



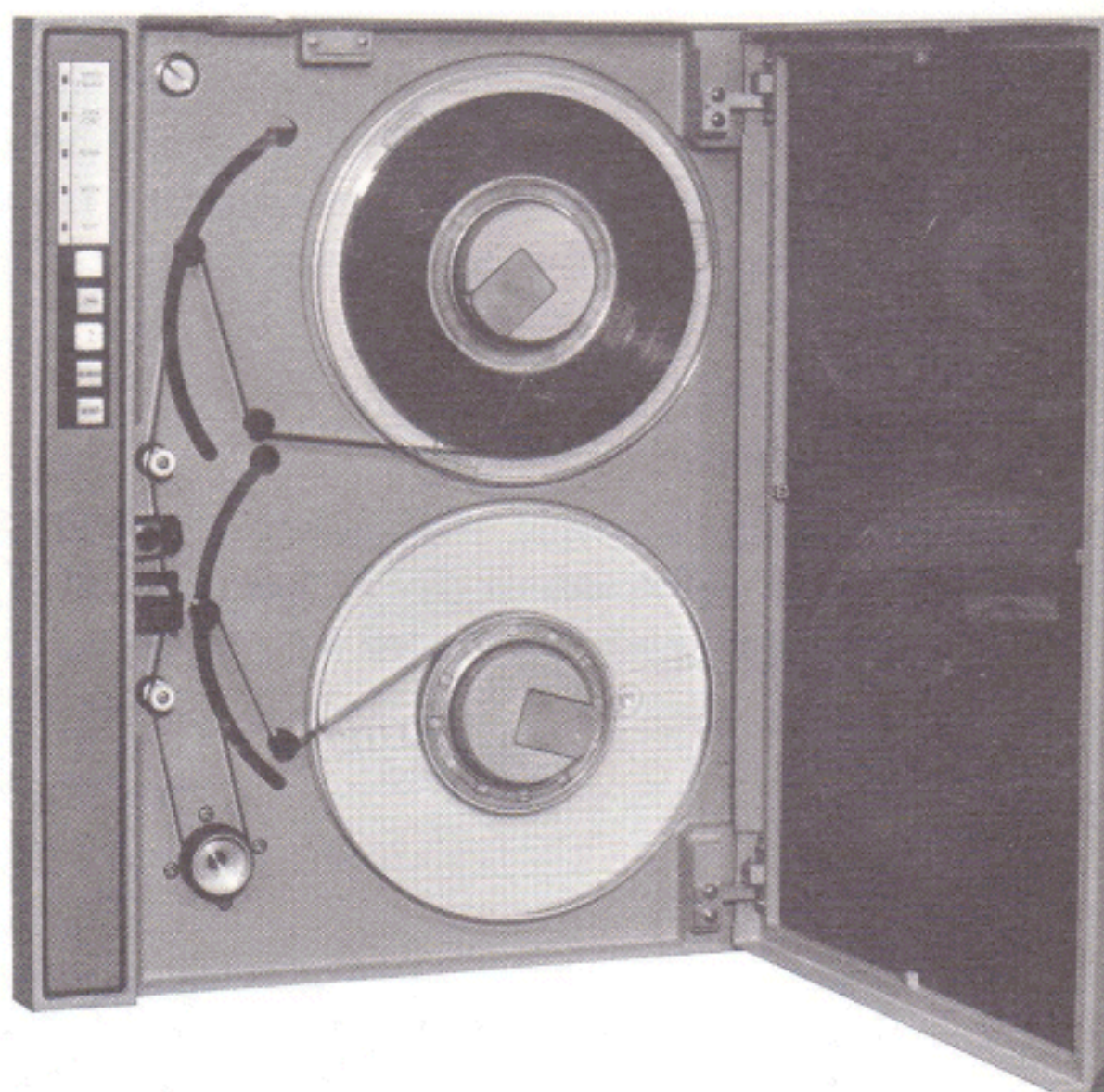
# Microdata OEM Peripherals Group

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## Series 6000 NRZI Magnetic Tape Transports

Microdata Series 6000 NRZI Magnetic Tape Transports provide dependable, full capability storage to meet the wide ranging requirements of mini and midi computer systems. These IBM compatible tape transports use 10.5 inch reels for maximum capacity, and offer a full selection of performance features to allow the OEM or system user to tailor the transport capabilities to his individual system requirements.

Series 6000 tape transports are available with 7- or 9-track read-after-write head configurations and non-return-to-zero (NRZI) data electronics. Recording densities of 200, 556, or 800 bpi are permitted at tape speeds of 25, 37.5 and 45 ips. Rewind and fast forward operations take place at 200 ips.



### FEATURES

- Full IBM compatibility
- 10.5 inch tape reels
- Read/write tape speeds 25, 37.5 and 45 ips
- 200 ips rewind/fast forward
- Self contained formatter available
- Seven or nine-track dual-gap heads
- Four-unit daisy chaining on one controller
- Multi-density read
- All standard tape densities
- Compact — 24.5 inches high, 14 inches deep
- Modular electronics
- Direct drive motors
- Photo-optical/electronic speed regulation
- Direct, precision mounting to front casting
- Front access to all mechanics and electronics
- Opto-isolator servo control coupling
- Eight-ounce buffer arm tension
- Electronic deskewing
- Power failure detection (*soft* shutdown)
- Dual power supplies
- Easily replaceable heads
- Industry standard interface



## DESIGNED FOR PERFORMANCE, DEPENDABILITY

The Series 6000 tape transport design concept is based on precision and simplicity. Sound design and precision manufacturing have obviated the need for complex mechanical assemblies which cost more to produce and are more likely to wear out or misalign during operation. For example, the tape drive system employs all direct drive motors without belts, pulleys, gears or drive wheels to wear out or require adjustment. All elements of the tape handling system mount directly to the precision machined front panel casting for perfect alignment upon installation.

Wherever new technology could improve performance and dependability, Microdata departed from convention and developed new techniques. The unique photo-optical speed tachometer and electronic tape speed control provides smooth, accurate tape handling. An isolated power supply has been incorporated for the tape drive system to prevent fluctuations and noise in the dc power to the electronics. Control signals to the servo electronics are coupled through opto-isolators. Lifetime light emitting diodes (LEDs) are used in place of incandescent bulbs on the front panel and in the photo-optical systems. In short, Series 6000 tape transports offer trouble free, accurate information storage across the entire performance range.

## PACKAGED FOR EASY SERVICING

Modular packaging and other maintainability features make Microdata tape transports easy to service. For convenient access to all internal components, the hinged front panel swings fully

open. Within the transport, all electronics are logically grouped on three printed circuit cards. This modular packaging speeds repair and simplifies spare parts control.

The plug-in cards are interconnected by a flat ribbon cable. All electronics for the Series 6000 tape transports are mounted on three printed circuit boards, resulting in less wiring interconnections and increasing system overall reliability. Direct mounting of all mechanical components to the front panel allows removal and replacement of individual components without removing other parts. Precision milled surfaces on the front panel casting and on the mechanical components eliminate the need for procedural alignments after installation.

Finally, periodic maintenance has been minimized by design reliability and the use of trouble free components. The drive motors require no lubrication. There are no belts or other indirect drive assemblies. The speed tachometer has no brushes to wear out, and its output is digital which, unlike analog generators, does not require adjustment. All these factors contribute to the ease of service.

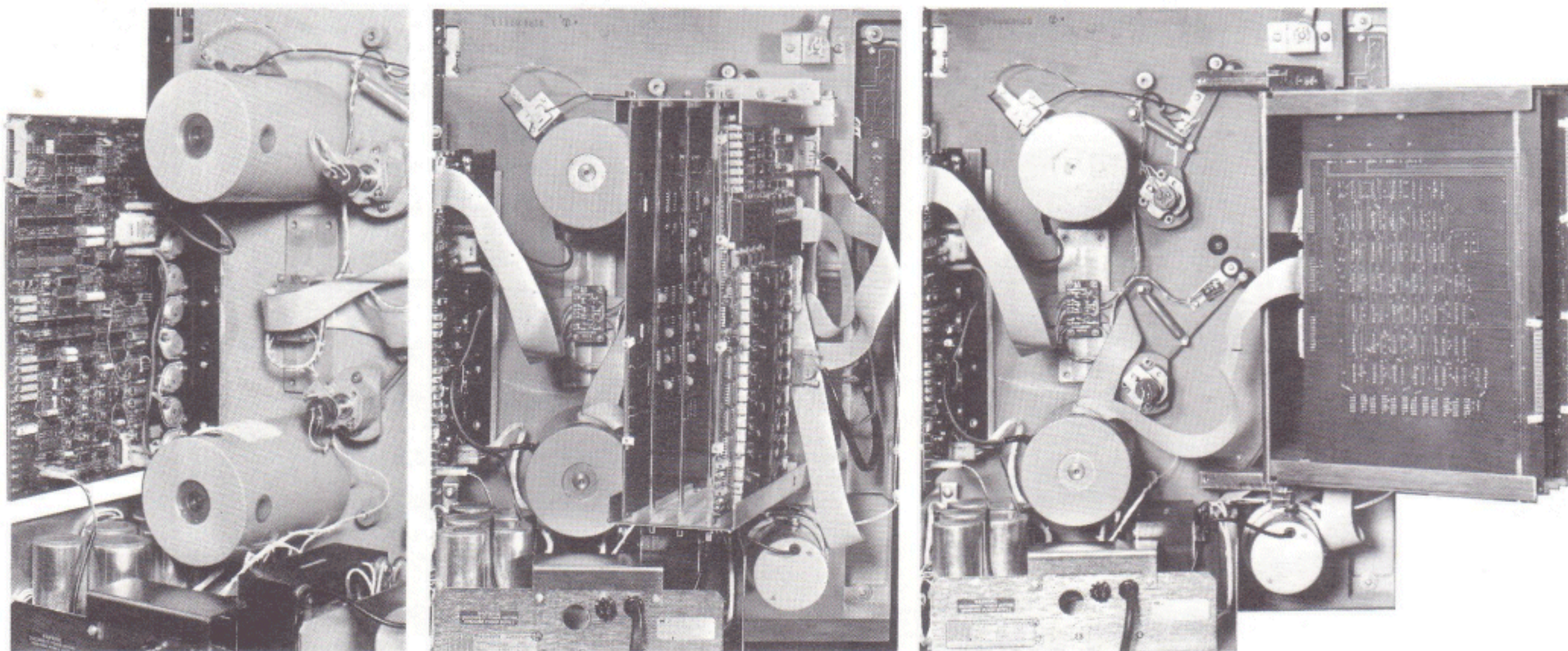
## TAPE DRIVE AND GUIDANCE

### IBM Compatibility

The Microdata tape drive and guidance system recreates the IBM geometry and tape handling characteristics exactly.

### Tape Motion

The capstan, directly driven by a dc motor, controls tape motion for all operations (including rewind and fast forward). Tape-capstan wraparound of 180 degrees prevents slippage for highly stable speed regulation and positive starts and stops. Acceleration, deceleration, and capstan speed are electronically





controlled using velocity signals from the photo-optical tachometer. The capstan drive optical encoder generates pulses at a frequency directly proportional to tape speed. The tape drive electronics regulate the drive motor current which cause the pulses to occur at the determined rate. This system provides precise speed control with excellent short- and long-term stability. Adjustments on the tape drive electronics circuit board allow field adjustment for any speed from 25 to 45 ips. Rewind and fast forward operations take place at 200 ips.

#### **Reel Servo System**

Independent direct drive dc motors are also employed in the reel servo systems. The tape reels follow capstan motion by attempting to maintain the buffer arms in their middle positions. Oversize reel motors are used to closely track the rapid starts and stops and the high tape speeds during rewind/fast forward operations.

#### **Low-Tension Buffer Arms**

Buffer arms, which isolate the tape reels from acceleration and deceleration of the capstan, employ a low tension force of 8 ounces. This low tension minimizes the chance of tape stretching or breakage.

#### **Power Failure Detection**

A circuit in the transport constantly monitors primary ac power. Any drop below acceptable limits is detected, and the tape is brought safely to a stop before the failure can affect the tape drive voltages.

### **RECORDING HEADS**

Series 6000 tape transports use either 7- or 9-track recording heads. The dual-gap read/write/erase head assembly mounts directly to a precision machined surface on the transport panel casting. The assembly is factory aligned, requiring no field adjustment during the operational life of the head. Replacement heads are supplied as complete, pre-aligned assemblies that install in minutes. The heads feature a crosstalk shield and spring-loaded ceramic tape guides that slide out of the way for cleaning.

### **DATA ELECTRONICS**

The NRZI data electronics contain a dual-density read amplifier which is factory set to any two recording frequencies from 2.5kHz to 18kHz. This frequency range permits recording at the standard densities of 200, 556 or 800 bpi at IBM compatible speeds of 25, 37.5 and 45 ips. Density is computer selectable at any two preset rates.

For optimum immunity to tape noise, Series 6000 tape transports employ multi-threshold read circuitry. Threshold levels of 45 and 20 percent auto select, and 12 percent are computer selectable.

### **ISOLATED POWER SUPPLIES**

Series 6000 tape transports contain two separate dc supply sections, one for transport electronics and one for tape drive/reel servo system. This arrangement isolates the electronics sections from noise and spurious fluctuations created by fast starts and stops.

### **INDUSTRY STANDARD INTERFACE**

The transport interface provides industry compatible logic levels and data, control and status lines for easy integration into your system, even direct plug compatibility with existing formatters in many instances. Transport select lines facilitate daisy-chain operation of up to four transports under control of a single formatter.

### **OEM OPTIONS**

**Front Panel Color** — Standard front panel color combination is Microdata gold and gray behind smoked plexiglass dust cover. Panel can be painted to your specifications.

**Logo** — Transports are normally supplied with Microdata logo. Can be supplied without logo, and with mounting provisions for your identification.

**Custom Interface Connectors** — Units can be equipped with interface connections of your specification.

### **MICRODATA SUPPORT**

#### **Documentation and Technical Support**

Microdata Corporation, a leading manufacturer of computer systems hardware, offers complete support to customers and users of Series 6000 tape transports. Complete formal documentation for operation, maintenance and interfacing is supplied with all units. Microdata's staff is available to assist with any technical or marketing questions that may arise.

#### **Custom Interfaces**

The interface circuitry in the transport is TTL IC logic, compatible with industry standards. Custom connectors and interface configurations can be supplied for plug compatibility with your product line.

#### **Maintenance**

Microdata has service and parts centers in major cities throughout the country. These service centers are staffed with trained field service engineers who can provide training as well as preventive and emergency maintenance.

A diagnostic program developed for Microdata computers is available for comprehensive computer testing of the Series 6000 tape transports. The program exercises the transport with worst-case data patterns and tape motion, and checks all formatter functions.



# Microdata Series 6000 Magnetic Tape Transports

## Interface Specifications

The Series 6000 Magnetic Tape Transport interface is connected to the user's computer-controlled formatter (controller) via three printed circuit edge connectors (J101, J102, and J103) on the rear of the transport unit.

This interface description contains information to assist Series 6000 users in integrating the transport into a computer system.

Interconnection of Series 6000 tape transports and user equipment uses a harness of individual twisted pairs, each with the following characteristics:

- Maximum length of 20 feet
- Not less than one twist per inch
- 22- or 24-gauge conductor with minimum insulation thickness of 0.01 inch

It is important that the ground side of each twisted pair is grounded within a few inches of the board to which it is connected.

The three printed circuit edge connectors supplied with each transport must be wired by the customer and strain relieved as shown in Figure 1. Interface signals are thus routed directly to and from the printed circuit boards. Table 1 shows the input/output lines for the tape transport, and Table 2 defines the input/output signals.

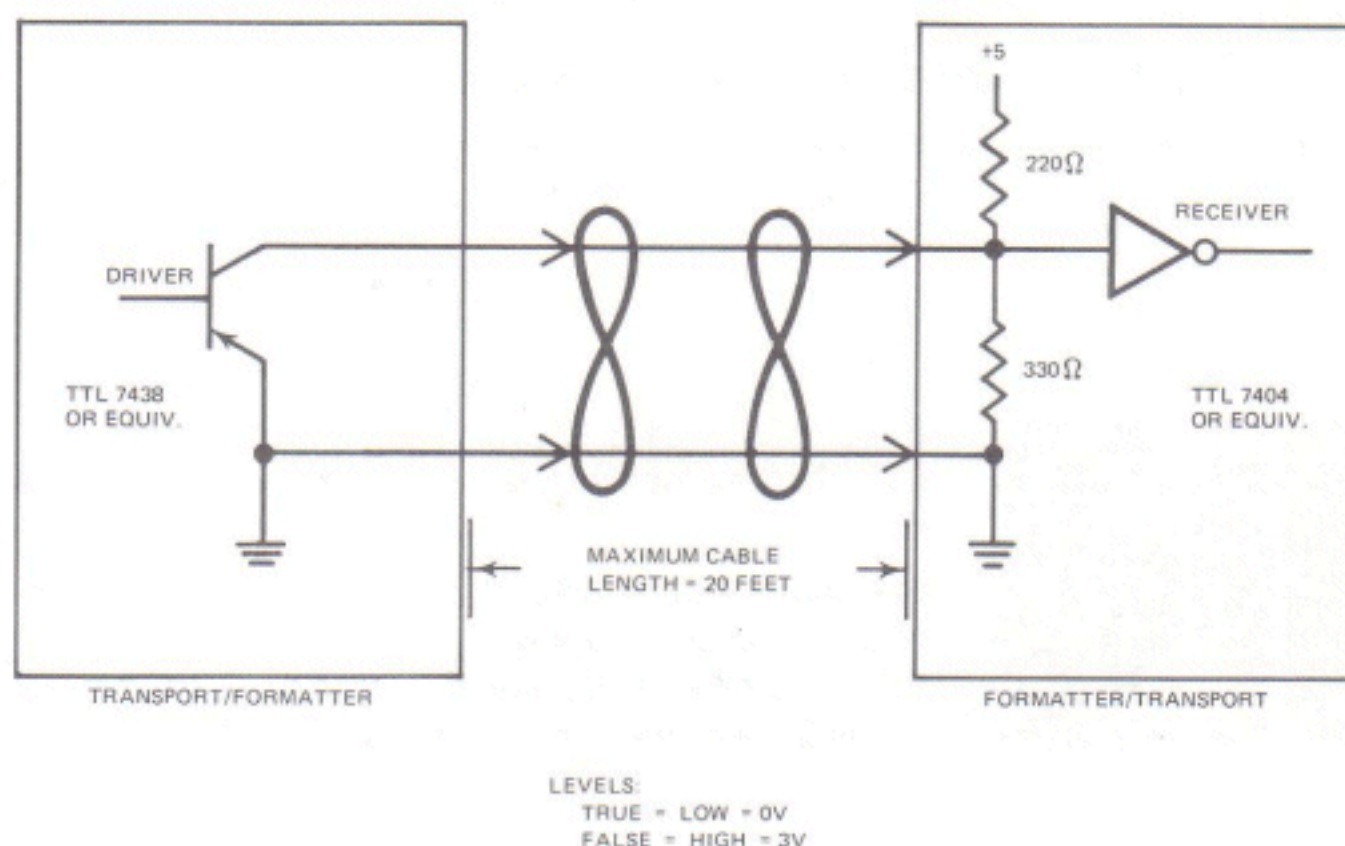


Figure 1. Receiver/Driver Schematic Diagram

Table 1. Interface Signal Summary/Pin List

SIGNAL NAME	MNEMONIC	SIGNAL PIN	GROUND PIN
Transport Command/Status Connectors (J101)			
<b>Command Lines</b>			
Select Transport 0	SEL0/	J	8
Select Transport 1	SEL1/	B	2
Select Transport 2	SEL2/	V	18
Select Transport 3	SEL3/	A	1
Forward Tape Motion	FWD/	C	3
Reverse Tape Motion	REV/	E	5
Rewind	REW/	H	7
Density Select	DENSEL/	D	4
Select Off-Line	OFFL/	L	10
Enable Write Status	SWRTS/	K	9
Fast	FST/	S	
<b>Status Lines</b>			
Transport Ready	RDY/	T	16
On-Line	ONL/	M	11
Rewinding	REWS/	N	12
End of Tape (EOT)	EOT/	U	17
Load Point (BOT)	BOT/	R	14
File Protected	FPROT/	P	13
High Density Status	HDENS/	F	6
Write Data Connectors (J102)			
<b>Data Lines</b>			
Write Data	WDP/	L	10
Write Data (MSB)	WD0/*	M	11
Write Data	WD1/*	N	12
Write Data	WD2/	P	13
Write Data	WD3/	R	14
Write Data	WD4/	S	15
Write Data	WD5/	T	16
Write Data	WD6/	U	17
Write Data (LSB)	WD7/	V	18
<b>Data Control Lines</b>			
Write Data Strobe	WDS/	A	1
LRC Reset	WARS/	C	3
Low Threshold Enable	THA/	F	6
Read Data Connector (J103)			
Read Data P	RDP/	1	A
Read Data 0 (MSB)	RD0/*	3	C
Read Data 1	RD1/*	4	D
Read Data 2	RD2/	8	J
Read Data 3	RD3/	9	K
Read Data 4	RD4/	14	R
Read Data 5	RD5/	15	S
Read Data 6	RD6/	17	U
Read Data 7 (LSB)	RD7/	18	V
Read Data Clock	RDS/	2	B

\* 9-track transports only



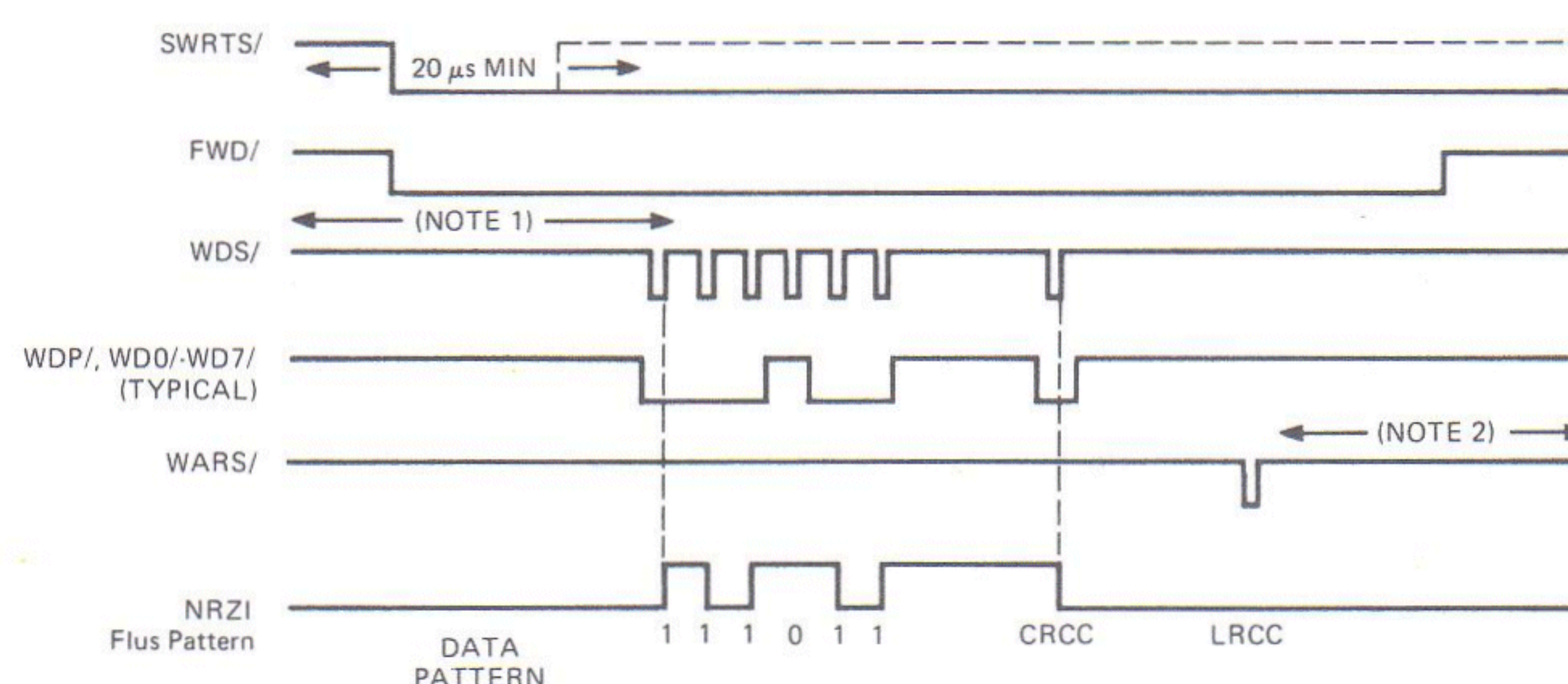
Table 2. Signal Definitions

SIGNAL	DEFINITION
<b>Transport Data Inputs</b>	
WRITE DATA LINES (WDP, WD0 thru WD7)	One input line for each recording track. Write data lines must be held in the desired state from 0.5 $\mu$ s before to 0.5 $\mu$ s after the write data strobe.
WRITE DATA STROBE (WDS)	A 2 $\mu$ s pulse on this line causes the character on the data input lines to be written on tape.
LRC RESET (WARS)	A 2 $\mu$ s pulse on this line resets the NRZI write register and causes a longitudinal redundancy check (LRC) character to be recorded on NRZI tape.
<b>Transport Data Outputs</b>	
READ DATA LINES (RDP, RD0 thru RD7)	One output line for each recording track. Read data lines are asserted prior to the Read Data Clock and remain asserted until 500 ns prior to the next Read Data Clock.
READ DATA CLOCK (RDS)	A low level pulse of 500 ns to 3 $\mu$ s is used to cause sampling of the read data lines by the formatter.
<b>Transport Command Inputs</b>	
SELECT TRANSPORT (SELO/ thru SEL3/)	Four lines activated individually connect a transport to the interface cable. A low level enables all the write and read circuitry, on-line transport control circuitry, and status lines.
FORWARD TAPE MOTION (FWD/)	Low level on this line causes the transport to start and maintain synchronous speed in the forward direction.
REVERSE TAPE MOTION (REV/)	Low level on this line causes the transport to start and maintain synchronous speed in the reverse direction. Reverse motion is inhibited at load point.
REWIND (REW/)	Low level on this line causes the transport to rewind to load point at 200 ips. Rewind is inhibited at load point.
DENSITY SELECT (DENSEL/)	In dual-density NRZI transports, low level on this line selects the higher of the two preset densities.
SELECT OFF-LINE (OFFL/)	A low level pulse on this line causes the transport to be switched off-line. Transport may be returned to on-line only by the ON-LINE switch.
ENABLE WRITE STATUS (SWRTS/)	A low level on this line enables the write current $\geq 20$ $\mu$ s after a forward or reverse tape motion command (assuming a write ring is installed on the reel).
THRESHOLD SELECT (THA)	Low level on this line selects 12% threshold; high level selects 20% threshold. This line must be high during write operations.

# Transport Command Outputs

TRANSPORT READY (RDY/)	Low level on this line indicates the transport is on-line and ready to accept a tape motion command.
ON-LINE (ONL/)	Low level on this line indicates the transport is ready for on-line operation.
REWINDING (REWS/)	True level indicates the transport is in rewind cycle.
END OF TAPE (EOT/)	Low level indicates the transport is at the EOT sensor tab.
LOAD POINT (BOT/)	Low level indicates the transport is at load point.
FILE PROTECTED (FPROT/)	Low level on this line indicates the tape unit is selected and no write ring is installed.
HIGH DENSITY STATUS (HDENS/)	In dual-density NRZI transports, a low level indicates the higher of the two densities has been selected.

## WRITE WAVEFORMS



- NOTES:
1. PRE-RECORD DELAY SHOULD BE CALCULATED TO PRODUCE 3.5 INCHES OF TRAVEL WHEN STARTING FROM BOT; OTHERWISE 0.25 INCH IN A 9-CHANNEL TRANSPORT AND 0.36 INCH IN A 7-CHANNEL TRANSPORT.
  2. THE POST-RECORD DELAY SHOULD BE CALCULATED TO PRODUCE 0.075 INCH OF TRAVEL AFTER THE LRCC HAS BEEN DETECTED BY THE READ ELECTRONICS, BEFORE REMOVING THE SFC.

## READ WAVEFORMS

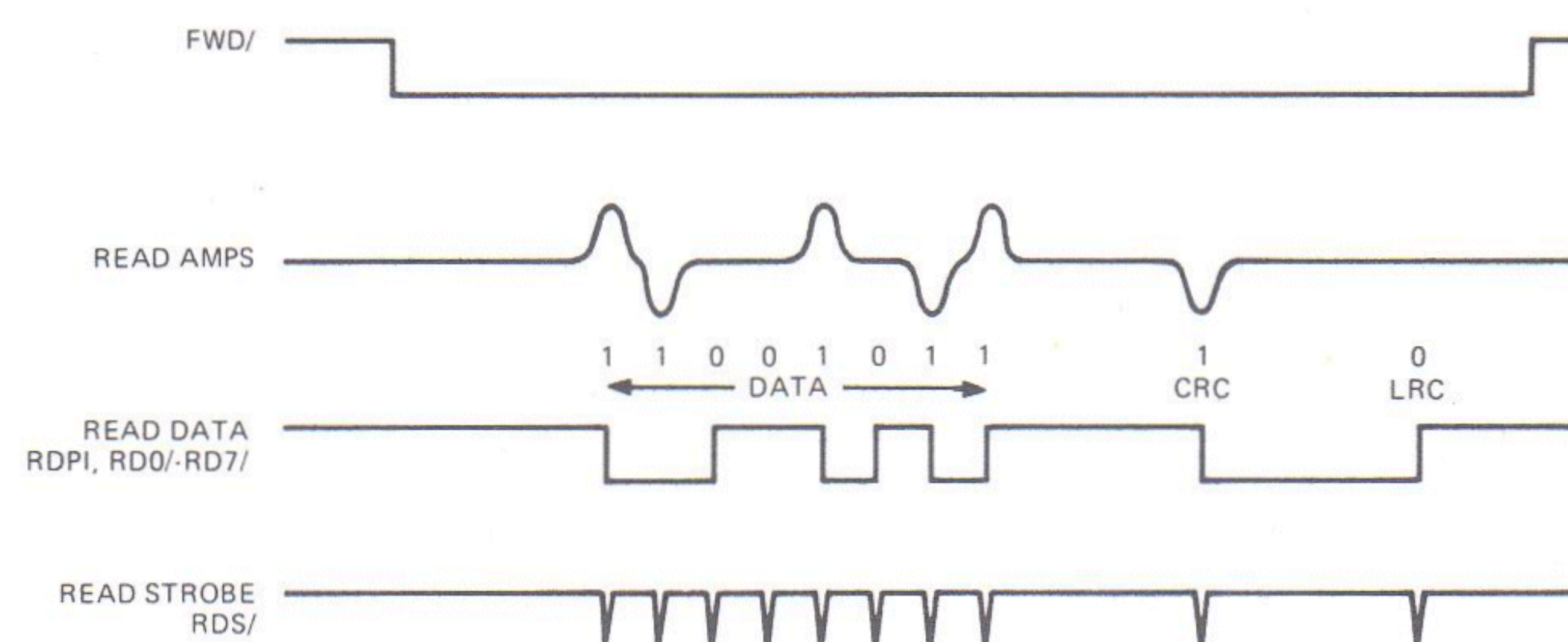


Figure 2. Timing and Waveform Diagram (NRZI)



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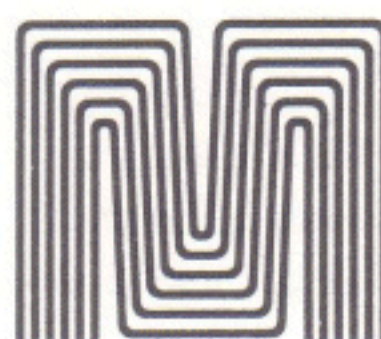


## SERIES 6000 SPECIFICATIONS

Reel Diameter . . . . .	10.5 inches
Tracks . . . . .	Seven or nine
Recording Format . . . . .	NRZI
Data Densities . . . . .	200, 556, or 800 bpi (dual-density read)
Tape Speeds . . . . .	Any speed from 25 to 45 ips
Rewind/Fast Forward . . . .	200 ips
Data Transfer Rate . . . . .	36,000 characters per second at 45 ips, 800 bpi
Tape . . . . .	Computer grade, 0.5 inch wide, 1.5 mils thick
Tape Tension . . . . .	8 ounces $\pm$ 0.5 ounce
Tape Drive and Guidance Geometry . .	IBM compatible
Skew . . . . .	150 micro-inches maximum
Speed Variation . . . . .	Instantaneous: $\pm$ 1% Long Term: $\pm$ 0.5%
Start/Stop Time . . . . .	380 milliseconds $\div$ speed (ips)
Start/Stop Distance . . . . .	0.170 to 0.210 inch
Reel Motor Braking . . . . .	Dynamic
Read Thresholds . . . . .	45%, 20% or 12% (computer selectable)
Magnetic Head Assembly . . . .	7- or 9- track dual gap read/write/erase
Gap Scatter . . . . .	150 microinches maximum (read and write), electronically compensated
Write-to-Read Crosstalk . . . .	5% (maximum) of read signal
Read-to-Read Crosstalk . . . .	5% (maximum) of read signal
BOT/EOT Reflective Strip Detection . . . . .	IBM compatible
Interface Logic Levels . . . . .	TTL/DTL compatible (negative logic) 0V true, +5V false
Operating Environment . . . . .	Temperature: +32° to +131°F (0° to +55°C) Relative Humidity: 5% to 95% (no condensation)
Power Requirements . . . . .	115 or 230 VAC $\pm$ 10% 47 to 63 Hz 250 Watts
Dimensions . . . . .	Height: 24.5 inches Width: 19 inches Depth (from mounting surface): 14 inches Overall Depth: 17.5 inches
Weight . . . . .	125 pounds
Mounting . . . . .	Vertical, standard 19-inch RETMA or EIA rack

## CONTROLS AND INDICATORS

Nomenclature	Description	Function
Power	Alternate action switch/indicator	Controls application of power to the tape transport. When pressed to apply power, the indicator lights. When pressed again to interrupt power, the indicator goes out.
Load	Momentary action switch/indicator	Controls action of the buffer arms. If arms are not tensioned, it activates them. If arms are activated, it causes the tape to advance to load point. If tape is at or past load point, it advances to EOT, rewinds, and advances to load point. Pressing switch also causes the indicator to light.
On-Line	Momentary action switch/indicator	Places tape transport under remote or local (manual) control. Pressing switch also causes the indicator to light.
Rewind	Momentary action switch/indicator	Initiates a rewind operation when transport is under local control. When pressed, the indicator lights and the tape rewinds to load point. When the tape is positioned at load point and is off line, activation of this switch initiates the tape unload sequence.
Reset	Momentary action switch	Used to override a local forward command.
Write Enable	Indicator lamp	Lights when a write ring is installed.
Load Point	Indicator lamp	Lights when the tape is positioned at load point.
Ready	Indicator lamp	Lights when power has been applied, interlocks are closed, tape is tensioned and has advanced to load point or further.
Write	Indicator lamp	Lights when a write operation is being performed.
Read	Indicator lamp	Lights when a read-only operation is being performed.



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