89638000

CONTROL DATA CORPORATION

CONTROL DATA®
SYSTEM 17
CARTRIDGE DISK DRIVE CONTROLLER

GENERAL DESCRIPTION
OPERATION AND PROGRAMMING

REFERENCE MANUAL

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or use Comment Sheet in the back of this manual.

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INTRODUCTION

The CONTROL DATA® 1733-2 Cartridge Disk Drive Controller acts as the controlling link between the CDC 1784 Computer and up to four 856-2 or 856-4 Cartridge Disk Drives (CDD). The 1733-2 Controller is accommodated in the 1784 Computer main enclosure. Any combination of versions of the 856-2 and 856-4 CDD's can be controlled. The 856-2 and 856-4 CDD's may have both a fixed disk as well as the standard removable (cartridge) disk, giving total capacity of 2.2 and 4.4 million words respectively.

The controller interfaces the computer and disk drives. It controls input/output operations using programmed instructions from the computer. The controller consists of logic circuitry mounted on five 50-PAK printed wiring boards, which are mounted inside the 1784 Computer main enclosure.

SYSTEM CONFIGURATION

The relationship between computer, disk drive units and controller is shown in Figure 1-1.

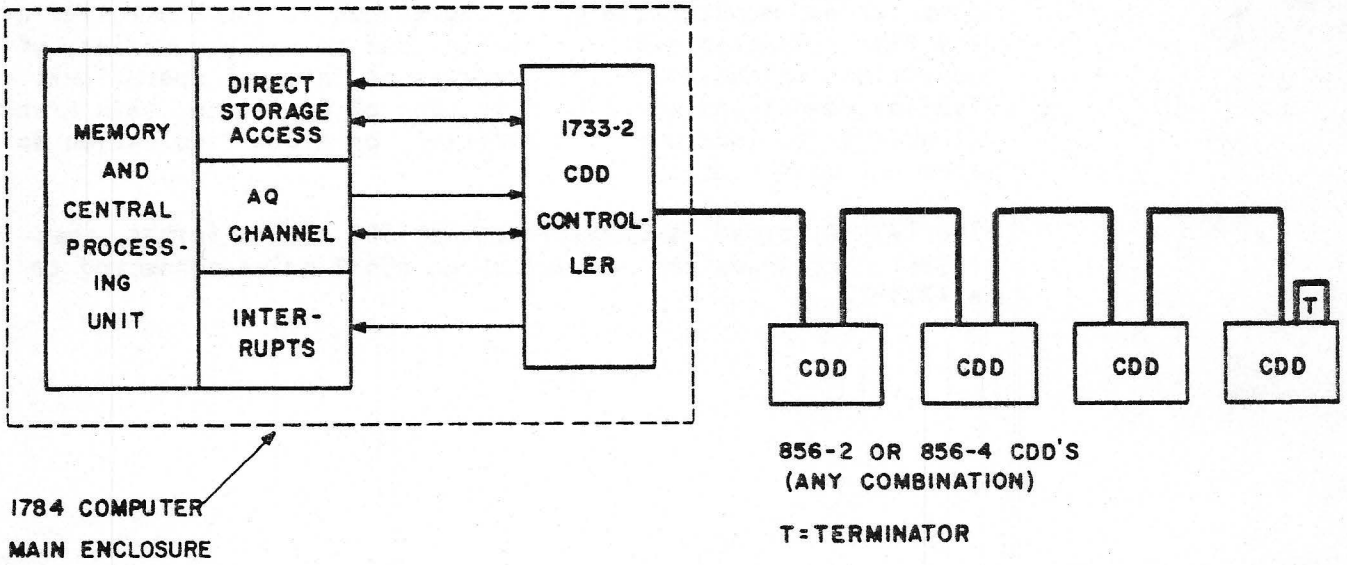


Figure 1-1. System Configuration

CONTROLLER OPERATIONS

The controller interfaces the computer AQ and DSA channels, and the drive. It translates function codes, transfers data, transmits status, and controls drive operations. The controller responds to function codes in the computer AQ channel registers which direct controller operations. It accepts data in parallel format from the computer DSA channel and transmits it serially to the selected drive. Similarly, the controller takes serial data from the drive and assembles it into 16-bit words which are transferred in parallel to the computer. During input/output data transfer (read or write), operations with the DSA proceed independently of computer control once they are established. The starting location and size of a data record are specified by the computer program. The controller then increments addresses and decrements the word count as each data word is transferred. When the word count equals zero the operation ends. The Cylinder Address of a data operation may begin where a previous operation (Read, Write, Checkword Check, Compare, or Load Address) ended, or it may begin at a new cylinder address. This cylinder address when transmitted to the drive, causes movement of the file positioner to the new address location.

The controller can be conditioned to compare data stored on the disks with the contents of computer storage (Compare) and to perform a separate check of the accuracy of data already written (Checkword Check). The controller will accept functions if the required conditions are present: Ready, Not Busy, On Cylinder, and if the Protect conditions are met. The computer may monitor the operating status of the controller at any time. Sixteen status bits are used to sense a variety of conditions which sample the progress of internal operations. Typical conditions would be Busy, End of Operation, Seek Error (inability to locate a file address), or Alarm (indication an abnormal condition).

The 1733-2 format is compatible with CDC 1739-1 format, that is, 1739-1 cartridges can be read by an 856-2 drive connected to a 1733-2.

Record Addressing

Addressing of the records is under program control. Records within the file are accessed by a 16-bit File Address Word sent to the drive via the AQ channel. The address word is divided into four parts, the sector, disk, surface and cylinder. Bits 0 through 4 designate one of the 29 sectors within a track. Bit 5 designates either a fixed (bit 5 = 1) disk, or the removable (bit 5 = 0) cartridge disk, and bit 6 specifies one of two surfaces in a cylinder (bit 6 = 0 specifies "top" surface; bit 6 = 1 specifies "bottom" surface). Bit 7 through 15 designates one of 406 cylinders within a disk. The File Address Word format is shown in Figure 1-2.

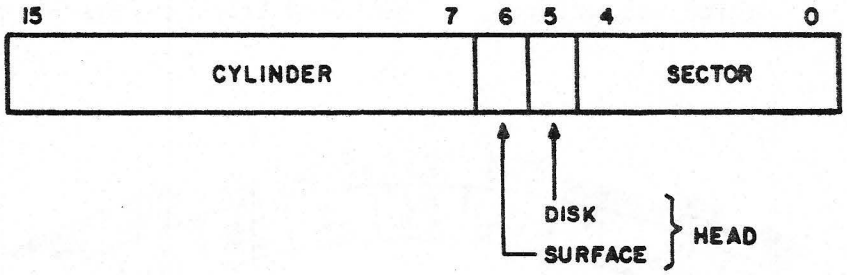


Figure 1-2. File Address Word

The file, disk, cylinder, track, and sector are defined as follows:

File - The file is defined as the entire recording surface available in the CDD unit.

Disk - The disk is defined as the entire recording surface on both sides of one disk; either the cartridge disk or the fixed disk.

Cylinder - The cylinder is defined as the recording surface on both surfaces of the cartridge and fixed disk at a given position of the head positioner.

Track - The track is defined as the recording surface under one read/write head at a given cylinder position.

Sector - The sector is defined as one data record and is the smallest addressable section of the file. The sector is 1/29th of a track and contains 1536 data bits or 96 sixteen-bit data words.

The sector includes head gaps and sync patterns in order to synchronize the data between a drive and the controller.

SECTOR FORMAT

The total sector length is 2155 bits of which 1536 bits are data. Bit assignments are as indicated in Figure 1-3.

The head gap is required to allow the current to stabilize after turning on the read/write heads. The sync patterns are written as all zeros except for the least significant bit which is a 1, which denotes the end of the pattern. The sync pattern enables the controller to recognize the start of serial data bits from the drive. The 24-bit Address Format is shown in Figure 1-4. The controller generates and writes a checkword at the end of each address written and also at the end of each data record. The checkword is used during a Read to verify the accuracy of the data previously written. If the checkword does not agree with that which was written, a Checkword Error status bit will be set.

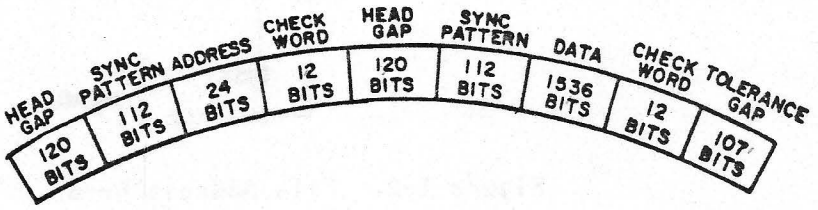


Figure 1-3. Sector Format

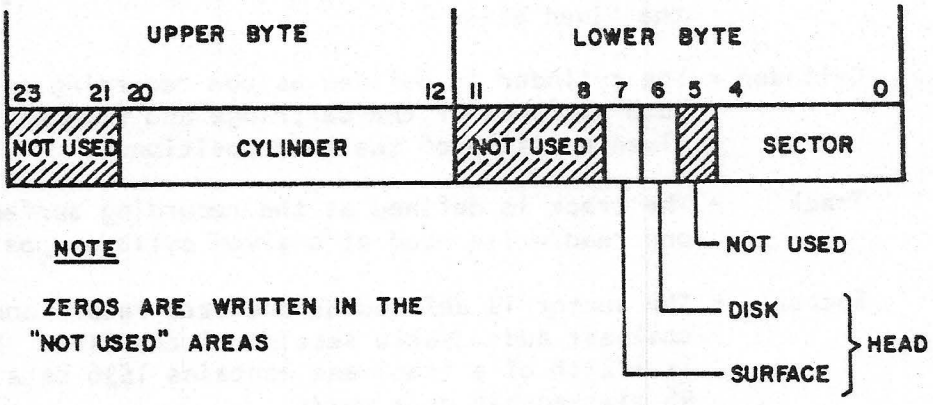


Figure 1-4. Address Format

CHECKWORD

The checkword is a cyclic code generated from the data or address by the controller. The checkword is the remainder which is obtained by dividing the data or the address (which is taken as a code polynomial) by the polynomial:

$$(X^{12} + X^{11} + X^3 + X^2 + X + 1).$$

Example:

1 0 1 ..... 1 1 0 1	Binary data or address record
$X^n + 0 + X^{n-2} \ldots X^3 + X^2 + 0 + 1$	Polynomial representation (where X is a dummy variable)

Record Polynomial

$X^{12} + X^{11} + X^3 + X^2 + X + 1 =$	Quotient Polynomial + Remainder Polynomial = Coefficient of Checkword

These polynomials are treated according to the theorems of ordinary algebra with one exception, addition is done in modulus two.

$1X^a + 1X^a = 0X^a + 0X^a = 0X^a$

$1X^a + 0X^a = 1X^a$, $0X^a + 1X^a = 1X^a$

The generation of the checkword is represented by the diagram in Figure 1-5.

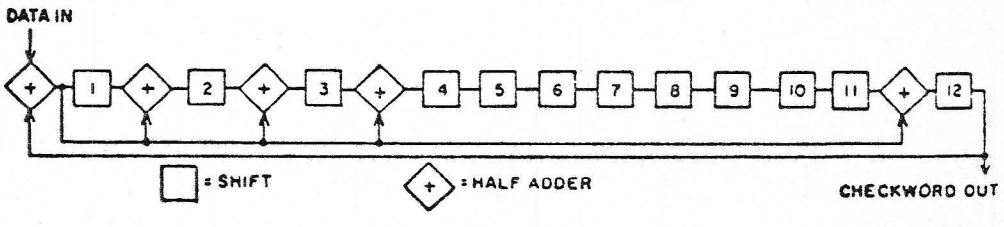


Figure 1-5. Checkword Generation

DISK ORGANIZATION

Refer to Figure 1-6 for view of disk organization.

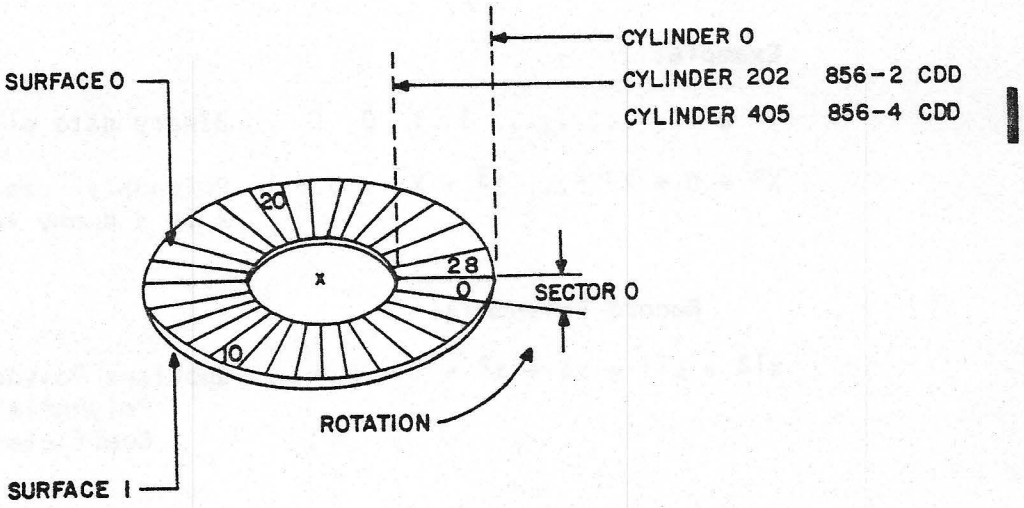


Figure 1-6. Disk Organization

SPECIFICATIONS

STORAGE CHARACTERISTICS

Data format:	16	bits per word
	96	words per sector
	29	sectors per track
	2	tracks per cylinder
856-2 CDD	203	cylinders per disk
856-4 CDD	406	cylinders per disk
	1 (or 2)	disks per drive
	Up to 4	drives

Data Capacity:	1,536	bits per sector	(96 words per sector)
	44,544	bits per track	(2,784 words per track)
	89,088	bits per cylinder	(5,568 words per cylinder)
856-2 CDD	18,084,864	bits per disk	(1,130,304 words per disk)
856-4 CDD	36,347,904	bits per disk	(2,271,744 words per disk)
856-2 CDD	36,169,728	bits per drive (max)	(2,260,608 words per drive)
856-4 CDD	72,695,808	bits per drive (max)	(4,543,488 words per drive)

ACCESS TIME

Head positioning time	35 msec (ave); 70 msec (max)
Cylinder-to-cylinder positioning time	7 msec
Latency time	25.0 msec (one disk revolution)
	12.5 msec (1/2 disk revolution)
Access time (positioning plus latency time)	47.5 msec (ave); 95.0 (max)

TRANSFER RATE

Bit rate	0.4 µsec per bit (2.5 Mega bits/sec)
Word rate	6.4 µsec per 16-bit word (156K words/sec)

INTRODUCTION

Function codes are transmitted via the AQ channel. Bits set in the lower portion (0-2) of the Q register define the contents of the A register. Refer to Figure 2-1. Bits 7 through 10 must match the equipment number setting on the controller. The remaining bits of Q are ignored (should be zero). The function codes are listed in Table 2-1. An AQ channel Read or Write signal indicates an Input or Output to A instruction, respectively. The codes and resulting operations are described in this section.

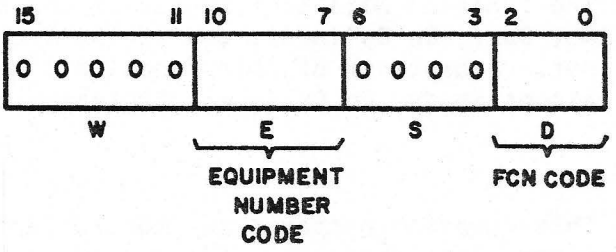


Figure 2-1. Q Register Format

TABLE 2-1. FUNCTION CODES

Value set in Q (Bits 02-00)	Output from A	Input to A
000	Load Buffer	Clear Controller
001	Director Function	Director Status
010	Load Address	Cylinder Address Status
011	Write	Current Word Address Status
100	Read	Checkword Status
101	Compare	Drive Cylinder Status
110	Checkword Check	Illegal
111	Write Address	Illegal

DESCRIPTION OF OUTPUT FROM A FUNCTIONS

A Write signal present on the computer A0 channel defines the contents of A as an Output. The significance of the contents of A varies with the value in bits 00-02 of the Q register as follows:

LOAD BUFFER (000)

This function loads the Buffer Length register in the controller with a 16-bit binary value which defines how many data words will be transferred to or from the file via the DSA channel during a Read, Write, or Compare operation.

The function will be accepted if the controller is Ready, Not Busy, On Cylinder, and if the Protect Conditions are met. Acceptance of this function clears all status bits except Ready, On Cylinder, Protected and Single Density.

DIRECTOR FUNCTION (001)

This function prepares the controller for a data transfer or addressing operation. The contents of the A register determine what conditions will be set in the controller. Refer to Figure 2-2.

A0 - Not Used

A1 = 1 - Clear Interrupt - This bit causes all the interrupt selections to be cleared. This bit is subordinate to the interrupt request bits A02 through A04.

A2 = 1 - Next Ready and Not Busy Interrupt Request - The selection of this request causes the interrupt line to become active when the controller becomes Ready and Not Busy. Note that any of the drives may be busy while seeking.

A3 = 1 - End of Operation Interrupt Request - The selection of this request causes the interrupt to become active when the End of Operation Status bit is set.

A4 = 1 - Alarm Interrupt Request - The selection of this request causes the interrupt line to become active when the alarm status bit is set.

A5 and A6 - Not used

A7 = 1 - Unit De-select. This bit releases the selected drive unit. It is used by a protected program to allow system control to pass to an unprotected program. The protected status is cleared by this bit. The drive remains selected.

A8 = 1 - Unit Select. This bit allows the program to change the drive unit selection. The drive unit selected is determined by bits A9, A10.

A9 = 1 - Unit Select Code. Least significant bit of 2 bit code.

A10 = 1 - Unit Select Code. Most significant bit of 2 bit code.

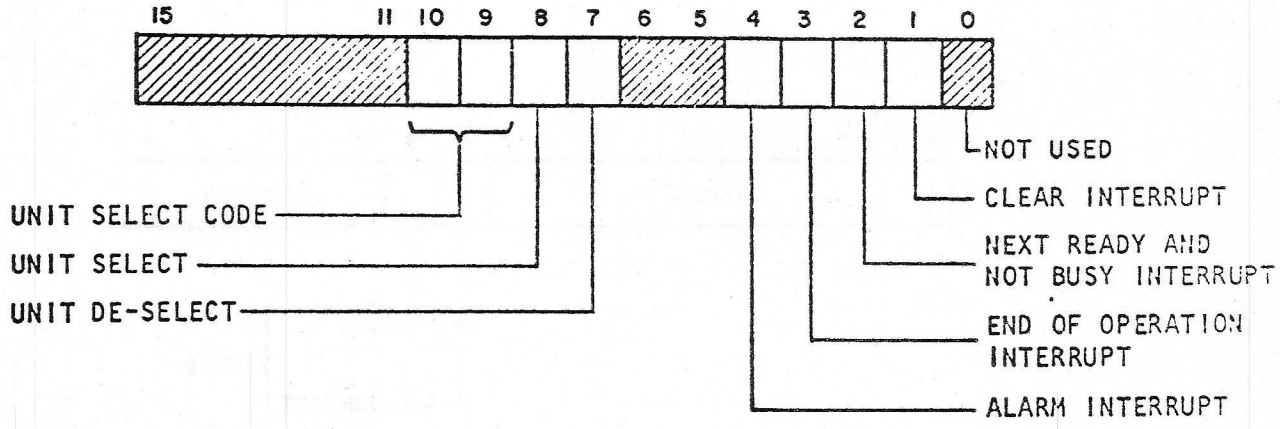


Figure 2-2 - Selectable Interrupt Conditions and Unit Selection

Director Function will be accepted if no Write, Read, Compare, Checkword Check or Write Address is in process on any unit and Protect conditions satisfied for the selected unit. If any unit is positioning, the Director Function will be accepted.

LOAD ADDRESS (010) The Load Address function strobes the cylinder address from A into the drive and loads the surface and disk (head select) bits and sector address from A into the controller. The function initiates the head positioning motion in the file. The only addresses the controller will accept are those between cylinder 0-202 (for 856-2 CDD) and 0-405 (for 856-4 CDD) and sector 0-28. Any other cylinder or sector address will cause the Load Address to be aborted and the Cylinder Address Register will not be modified. Address Error Status will be set. Refer to Figure 2-3.

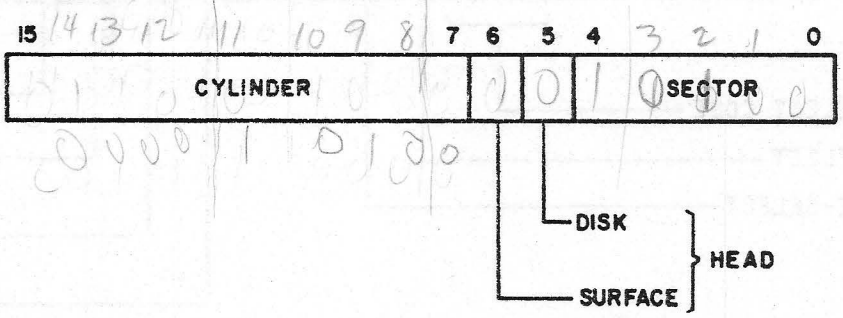


Figure 2-3. Load Address Format

The controller will accept this function if selected unit is Ready, Not Busy, On Cylinder, and if the Protect conditions are met. Acceptance of this function causes the clearing of all status bits except Ready, On Cylinder, Protected and Single Density.

The selected unit (not the controller) becomes Busy upon accepting the function and remains Busy until it completes the movement of the cylinder positioner, at which time it becomes Not Busy. The On Cylinder status bit in the selected unit is cleared when the controller initiates the positioning and remains cleared until the cylinder positioner reaches its new position. The EØP status is set when the drive completes a seek (including First Seek) and the controller is Not Busy.

If the controller receives an address from the computer which is greater than 202 (for 856-2 CDD) or greater than 405 (for 856-4 CDD), it will set the Address Error, End of Operation and Alarm status bits. The controller will not initiate a cylinder movement or change the contents of the Cylinder Address Register.

If the drive unit is unable to obtain the correct cylinder due to a failure of the positioner, or due to a malfunction of the controller, the Drive Seek Error and Alarm status bits will be set when the positioner comes to a halt.

The controller busy status is not set during the Load Address instruction. Thus the Next Ready and Not Busy Interrupt must not be used.

WRITE (011)

The Write function code directs the controller to transfer data from computer storage to file storage via the DSA. The addresses in computer storage are determined as follows:

The A register during the Write function contains the First Word Address of the Buffer area to be used. The Buffer Length register was loaded previously by the Load Buffer function. The First Word Address is loaded into the CWA (Current Word Address) register and determines the computer storage location. The CWA register is incremented and the Buffer Length register is decremented after each word transferred. When the buffer length equals zero, the controller ends the data transfer from computer storage. If the data transfer ends within a sector, the controller fills the remainder of the sector with zeros and then writes the checkword. If the data transfer extends beyond the last sector of the "top" surface, the controller will automatically continue the transfer on the first sector of the "bottom" surface.

If data transfer extends beyond the last sector in a cylinder, the controller will move the cylinder positioner to the next cylinder and continue the transfer there. If transfer is attempted beyond the last cylinder in a disk an address error will occur. No switching from fixed to cartridge or vice versa occurs.

The controller will accept this function if it is Ready, Not Busy, On Cylinder and if the Protect conditions are met. Acceptance of this function causes the clearing of all status bits except Ready, On Cylinder, Protected and Single Density.

The controller becomes Busy upon acceptance of this function and remains Busy until the end of the last sector operated on. The End of Operation status is set 30-50 NSEC after the Busy status is cleared. The File Address status at the completion of this operation is that of the last sector written plus one.

Several abnormal conditions can develop during this operation. Detection of these conditions by the controller causes the operation to end as soon as possible, that is, immediately or at the end of the sector presently operated on (see definition of Alarm status). The abnormal conditions are:

a. Lost Data

b. Address Error

c. Seek Error (Controller or Drive)

d. Storage Parity Error

Detection of any of these abnormal conditions causes the corresponding status bit and the Alarm status bit to set.

Notes: (i) During an overlap seek operation the function will be accepted if the controller and the selected unit are not busy. The controller's data path can only be used by one unit at a time.

(ii) Cylinder address status after End of Operation is next sector address.

READ (100)

The Read function directs the controller to transfer data from file storage to computer storage. The method for obtaining the starting addresses and the buffer length is the same as for the Write function. If data transfer to the computer stops within a sector, the controller continues reading the data until the end of the sector and determines if the checkword is correct.

If the data transfer extends beyond the last sector of the "top" surface, the controller will automatically continue the transfer on the first sector of the "bottom" surface. If the data transfer extends beyond the last sector in a cylinder, the controller moves the cylinder positioner to the next cylinder and continues the transfer there. If transfer is attempted beyond the last cylinder in a disk an address error will occur.

The controller will accept this function if it is Ready, Not Busy, On Cylinder and if the Protect conditions are met. Acceptance of this function causes the clearing of all status bits except Ready, On Cylinder, Protected and Single Density.

The controller becomes Busy upon acceptance of this function and remains Busy until the end of the last sector operated on. The End of Operation status is set 30-50 NSEC after the Busy status is cleared. The File Address status at the completion of this operation is that of the last sector read from plus one.
Several abnormal conditions can develop during this operation. Detection of these conditions by the controller causes the operation to end as soon as possible, that is, immediately or at the end of the sector presently operated on. The abnormal conditions are:

a. Lost Data
b. Address Error
c. Seek Error (Controller or Drive)
d. Protect Fault
e. Checkword Error
f. Storage Parity Error

Detection of any of the abnormal conditions causes the corresponding status bit and the Alarm bit to be set.

Notes: (i) During an overlap seek operation the function will be accepted if the controller and the selected unit are not busy. The controller's data path can only be used by one unit at a time.

(ii) Cylinder address status after End of Operation is next sector address.

COMPARE (101)

The Compare function directs the controller to compare data from computer storage with data read from file storage. Addressing is the same as that for the Write and Read operation. The comparison stops when the computer buffer limits are reached but the controller will read to the end of the last sector compared in. If the data does not compare the No Compare status bit will be set.

The controller will accept this function if it is Ready, Not Busy, On Cylinder, and if the Protect condition are met. Acceptance of this function causes the clearing of all status bits except Ready, On Cylinder, Protected and Single Density.

The controller becomes Busy upon acceptance of this function and remains Busy until the end of the last sector operated on. The End of Operation status is set 30-50 NSEC after the Busy status is cleared. The File Address status at the completion of this operation is that of the last sector read from, plus one.
Several abnormal conditions can develop during this operation. Detection of these conditions by the controller causes the operation to end as soon as possible, that is, immediately or at the end of the sector presently operated on. The abnormal conditions are:

a. Lost Data
b. Address Error
c. Seek Error (Controller or Drive)
d. Checkword Error
e. Storage Parity Error

Detection of any of the abnormal conditions causes the corresponding status bit and the Alarm bit to be set.

Notes: (i) During an overlap seek operation the function will be accepted if the controller and the selected unit are not busy. The controller's data path can only be used by one unit at a time.

(ii) Cylinder address status after End of Operation is next sector address.

CHECKWORD CHECK (110) The Checkword Check function directs the controller to read all of the sectors in the track specified by the Cylinder Address register. No data is transferred to or from computer storage. Data is simply read from the 29 sectors into the checkword logic to be checked. The controller will accept this function if it is Ready, Not Busy, On Cylinder, and if the Protect conditions are met. Acceptance of this function causes the clearing of all status bits except Ready, On Cylinder, Protected and Single Density.

The controller becomes Busy upon acceptance of this function and remains Busy until the end of the 29th sector checked. The End of Operation status is set 30-50 NSEC after the Busy status is cleared. The File Address at the completion of this operation is that of sector zero of the track specified.

Several abnormal conditions can develop during this operation. Detection of these conditions by the controller causes the operation to end as soon as possible, that is, immediately or at the end of the last sector in the track. The abnormal conditions are:

a. Address Error
b. Controller Seek Error
c. Checkword Error

Detection of any of the abnormal conditons causes the corresponding Status bit and Alarm bit to be set.

WRITE ADDRESS (111) The Write Address function causes the controller to write the address tags of all the sectors in the track specified by the Cylinder Address register. No data is transferred to or from storage. The address tags and the address-checkword are written sequentially from 0 through 28$_{10}$, starting from the Index Mark. The controller will accept this function if it is Ready, Not Busy, On Cylinder, and if the Protect conditions are met. Acceptance of this function causes the clearing of all status bits except Ready, On Cylinder, Protected and Single Density. The controller becomes Busy upon acceptance of this function and remains Busy until the end of the 29th sector written. The End-of-Operation status becomes active 30-50 Nsec after Busy status is cleared. The File Address at the completion of this operation is that of sector zero of the track specified.

The only abnormal condition is Address Error. Detection of this causes the corresponding Status bit and Alarm bit to be set.

DESCRIPTION OF INPUT TO A FUNCTIONS

A Read signal from the computer AQ channel defines the contents of A as an Input. The significance of the contents of A varies with the value in bits 00-02 of the Q register. See Table 2-1.

CLEAR CONTROLLER (000) This function will clear the controller unconditionally and will generate a Return to Zero Seek (RTZS) to the selected drive. This function must be used with discretion since a Clear Controller signal will stop any current operation. RTZS signal is issued, Busy is not set. Unit Select is not cleared. If the controller is not busy at the end of the RTZS, End of Operation will be set.

DIRECTOR STATUS (001) This function is used to monitor the controller's operating status. The status information is loaded into the A register as shown in Figure 2-4.

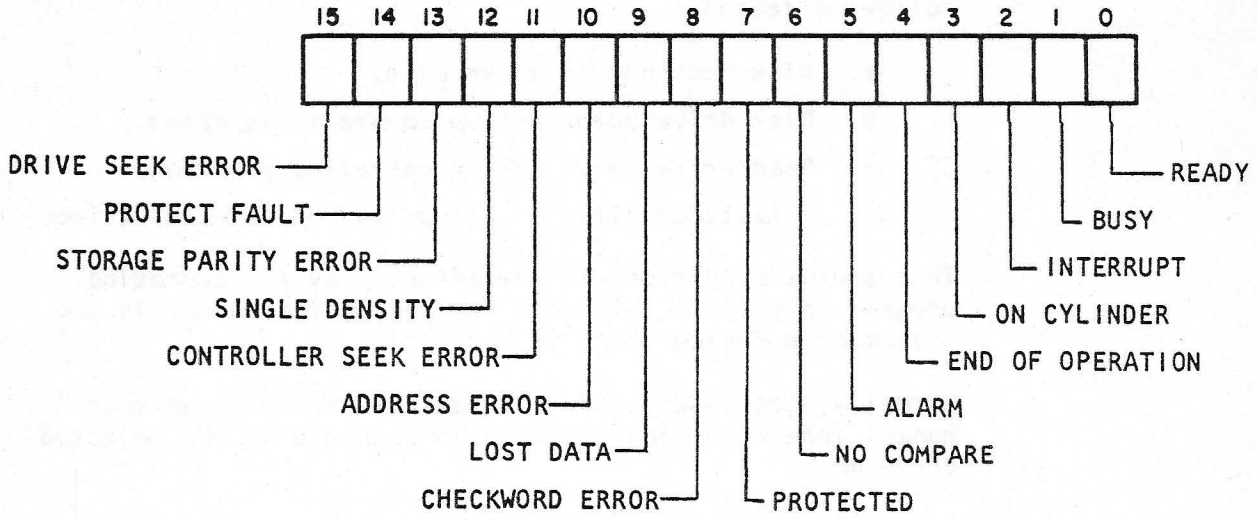


Figure 2-4. Director Status Format

The controller will accept this function at any time. The acceptance of this function causes no changes in the status of the controller.

The controller status is indicated by the presence of a one or zero bit in each of the A register bit positions. The conditions associated with each bit position is given above.

Ready (A0=1)

This bit indicates that the selected drive is available and ready to operate. The drive becomes Not Ready for the following reasons:

a. Disk Pack not in drive unit.

b. Disk drive motor not up to operating speed.

c. Read/Write heads not in operating position.

d. A fault condition develops in the selected drive.

This status condition will be affected by the operating program only if it selects a device physically not in the system or a device which is Not Ready.

Normally, the absence of this status bit indicates that manual (operator) intervention is required at the selected drive unit.

Busy (A1=1)

This bit indicates that the controller is presently involved in an operation.

This bit is set by the acceptance of a Write, Read, Compare, Checkword Check, or Write Address function.

This bit will be cleared when the controller has completed its operation or an abnormal condition is detected which aborts the operation. Once initiated, the computer cannot clear the Busy condition except by a Clear Controller instruction.

Interrupt (A2=1)

This bit indicates that the selected interrupt condition has occurred. The bit will be cleared by the acceptance of any Output from A function.

On Cylinder (A3=1)

This bit will be set when the drive positioner of the selected unit is On Cylinder. It will be cleared if the drive unit is presently positioning or if a Seek Error is detected and the heads have not yet returned to cylinder zero.

End of Operation (A4=1)

This bit will be set whenever the controller portion of an operation is complete, or if any of the four units completes a seek and the controller is not busy. This bit will be cleared by an Output from A function.

Alarm (A5=1)

This bit indicates that one of the following abnormal conditions has occurred:

a. Not Ready and Busy (Alarm sets immediately).
b. Checkword Error (Alarm sets at EOP).
c. Lost Data (Alarm sets at EOP).
d. Controller Seek Error (Alarm sets immediately).
e. Address Error (Alarm sets immediately).
f. Drive Seek Error (Alarm sets immediately).
g. Storage Parity Error (Alarm sets at EOP).
h. Protect Fault (Alarm sets at EOP).

This bit will be cleared by any Output from A function. The Not Ready condition can be changed by manual intervention.

No Compare (A6=1)

This bit indicates that the data received from computer storage does not compare with data read from the file storage during a compare operation. This bit is cleared by any Output from A function.

Protected (A7=1)

This bit is present when the selected unit's PROTECT switch is on. (Allows only programs from the protected area of computer storage to have access to the drive.)

Checkword Error (A8=1)

This status bit indicates that the controller logic has detected an incorrect checkword in data read from file storage during a Read, Compare, or Checkword Check operation. This bit is cleared by any Output from A function.

Lost Data (A9=1)

This bit indicates that the computer's DSA bus has not been able to keep up to the file data transfer rate during a Write, Read, or Compare operation. This bit is cleared by any Output from A function.

Address Error (A10=1)

This bit indicates that the controller has detected a file address which is beyond the limits of the file storage capacity received from the computer or that the controller has advanced the file address beyond the limits of the file storage capacity. This bit is cleared by any Output from A function, accepted by controller.

The contents of the Cylinder Address register are not altered if the error is detected during a Load Address instruction. If the error is detected during a Read, Write or Compare operation, the heads will be advanced one track beyond the limit (that is, track 406 of the 856-4 CDD or track 203 of the 856-2 CDD). Note, if the last sector in the last cylinder is addressed during a Read, Write or Compare operation, an Address Error will be indicated after the last sector has been read, written or compared.

Controller Seek Error (A11=1)

This bit indicates that the controller has been unable to obtain the file address selected during a Write, Read, Compare or Checkword Check operation. This error usually indicates a positioning error, dirty heads, or defective cartridge disk. The positioning error can be corrected by doing a status check of the drive cylinder, comparing this with the contents of the Cylinder Address register (to determine if, indeed, a positioning error has occurred). This bit will be cleared by any Output from A function accepted by the controller.

Single Density (A12=1)

When "one" this bit indicates that the selected drive is type 856-2. When zero the selected drive is type 856-4.

Storage Parity Error (A13=1)

This bit indicates that the controller has received a Parity Error signal from the DSA bus during a Controller-DSA transfer. The operation will end at the end of the sector being operated on. This bit will be cleared by any Output from A function.

Protect Fault (A14=1)

This bit indicates that an unprotected Read instruction initiated an operation to write in a protected computer storage area. The operation will end at the end of the sector being operated on. The protected computer storage area is not changed. This bit will be cleared by any Output from A function.

Drive Seek Error (A15=1)

This bit indicates that the drive unit has detected that the cylinder positioner has moved beyond the legal limits of the file storage area (below zero cylinder position 0 or above cylinder position 202 or 405) during a Write, Read or Compare function. This bit will be cleared by any Output from A function accepted by the controller.

NOTE: If the last legal sector of the last legal cylinder is addressed during Read, Write, or Compare Operation, a drive seek error may or may not occur after the operation is complete depending upon the revision level of the C.D.D.

CYLINDER ADDRESS STATUS (010)

This function is used to monitor the file address, which is the address of the sector, track, and cylinder of selected unit being operated in when the controller is Busy. When the controller is Not Busy, it represents the address of the sector last processed plus one. See Figure 2-5. The address information is loaded into the A register and is arranged in the same format used by the computer to transfer the file address to the controller. This function will be accepted at any time by the controller.

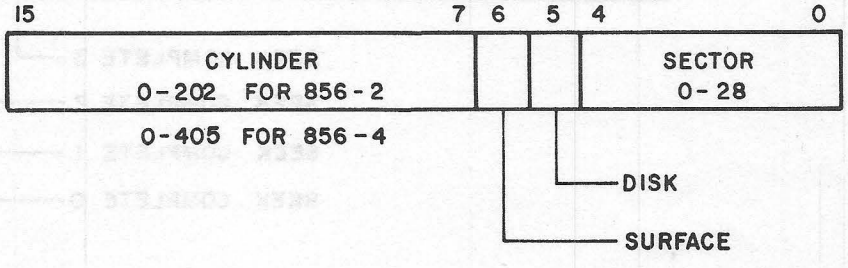


Figure 2-5. Cylinder Address Status Format

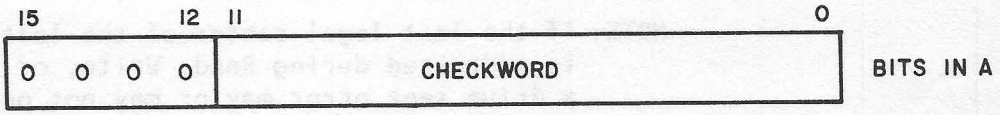
CURRENT WORD ADDRESS STATUS (011)

This function is used to monitor the Current Word Address (CWA) register. The contents of the CWA register are loaded into the A register. This provides the computer with information as to the area in storage being transferred, or the location of the area already transferred in a previous DSA operation, such as Read, Write or Compare. This function will be accepted unconditionally at any time by the controller.

CHECKWORD STATUS (100)

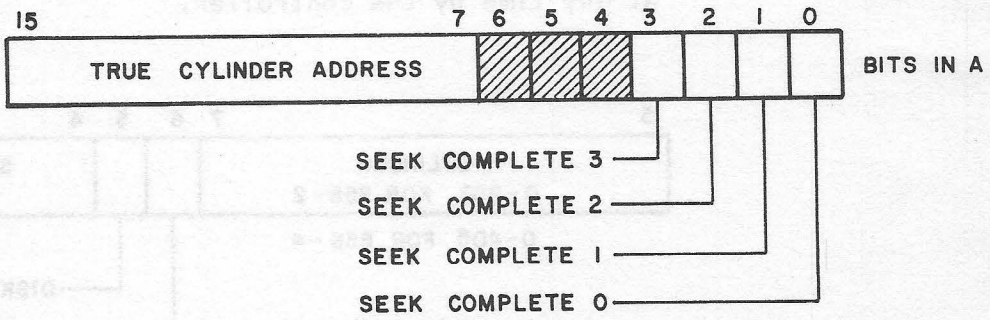
The Checkword Status is used to monitor the contents of the Checkword 2 register. This register holds the Data Checkword on the last sector operated on.

The Checkword Status function will be accepted unconditionally at any time by the controller.



DRIVE CYLINDER STATUS (101)

The Drive Cylinder Status is used to monitor the true cylinder address read from the disk on the previous Read, Write, or Compare operation. This status word contains the cylinder address in bits 7 through 15. Bits 4 - 6 are unused. Bits 0-3, Seek Complete or Seek Error.



Four bits contain signals to indicate after EØP status is true, that the corresponding unit has completed a seek (Seek Complete) or is unable to complete a seek (Seek Error). These bits are available without the unit being selected. The Seek Complete is cleared by a new Load Address, Write, Read, Compare or Checkword Check Command issued to the particular unit. If a Seek Error occurred, bit 15 in the Director Status word is set if corresponding unit is selected, it must be cleared by Clear Controller (i.e. RTZS to selected unit).

INTRODUCTION

Several operating conditions for the controller are selected by inserting jumper plugs in appropriate positions on one of the printed wiring boards of the Controller. The jumper plugs are located on the printed wiring board in slot 15 of the 1784 Computer, main enclosure.

Head 0 Fixed Disk/ Cartridge Disk

When present this jumper plug selects Head 0 to be on the cartridge disk. The absence of the jumper plug selects Head 0 to be on the fixed disk.

Protect

Four jumper plugs, one per drive. When absent, instructions from only protected area of computer storage are allowed access to the given disk drive.

Equipment Number Selection

These four jumper plugs can be set to represent any digit, 0-15. They are used to assign an equipment number to the controller/drives. Any instruction sent by the computer must be accompanied by an equipment number (bits 7-10 of Q) that matches the switch setting. When the jumper plug is present the corresponding bit is a logical zero.

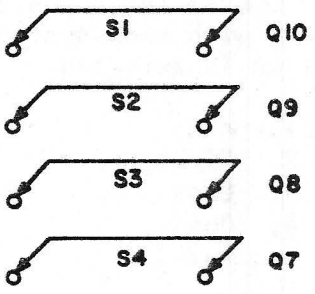


Figure 3-1. Equipment Select Jumper Plugs

TABLE 3-1. HEXADECIMAL CODE FOR EQUIPMENT SELECTION CODE

Links		S1	S2	S3	S4
Hexadecimal Code	0	0	0	0	0
	1	0	0	0	1
	2	0	0	1	0
	3	0	0	1	1
	4	0	1	0	0
	5	0	1	0	1
	6	0	1	1	0
	7	0	1	1	1
	8	1	0	0	0
	9	1	0	0	1
	A	1	0	1	0
	B	1	0	1	1
	C	1	1	0	0
	D	1	1	0	1
	E	1	1	1	0
	F	1	1	1	1

Note:

A '0' in the binary code indicates the presence of a jumper plug for the setting of the equipment code; a '1' its absence.

Track Density Selection

These four jumper plugs, one per CDD, allow the selection of either 100 Tracks per inch (TPI) or 200 TPI depending on whether the particular file is a 856-2 (100 TPI) or 856-4 (200 TPI). When the jumper plug is present, 200 TPI is selected for the given drive.

Scanner Selection (Slot 16)

This jumper plug may be on any one of five positions depending on the CDD Controller's position in the Direct Storage Access Bus. It will vary with each system. If the jumper plug is present that position is selected.

1. Mid
2. First
3. Last
4. One
5. Out

CUT ALONG LINE

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