

**WANG**

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## DATA SHEET

The Wang Model 2209A Nine Track reel-to-reel magnetic tape drive is a reliable, moderate speed digital input/output peripheral used primarily for remote storage and interfacing other digital computer systems to a Wang CPU (i.e. IBM 360 with series 2400 Tape unit, etc.) The on-line storage capacity is approximately 35 megabytes (35 million bytes). The raw data transfer rate (head/buffer) is about 120 KBS (120 Kilobytes per second). Data transfer to the CPU is limited by the speed of the I/O Controller interface and/or CPU. The 2209A can be utilized with any system 2200 CPU which contains a minimum of 12K bytes memory, and supports the General Input/Output instruction set.

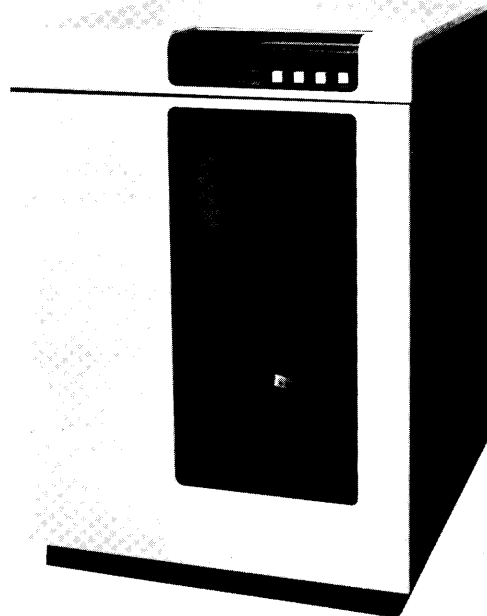
The 2209A utilizes a 4K (4096 byte) buffer to read and write at the singular density of 1600 BPI (bytes per inch) (630 B/cm) with full saturation in the Phase Encoded mode. Tapes conform to the industry wide IBM/ANSI (American National Standards Institute) format conventions for nine track tapes, and can be translated into most other nine-track formats with the appropriate conversion routines. The 2209A can process tapes with or without IBM/ANSI labels with the Wang Model 2209A Utility Program Set. Non-standard labels and special applications must be processed with user programmed routines using the General I/O statements.

Tape reels up to 10.5 in (26.6 cm) in diameter containing up to 2400 ft (732cm) of 1/2 in (1.27 cm) tape can be accepted. Reading and writing can occur in forward mode only, writing requires a write-enable ring. Tape transport is vacuum buffered to prevent tape breakage or distortion.

The 2209A contains a dual gap read-after-write head configuration allowing immediate write verification. Single track read errors are corrected automatically using Vertical Redundancy Characters. Permanent errors are flagged.

Physical records (blocks) can be a variable length from 1 to 4,096 bytes, the capacity of the I/O buffer. Through overlays and customized user routines, record length can effectively approach the capacity of the CPU.

Tape motion and data transfer (head to buffer and buffer to CPU) are distinct operations in a read or write sequence, they can therefore logically overlap significantly speeding the data thrupt rate during large read or write operations.



## MODEL 2209A NINE TRACK REEL-to-REEL MAGNETIC TAPE DRIVE

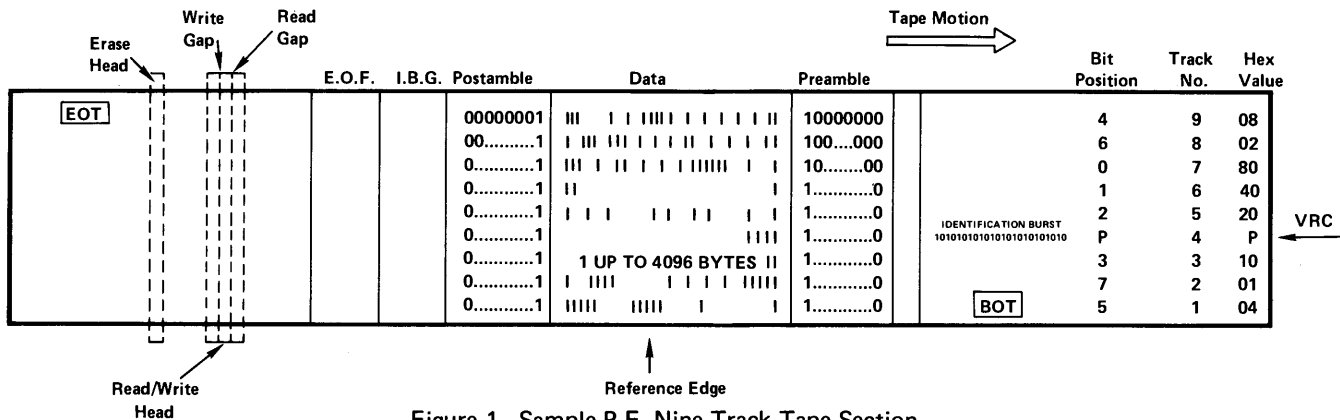


Figure 1. Sample P.E. Nine Track Tape Section

To insure industrial compatibility, bit position and place value as well as conventions in gap lengths and begin/end markers on the tape conform to the ANSI standards (American National Standards Institute).

The Phase Encoded Format is:

- Identification code – Beginning at least 1.7 in (4.3 cm) before the load pointer marker but ending at least 0.5 in (1.27 cm) before the first data block, a burst of alternating 0 and 1 characters are recorded in track 4 (parity channel) which identifies PE tapes.
- Initial Gap – A gap of at least 3 in (7.6 cm) between the load point marker and the beginning of the first data block.
- Preamble – A burst of 40 zeros followed by a one in every track.
- Data – Nine tracks, ASCII (American Standard Code for Information Interchange).
- Postamble – A one followed by 40 zeros in every track.
- Interblock Gap – A gap 0.6 in long nominal (0.5 in minimum, 25 ft. maximum) is erased in the reference direction. (IBG)
- File markers – Special control blocks from 64 to 256 characters in length used to identify, count, and format blocks on tape. (EOF)
- Reflective Strips – Load point and end-of-tape Photoelectric Reflective Indicator strips. (BOT, EOT)
- Check Characters – The odd vertical parity coding VRC, replaces the LRC and CRC characters for detection and correction of track error.

Information is recorded on tape by magnetizing small discrete areas (bits) in nine parallel channels. Each bit column is called a byte. In the Phase Encoding Mode, one bits are produced by each magnetic flux reversal toward the reference polarity, zero bits are produced by flux reversals opposite to the reference polarity, and a "phase flux reversal" will occur at the nominal midpoint of successive ones or zeros to maintain the proper reference polarity. As data is being recorded at 1600 FRPI (Flux Reversals Per Inch), a clock is simultaneously recording at 3200 FRPI on each track. This clocked data can then be assembled in a register negating the effects of skew. The

preamble and post-amble allow synchronization with the data signals by a phase-locked oscillator which compensates for speed variation and data timing. Single track read errors are corrected automatically. A missing bit is reconstructed by placing the remaining bits in a parity generator and adjusting the missing bit so that odd parity is achieved. To correct multiple track errors, the data must be reread. The Model 2209A has a tape speed of 75 ips (190 cm/sec) during read and write operations, and up to 200 ips (508 cm/sec) during rewind.

The 2209A contains several controls and indicators to facilitate its use both on- and off-line. They include:

Test/Skew – indicates if tape skew exceeds appropriate read/write gate setting.

Write Indicator – indicates write status selected.

Read Indicator – indicates read status selected.

Select Indicator – indicates tape unit is on-line.

EOT Indicator – indicates tape is at or past end of tape mark.

Load Point Indicator – indicates tape is at load point.

On-line Indicator/Push Button – activates and indicates tape ready for Remote Selection.

Load Indicator/Push Button – activates reel servos (tension tape), indicates start of the load sequence.

Rewind Push Button/Indicator – activates and indicates local and remote rewind and unload.

Cycle Push Button – alternately runs tape forward and reverse for ramp and vacuum sensor adjustments.

Fast Forward Push Button – runs tape forward at fast speed.

Reverse Run Push Button – runs tape reverse at normal speed.

Forward Run Push Button – runs tape forward at normal speed.

Test Mode Push Button/Indicator – activates test panel, indicates test mode.

Write Test Push Button/Indicator – activates write skew adjustment process.

A set of utility programs is available to facilitate use of the Model 2209A. These utilities principally support the use of the 2209A as an on-line peripheral and an inter-

change medium between a Wang CPU and other computers, particularly the IBM 360. They are described in the Nine-Track Tape Utilities manual. To transfer data from card reader or disk to tape or from tape to disk, or to dump data from tape, the appropriate peripheral must be available. The routines in this package can process single volume, single data set tapes. Tapes may have IBM/ANSI standard tape labels, or have no labels. Non-standard labels cannot be processed.

The routines operate at four levels:

1. A **LOADER** to load all nine-track routines and sub-routines into memory, and to provide a user 'menu' to simplify program selection.
2. A **Physical I/O Control System (Physical IOCS)** containing the subroutines which perform physical operations on tape such as rewinding, backspacing, writing a file mark (EOF), etc.
3. A **Logical I/O Control System (Logical IOCS)** containing the subroutines which perform logical I/O operations including opening and closing of files, translations from ASCII to EBCDIC (and vice versa), and creating or updating internal tape labels.
4. A set of primary routines to initialize or write and update volume labels, to read or write data and to transfer data from tape to disk, disk to tape and card to tape.

The primary routines are:

<b>LOADER</b>	Loads subroutines and menu.
<b>INITIALIZE/ REWRITE</b>	Initializes or rewrites tape volume labels.
<b>VOLUME LABEL</b>	
<b>WRITE DATA ON or READ DATA FROM TAPE</b>	Writes on or reads from nine-track tape; the user must supply certain program lines.
<b>TAPE TO DISK DATA TRANSFER</b>	Transfers data from tape to disk, with or without translation.
<b>DISK TO TAPE DATA TRANSFER</b>	Transfers data from disk to tape, with or without translation.
<b>CARD READER TO TAPE DATA TRANSFER</b>	Transfers data from punched cards to tape.
<b>DUMP THE TAPE CONTENTS</b>	Reads variable length blocks and outputs block size, untranslated hex image, translated hex image and translated alphanumeric image of the data on the available output device.

The Logical IOCS subroutines are:

- 'OPEN WRITE'.
- 'OPEN READ'.
- 'CLOSE WRITE'.

'CLOSE READ'.

TRANSLATION (ASCII to EBCDIC or EBCDIC to ASCII);

The Physical IOCS subroutines are:

backspace and position to write	status request
backspace a record	master reset
forward space a record	buffered write
backspace a file	finish write
forward space a file	look ahead read
rewind the tape	finish read
write a gap	write a block
clean the tape	read a block
write a Tape Mark (File Mark or EOF)	re-read a block

For those users whose needs cannot be met by the standard utilities or who wish to gain a better understanding of the 2209A, five Wang BASIC statements, collectively called the General I/O Instruction set, generate customized processing routines for the 2209A. They allow all or part of an array to be referenced without regard to its boundaries, test the ready/busy status of specified devices and automatically feedback the error status generated during read, write, pack, unpack, and translate operations. The mnemonics along with tape operations they support are:

- \$G10** — Facilitates general input/output and control operations.  
Backspace One Record  
Forward Space a Record  
Backspace a File  
Forward Space a File  
Rewind  
Write a Gap  
Write a File Mark (EOF)  
Write a Record or Block  
Read a Record or Block
- \$IF ON** — Tests the Device Ready condition of a specified input or output device and initiates a branch to a specified line number when a ready condition is sensed.
- \$TRAN** — Performs high-speed character code translations using table look-up or character replacement procedures.
- \$PACK** — Facilitates gathering and formatting data (by fields, delimiters, or Wang's standard record format) between a specified alphanumeric array buffer and specified arguments.
- \$UNPACK**

**NOTE**

General I/O Statements, must be used to activate the 2209A. LOAD, SAVE, DATALOAD, DATA-SAVE, etc. cannot activate the unit.

# DATA SHEET

## SPECIFICATIONS

### Tape (Computer Quality)

Capacity: to 2400 ft (732 m)  
Width: 0.5 in. (1.3 cm)  
Thickness: 1.5 mil (0.04 mm)  
Tension: 8.0 oz (227 gr)  
Reel: to 10.5 in. (26.6 cm) HUB 3.69 in. (9.37 cm) (compatible with IBM Series 2400 units with WRITE PROTECT ring.)

### Recording

Tracks: 9  
Format: ANSI  
Density: 1600 BPI (630 b/cm)  
Mode: Phase Encoding (Saturated)  
Interblock Gap 0.60 in. (1.52 cm)

### Tape Speed

75 IPS (190 cm/sec) Bidirectional  
200 IPS (508 cm/sec) Nominal During Rewind  
Character Code: ASCII

### Data Transfer Rate

120K Bytes/sec (Head to Buffer)  
20K to 100K Bytes/sec (Buffer to CPU)

### Tape Transport

Transport Buffer: Vacuum Column  
Tape Drive: Single Capstan Reel to Reel  
Start/Stop Displacement 0.19 in. (0.476 cm)  
Start/Stop Time @ 75 IPS 5.0 msec.  
Instantaneous/Long-Term Speed Variation  $\pm 1\%$   
Braking: Dynamic

### Tape Heads

Write Then Read: Dual Gap 0.15 in. (0.38 cm)  
Erase: Side Mounted Full Width

### Drive Dimensions

Height: \* 34.5 in. (77.6 cm)  
Width: 24.0 in. (61.0 cm)  
Depth: 26.0 in. (66.1 cm)

### Site Dimensions

Height: \* 36.5 in. (82.7 cm)  
Width: 26 in. (66.1 cm)  
Depth: 73 in. (185.4 cm) accommodate front and rear access doors

### Approximate Weight

Installed: 170 lb (77.35 kg)  
Shipping: 222.6 lb (85.75 kg)

### Cables

(2) 12 ft. (3.7 m) 50 pin to controller  
(2) 8 ft (2.4 m) 3 prong AC to power source

### Controllers

1 Dual Output 50 pin

*Wang Laboratories reserves the right to change specifications without prior notice.*

### Fuses

(1) 15 AMP 115 VAC 8 AMP 230 VAC  
(1) 3 AMP 115 VAC 1.5 AMP 230 VAC  
(1) 8 AMP 115 VAC 4 AMP 230 VAC

### Operating Environment

Temperature: 60° to 90° F (16° to 32° C)  
Relative Humidity: 40% R.H. to 60% R.H. (non-condensing)

### Power

115/230 VAC  $\pm 10\%$  Single Phase  
50 to 60 Hz  $\pm 1$  Hz  
475 Watts

### Controls/Switches/Indicators

Write	On Line	End of Tape
Read	Load	Test
Select	Rewind	Skew
Write Enabled	Stop	Load Point

Cycle	Write Test
Fast Forward	Test Mode
Forward Run	
Forward Run	

### ORDERING SPECIFICATIONS

The Model 2209A Nine-Track reel-to-reel tape drive must be fully compatible with the Wang System 2200 CPU which contains 12K Memory (minimum) and supports General Input/Output Instruction set. The drive must access tapes up to 10.5 inches diameter, utilizing the Write Protect Ring when writing on tape, and be fully compatible with the industry's IBM/ANSI nine-track tape standards. The tape drive must advance tapes at a rate of 75 IPS (190 cm/sec), read and write at a density of 1600 BPI (630 B/CM) in the Phase Encoded mode, and transfer data at a rate of 120 KBS. IBG must not be less than 0.60 in. (1.53 cm). The unit must have a single-capstan drive and utilize vacuum columns as a Tape Transport Buffer. The unit must contain a dual Gap Read/Write head capable of performing read-after-write for all write operations, and separate erase and tape cleaner assemblies and utilize standard photoelectric, load point, end of tape and broken tape detection devices.

### Standard Warranty Applies

\*Available with integral storage cabinets in heights up to 64 in. (162.6 cm)

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