



Microdata Peripheral

Paper Tape System, Model 2710, 8984

GENERAL DESCRIPTION

The Microdata high speed paper tape system increases the efficiency of the Micro 800 and Micro 1600 computer systems by reducing the time required to read and punch paper tape. The paper tape system consists of a combination 8-channel paper tape reader/punch, an interface controller, interconnecting cables and mounting hardware. Fanfold tape is read at rates up to 300 characters per second and punched at up to 75 characters per second.

STANDARD FEATURES

- Fanfold Paper Tape
- Combination Reader and Punch in a single rack mountable enclosure
- 300 Characters per second — Reader
- 75 Characters per second — Punch
- Programmed and Concurrent I/O Operation with Interrupt

CONTROLLER

The interface controller contains the logic and interface circuitry for control of the reader/punch and transfer of data between the computer and the paper tape unit. Data can be transferred on a character-by-character basis in the programmed mode of operation, or entire blocks of data can be transferred automatically using the concurrent I/O channel of the computer.

Operating and Programming the Controller

There are three operating modes in which data transfers between the computer and the paper tape system can occur:

1. Programmed mode
2. Programmed mode with interrupt on character
3. Concurrent I/O mode for automatic block transfer

In the programmed mode, data is transferred using I/O instructions. A program sense loop determines that the device is ready to send or accept a character. In the programmed mode with interrupt, the need for the sense loop is eliminated. The controller interrupts the computer to a subroutine when the device is ready. The subroutine then affects the transfer using programmed instructions. In the concurrent I/O mode (discussed in detail later), entire blocks of data are transferred automatically under firmware control.

In the programmed modes of operation, the six basic I/O commands of the Micro 800 and Micro 1600 computers are used for control of the reader and punch, for status testing, and for data transfer. The assembler mnemonics for these commands are:

- OBA — Output Byte from A Register
- OBB — Output Byte from B Register
- OBM — Output Byte from Memory
- IBA — Input Byte to A Register
- IBB — Input Byte to B Register
- IBM — Input Byte to Memory

When writing these commands in assembly language, the instruction mnemonic is followed by a 3-bit function code (f), a 5-bit device address (d), and in the case of the OBM and IBM instructions, a 15-bit address (addr). The formats for writing these commands are:

OBA f,d IBM f,d,addr

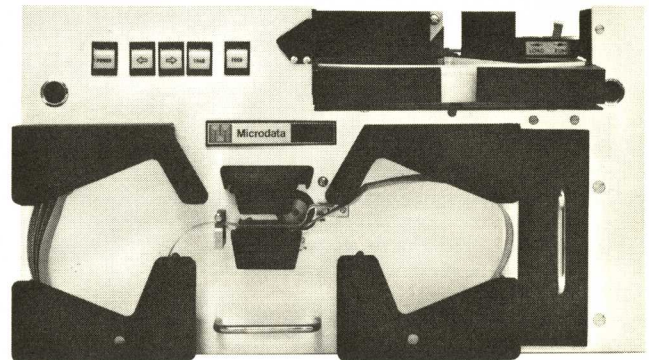


Figure 1. Paper Tape Reader/Punch.

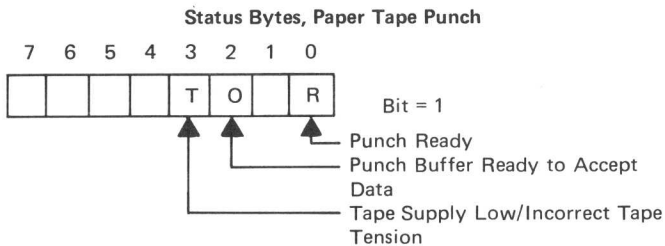
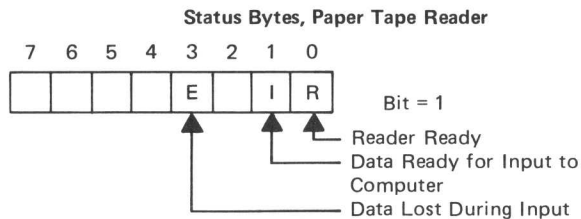
The device address (d) is used to identify which peripheral device is being addressed. Device address 2 is assigned to the paper tape reader; device address 3 is assigned to the paper tape punch.

The 3-bit function code (f) specifies a function to be performed by the controller and/or the punch or reader. This function code provides all required control of the paper tape system. The functions which can be specified are listed below:

Function Codes, Paper Tape Reader		
Value of f	Input Instruction	Output Instruction
0	Input Data Byte	.....
1	Input Status Byte	.....
2	.....	Enable Concurrent I/O Mode and Interrupt
3	.....	Enable Interrupt
4	.....	Disconnect/Stop Reader
5	.....	Disable Interrupt
6	.....	Start Reader
7	.....	.....

Function Codes, Paper Tape Punch		
Value of f	Input Instruction	Output Instruction
0	Output Data Byte
1	Input Status Byte	.....
2
3	Enable Interrupt
4	Disconnect/Stop Punch
5	Disable Interrupt
6	Enable Concurrent I/O Mode and Interrupt
7

Bytes input to the computer from the controller contain either data or status information. Status bytes are tested by the computer program to determine the status of the tape unit and/or the controller. Status bytes input to the computer (by executing an input command with function code 1) contain the following information.



Concurrent I/O operation is the name given to the automatic block transfer technique used in Micro 800 and Micro 1600 computers. The software program sets up the starting and ending memory addresses of the transfer in dedicated memory locations. The firmware then controls the data transfer automatically at the maximum rate of the reader or punch until the entire block has been transferred.

When the concurrent transfer is initiated, the reader or punch is started. As soon as a character has been read or the punch is ready to accept a character, the controller issues a "Concurrent I/O Request." This stops the computer at the end of the operation in process, and one byte is transferred to or from memory under firmware control. After the transfer, the computer resumes program operation until the controller issues the next Concurrent I/O Request.

Concurrent I/O operations can be terminated with a controller-generated, "end-of-operation" interrupt which traps the computer to a user subroutine stored in memory. The location of the subroutine is specified at an "interrupt address," which is actually two sequential memory locations reserved for this purpose. There are separate interrupt addresses for the punch and reader.

The dedicated memory locations for the paper tape system are listed below:

Dedicated Memory Locations

	Reader	Punch
Starting Address:	0008 ₁₆ , 0009 ₁₆	000C ₁₆ , 000D ₁₆
Ending Address:	000A ₁₆ , 000B ₁₆	000E ₁₆ , 000F ₁₆
Interrupt Address:	0104 ₁₆ , 0105 ₁₆	0106 ₁₆ , 0107 ₁₆

Functional Description

The controller for the paper tape system functions as two complete controllers — an input controller for the paper tape reader and an output controller for the paper tape punch. The two controllers have individual device addresses and operate completely independent of one another.

Figure 2 shows a simplified functional block diagram of the controller. The major functional elements shown in the figure are described in the paragraphs that follow:

Data Receivers — The receivers provide buffering of the data, control information, and device addresses sent from the computer.

Control Decoder — This section decodes various internal computer control terms.

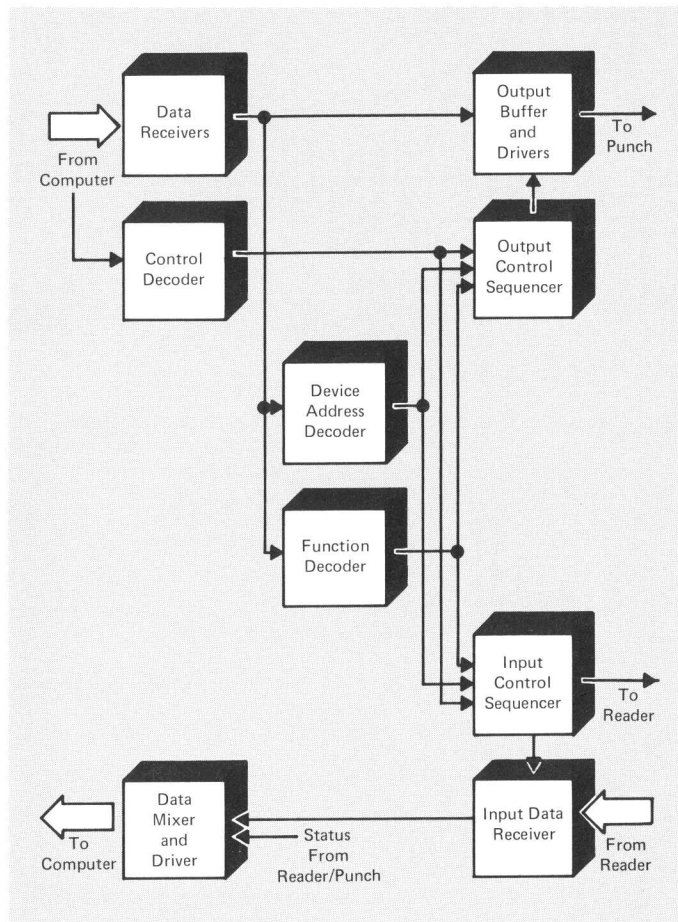


Figure 2. Controller, Simplified Block Diagram

Device Address Decoder — This section checks the device address of every I/O command executed by the computer. If it matches the device address of the reader or punch, it causes the controller to respond to the command.

Function Decoder — Logic in this section decodes the 3-bit function code of the I/O command.

Output Control Sequencer — This section controls the transfer of data from the computer to the punch in the programmed and concurrent I/O modes. It also monitors the status of the device and provides this information to the computer.

Output Buffer and Drivers — The parallel data from the computer is set into the output buffer for transmission to the device. The drivers provide the actual connections to the device via the interface cable.

Input Control Sequencer — The input sequencer controls data transfer from the reader to the computer in the programmed and concurrent I/O modes.

Data Drivers and Mixer — Depending on the function being performed by the controller, this section selects data, status information, or the interrupt address for transfer to the computer. It also provides the connection to the computer I/O data bus.

Physical Construction

The paper tape controller is constructed on one printed circuit board which mounts in any available I/O card slot in the computer mainframe or an expansion chassis. The cable to the reader/punch unit connects to the printed circuit edge connectors on the rear of the controller board.

PAPER TAPE READER/PUNCH

The paper tape reader and punch are combined in a single, compact, rack-mountable unit. The low price and excellent performance characteristics of the reader/punch make this unit ideally suited for today's minicomputer systems.

Paper Tape Reader

The reader portion of the unit is an optical-type reader capable of reading 1-inch, 8-channel, fanfold tapes at up to 300 characters per second. A wide range of tapes (including oiled and unoled paper, Mylar®, and foil) can be accepted.

In the programmed modes of operation where each character is read on command from the computer, the maximum speed is 200 CPS. In concurrent I/O operation, the reader is started at the maximum speed of 300 CPS and the characters are transferred automatically at this rate to the computer.

As shown in the photo (Figure 1), the fanfold tape is placed in the tape bin on the left and is threaded through the read mechanism. As the reader operates, the tape is automatically folded into the tape bin on the right.


Paper Tape Punch


The paper tape punch can accept virtually all types of 1-inch paper, Mylar®, and foil tapes. A tape bin above the punch mechanism holds the unpunched fanfold tape. After the tape is punched, it folds into the tape bin below the punch mechanism.

Tapes are punched in the concurrent I/O and programmed-with-interrupt modes at the maximum tape speed of 75 CPS. Programmed punching operations take place on command from the computer at any rate up to 75 CPS.

Manual Controls


POWER — A two-position switch which applies AC power to the reader and punch.

 — A momentary-action pushbutton which drives reader to the left when pressed. When not pressed, it allows the reader to be operated by the controller.

 — A momentary-action pushbutton which, when pressed, drives the reader to the right. When not pressed, it allows the reader to be operated by the controller.

LOAD — A "press-on, press-off" pushbutton which is used to inhibit operation of the reader when tape is being loaded or unloaded.

FEED — A momentary-action pushbutton which, when pressed, causes the punch to feed tape through the punch mechanism at 75 character positions per second. Feedholes only are punched, and the data input lines from the controller are inhibited. When the FEED switch is not pressed, the punch can be operated by the controller.

 **LOAD RUN** — A lever located to the left of the punch take-up bin, used to disengage the pinch roller from the punch capstan while threading tape.

Construction and Mounting

The complete paper tape reader/punch is a 19-inch-wide, 10.5-inch-high, 14.5-inch-deep unit, designed for mounting in a standard 19-inch equipment rack. Installed, the reader/punch combination requires just 10.5 inches of vertical rack space.

All controls required for normal operation are located on the front panel of the unit. For ease of servicing, the entire reader/punch slides out to the front of the equipment rack.

SOFTWARE

The standard Microdata utility software packages which utilize paper tape equipment are fully compatible with the paper tape system. The assembler programs (MAP), the debugging packages (TOS), and tape editor programs (TED) can operate with the high speed tape system for maximum efficiency.

INSTRUCTION LIST

The command set used with the paper tape system is listed in the following table:

MNEMONIC	MACHINE CODE (HEX)	DESCRIPTION
Data Transfer		
OBA 0,3	3903	Output data byte from A Register to punch
OBB 0,3	3A03	Output data byte from B Register to punch
OBM 0,3	3B03	Output data byte from Memory to punch
IBA 0,2	3102	Input data byte from reader to A Register
IBB 0,2	3202	Input data byte from reader to B Register
IBM 0,2	3302	Input data byte from reader to Memory
Status Transfer		
IBA 1,3	3123	Input status byte from punch to A Register
IBB 1,3	3223	Input status byte from punch to B Register
IBM 1,3	3323	Input status byte from punch to Memory
IBA 1,2	3122	Input status byte from reader to A Register
IBB 1,2	3222	Input status byte from reader to B Register
IBM 1,2	3322	Input status byte from reader to Memory
Function Transfer		
OBA 3,3	3963	Arm punch interrupt
OBA 5,3	39A3	Disarm punch interrupt
OBA 4,3	3983	Disconnect punch
OBA 6,3	39C3	Enable punch concurrent I/O mode with interrupt
OBA 3,2	3962	Arm reader interrupt
OBA 5,2	39A2	Disarm reader interrupt
OBA 4,2	3982	Disconnect/Stop reader
OBA 2,2	3942	Enable reader concurrent I/O mode with interrupt
OBA 6,2	39C2	Start reader

SPECIFICATIONS

Model

Micro 800 Computer Series 8984
 Micro 1600 Computer Series 2710

Controller

General Organized as an input controller
 for paper tape reader and a
 separate output controller for
 paper tape punch

Modes of Operation Programmed
 Programmed with interrupt
 or character
 Concurrent I/O

Device Addresses 02₁₆ assigned to reader
 03₁₆ assigned to punch

Dedicated Memory:

Reader Controller Interrupt Address: 0104₁₆, 0105₁₆
 Starting Address (Concurrent I/O):
 0008₁₆, 0009₁₆
 Ending Address (Concurrent I/O):
 000A₁₆, 000B₁₆

Punch Controller Interrupt Address: 0106₁₆, 0107₁₆
 Starting Address (Concurrent I/O):
 000C₁₆, 000D₁₆
 Ending Address (Concurrent I/O):
 000E₁₆, 000F₁₆

Construction One printed circuit board

Mounting Mounts in any available I/O
 card slot in computer mainframe
 or expansion chassis

Operating Power +5VDC @ 1.5 amperes (supplied
 by computer power supply)

Operating Temperature 0°C to 50°C

Humidity 0% to 90% relative (no condensation)

Reader/Punch Unit

General Combination unit containing high-
 speed paper tape reader and punch
 Dimension 19 inches wide, 10.5 inches high,
 14.5 inches deep
 Mounting Mounts in standard 19-inch equipment
 rack; requires 10.5 inches vertical
 rack space
 Weight 40 pounds
 Input Power 100, 115, 127, 220, or 240 VAC,
 47 to 64 Hz.
 Operating Temperature 5°C to 55°C
 Operating Humidity 10% to 90% relative (no condensation)

Paper Tape Reader

Type 8-channel optical reader
 Speed Up to 200 CPS asynchronous; 300 CPS
 continuous (concurrent I/O) operation
 Tape Type 1-inch wide fanfold tape of any
 material with thickness between
 0.0027 inches and 0.0045 inches,
 transmissivity less than 57%
 (Tape must meet ANSI X3.18 or
 ECMA 10 standards for base
 material and perforations.)
 Lamp Life Greater than 13,000 hours

Paper Tape Punch

Speed Up to 75 CPS in asynchronous
 or continuous operation
 Tape Type Standard 1-inch fanfold tapes,
 oiled (preferred) or unoled
 paper tapes, as well as most
 Mylar® and foil tapes with
 thickness between 0.003 inches
 and 0.0043 inches
 Punch Life Greater than 8.4 X 10⁷
 characters with paper tape



Microdata

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