# AMPEX

TM-Z low-speed, high-performance, computer-class tape memory system

The new Ampex TM-Z is a tape memory system that best fulfills the need for a low-cost, high-performance, low-speed unit for your computer, data terminal or data acquisition system. Completely computer-compatible, it conforms to all requirements of IBM and ASCII 7- and 9-track formats.

At its standard speed of 24 ips, the TM-Z provides a data transfer rate of up to 19.2 kHz.

Optional speeds down to 10 ips are available.

Simplicity of design results in the utmost in reliability and easy maintenance. This completely new, ready-to-plug-in tape memory system features the same precision as the higher speed Ampex TM-7 and TM-16 tape memories, yet it is priced as low as $3,500 for a complete system including read/write electronics.
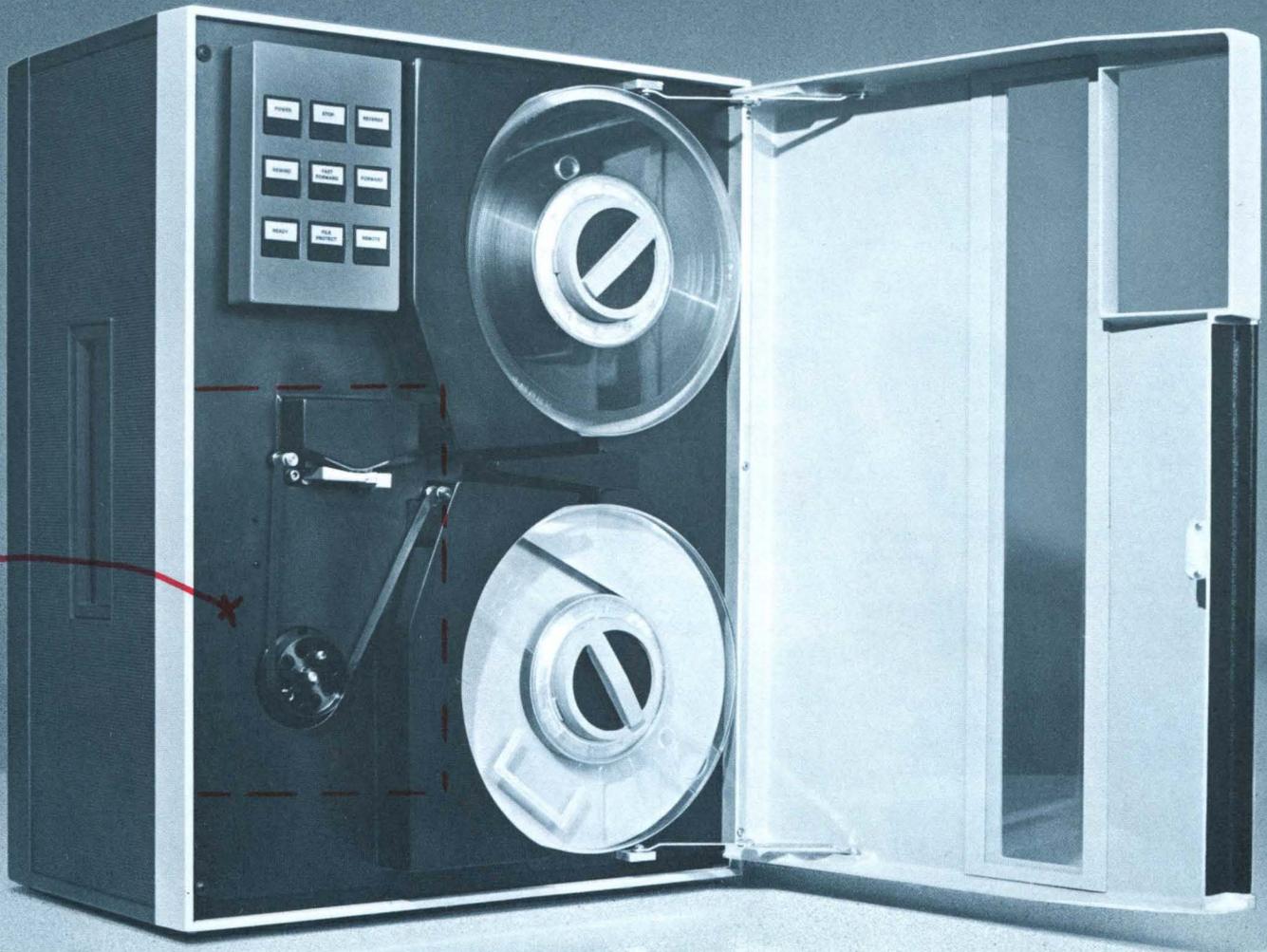
Head/Capstan Assembly
Precision alignment at Factory

TM-Z digital tape memory system

three versions of the TM-Z are available:

TM-Z-1 Digital Tape Memory System with Read and Write data electronics

TM-Z-2 Digital Tape Memory System with Read only electronics

TM-Z-3 Digital Tape Transport with control and servo electronics (less data electronics) but including read/write head

To maximize component reliability, DTL and TTL integral circuit plastic dual in-line units are employed in conjunction with silicon transistors. Electronics are packaged on three connector interfaced circuit board assemblies: (1) 9-channel read and write data electronics board; read-write heads interfaced with connectors; (2) transport electronics board; (3) option board.

Precision mechanical construction is emphasized. The magnetic head assembly has minimal gap scatter. A precision head adjustment is provided to eliminate azimuth error. This eliminates the need for read and write deskewing electronics and permits bi-directional read operation without complicated network adjustments.

The system converts from 9-track (standard) to 7-track (optional) by a simple head assembly change.

major system components are:

tape transport assembly—Houses the mechanics of the capstan servo drive, reel servos, read/write and erase heads, photosensing, file protect, and local operator controls.

transport electronics assembly—Contains the power supply and electronic components necessary to actuate capstan and reel drive servos. The control logic and control I/O circuitry are packaged in this assembly.

data electronics assembly—Consists of nine write amplifiers, nine peak detection read amplifiers, data control and data I/O circuitry.

PERFORMANCE CHARACTERISTICS

tape speeds:
Standard speed is 24 inches per second, Read/Write (19.2 kHz transfer rate at 800 cpi). Any single tape speed between 10 and 24 ips can be obtained by utilizing a continuously variable adjustment.

tape width and thickness:
½-inch width, 1.5 mil by 2400 feet (732 meters)—for best performance use Ampex Tapes 832, 838, 839 or 873.

tape reels:
10½-inch (26.7 cm) IBM or NAB type.

recording density:
Standard: 556 and 800 cpi. Optional densities available.

recording formats:
Standard: 9-track, ASCII, 0.6 inch IRG (IBM 360, 2400 Series compatible).

Optional: 7-track, NRZI, 0.75 inch IRG (IBM 7330, 729 Series compatible).

read/write gap to gap spacing:
9-track—0.150 ±0.005 inch
7-track—0.300 ±0.005 inch

rewind and fast forward speed:
150 inches per second nominal

start/stop:
Tolerances permit bilateral interchange of tapes with equipment compatible with IBM and ASCII 9-track standards.

instantaneous speed variation:
Short-term speed variations are less than ± 1% of the design center character rate.

linear speed variation:
The average tape speed of any and all one-second intervals is within ± 3% of the design center speed exclusive of start-stop transitions.

input voltage and frequency:
Voltage: 100-250 volts RMS with transformer taps. On each tap the system meets all specification requirements at the design center tap voltage ± 10%. Frequency: 48 to 63 Hz. Consumption: Average, 400 watts. Peak, 500 watts.

operating environment:

	Operating	Shipment and Storage
Ambient Temperature:	40° to 110°F	−30° to +140°F
Relative Humidity:	20% to 80%	5% to 95%
Altitude:	0 to 10,000 feet	0 to 40,000 feet

acoustical noise:
Within the limits of curve NC60 or MIL-STD-803-2.

interface requirements
(TTL, Data and Control Lines):

inputs:
TRUE = + 0.2 volt (−0.2 + 0.2 volt) −19 ma max. customer sink current
FALSE = +3.3 volts (−0.9 + 1.7 volts) −3.5 ma sink current to plus 16 ma source

outputs:
TRUE = + 0.2 volt (−0.2 + 0.2 volt) +16 ma max. customer source
FALSE = +3.3 volts (−0.9 + 1.7 volts) − 0.4 ma max. sink current

dimensions:
The complete tape memory system, including self-contained data electronics, can be mounted in a standard 19" or 24" rack.

Height: 24"

Width: 19" or 24"

Depth: 17" overall (14½" rack depth)

weight:
100 lbs. max.

controls/indicators:
Remote: Pushbutton, backlighted
Stop (reset): Pushbutton, backlighted
Forward: Pushbutton
Reverse: Pushbutton
Rewind: Pushbutton
Fast Forward: Pushbutton
Power On: Indicator only
File Protect: Indicator only

	TRUE	FALSE
Run/Stop Line	Run	Stop
Rwd/Rev Line	Fwd	Rev
Rewind	Rewind	Rewind

Functional Modes (selective):
1. Write Forward, Read Forward
2. Read Only Forward
3. Read Only Reverse

Options:
1. Vertical Parity Check
2. Vertical Parity Generate
3. Write Echo Check
4. Longitudinal Parity Check
5. Longitudinal Parity Generate

SPECIFICATION (INTERIM)

TM-Z TAPE MEMORY SYSTEM

1. PURPOSE

The purpose of this specification is to define the features, performance characteristics, and physical characteristics of the TM-Z Tape Memory System. This specification is preliminary in nature and is subject to change.

2. GENERAL

The TM-Z Tape Memory System is a low cost, high performance, high production quantity item. Effort has been concentrated on the use of materials and production processes suitable to achieve this end. The major theme of the program is simplicity, both from the standpoint of hardware design and marketing efforts. This will best be achieved by holding the requirements for optional features and performance requirements to an absolute minimum, consistant with industry needs.

3. EQUIPMENT DESCRIPTION

The TM-Z Tape Memory System is a low speed computer compatible recording system conforming to the requirements of IBM and ASCII for parallel digital recording at densities of 200, 556, and 800 characters per inch.

The system will consist of four basic subassemblies: the tape transport, transport electronics, data electronics, and trim package.

TAPE TRANSPORT ASSEMBLY

This assembly consists of an integral cast chasis upon which the reel motors, control panel, and electrical assemblies are affixed. A precision assembly containing the capstan motor, guides, read/write head, EOT/BOT sensors, erase head and tape cleaner is also secured to this assembly.

TRANSPORT ELECTRONICS

A single printed circuit board contains the power supply regulation circuitry, capstan and reel servo electronics, and the integrated circuit control logic and I/O circuitry for the control functions.

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DATA ELECTRONICS

This printed circuit board contains nine channels of read and write electronics. In addition, provisions have been made for VPC, LPC and special interface requirements which can be offered on an "Optional" board.

TRIM PACKAGE

This consists of a door with provisions to view the supply and take up reels, along with an "over lay" which covers the chasis and exposes the reels, tape path and control panel.

4. ## SPECIFICATIONS-TAPE TRANSPORT

Tape Speed-Read & Write	Any single tape speed between 10 and 24 inches per second bidirectional can be established by a continuously variable adjustment.
Inst. Speed Variation (ISV) (Short Term Variations)	When reading a tape, pre-recorded on the same machine, the peak to peak jitter shall be less than $\pm 1\%$ of the design center character rate.
Linear Speed Variation (LSV) (Long Term Variations)	The average tape speed of any and all 1 second intervals shall be within $\pm 3\%$ of the design center speed exclusive of start-stop transitions.
Tape Speed-FF & RW	150 inches per second $\pm 10\%$.
Start and Stop Distances	Start and stop distances will be as required for bilateral interchange of tapes with equipment compatible to IBM and ASCII 9 track standards.
Command Rate	50 commands per second maximum average.
Tape Type	Ampex 832, 838, 839 and 873 types as applicable per IBM/ASCII specifications.
Tape Capacity	2400 feet of 1 mil tape specified above.
Reels	10.5 inch diameter per IBM/ASCII specifications.

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Recording Densities	Standard 556/800 characters per inch.
	Optional: 200/556 characters per inch.
Recording Format	Standard - 9 track IBM/ASCII.
	Optional: 7 track IBM
Read-Write Gap to Gap Spacing	9 track - 0.150 ± 0.005 inch
	7 track - 0.300 ± 0.005 inch

Controls-Local

Remote	Push button backlighted.
Stop-Reset	Push button
Forward	Push button
Reverse	Push button
Fast Forward	Push button
Rewind	Push button

Indicators

Power	Backlighted button
File protect	Backlighted button

Interface Requirements

Data and Control Lines (TTL Logic Employed)

Inputs

$\underline{TRUE}$ = +0.2 Volts (-0.2 +0.2 volts)
-19 ma. max. customer sink current.

$\underline{FALSE}$ = +3.3 Volts (-0.9 +1.7 volts)
-3.5 ma. sink current to plus
16 ma. source.

Outputs

$\underline{TRUE}$ = +0.2 Volts (-0.2 +0.2 volts)
+16 ma. max. customer source.

$\underline{FALSE}$ = +3.3 Volts (-0.9 +1.7 volts)
-0.4 ma. max. sink current.

Controls - Remote	TRUE	FALSE
Run/Stop Line	Run	Stop
Fwd/Rev Line	Fwd	Rev
Rewind	Rewind	<u>Rewind</u>

Selective Features	Magnetic Head Assembly

> 9 track - read and write with erase head (standard).
>
> 7 track - read and write with erase head (special order).

Functional Modes

> Write Forward, Read Forward
>
> Read Only Forward

5. SPECIFICATIONS - DATA ELECTRONICS

Construction	Nine channels of Read/Write NRZ-I data electronics are packaged on one printed circuit board. Deskew electronics are not employed because of other design considerations.
	Optional features are packaged on a second printed circuit board. These options are discussed in section 6.
Format Compatibility	The system functions shall provide all compatibilities required to read and write information on tape at densities up to 800 bpi that is bilaterally interchangeable with tapes prepared on IBM 729 or ASCII compatible tape transports.
Density	A density of 556 or 800 bpi can be selected by means of the density select switch. A status line to the customer is provided to indicate high or low density. As an option, densities of 200 or 556 can also be provided.

Interface Requirements

All connections for interface data signals will be made through AWG #24 twisted pairs of single wires. The maximum length of the single cables shall be 20 feet. These cables shall be supplied by the buyer.

Input Requirements
    Input List

Signal Name	No. of Lines
Write Data	7 or 9
Write Strobe	1
Write Reset	1
Write Permit	1
Read Permit	1
Select	1

Input Voltage Levels

See Interface Requirements of Section 4.

Input Timing

Compatible with DE-211.

Output Requirements

    Output Signal List

Signal List	No. of Lines
Read Data	7 or 9
Read Clock	1
Write Enable	1
Unit Select Status	1
Write Echo Check Error (Option)	1

Output Voltage Levels

The standard levels are given in Section 4. Other levels can be furnished as extra cost options.

Output Timing

The timing requirements for all outputs are to be compatible with Ampex DE-211 output timing requirements. The values shall be for a combined cable and load capacitance of 500 pf max.

Reliability

    Temporary Error Rate

A temporary error shall be an error that persists for less than 16 successive tries. The error rate shall be defined according to modes of operation as given below and shall be averaged over any two successive read passes of 5,000 blocks of 1,024 characters per block.

1. Write/Check Mode. In this mode, the Write/Check temporary error rate shall be less than 2 in 10^7 bits.

2. Read Only Mode. In this mode, the Read only temporary error rate shall be less than 1 in 10^7 bits.

6. OPTIONAL ITEMS

Optional Extra Cost Features (choose any or all for 100 unit minimum order.)

1. Vertical Parity Check
2. Vertical Parity Generate
3. Write Echo Check
4. Longitudinal Parity Check
5. Longitudinal Parity Generate

7. SPECIFICATION-SYSTEM

Weight

100 lbs. max.

Dimensions

19" x 24" x 16" (14.5" from rack rail). May be mounted in a 19" or 24" RETMA/EMA rack.

Input Power

Frequency

48 to 63 cps

Voltage

100 to 250 volts RMS with transformer taps. On each tap the system will meet all specification requirements at the design center tap voltage ± 10%.

Consumption

Average: 400 watts

Peak: 500 watts

Environment	Operating	Shipment and Storage
Temperature	40°F to 110°F	-30°F to +140°F
Relative Humidity	20% to 95%	5% to 95%

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Components	Plastic, Dual In Line, Transistor - Transistor Logic is used for all integrated circuit components.

Altitude

Operating	Shipment and Storage
0 to 10,000 ft	0 to 40,000 ft

Acoustical Noise	Within the limits of curve NC60 or MIL-STD-803-2.
Mean Time Between Failure	No less than 3,000 hours per MIL-Handbook 217A.