

# CartriFile 4096

INTERFACE MANUAL



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# INTRODUCTION

The CartriFile 4096 consists of four computer magnetic tape units and their tape unit controller combined in a single integrated unit for operation under program control of a using data system. The unit contains four electromechanical tape drives, write and read electronics, and electronics for head switching, error detection, error correction, input/output data formatting, tape motion control and timing. CartriFile tapes are contained in cartridges, the unit accepting two cartridges, each containing two tapes.

This manual contains a brief description of the equipment, including outline drawings and dimensions; the data transfer and storage characteristics of the unit; and the information needed for the electrical interface and operation of the CartriFile 4096 with a digital computer or other electronic system control unit.



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SECTION I

# EQUIPMENT DESCRIPTION

# 1. Equipment Supplied

The CartriFile 4096 is supplied in a cabinet suitable for desk or table top mounting. Two tape cartridges, each containing two tapes, two interface board mating connectors, an AC power cable and two copies of the Instruction and Maintenance Manual complete the equipment furnished. Brackets for standard 19 inch rack mounting of the cabinet are available as Option 4096-01.

The unit is comprised of three major sections: a Tape Drive Assembly, an Electronics Assembly, and a Power Supply. Descriptions of the major sections, the Front Panel Assembly and the Tape Cartridges follow the unit illustrations. (see Fig. 1-1, 1-2).



Fig. 1-1



Fig. 1-2

## 2. Tape Drive Assembly

The tape drive assembly contains the electromechanical components for driving the tape, the read/write heads, load point sensors and amplifiers, write driver amplifiers, read preamplifiers, and sensors for detecting proper cartridge insertion and write enable status of the individual tapes. The assembly is mounted to a casting which is pivotmounted in the cabinet so that it swings forward out of the cabinet for ready access.

Tape drive is accomplished by a single, constantly rotating capstan and four tape drive actuators which cause corresponding pinch rollers in the cartridges to clamp the tapes to the capstan. The tapes are started, driven, and stopped independently or in any combination as their corresponding actuators are energized and de-energized.

The capstan drive motor operates from power at either 50 Hz or 60 Hz. The pulley on the motor shaft has two grooves for the drive belt. Units sold domestically are furnished with the belt positioned to the 60 Hz pulley groove; should 50 Hz operation be desired, the pulley may be simply reversed and the belt repositioned to the 50 Hz groove.

#### 3. Electronics Assembly

The electronics assembly card rack contains 10 printed circuit boards and an extender board. The printed circuit boards are readily removable from the front, and the extender board will bring any of the circuit boards outside the cabinet for testing or service with the unit operating.

A switch and lamp assembly mounted on one of the printed circuit boards is positioned so that the switches are operated when the front panel push buttons are pressed, and the lamps back-light the indicators. Two interface terminal connectors on the rear of the card rack are positioned so that two interface boards extend all interface connections to two connectors at the back of the cabinet.

## 4. Power Supply

The power supply provides the power requirements of the unit from an AC line source and mounts a small fan for unit cooling. The supply is assembled integrally with the rear panel of the cabinet which is hinge mounted to the bottom of the cabinet frame. On loosening two screws at the top of the panel, the panel may be opened downward on its hinge, exposing the power supply outside the cabinet for ready access to all components.

The power supply may be operated at either 50 Hz or 60 Hz line frequency. The input voltage may be either 105 -125V AC or 210 - 250V AC, depending upon the position of a two-position slide switch mounted on the rear panel.

A primary power relay and logic circuit permit push button control of power on/off at the front panel, and remote logic-level power-off control at the interface. The primary power input connector is located on the rear panel.

#### 5. Front Panel

The front panel contains push buttons that operate switches (mounted in the electronics assembly) for Local and Automatic status, and hinged doors covering openings for insertion of the tape cartridges (See Fig. 3-4, page 12).

The push buttons and a portion of the decorative trim strip between them are translucent, back-lighted by lamps on the electronics assembly to indicate Local, Power On, and Automatic status. The panel may be quickly snapped off for access to the tape drive and electronics assemblies.

## 6. Tape Cartridges

Each cartridge contains two separate tapes, so that inserting two cartridges loads the unit with four tapes. The tapes are contained in the cartridge as endless loops. A reflective marker on each tape determines the Load Point, which is both the "beginning" and the "end" of the tape. Manual File Protect switches and indicators on the cartridge for each tape provide write lock-out. An integral slide cover encloses the tapes completely when the cartridge is not in use.



Fig. 1-4

SECTION III

# DATA TRANSFER AND STORAGE CHARACTERISTICS

#### 1. Tape Motion

The tape is driven at 10 inches per second in the same direction in each of three modes of operation: Write Tape, Read Tape, and Load Point search.

#### 2. Record Format

Records of sequential data words are written on the tapes, with the records separated by gaps. Each record may contain any number of words as determined by the external control unit during writing.

The data words contain 4, 6, 8, or 12 bits. Any one of these bits-per-word formats may be program selected for each tape by the external control unit, or the format desired may be made fixed for all tapes by wiring the select input to ground at the interface.

## 3. Data Transfer

The data words are transferred in and out bit-parallel. The data is written on the tapes bit-serial, internal circuitry making the parallel-to-serial conversion during writing and the serialto-parallel conversion during reading.

The using external control unit such as a digital computer has wide latitude in servicing the data transfers during both writing and reading. During writing, a Write Data Call pulse output occurs at a fixed rate, and the using control unit has the major portion of the period between each Data Call to input the data word with a Write Data Transfer input pulse. During reading, the data outputs may be sampled by the external control unit at any time during the major portion of the period between Read Clock pulse outputs. Precise timing for the data transfers is given in Section III.

#### 4. Inter-Record Gaps

In writing each record, a write-start delay of 15 milliseconds and a writestop delay of 10 milliseconds accommodate the start and stop tape motion transients and provide the time for writing an 0.2 inch (maximum length) inter-record gap. Internal circuitry times both delays and controls the tape motion and gap writing.

After reading each record, internal circuitry recognizes the inter-record gap and stops the tape with adequate gap remaining to accommodate the start transient prior to reading the next record. The read-start and read-stop delays are 15 milliseconds and 7 milliseconds respectively.

## 5. Beginning-of-Tape and End-of-Tape

A photoreflective Load Point marker 1.5 inches long affixed to the continuous loop tapes marks both the "beginning" and "end" of the tape. Photosensors for each tape are located 1.45 inches ahead (that is, passed first by a point on the tape) of the magnetic heads. This arrangement permits the following beginning-of-tape timing and end-of-tape warning.

On writing the first record on a tape, a write-start delay of 200 milliseconds is initiated after the Load Point marker passes the photosensor to assure adequate beginning-of-tape gap. The resulting total write-start or read-start delay for the first record is, therefore, between 200 and 350 milliseconds depending upon the exact Load Point position of the tape when the start command input occurs. End-of-tape warning is provided during writing by the leading edge of the marker coming under the photosensor and causing the Load Point Status line for the tape to go True. When this occurs, 1.2 inches of the tape (up to 80 8-bit words) may be written before a Write Stop command is mandatory.

#### 6. Data Transfer Rate

The bit rate is 6,000 bits per second, recording 600 bits to the inch at 10 inches per second. The written tape format is bit serial, and a start bit is added to each data word prior to writing it on the tape. The transfer rate during either writing or reading is therefore:

Transfer Rate =  $\frac{6,000}{B+1}$  words per second

where B is the number of data bits in each word at the data input and data output.

Word Length	Peak Transfer Rate
4 bits	1200 words/second
6 bits	857 words/second
8 bits	667 words/second
12 bits	462 words/second

# 7. Data Transfer Time Per Record

When writing records either sequentially on one of the tapes or alternately among the four tapes at the maximum rate, the elapsed time for each record is:

Time per record =  $\left(\frac{B + 1}{6,000} \times N\right)$  + 0.025 seconds Where: B = Data bits per word (4, 6, 8, or 12) N = Record length in words 0.025 = The sum of the Write Start and Write Stop delays.

with the exceptions that an additional 0.2 to 0.35 second Write Start delay occurs at the beginning of each tape.

When reading records either sequentially on one of the tapes or alternately among the four tapes at the maximum rate, the elapsed time for each record is:

Time per record =  $\left(\frac{B+1}{6,000} \times N\right)$  + 0.022 seconds

with the exceptions that an additional 0.2 to 0.35 second Read Start delay occurs at the beginning of each tape.

Writing or reading each record commits the external control unit for a lesser total time than that resulting from the above formulas; the stop delays need not be included in the times per record if the control unit can utilize the time for some other operation.

Precise timings for the Write and Read sequences are given in Section III.

## 8. Load Point Search Time

On receipt of a Load Point Search command input for one of the tapes, the tape is advanced at 10 inches per second until the Load Point marker is reached. Load Point Search time is directly proportional to the amount (length) of tape remaining on the tape loop at the time of the Load Point Search command input.

Load Point Search Time =  $\frac{L}{10}$  seconds

Where L is the length of tape remaining in inches.

## 9. Data Storage Capacity

The data storage capacity on each tape varies with the bits per word and words per record formats written and the length of the tape. The total storage available in the unit without re-loading tapes is the sum of the capacities of the four tapes with which it is loaded. The tape length required per record is:

Tape length per record =

$$\frac{(B + 1) N}{600} + 0.2$$
 inches

- N = Words per record
  - 600 = CartriFile recording density
     in bits per inch
    0.2 = Inter-record gap, inches
  - (maximum)

The tape length required to store a number of records is the sum of the lengths required for each record plus two inches for the Load Point marker and initial record gap. For fixed record lengths, the capacity of a tape in records is:

- Record capacity =
- Total inches tape 2 inches Inches Tape Per Record records

The capacity in words is the capacity in records times the words per record.



#### 10. Simultaneous Operations

Any one of the modes of operation, Write Tape, Read Tape, or Load Point Search, may occur on any tape independently of the status of the others with three exception conditions:

While one tape is writing, writing may not be initiated on any other tape. (The same data may be written simultaneously on any number of tapes if their writing is initiated simultaneously.)

While one tape is reading, no other tape may be read.

While one tape is writing data in a certain bits-per-word format (4, 6, 8 or 12), no tape that was written in a different format may be read.

Permissable simultaneous operations are therefore:

Writing a record on any one tape or the same record concurrently on two or more tapes, while

Reading a record from any one tape not writing, providing that the record was written in the same bitsper-word format now being used in writing, and

Load Point Search on any tapes not writing or reading.

Any of the operations may be initiated or terminated on any one tape while the others are in any permissable simultaneous operation.

SECTION III

# ELECTRICAL INTERFACE AND SYSTEM OPERATION

## 1. Interface General Description

Figure (3-1) is a block diagram showing the functions of the CartriFile electrical inputs and outputs and the unit's internal system organization.

The input and output circuitry is Transistor Transistor Logic (TTL), +2.5 to +5 volts True and -0.5 to +0.5 volts False. Sink current requirements for a False input will not exceed 2 milliamperes except for 0 volt activated lines, which will not exceed 8 milliamperes. Loading on a True input will not exceed 100 microamperes. The outputs can supply 1 milliampere at minimum True voltage and can sink 10 milliamperes at maximum False voltage.

The electrical inputs and outputs terminate at two connectors located inside the unit on the electronics card cage.



Fig. 3-1

Two interface extender boards, containing no circuitry, are mounted to these internal connectors and protrude at the rear of the cabinet, extending the interface connections to two external cable connectors that are furnished with the unit.

The two interface extender boards may be replaced with boards containing interface translation circuitry to match various external control units. Dimensions and other requirements for the replacement boards are given in Figures(3-2) and (3-3). The two internal interface connectors provide +15 volt, +5 volt and -15 volt power, ground and reset buses, and connector-to-connector ties in addition to the inputs and outputs for operation of the CartriFile. The maximum power that may be drawn at these connectors is:

> 40 ma from the -15 V, 80 ma from the +15 V, and 200 ma from the +5 V.



Fig. 3-2



Fig. 3-3

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#### 2. Manual Operations and Indicators

Manual operations consist of those associated with selecting, preparing, inserting and removing the tape cartridges; turning power on or off; and switching the unit to Automatic or Local. Panel indicators show power-on, in local, in automatic, and that certain fault conditions have occurred.

The cartridge inserted in the upper position in the unit will contain Tape 1 (top tape) and Tape 2, and the lower cartridge will contain Tape 3 and Tape 4 (bottom tape). The data transfer characteristics at the four tape positions are identical. However, the tapes may be of different lengths, hence may vary accordingly in data storage capacity and Load Point Search time. (See Data Transfer and Storage Characteristics, Section II.)

Prior to inserting a cartridge, the cartridge protective slide panel must be moved to its recessed position, and the File Protect switches on the side of the cartridge set to protect (or not protect) each of the two contained tapes from the unwanted erasure that would occur should a tape containing records be written over inadvertently. The file protected position of the switch is indicated by a clear flag showing in the corresponding small window. The write enabled position of the switch is indicated by a red flag showing in the window. Momentarily pressing the Local button will turn the power on (if it is not already on). Power-on is indicated by illumination of a portion of the red trim between the Local and Automatic buttons.

The Local button will be illuminated when both cartridges are inserted and power is on.

With both cartridges inserted and power on, momentarily pressing the Automatic button will place the CartriFile under control of the data system control unit with which it is interfaced. The Automatic button will light and the Local button will go dark.

When the unit is in Automatic, momentarily pressing the Local button (or removing a cartridge) will switch the unit away from the external control, stop any tape motion, and place the unit in Local status.

When the unit is in Local status with power on, momentarily pressing the Local button will turn the power off.

The Local indicator will blink on and off repeatedly should one of three fault conditions occur.

There was no write head current during a write tape operation.

A write start has been followed by a write stop prior to any data being written.

A photosense lamp was not operating.



Fig. 3-4

## 3. Bits Per Word Format Selection

The data input and output registers provide for up to 12 parallel data bits in each data word. The internal circuitry is set by the Bits-Per-Word Select inputs to write and read 4-bit parallel data words using only the first four data bit inputs and outputs; or for 6-bit parallel words using the first 6; or for 8-bit parallel words using the first 8; or for 12-bit parallel words using all 12. The word transfer rate for each bits-per-word format is a different constant, since the data is written on the tapes bit-serially at a constant bit rate.

If the bits-per-word format to be used in a particular CartriFile installation is to be fixed, the Bits-Per-Word Select input may be pre-wired at the interface for the format used. If the bits-perword format is selected under program control:

The Bits-Per-Word Select input must be held True during writing a record from the time of initiation of the Write Start pulse until the record is complete.

The Bits-Per-Word Select input must be held True during reading a record from the time of initiation of the Read Start pulse until the record has been completed, and the select input must be the same as that used in writing the record.

Writing one tape simultaneously with reading another using a different bits-per-word format is not permitted.

## 4. Write Sequence and Timing

Figure(3-5) shows the time relationships of the input and output signals associated with writing a record on Tape 1. These relationships are typical for writing a record on any tape; transpositions of the tape numbers would make the diagram and the following description apply to writing a record on Tape 2, 3 or 4.

With the Write Select Tape 1 input True, a Write Start input pulse commits Tape 1 to write a record. The Read Ready status line for Tape 1 goes False at the initiation of the pulse. At the fall of the pulse, the Write Ready status lines for all four tapes go False, the Tape 1 drive circuits are enabled, and an internal Write Start delay is initiated.

A Write Data Call output pulse occurs 15 milliseconds after the fall of the Write Start input pulse (the delay is between 200 and 350 milliseconds at the beginning of each tape), and subsequent Write Data Call outputs occur at a fixed rate until a Write Stop input pulse is received.

After each Write Data Call output pulse, either a Write Word Transfer input pulse or a Write Stop input pulse MUST OCCUR within a fixed time period, or the last previously transferred data word will be repeated on the tape. A Write Word Transfer input pulse will set the (4, 6, 8, or 12) data input registers being used to a "1" or "0" state determined by whether the data bit inputs are True or False at the time the Write Word Transfer pulse occurs. At the end of the fixed period, if a Write Stop input pulse has not been received, internal circuitry samples the input registers, transferring the data to an internal register. The data is written on the tape from the internal register while the input register may accept the next data word.

A Write Stop input commits the tape that is writing to terminate the record and stop. Further transfers of input data and further Write Data Call outputs are inhibited. At the time at which the next Write Data Call would have occurred (had the Write Stop input not occurred), the Tape 1 drive circuitry is de-energized and an internal 10 millisecond assurance time delay is initiated. At the end of this 10 milliseconds a Write Record Complete pulse output occurs, and the Write Ready status lines for all tapes and the Read Ready status line for Tape 1 go True. (Exception: should a Load Point Search Tape 1 input have occurred during writing the record, at the completion of the record the Ready status lines for Tape 1 will remain False and Tape 1 will immediately begin Load Point Search.)

Duplicate records may be written on two, three or all four tapes simultaneously (reference "Simultaneous Operations," Section II). The above description and the write timing diagram apply, changed only by replacing "Tape 1" wherever it occurs with all the tape numbers to be written simultaneously, and "Tape 2, 3, 4" on the diagram with the tape numbers not to be written.

Bits per word selection	Time between Write Data Call outputs	Time after each Write Data Call output pulse during which a Write Word Transfer or a Write Stop input pulse must occur
4	0.83 milliseconds	0.6 milliseconds
6	1.17 milliseconds	0.9 milliseconds
8	1.50 milliseconds	1.2 milliseconds
12	2.17 milliseconds	1.9 milliseconds



Fig. 3-5

### 5. Read Sequence and Timing

Figure (3-6) shows the time relationships of the input and output signals associated with reading a record on Tape 1. These relationships are typical for reading a record on any tape; transpositions of the tape numbers would make the diagram and the following description apply to reading a record on Tape 2, 3, or 4.

With the Read Select Tape 1 input True, a Read Start input pulse commits Tape 1 to read a record. The Write Ready status line for Tape 1 goes False at the initiation of the pulse. At the fall of the pulse, the Read Ready status lines for all four tapes go False, and the Tape 1 drive circuits are enabled.

The first Read Clock output pulse occurs 15 milliseconds\* after the fall of the Read Start input pulse (at the beginning of the tape, the delay will be between 200 and 350 milliseconds). Subsequent Read Clock outputs occur as each data word is read from the tape. The data bit outputs will be True or False representing the word read from the tape continuously from the time of the fall of the Read Clock output pulse until the time of the next Read Clock output pulse.

Bits Per Word	Nominal Time* Between
Selected	Read Clock Outputs
4	0.83 milliseconds
6	1.17 milliseconds
8	1.50 milliseconds
12	2.17 milliseconds

#### \*READ TIMING VARIATIONS

The 15 milliseconds read start delay and the times between Read Clock outputs shown in Figure (3-6), and in Table (1), page (21), are determined by times at which data is read from the tapes, hence are varied by all conditions that change the tape length or the tape speed between writing and reading the data. When operating from input power within the voltage and frequency limits specified in Section I, page :

The Read Start Delay will be no shorter than 10 milliseconds.

The time between Read Clock output pulses will be no shorter than the normal values given minus 15%.

The CartriFile has adequate margin to operate normally with the Read tape speed departing from the Write tape speed by as much as  $\pm 40\%$ .

When the last word of the record has been read, internal circuitry recognizes the absence of data in the inter-record gap and de-energizes the Tape 1 drive. After a 7 millisecond delay, a Read Record Complete output pulse occurs, and the Read Ready status lines for all tapes and the Write Ready status line for Tape 1 go True. (Exception: Should a Load Point Search Tape 1 input have occurred during reading the record, at the completion of the record the Ready status lines for Tape 1 will remain False and Tape 1 will immediately begin Load Point Search.)

One or more of three Error outputs may go True during reading a record. The timing and significance of these outputs is as follows:

The Detected Error output goes True at the time of the Read Clock output if a bit error has been detected in reading that word on either of the redundant tape tracks, whether or not the error has been corrected in the data output. This output is reset False at the time of the next Read Clock output.

The Word Error output goes True at the time of the Read Clock output if an uncorrectable error has occurred for that word. The error condition is indicated until the time of the next Read Clock. The Record Error output goes True at the time of the Read Clock output if an uncorrectable error has been detected and the data output word may contain an error, and remains True until the tape has completed reading the record in which the uncorrectable error has occurred.



Fig. 3-6

## 6. Load Point Search and Status

A pulse on one of the Load Point Search inputs causes one of three actions on the corresponding tape and its status outputs:

If the tape is at Load Point when the Load Point Search input occurs, no action results due to the input.

If the tape is not at Load Point and not being written or read when the Load Point Search input occurs, a Load Point Search sequence results: The Write Ready and Read Ready status outputs for the tape go False, and the tape is advanced until it reaches its Load Point, at which time the tape stops and the Write Ready, Read Ready and Load Point status outputs for the tape all go True.

If the tape is being written or read when the Load Point Search input occurs, writing or reading will continue until the record is completed, at which time the Load Point Search sequence described above will occur.

The Load Point Status outputs are True when their corresponding tapes are at their Load Points, and False when they are not.

# ALPHABETIC LISTING OF MNEUMONICS

MNEUMONIC	INPUT OR OUTPUT FUNCTION
AUTO	Automatic Status
BPW 4, 6, 8	Bits Per Word Select (X)
CMN	Common, Signal
DERR	Detected Error
LPA 1, 2, 3, 4	Load Point Status Tape (X)
LPSC 1, 2, 3, 4	Load Point Search Tape (X)
PROF	Turn Power Off
RBT 1, 2, 3, 4, 5, 6,	Read Data Bit (X)
7, 8, 9, 10, 11, 12	
RDCL	Read Clock
RERR	Record Error
RRCC	Read Record Complete
RRDY 1, 2, 3, 4	Read Ready Status Tape (X)
RSLT 1, 2, 3, 4	Read Select Tape (X)
RSTC	Read Start
WBT 1, 2, 3, 4, 5, 6,	Write Data Bit (X)
7, 8, 9, 10, 11, 12	
WCAL	Write Data Call
WERR	Word Error
WRCC	Write Record Complete
WRDY 1, 2, 3, 4	Write Ready Status Tape (X)
WSLT 1, 2, 3, 4	Write Select Tape (X)
WSPC	Write Stop
WSTC	Write Start
WXFR	Write Word Transfer

#### INTERFACE SPECIFICATION TABLE

			CONNE	ECTOR P	IN NUME	BERS			
FUNCTION	INPUT	MNEMONIC	EXTE	RNAL	INTE	RNAL	SIGNAL		REMARKS
	OUTPUT		J2	J1	J4	J3	TRUE	FALSE	
			WRITE	READ	WRITE	READ			
		WSLT 1			8	-	+50		a. The tapes for which WSLT is True during WSTC are committed to write a record at the fall
WRITE	I	WSLT 2	2	-	10	-	DURING		of the WSTC pulse.
SELECT		WSLT 3	3	-	12		WSTC		simultaneously.
		WSLT 4	4	-	14	-	PULSE		
		RSLT I				10	+50	00	is committed to read a record at the fall of
READ		RSLT 2		2	-	10	DURING		the RSTC pulse.
SELECT		RSLT 3	-	3		12	RSTC		b. Only one tape may read at a time.
	1	RSLT 4		4	-	14	PULSE		
BITS PER WORD		BPW 4	11	-	28		00	+5V	a. Ground appropriate Input to select BPW4, BPW6 or BPW8.
SFIFCT	I	BPW 6	12	-	30	-	DURING	OR	b. To select 12 bits per word (BPW 12), leave
SEBEGI		BPW 8	13	-	32	-	RECORD	OPEN	BPW4, BPW6 and BPW8 all open or all at +5V.
4, 6, 8 OR 12	-	BPW 12	-	-	-	-	REMARKS	REMARKS	with which they were written.
WRITE START	I	WSTC	5		16	-	+5V	ov	a. At fall of WSTC pulse the WSLT True tapes are
							PULSE		committed to write a record.
WEITHE CHOP			10				>0.5 µs	011	
WRITE STOP	1	WSPC	10	-	26	-	+5V PULSE	00	a. WSPC True commits the tape(s) writing to end the record after completing the last word pre-
							sبر 0.5<		viously transferred by WXFR Input.
READ START	I	RSTC	-	5	-	16	+5V	ov	a. At fall of RSTC pulse the RSLT True tape is
							PULSE		committed to read a record.
	I	LPSC 1		14		34	+5V	ov	a. LPSC True tape will advance to Load Point and
LOAD POINT							PULSE		stop.
SEARCH		LPSC 2	-	15	-	36	>0.5 µs		b. If a tape is writing or reading when its LPSC input True occurs, tape will LPSC after com-
	I	LPSC 3	-	16	-	38			pleting the record.
	I	LPSC 4		17		40			
	0	WRDY 1	6	-	18	-	+5V	07	a. WRDY True = all following conditions: <ol> <li>CartriFile is in Automatic.</li> </ol>
WRITE	0	WRDY 2	7	-	20	-			2. Both cartridges are inserted.
READY	0	WRDY 3	8		22	-			3. None of the tapes are writing. 4. WRDY tape is not file protected.
STATUS	0	WRDY 4	9	-	24	-			5. WRDY tape is not in LPSC.
									6. WRDY tape is not reading.
	0	RRDY 1	-	6		18	+5V	ov	a. RRDY True = all following conditions:
READ	0	RRDY 2	-	7		20			2. Both cartridges are inserted.
READY	0	RRDY 3		8		22			3. None of the tapes are reading. 4. RRDY tape is not in LPSC.
STATUS	0	RRDY 4	-	9	-	24			5. RRDY tape is not writing.
	0	LPA 1	14	-	34	-	+5V	ov	a. LPA True = that tape at Load Point.
LOAD	0	LPA 2	15	-	36	-		1	
POINT	0	LPA 3	16	-	38	-			
STATUS	0	LPA 4	17	-	40	-			
AUTOMATIC	0	AUTO	10	-	26	-	+5V	0V	a. Auto True = all following conditions:
STATUS									<ol> <li>Power is On.</li> <li>Cartridges are inserted.</li> </ol>
									3. AUTO manual control has been pressed, and
				1					LOCAL control has not been pressed subse-
									4. A Write Fault condition has not occurred
									since AUTO manual control was last pressed. b. This Output guaranteed to be at Ground poten-
]			1	]					tial under a current sink condition with power
			L			<u> </u>			Off
WRITE DATA	0	WCAL	18	-	42	-	+5V	ov	a. In writing each record, the first WCAL occurs
CALL							PULSE		at the end of a delay initiated with a WSTC, and subsequent WCAL outputs occur at a fixed rate un-
WRITE DATA	I	WBT 1	20	-	46	-	+5V	ov	til a WSPC input. After each WCAL, a WXFR input
	I	WBT 2	21	-	48	_	AT TIME	AT TIME	pulse within a fixed period sets the input regis- ters to the "1" or "0" condition of the WBT in-
BITS	I	WBT 3	22	-	50	-	OF WXFR ="1"BIT	OF WXFR ="0"BIT	puts. The registers are sampled for writing at
		WBT 4	23	-	7	-	(MUST	(MUST	the end of the fixed period.
l	I	WBT 5	•24	<u> </u>	9	-	BE MAIN- TAINED	BE MAIN-	Time between Period after WCAL during
	I	WBT 6	25	- 1	11	-	0.5 us	0.5 us	Brw True WCAL pulses which WXFR may occur
	I	WBT 7	26		13		MIN.	MIN.	BPW4 0.83 ms 0.6 ms BPW6 1.17 ms 0.9 ms
ļ	I	WBT 8	27	- 1	15	<u> </u>	FOLLOWING	FOLLOWIN	G BPW8 1.50 ms 1.2 ms
	I	WBT 9	28	-	17	-	WXFR)	WXFR)	BPW12 2.17 ms 1.9 ms
1	ī	WBT 10	29	1 -	19	-	1		b. A WSPC command input occurring prior to the end of the fixed period inhibits writing that
ł	<u> </u>	WBT 11	30	<u> </u>	21	-	1	word and inhibits any subsequent	word and inhibits any subsequent WCAL.
		WBT 12	31	+ -	23		1		c. II neither WXFR nor WSPC input occurs during the period after a WCAL, the last previous word
	_								is repeated on the tape.
WRITE WORD	I	WXFR	19	-	44	-	+50	ov	c. WXFR 0.5 µs minimum pulse may stay True up
TRANSFER				1			>0.5µs		to the end of the permissable transfer period.
				1				1	
L	1	1	I	1	1	I I		1	

			CONNE	ONNECTOR PIN NUMBERS					
FUNCTION	INPUT		EXTE	RNAL	INTE	RNAL	SIGNAL		
FUNCTION	OUTPUT	MNEMONIC	.12	.11		73	TOTTE	PALCE	REMARKS
			WRITE	READ	WRITE	READ	INCE	FALSE	
WRITE	0	WRCC	33	-	27	-	+5V 50 usec	ov	a. The fall of pulse output occurs when the record and gap are completed and the tape is
RECORD							maximum		ready for another command. (If a LPSC input
COMPLETE		1	1				pulse		and RRDY status outputs will not go True until
ł									the tape reaches its Load Point.)
READ DATA		RBT 1		20	<u> </u>	46	+5V	ov	a. In reading each record, the first RDCL output
	0	RBT 2	-	21	-	48	"1" BIT	"O" BIT	occurs 15 ms* (200 to 350 ms at beginning of tape)
BITS	0	RBT 3		22	-	50			after RSTC, with subsequent RDCL outputs occurring
	<u> </u>	PPT /	<u> </u>	22		7			puts remain True or False representing the data
[	<u> </u>	PBT 5		24	<u> </u>	, ,	-		word from the fall of the significant RDCL until
ł	<u> </u>	RBT 6	<u> </u>	25	<u> </u>				Nominal Timest between
1		RBT 7	-	26	-	13	1		BPW True RDCL Output Pulses
	0	RBT 8	-	27	-	15	1		BPW4 0.83 ms
		RBT 9		28	-	17	1		BPW6 1.17 ms BPW8 1.50 ms
		RBT 10		29		19	1		BFW12 2.17 ms
		RBT 11		30	-	21	1	[	*Values subject to tape speed variations. The
		RBT 12	-	31	-	23	-		minimum RSTC delay will be 10 ms, and the min- imum time between RDCL output pulses will be
									15% less than the table value.
READ	0	RDCL	-	19	-	44	+5V	ov	
CLOCK	1	l			ł	1	$2 \pm 1 \mu s$	ł	
	<u> </u>		<u> </u>				puise		The fall of rules output convertion the
READ	0	RRCC	-	33	- 1	27	+5V 50 usec	00	record and gap are completed and the tape is
RECORD							maximum	ĺ	ready for another command. (If a LPSC input
COMPLETE						Į	pulse		and RRDY status outputs will not go True until
JOIN DETE						{			the tape reaches its Load Point.)
DETECTED	0	DERR	-	13	-	32	+5V	ov	a. Goes True with RDCL if Bit Error detected in
ERROR									that word. Resets to False with next RDCL.
[					1			1	c. True may indicate an error in Data Output.
WORD	0	WERK	-	11	-	28	+5V	ov	a. True indicates uncorrectible error is in the
ERROR									Data Output.
									and resets to false with the next RDCL.
RECORD	0	RERR	-	12	-	30		1	a. True indicates an uncorrectable error has
ERROR									occurred in Data Output for this record.
									remains True until RRCC.
TURN POWER	1	PROF	32	-	25	-	ov	OPEN	a. Momentary ground turns CartriFile Power Off.
OFF	6						5ma SINK	5V	panel.
									c. Power may be turned Off also at Front Panel.
SIGNAL	1/0	CMN	34	34	29	29	NA	NA	a. Tied to Chassis Ground with both a jumper and a
COMMON						ļ			(located on top of tape drive assembly top plate)
									will DC Isolate the Signal Common from the chassis.
GROUND BUS	-	<u> </u>	-		1	1	NA	NA	a. These functions do not appear at the external
GROUND BUS	-		-	-	2	2			connectors J1 or J2.
-15V BUS	-	-	-		3	3			
-15V BUS	-	-	-	-	4	4	1	1	
RESET BUS	_	-	-	-	5	5			
RESET BUS	-	-	-	_	6	6			
+15V BUS	-	-	-	-	53	53			
+15V BUS	-	- 1	-	-	54	54	1		
+5V BUS	-	-	-	-	55	55			
+5V BUS	-	-	-	-	56	56			
TIE	-	-	39	39	39	39	NA	NA	a. Pin 39 of J3 is tied to Pin 39 of J4; Pin 39
TIE	-	-	40	40	41	41			of J1 is tied to Pin 39 of J2; etc.
TIE	-	-	41	41	43	43			
TIE	-	-	42	42	45	45			
TIE	-	-	43	43	47	47			
TIE	- 1	-	44	44	49	49			

# CONNECTOR TERMINALS LIST:

EXTERNAL CONNECTORS J1 or J2 PIN NOS.	INTERNAL CONNECTORS J3 or J4 PIN NOS.	J2 or J4 WRITE	Jl or J3 READ
1	8	WSLT1	RSLT1
2	10	WSLT2	RSLT2
3	12	WSLT3	RSLT3
4	14	WSLT4	RSLT4
5	16	WSTC	RSTC
6	18	WRDY1	RRDY1
7	20	WRDY2	RRDY 2
8	22	WRDY3	RRDY3
9	24	WRDY4	RRDY4
10	26	WSPC	AUTO
11	28	BPW4	WERR
12	30	BPW6	RERR
13	32	BPW8	DERR
14	34	LPA1	LPSC1
15	36	LPA2	LPSC2
16	38	LPA3	LPSC3
17	40	LPA4	LPSC4
18	42	WCAL	-
19	44	WXFR	RDCL
20	46	WBT1	RBT1
21	48	WBT2	RBT2
22	50	WBT3	RBT3
23 or A	7	WBT4	RBT4
24 or B	9	WBT5	RBT5
25 or C	11	WBT6	RBT6
26 or D	13	WBT7	RBT7
27 or E	15	WBT8	RBT8
28 or F	17	WBT9	RBT9
29 or H	19	WBT10	RBT10
30 or J	21	WBT11	RBT11
31 or K	23	WBT12	RBT12
<u>32 or L</u>	25	PROF	-
33 or M	27	WRCC	RRCC
<u>34 or N</u>	29	CMN	CMN
35 or P	31	-	
<u>36 or R</u>	33	_	
37 or S	35	-	-
<u>38 or T</u>	3/		-
<u>39 or U</u>	39	– – – Ti	.e
40 or V	41	Ti	.e – – – –
41 or W	43	Ti	.e – – – –
42 or X	45	Ti	.e – – – –
<u>43 or Y</u>	4/	Ti	.e – – – –
44 or Z	49	Ti	e – – – –

# CONNECTOR TERMINAL LIST (continued)

EXTERNAL CONNECTORS J1 or J2 Pin No.	INTERNAL CONNECTORS J3 or J4 Pin No.	J2 or J4 Write	Jl or J3 Read
These functions	1	Ground Bus	Ground Bus
are not available	2	Ground Bus	Ground Bus
at the external	3	-15V Bus	-15V Bus
connectors	4	-15V Bus	-15V Bus
	5	Reset Bus	Reset Bus
	6	Reset Bus	Reset Bus
	51	Spare	Spare
	52	Spare	Spare
	53	+15V Bus	+15V Bus
	54	+15V Bus	+15V Bus
	55	+5V Bus	+5V Bus
	56	+5V Bus	+5V Bus

# CONNECTOR TYPES AND PIN LOCATIONS:

External connectors furnished are Cinch- Jones 50-44A-30 or equivalent, 22 dual Read-outs on .156° centers, 44 total Pins each connector.	Internal connectors are part of the Elec- tronics Assembly. 28 Dual Read-outs on .125" centers, 56 pins total.
222 221 222 221 222 222 221 220 222 222	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
Rear view of External Connector, typical of two.	Front view of Internal Connector, typical of two.

