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A MICROPROCESSOR BASED MAGNETIC TAPE DRIVE INTERFACE

Details of a microprocessor-based interface to transfer data from 1/4 inch to 1/2 inch magnetic tape in a computer compatible format is described. The interface was designed as an OFF-line transfer system to store large volume of data from 1/4 inch tape onto 1/2 inch magnetic tape. The interface is between the widely used Aanderaa 2650 model 1/4 inch magnetic tape reader and the Kennedy 1/2 inch tape recorder model 1600/360.

MANY field instruments use 1/4 inch magnetic tapes for storing large amount of data. One such widely used instrument for oceanographic parameters, is the Aanderaa current meter. The data stored on a 1/4 inch magnetic tape by this instrument is read using the Aanderaa Tape Reader. The raw data is stored in a 10-bit binary format and further processing on the computer requires

it to be on a 1/2 inch tape. An on-line serial transfer of voluminous amount of data from 1/4 inch to 1/2 inch tape previously undertaken was slow and expensive on computer time and therefore an alternate method of data transfer was necessary. This paper describes such an off-line, microprocessor based, software oriented transfer system. The interface details between the 1/4 inch tape reader and the Kennedy 1/2 inch recorder with the software description are given.

DESCRIPTION

A simplified block diagram of the interface system is shown in Fig 1. The interface is built around the 8085A microprocessor single board computer (SBC) built inhouse. The SBC is provided with on-board 6K EPROM, 1K RAM and two Intel 8255 Input/Output Programmable Peripheral Interface ports. The Aanderaa Tape Reader outputs the data from 1/4 inch tapes in three modes. It has a display, a serial and a parallel output. The parallel output from the tape reader is in a 10-bit binary format. The tape reader has two modes of operation, the STEP and RUN mode. In the run mode the tape reader reads the data continuously and in the step mode, the data is read one data word at a time either when

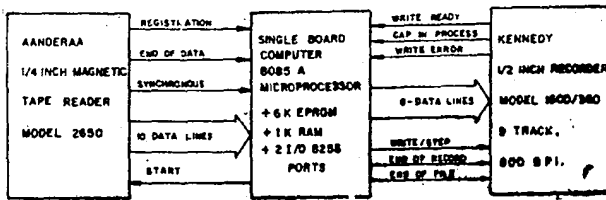


Fig 1 Block diagram showing the tape reader and recorder interfaced to SBC through I/O ports

triggered manually by the start button in the front panel or when an external start pulse is applied. The tape reader is connected to the SBC microprocessor through the I/O port. Besides the 10-bit binary outputs, the tape reader is provided with other status and control lines which are used by the program for tape reader control. The start pulse, a negative going pulse of minimum 50 μ s width, is given to the tape reader to transfer the 10 bit binary data to the data output lines. The registration status output indicates if the tape reader is ready to output data. The synch. output indicates that a record of data has ended on the 1/4 inch tape. There is also an end of data output on the tape reader.

The Kennedy Incremental tape recorder is a nine-track, 800 bpi recorder model 1600/360 which stores data in a standard computer compatible format. The data stored by the recorder on the 1/2 inch tape can be read on any standard computer system having a magnetic tape drive system. The data recording rate on the 1/2 inch tape using the Kennedy incremental recorder can vary from 0 to 300 characters/s. The inter-character gaps are automatically generated after every write command and they are evenly spaced, even though the data source may be operating in a random manner.

The TDC-316 computer on which the data on 1/2 inch magnetic tape is processed; reads the data in EBCDIC format. Hence the same format is used for storing the data in the off-line mode. The Kennedy recorder is also connected to the processor of the SBC through the I/O port. Data is written on tape in EBCDIC, one character at a time, when the Kennedy recorder is ready to receive the data. The simplified timing diagram for the recorder is shown in Fig 2. The different status conditions to be met and the commands to be given to the Kennedy recorder for writing data on the 1/2 inch tape are also shown. From the timing diagram, the first four signals indicate the conditions required for writing a character onto tape. As the recording speed can vary from 0 to

300 character/s the minimum time for writing two consecutive characters is approximately 3.3 ms. The ready signal indicates that the recorder is ready to write data onto tape and is normally high. The gap in process signal is normally low and indicates that no inter record gap or end of file gap is being written onto tape. With these two status conditions met and valid data on the data bus as shown in the timing diagram, a write/step pulse given, records the data on the magnetic tape. After the write/step pulse is given the ready line remains low for approximately 3.3 ms and no data can be written during this period. When the end of record or end of file pulse is given the gap in process goes high indicating an inter record or file gap is being written onto tape and hence, no data can be recorded. The command pulses t_w, t_{cor} given to the recorder should lie between 20 to 100 μ s,

The interface processor board is operated by using the 5 volts supply from the Aanderaa tape reader itself. Also, the interface hardware being a single pcb card, it was easily fitted inside the tape reader for portability and ease of use. A toggle switch was provided at the rear end of the tape reader for enabling the data transfer operation between the Tape reader and the Kennedy recorder.

OPERATION

The system is set up for operation by first loading the 1/4 inch data tape on the tape reader and the 1/2 inch tape on the Kennedy recorder. The 1/2 inch magnetic tape reel with a write protect ring is next moved forward and kept ready at the beginning of tape position. The data transfer is now initiated by switching the toggle switch to the ON position. At the end of each record block on the 1/4 inch tape, an inter record gap is generated on the 1/2 inch tape when the data on the 1/4 inch tape is over. The transfer operation can be halted at any time by switching the transfer switch to OFF position.

SOFTWARE DESCRIPTION

The software developed for the interface was written in 8085 microprocessor assembly language on an Intel Microprocessor Development system. The simplified flow diagram of the interface software is shown in Fig 3. The two I/O ports of the SBC were appropriately initialized for proper input/output operations between the microprocessor, the Aanderaa tape reader and the Kennedy recorder. Before the start of data transfer operation

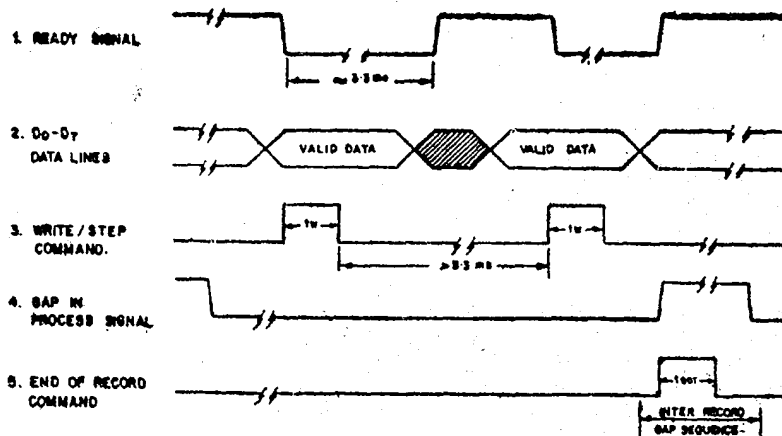


Fig 2 Simplified timing diagram for Kennedy recorder

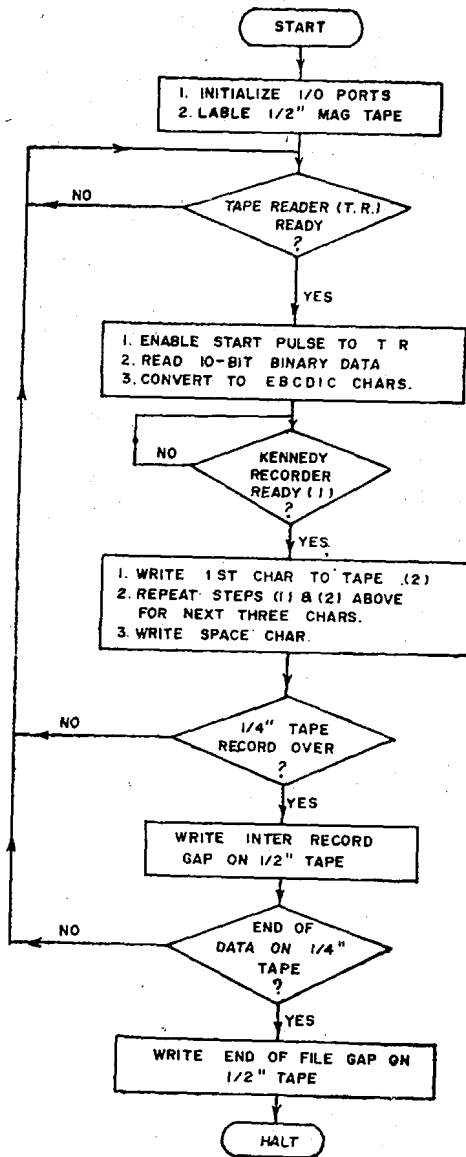


Fig 3 Simplified software flow diagram

the 1/2 inch magnetic tape is labelled by writing a file name in the appropriate format as required by the computer, to enable the direct program access of the data that is stored on the 1/2 inch tape. The microprocessor through the I/O ports checks the different status signals of the tape reader. A software check on the registration output of the tape reader indicates its status. A high output indicates that the tape reader is ready to transmit data. A pulse greater than 50 μ s is then applied to the start line of the tape reader which then enables the 10-bit data on the data lines and this is then taken into the accumulator. This data is conver-

ted to BCD and then to EBCDIC before storing it on the 1/2 inch magnetic tape. The data stored on the 1/4 inch tape is in numeric binary format and each record contains a reference number.

The four EBCDIC characters thus formed from the 10-bit binary data are now to be transferred to the 1/2 inch tape. The ready and the gap in process output are checked for high and low status condition. If both conditions are true then a write pulse is applied to the Kennedy recorder which allows the data on the data lines of the recorder to be written onto the 1/2 inch tape. The EBCDIC characters are written on the 1/2 inch tape sequentially. A blank character is written on the tape between sample values. The write error output of the Kennedy Recorder is continuously monitored and if present indicates bad recording and transfer is stopped. The tape reader synchronous output which indicates an end of data record on the 1/4 inch tape and the end of data line are also monitored by the CPU. If the synch output is not set then the program loops and acquires the next data value from the tape reader. If it is set, then it indicates the end of a data record on the 1/4 inch tape and a corresponding inter record gap is generated on the 1/2 inch tape by applying a pulse on the IRG input of the Kennedy recorder. The program next loops back to transfer the next block of data from the 1/4 inch tape. If the end of data output of the tape reader is set, then it indicates the end of data on the 1/4 inch tape and an end of file mark is generated on the 1/2 inch tape by applying a pulse on the EOF input of the Kennedy recorder and the program then halts the transfer.

CONCLUSION

The microprocessor interface for the data transfer between the 1/4 inch and 1/2 inch tape has shown to be very convenient and useful system for large data transfer operations. Since the interface is mainly software oriented many modifications can be incorporated for different other models of tape readers and 1/2 inch recorders. The format in which the data is written on the 1/2 inch magnetic tape can also be easily changed to suit any other computer system.

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