interval of each field. They are merged into the video memory storage. They can then be displayed on the video monitor with the Video/Track switch in the Track position.

FRAME GRABBER

This frame grabber design differs from the conventional design because its memory is written into at a real-time rate on a continuous basis while being read from on a continuous basis. The stepping channel selection switch determines which channel is written into the memory when in the manual mode. When in the automatic mode, a priority channel selection determines which channel is selected for writing into the memory. This selection is the channel of any single alarm condition. If multiple alarms occur, the channel with the lowest channel number has priority. If no alarms exist, the channel of the last alarm is maintained.

If one or more channels are in alarm status, both the odd and even field outputs are displayed from the most current odd or even field in video memory. This is done to eliminate smear of the two interlaced fields during motion. It results in half the vertical resolution (while retaining full horizontal resolution) during this time. Once the alarm status clears, the display will return to interlaced display at full resolution.

APPLICATIONS

The primary intent of the companion MT100 unit is to communicate intrusion status to a computer without the need for an operator. The TR100 permits display of the intrusion status to an operator (or recording device). This unit cannot utilize the important and available tracking data; however, the application of the decoding chip of the TR100 to tracking data reception can be readily understood. The TR100 has the following applications in its present configuration.

1) **Receiver for MT100 -** The TR100 unit can be used for human interface with or without a computer detection device.
2) **Playback for Recorded MT100 Output -** A device could record the two outputs (video and digital tracking). It would record only during alarm intervals (or start recording a time interval before and continue until an interval after the alarm condition). The TR100 could then be used for playback of intrusion recordings. The data content could be small without the need for compression; compression could also be applied.

FUTURE EVOLUTION

The TR100 decoder chip is the fundamental building block for a computer resident circuit board to receive and convert special data and tracking data to a form usable by the host computer. The single bit per cell tracking data could be converted to 16 or 32 bit parallel format for transfer through the computer bus. The special data could be formatted for a compatible data transfer. The circuit board would ideally apply data to the PCI bus. It should be able to support four MT100 units, each covering a zone of view (total of 32 channels). Figure 2 illustrates this concept. This projected circuit board could permit computer processing to accomplish the following **autonomous** responses:

1) **Computer Identification of the Intrusion -** Computer processing could convert the tracking data into identification profiles; humans would have a unique signature.
2) **Computer Creation of Motion Vectors -** The computer could easily process the tracking data over a short time and determine the direction and speed of the intrusion.
3) **Computer Control of Video Camera Pan and Tilt for Tracking -** The computer could process motion vectors to control the pan and tilt of video camera platforms. Intrusions could then be tracked with the camera.
4) **Extensive Treat Evaluation and Response -** The computer could evaluate the type and severity of an intrusion. The computer could automatically provide appropriate response. This could be to notify fire or police personal through telephone links.

The computer processing of this concept could further reduce the false alarms of the system. The MT100 already provides substantial screening to eliminate false alarms.

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