CONTROL DATA
CORPORATION

CONTROL DATA®
1700 COMPUTER SYSTEM

1732-A/B MAGNETIC TAPE CONTROLLER
REFERENCE MANUAL

REVISION RECORD

REVISION	DESCRIPTION
A	Manual released; this manual supersedes the 1732-A/B Magnetic Tape Controller section of the
(9-15-70)	obsolete CONTROL DATA® 1700 COMPUTER SYSTEM STANDARD PERIPHERAL REFERENCE
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PREFACE

This manual gives reference information for the CONTROL DATA® 1732-A/B Magnetic Tape Controller which may be used in conjunction with the 1705 Interrupt Data Channel of the 1700 Computer. For reference information on 1700 Basic Peripheral Equipments (which attach directly to the 1704 Basic Computer) see the 1700 Computer System Reference Manual, Pub. No. 60153100.

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1732-A/B MAGNETIC TAPE CONTROLLER

INTRODUCTION

The CONTROL DATA® 1732 Magnetic Tape Controller synchronizes data transfer between a 1700 Computer System and up to eight 608 or 609 Tape Transports. This section describes the physical system, the programming information, and the operating procedures for the 1732 and 608/609.

FUNCTIONAL DESCRIPTION

System Relationship

As Figure 1 illustrates, the 1732 may be attached directly to the AQ Channel or it may be attached to a 1706 or 1716 converter. The tape transports with which the 1732 is associated are the 7-track 608 and 9-track 609. These may be intermixed on the system as the user desires.

The equipment number switch, located on the controller, designates the controller address (0 through F hexadecimal). Any one of the eight tape transports attached to the controller may be selected.

Character-Assembly/Disassembly Operating Modes

The 1732 operates in either Character mode or Assembly/Disassembly mode. In Character mode the 1732 sends data bits 0-5 or 0-7 to the tape transport (depending upon whether the tape unit is 7 or 9 track). The upper 8 or 10 bits are ignored by the controller. Likewise, when the computer reads data from the tape via the 1732 in Character mode, each tape word is sent to the computer in bit positions 0-5 (or 0-7); the remaining bits are ignored by the computer.

However, in A/D mode each computer word sent to the tape via the 1732 is disassembled into two sections before being sent to the tape unit. If the computer is sending data to a 7-track 608 tape unit, data bits 8-13 comprise the first tape word and data bits 0-5 comprise the alternate tape word. Bits 6, 7, 14 and 15 are ignored.

If the computer is sending data to a 9-track 609 tape unit, data bits 8-15 comprise the first tape word and data bits 0-7 comprise the alternate tape word.

If the controller, operating in A/D mode, reads an odd number of tape words, the lower bits of the last assembled word will be filled with zeroes. The FILL status bit will set to indicate that this portion of the assembled word is not a tape word.

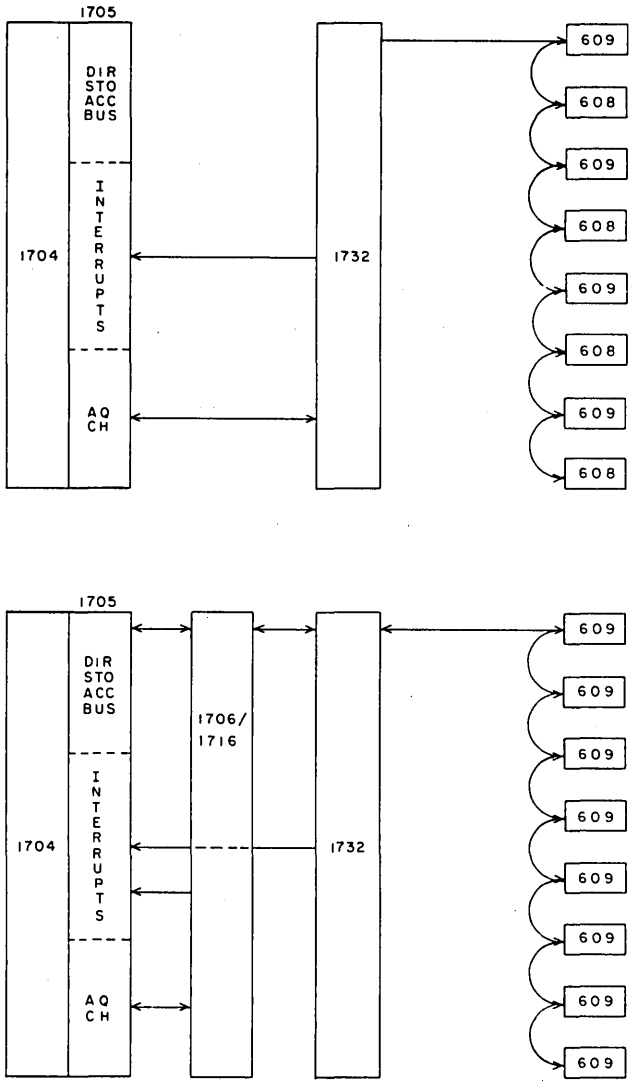


Figure 1. Typical Configurations

Magnetic Tape

Magnetic tape provides a high-speed, nonvolatile storage medium. The tape has a plastic base and is coated on one side with a magnetic oxide. Information is recorded on this coating. Extreme care is taken to prevent error-causing imperfections.

Information is read (detected) or written (stored) by passing the oxide side of the tape over read/write heads. Information may be written on any or all of the tape tracks. During a Read or Write operation, the tape pasces over seven or nine evenly aligned heads; therefore, all bits of the tape word may be simultaneously recorded, one bit on each track.

A non-return-to-zero (change-on-ones) recording scheme is used. In this system, magnetic particles on the tape are aligned in either the positive or negative direction. A binary "1" is recorded by reversing the alignment (polarity); no polarity reversal indicates a "0". Thus, each track of the tape is fully magnetized and the polarity is reversed as each "1" bit is recorded.

Tape Format

Table 1 and Figure 2 describe the data format of magnetic tape. A line or frame of tape data consists of a 6-bit or 8-bit tape word and a parity bit. In a 608, tracks 0 through 5 contain the data bits and track 6 holds the parity bit. In a 609, tracks 0 through 7 contain the data bits, and track 8 holds the parity bit.

Density

The controller, when connected to the 608 tape transport, may be selected to synchronize data at a rate of 200, 556 or 800 bits per inch. When the controller is connected to a 609 tape, 800 bpi is the only possible density selection. The tape speed in both tape handlers is 37-1/2 inches per second.

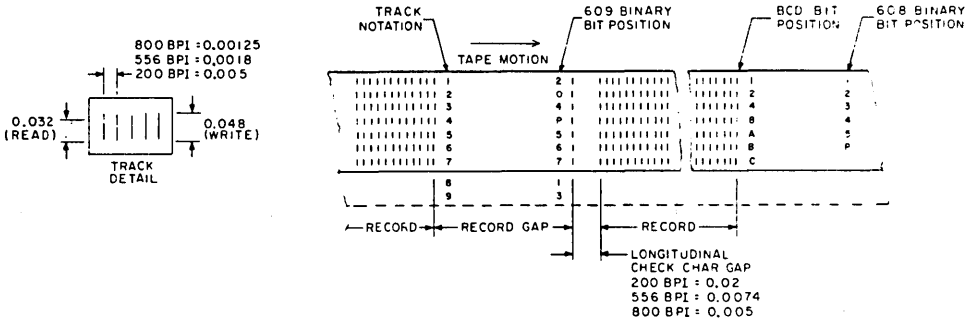
Mode

The 608 tape transport records data in either of two modes: Binary mode, which uses odd parity; or BCD mode, which uses even parity. Since there is no BCD conversion in the 1732, the BCD "zero" character is illegal and should not be used.

BCD can not be used with the 609 tape transport.

TABLE 1. TAPE FORMAT

	608	609
Tracks	seven	nine
Tape Speed	37 1/2 ips	same
Density (bpi)	200 556 800	800
Parity		
Vertical	Binary-odd BCD-even placed in seventh track	odd - placed in ninth track
Longitudinal	even parity check character spaced 4 frames from last data character.	even parity check character spaced 4 frames from the CRC code word.
Cyclic Redundancy Code Word	none	spaced 4 frames from last data character
File Mark	A BCD 17_8 six inches from last record. The file mark is followed by a longitudinal check character of BCD 17_8.	none
Tape Mark	none	A 23_8 6 inches from the last record. It is followed by an identical check character.
Initial Gap	3.0 inches minimum for write 0.5 inches for read	same
Record Gap	0.687 inches minimum 0.960 inches maximum 0.750 inches nominal	0.50 inches minimum 0.75 " maximum 0.60 " nominal



NOTES:
1. OXIDE SIDE UP ON DIAGRAM, RECORDING HEAD ON SAME SIDE AS OXIDE.
2. WRITE FREQUENCY 7.5 KC ±1%, 20.85 KC ±1%, OR 30 KC ±1%.
3. AVERAGE STEADY STATE TAPE SPEED 37.5 ips.

Figure 2. Tape Format

Records and Files

Data recorded on the tape is arranged in groups called records and files. A record consists of consecutive frames of information. A minimum of one frame of information constitutes a record. Adjacent records are separated by a 0.6 inch (609) or 3/4 inch (608) unrecorded area called a record gap. In a 609 tape transport a cyclic code word and a longitudinal parity check character are recorded at the end of each record. In a 608 tape transport the cyclic code word is not present. A file consists of a group of records. Adjacent files are separated by recording an end-of-file marker six inches from the last record in the file. In the 608 the end-of-file marker is called File Mark; in the 609 the end-of-file marker is called Tape Mark.

Load Point

The load point is a reflective marker indicating the beginning of the usable portion of the tape. It is located at least 10 feet from the beginning of the tape.

End-of-Tape Marker

The end-of-tape marker is a reflective marker placed not less than 18 feet from the end of the tape. This provides approximately 10 feet of tape trailer and enough tape to hold a record of 96,000 characters after the end-of-tape marker is sensed. See Figure 3.

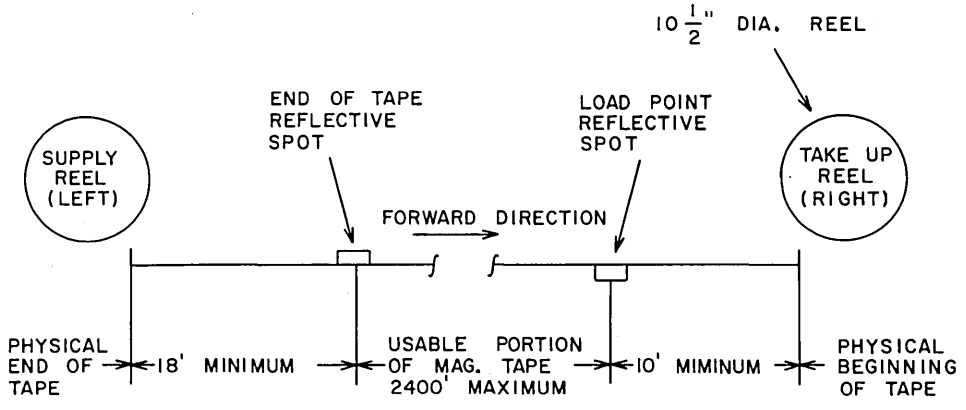


Figure 3. Physical Layout of Tape

Parity

The controller may be selected to operate with even (BCD) vertical parity or with odd (binary) vertical parity. The controller generates an even longitudinal parity check character for each physical record.

During a Write, the read heads of the tape transport transfer the newly written character to the controller. The controller performs a parity check and sets the Parity Error status bit if an error has occurred. If the Alarm interrupt has been selected, an interrupt occurs.

During a Read, the parity bit recorded on the tape is checked against the character. The Parity Error status bit sets if an error occurs. If the Alarm interrupt has been selected, an interrupt occurs.

Cyclic Redundancy Check (CRC)

The Cyclic Redundancy feature is an additional check of the accuracy of data transmission and reception between the controller and the tape unit. The CRC, used by the 1732 only in conjunction with the 609, is accomplished by writing a cyclic code word at the end of each record. When the record is read by the controller, the code word should toggle the CRC register to an all clear condition if the data is correct. If the CRC determines that the data is incorrect, a parity error is indicated via the Parity Error light and via a parity error status response. Note that if the number of data characters in a record is even, the parity bit of the Cyclic code word will be odd; if the number of data characters is odd, the parity bit of the code word will be even.

Master Clear

Pressing the 1704 Computer CLEAR switch clears all interrupt selections and error conditions of a connected 1732. It clears a BCD selection and A/D mode selection, but does not clear a connection.

Reply/Reject

The Reply signal indicates an operation requested is possible. It is returned to the computer or converter within 4 μsec and at least 0.2 μsec after the request is initiated. A Reject signal indicates the operation requested cannot or should not be performed at that time. If neither a Reply nor a Reject is received for 4.0 μsec, the computer generates an Internal Reject.

File Protection

The back of a tape reel has a slot near the hub for a plastic file protection ring (Figure 4). Writing on a tape is possible only when the reel contains a file protection ring. Reading from the tape is possible with or without the ring. Removal of the file protection ring after writing avoids loss of valuable records due to accidental rewriting.

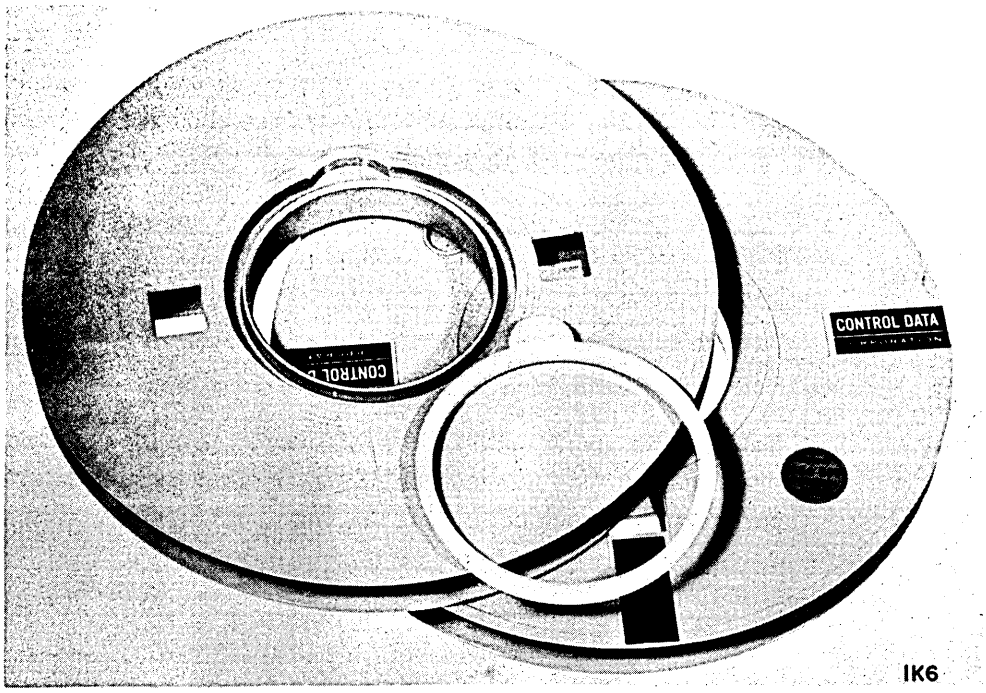


Figure 4. File Protection Ring

Program Protection

The 1700 I/O system has a program protect feature which reserves protected equipment for use by protected programs. A 608 or 609 Tape Transport is protected by setting the PROGRAM PROTECT switch on the 1732 controller chassis which corresponds to the setting of its Unit Select switch. When its PROGRAM PROTECT switch is set, all instructions for that tape transport (except the two status requests) are rejected if their Program Protect bit is not set or the 1704 protect system is not enabled. To explain in more detail:

1) A protected program may select any unit that is physically in the system, loaded, under external control, and Not Busy.

2) An unprotected program cannot select a tape unit whose switch is in the protected position.

After an attempt by an unprotected program to select a protected transport, the status is:

1) Not Ready, Protected - No tape transport is selected and the requested transport is protected. Any previously selected transport is unprotected and is now deselected.

2) Ready, Protected - The previously selected tape transport is still selected. Once selected, a protected transport can be deselected only by using an Output from A instruction whose Program Protect bit is set to initiate either a Deselect Tape Unit function or a new Select Tape Unit function.

PROGRAMMING

Summary of Programming Information

Tables 2 through 5 and Figures 5, 6, and 7 provide the experienced programmer with the information necessary to program the 1732. The following paragraphs further define this information.

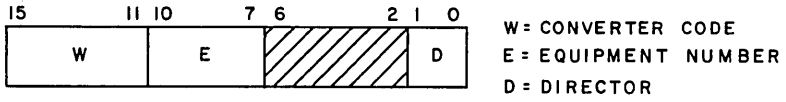


Figure 5. Format of Q Register

TABLE 2. 1732 OPERATIONS

D	COMPUTER INSTRUCTION	
	Output from A	Input to A
00	Write	Read
01	Control Function	Director Status 1
10	Unit Select	Director Status 2

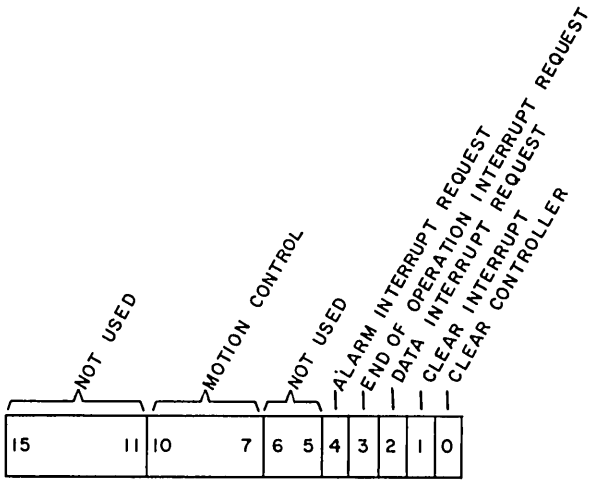


Figure 6. (A) for Control Function

TABLE 3. MOTION CONTROL

BITS 10-7 OF A	MOTION FUNCTION
0001	Write Motion
0010	Read Motion
0011	Backspace
0101	Write File Mark/Tape Mark
0110	Search File Mark/Tape Mark Forward
0111	Search File Mark/Tape Mark Backward
1000	Rewind Load
1100	Rewind Unload

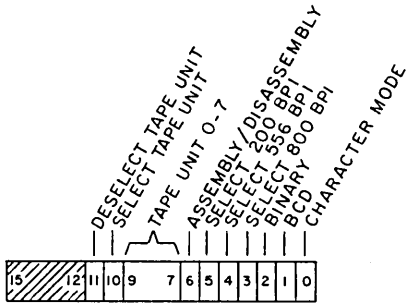


Figure 7. (A) for Unit Select

TABLE 4. DIRECTOR STATUS 1 RESPONSE BITS

BIT SET IN A REGISTER	MEANING
0	Ready
1	Busy
2	Interrupt
3	Data
4	End of Operation
5	Alarm
6	Lost Data
7	Protected
8	Parity Error
9	End of Tape
10	Load Point
11	File Mark
12	Controller Active
13	Fill
14 - 15	(Not Used)

TABLE 5. DIRECTOR STATUS 2 RESPONSE BITS

BIT SET IN A REGISTER	MEANING
0	556 bpi
1	800 bpi
2	(Not Used)
3	Seven Track
4	Write Enable
5-15	(Not Used)

Addresses

The W = 0 signal plus bits 10-7 of the Q register are used to select the desired 1732. If the 1732 is connected via the A/Q Channel, the W field of Q is always loaded with zeros. If the 1732 is connected to a converter, the converter code is placed in the W field, but the converter supplies the W = 0 signal to the controller. Bits 0-1 of Q are used to specify an operation. Figure 5 illustrates the format of the Q Register. Table 6 lists the values of E required to select a controller with a given equipment number setting.

TABLE 6. CONTROLLER SELECT CODES

E (BITS 10-7 OF Q)	EQUIPMENT NUMBER	E (BITS 10-7 OF Q)	EQUIPMENT NUMBER
0000	0	1000	8
0001	1	1001	9
0010	2	1010	A
0011	3	1011	B
0100	4	1100	C
0101	5	1101	D
0110	6	1110	E
0111	7	1111	F

Bits 10-7 of the A register are used along with the contents of Q and Output from A to select a tape transport. (See Unit Select.)

Operations

The D field of Q is combined with a 1704 Input from A or Output from A instruction to specify an operation (see Table 2). The operations initiated by an Output from A may be further modified by the contents of the A register. See Table 3, Figure 6, and Figure 7. The following paragraphs define these operations.

Operations Defined by Q and Output from A

Write: A Write transfers data from the computer to the controller which generates a parity bit and writes the data plus parity bit on the tape. To perform a Write, load Q with W = 00*, E = equipment number setting of desired 1732 controller and D = 00. An Output from A instruction initiates the transfer of the computer word to the tape.** Any number of consecutive characters sent to the tape are written (along with a parity bit) on the tape as a single record. Whenever the computer breaks the continuity of the computer word outputs, the controller initiates an End of Record sequence. The End of Record sequence leaves three blank character spaces, writes the cyclic code word, leaves three more spaces, writes the longitudinal parity check character, and leaves a record gap.

*W is written as two digits; the left, binary; the right, hexadecimal. If the 1732 is connected to the computer via a converter, W equals the appropriate converter code. See the reference material for that converter.

**If the Output is a buffered output via the converter, the Output from A instruction supplies address information to the converter. The converter controls the buffered operation.

If no new Control Function is received from the computer, tape motion stops. A Write is rejected if Not Ready or Write Motion has not been initiated.

Control Function: The Control Function operation specifies operating conditions for the selected controller and transport and initiates tape motion. To perform a Control Function, load Q with W = 00, E = equipment number, and D = 01. Load A according to Figure 6 and Table 3. Execute an Output from A.

The controller rejects control functions if it is Not Ready, the End of Operation status condition is not present, an illegal code exists in bits 7-10 of A, or if the tape transport is Busy and Rewind or Rewind Unload function is selected.

Table 3 lists the legal motion control codes. One motion control plus any or all clears and interrupt selections may be selected simultaneously or individually. The requests are honored in this order: clears, interrupt selections, motion control. The following describes these codes:

1) Clear Controller (A0 = 1) - directs the clearing of all interrupts, interrupt selections, errors, and File Mark/Tape Mark status. All other select codes coded with it will also be honored. For example, A = 0011 would clear the controller and the select interrupt on end of operation.

2) Clear Interrupt (A1 = 1) - clears all interrupts and interrupt requests. If an interrupt request is coded along with a Clear Interrupt, that selection is honored, but any previous selections are cleared.

3) Data Interrupt Request (A2 = 1) - causes an interrupt to be generated when an information transfer may occur. The interrupt response is cleared by the Reply to the data transfer. The request and response are cleared by a Clear Controller or a Clear Interrupt code.

4) End of Operation Interrupt Request (A3 = 1) - causes an interrupt to be generated at the end of an operation. The request and response are cleared by a Clear Controller or a Clear Interrupt code.

5) Alarm Interrupt Request (A4 = 1) - causes an interrupt to be generated upon a condition which warrants program or operator attention. The Alarm interrupt is generated by any of the following conditions:

    a) End of tape

    b) Parity error

    c) Lost data

d) File mark/tape mark, or

e) The transport goes to Not Ready during an operation.

6) Write Motion (A10-7 = 0001) - initiates write motion. A direct or buffered output must follow for data transfer to occur. If the tape is at load point, the first word is written 3 inches after load point. All data requests are rejected while the unit is Busy and before End of Operation status. For a non-stop Write, initiates a Write Motion or Write File Mark function within 5 ms after End of Operation status/ interrupt.

   If Write Motion is selected and no data transfer follows, the controller locks out and terminates the Write Motion function when it is time to write the first character on tape. Forward drops to the selected transport and the transport goes Not Busy after 4 ms but no End of Operation is generated. To recover from this error condition, a Unit Select or Clear Controller function can be issued to accept another motion function. An External Master Clear from the 1700 console will also reset End of Operation.

7) Read Motion (A10-7 = 0010) - initiates read motion. A direct or buffered input must follow for data transfer to occur. If the tape is at load point, data can be read within 0.5 inch. CDC tape does not have information this close to the load point, but other formats do. All data requests are rejected while the unit is Busy and before End of Operation status. Read motion terminates by absence of data from the data handler for three frames. If the computer (or converter) stops requesting characters, data transfer stops, but the tape continues to move to the end of the record. For a non-stop Read, initiate a Read Motion within 4 ms after End of Operation status/interrupt. If a data transfer request is not received by the controller in time to complete the transfer properly, a lockout prevents further transfers from the block and all subsequent data transfer requests are rejected. When data is read but not accepted by the computer, the Lost Data status bit is set if Data Request is late and data overlaps in O register.

8) Backspace (A10-7 = 0011) - moves tape backward one record. Backspace from load point and non-stop backspace and possible.

9) Write File Mark/Tape Mark (A10-7 = 0101) - moves tape forward approximately 6 inches and writes a 1-character word of 17_8 (File Mark) in a 608 or a 23_8 (Tape Mark) in a 609. The normal End of Operation sequence follows the Tape Mark/File Mark, writing the longitudinal check character. When the transport is operating in binary mode, the File Mark registers a parity error.

10) Search File Mark/Tape Mark Forward (0110) - moves tape forward until a File Mark or Tape Mark is detected; an end of operation is generated and tape motion stops.

11) Search File Mark/Tape Mark Backward (0111) - moves tape backward until a File Mark or Tape Mark is detected. When it has been detected, an end of operation is generated, and tape motion stops. If no file mark or tape mark is detected, an end of operation will be generated and motion will stop at load point.

12) Rewind Load (A10-7 = 1000) - rewinds tape at high speed to load point. The controller remains Busy until tape is positioned at load point and End of Operation status/interrupt occurs.

13) Rewind Unload (A10-7 = 1100) - rewinds tape to load point. The tape transport becomes Not Ready upon acceptance of the command. Manual intervention is required to reload the tape and place the transport in a Ready condition.

Unit Select: A Unit Select selects a tape transport and its operating conditions or deselects a transport. To perform a Unit Select, load Q with W = 00, E = equipment number, D = 10. Load A according to Figure 7 and Table 7, and do an Output from A. Tape unit, density, and mode (BCD or binary) can be selected simultaneously or individually. Unit Select is rejected if Controller Active or a program protect fault occurs or if an illegal code is selected (for example, two densities chosen).

TABLE 7. TAPE UNIT SELECT CODES

BITS 9-7 OF A	UNIT SELECT SWITCH SETTING
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

1) Character Mode (A0 = 1) - In this mode the computer word consists of the lower 6 or 8 bits only.

2) BCD (A1 = 1) - Data is read or written in even parity (608).

3) Binary (A2 = 1) - Data is read or written in odd parity.

4) 800 bpi (A3 = 1) - Data is recorded at a density of 800 bits per inch.

5) Select 556 bpi (A4 = 1) - Data is recorded at a density of 556 bits per inch.*

6) Select 200 bpi (A5 = 1) - Data is recorded at a density of 200 bits per inch.*

7) Assembly/Disassembly Mode (A6 = 1) - In this mode the computer word consists of 12 or 16 bits which, during a write, are disassembled into two 6-or 8-bit tape words. During a Read, the tape words are assembled into the original computer word.

8) Tape Unit 0-7 (A9 - 7) - This code matches the Unit Select setting of the desired transport.

9) Select Tape Unit (A10 = 1) - This code and bits 9-7 of A select a tape transport.

10) Deselect Tape Unit (A11 = 1) - This bit disconnects a tape transport that is selected and protected, thus allowing an unprotected program access to the controller. Deselect Tape Unit must be a singular type function.

Operations Defined by Q and Input to A

Read: A Read operation transfers data from tape to the computer and checks parity. To perform a Read, load Q with W = 00, E = equipment number, and D = 00. An Input to A initiates the transfer of one 6-, 8-, 12- or 16-bit character to the lower bits of A.**

The controller transfers characters to the computer until the computer (or converter) stops requesting characters, or until the controller senses the end of a record. If the computer stops requesting characters, data transfer to the computer stops, but tape motion continues until the end of the record. If a new Read Motion function is received by the controller before tape motion stops at the end of a record, motion continues in a non-stop read.

*Not used with 609 Tape Transport.

**If the input is a buffered input via the converter, an Output from A supplies address information to the converter. The converter controls the buffered operation. The controller loads each tape word into the buffer area.

Director Status 1: Director status 1 is a status request which loads into the A register a status reply word showing the current operating conditions of the 1732. The request is initiated by loading Q with W = 00, E = equipment number, D = 01, and executing an Input to A. Table 4 describes the contents of A register following the execution of this function. The Status Response section defines these bits.

Director Status 2: Director Status 2 is a status request which loads the A register a status reply word showing the static operating conditions of the 1732. The request is initiated by loading Q with W =00, E = equipment number, D = 10, and executing an Input to A. Table 5 describes the contents of A register following the execution of this function. The Status Response section defines these bits.

Status Response

Director Status 1

Table 4 lists the meaning of bits set in the A register following a status requset for operating conditions. These bits are further defined below.

Ready (A0 = 1): The tape transport is connected to the equipment and the tape system can perform on command.

Busy (A1 = 1): Equipment is in operation. The 1732 becomes Busy before a Reply is returned if a function can be performed.

Interrupt (A2 = 1): An interrupt condition exists and interrupt upon this condition has been selected. This bit is cleared when the interrupt is cleared.

Data (A3 = 1): A read/write data transfer can now be performed. It is cleared by a data transfer request.

End of Operation (A4 = 1): A new tape function can now be accepted. This bit sets at the completion of all tape motion functions except Rewind Unload.

Alarm (A5 = 1): This status bit monitors those conditions requiring the attention of the program or the operator. The following conditions set this bit as well as their own status bit:

1) End of Tape,
2) Parity Error,
3) Lost data,
4) Ready, i.e., change in Ready status is sensed at a time other than a Unit Select operation, or
5) File mark/Tape mark.

Lost Data (A6 = 1): The Data Transfer register was not empty when a new frame of data was received from the tape transport. This status bit sets only during a Read operation. A Lost Data condition causes all further data requests to be rejected and the Data interrupt to be disabled. Parity status is valid at the end of operation. A new Control Function or a new Unit Selection can be used to clear the Lost Data condition.

Protected (A7 = 1): The PROGRAM PROTECT switch of the selected tape transport is enabled.

Parity Error (A8 = 1): An error was detected during data transfer or the controller has written a file mark or done a Read operation in the wrong mode. The parity check is complete and Parity Error status is valid at end of operation. Parity is not checked on backspace. This condition responds to transverse, longitudinal, and cyclic redundancy parity errors.

End of Tape (A9 = 1): An end of tape marker has been sensed.

Load Point (A10 = 1): The tape load point has been sensed.

File Mark/Tape Mark (A11 = 1): A file mark or tape mark has been sensed.

Controller Active (A12 = 1): 1732 is Active controlling tape motion. Controller remains active approximately 5.5 ms after End of Operation following a Write or Write File Mark/Tape Mark operation, approximately 4 ms after an End of Operation following a Read or a Search File Mark/Tape Mark operation, and approximately 6 ms (609) or 9.5 ms (608) after an End of Operation following a backspace or Search File Mark/Tape Mark backward.

Fill (A13=1): If an odd number of tape words is read, this status will be set to indicate that the lower portion of the word read is not a tape word. It clears on New Function Clear, Clear Controller, Master Clear or Unit Clear.

Director Status 2

Table 5 lists the meaning of bits set in the A register following a status request for static operating conditions. These bits are further defined below.

556 bpi (A0 = 1): The selected tape unit is set to operate at a density of 556 bits per inch.

800 bpi (A1 = 1): The selected tape unit is set to operate at a density of 800 bits per inch. If bits 0 and 1 of A are "0", the tape is selected to operate at a density of 200 bits per inch.

Seven Track (A3 = 1): The selected tape unit is in 7-track mode. This bit should always be set when a 608 is selected and never be set when the 609 is selected.

Write Enable (A4 = 1): The file protect ring is in the supply reel and the tape has been loaded. Write operations may now be performed.

Interrupts

Interrupts are selected by the Control Function. They may be cleared by:

1) Issuing an Interrupt Clear which clears both the interrupt request and the interrupt.
2) Re-issuing the interrupt request except for the Alarm interrupt when the Alarm condition still exists, e.g., end of tape.
3) Issuing a Clear Controller.
4) Transferring data in the case of the data interrupt.
5) Reselecting a unit.

Programming Example

This sample program performs the following:

1) Connects Equipment 1, Unit 1.
2) Selects Binary mode, 556 bpi.
3) Writes a 200-word record of all "1's".
4) As soon as Busy drops, backspaces one record.
5) Reads the 200-word record and stores the data in 200 successive memory locations.

SAMPLE PROGRAM

Hexa-decimal Address	Machine Code	Assembly Language			Comments	Step
0000 P	E000	A	LDQ	=N$0082	Connect Equipment 1	00001
0001 P	0082					
0002 P	C000		LDA	=N$04D4	Select Unit 1, 556 bpi, Binary Mode, Assembly/ Disassembly	00002
0003 P	04D4					
0004 P	0302		OUT	A1-*-1		00003
0005 P	1804		JMP*	A2	Reply	00004
0006 P	0000				INTERNAL REJECT	00005
0007 P	0000	A1			EXTERNAL REJECT	00006
0008 P	18F7		JMP*	A	Try Again to Connect	00007
0009 P	E000	A2	LDQ	=N$0081	Equipment 1	00008
000A P	0081					
000B P	C000		LDA	=N$0080	Select Write Function	00009
000C P	0080					
000D P	0302		OUT	A3-*-1		00010
000E P	1804		JMP*	A4	Reply	00011
000F P	0000				INTERNAL REJECT	00012
0010 P	0000	A3			EXTERNAL REJECT	00013
0011 P	18F7		JMP*	A2	Reselect Write Function	00014
0012 P	C000	A4	LDA	=N-200	200-Word Counter	00015
0013 P	FF37					
0014 P	60FF		STA-	I		00016
0015 P	E000	A5	LDQ	=N$0080	Equipment 1	00017
0016 P	0080					
0017 P	C000		LDA	=N$FFFF	Pattern of All 1's	00018
0018 P	FFFF					
0019 P	0305		OUT	A6-*-1	Write 200-Word Record	00019
001A P	D0FF		RAO-	I		00020
001B P	C0FF		LDA-	I	Check Counter	00021
001C P	0104		SAZ	A7-*-1		00022
001D P	18F7		JMP*	A5		00023
001E P	0000				INTERNAL REJECT	00024
001F P	0000				EXTERNAL REJECT	00025
0020 P	18F4		JMP*	A5		00026
0021 P	18F4	A7	LDQ	=N$0081	Equipment 1	00027
0022 P	0081					
0023 P	0205		INP	A8-*-1	Input Status	00028
0024 P	A000		AND	=N$2	Check Busy	00029
0025 P	0002					

Hexa-decimal Address	Machine Code	Assembly Language			Comments	Step
0026 P	0104		SAZ	A9-*-1	Not Busy	00030
0027 P	18F9		JMP*	A7	Loop On Busy	00031
0028 P	0000				INTERNAL REJECT	00032
0029 P	0000	A8			EXTERNAL REJECT	00033
002A P	18F6		JMP*	A7	Re-Status	00034
002B P	E000	A9	LDQ	=N$0081	Equiment 1	00035
002C P	0081					
002D P	C000		LDA	=N$0180	Backspace	00036
002E P	0180					
002F P	0302		OUT	A10-*-1		00037
0030 P	1804		JMP*	A11	Reply	00038
0031 P	0000				INTERNAL REJECT	00039
0032 P	0000	A10			EXTERNAL REJECT	00040
0033 P	18F7		JMP*	A9	Re-Function	00041
0034 P	E000	A11	LDQ	=N$0081	Equipment 1	00042
0035 P	0081					
0036 P	C000		LDA	=N$0100	Select Read Function	00043
0038 P	0302		OUT	A12-*-1		00044
0039 P	1804		JMP*	A13	Reply	00045
003A P	0000				INTERNAL REJECT	00046
003B P	0000				EXTERNAL REJECT	00047
003C P	18F7		JMP*	A11	Reselect Read Function	00048
003D P	C000	A13	LDA	=N-200	200-Word Counter	00049
003E P	FF37					
003F P	60FF		STA-	I		00050
0040 P	E000	A14	LDQ	=N$0080	Equipment 1	00051
0041 P	0080					
0042 P	0207		INP	A13-*-	Input Data to A	00052
0043 P	6900		STA	DATA+200, I	Store Data at Data Block	00053
0044 P	00D1					
0045 P	D0FF		RAO-	I		00054
0046 P	C0FF	LDA-	I	Check Counter		00055
0047 P	0104		SAZ	A16-*-1		00056
0048 P	18F7		JMP*	A14		00057
0049 P	0000				INTERNAL REJECT	00058
004A P	0000				EXTERNAL REJECT	00059
004B P	18F4		JMP*	A14		00060
004C P	0000	A16	SLS	O	STOP	00061
004D P	00C8		BZS	DATA (200)	Data Block	00062
			END			00063

SYMBOL TABLE

A10	0032	P	A11	0034	P	A12	0038	P	A13	003D	P	A14	0040	P	A15	004A	P	A16	004C	P
A1	0007	P	A2	0009	P	A3	0010	P	A4	0012	P	A5	0015	P	A6	001F	P	A7	0021	P
A8	0029	P	A9	002B	P	A	0000	P	DATA	004D	P	I	00FF							

MANUAL OPERATION

Switches and Indicators

1732 Switches and Indicators

Equipment Number Switch: This 16-position switch selects the address number of the controller. It is located on the controller chassis and can be found by opening the back door of the controller cabinet.

PROGRAM PROTECT Switches: These eight toggle switches, one for each tape transport, select the Program Protect condition for that transport.* These switches are located beside the Equipment Number switch.

TEST MODE Switch: This switch,located on the controller chassis beside the PROGRAM PROTECT switches, activates the controller test mode. Test mode provides the means for checking the hardware which generates the cyclic redundancy character. This feature is intended for checkout and diagnostic purposes only, and care should be taken to deactivate the TEST MODE switch (down position) before attempting normal operation.

Controller Power On Switch: This switch, located on the power supply, applies power to the controller power supply and blower.

CONNECT Indicator: This indicator lights when the controller is connected and has selected a tape unit. It is located on the front indicator panel of the controller cabinet.

PROTECT Indicator: This indicator lights when a protected tape transport is selected.

*See Program Protection.

BCD/PE Indicator: The BCD half of this indicator lights when BCD (even parity) is selected. The PE half lights when a parity error occurs.

608/609 Switches and Indicators

The Operator Control Panel Contains the following switches and indicators.

POWER Switch: Applies/removes power from all tape transport components. When lighted, power is on.

WRITE ENABLE Indicator: This indicator lights when write ring is installed in tape reel.

READY Switch/Indicator: This switch places the tape transport under external control. It is lighted when under external control.

CLEAR Switch/Indicator: CLEAR master clears all previous tape transport settings and conditions. When lighted, it indicates a clear or fault condition.

LOAD Switch/Indicator: The LOAD switch loads tape into loop box vacuum columns and moves tape forward until the load point marker is sensed. The indicator shows that tape is at the load point.

REWIND Switch/Indicator: This switch moves tape in reverse at high speed (150 ips) until load point marker is sensed. It lights during the high speed tape movement.

200 Switch/Indicator*: This switch selects density of 200 bpi, and indicator shows this density is selected.

556 Switch/Indicator*: This switch selects density of 556 bpi, and indicator shows this density is selected.

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*608 Tape Transport only.

800 Switch/Indicator: This switch selects density of 800 bpi and lights to show that this density is selected.

UNIT SELECT Switch: This switch assigns an address designation to the tape transport for external control.

The Maintenance Panels (front and rear) contain the following.

FORWARD Switch: FORWARD moves tape forward at normal speed of 37-1/2 inches per second.

CLEAR Switch: This switch master clears all previous tape transport settings and conditions.

REVERSE Switch: REVERSE moves tape in reverse at normal speed.

LEVEL Switch: (rear maintenance panel only) This switch increases or decreases read clipping level voltage by percentage shown at various switch positions.

The following are found on the Power Supply Panel.

COOLING FAN Circuit Breaker: This provides overload protection for the cooling blower motor.

CAPSTAN MOTOR Circuit Breaker: This provides overload protection for the capstan and rewind motors.

MAIN POWER Circuit Breaker: This protects the power supply from overload.

MAIN POWER Indicator: This shows that line power is supplied to the power supply.

-20 and +20 Circuit Breakers: These provide overload protection for the respective dc circuits.

PNEUMATIC MOTORS Circuit Breaker: These provide overload protection for the rotary pump motor and loop box vacuum pump.

-20, +20 and GRD Test Jacks: These are connection points for monitoring the respective dc voltages.

Operating Procedures

Power Application

1) Open the rear door of tape transport.
2) Turn on all circuit breakers.
3) Close rear door of tape transport.
4) Check that Unit Select switch on operator control panel is in desired position.
5) Press POWER switch on operator control panel.

Tape Loading Procedure

1) Press down on top of window assembly to open.
2) Check that the reverse reel (supply reel) has a write ring if a Write operation is to be performed. Remove the ring for a Read operation.

CAUTION

Make sure that valuable information has not been stored on the reel before using it for Write operation.

3) Place the reverse reel on the reel hub. Press the reel against the hub stop and close the reel knob latch.
4) Check that the pad is not under the head assembly. If necessary, press down on the shield arm assembly handle until it latches.
5) Unwind about 4 feet of tape from the reverse reel. Thread tape along the tape path as follows:

a) Place the tape under the tape guide that is located near the reverse reel and then over the top of the head assembly.

CAUTION

The first few feet of tape become extremely dirty due to repeated handling. Avoid contamination of the head assembly by keeping this portion of the tape away from the head assembly.

b) Place the tape under the tape guide that is located near the forward reel and then thread onto the forward reel.

c) Hold the end of the tape in place and turn the forward reel clockwise until tape-to-tape contact is made on the forward reel. Continue winding a few more feet of tape onto the forward reel.

NOTE

Wind sufficient tape onto the forward reel to allow for loading the vacuum column. Do not allow the load point reflective marker to move beyond the sensor.

d) Slide the tape under the head assembly.

e) Take up the tape slack by turning the forward reel clockwise.

6) Press the shield arm assembly release lever. The pad should move up, contacting the tape and the head assembly.

7) Close the window assembly.

8) Press the LOAD switch on the operator control panel. If a write ring is installed in the reverse reel, the WRITE ENABLE indicator on the operator control panel should light. Tape should be drawn into the vacuum columns and move forward until the load point reflective marker is sensed. When tape stops at load point, the LOAD indicator on the operator control panel should light.

Local Operation

1) Apply power and load tape.

2) Press the FORWARD switch on either the front or rear maintenance panel. Tape should move forward.

3) Press the REVERSE switch on either the front or rear maintenance panel to move tape in reverse.

4) Press the CLEAR switch on either the front or rear maintenance panel or the operator control panel to stop forward or reverse tape motion.

External Operation

1) Apply power and load tape.

2) Press the READY switch on the operator control panel. The READY indicator on the operator control panel should light. The tape transport is now under external control.

Unload Tape Procedure

1) Press either CLEAR switch to stop tape motion and to remove the Ready Condition.

2) Press the REWIND switch on the operator control panel. The REWIND indicator on the operator control panel should light and tape should move in reverse at high speed until it stops at load point.

3) Again press the REWIND switch. Tape should completely unwind from the forward reel and drop into the vacuum column.

4) Open the window assembly. Manually wind the remaining tape onto the reverse reel.

5) Raise the reel knob latch and remove the reverse reel.

6) Remove the write ring from the tape reel if recorded information is to be preserved. Label the tape reel to ensure that information is not destroyed.

Power Removal

1) Press the POWER OFF switch on the operator control panel. The POWER indicator should go out.

2) Open the rear door of the tape transport. Turn off the MAIN POWER circuit breaker.

Application of Reflective Marker

Reflective markers are required near the beginning of the tape (load point marker) and near the end of the tape (end-of-tape marker). These markers

are plastic strips coated on one side with vaporized aluminum and on the other with adhesive, and should be 1 inch long and 3/16 inch wide. They are placed on the uncoated side of the tape.

Positioning: The load point marker is placed at least 10 feet from the beginning of the tape with the 1-inch dimension parallel to and not more than 1/32 inch from the track 0 edge of the tape (the edge nearer the operator when the reel is mounted).

The end-of-tape marker is placed at least 18 feet from the end of the tape when the tape is on the take-up reel. The 1-inch dimension should be parallel to and not more than 1/32 inch from the track 6 (608) edge of the tape (the edge nearer the unit when the reel is mounted).

Precautions:

1) Avoid tape contamination and/or damage.
2) Perform work on a flat stationary surface.
3) Align marker properly.
4) Remove all air bubbles and excess adhesive.

COMMENT SHEET

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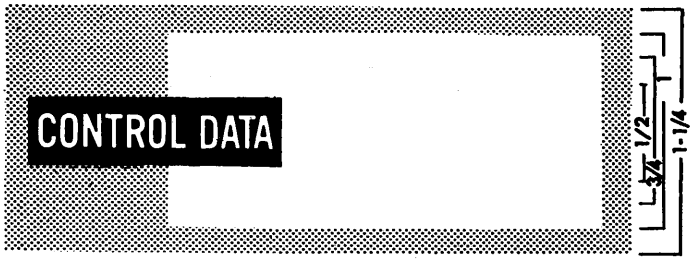

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