CartriFile® magnetic tape systems

CartriFile 40

Real power and flexibility for your minicomputer system is offered by the CartriFile 40 cartridge-loaded magnetic tape unit. The CartriFile 40 provides four independently controllable tape drives to log, compare, sort, collate, and merge data, adding new dimensions to your mini system's range of operation. The CartriFile 40 is particularly appropriate for systems requiring the utmost in reliability, convenience, and ease of maintenance.

A complete subsystem in itself, the CartriFile 40 includes four tape drives, read/write electronics, tape unit controller, and power supply, all contained within a compact, attractive cabinet for desk-top use or rack mounting. Interfaces are available for all popular minicomputers.

TRI-DATA

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The CartriFile 40
magnetic tape systems

FUNCTIONAL DESCRIPTION

The CartriFile 40 tape unit provides data input, data output, and intermediate storage for digital data systems.

The tape drive mechanism used in the CartriFile 40 includes four independent tape drives. Each CartriFile tape is contained in a separate cartridge as an endless loop. A reflective marker on the tape determines load point, which marks both the beginning and the end of the tape.

Operating under control of the data system, the tape unit writes or reads any one tape and simultaneously advances any or all of the other tapes to load point. For each Write or Read operation, the tape is started, the record written or read, and the tape stopped. Gaps between records are written automatically by the CartriFile unit. The records may be written or read consecutively or alternately among the tapes in any sequence.

Each record written on the tape may contain any number of sequential data words. Since there are no pre-editing, indexing, or fixed-character requirements, the record length may vary without restriction to the desired data organization. File marks, segment marks, or other identifying information may be written on the tape as single-word or multiple-word records with complete programming freedom.

Data transfer between the CartriFile 40 and the data system is in bit-parallel words. The choice of 8 bits, 12 bits, or 16 bits per word is made at the tape unit interface.

TRI-DATA POLYDRIVE

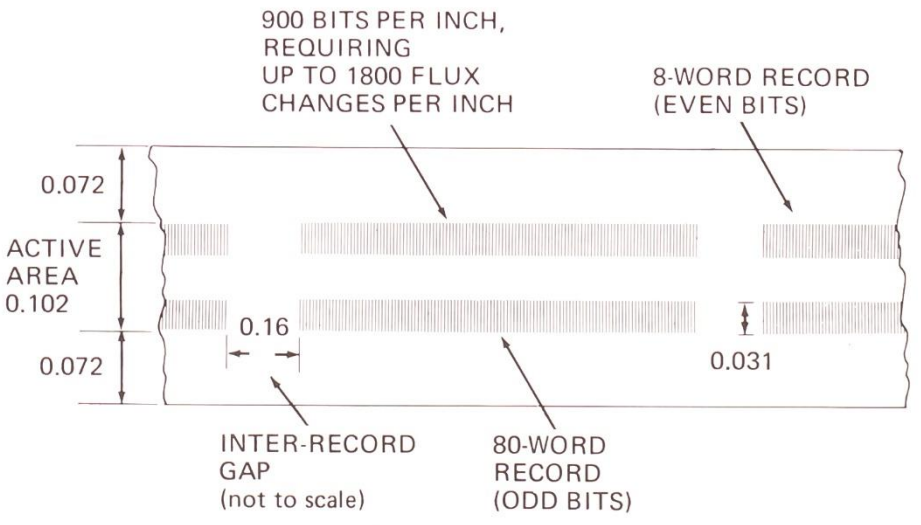
The Tri-Data PolyDrive concept is a unique method of driving a number of tapes independently by a common motor and capstan. The simplicity and ruggedness of the design enables CartriFile tape units to perform reliably for years over a wide range of operating conditions.

The PolyDrive mechanism is basically a drive motor and belt, a single capstan, a pinchroller actuator, and a read/write head assembly. Up to four tapes can be driven by the same capstan, with the addition of an actuator and head assembly for each tape. Switches for sensing the presence and file-protect status of each tape and a photoelectric system for sensing the EOT/BOT reflective tab on each tape complete the assembly. The increase in mechanical complexity is small compared to most other minitape systems in which the entire drive mechanism and structure must be duplicated for each additional tape. As a result, the multi-tape PolyDrive mechanism is both less expensive and more reliable than other minitape drives offering the same number of transports. With a minimum number of moving parts, the PolyDrive concept contributes substantially to the high reliability of the CartriFile tape system.

BI-TRACK TAPE FORMAT

Bi-Track, developed by Tri-Data in 1970, is a two-track format that combines high storage capacity with highest data reliability. The format eliminates skew-caused errors, greatly reduces the incidence of dropouts, and permits tape errors to be detected by the tape unit during reading.

The data are written on the tape in records containing any number of data words, with the records separated by 0.16-inch inter-record gaps. Each bit-parallel input word is converted into two bytes, and a word-synchronism bit is added to each byte. One byte contains the odd bits of the input data word, and the other the even bits. The two bytes are simultaneously written bit-serially on independent tape tracks using phase encoding at a density of 900 bits per inch. The phase encoding requires an inter-bit flux transition for 1-1 and 0-0 sequences, so the flux transition density may be twice the bit density, or up to 1800 flux transitions per inch.



When the tape is read, the outputs of the two tracks are independently amplified and the flux transitions detected by peak detectors. The resulting pulses are decoded serially from the phase encoding to normal binary and stored in a byte buffer for each track. The end of the word is determined by counting the bits as they are stored in the serial buffers. When a serial buffer is loaded, the byte is transferred in parallel to a second byte buffer. When both parallel buffers are loaded, they are then read out simultaneously to provide the bit-parallel word output. The independent double buffering of the two tracks permits almost a full byte time of track-to-track time displacement to be tolerated. Head alignment and tape guiding may be badly out of specifications, yet a tape may be written on one maladjusted machine and read on another without error.

As shown in the illustration, the entire active track width is 0.102 inch. The tape width is nominally 0.246 inch and the distance from either edge of the tape to the active, data-carrying area is 0.072 inch. The spaces adjacent to the tape edges are not used. Data dropouts, which occur predominantly in the tape tracks close to the tape edges in other computer tape systems, are reduced to near the vanishing point in this format.

PERFORMANCE CHARACTERISTICS

Data Transfer Rate Half of each data word is written on each of two tracks, and a synchronism bit is added to each half-word during writing. The combined bit rate is 18,000 bits per second, and the word transfer rate during writing or reading is

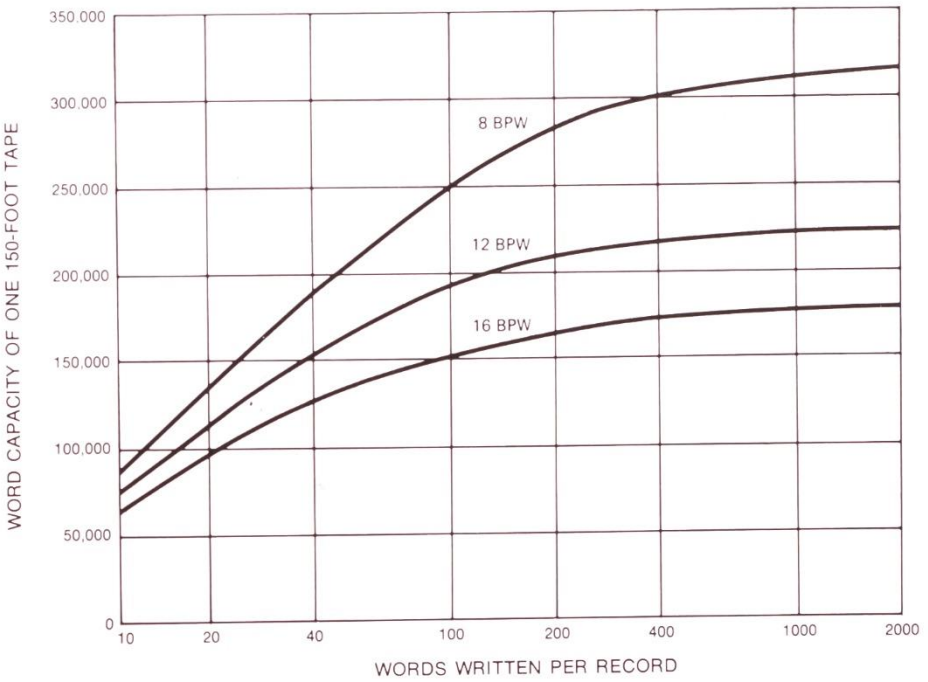
for 16-bit transfers: 1000 words per second.
for 12-bit transfers: 1286 words per second.
for 8-bit transfers: 1800 words per second.

Thru-put Capability The system thru-put capability of the CartriFile 40 is determined by the data transfer rate given above, plus the start and stop time delays between data records. There are no other restrictions. The table shows the average data transfer rates for the CartriFile 40 when handling records of 20, 40, 100, and 400 words.

Average Data Transfer Rates in Words Per Second

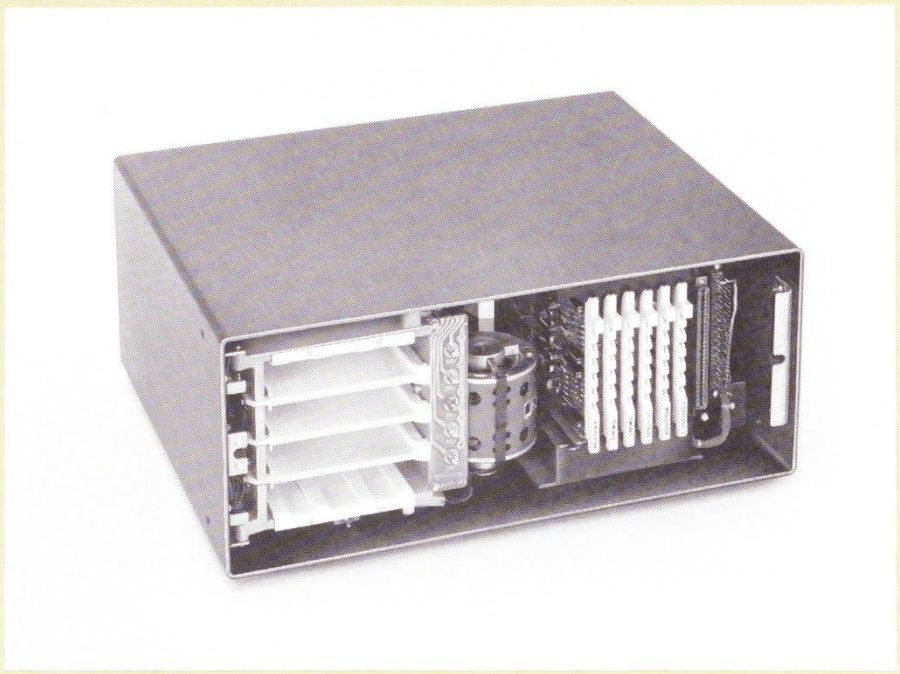
word length	20-word record	40-word record	100-word record	400-word record
8 bits	606	908	1290	1639
12 bits	540	755	1010	1200
16 bits	476	645	820	948

Data Storage Capacity The storage capacity of each tape varies with tape length, number of bits per word, and number of words per record. Standard cartridge tape lengths are 10, 25, 50, and 150 feet. For given word and record lengths, the capacity of one 150-foot tape is shown in the graph. The total storage capacity of the CartriFile 40 system is the sum of the capacities of the four tapes with which it is loaded.

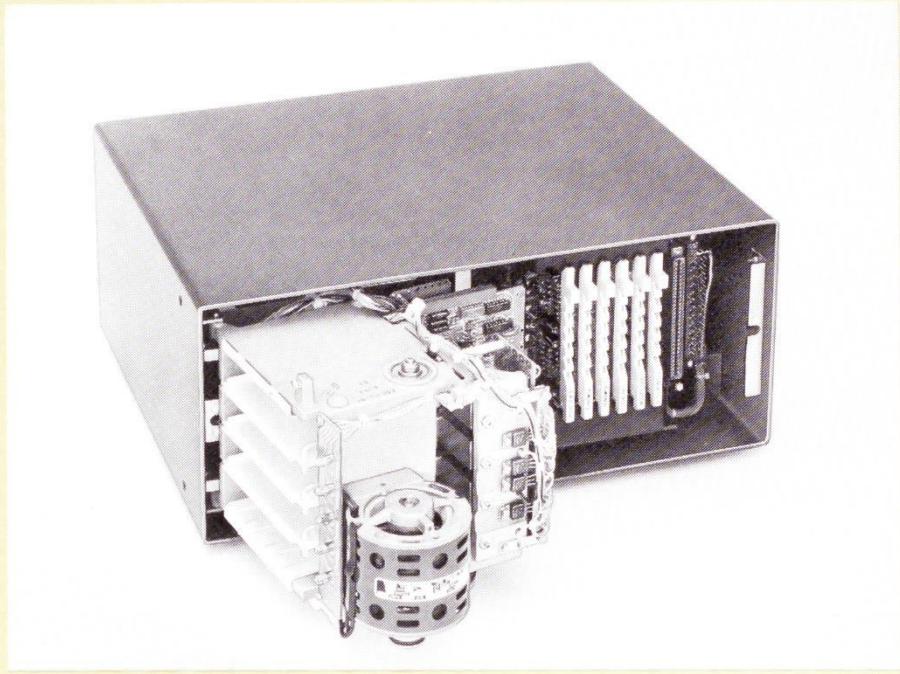


Data Reliability CartriFile tape units have been operating reliably in minicomputer-based data-processing systems since 1968. Data reliability equivalent to that of the largest, most sophisticated systems is built into the CartriFile 40 tape unit. The tape units in these large systems normally perform with bit-error rates of 1 part in 10^7 to 1 part in 10^9, depending on systems housekeeping, controls, and personnel training. The CartriFile system operates on the favorable side of this range, i.e., toward a bit-error rate of 1 part in 10^9, enabling its use in applications requiring the highest level of data reliability.

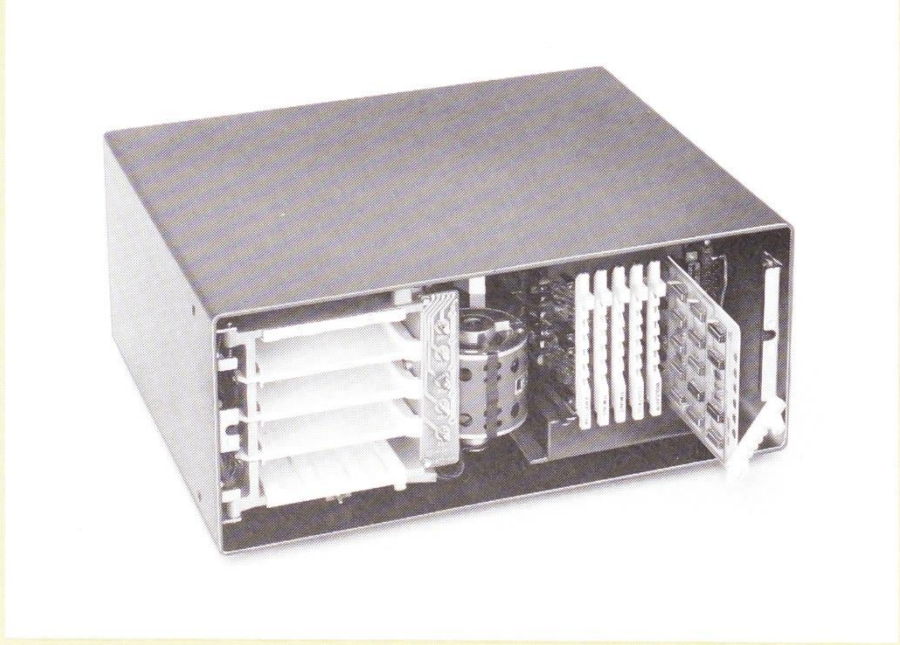
CartriFile 40 magnetic tape system—
simplicity, accessibility, reliability . . .



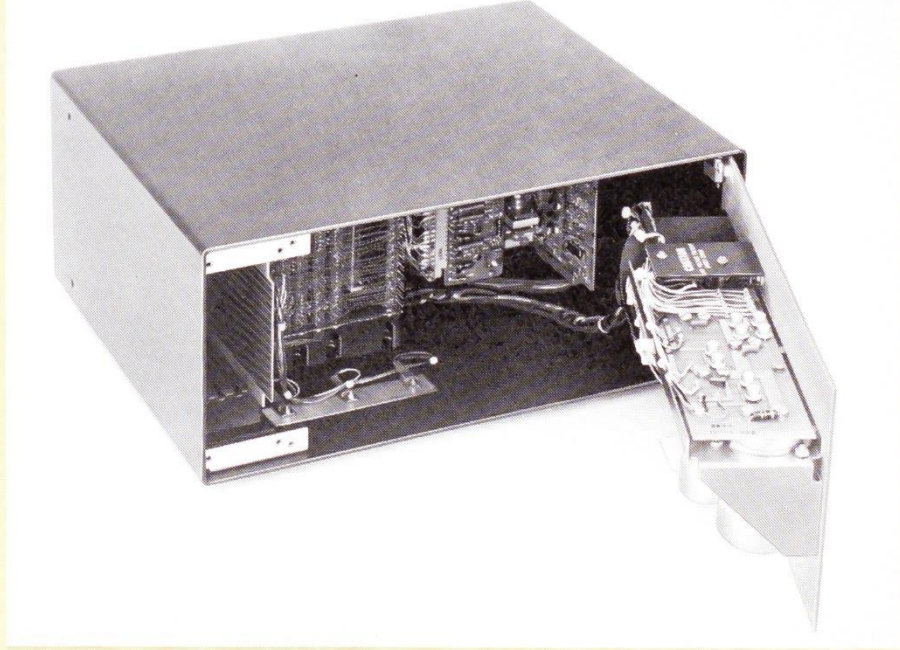
Clean design and reliable operation are the hallmarks of all CartriFile tape systems. With the front panel removed, the CartriFile 40 exhibits the simple elegance achieved only by careful engineering. Easily installed, operated, and maintained, the CartriFile 40 is designed in every respect for years of service.



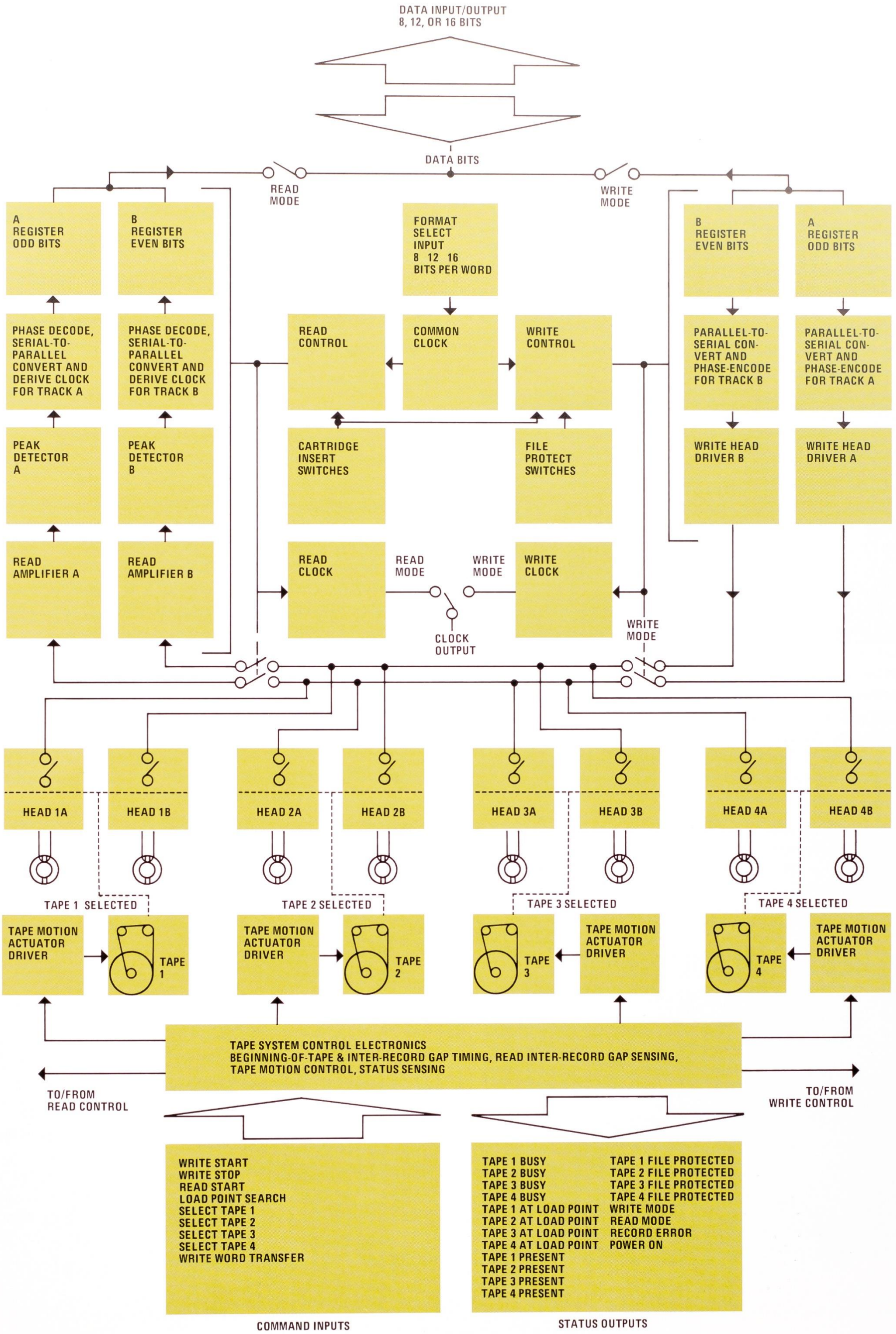
The entire transport assembly pivots outward for access to tape drive components, magnetic heads, and transport control electronics, all of which are mounted on the one-piece transport casting. The mechanical simplicity of a single motor, single capstan, and individual tape drive actuators insure the reliable operation for which CartriFile tape systems are well known.



The six printed circuit cards contain the read/write and controller electronics and power regulation circuitry. The card ejector lever on each card also exposes six test points for ease of servicing. An extender card is stored in the cabinet to the right of the card cage.



The power supply assembly swings outward from the rear of the wrap-around cabinet. The brackets on the left mount the connector (not shown) which carries data and control signals between the CartriFile 40 and the computer. Even from the rear, the uncluttered, good design and workmanship of the CartriFile 40 are apparent.


DATA INPUT/OUTPUT
8, 12, OR 16 BITS
DATA BITS
READ MODE
WRITE MODE
A REGISTER ODD BITS
B REGISTER EVEN BITS
FORMAT SELECT INPUT 8 12 16 BITS PER WORD
B REGISTER EVEN BITS
A REGISTER ODD BITS
PHASE DECODE, SERIAL-TO-PARALLEL CONVERT AND DERIVE CLOCK FOR TRACK A
PHASE DECODE, SERIAL-TO-PARALLEL CONVERT AND DERIVE CLOCK FOR TRACK B
READ CONTROL
COMMON CLOCK
WRITE CONTROL
PARALLEL-TO-SERIAL CONVERT AND PHASE-ENCODE FOR TRACK B
PARALLEL-TO-SERIAL CONVERT AND PHASE-ENCODE FOR TRACK A
PEAK DETECTOR A
PEAK DETECTOR B
CARTRIDGE INSERT SWITCHES
FILE PROTECT SWITCHES
WRITE HEAD DRIVER B
WRITE HEAD DRIVER A
READ AMPLIFIER A
READ AMPLIFIER B
READ CLOCK
READ MODE
WRITE MODE
WRITE CLOCK
CLOCK OUTPUT
WRITE MODE
HEAD 1A
HEAD 1B
HEAD 2A
HEAD 2B
HEAD 3A
HEAD 3B
HEAD 4A
HEAD 4B
TAPE 1 SELECTED
TAPE 2 SELECTED
TAPE 3 SELECTED
TAPE 4 SELECTED
TAPE MOTION ACTUATOR DRIVER
TAPE 1
TAPE MOTION ACTUATOR DRIVER
TAPE 2
TAPE 3
TAPE MOTION ACTUATOR DRIVER
TAPE 4
TAPE MOTION ACTUATOR DRIVER
TAPE SYSTEM CONTROL ELECTRONICS
BEGINNING-OF-TAPE & INTER-RECORD GAP TIMING, READ INTER-RECORD GAP SENSING,
TAPE MOTION CONTROL, STATUS SENSING
TO/FROM READ CONTROL
TO/FROM WRITE CONTROL
WRITE START
WRITE STOP
READ START
LOAD POINT SEARCH
SELECT TAPE 1
SELECT TAPE 2
SELECT TAPE 3
SELECT TAPE 4
WRITE WORD TRANSFER
COMMAND INPUTS
TAPE 1 BUSY
TAPE 2 BUSY
TAPE 3 BUSY
TAPE 4 BUSY
TAPE 1 AT LOAD POINT
TAPE 2 AT LOAD POINT
TAPE 3 AT LOAD POINT
TAPE 4 AT LOAD POINT
TAPE 1 PRESENT
TAPE 2 PRESENT
TAPE 3 PRESENT
TAPE 4 PRESENT
TAPE 1 FILE PROTECTED
TAPE 2 FILE PROTECTED
TAPE 3 FILE PROTECTED
TAPE 4 FILE PROTECTED
WRITE MODE
READ MODE
RECORD ERROR
POWER ON
STATUS OUTPUTS

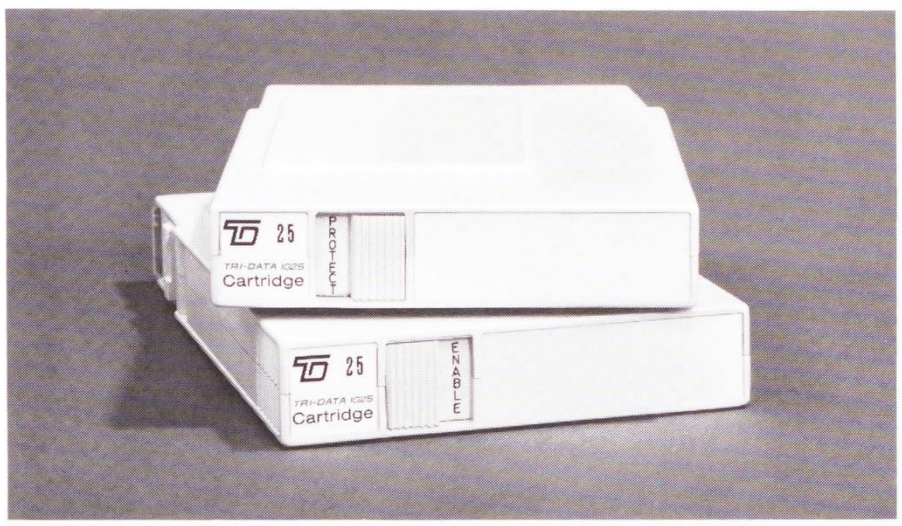
CartriFile 40 specifications

CartriFile 40 Magnetic Tape System

Configuration	Four independently controlled transports, each loaded with one single-tape cartridge
Capacity per tape	314,000 8-bit words in 1000-character records. Varies with tape length and record length
Record length	Variable
Word length	Selectable: 8, 12, or 16 bits
Tape speed, all modes	10 inches per second
Transfer rate	1800 8-bit, 1286 12-bit, or 1000 16-bit words per second
Inter-record gap	0.16 inch
Inter-record delays	Start and stop delays total 22 milliseconds between records, whether writing or reading sequentially on one tape or alternately between tapes
Load-Point search time	6 seconds average for 10-foot tapes; 90 seconds average for 150-foot tapes. Time required is inverse to amount of data stored
Recording format	Tri-Data *Bi-Track*
Recording density	900 bits per inch per track
Recording technique	Odd bits of the data words are phase encoded and recorded bit-serially on one track; even bits are phase encoded and recorded on the other track
Electrical interface	False: +2.5 V to +5.0 V True: −0.5 V to +0.5 V
Interface connector	Winchester HW28D2111 (external mating connector supplied)
Power	180 watts max. All units operate from 105–125 VAC or 210–250 VAC, 47–53 Hz or 57–63 Hz
Mounting	Desk top or 19-inch rack mount (rack-mount hardware included)
Dimensions	17 inches wide, 6–31/32 inches high, 13½ inches deep. Requires 7 inches (nom.) rack space when rack-mounted
Weight	34 pounds
Temperature range	Operating: 40°F. to 110°F. Storage: −50°F. to 150°F.
Humidity range	Operating: 20% to 90% relative, without condensation
Vibration	Operating: 5–15 Hz at ±0.03 in. 16–25 Hz at ±0.02 in. 26–55 Hz at ±0.01 in.
Shock	Operating: 1.5 g, 11 ms duration, perpendicular to base and parallel to base Non-operating: 3.0 g, 11 ms duration, perpendicular to base and parallel to base

1000 Series Tape Cartridge

Tape Capacity	10 feet to 150 feet
Contents	One tape per cartridge
Configuration	Endless loop with reflective load-point tab
Certification	Tested and certified error-free
Useful Life	Greater than 200 hours running time. Useful life is defined as that period of use during which errors attributable to the cartridge are less than one bit in 10^9 bits The average useful life of a statistically significant group of cartridges is in excess of 500 hours running time



PRICES

CartriFile 40 magnetic tape system $4,150.00

CartriFile 40 magnetic tape system including interface circuitry and cables for most minicomputers $4,950.00

Information regarding availability of computer interfaces, quantity discounts, OEM configurations, and prices can be obtained through the nearest Tri-Data sales representative.

WARRANTY

CartriFile magnetic tape systems are warranted by Tri-Data Corporation for a period of one year from date of shipment to meet all quoted specifications, provided that the preventive maintenance procedures in the Tri-Data Instruction and Maintenance manual are followed in the use of the equipment. This warranty does not apply to equipment which has been subjected to misuse, neglect, unathorized repair or alteration, or accidental damage. Liability is limited to servicing or adjusting the equipment and replacing or repairing components as needed and does not extend to any consequential, special or contingent damages resulting from the sale or use of defective material.

Typical applications

The CartriFile 40 will operate with a cartridge in any one drive, any combination of drives, or all four drives. This flexibility enables the unit to be used for such operations as program loading, tape editing, tape duplication, program assembly, and data logging. However, it is the availability and imaginative use of all four tapes which enables the CartriFile 40 to expand the power, performance, and efficiency of minicomputer systems. Small-sized accounting systems, computer-based test systems, and process control and monitoring systems are only a few of the applications where the capabilities of the CartriFile 40 are particularly advantageous.

Minicomputer Programming

The CartriFile 40 four-tape unit allows the user to have four independent files on-line for programming use. Typically, one tape is reserved for the operating programs, such as editors, assemblers, linking loaders, and debuggers. A second tape is reserved for the object program library. The two remaining tapes are used for input source programs to be edited or assembled and output files for the editor or assemblers. Using this arrangement, a new program can be processed from raw input, edited, assembled, and cataloged into the object program library without operator intervention to change or move tapes. Alternative file arrangements are, of course, available to the programmer. Any of the four available tapes may be used for any file without restriction.

Small Accounting Systems

The CartriFile 40 provides a file capability for the small accounting system. The four independently controlled tapes make the CartriFile 40 ideal for sorting and merging files. The Tri-Data 1000 series tape cartridge provides a convenient and inexpensive method of storing master files and transaction data for historical records. Each 150-foot tape will store in excess of 300,000 alphanumeric characters.

Minicomputer-Based Test Systems

The CartriFile 40 provides great flexibility in production test systems. Typically, one tape is reserved for operating programs, one is reserved for test patterns, and the remaining two are used for data logging. Utilizing two tapes for data logging allows continuous operation since it is not necessary to halt the system when one tape reaches its capacity.

In systems where one computer is controlling several test or production machines, it may be advantageous to assign one tape to each device being controlled. For example, if a single computer is controlling four NC machine tools, it is likely that the four machines will be making totally different parts. It simplifies the system if a separate source file is provided for each NC machine.

Optional equipment

Interfaces

CartriFile 40 magnetic tape systems are available with interface circuitry and cabling to enable their use with the most commonly employed minicomputers. Each interface version of the CartriFile system, with a brief listing of accompanying software, is described in a separate data sheet, available on request.

Model 4092 Exerciser The Tri-Data Exerciser is a compact unit containing circuitry to perform read, write, and load-point search operations on CartriFile 40 magnetic tape systems. The unit is useful for off-line checkout and demonstration purposes since it provides a convenient means of verifying the functional performance of the CartriFile tape system without the need for engaging the computer. Price: $875.00.

CartriFile magnetic tape systems for minicomputers have been in use since 1968 in a variety of data-processing applications. Designed specifically for heavy-duty digital data recording, they combine economy of operation with fast thru-put and high data reliability. CartriFile systems may be purchased complete with interface circuitry and software ready to plug in to most popular minicomputers or in OEM configurations.

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