

SYSTEM FOR MULTIPLEXING PCM DATA WITH VIDEO DATA

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ABSTRACT

When video signals are transmitted in a telemetry system it is usually necessary to simultaneously transmit other basic data such as temperature, pressure, audio, etc. In recent years these video/data telemetry systems have been implemented by transmitting the video through an analog link and the digital data through a parallel separate digital channel. Most recently it has become practical to transmit video signals by digital means, and this makes it possible to digitally multiplex the narrowband data with the wider band video. This results in a large reduction in system complexity since both data streams are transmitted over one channel rather than two.

This paper describes a particular technical approach to multiplexing data and video which supports PCM data rates up to 60 kilobits per second. The approach has the advantage that PCM data is only embedded into the Video data as required. This results in the maximum utilization of the bandwidth of the transmission link.

An airborne device has been developed which implements the video encoding and data multiplexing function. The paper describes the general multiplexing concept, the communication protocol, and the particular implementation. A description of the video encoding system, including the data multiplexing option, can be found in the "Draft Standard for Digital Transmission of Television Images" - RCC/TCG 209.

INTRODUCTION

The data multiplexing system takes advantage of the fact that during vertical retrace time, the video system is not actively encoding video data. This lull in the video encoding process presents a window during which telemetry data can be multiplexed into the data stream. In normal operation 240 horizontal lines of video data are encoded for each field of video transmitted. Associated with each of these video lines is a unique start of line code

and format information that describes the following line. When telemetry data is multiplexed in during vertical retrace time, it will always be inserted between line number 240 (the last line) of one field and line 1 (the first) of the next field of video to be encoded. This establishes, in the transmitted data stream, the exact location where the multiplexed data will be inserted. The multiplexed data line is identified as line number 241 and is loaded along with the compressed video data into the encoder's output buffer. This process reduces the amount of overhead that would be required if the multiplexing were done outside of the video encoding unit. This data line will be preceded by the normal start of line code, a unique format code, 10 bits that identify the length of multiplexed data and is followed by the data itself. All of this is done by the video encoder. The length of the data can vary between 1 and 1024 bits long. If multiplexed data is not sent, line number 241 is simply skipped. The data length is normally preset and a "data ready" signal is activated by the user to flag the encoder when the telemetry system has collected enough data to be transmitted. If the encoder is transmitting 60 fields per second and the multiplexed data length is set to 1024 bits, the multiplexed data rate will be 61kbps.

TABLE I

FORMAT OF DATA STREAM WITH MULTIPLEXED DATA

Line Number	Number of bits		
	12	10	X
line 1	sync code	format code	video line 1
.			
line 239	sync code	format code	video line 239
line 240	sync code	format code	video line 240
line 241	sync code	unique code	length + muxed data
line 1	sync code	format code	video line 1

The only interface needed to implement the data multiplexing option is comprised of three TTL level signals. These are "data ready", "multiplexed data" to the video encoder, and "data strobe" from the encoder. This establishes a serial interface with a clock and data and one control signal. The data ready signal flags the video encoder when telemetry data is ready for transmission. If sufficient data is present to be sent as indicated by the "data ready" signal the video encoder will furnish the number of "data strobes" programmed in the encoder as data multiplex length. All of the data strobes will occur during the vertical retrace time of the video signal being encoded. The strobe rate is 5 MHz. "Data" is clocked into the encoder on the rising edge of the "Data strobe" signal. If insufficient data

is available for transmission, the user can leave the “data ready” signal at a high level and the encoder will omit the “data strobes” at the next vertical retrace time.

The effects of multiplexing PCM data along with the video data in general lowers the resolution of the picture that is sent. There are situations however when the video encoder has insufficient data to transmit and is forced to add fill bits to maintain the communication data rate. If the picture being transmitted is highly compressible, multiplexing data will have little or no effect on the resolution since the encoder would be swapping data bits for fill bits. At the 60kbps rate, 4.4 bits of overhead per video line would be required. On the average, this would lower the resolution on only 4 lines of video at the 512 pixels per line rate.

If a parallel rather than the serial interface is required by the user, the addition of a simple interface circuit external to the video encoder can be added. Figure 1 is a block diagram of a parallel interface to the video encoder. This circuit would include a FIFO and a parallel to serial converter with the FIFO half full output used to control the “data ready” input to the encoder. Whenever the FIFO is half full the data multiplexing will be enabled. This circuit can also be used to remove the burst nature of the direct serial interface and allows the user to load data for transmission with a clock of their choice.

The major advantage of multiplexing narrow band PCM data along with the wideband Video data is system simplicity. Only one encryption and transmission package is required. Any data rate up to 60kbps can be achieved by varying the multiplexed data length or by only entering data when it is available. if PCM data is not multiplexed into the video data no overhead is required of the video data link. When data is multiplexed into the video data a minimum of overhead is needed.

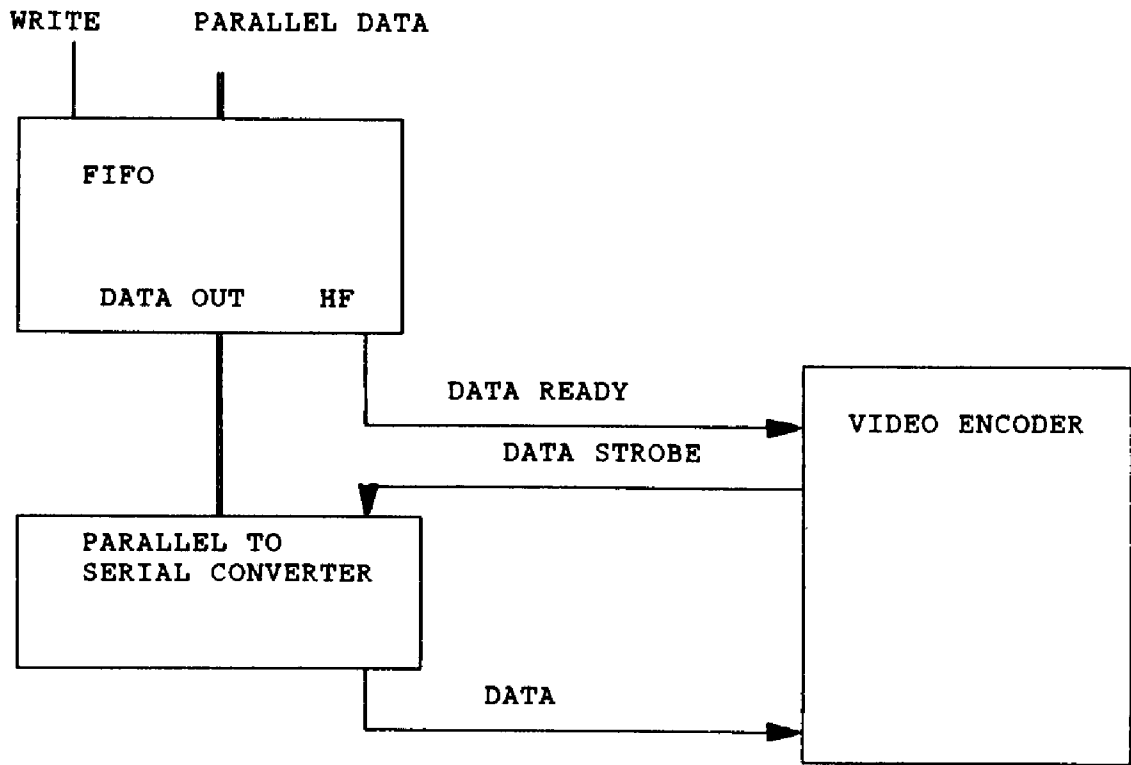


FIGURE 1: BLOCK DIAGRAM OF PARALLEL INTERFACE TO ENCODER