Title:

DSC 803 / DSA 802

DISC STORAGE CHANNEL

REFERENCE MANUAL

A/S REGNECENTRALEN

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Abstract:

This paper describes the logical structure of the DSC 803 / DSA 802 Disc Storage Channel.

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1. MAIN CHARACTERISTICS. 1.

1.1 Description. 1.1

The DSM 808-815 Disc Storage Modules are random-access, mass memory devices consisting of a disc pack spindle with associated drive motor, a voice coil positioner and servo, read/write fault, transmitter/receiver electronics, and air supply. The power supply is mounted within the basic DSM enclosure.

The DSM 812-815 are storage modules with removable disc pack. They are placed in base cabinets with a wheel socket for easy handling. A hinged shroud cover on top of the DSM allows access to the spindle for normal pack installation and removal. The storage modules are equal to DSM 801-807 except that electronics have been added to decode MFM read data into NRZ read data (phase locked oscillator data separator).

The DSM 808-811 are rack mounted minimodules with non-removable disc pack.

The DSA 802 Disc Storage Adapter is an adapter / formatter for the DSM 808-815. In connection with the DSC 803 Disc Storage Controller it provides an interface with the RC8000 central processing unit (CPU). The controller / adapter provide multiplexing capability for from one to four DSM's and handle the syncronisation and formatting of data during read and write operations.

Standard features for the controller / adapter are seek overlap capability, disc pack formatting, physical to logical drive correlation, and multiplexing for four drives. It also contains Error Correction Code (ECC) circuitry to detect errors and leave information to correct errors.

Furthermore 2 different controllers can share the adapter and in this 2 systems can share the 4 discs.

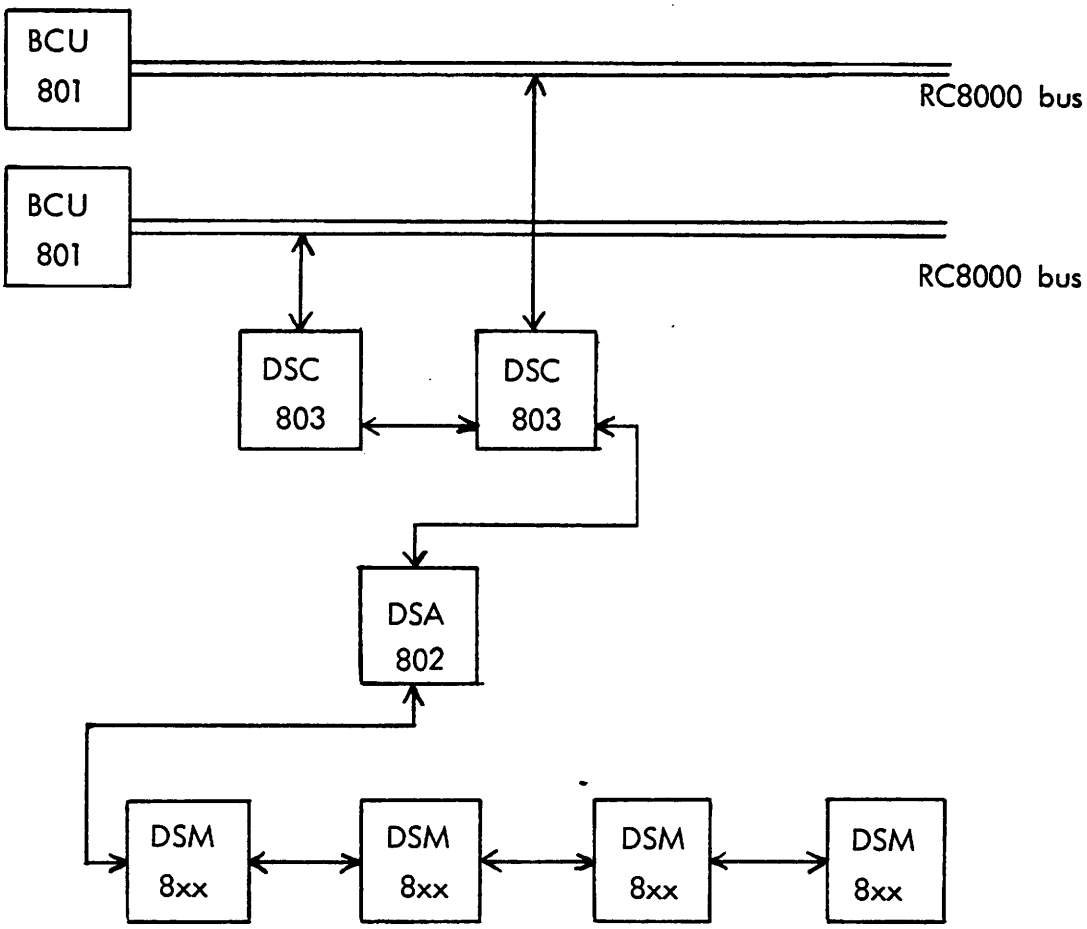


Fig. 1.1 System Block Diagram for a dual access system.

1.2 The Data Medium. 1.2

As a storage medium a disc is similar to a phonograph record excepts that the data are recorded as flux reversals in a magnetic layer on the disc surfaces.

The disc pack consists of a sets of coaxially arranged discs rotating together.

Data is stored in tracks that are concentric circles on the disc surface. A read/write head is allocated to each surface on the disc pack; these read/write heads are movable in radial direction by means of common head activator. Hence the radial positon of the heads defines a track on all surfaces; these tracks are in common called a cylinder. To select a certain track it is necessary to select a read/write head corresponding to a certain disc surface.

The disc pack is further divided into 21 sectors, i.e. pie-shaped sections. Hence the tracks are divided into arcs, each being the intersection of a track with a sector (referred to as a 'segment').

The subdivision of a disc pack in three dimensions cylinders (defined by head movement), surfaces (defined by head selection) and sectors (defined by the angular position of the disc pack related to an index mark) are shown in figure 1.2.

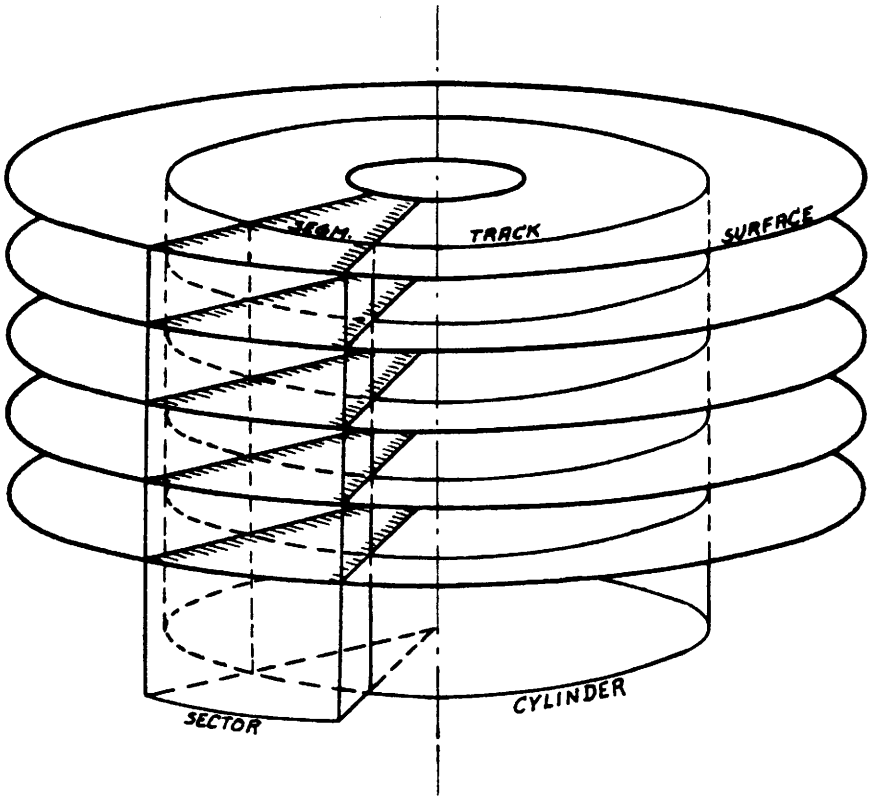


Fig. 1.2. The principle of subdivision of a disc pack. (One cylinder, surface and sector pointing out one segment is shown). For the purpose of clarity, the surfaces are rearranged on the drawing.

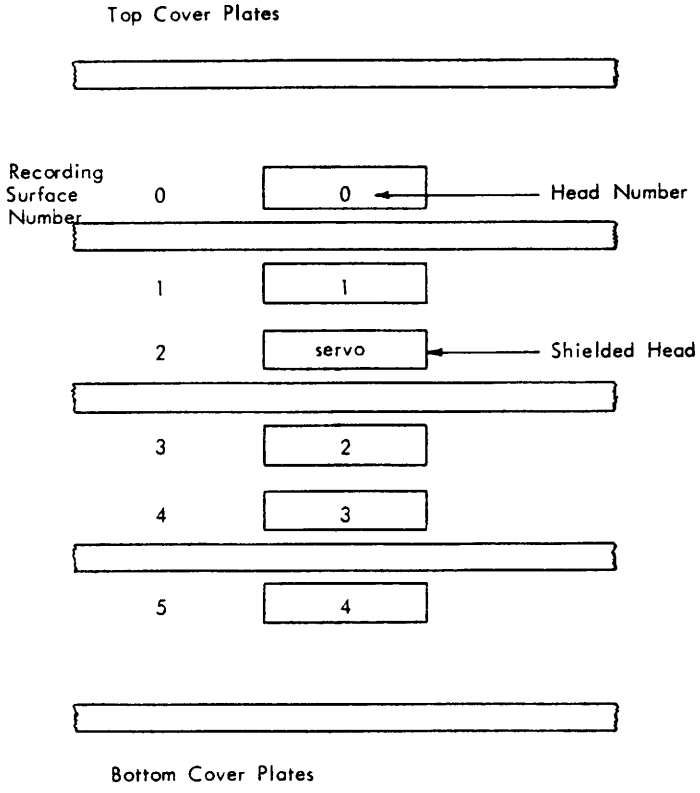


Fig. 1.3. Surface allocation.

The actual surface allocation on the DSM 812 and 813 storage modules are shown on figure 1.3.

The DSM 814 and 815 have 19 heads instead of 5 heads.

The surface allocation for the fixed discs, DSM 808-811 are shown on figure 1.4.

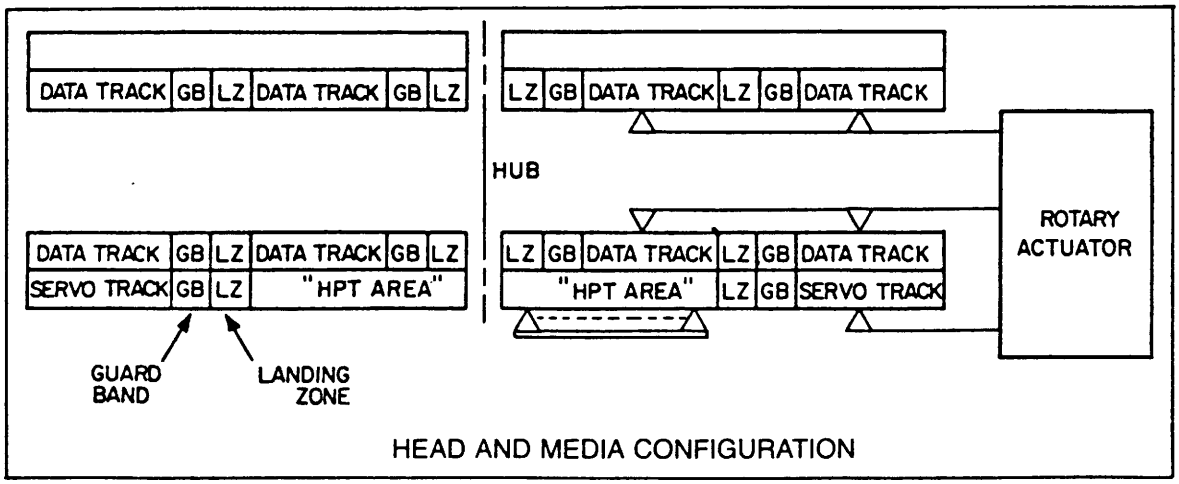


Fig. 1.4 Fixed disc surface allocation.

What is shown is the DSM 811 configuration. The DSM 808 and 809 does not have the heads below the 'HPT AREA' (head per track), and the DSM 808 and 810 only have the lower disc, and therefore only half the capacity.

1.3 Data Format.

A segment is composed as shown in figure 1.5

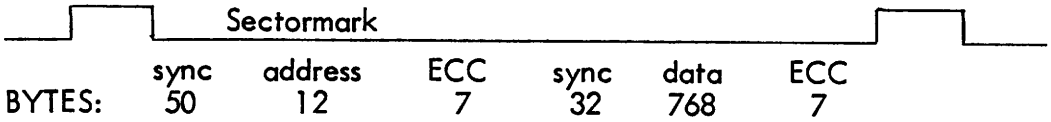


Figure 1.5 Segment Recording Format

1.4 Applicable Documents.

1. Product Specification
   Mini Module Drive Family 9731 (CDC Spec. 64711600)
2. Product Specification
   Storage Module Drive Family 976x-1 (CDC Spec. 64710800)
3. 9876 Disc Pack Product
   Specification (CDC Spec. 70439600)
4. 9877 Disc Pack Product
   Specification (CDC Spec. 70438100)
5. 9883-91 Disc Pack Product
   Specification (CDC Spec. 70429400)
6. Reference Manual 9760-1 (CDC Publ. 83311200)
7. Reference Manual 9762-1 (CDC Publ. 83317300)
8. Reference Manual 9764-1/9766-1 (CDC Publ. 83322460)

The 50 and 32 bytes of synchronisation contain decision time, zeros, address marks, and identification bytes. The 7 bytes of ECC are error detection and correction information. The address field and data field are supplied by the software, the rest is supplied by the adaptor when the software has formatted the disc with address fields, these fields are read and checked before every read/write operation. Prior to initial use of a track it should be written with zeros by a format write command to remove all address marks.

All RC8000 DSM's are divided into 21 sectors and drive capacity is as follows:

Drive	DSM 808	809	810	811
Bytes/drive	10.321.920	20.643.840	11.076.064	21.397.984
Fixed head	0	0	774.144	774.144
Bytes/cylinder	32.256	64.512	64.512	64.512
Bytes/track	16.128	16.128	16.128	16.128
Bytes/segment	768	768	768	768
Bit/byte	8	8	8	8

Drive	DSM 812	813	814	815
Bytes/drive	33.143.040	66.366.720	125.943.552	252.193.536
Fixed head	0	0	0	0
Bytes/cylinder	80.640	80.640	306.432	306.432
Bytes/track	16.128	16.128	16.128	16.128
Bytes/segment	512	512	512	512
Bit/byte	8	8	8	8

Media and recording specifications are as follows:

DSM	808	809	810	811	812	813	814	815
Media								
Recording surfaces	1	2	2	3	5	5	19	19
Tracks/inch.	300	300	300	300	192	384	192	384
Track spacing, 10^{-3} inch.	3.3	3.3	3.3	3.3	5.2	2.6	5.2	2.6
Disc diameter, inches	14	14	14	14	14	14	14	14
usable tracks	640	1280	688	1328	2055	4115	7809	15637
Tracks with heads per track	0	0	48	48	0	0	0	0
Recording								
Bit density bit/inch	6125	6125	6125	6125	6038	6038	6038	6038
Rate MhZ	9.67	9.67.	9.67	9.67	9.67	9.67	9.67	9.67
Mode	MFM	MFM	MFM	MFM	MFM	MFM	MFM	MFM
Heads:								
Read/write	2	4	2+48	4+48	5	5	19	19
Servo (positioning)	1	1	1	1	1	1	1	1
Read/write width 10^{-3} inch.	2.3	2.3	2.3	2.3	4.0	2.0	4.0	2.0

2. PERFORMANCE CHARACTERISTICS. 2.

2.1 The Disc Drives. 2.1

2.1.1 Positioning Time. 2.1.1

The maximum positioning time for the storage modules are 55 ms and for the minimodules 60 ms. This is defined as the time needed to move the heads from lowest to higest order cylinder.

The maximum single track positioning time is 7 ms for the storage modules and 10 ms for the minimodules. This is defined as the time needed to move between any pair of adjacent tracks.

The average positioning time is 30 ms for the storage modules and 40 ms for the minimodules. This is defined as the time required for all possible moves divided by the number of all possible moves.

Maximum seek times for moves between various tracks follow approximately the equations below:

Storage modules

DSM 812 and 814: $\text{Time} = 22 + \frac{8}{100}(\text{track}) - \frac{300}{(\text{track}) + 20}$

DSM 813 and 815: $\text{Time} = 22 + \frac{4}{100}(\text{track}) - \frac{600}{(\text{track}) + 40}$

Minimodules

DSM 808-811: $\text{Time} = 38 + \frac{9}{100}(\text{track}) - \frac{1000}{(\text{track} + 35)}$

Time: Seektime in msec.

Track: Number of tracks to move (integer and >0).

The actual seektimes will be: (the figures are maximum times; the actual performance will be somewhat faster).

	DSM 808-811	812/814
Track	Time (ms)	Time (ms)
1	10.0	7.0
2	11.0	8.0
3	11.9	8.8
4	12.6	9.5
5	13.5	10.7
10	16.5	12.5
20	21.5	15.6
30	25.3	18.4
100	39.6	28.4
200	52.7	38.0
300	62.0	46.5
400	-	54.5

For the DSM 813/815 the track numbers of DSM 812/814 must be doubled to find the seektimes.

2.1.2 Latency Time. 2.1.2

Latency time is defined as the time required to reach a particular track location when positioning has been completed.

The average latency time is 8.33 ms, based on a nominal disc speed of 3600 rpm.

The maximum latency time is 17.2 ms, based on a nominal disc speed of 3774 rpm (3600 - 3.5%).

2.1.3 Transfer Rate. 2.1.3

The transfer rate within a segment is 1 byte every 0.8 microsecond or a busaccess (one word) every 2.4 microsecond. The maximum average transfer rate within one cylinder is 322560 words per second or one word every 3,1 microsecond.

2.1.4 Error Rate. 2.1.4

Of transient errors, i.e. errors that can be corrected within 3 retries, there will be no more than one error in 10^9 bits of data transferred.

Of read errors that cannot be corrected within 3 retries there will be no more than one per 10^{10} bits transferred.

It is possible to let the disc strobe the data in a little earlier or a little later. It is also possible to move the head a little outside nominal position (off-set). (In DSM 813/815) this can be done with specified magnitude.

Of read errors which cannot be corrected within 27 retries (3 times for each combination of strobe and off-set) there will be no more than one per 10^{11} bits of data transferred.

With the above mentioned transfer rate this means that one non-correctable error will occur in every 15 hours of constant reading (without seeking).

Of seek errors there will be no more than one positioning error in 10^6 seeks, i.e. one positioning error in 11 hours of constant seeking (with the average seek time equal to average positioning time plus average latency time, equal to about 40 ms).

2.2 Operational Features.

2.2.1 Sector Fields.

As shown in fig. 1.5, a sector consists of two fields - address and data (the rest is supplied by the adaptor). The address field is short in length (12 bytes) and contains sufficient information to ensure that the correct sector is accessed. The data field is long in length (768 bytes) and contains the information being stored. The address and data fields may be written independently, the address field must, however, always be written prior to a data operation. The controller then checks the address field with the address information it has received, before any data operation is allowed.

2.2.2 Alternative Tracks Assignment.

The disc packs are initialized at the factory with a predefined header area. This cannot be retrieved by the adaptor. Therefore the pack must be initialized by the program, by means of 'format write' commands which erase the pack, followed by the appropriate 'write address mark' commands.

A pack defect in the address or the sync field of the data field requires either alternative track assignment or skip of the segment in error. If an area becomes defective during normal use, the program can reformat the addresses on the track or sector in error. If the track contains an error after reformatting, an alternative track operation may be necessary. (Note: The first 75 bytes following Index of every track are certified error-free to ease alternative track reassignment).

Alternative track assignment can be implemented by letting the defective track contain a flag bit denoting that the track is defective, its own address, and the address of the alternative track. The software then issues the same command, positoning the servo to the alternative track. The alternative track would contain a flag bit indicating that it is an alternative track, its own address, and the address of the defective track.

It is recommended to keep 7 spare tracks for alternative track use.

2.2.3 Error Recovery. 2.2.3

Disc packs are usually certified to have no errors of any type on cylinder 000, heads 00 and 01 for autoload and operating systems requirements. Also, the first 75 bytes of every track are usually certified error-free to permit alternative track assignment without error. The disc pack is certified to have no non-correctable tracks detected. A non-correctable track is defined as any train of missing bits or extra bits exceeding 8 bits in duration. Besides, no more than 12 correctable errors are permitted.

Soft errors or transient errors in reading data are handled by the use of off-set and strobe. Off-set permits compensation for mechanical head alignment errors. In turn, strobe permits timing compensation which may be caused by 'peak shift' in the media or logic timing considerations. It is recommended that 3 retries be made at each combination of strobe and off-set to recover data.

Hard errors, ones not recoverable by off-set and strobe, are recovered by the use of Error Correction Code (ECC). The ECC will detect burst errors up to 22 bits in length and correct burst errors up to 11 bits in length. ECC is simply used in a cyclic redundancy code mode where no corrections are made. The data can then be recovered at the CPU.

However, the computation required for this correction is very time and store consuming (see "Data Field and Data Check"). The real value of the ECC lies in its ability to permit continued operation of the system when some minor degradation of the system has occurred, and to save qualified data when errors occur. This can be implemented by having access to two different drivers.

2.2.4 Fixed Heads.

The DSM 810 and 811 have 48 non-moving heads. This gives possibility for fast access of 774.144 bytes (1008 segments with 768 bytes each). These segments can be accessed using only latency time, 8,3 ms average. The 1008 segments are addressed using cylinder 0-23 on DSM 810 (42 segments per cylinder) and cylinder 0-11 on DSM 811 (84 segments per cylinder). The rest of the storage on the discs is then addressed using cylinder 24-343 on DSM 810 and 12-331 on DSM 811.

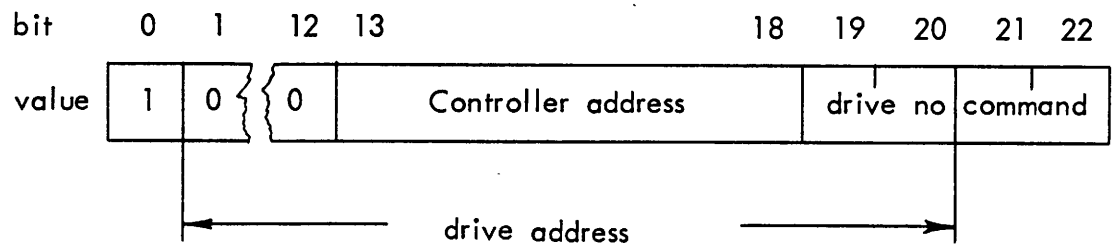
3. LOGIC SPECIFICATION 3.

The system is operated by means of channel programs stored in the RC 8000 core store, i.e. when started, the controller fetches instructions directly in the core store and executes them. This means that the only i/o commands that are needed (and accepted) by the controller are a start command and a reset command, of which the latter is not even necessary for normal operation. Thus the controller works quite autonomously and is only synchronized to the running software by means of start commands and interrupts.

3.1. I/O Commands 3.1.

The i/o commands concerning the disc controller are issued by a CPU (or any other device capable of being bus master) and have the following characteristics:

Only dataout commands are accepted.
The data transferred is irrelevant.
The command is entirely specified by its address:



bit 0	must be 1
bits 1-20	device address for one drive (unit in bit 20)
bits 1-12	zeroes
bits 13-18	indicate the controller address
bits 19-20	the logical driveno. within this controller
bits 21-22	specify the command

bit 21	irrelevant	
bit 22	0 : start :	Instructs a drive to run a channel program.
	1 : reset :	Depending on what other units connected to the same controller are doing at the moment, some time may be required between a reset and a new start to guarantee the latter to be accepted.

Within a certain controller only the device addresses corresponding to actually connected drives exist, hence an attempt to address a non-existent drive within an existing controller will cause bustimeout.

A disc drive exists in the sense used above if it is connected to the controller, has power on, has a number plug with value 0, 1, 2, or 3 mounted, and no other drive connected to the same controller has a plug with the same number mounted.

3.2. Channel Programs

3.2.1. General

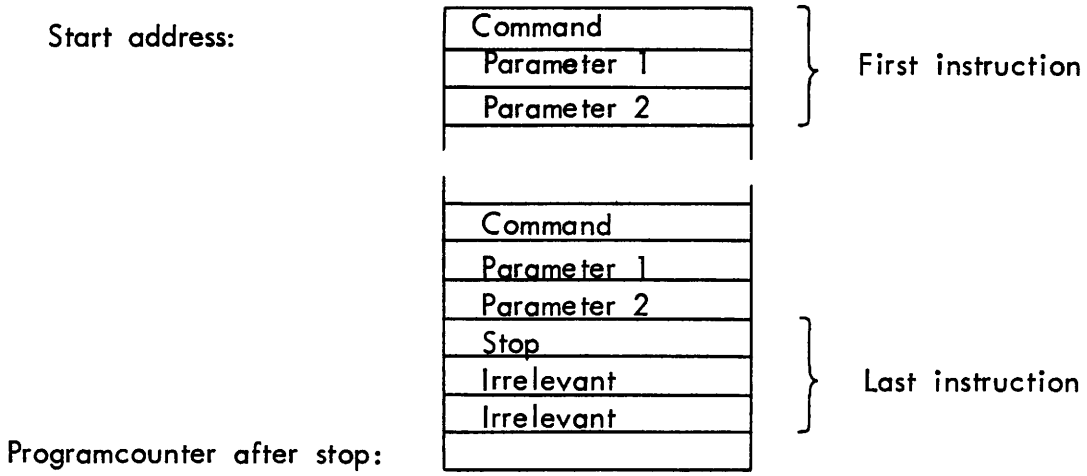
Before a start command to a drive is issued, the following information must be placed in core store :

Core Address	Contents
8 :	Base (common to all devices)
Base + 8 * driveaddress :	Start address of channel program
Base + 8 * driveaddress + 2 :	First address of status area
Base + 8 * driveaddress + 4 :	Interrupt destination
Base + 8 * driveaddress + 6 :	Interrupt level

Further, an area of four words must be available in core store where the drive can store its status information.

The channel program to be executed must be stored before start as well.

A channel program has the following structure:

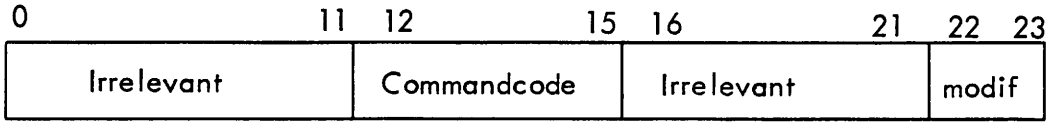


The channel program is composed of a number of instructions terminated by a "stop" or "wait" instruction. An instruction consists of three words, the first containing a channel command and the two following containing parameters for the command. The instruction address is the address of the command word.

Channel instruction:

Instruction address :	Command word
Instruction address + 2 :	Parameter 1
Instruction address + 4 :	Parameter 2

The command word has the following format:



bits 0-11 are ignored

bits 12-15 carries the command code

bits 16-21 are ignored

bits 22-23 are used as modifications to some commands

In most instructions Parameter 1 is the first address of a data area and Parameter 2 is a bytecount indicating the length of the data area.

In some instructions the data area has a fixed length, and in such cases Parameter 2 is irrelevant.

In the list of instructions it is specified to which class the actual instructions belong.

3.2.2. Command Codes:

The following commands are defined:

Code	Modification	Command
0	0	sense status
1	0	read data
	1	read address mark
2	0	seek
	1	set mode
3	0	write data
	1	write address mark
	3	clean track
4	0	wait
6	0	init
15	0	stop

Other commands are undefined.

3.2.3. SENSE STATUS

Command code : 0
Modification : 0
Parameter 1 : First address
Parameter 2 : Bytecount

Transfers status information to core store, starting at First address.

Bytecount is tested for being equal to or greater than one of the values 12, 24, 30, and 33, and the result defines the amount of status information to be transferred consecutively to core store.

Bytecount : Transferred status information:

- <12 : Nothing is transferred. (No op).
- ≥12 : Standard status. (4 words).
- ≥24 : The last read address mark . (4 words).
- ≥30 : Error correction information. (2 words). Meaningful only after a read operation.
- ≥33 : Detailed status word. (1 word).

After the execution of a SENSE STATUS instruction the contents of remaining bytecount will be undefined.

3.2.4. Read Data

3.2.4.

Command code: 1
Modification : 0
Parameter 1 : First address
Parameter 2 : Bytecount

Transfers a number of segments to core store, starting at First address.

The number of segments read and transferred equals Bytecount//768, i.e. if Bytecount is less than 768, the instruction has no other effect than changing the contents of Program Counter and Remaining Bytecount (see standard status). The Read Data instruction presumes the "addressmark register" to be defined. An automatic positioning is performed before the reading of each segment if necessary.

Addressmark check (see Section 3.3. Addressmarks) is performed before the transfer of each segment. This check may cause the status bit Positionerror to be set and the run to be terminated with an interrupt.

Datacheck is performed during the Read operation. This may cause the statusbit Dataerror to be set, the Errorcorrection information to be defined, and the instruction but not the run to be terminated, giving a succeeding sense instruction the opportunity to debug the error.

After a Read Data operation the Remaining Bytecount is defined and equal to Bytecount minus the number of actually transferred bytes.

3.2.5. Read Addressmarks

Command code : 1
Modification : 1
Parameter 1 : First address
Parameter 2 : Bytecount

Transfers a number of Addressmarks to core store, starting at First address.

The number of Addressmarks read and transferred equals Bytecount//12, i.e. if Bytecount is less than 12, the instruction has no other effect than changing the contents of Programcounter and Remaining bytecount (see standard status).

The Read Addressmark instruction presumes the Addressmark register to be defined. An automatic positioning is performed before the reading of each addressmark if necessary.

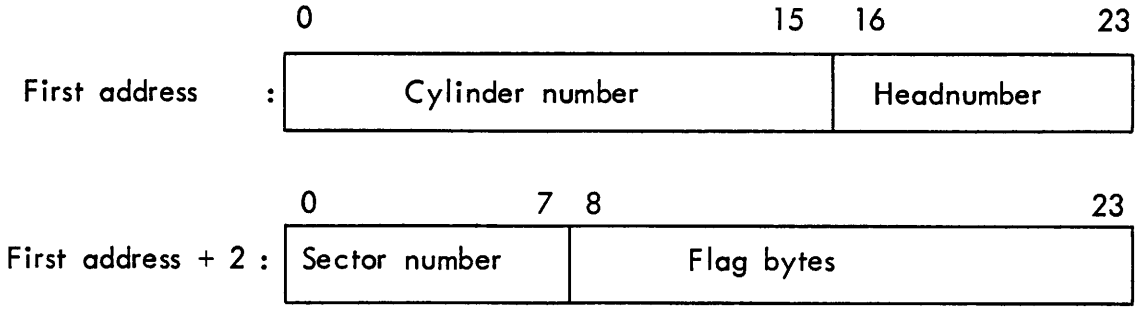
After a Read Addressmark operation the Remaining Bytecount is defined, and equal to Bytecount minus the number of actually transferred bytes.

3.2.6. SEEK

Command code : 2
Modification : 0
Parameter 1 : First address
Parameter 2 : Irrelevant

Transfers two words from core store, starting at First address to both the identification part and the next address part of the addressmark register and performs a seek to the indicated cylinder.

The two words have the format: (see Section 3.3. Addressmarks)



The values of the addresses are not checked by the controller, which in all cases attempts a seek.

However, if the maximum values are exceeded, the reactions will be:

cylinder number > max	:	the statusbit seekerror will be set.
head number > max	:	the statusbit harderror will be set on a succeeding read or write.
sector number > 20	:	a succeeding read or write instruction will never be exectued (a timeout situation will result).

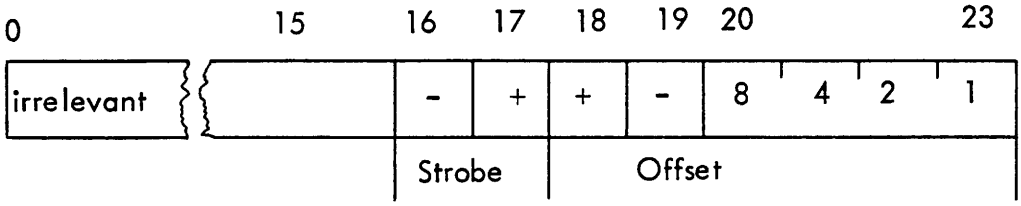
If the seekdata does not equal the addressmark of the corresponding segment, the status position error will be set, and an interrupt will be sent.

The flagbyte-feature makes possible the use of an automatic Accesskey-check, the flagging of bad segments, and reference to alternative segments. Note that fixed heads are not addressed this way. See Section 22.4 Fixed Heads.

3.2.7. SET MODE

Command code : 2
Modification : 1
Parameter 1 : Address of parameter word
Parameter 2 : Irrelevant

Transfers the parameter word to the disc drive, which offsets the read conditions according to the parameter word:



bits 0-15 are irrelevant

bits 16-17 indicate strobe offset (force the drive to strobe the readdatabits a little later or earlier than nominally).

bit 16 Early strobe

bit 17 Late strobe

bits 18-23 indicate head position offset (force the heads to be positioned a little beside the nominal track position).

bit 18 Positive offset (Storage modules only)

bit 19 Negative offset (Storage modules only)

bits 20-23 Offset magnitude (DSM 813 and 815 only)

The instruction is usable for retrying unsuccessful readings under various conditions.

If a SET MODE instruction has been used, an INIT command should be issued before a WRITE is attempted.

3.2.8. WRITE DATA

Command code : 3
Modification : 0
Parameter 1 : First address
Parameter 2 : Bytecount

Transfers a corestore area specified by First address and Bytecount to an integer number of segments on the disc equal to bytecount//768.

The remainder of bytecount//768 will be placed in Remaining bytecount after the operation.

Automatic positioning and Addressmarkcheck will be performed before the writing of each segment. Redundant checkbytes are automatically generated during the write operation and written after the data on each segment.

3.2.9. WRITE ADDRESS MARKS

Command code : 3
Modification : 1
Parameter 1 : First address
Parameter 2 : Bytecount

Transfers a corestore area specified by First address and Bytecount to the addressmarkfield of a number of segments equal to Bytecount//12. The datafields of the segments are not affected.

The contents of the corestore area should obey the rules given for Addressmarks in the section Addressmarks.

The automatic positioning is performed in the sequence given by the data in corestore.

The previous contents of the addressmarks are not checked.

3.2.10. Clean Track

Command code : 3
Modification : 3
Parameter 1 : Irrelevant
Parameter 2 : Irrelevant

Cleans a whole track found in a previous SEEK command. Addressmarkcheck is not performed.

The Clean Track is implemented for use the first time a disc kit is formatted.

3.2.11. WAIT

Command code : 4
Modification : 0
Parameter 1 : Irrelevant
Parameter 2 : Irrelevant

The device stops executing channel programs but generates no interrupt before one of the following events occurs: Manual intervention or Power failure.

The device in this state may be started in a new channel program.

3.2.12. INIT

Command code : 6 or 14
Modification : 0
Parameter 1 : Irrelevant
Parameter 2 : Irrelevant

The instruction forces the drive to recalibrate (reset the cylinder counter and retract the heads to cylinder zero), clear the Address-mark register, and clear all error flip-flops.

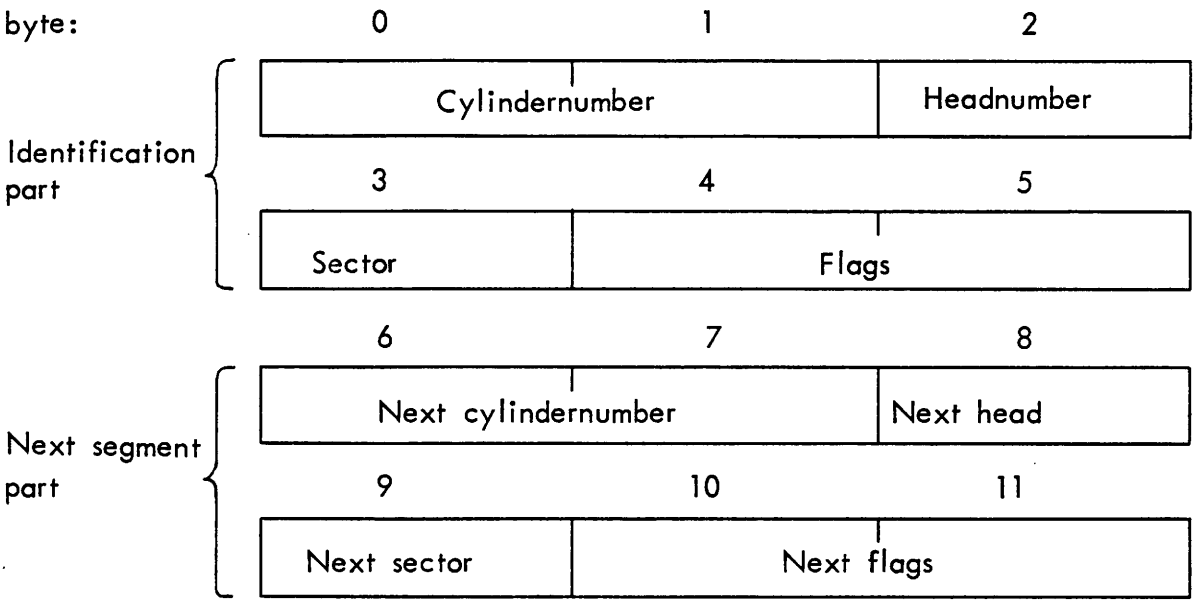
3.2.13. STOP

Command code : 15
Modification : 0
Parameter 1 : Irrelevant
Parameter 2 : Irrelevant

The device stops executing channel programs, stores the standard status in the standard status area in corestore (programcounter points at the location after the stop instruction. Remaining bytecount is undefined unless the preceding instruction was a read or write).

3.3. Addressmarks

All segments on the disc kit are preceded by an Addressmark of twelve bytes containing information about the position of the segment, and where to find the next segment:



The controller has a corresponding register composed in the same manner. The addressmark register is used by the micro-programmed position routine:

The position routine selects head number given by byte 8 (next head), compares bytes 0, 1 with bytes 6, 7, moving the heads if a difference is found, and finally copies bytes 6 to 9 into bytes 0 to 3.

When a read or write operation is issued, the sector register in the drive is loaded with the contents of byte 9 (next sector).

The addresscheck routine waits for an "on sector signal" and reads the addressmark, loads the first six bytes into bytes 0-5 of the addressmark register, checks them against bytes 6-11, and flags a difference. It then loads the next six bytes into bytes 6-11. If the flag is set, it now interrupts, else it proceeds with reading or writing.

A seek command loads the addressmark register bytes 6-11 with the seek data and byte 0 with a minus one and proceeds to the position routine.

The read/write data or addressmark commands all start each segment by running the position routine, and then the read/write data commands run the check addressmark routine before actually reading/writing the segment.

The write addressmark command simply reads twelve bytes in corestore and loads them into the addressmarkregister as well as writes them into the addressmark area of the segment.

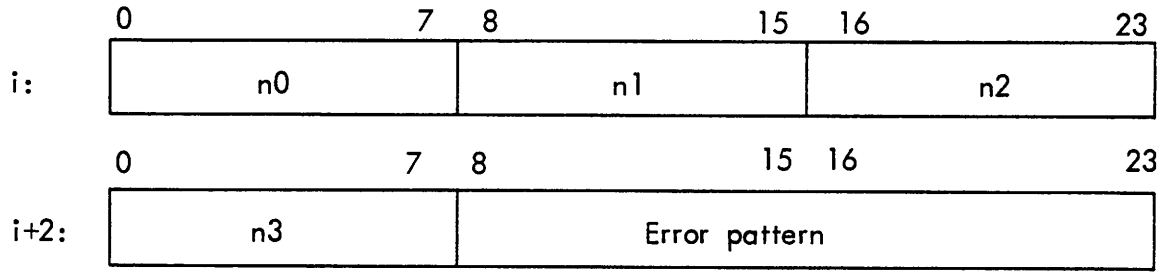
The read addressmark command reads the addressmark on the segment and transfers the contents to the addressmark register as well as to the corestore.

3.4 ECC.

The datafield consists of 768 characters of data plus 7 checkcharacters. The latter are automatically generated and written after the data in a write operation and checked after a read operation. The checkcharacters are generated according to an Error Correcting "Fire" code.

The ECC (Error Correcting Code) is capable to detect any errorburst shorter than 22 bits, and to correct any errorburst of up to 11 bits in length. If after a read operation a dataerror is detected, it is possible by means of a SENSE operation to extract the information necessary to determine correctability and to correct an error.

The information accessible is contained in two words:



The characters n0-n3 are signed integers in the range -128 to 127.

If any of these four bytes are negative, the error is uncorrectable.

The bitdisplacement is calculated as ((21-n0)x 452387 + (88-n1)x 72358 +(12-n2)x 315238 +(22-n3)x 330902) mod 585442-56;

If the result is negative, the error is totally located in the checkcharacter, and if the result is greater than 8x768=6144, the error is uncorrectable.

If the error is determined to be correctable, the bitdisplacement is the bitdistance from last databit (bit 23 in the last dataword) to the first bit of the errorburst (bit 23 in the error pattern word i + 2). To correct the error remains now only to align the error pattern with the errorburst and xor the data with the error pattern.

3.5 Statusinformation. 3.5

3.5.1 Standard status. 3.5.1

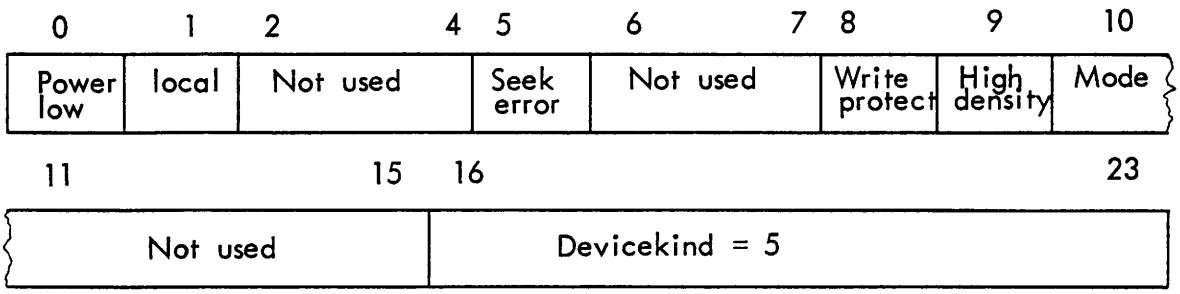
Standard status is stored in the corestore as function of a senseinstruction with bytecount greater than twelve in the locations from Firstaddress and up, or in the standard status area given in the device description before an interrupt is generated.

The standard status is composed by the following four words:

Channel program counter
Remaining byte count
Current status
Event status.

The channel program counter points at the instruction after the instruction causing the status to be stored, i.e. in case of a STOP, the channel program counter holds the address of the STOP instruction plus 6.
Remaining byte count is defined only immediate after a READ or WRITE operation, and indicates how many bytes that remain to be transferred. After a READ or WRITE the remaining byte count may be nonzero in two cases: The specified byte count for the READ/WRITE was not an integer multiple of the blocklength, or the transport was for some reason not completed.
Current status and Event status carry information about fault situations.

3.5.2 Current Status.



Bit 0 : Power low — Indicates voltage fault.

Bit 1 : Local — The disc is not up to speed and ready.

Bit 5 : Seek error — A seek to a non existent track or selection of a non existent head has been attempted. The condition must be cleared by means of an INIT operation.

Bit 8 : Write protect — The unit is write protected.

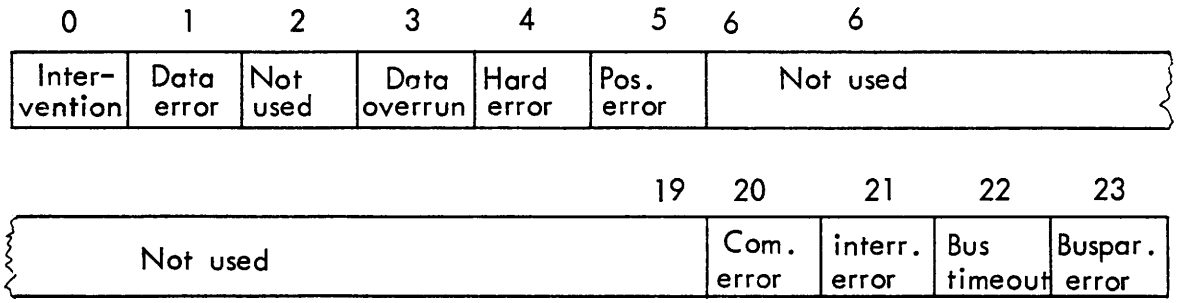
Bit 9 : High density — The connected unit has 823 tracks (else 411 tracks).

Bit 10 : Mode — Offset mode is selected.

Bits 16-23 Devicekind — Is 5 for discs.

Not used bits are zero.

3.5.3 Event Status.



3.5.2

Bit 0 : Intervention (powerchange)

A transmission over the tolerance limit of the primary power supply has occured, or manual intervention in the disc has occurred.

Bit 1 : Data error.

Data error is detected during read data or read address, and ECC carries valid information.

Bit 3 : Data overrun.

The RC8000 bus has not been able to transfer data so fast as the disc datatransferrate requires.

Bit 4 : Hard error.

Is set in all cases of disc-oriented errors except address check fault, that is the hard error reflects an error bit set in the detailled status word.

Bit 5 : Position error.

This bit set alone indicates that the address mark was correctly read but did not satisfy the address mark check. If both the position error bit and the hard error bit is set, the reading of the address mark was not succeeded.

Bits 6-19 : not used (zero).

Bit 20 : Communication error.

A Nack signal was received instead of an Ack from the RC8000 bus.

Bit 21 : Interrupt error.

Indicating that something went wrong during storing of status.

Bit 22 : Bus timeout.

The RC8000 bus has failed to respond within a certain maximum time.

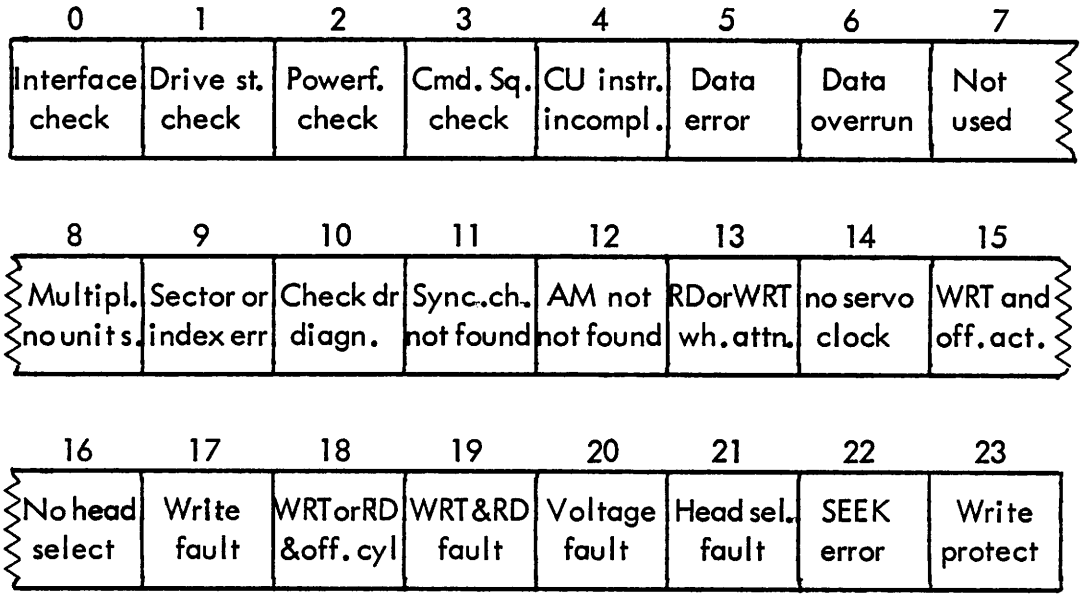
Bit 23 : Bus parity error.

A parity error was detected in a word received from the RC8000 bus.

Not used bits are zero.

3.5.4 Detailled status word.

The Detailled statusword is fetched directly from the adapter and is mostly usefull as diagnostics:



Bit 0 : Interface check
A parityerror has occurred in the connection between controller and adapter.

Bit 1 : Drive status check
One or more of the bits 8-15 are set.

Bit 2 : Powerfail check
Powerfailure in the adapter is in progress. App. 2mS of operationtime is left from the time, the event occurred.

Bit 3 : Command Sequence Check
A read- or write-data was not preceded by a read- or write-address. (Controller malfunction).

Bit 4 : CU instruction execution incomplete
(Adapter malfunction)

Bit 5 : Data check
Dataerror was detected during a data transfer.

Bit 6 : Data Overrun
Same as Event status bit 3.

Bit 7 : Not used
(Zero)

Bit 8 : Multiple or no unit selected
Several or no disc units respond to the drivenumber.

Bit 9 : Sector- or Index-error
A Read or Write operation has been attempted, but no sector or index pulses has been received from the drive.

Bit 10 : Check drive diagnistic
Indicates that one or more bits 16-23 are set.

Bit 11 : Synccharacter not found
The synccharacter has not been found in a Read or Write command.

Bit 12 : Address Mark not found
A Read or Write command has been issued, but no Address Mark has been found in two revolutions of the disc.

Bit 13 : Read or Write while attention
A Read or Write command has been attempted with the Intervention bit set (Event status bit 0).

Bit 14 : No servo clock
No servo clock was detected during a Read or Write command.

Bit 15 : Write and offset active
A Write command was issued with the servo in an offset mode.

Bit 16 : No Head select
A non existent head has been selected.

Bit 17 : Write fault
The absence of write current has been detected in the drive.

Bit 18 : Write or Read and off cylinder
A Write or Read command has been attempted while the heads were not on cylinder.

Bit 19 : Write and Read fault
A Write and Read command has been received simultanously in the drive.

Bit 20 : Voltage fault
A below normal voltage is or was present in the drive.

Bit 21 : Head select fault
More than one head has been selected in the drive.

Bit 22 : Seek - error
Same as Event status bit 5.

Bit 23 : Write protect
Same as Current status bit 8.

4. OPERATOR INTERACTION 4.

Operator Panel

NAME	TYPE: LIGHT	TYPE: SWITCH	FUNCTION
START	X	X	Indicates conditions of start switch and top cover interlocks. The switch starts the unit.
READY	X		Indicates Unit Ready status, i.e. pack is up to speed, the heads are loaded, and no fault conditions exist within the unit.
FAULT	X	X	Indicates any fault condition. The switch clears the fault flip-flop.
PROTECT	X	X	Indicates that the drive is write protected. The switch disables the write driver.