Microdata Peripheral

Magnetic Tape System

GENERAL DESCRIPTION

The Microdata magnetic tape system provides economical bulk data storage for Micro 800 and Micro 1600 series computers. The basic system consists of a single magnetic tape transport, an interface controller which can operate up to four intermixed 7- and 9-track transports, and all necessary interconnecting cables and mounting hardware. Additional tape transports can be specified at the time of initial purchase or ordered separately as "add-on" units.

Tape speeds of 12.5 inches per second (ips) and 25 ips are available in 7- and 9-track recording formats. Recording density for all models is 800 bytes per inch (bpi) in an IBM compatible format. This compatibility means that recorded information can be completely recovered when the tape is played back on a comparable IBM system. Conversely, information recorded on a comparable IBM system can be recovered when played on a Microdata tape transport.

STANDARD FEATURES

- Up to four intermixed 7-track/9-track transports per controller
- 25 ips or 12.5 ips read/write/erase speed
- 125 ips rewind speed
- IBM compatible 7- or 9-track recording format
- Read-after-write parity checking
- Automatic block transfers and programmed I/O

CONTROLLER

The interface controller contains the logic and interface circuitry for control of from one to four tape transport units and transfer of data between the computer and the transport(s). Data transfers may take place under program control, or automatically via the concurrent I/O channel.

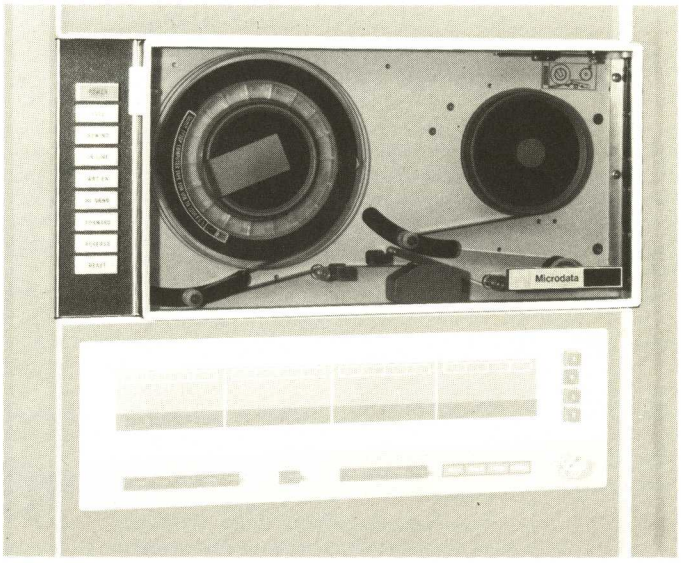


Figure 2. Magnetic Tape Transport Installation

Operating and Programming the Controller

In the programmed mode of operation, the six basic I/O commands of the Micro 800 and Micro 1600 computers are used for transport control, status testing, and 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

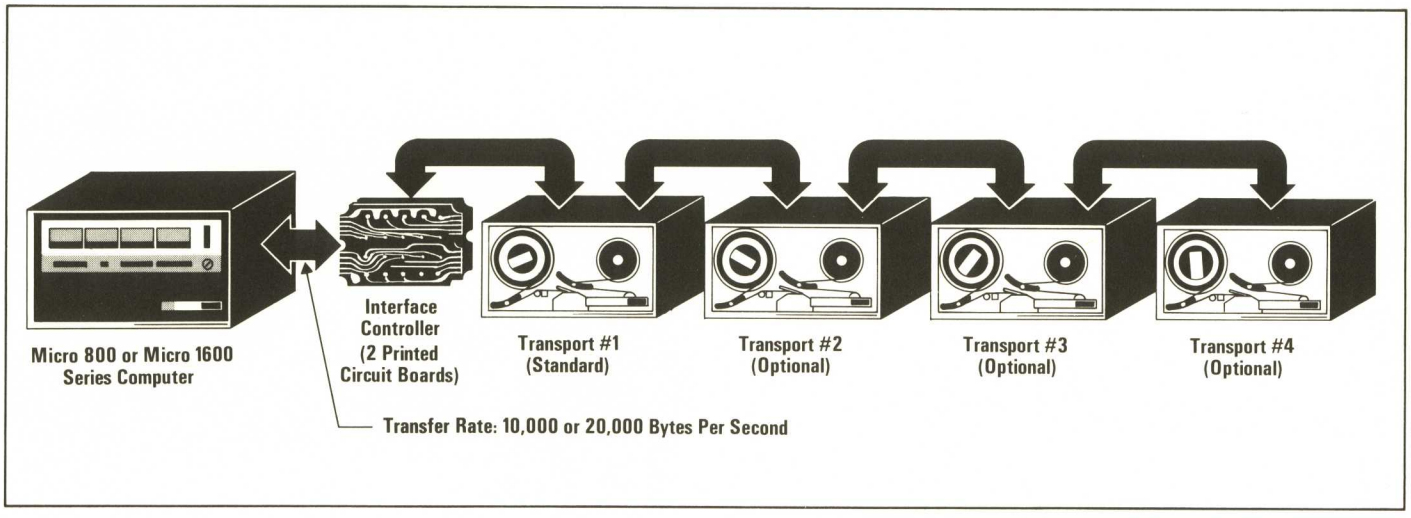


Figure 1. Microdata Magnetic Tape System

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 memory address (addr). The formats for writing these commands are:

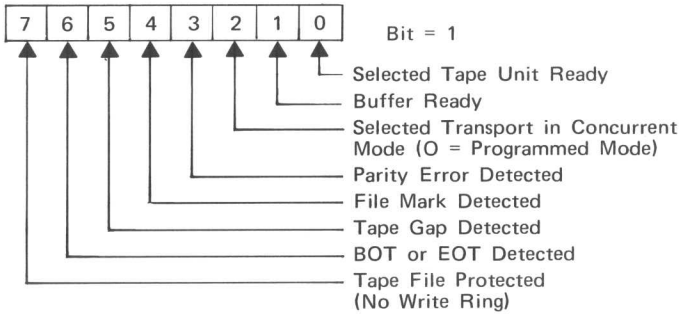
OBA f,d IBM f,d,addr

The 3-bit function code, f, specifies a function to be performed. The functions which can be specified are listed below:

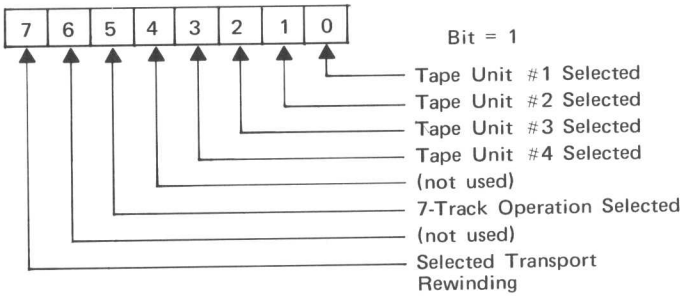
Value of f	Input Instruction	Output Instruction
0	Input Data Byte	Output Data Byte
1	Input Primary Status Byte	Output Primary Control Byte
2	----------	Enable Block Input/Interrupt
3	----------	Arm Interrupt
4	----------	Disconnect Controller
5	----------	Disarm Interrupt
6	----------	Enable Block Output/Interrupt
7	Input Alternate Status Byte	Output Alternate Control Byte

Bytes input from the controller are either data or status. Status bytes are tested by the computer program to determine the status of the tape transport/controller. As selected by the f code in the input command, either the Primary Status Byte or the Alternate Status Byte will be input from the controller. The contents of these status bytes are listed below:

Primary Status Byte

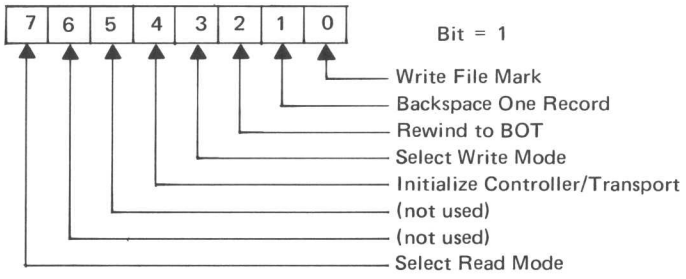


Alternate Status Byte

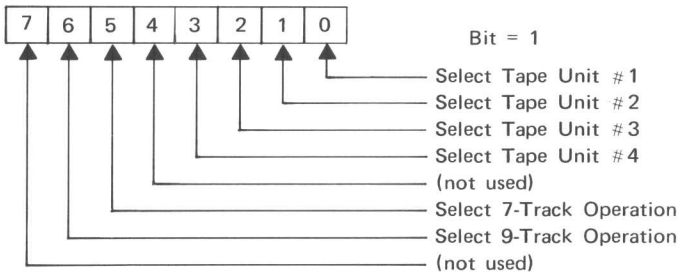


Bytes output to the controller can be either data or control, as specified by the f code in the instruction. Control bytes cause the controller to initiate certain actions within the controller/transport. As selected by the instruction f code, the control byte can be sent to the primary or alternate control logic in the controller. The meaning of each bit in the primary and alternate control bytes is as follows:

Primary Control Byte



Alternate Control Byte



Concurrent I/O Operation

In the concurrent I/O mode, transfers of blocks of data take place automatically between the magnetic tape transport and the computer memory. The starting and final addresses in memory of the block of data are specified using certain dedicated memory locations. For the normal magnetic tape device address (09_{16}), four memory locations (0024_{16} through 0027_{16}) are reserved for this purpose. When a concurrent I/O transfer is initiated, the block transfer begins at the memory address specified in locations 0024_{16} and 0025_{16}, and continues until data is transferred to or from the address specified in locations 0026_{16} and 0027_{16}.

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 address of the subroutine is specified at an "interrupt address" which is actually two sequential memory locations reserved for this purpose. A standard magnetic tape controller with device address 09_{16} uses locations 0112_{16} and 0113_{16} as the interrupt address.

Functional Description

Figure 3 shows a simplified functional block diagram of the magnetic tape controller. A brief description of the function of each element is provided in the paragraphs that follow.

Decoding and Control Section - This section decodes the device address and 3-bit function code of I/O commands from the computer. If the device address in the instruction matches the device address of the controller, the function code is then decoded and control signals are sent to every other element in the controller for routing of the next byte to be transferred to or from the computer.

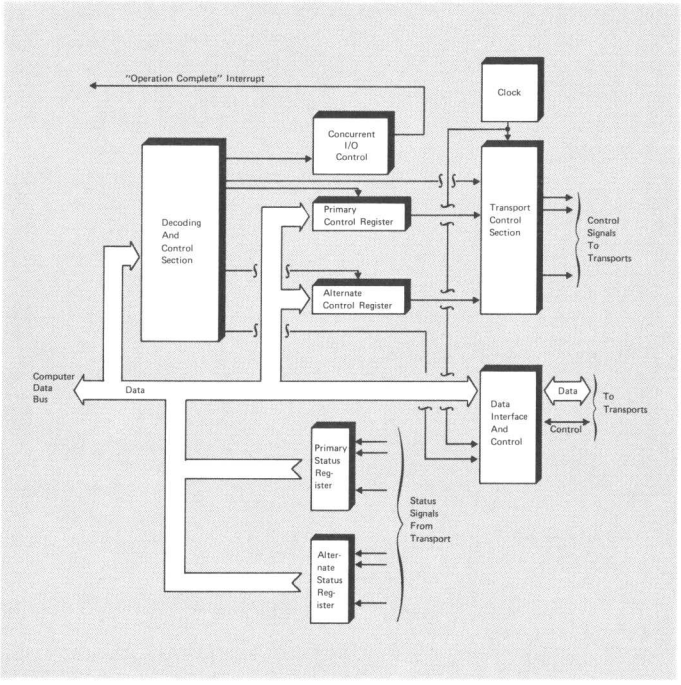


Figure 3. Simplified Block Diagram, Controller

Concurrent I/O Control - This section controls block transfers of data in the concurrent I/O mode of operation. It also contains the circuitry to generate the end-of-block interrupt. Like the other controller elements, this section is under control of the Decoding and Control Section.

Primary and Alternate Control Registers - These 8-bit registers receive control bytes from the computer and provide control signals to other controller elements and to the tape transport. The registers control such functions as transport selection, 7- or 9-track operation, etc.

Primary and Alternate Status Registers - These 8-bit registers are tied directly to various places in the controller and the transport. Their contents indicate the status of the tape system at any given time. Properly coded input commands cause the contents of the registers to be transferred to the computer for testing by the computer program.

Timing Clock - This element provides the basic timing signals used in writing data on the tape.

Transport Control Section - This section receives the timing clock and control signals from other elements in the controller and formats data to be written on the tape. It also provides parity and CRC generation and checking.

Physical Construction

The tape controller circuitry is constructed on two printed circuit boards which mount in I/O card slots in the computer mainframe or an expansion chassis. The cables to the transport connect to printed circuit edge connectors on the rear of the boards.

TAPE TRANSPORT UNIT

The tape transport can be functionally divided into three major sections: the tape drive, tape control, and data electronics sections. Each of these sections is described in the paragraphs that follow.

Tape Drive Section

A single capstan drive provides tape motion during read, write and rewind operations. Tape speed is precisely regulated by a velocity servo using tachometer feedback from the capstan motor. A ramp generator controls acceleration and deceleration when the tape motion is started and stopped.

Independent supply and take-up reel motors, in conjunction with buffer storage arms, maintain constant tape tension during the relatively fast starts and stops of the capstan. Photoelectric sensors detect displacement of the storage arms, and an error signal is sent to the reel servo amplifiers. The error signal is amplified and used to maintain the storage arms in their normal operating positions.

The tape unit is fully protected by interlocks to prevent damage to the tape in the event of component or primary power failure. A special disc braking feature prevents tape spillage after loss of power.

Tape Control Section

The tape control section causes the various tape motion operations to occur in response to control signals from the controller and the tape transport control panel. In addition, it sends tape status signals to the controller.

When operating the transport under computer control, external control commands are decoded in the controller and the appropriate control lines to the transport are activated. Tape motion control inputs to the transport are provided to connect the desired transport to the controller and cause the desired tape motion.

Manual control is provided by a control panel on the front of the transport. Each of the manual controls and indicators is listed and briefly described below:

POWER - turns the transport power supplies on and off, but does not activate the transport.

LOAD - energizes the tape tension servos when pressed once; causes tape to move to the load point when pressed a second time.

REWIND - causes tape to rewind to load point. If pressed when tape is at load point, tape rewinds until tape tension is lost.

ON-LINE - selects on-line or manual operation of the transport.

WRT EN (Write Enable) - indicator which lights when a tape reel with a write ring is installed on the supply reel hub.

HI DENS (High Density) - not used.

FORWARD - causes forward tape motion at 12.5 ips or 25 ips. Motion continues until tape reaches EOT tab or until RESET switch is pressed.

REVERSE - causes reverse tape motion at 12.5 ips or 25 ips. Motion continues until BOT tab is reached or until RESET switch is pressed.

RESET - in the off-line (manual) mode, causes tape motion to cease; in the on-line mode, causes transport to revert to off-line mode.

In addition to receiving control inputs from the computer and the manual control panel, the transport sends various signals to the controller to allow the computer to determine transport status.

Data Electronics Section

The data electronics section of the transport unit contains the circuitry to permit reading and writing of data on the tape. The major elements of this section include the dual-gap read/write/erase heads, data registers, and circuitry to control the read and write operations.

To read data from tape, the tape is set in motion at either 12.5 ips or 25 ips and the read mode is selected. As a character is read from tape, a read strobe signal is sent to the controller to indicate that the data can be sampled. Transfer to the controller takes place on a bit-parallel basis.

Data to be written on the tape is transferred bit parallel to the transport write buffer when tape is in motion and the transport is in the write mode. The data is formatted along with inter-record gaps and parity (and CRC data in 9-track models) by the controller. A write strobe signal from the controller strobes each character onto the tape.

Parity is generated automatically by the controller for each character written on the tape. After each character is written and as the tape passes under the read head, the data is read and sent to the controller for parity checking. Both vertical and longitudinal parity are checked in the controller, and an error status bit is set after each record if either parity error occurs. The 9-track systems also feature CRC error detection.

Construction and Mounting

The complete tape transport (including power supply) is contained in a 19-inch wide, 8.75-inch high, 12.5-inch deep rack-mountable package. All the data electronics and control circuitry are mounted on two printed circuit boards which are hinged to swing out to the rear for easy servicing. The cables which connect the transport with the interface controller mate with three printed circuit edge connectors on these boards.

A front panel dust cover protects the magnetic tape, read/write head, capstan and tension arms from contamination and accidental damage. All manual operating controls are located on a panel to the left of the dust cover permitting access with the dust cover closed.

The transport is intended for mounting in a standard 19-inch equipment rack. Due to the transport's compact design, only 8.75 inches of vertical rack space is required.

SOFTWARE

A basic software package is provided with the magnetic tape system. A diagnostic program allows operational checkout of the system and serves as a valuable maintenance aid. A driver package contains callable sub-routines which perform read and write operations and control tape motion.

Table 1. Microdata Tape Systems and Transports

Model Number		Description
Micro 800	Micro 1600	
		Complete Systems
8960	2810	One tape transport (Model 2820), 7-inch reel, 12.5 ips, 9-track format, 800 bpi, dual-gap read/write/erase head. Transfer rate is 10,000 bytes per second via concurrent I/O channel. Controller to accommodate up to four 12.5 ips transports. Interconnecting cables and mounting hardware.
8960-7	2810-7	One tape transport (Model 2820-7), 7-inch reel, 12.5 ips, 7-track format, 800 bpi, dual-gap read/write/erase head. Transfer rate is 10,000 bytes per second via concurrent I/O channel. Controller to accommodate up to four 12.5 ips transports. Interconnecting cables and mounting hardware.
8961	2811	One tape transport (Model 2821), 7-inch reel, 25 ips, 9-track format, 800 bpi, dual-gap read/write/erase head. Transfer rate is 20,000 bytes per second via concurrent I/O channel. Controller to accommodate up to four 25 ips transports. Interconnecting cables and mounting hardware.
8961-7	2811-7	One tape transport (Model 2821-7), 7-inch reel, 25 ips, 7-track format, 800 bpi, dual-gap read/write/erase head. Transfer rate is 20,000 bytes per second via concurrent I/O channel. Controller to accommodate up to four 25 ips transports. Interconnecting cables and mounting hardware.
		Add-On Transports
2820	2820	Tape transport, 7-inch reel, 12.5 ips, 9-track format, 800 bpi, dual-gap read/write/erase head. Transfer rate is 10,000 bytes per second via concurrent I/O channel.
2820-7	2820-7	Tape transport, same as Model 2820 above except 7-track recording format.
2821	2821	Tape transport, 7-inch reel, 25 ips, 9-track format, 800 bpi, dual-gap read/write/erase head. Transfer rate is 20,000 bytes per second via concurrent I/O channel.
2821-7	2821-7	Tape transport, same as Model 2821 above except 7-track recording format.

SPECIFICATIONS

Tape Transport Units

Tape Speeds	12.5 or 25 inches per second
Data Density	800 bytes per inch
Rewind Speed	125 inches per second
Recording Format	7- or 9-track, IBM compatible, NRZI recording mode
Tape Start/Stop Time	28 to 32 milliseconds
Tape Speed Variations	±3% instantaneous, ±1% average
Dynamic Skew	75 micro inches maximum
Static Skew	100 micro inches maximum
Reel Size	Up to 7 inches in diameter, IBM compatible
Head Type	Dual-gap with full-track erase
Recording Tape	0.5 inches wide, 1.5 mil thick, computer grade
Weight	35 pounds
Dimensions	19 inches wide, 8.75 inches high, 12.5 inches deep
Mounting	Mounts in standard 19-inch equipment rack; requires 8.75 inches vertical rack space
Operating Power	115 VAC or 230 VAC, 48 Hz to 440 Hz, 110 Watts
Operating Temperature	4.5° C to 55° C (40°F to 115° F)
Humidity	15% to 95% relative (no condensation)

Controller

General	Interfaces up to four magnetic tape transports to Micro 800 or Micro 1600 series computer
Modes of Operation	Programmed and concurrent I/O
Device Address	00_{16} to $1F_{16}$; normally address 09_{16} is assigned to tape controller
Error Detection	Parity and cyclic redundancy checking
Interrupt Address	0112_{16} for standard controller with device address 09_{16}.
Concurrent Block Addresses:	
Starting Address	Specified at locations 0024_{16} and 0025_{16}.
Ending Address	Specified at locations 0026_{16} and 0027_{16}.
Construction	Two printed circuit boards
Mounting	Mounts in any two available I/O card slots in computer mainframe or an expansion chassis
Operating Power	+5Vdc @ 2.2 Amperes (supplied by computer power supply)
Operating Temperature	0° C to 50° C (32° F to 122° F)
Humidity	0% to 90% relative (no condensation)

Microdata

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