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FLOPPY DISC
PROGRAMMING MANUAL

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FLOPPY DISC PROGRAMMING MANUAL

1. INTRODUCTION

This document provides programming information for the INTERDATA Floppy Disc System. It is assumed that the reader is familiar with the I/O programming structure of INTERDATA Processors.

For information about programming INTERDATA 32-bit Processors, refer to the following:

INTERDATA 32-Bit Series Reference Manual, Publication Number 29-365

Model 7/32 Processor User's Manual, Publication Number 29-405

Model 8/32 Processor User's Manual, Publication Manual 29-428

Extended Selector Channel (ESELCH) Programming Manual Publication Number 29-529

For information about programming INTERDATA 16 bit Processors, refer to the following:

16-Bit Processor User's Manual, Publication Number 29-509

16-Bit Selector Channel (SELCH) Programming Manual, Publication Number 29-567

The INTERDATA Floppy Disc System provides a compact random access, removable media, rotating memory storage facility for the INTERDATA family of computers. The system contains one microprocessor based controller capable of handling up to four Diskette Drives. Table 1 lists Product Numbers associated with the Floppy Disc System.

TABLE 1. INTERDATA FLOPPY DISC SYSTEM

Floppy Disc Marketing Numbers

M46-630	FMD-1	System, Single Drive, Mus Bus 60Hz
M46-631	FMD-1	System, Dual Drive, Mux Bus 60Hz
M46-632	FMD-1	System, Single Drive, Micro Bus 60Hz
M46-633	FMD-1	System, Dual Drive, Micro Bus 60Hz
M46-634	FMD-1	Expansion, 2nd or 4th Drive 60Hz
M46-635	FMD-1	Expansion, 3rd Drive 60Hz
M46-636	FMD-1	System, Single Drive, Mux Bus 50Hz
M46-637	FMD-1	System, Dual Drive, Mus Bus 50Hz
M46-638	FMD-1	System, Single Drive, Micro Bus 50Hz
M46-639	FMD-1	System, Dual Drive, Micro Bus 50Hz
M46-640	FMD-1	Expansion, 2nd or 4th Drive, 50Hz
M46-641	FMD-1	Expansion, 3rd Drive, 50Hz
M46-642	FMD-1	Flexible Media (Package of 10)

INTERFACE is through either a MICRO I/O BUS or a MICRO I/O BUS Adapter to the Multiplexor Channel, Selector Channel, ESELCH or BSELCH. Data is recorded in a fixed-sector format, with each sector containing 128 data bytes. The Floppy Controller permits data transfers across sector and track boundaries. A single transfer can range from 1 byte to an entire diskette (except on a SELCH, ESELCH or BSELCH, where a maximum single data transfer is 128 bytes long).

Table 2 summarizes specifications pertinent to programming the Floppy Disc System.

TABLE 2. FLOPPY DISC SYSTEM SPECIFICATIONS

SYSTEM

Up to 4 Drives. One Diskette per Drive
Ready light for each drive
Write Protect Light for each drive

DRIVE

Number of Recording Surfaces	1
Rotational Speed	360 RPM
Average Latency Time	83 msec
Maximum Latency Time	167 msec
Head Positioning Time Max.	462 msec
Head Positioning Time Track to Track	6 msec

DISKETTE

Capacity	256 K Bytes
Number of Tracks/Diskette	77, (X'4C')
Number of Sectors/Track	26, (X'1A')
Number of Sectors/Diskette	2002, (X'7D2')
Bytes per Sector	128
Bytes per Track	3328
Number of 80 bytes records (cards per diskette)	3200 approx.
Maximum Number of Defective Tracks	2

SYSTEM SOFTWARE REQUIREMENTS

Track 0 sector 1 and 2 reserved for Volume Descriptors
Track 0 sector 5 reserved for the Auto Load (if used)
All other Tracks and Sectors are available to the user.

OTHER RESTRICTIONS

Track 0 can not be defective (reserved for System Software)
Track 76 can not be defective due to controller restrictions.
To achieve maximum data transfer rates, buffers should be read/written in no more than 1.1 milliseconds.

2. CONFIGURATION

The Floppy Disc System operates through a Micro I/O Bus Adapter on a Miltiplexor Bus or directly through a Micro I/O Bus or through a SELCH, ESELCH, BSELCH on a Micro I/O Bus Adapter.

3. OPERATING PROCEDURES

3.1 Switches and Indicators

The Floppy Disc System provides the following switches and indicators (refer to Figure 1):

OPERATOR CONTROL PANEL

POWER ON Pushbutton Switch	When this button is depressed and lights, the drive is turned on. When this button is depressed and the light is out, the drive is turned off.
Write Protect Switch	This switch is located inside the drive. When the diskette is slid under this switch, the drive is unprotected. When slid over the switch, the drive is write protected.
Write Protect Indicator (Red)	When this indicator is lit, the drive is write protected.
Ready Indicator (Green)	When this indicator is lit, the diskette is inserted properly and the drive door is closed.

3.2 Diskette Removal and Installation

To remove the diskette:

1. Open front door on drive.
2. Slide diskette out.

To install the diskette:

1. Depress Power Switch on.
2. Open door on desired drive.
3. Slide the diskette into drive as follows:

a. For Write Protect, slide diskette over Write Protect switch located on the inside of the drive. (See Figure 1.) The Write Protect lamp turns on when the drive is Write Protected.

b. For not Write Protect, slide the diskette under the Write Protect switch located on the inside of the drive (see Figure 1).

NOTE

This SWITCH is spring operated and is normally in the Write Protect position.

4. Close the door.

5. Wait for the Ready light on the drive to turn on. If the Ready light does not turn on in 3 seconds the diskette was inserted incorrectly. (Remove and insert correctly.)

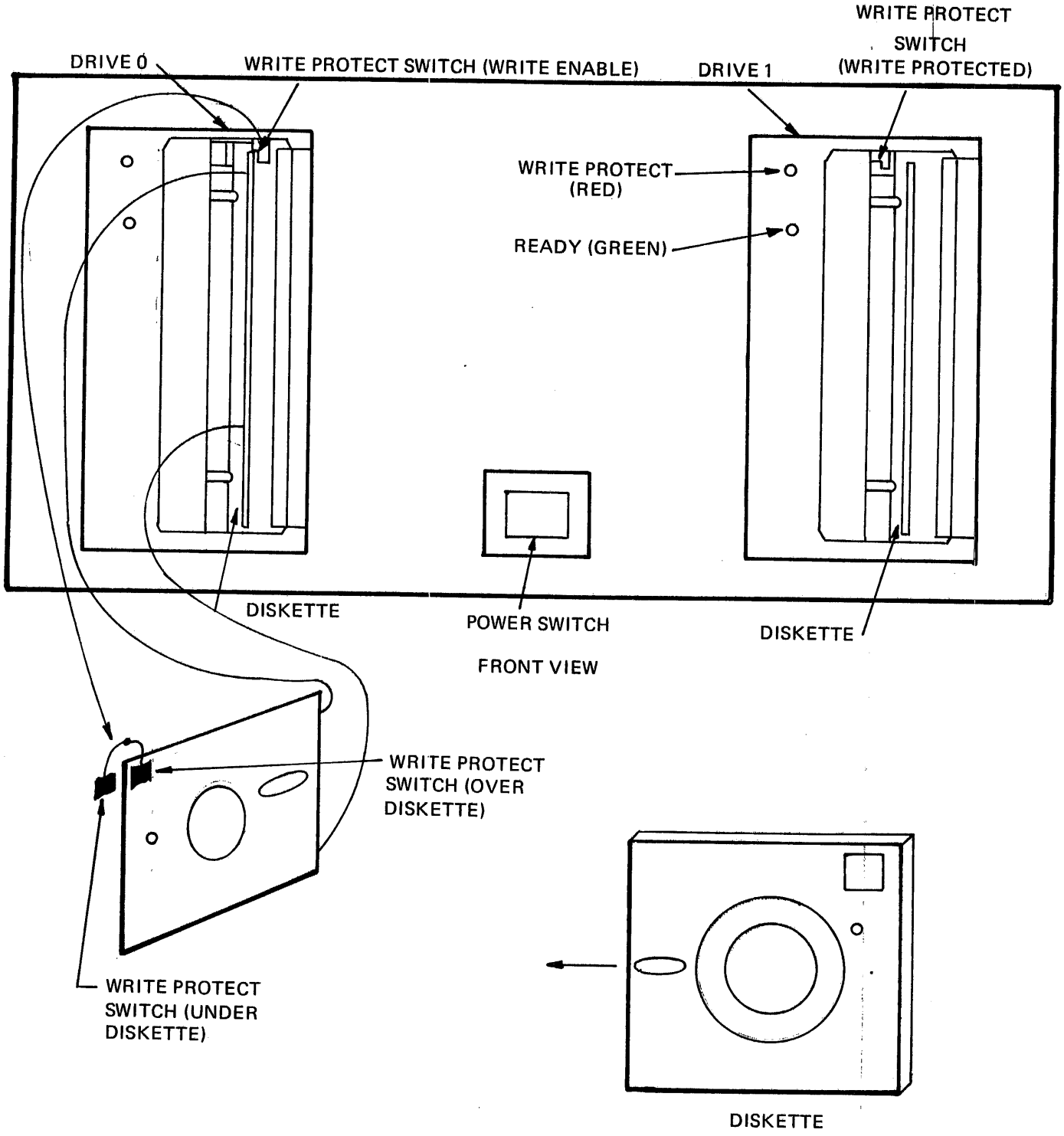


Figure 1. Disc Drive Switches and Indicators

4. DATA FORMAT

The diskette is a flexible software sectored recording media. During the format operation the diskette is divided into 77 tracks with 26 sectors on each track. Tracks are numbered 0 through 76 and defective tracks are flagged (See Figure 2). Each valid track is divided into 26 sectors (physical records). Each sector contains an Address Mark, ID Field, and Data Field. (See Figure 2.)

A Physical Record Number refers to an actual Track/Sector combination (See Appendix 4). The user does not work with Physical Record Numbers except for the Read ID function. A Logical Record refers to the pseudo-sequential Track/Sector combination. The conversion from Logical Record Number to Physical Record Number is accomplished internal to the controller and is transparent to the user. All operations, except Read ID, use Logical Record numbers.

Defective Tracks are flagged during the format operation by writing binary ones in all the sector ID fields of that track. When the controller encounters an ID field which is flagged defective, it automatically increments to the next track. This is done transparent to the user. If there are no defective tracks on the diskette, then there is no difference between Physical Record Numbers and Logical Record Numbers. If there are any defective tracks on the diskette then there is a difference between Physical Record Numbers and Logical Record Numbers.

i.e., Physical Record Numbers are sequential despite the presence of a defective Track, e.g., TRACK 1,2,3,4,
Defective Track, 6....
Logical Record Numbers are pseudo-sequential
TRACK 1,2,3,4, Defective Track, 5,6... .

Deleted records, used for file maintenance, are recognized by the controller during data transfers. During the Delete operation the address mark of the sector is changed from X'FB' to X'F8'. When reading a deleted sector, the data is read but the status reflects that of a deleted record. Writing to a deleted record overwrites the deleted status of that record.

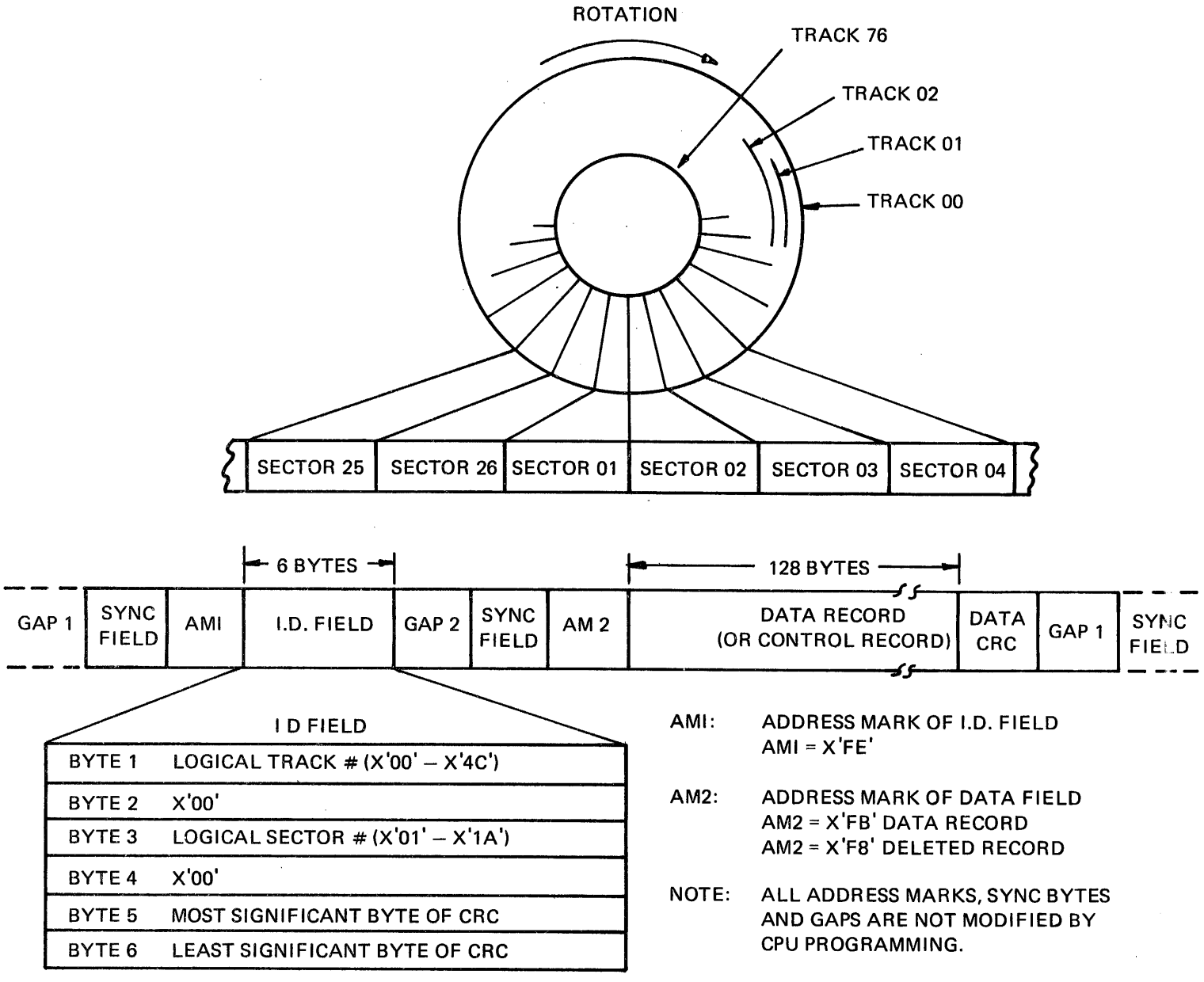


Figure 2. Data Format

5. DATA TRANSFER

The bytes per second transfer rate between the processor and the controller through:

Micro Bus	= Maximum 250 K Byte (see Note) No minimum
I/O Bus	= Max 250 K Byte (see Note) No Minimum
SELCH	= 250 K Byte
E-SELCH	= 250 K Byte
B-SELCH	= 250 K Byte

NOTE

The transfer rate between the Processor and the Controller depends upon the programming mode, RB/WB, RD/WD, RH/WH. To achieve multi-sector data transfer without loosing a rotation of latency, 128 bytes of data must be transferred between the Controller and the Processor in 1.1 milliseconds.

All data transfers use a 128 byte internal buffer on the Floppy Controller. When the controller recognizes a read command, it remains busy while the data is loaded into the sector buffer. When the Processor issues a command to read data, the data is read from the sector buffer. Therefore, when a Read command is issued, the controller buffers one 128 sector. After the 128 bytes are read the next sector is automatically loaded into the internal buffer.

6. PROGRAMMING INSTRUCTIONS

Processor instructions provide communication between the Floppy Disc Controller and the processor.

6.1 Processor Instructions

Sense Status (SS or SSR)

The Sense Status instruction is used to interrogate the status of the controller.

Output Command (OC or OCR)

The Output Command instruction is used to set the controller to a desired state.

Write DATA (WD, WDR, WH or WHR)

The Write Data instruction is used to transfer Logical Record Numbers (LRN) to the controller or to write data to the disc.

Read DATA (RD, RDR, RH or RHR)

The Read Data instruction is sued to retrieve data from the Floppy Disc.

Acknowledge Interrupt (ACK or ACKR) (16-bit Processor only)

The Acknowledge Interrupt instruction is used to service interrupts in 16-bit processors. Execution of this instruction returns the address and status of the interrupting device.

TABLE 3. STATUS AND COMMAND BYTE DATA

BIT	0	1	2	3	4	5	6	7
STATUS	WRITE PROTECT	DEF TRACK	DELETED RECORD	ERROR	BUSY	EXAMINE	IDLE	FAULT
COMMAND	INTERRUPT MODE		DRIVE SELECT		FUNCTION			
No Change	0	0						
Enable	0	1						
Disable	1	0						
Disarm	1	1						
Select Drive 0, (A)			0	0				
Select Drive 1, (B)			0	1				
Select Drive 2, (C)			1	0				
Select Drive 3, (D)			1	1				
Illegal Function					0	0	0	0
READ					0	0	0	1
WRITE					0	0	1	0
READ ID					0	0	1	1
READ AUXILIARY STATUS					0	1	0	0
DELETE RECORD					0	1	0	1
BOOT LOAD					0	1	1	0
STOP					0	1	1	1
RESET					1	0	0	0
FORMAT					1	0	0	1
Illegal Function					1	0	1	0
Illegal Function					1	0	1	1
Illegal Function					1	1	0	0
Illegal Function					1	1	0	1
Illegal Function					1	1	1	0
Illegal Function					1	1	1	1

6.2 Status and Command Bytes

The Status and Command Bytes for the Floppy Disc Controller are shown in Table 3.

6.2.1 Status

Write Protect	This bit is set when the diskette is write protected.
Defective Track	This bit is set when a Read/Write command is issued to a record number whose Track is defective. When this occurs the controller internally increments the record number and the operation is performed on the next Track. This bit is cleared by any Output Command except Read Auxiliary Status or the Stop Command.
Delete Record	This bit is set if a deleted record Address Mark is detected. A Write operation may be performed to a deleted record, which changes the Address Mark to a non-deleted state.
Error	This bit is set if any of the following errors are present, ID CRC Error, Data CRC Error, Logical Record Error or Error in the Error Status byte of the Auxiliary Status, No Address Mark, Command Error, or Seek Error in the Drive Status Byte of the Auxiliary Status.

Busy — This bit is set during the internal data transfer between the diskette and the controller or while other controller functions are being completed. This bit is reset when the controller is free for data transfer between the processor and the controller.

Examine — This bit is set when the Error or Write Protect (after a Write command is issued) bit is set.

Idle — This bit is set when the controller is ready to accept a command.

Fault — This bit is set when the selected drive is unsafe (internally determined), or not Ready. This is set if the Drive power is on but no diskette is in the Drive. This bit is reset when the drive power is off or the Drive is safe. (see Note)

NOTE
When the drive power is off the status returned in X'00'.

6.2.2 Command

DIS — When this bit is set and EN is reset, the Floppy is prevented from interrupting the Processor, but the interrupt is queued when generated.

EN — When this bit is set and DIS is reset, the controller can interrupt the processor as the interrupt occurs if enabled by the PSW.

DISARM

When the DIS and EN bits are both set the controller is prevented from interrupting the processor. Pending interrupts, if any, are cleared. Further interrupts are not queued.

DRIVE SELECT

Selects one of the four possible drives.

bit 2	3	
0	0	- Drive 0 selected
0	1	- Drive 1 selected
1	0	- Drive 2 selected
1	1	- Drive 3 selected

READ

Enables the Controller to read the DATA field of the specified diskette sectors. After the controller receives the READ command, all 128 bytes on the diskette sector are loaded into an internal buffer in the controller, sequentially from byte 0 to byte 127. Once the data is in this buffer, busy goes low and the data is accessible to the processor.

WRITE	Enables the controller to write data onto the DATA field of the specified diskette sectors. After the controller receives the WRITE command, write data instructions are accepted for 128 bytes or until a STOP command is issued. The internal buffer is now full and upon receipt of the STOP command the data is then written to the Floppy Disc. If a STOP command is issued before 128 bytes are written, the last data byte is repeated for the rest of the buffer.
READ ID	Enables the Controller to read the ID field and the two following CRC bytes. After the READ ID command is issued and busy drops, all 6 bytes of the ID Field are valid for retrieving. (Refer to Figure 2.) This command refers to a Physical Record Number.
DELETE RECORD	Enables the controller to Delete the specified sectors. This command is accomplished internally by the controller by changing the Address Mark of the DATA field (AM2) from X'FB' to X'F8'.
BOOT LOAD	Enables the controller to transfer data via the AUTO LOAD instruction. The Boot Load Program must reside on Logical Record Number 5 (TRACK 0 SECTOR 5). When the Boot Load command is issued the controller loads the contents of the diskette from track 0 sector 5 into memory location X'80'

and continues to read until it fills up memory to the location specified by the second operand of the Auto Load instruction. The software must then issue a STOP command and use the program data loaded by the bootload. (For further details on how to Boot Load the diskette see Section 7.9)

STOP — Terminates data transfer after a diskette sector has been written, read or deleted. The STOP command must be given to terminate all operations that require any data transfer to or from the processor.

RESET — This command updates the Drive status. If RESET is issued when the controller is not IDLE, the read/write head does not restore to TRACK 0. If RESET is issued when the controller is IDLE, the read/write head does restore to TRACK 0.

FORMAT — Enables the controller to analyze the recording surface of the selected diskette and to write the correct ID information into the ID field of each sector. All defective tracks are marked. Formatting is done internally (approximately two minutes). Three bytes of data must be written to the controller after the FORMAT command is given:

BYTE 1 - AB = most significant portion of data (suggested setting = X'E5')

BYTE 2 - CD = least significant portion of data (suggested setting = X'E6')

BYTE 3 - XY = format parameter where X = number of errors allowed, Y = number of reads. (Suggested setting = X'0F')

A STOP command must then be issued.

After the controller acknowledges a Format command and the 3 bytes of Format data are written out, the entire diskette is software sectored. The Address Marks, ID fields and Sync fields are written and defective tracks are flagged. After this operation is complete the busy bit drops and the controller is waiting to acknowledge a STOP command.

The Format operation does not reject a diskette with Track 0 or 76 or more than 2 defective tracks. However this should be verified by the use of the Read Auxiliary Status operation immediately after Formatting.

A diskette must be formatted at least once before used in any seek operation. If not, the controller gets lost internally.

Interdata diskettes are Formatted before shipping. If other vendor diskettes are used, they must be formatted to be compatible with the IBM 128 byte sector format or be formatted using this command. (For further detail on how to format the diskette see Section 7.10.)

READ AUXILIARY STATUS

Enables the controller to interrogate the status of the disc drive and diskette. After the READ AUXILIARY STATUS command is issued and busy drops, the auxiliary status is valid for retrieving. The format of the six bytes is shown in Table 4. After any or all of the six bytes are read, a STOP command must be issued.

TABLE 4. AUXILIARY STATUS

Bit	0	1	2	3	4	5	6	7
BYTE 1	I.D.** CRC ERROR	DATA** CRC ERROR	LRN * ERROR	WRITE* PROTECT	ERROR	DEF TRACK	DEL REC	FAULT
2	TRACK 0	$\overline{\text{RDY}}$ *	NO * AM	CMD * ERROR	SEEK ERROR	FILE UNSAFE	DRIVE ADDRESS	
3	Logical address of last Sector Read/Write (See Note 2)							
4	Logical address of last Track Read/Write (See Note 2)							
5	1st physical defective track (See Note 1)							
6	2nd physical defective track (See Note 1)							

NOTE 1

Byte 5	Byte 6		
FF	FF	No defective tracks	valid only after R/W
00	FF	TRACK 0 defective R/W	valid only after R/W
NN	FF	TRACK NN defective	Valid only after format operation
NN	XX	TRACK NN and XX are defective	Valid only after format operation
00	00	More than 2 defective tracks	Valid only after format operation

NOTE 2

If any of the bits marked with * are set, then Byte 3 and 4 are invalid. On any multiple sector transfer if any of the bits marked with ** are set, then Byte 3 and 4 are valid only after the last sector is successfully transferred.

ID CRC ERROR - This bit is set when there is a CRC error in the ID field.

DATA CRC ERROR - This bit is set when there is a CRC error on a data transfer.

LRN ERROR - This bit is set when an illegal Logical Record Number is passed to the controller.

WRITE PROTECT - This bit is set wen the diskette is write protected.

ERROR - This bit is set when the I.D. CRC error, Data CRC error, LRN, No Address Mark, CMD error, or Seek error bit is set. (See Appendix 3)

DEF TRACK - This bit is set when a defective track is encountered.

DEL REC - This bit is set when a deleted record is encountered.

FAULT - This bit is set when $\overline{\text{RDY}}$ or FILE UNSAFE bits are set.

TRACK 0 - This bit is set when the read/write head is at TRACK 0.

$\overline{\text{RDY}}$ - This bit is set when the drive is not ready for any operation. i.e., the ready light is not turned on.

NO AM - This bit is set when the controller can not find the Address Mark.

CMD ERROR - This bit is set when an illegal command is issued.

SEEK ERROR	- This bit is set when the controller cannot find the desired track.
FILE UNSAFE	- This bit is set when the drive is in an unsafe condition. i.e., the internal write protection detects an error.
DRIVE ADDRESS	- Contains the current drive address.

7. PROGRAMMING SEQUENCES

7.1 Read One Sector

Use the following sequence to read one sector.

1. Wait for IDLE = 1.
2. Write the Logical Record Number (1-WH/WHR or 2-WD/WDR); write most significant half of Logical Record Number to the Controller first.
3. Issue a READ Command.
4. Wait for Busy - 0.
5. Read up to 128 bytes from Diskette.
6. Issue a STOP Command.
7. Wait for IDLE = 1.

7.2 Read Multiple Sectors

Use the following sequence to read multiple sectors.

1. Wait for IDLE = 1.
2. Write Logical Record Number to the Controller.
3. Issue a READ Command.
4. Wait for Busy = 0.
5. Read 128 bytes. Read first sector.
6. Repeat steps 4 and 5. Read following sectors.
7. Wait for Busy = 0.
8. Read up to 128 bytes. Read last sector.
9. Issue a STOP Command.
10. Wait for IDLE = 1.

7.3 Write One Sector

Use the following sequence to write one sector.

1. Wait for IDLE = 1.
2. Write the Logical Record Number to the Controller.

3. Issue a WRITE Command.

4. Wait for Busy = 0.

5. Write up to 128 bytes of data.

6. Issue a STOP command.

7. Wait for IDLE = 1.

7.4 Write Multiple Sectors

Use the following sequence to write multiple sectors.

1. Wait for IDLE = 1.

2. Write the Logical Record Number to the Controller.

3. Issue a WRITE Command.

4. Wait for Busy = 8.

5. Write the 128 bytes of data. — write first sector

6. Repeat steps 4 and 5. — write following sector

7. Wait for Busy = 0.

8. Write up to 128 bytes of data — write last sector

9. Issue a STOP Command.

10. Wait for IDLE = 1.

7.5 Delete One Record

Use the following sequence to delete one record.

1. Wait for IDLE = 1.

2. Write Logical Record Number to the Controller.

3. Issue a DELETE Command.

4. Wait for Busy = 0.

5. Write on identifying character. — (If required by system software see IBM Diskette General Information Manual GA 21-9182-1 for compatability requirements)

6. Issue a STOP Command.

7. Wait for IDLE = 1.

7.6 Delete Multiple Sectors

Use the following sequence to delete multiple sectors.

1. Wait for IDLE = 1.
2. Write Logical Record Number to the Controller.
3. Issue a DELETE Command.
4. Write on identifying character.
5. Write 127 characters to fill buffer (these characters can be the same as the identifying character) to delete the first sector.
6. Repeat Steps 4 and 5 to delete subsequent sectors.
7. Write one identifying character.
8. Issue STOP Command.
9. Wait for IDLE = 1.

7.7 Read ID

Use the following sequence to read the ID.

1. Wait for IDLE = 1.
2. Write Physical Record Number to the Controller.
3. Issue a READ ID command.
4. Wait for BUSY = 0.
5. Read any number of I.D. bytes.
6. Issue STOP command.
7. Wait for IDLE = 1.

7.8 Read Aux Status

Use the following sequence to read the Auxiliary Status.

1. Wait for IDLE = 1.
2. Issue READ AUX STATUS Command.
3. Wait for Busy = 0.
4. Read any number of Auxiliary Status bytes.
5. Issue a STOP command.
6. Wait for IDLE = 1.

7.9 Boot Load

Use the following sequence to perform a Boot Load.

1. Insert Diskette containing Loader Program on LRN 5 (Track 0 Sector 5).
2. Set up memory location X'78' for Floppy device address and BOOT LOAD command. (normally X'78' = X'C186')
3. Start standard X'50' sequence or issue AL instruction with second operand containing the number of bytes in the bootloader +X'80'.
4. Issue a STOP command when the main program is loaded from the diskette.
5. Wait for IDLE = 1.

7.10 Format

Use the following sequence to format the diskette.

1. Wait for IDLE = 1.
2. Output a FORMAT command.
3. Wait for Busy = 0.
4. Write 2 data bytes as Format Data. (Suggested data = X'E5E6)
5. Write 1 data byte XY as Format Parameter where,

   X = # of errors allowed

   Y = # of retry reads

   Suggested data = X'0F')
6. Issue a STOP command.
7. Wait for IDLE = 1 (approximately 2 mintues later).
8. Check data (if desired).

8. INTERRUPT

Interrupts are generated on the following conditions:

1. BUSY bit goes to 0.
2. EXAMINE bit goes to 1.
3. FAULT bit goes to 1.
4. IDLE bit goes to 1.
5. Writing a byte to Sector Buffer after issuing WRITE Command X'02'.
6. Reading a byte from Sector Buffer after issuing READ Command X'01'.
7. Reading/Writing a halfword generates one interrupt.

9. INITIALIZATION

When the processor is initialized, the controller disarms all interrupts and selects drive 0.

10. DEVICE NUMBER

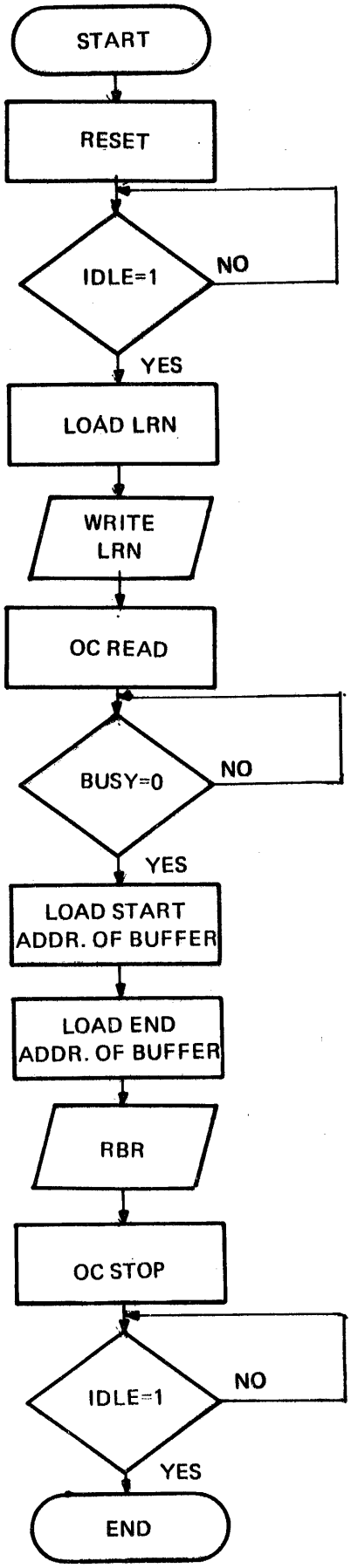
INTERDATA's preferred address for the Floppy Disc System is X'C1'.

11. PROGRAMMING EXAMPLES

Appendix 1 contains 3 programming examples for 16-bit processors. The first program reads one sector under Sense Status Loops. The second program reads one sector under Interrupt control. The third program reads the Auxiliary Status.

Appendix 2 contains three programming examples for 32-bit processor. The first writes one sector under Sense Status. The second writes one sector under Interrupt control. The third Formats the diskette.

APPENDIX 1
16 BIT PROGRAMMING EXAMPLES



READ 1 SECTOR UNDER SENSE STATUS CONTROL

PROG= *NONE* ASSEMBLED BY CAL 03-066R04-01 (32-BIT)

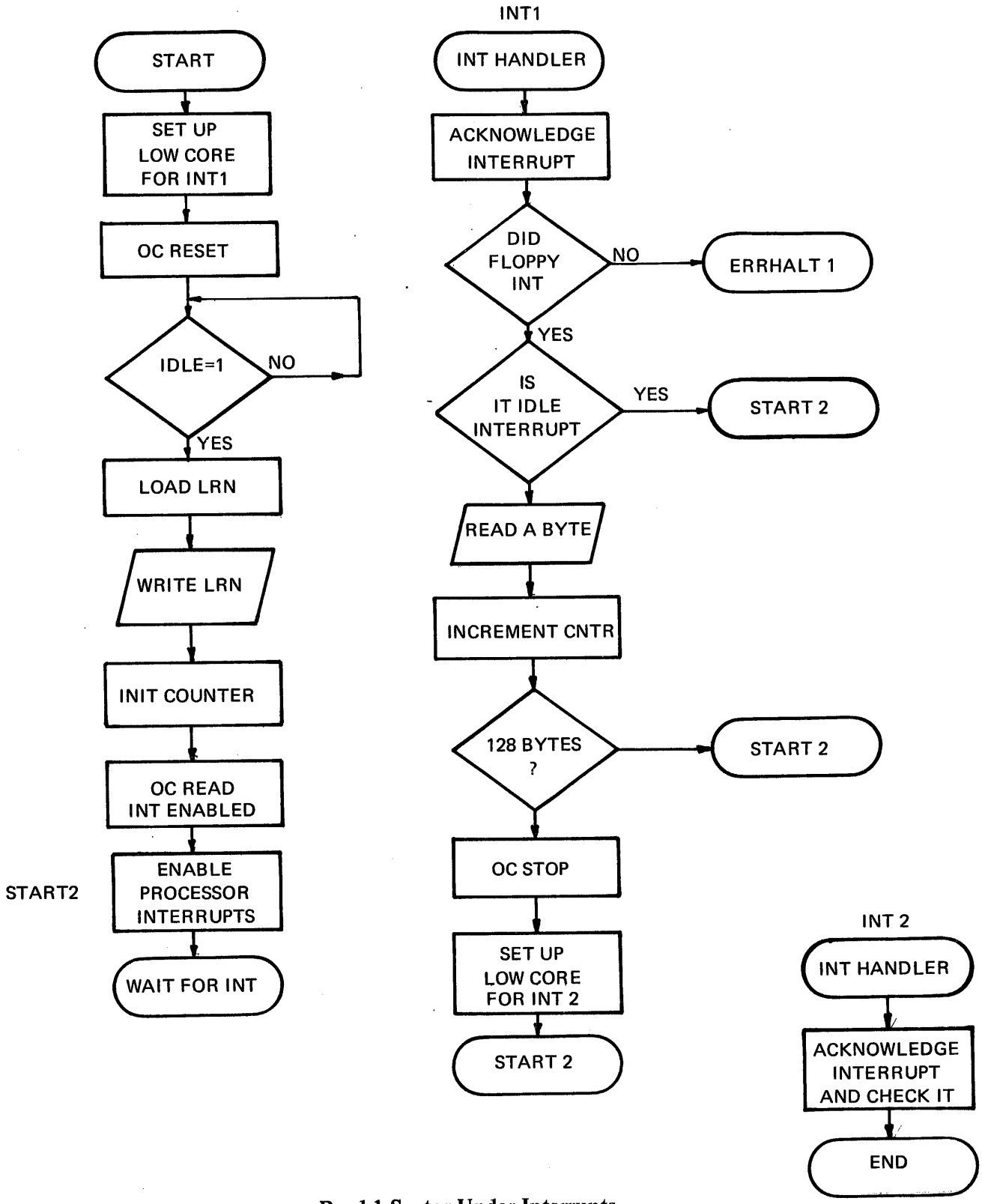
```
                                1          SCRAT
                                2          CROSS
                                3          TARGT  16
                                4          WIDTH  120
                                5  *
                                6  *  SAMPLE PROGRAM FOR A FLOPPY DISC SYSTEM ON A 16-BIT PROCESSOR
                                7  *
                                8  * THIS PROGRAM UTILIZES SENSE STATUS LOOPS TO TRANSFER A BUFFER OF
                                9  * DATA ON THE DISC INTO CORE
                               10  *
                               11  *  REGISTER ASSIGNMENTS
0000 0002                      12  IDLE     EQU    2                 IDLE =2
0000 0008                      13  BUSY     EQU    8                 BUSY =8
0000 0009                      14  LRN      EQU    9                 LOGICAL RECORD NUMBER REGISTER
0000 000C                      15  WORK1    EQU    12                WORK REGISTER 1
0000 000D                      16  WORK2    EQU    13                WORK REGISTER 2
0000 000E                      17  STATUS   EQU    14                STATUS REGISTER
0000 000F                      18  DEVADR   EQU    15                DEVICE ADDRESS
0000R                          19           ORG    X'1000'           ORIGIN ADDRESS
                               20  *
                               21  *       RESET  CONTROLLER
                               22  *
1000   43F0 1048               23  START1   LH     DEVADR,FLPADR     LOAD FLOPPY DISC ADDRESS
1004   DEF0 104A               24           OC     DEVADR,RESET      RESET CONTROLLER
1008   9DFE                    25  SENSE1   SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
100A   4320 1008               26           BFC    IDLE,SENSE1       WAIT FOR IDLE TO SET
                               27  *
                               28  *       WRITE LOGICAL RECORD NUMBER
                               29  *
100E   C890 0700               30           LRI    LRN,X'700'        LOAD LOGICAL RECORD NUMBER OF 700
1012   98F9                    31           WBR    DEVADR,LRN        WRITE THE LOGICAL RECORD  NUMBER
                               32  *
                               33  *       READ ONE SECTOR FROM THE FLOPPY
                               34  *
1014   DEF0 104B               35           OC     DEVADR,READ       GIVE READ COMMAND TO FLOPPY
1018   9DFE                    36  SENSE2   SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
101A   4280 1018               37           BTC    BUSY,SENSE2       WAIT FOR  BUSY TO SET
101E   C8C0 1050               38           LRI    WORK1,BUFFER      LOAD  START ADDRESS OF BUFFER
1022   C8DC 007F               39           LRI    WORK2,127(WORK1)  LOAD  END ADDRESS OF BUFFER 128
1026   97FC                    40           RBR    DEVADR,WORK1      READ 128  BYTES OF DATA
1028   4270 103A               41           BTC    7,ERRHALT
102C   DEF0 104C               42           OC     DEVADR,STOP       STOP CONTROLLER
1030   9DFE                    43  SENSE3   SSR    DEVADR,STATUS     SENSE CONTROLLER  STATUS
1032   4320 1030               44           BFC    IDLE,SENSE3       WAIT FOR IDLE
1036   C200 1044               45  END1     LPSW   PSW1
103A   C200 1040               46  ERRHALT  LPSW   PSW2
1040                           47           ALIGN  8
1040   8000                    48  PSW2     DC     X'8000',A(ERRHALT)
1042   103A
1044   8000                    49  PSW1     DC     X'8000',A(END1)
1046   1036
1048   00C1                    50  FLPADR   DCX    C1                FLOPPY ADDRESS
104A   C8                      51  RESET    DB     X'C8'             RESET /DISARM /DRIVE 0
104B   C1                      52  READ     DB     X'C1'             READ /DISARM / DRIVE 0
```

```
104C  C7                    53  STOP    DB      X'C7'           STOP /DISARM /DRIVE 0
                            54  *
                            55  *       BUFFER
                            56  *
1050                        57          ALIGN   8
1050                        58  BUFFER  DS      128
1000                        59          END
```

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	1000									
ADC	0002									
BUFFER	1050	38								
BUSY	0008	37								
DEVADR	000F	23	24	25	31	35	36	40	42	43
END1	1056	49								
ERRHALT	105A	41	48							
FLPADR	1048	23								
IDLE	0002	26	44							
IMPTOP	0000R									
LADC	0001									
LRN	0009	30	31							
PSW1	1044	45								
PSW2	1040	46								
PURETOP	0000R									
READ	104B	35								
RESET	104A	24								
SENSE1	1008	26								
SENSE2	1018	37								
SENSE3	1030	44								
START1	1000									
STATUS	000E	25	36	43						
STOP	104C	42								
WORK1	000C	38	39	40						
WORK2	000D	39								



Read 1 Sector Under Interrupts

PROG= *NONE* ASSEMBLED BY CAL 03-066R04-01 (32-BIT)

```
                                1          SCRAT
                                2          CROSS
                                3          TARGT  16
                                4          WIDTH  120
                                5  *
                                6  *  SAMPLE PROGRAM FOR THE FLOPPY DISC SYSTEM ON A 16-BIT PROCESSOR
                                7  *
                                8  *  THIS PROGRAM TRANSFERS A BUFFER OF DATA FROM THE FLOPPY UNDER
                                9  *  INTERRUPTS
                               10  *
                               11  *  REGISTER ASSIGNMENTS
0000 0002                      12  IDLE     EQU    2                 IDLE=2
0000 0009                      13  WORK1    EQU    9                 WORK REGISTER
0000 000A                      14  COUNT    EQU    10                COUNTER REGISTER
0000 000B                      15  INTDEV   EQU    11                INTERRUPT DEVICE REGISTER
0000 000C                      16  INTSTAT  EQU    12                INTERRUPT STATUS REGISTER
0000 000D                      17  LRN      EQU    13                LOGICAL RECORD NUMBER
0000 000E                      18  STATUS   EQU    14                STATUS REGISTER
0000 000F                      19  DEVADR   EQU    15                DEVICE ADDRESS REGISTER
0000R                          20           ORG    X'2000'           ORIGIN ADDRESS
                               21  *
                               22  *  SET UP LOW CORE
                               23  *
2000  48F0 209C                24  START1   LH     DEVADR,FLPADR     LOAD FLOPPY ADDRESS
2004  2490                     25           LIS    WORK1,0           LOAD ZERO
2006  4090 0040                26           STH    WORK1,X'40'       ZERO OLD PSW
200A  4090 0042                27           STH    WORK1,X'42'       ZERO OLD LOC
200E  4090 0044                28           STH    WORK1,X'44'       ZERO NEW PSW
2012  C890 2038                29           LHI    WORK1,FLPINT      LOAD  FLOPPY INTERRUPT VECTOR ADDRES
2016  4090 0046                30           STH    WORK1,X'46'       SET UP INTERRUPT HANDLER ADDRESS
                               31  *
                               32  *  SET UP FLOPPY
                               33  *
201A  DEF0 209E                34           OC     DEVADR,RESET      RESET CONTROLLER
201E  9DFE                     35  SENSE1   SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
2020  4320 201E                36           BFC    IDLE,SENSE1       WAIT FOR IDLE
                               37  *
                               38  *  WRITE LRN
                               39  *
2024  C800 0700                40           LHI    LRN,X'700'        LOAD UP LOGICAL RECORD NUMBER
2028  98F0                     41           WHR    DEVADR,LRN        WRITE THE LOGICAL RECORD NUMBER
202A  24A0                     42           LIS    COUNT,0           INITIALIZE COUNT
                               43  *
                               44  *  START  INTERRUPT TRANSFER
                               45  *
202C  DEF0 209F                46           OC     DEVADR,ENA.READ   ENABLE INTERRUPTS AT FLOPPY
2030  C200 2088                47  START2   LPSW   PSW1              ENABLE INTERRUPTS AT PROCESSOR
2034  4300 2082                48           B      ERRHALT3          ERROR
                               49  *
                               50  *  INTERRUPT HANDLER
                               51  *
2038  9FBC                     52  FLPINT   ACKR   INTDEV,INTSTAT    AC,NOWLEDGE INTERRUPT
203A  05FB                     53           CLHR   DEVADR,INTDEV      CHECK THAT IT WAS FLOPPY
203C  4230 207A                54           BNE    ERRHALT1          NO GO TO ERROR
```


APPENDIX 1 CONTINUED

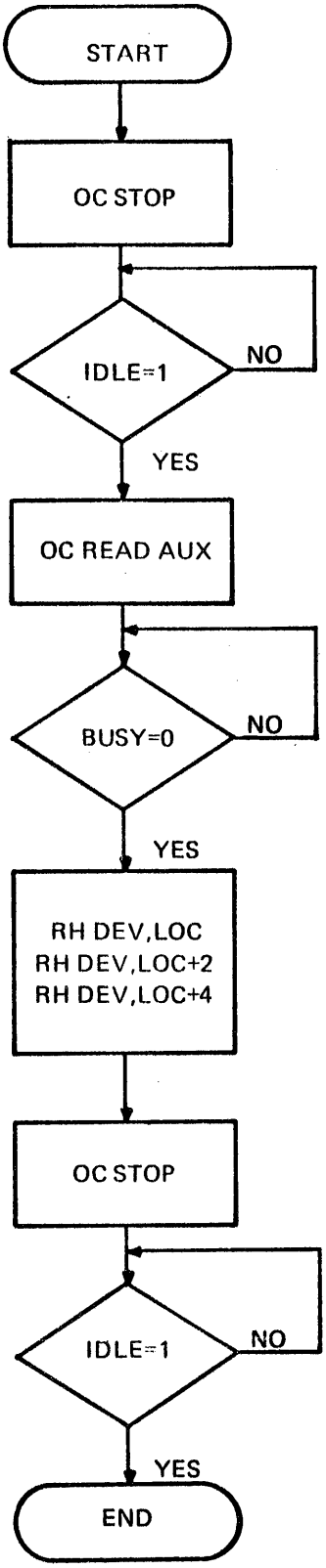
```
2040  C3C0 0002          55          THI   INTSTAT,2          IS IT IDLE INTERRUPT
2044  4230 2030          56          BNZ   START2             WAIT FOR ANOTHER INTERRUPT
2048  0BFA 20A8          57          RD    DEVADR,BUFFER(COUNT)   READ A BYTE
                         58  *
                         59  * ADJUST  COUNTER
                         60  *
204C  26A1               61          AIS   COUNT,1            INCREMENT COUNTER
204E  C5A0 0080          62          CLHT  COUNT,128          LIMIT YET?
2052  4230 2030          63          BNE   START2             NO GO AGAIN
2056  DEF0 20A0          64          OC    DEVADR,STOP        STOP CONTROLLER
205A  C890 2066          65          LHI   WORK1,END          LOAD NEW INTERRUPT ROUTINE
205E  4090 0046          66          STH   WORK1,X'46'        STORE IN INTERRUPT HANDLER
2062  4300 2030          67          B     START2             WAIT FOR ANOTHER INTERRUPT
                         68  *
                         69  *  FINISH
                         70  *
2066  9FBC               71  END     ACKR  INTDEV,INTSTAT     ACKNOWLEDGE INTERRUPT
2068  05BF               72          CLHR  INTDEV,DEVADR      IS IT A FLOPPY
206A  4230 207A          73          BNE   ERRHALT1           NO GO TO ERROR
206E  C3C0 0002          74          THI   INTSTAT,2          IDLE INTERRUPT
2072  4330 2030          75          BZ    START2
2076  C200 208C          76  END1    LPSW  PSW2               FINISH
207A  C200 2090          77  ERRHALT1 LPSW PSW3               ERROR HALT DEVICE
207E  C200 2094          78  ERRHALT2 LPSW PSW4               ERROR HALT STATUS
2082  C200 2098          79  ERRHALT3 LPSW PSW5               ERROR HALT NO INTERRUPT
2088                     80          ALIGN 8
2088  C000               81  PSW1    DC    X'C000',A(START2)
208A  2030
208C  8000               82  PSW2    DC    X'8000',A(END1)
208E  2076
2090  8000               83  PSW3    DC    X'8000',A(ERRHALT1)
2092  207A
2094  8000               84  PSW4    DC    X'8000',A(ERRHALT2)
2096  207E
2098  8000               85  PSW5    DC    X'8000',A(ERRHALT3)
209A  2082
209C  00C1               86  FLPADR  DCX   C1
209E  C8                 87  RESET   DB    X'C8'              RESET/DRIVE 0 /DISARM
209F  41                 88  ENA.READ DB   X'41'              READ/DRIVE 0/ENABLE INTERRUPTS
20A0  47                 89  STOP    DB    X'47'              STOP/DRIVE 0/ENABLE INTERRUPTS
20A8                     90          ALIGN 8
20A8                     91  BUFFER  DS    128                BUFFER OF 128 BYTES
2128                     92          END
```

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	2128									
ADC	0002									
BUFFER	20A8	57								
COUNT	000A	42	57	61	62					
DEVADR	000F	24	34	35	41	46	53	57	64	72
ENA.READ	209F	46								
END	2066	65								
END1	2076	82								
ERRHALT1	207A	54	73	83						
ERRHALT2	207E	84								
ERRHALT3	2082	48	85							
FLPADR	209C	24								
FLPINT	2038	29								
IDLE	0002	36								
INPTOP	0000R									
INTDEV	000B	52	53	71	72					
INTSTAT	000C	52	55	71	74					
LADC	0001									
LRN	000D	40	41							
PSW1	2088	47								
PSW2	208C	76								
PSW3	2090	77								
PSW4	2094	78								
PSW5	2098	79								
PURETOP	0000R									
RESET	209E	34								
SENSE1	201E	36								
START1	2000									
START2	2060	56	63	67	75	81				
STATUS	000E	35								
STOP	20A0	64								
WORK1	0009	25	26	27	28	29	50	65	66	

APPENDIX 1 CONTINUED



READ AUXILARY STATUS

PROG= *NONE* ASSEMBLED BY CAL 03-066R04-01 (32-BIT)

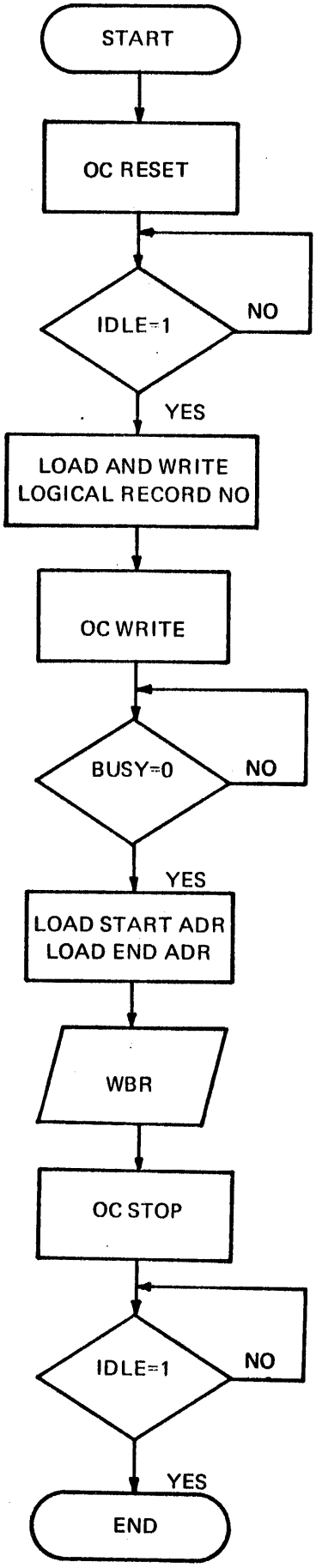
```
                        1          SCRAT
                        2          CROSS
                        3          TARGT  16
                        4          WIDTH  120
                        5  *
                        6  *  SAMPLE PROGRAM FOR THE FLOPPY DISC SYSTEM ON A 16-BIT PROCESSOR
                        7  *
                        8  *  THIS PROGRAM READS THE AUXILARY STATUS FROM THE FLOPPY
                        9  *
                       10  *  REGISTER  ASSIGNMENTS
0000 0002              11  IDLE     EQU    2                 IDLE=2
0000 0008              12  BUSY     EQU    8                 BUSY=8
0000 000D              13  WORK1    EQU    13                WORK1 REGISTER
0000 000E              14  STATUS   EQU    14                STATUS REGISTER
0000 000F              15  DEVADR   EQU    15                FLOPPY ADDRESS
0000R                  16          ORG    X'3000'           ORIGIN ADDRESS
                       17  *
                       18  *   STOP CONTROLLER AND WAIT FOR IDLE
                       19  *
3000  48F0 300C        20          LH     DEVADR,FLPADR     LOAD FLOPPY ADDRESS
3004  DEF0 300E        21          OC     DEVADR,STOP       STOP
3008  9DFE             22  SENSE1  SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
300A  4320 3008        23          BFC    IDLE,SENSE1       WAIT FOR IDLE
                       24  *
                       25  *          READ AUXILARY STATUS
                       26  *
300E  DEF0 300F        27          OC     DEVADR,RDAUXST    READ AUX STATUS COMMAND
3012  9DFE             28  SENSE2  SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
3014  4280 3012        29          BTC    BUSY,SENSE2       WAIT FOR BUSY TO DROP
3018  D9F0 3040        30          RH     DEVADR,RAUXBUF    READ 1ST AND 2ND BYTES OF AUX STATUS
301C  D9F0 3042        31          RH     DEVADR,RAUXBUF+2  READ 3RD AND 4TH BYTES OF AUX STATUS
3020  D9F0 3044        32          RH     DEVADR,RAUXBUF+4  READ 5TH AND 6TH BYTES OF AUX STATUS
3024  DEF0 300E        33          OC     DEVADR,STOP       STOP CONTROLLER
3028  9DFE             34  SENSE3  SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
302A  4320 3028        35          BFC    IDLE,SENSE3       WAIT FOR IDLE
                       36  *
                       37  *   FINISHED
                       38  *
302E  C200 3038        39  END1    LPSW   PSW               DONE
3038                   40          ALIGN  8
3038  8000             41  PSW     DC     X'8000',A(END1)
303A  302E
303C  00C1             42  FLPADR  DCX    C1                FLOPPY ADDRESS
303E  C7               43  STOP    DC     X'C7'             STOP/DRIVE 0/DISARM
303F  C4               44  RDAUXST DC     X'C4'             READ AUX STATUS/DRIVE 0 /DISARM
3040                   45          ALIGN  8
3040                   46  RAUXBUF DS     6
3046                   47          END
```

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	3046										
AJC	0002										
BUSY	0008	29									
DEVADR	000F	20	21	22	27	28	30	31	32	33	34
END1	302E	41									
FLPADR	305C	20									
IDLE	0002	23	35								
IMPTOP	0000R										
LADC	0001										
PSW	3058	39									
PURETOP	0000R										
RAUXBUF	3040	30	31	32							
RDAUXST	305F	27									
SENSE1	3008	23									
SENSE2	3012	29									
SENSE3	3028	35									
STATUS	000E	22	25	34							
STOP	305E	21	33								
WORK1	0000										

APPENDIX 1 CONTINUED



WRITE 128 BYTES UNDER SENSE STATUS

APPENDIX 2 32-BIT FLOPPY DISC PROGRAMMING EXAMPLES PAGE 1 10:54:08 01/18/77

PROG= *NONE* ASSEMBLED BY CAL 03-066R04-01 (32-BIT)

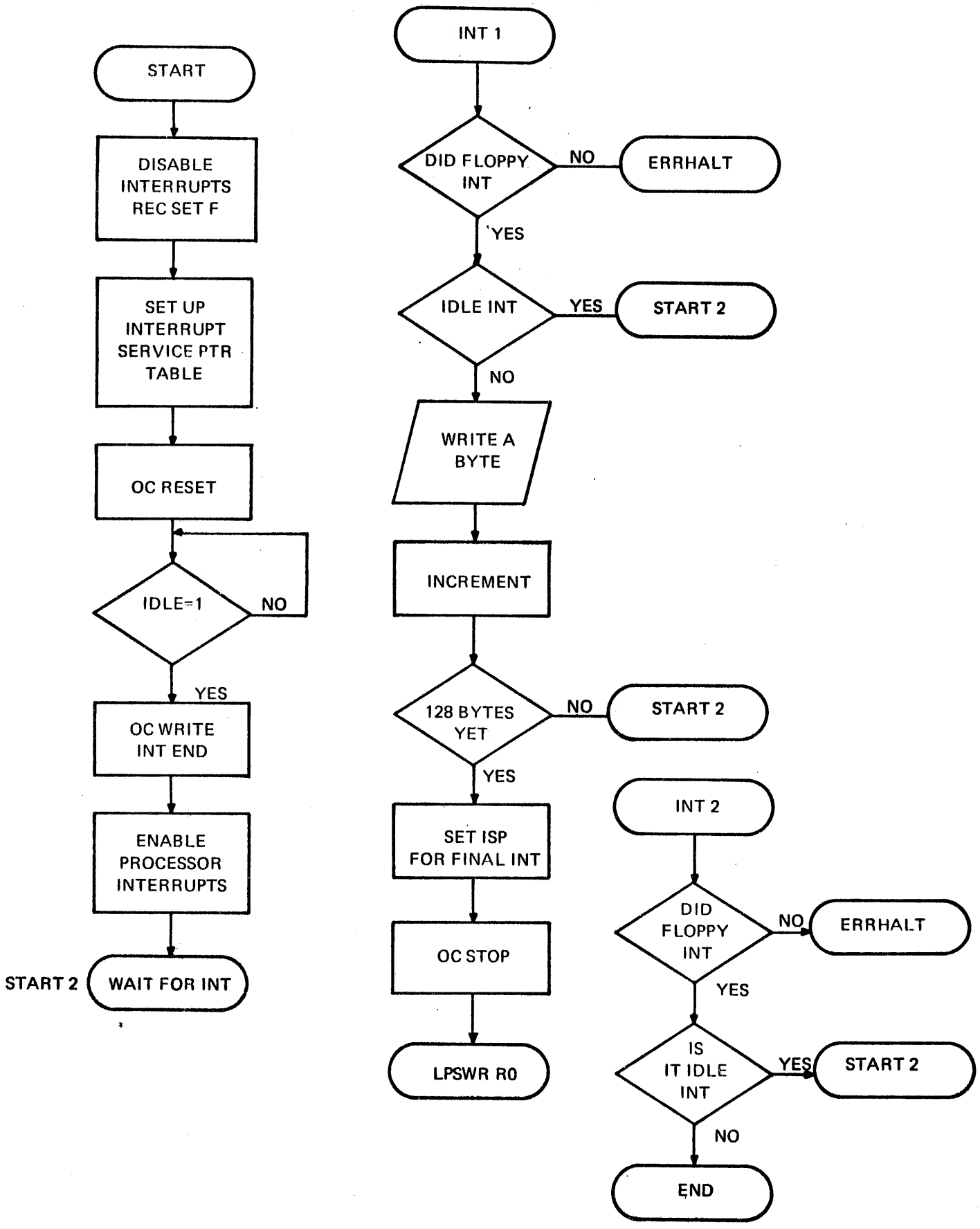
```
                                1          SCRAT
                                2          TARST  32
                                3          CROSS
                                4          WIDTH  120
                                5          NORX3
                                6  * SAMPLE PROGRAM FOR THE FLOPPY DISC SYSTEM ON A 32-BIT PROCESSOR
                                7  *
                                8  *
                                9  * THIS PROGRAM UTILIZES SENSE STATUS LOOPS TO TRANSFER A BUFFER OF
                               10  * DATA IN CORE TO THE DISC
                               11  *
                               12  * REGISTER ASSIGNMENTS
0000 0002                      13  IDLE     EQU    2                 IDLE=2
0000 0007                      14  TEST     EQU    7                 TEST=7
0000 0008                      15  BUSY     EQU    8                 BUSY=8
0000 0009                      16  LRN      EQU    9                 LOGICAL RECORD NUMBER REGISTER
0000 000C                      17  WORK1    EQU    12                WORK 1 REGISTER
0000 000D                      18  WORK2    EQU    13                WORK2 REGISTER
0000 000E                      19  STATUS   EQU    14                STATUS REGISTER
0000 000F                      20  DEVADR   EQU    15                DEVICE ADDRESS
0000001                        21           ORG    X'1000'           ORIGIN ADDRESS
                               22  *
                               23  *  RESET CONTROLLER
                               24  *
001000  73F0 1050              25  START1   LHL    DEVADR,FLPADR     LOAD FLOPPY ADDRESS
001004  DEF0 1052              26           OC     DEVADR,RESET      RESET FLOPPY CONTROLLER
001008  9DFE                   27  SENSE1   SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
00100A  4320 1008              28           BFC    IDLE,SENSE1       WAIT FOR IDLE
                               29  *
                               30  *  WRITE LOGICAL RECORD NUMBER
                               31  *
00100E  C890 0700              32           LHI    LRN,X'700'        LOAD LOGICAL RECORD NUMBER
001012  98F9                   33           WHR    DEVADR,LRN        WRITE THAT LRN
                               34  *
                               35  *  WRITE  ONE SECTOR TO THE FLOPPY
                               36  *
001014  DEF0 1053              37           OC     DEVADR,WRITE      SET UP CONTROLLER TO WRITE
001018  9DFE                   38  SENSE2   SSR    DEVADR,STATUS     SENSE CONTROLLER STATUS
00101A  4280 1018              39           BTC    BUSY,SENSE2       WAIT FOR BUSY TO DROP
00101E  E6C0 1058              40           LA     WORK1,BUFFER      LOAD START ADDRESS
001022  E6DC 007F              41           LA     WORK2,127(WORK1)  LOAD END ADDRESS
001026  96FC                   42           WBR    DEVADR,WORK1      WRITE BUFFER OF DATA
001028  4270 103A              43           BTC    TEST,ERRHALT      TEST FOR GOOD TERMINATION
00102C  DEF0 1054              44           OC     DEVADR,STOP       STOP CONTROLLER
001030  9DFE                   45  SENSE3   SSR    DEVADR,STATUS     SENSE CONTROLLE STATUS
001032  4320 1030              46           BFC    IDLE,SENSE3       WAIT FOR IDLE
001036  C200 1040              47  END1     LPSW   PSW1              HALT GOOD FINISH
00103A  C200 1048              48  ERRHALT  LPSW   PSW2              HALT ERROR TERMINATION
001040                         49           ALIGN  8
001040  0000 8000              50  PSW1     DC     Y'00008000',A(END1)
001044  0000 1036
001048  0000 8000              51  PSW2     DC     Y'00008000',A(ERRHALT)
00104C  0000 103A
001050  00C1                   52  FLPADR   DCX    C1                FLOPPY ADDRESS
```

```
001052  C8          53  RESET   DB      X'C8'       RESET/DRIVE 0/INTERRUPTS DISARMED
001053  C2          54  WRITE   DB      X'C2'       WRITE/DRIVE 0 /INTERRUPTS DISARMED
001054  C7          55  STOP    DB      X'C7'       STOP/DRIVE 0 /INTERRUPTS DISARMED
                    56  *
                    57  *  BUFFER
                    58  *
001058              59          ALIGN   8
001058              60  BUFFER  DS      128
0010D8              61          END
```

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	0000 1008								
ADC	0000 0004								
BUFFER	0000 1058	40							
BUSY	0000 0008	39							
DEVADR	0000 000F	25	26	27	33	37	38	42	44	45
END1	0000 1056	50							
ERRHALT	0000 105A	43	51						
FLPADR	0000 1050	25							
IDLE	0000 0002	28	46						
IMPTOP	0000 0000I								
LADC	0000 0002								
LRN	0000 0009	32	33						
PSW1	0000 1040	47							
PSW2	0000 1048	48							
PURETOP	0000 0000P								
RESET	0000 1052	26							
SENSE1	0000 1008	28							
SENSE2	0000 1018	39							
SENSE3	0000 1030	46							
START1	0000 1000								
STATUS	0000 000E	27	38	45					
STOP	0000 1054	44							
TEST	0000 0007	43							
WORK1	0000 000C	40	41	42					
WORK2	0000 000D	41							
WRITE	0000 1053	37							



WRITE 128 BYTES UNDER INTERRUPT CONTROL

PROG= *NONE* ASSEMBLED BY CAL 03-066R04-01 (32-BIT)

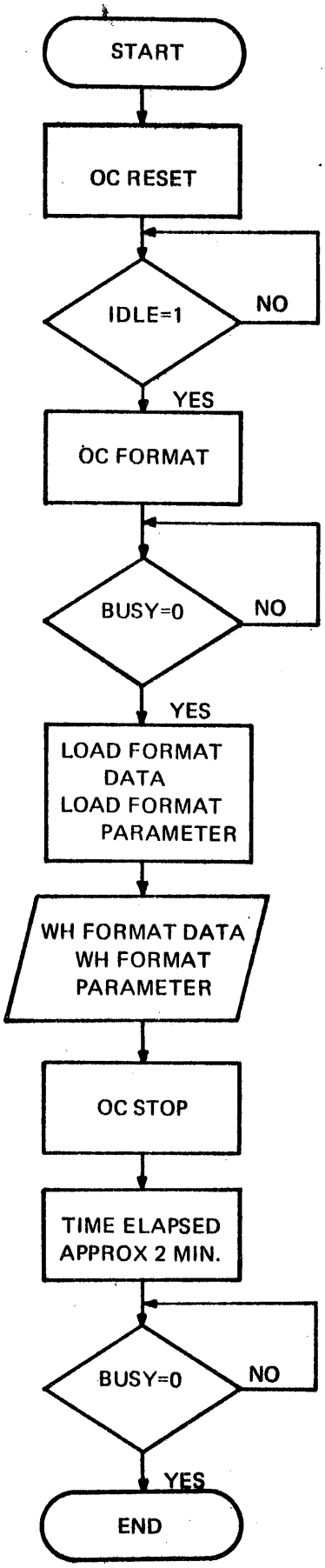
```
                                1          SCRAT
                                2          NORX3
                                3          CROSS
                                4          TARST  32
                                5          WIDTH  120
                                6  *
                                7  * SAMPLE PROGRAM FOR THE FLOPPY DISC SYSTEM ON A 32-BIT PROCESSOR
                                8  *
                                9  * THIS PROGRAM TRANSFERS 128 BYTES OF DATA TO THE FLOPPY UNDER
                               10  * INTERRUPT CONTROL
                               11  *
                               12  * REGISTER ASSIGNMENTS
0000 0000                      13  RESTART  EQU    0               RESTART PSW/LOC AFTER INTERRUPT
0000 0002                      14  IDLE     EQU    2               IDLE=2
0000 0002                      15  INTDEV   EQU    2               INTERRUPT  DEVICE
0000 0003                      16  INTSTAT  EQU    3               INTERRUPT  STATUS
0000 0006                      17  DEVADR   EQU    6
0000 000B                      18  COUNT    EQU    11              COUNTER
0000 000C                      19  WORK2    EQU    12              WORK2 REGISTER
0000 000D                      20  WORK1    EQU    13              WORK1 REGISTER
0000 000E                      21  STATUS   EQU    14              STATUS REGISTER
0000001                        22          ORG    X'2000'         ORIGIN ADDRESS
                               23  *
                               24  *  SET UP PROCESSOR IN FULL WORD MODE IN REGISTER SET 15
                               25  *
002000  C8D0 00F0              26  START1   LHI    WORK1,X'00F0'   DISABLE PROC INT REGISTER SET F
002004  95CD                   27           EPSR   WORK2,WORK1     LOAD UP NEW PSW
002006  7360 20D0              28           LHL    DEVADR,FLPADR   LOAD FLOPPY ADDRESS
                               29  *
                               30  *  SET UP INTERRUPT SERVICE POINTER TABLE
                               31  *
002008  24B0                   32           LIS    COUNT,0         ZERO OUT COUNT
00200C  C8C0 2092              33           LHI    WORK2,ERRHALT1  LOAD ERROR PATH
002010  40CB 00D0              34  LDAGAIN  STH    WORK2,X'D0'(COUNT) LOAD INTERRUPT SERVICE POINTER TBLE
002014  26B2                   35           AIS    COUNT,2         INCREMENT COUNT
002016  C5B0 02D0              36           CLHI   COUNT,X'2D0'    LIMIT YET?
00201A  4280 2010              37           BL     LDAGAIN         NO GO AGAIN
00201E  08D6                   38           LR     WORK1,DEVADR    LOAD UP FLOPPY ADDRESS
002020  1101                   39           SLLS   WORK1,1         X2
002022  C8C0 204A              40           LHI    WORK2,FLPINT    LOAD FLOPPY INTERRUPT HANDLER
002026  40CD 00D0              41           STH    WORK2,X'D0'(WORK1) STORE IN INTERRUPT SERVICE POINTER T   LE
                               42  *
                               43  *  SET UP FLOPPY
                               44  *
002028  DE60 20D4              45           OC     DEVADR,RESET    RESET CONTROLLER
00202E  9D6E                   46  SENSE1   SSR    DEVADR,STATUS   SENSE CONTROLLER STATUS
002030  4320 202E              47           BFC    IDLE,SENSE1     WAIT FOR IDLE
002034  24B0                   48           LIS    COUNT,0         INITIALIZE BUFFER COUNT
002036  40B0 20D2              49           STH    COUNT,COUNTER   INITIALIZE COUNTER
                               50  *
                               51  *  ENABLE EXTERNAL INTERRUPTS AND FLOPPY INTERRUPTS
                               52  *
00203A  DE60 20D5              53           OC     DEVADR,ENA.WRIT
00203E  F8D0 0000 C0F0         54  START2   LI     WORK1,Y'C0F0'   WAIT STATE /ENABL INT/ REG SET U5
```

```
002044  95CD                    55          EPSR    WORK2,WORK1         GO
002046  4300 2096               56          B       ERRHALT2            ERROR PATH
                                57  *
                                58  *  INTERRUPT HANDLER
                                59  *
00204A  0526                    60  FLPINT  CLR     INTDEV,DEVADR       IS IT THE FLOPPY
00204C  4260 209A               61          BNE     ERRHALT3            NO GO TO ERROR
002050  C330 0002               62          THI     INTSTAT,2           IS IT IDLE INTERRUPT
002054  4260 205E               63          BNZ     START2              WAIT FOR ANOTHER INTERRUPT
002058  DA6B 20D8               64          WD      DEVADR,BUFFER(COUNT)
00205C  4880 20D2               65          LH      COUNT,COUNTER       LOAD CURRENT COUNT VALUE
002060  26B1                    66          AIS     COUNT,1
002062  40B0 20D2               67          STH     COUNT,COUNTER       UPDATE COUNTER
002066  C5B0 0080               68          CLHI    COUNT,128           LIMIT YET?
00206A  4260 205E               69          BNE     START2
00206E  DE60 20D6               70          CC      DEVADR,STOP         STOP CONTROLLER
002072  08D6                    71          LR      WORK1,DEVADR        LOAD FLOPPY ADDRESS
002074  11D1                    72          SLLS    WORK1,1             X 2
002076  C8C0 2080               73          LHI     WORK2,END           LOAD UP INTERRUPT ROUTINE
00207A  40CD 00D0               74          STH     WORK2,X'D0'(WORK1)  STORE IN INTERRUPT SERVICE PTR TABLE
00207E  1800                    75          LPSWR   RESTART
002080  0526                    76  END     CLR     INTDEV,DEVADR       IS IT THE FLOPPY
002082  4260 209A               77          BNE     ERRHALT3            NO GO TO ERROR HALT
002086  C330 0002               78          THI     INTSTAT,2           IS IT IDLE
00208A  4330 205E               79          BZ      START2              WAIT FOR ANOTHER INTERRUPT
00208E  C200 20A8               80  END1    LPSW    PSW1                FINISH
002092  C200 20B0               81  ERRHALT1 LPSW   PSW2                WRONG DEVICE INTERRUPTED
002096  C200 20B8               82  ERRHALT2 LPSW   PSW3                NO INTERRUPT
00209A  C200 20C0               83  ERRHALT3 LPSW   PSW4                DEVICE ON INTERRUPT
00209E  C200 20C8               84  ERRHALT4 LPSW   PSW5                STATUS BAD ON INTERRUPT
0020A2                          85          ALIGN   8
0020A8  0000 8000               86  PSW1    DC      Y'8000',A(END1)
0020AC  0000 208E
0020B0  0000 8000               87  PSW2    DC      Y'8000',A(ERRHALT1)
0020B4  0000 2092
0020B8  0000 8000               88  PSW3    DC      Y'8000',A(ERRHALT2)
0020BC  0000 2096
0020C0  0000 8000               89  PSW4    DC      Y'8000',A(ERRHALT3)
0020C4  0000 209A
0020C8  0000 8000               90  PSW5    DC      Y'8000',A(ERRHALT4)
0020CC  0000 209E
0020D0  00C1                    91  FLPADR  DCX     C1
0020D2  0000                    92  COUNTER DCX     0
0020D4  C8                      93  RESET   DB      X'C8'               RESET /DRIVE 0 /DISARM
0020D5  42                      94  ENA.WRIT DB     X'42'               WRITE/DRIVE 0/ENABLE INTERRUPTS
0020D6  47                      95  STOP    DB      X'47'               STOP /DRIVE 0/ENABLE INTERRUPTS
0020D8                          96          ALIGN   8
0020D8                          97  BUFFER  DS      128
0021 58                         98          END
```

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	0000 2158										
ADC	0000 0004										
BUFFER	0000 2008	64									
COUNT	0000 000B	32	34	35	36	48	49	64	65	66	67	68
COUNTER	0000 2002	49	65	67							
DEVADR	0000 0006	28	36	45	46	53	60	64	70	71	76	
EVA.WRIT	0000 2005	53									
END	0000 2080	73									
END1	0000 208E	86									
ERRHALT1	0000 2092	33	87								
ERRHALT2	0000 2096	56	68								
ERRHALT3	0000 209A	61	77	89							
ERRHALT4	0000 209E	90									
FLPADR	0000 2000	28									
FLPINT	0000 204A	40									
IDLE	0000 0002	47									
IMPTOP	0000 00001										
INTDEV	0000 0002	60	76								
INTSTAT	0000 0003	62	78								
LADC	0000 0002										
LOAGAIN	0000 2010	37									
PSW1	0000 20A8	80									
PSW2	0000 20B0	81									
PSW3	0000 20B8	82									
PSW4	0000 20C0	83									
PSW5	0000 20C8	84									
PURETOP	0000 0000P										
RESET	0000 2004	45									
RESTART	0000 0000	75									
SENSE1	0000 202E	47									
START1	0000 2000										
START2	0000 203E	63	69	79							
STATUS	0000 000E	46									
STOP	0000 2006	70									
WORK1	0000 000D	26	27	38	39	41	54	55	71	72	74
WORK2	0000 000C	27	33	34	40	41	55	73	74		



FORMAT PROGRAM

PROG= *NONE* ASSEMBLED BY CAL 03-066R04-01 (32-BIT)

```
                        1          SCRAT
                        2          TARGT  32
                        3          WIDTH  120
                        4  *
                        5  * SAMPLE PROGRAM FOR THE FLOPPY DISC SYSTEM ON A 32-BIT PROCESSOR
                        6  *
                        7  *  THIS PROGRAM IS AN EXAMPLE OF HOW TO FORMAT THE DISKETTE
                        8  *
                        9  *  REGISTER  ASSIGNMENTS
0000 0002               10 IDLE     EQU    2
0000 0008               11 BUSY     EQU    8
0000 000C               12 FORPARTR EQU    12              FORMAT PARAMETER REGISTER
0000 000D               13 DATA     EQU    13              DATA FOR FORMAT REGISTER
0000 000E               14 STATUS   EQU    14              STATUS REGISTER
0000 000F               15 DEVADR   EQU    15              DEVICE ADDRESS REGISTER
0000001                 16          ORG    X'3000'         ORIGIN
                        17 *
                        18 *  RESET CONTROLLER
                        19 *
003000 73F0 4000 3048   20          LPL    DEVADR,FLPADR   LOAD FLOPPY ADDRESS
003006 DEF0 4000 304A   21          OC     DEVADR,RESET    RESET CONTROLLER
00300C 9DFE             22 SENSE1   SSR    DEVADR,STATUS   SENSE CONTROLLER STATUS
00300E 4320 300C        23          BFC    IDLE,SENSE1     WAIT FOR IDLE
                        24 *
                        25 *  OUTPUT FORMAT COMMAND
                        26 *
003012 DEF0 4000 304C   27          OC     DEVADR,FORMAT
003018 9DFE             28 SENSE2   SSR    DEVADR,STATUS
00301A 4240 3018        29          BTC    BUSY,SENSE2
                        30 *
                        31 *   SET UP DATA AND FORMAT PARAMETER
                        32 *
00301E C8D0 1234        33          LHI    DATA,X'1234'    LOAD  DATA FOR FORMAT
003022 C8C0 0013        34          LHI    FORPARTR,X'13'  LOAD  FORMAT PARAMETER
                        35 *
                        36 *   WRITE THE  DATA  AND  FORMAT  PARAMETER
                        37 *
003026 98FD             38          WBR    DEVADR,DATA     WRITE THE DATA
003028 9AFC             39          WBR    DEVADR,FORPARTR WRITE THE FORMAT PARAMETER
00302A DEF0 4000 304B   40          OC     DEVADR,STOP     STOP CONTROLLER
003030 9DFE             41 SENSE3   SSR    DEVADR,STATUS   SENSE CONTROLLER STATUS
003032 4320 3030        42          BFC    IDLE,SENSE3     WAIT FOR  IDLE
003036 C200 4000 3040   43 END1    LPSW   PSW1            FINISHED
003040                  44          ALIGN  8
003040 0000 8000        45 PSW1    DC     Y'00008000',A(END1)
003044 0000 3036
003048 00C1             46 FLPADR  DCX    C1              FLOPPY ADDRESS
00304A C8               47 RESET   DB     X'C8'           RESET/DRIVE 0 / DISARM
00304B C7               48 STOP    DB     X'C7'           STOP /DRIVE 0 / DISARM
00304C C9               49 FORMAT  DB     X'C9'           FORMAT /DRIVE 0/ DISARM
00304E                  50          END
```

NO ERRORS 0 SQUEZ PASSES

CAL 04-01

ABSTOP	0000 304E								
ADC	0000 0004								
BUSY	0000 0008	29							
DATA	0000 000D	33	38						
DEVADR	0000 000F	20	21	22	27	28	38	39	40	41
END1	0000 3056	45							
FLPADR	0000 3048	20							
FORMAT	0000 304C	27							
FORPARTR	0000 000C	34	35						
IDLE	0000 0002	23	42						
IMPTOP	0000 0000I								
LADC	0000 0002								
PSW1	0000 3040	43							
PUPETOP	0000 0000P								
RESET	0000 304A	21							
SENSE1	0000 300C	23							
SENSE2	0000 3018	29							
SENSE3	0000 3030	42							
STATUS	0000 000E	22	28	41					
STOP	0000 304B	40							

APPENDIX 3

FLOPPY REFERENCE GUIDE

BIT	8	9	10	11	12	13	14	15
STATUS	WRITE PROTECT	DEFECTIVE TRACK	DELETED RECORD	ERROR	BUSY	EXAMINE	IDLE	FAULT
COMMAND	INTERRUPT		DRIVE SELECT		COMMAND			

INTERRUPT

01 – DISABLE
10 – ENABLE
11 – DISARM

DRIVE SELECT

00 – DRIVE 0
01 – DRIVE 1
10 – DRIVE 2
11 – DRIVE 3

COMMAND

X'1' – READ
X'2' – WRITE
X'3' – READ I.D.
X'4' – READ AUX STATUS
X'5' – DELETE
X'6' – BOOT LOAD
X'7' – STOP
X'8' – RESET
X'9' – FORMAT
X'0' . X'A' : X'F' – INVALID COMMAND

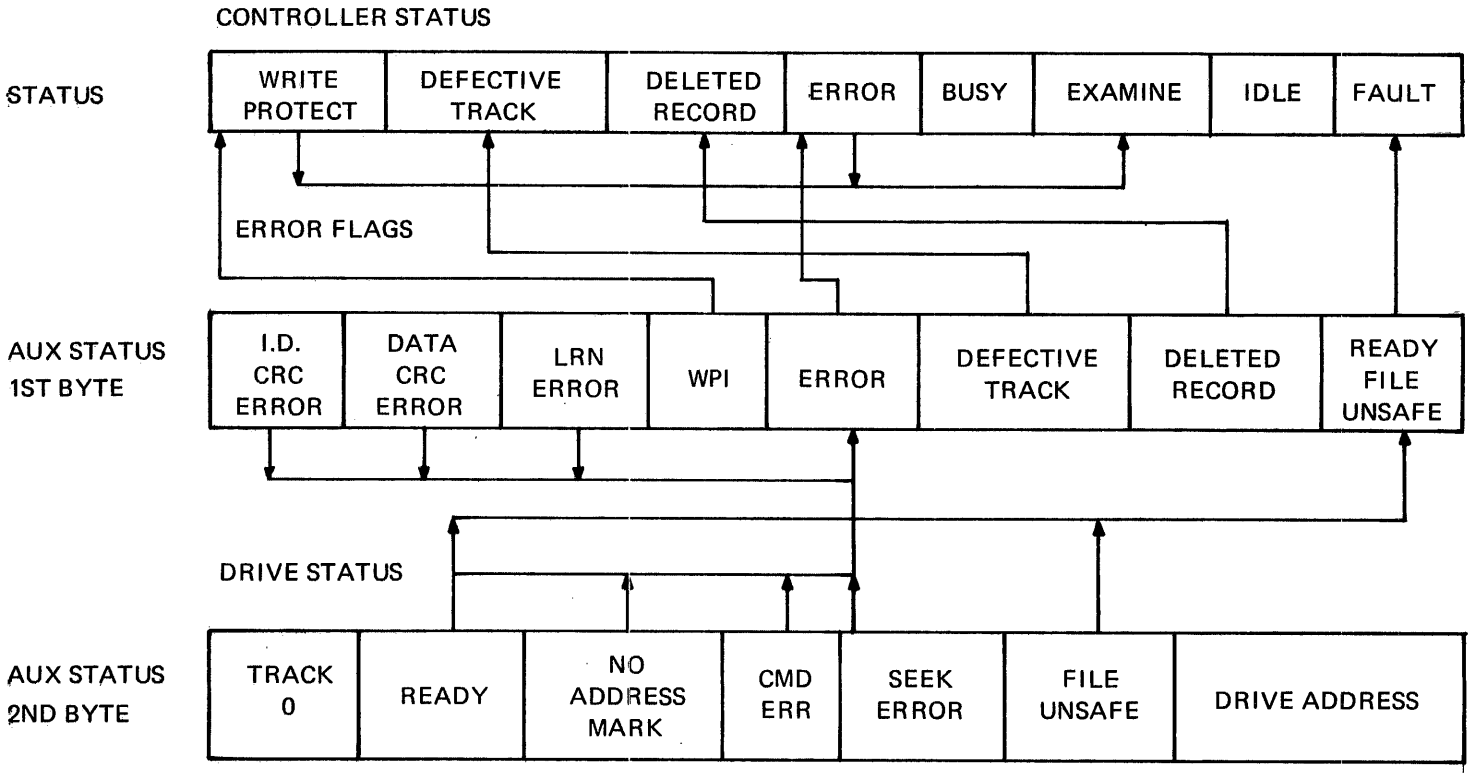
BYTE 1	ID CRR ERROR	DATA CRC	LRN ERROR	WPI	ERR	DEF TRACK	DEL REC	RDY FILE UNSAFE	ERROR FLAGS
BYTE 2	TRACK	READY	NO AM	CMD ERROR	SEEK ERROR	FILE UNSAFE	DRIVE ADDRESS		DEVICE STATUS
BYTE 3	LAST SECTOR			READ/WRITE					
BYTE 4	LAST TRACK			READ/WRITE					
BYTE 5	1ST DEFECTIVE TRACK (SEE NOTE)								
BYTE 6	2ND DEFECTIVE TRACK (SEE NOTE)								

NOTE

BYTE 5	BYTE 6	
FF	FF	NO DEFECTIVE TRACK
00	FF	TRACK 0 DEFECTIVE
2A	FF	TRACK 2A DEFECTIVE
21	23	TRACK 21 AND 23 DEFECTIVE
00	00	MORE THAN 2 DEFECTIVE TRACKS

I.D.

BYTE 1	LOGICAL TRACK # X'00' – X'4C'
BYTE 2	X'00'
BYTE 3	LOGICAL SECTOR # X'01' – X'1A'
BYTE 4	X'00'
BYTE 5	MOST SIGNIFICANT BYTE OF CRC
BYTE 6	LEAST SIGNIFICANT BYTE OF CRC



TRACTS SECTOR CONVERSION TABLE

TRACK	SECTOR																								
	**1	**2	**3	**4	**5	**6	**7	**8	**9	**A	**B	**C	**D	**E	**F	*10	*11	*12	*13	*14	*15	*16	*17	*18	*19	*1A
00	001	002	003	004	005	006	007	008	009	00A	00B	00C	00D	00E	00F	010	011	012	013	014	015	016	017	018	019	01A
01	01B	01C	01D	01E	01F	020	021	022	023	024	025	026	027	028	029	02A	02B	02C	02D	02E	02F	030	031	032	033	034
02	035	036	037	038	039	03A	03B	03C	03D	03E	03F	040	041	042	043	044	045	046	047	048	049	04A	04B	04C	04D	04E
03	04F	050	051	052	053	054	055	056	057	058	059	05A	05B	05C	05D	05E	05F	060	061	062	063	064	065	066	067	068
04	069	06A	06B	06C	06D	06E	06F	070	071	072	073	074	075	076	077	078	079	07A	07B	07C	07D	07E	07F	080	081	082
05	083	084	085	086	087	088	089	08A	08B	08C	08D	08E	08F	090	091	092	093	094	095	096	097	098	099	09A	09B	09C
06	09D	09E	09F	0A0	0A1	0A2	0A3	0A4	0A5	0A6	0A7	0A8	0A9	0AA	0AB	0AC	0AD	0AE	0AF	0B0	0B1	0B2	0B3	0B4	0B5	0B6
07	0B7	0B8	0B9	0BA	0BB	0BC	0BD	0BE	0BF	0C0	0C1	0C2	0C3	0C4	0C5	0C6	0C7	0C8	0C9	0CA	0CB	0CC	0CD	0CE	0CF	0D0
08	0D1	0D2	0D3	0D4	0D5	0D6	0D7	0D8	0D9	0DA	0DB	0DC	0DD	0DE	0DF	0E0	0E1	0E2	0E3	0E4	0E5	0E6	0E7	0E8	0E9	0EA
09	0EB	0EC	0ED	0EE	0EF	0F0	0F1	0F2	0F3	0F4	0F5	0F6	0F7	0F8	0F9	0FA	0FB	0FC	0FD	0FE	0FF	100	101	102	103	104
0A	105	106	107	108	109	10A	10B	10C	10D	10E	10F	110	111	112	113	114	115	116	117	118	119	11A	11B	11C	11D	11E
0B	11F	120	121	122	123	124	125	126	127	128	129	12A	12B	12C	12D	12E	12F	130	131	132	133	134	135	136	137	138
0C	139	13A	13B	13C	13D	13E	13F	140	141	142	143	144	145	146	147	148	149	14A	14B	14C	14D	14E	14F	150	151	152
0D	153	154	155	156	157	158	159	15A	15B	15C	15D	15E	15F	160	161	162	163	164	165	166	167	168	169	16A	16B	16C
0E	16D	16E	16F	170	171	172	173	174	175	176	177	178	179	17A	17B	17C	17D	17E	17F	180	181	182	183	184	185	186
0F	187	188	189	18A	18B	18C	18D	18E	18F	190	191	192	193	194	195	196	197	198	199	19A	19B	19C	19D	19E	19F	1A0
10	1A1	1A2	1A3	1A4	1A5	1A6	1A7	1A8	1A9	1AA	1AB	1AC	1AD	1AE	1AF	1B0	1B1	1B2	1B3	1B4	1B5	1B6	1B7	1B8	1B9	1BA
11	1BB	1BC	1BD	1BE	1BF	1C0	1C1	1C2	1C3	1C4	1C5	1C6	1C7	1C8	1C9	1CA	1CB	1CC	1CD	1CE	1CF	1D0	1D1	1D2	1D3	1D4
12	1D5	1D6	1D7	1D8	1D9	1DA	1DB	1DC	1DD	1DE	1DF	1E0	1E1	1E2	1E3	1E4	1E5	1E6	1E7	1E8	1E9	1EA	1EB	1EC	1ED	1EE
13	1EF	1F0	1F1	1F2	1F3	1F4	1F5	1F6	1F7	1F8	1F9	1FA	1FB	1FC	1FD	1FE	1FF	200	201	202	203	204	205	206	207	208
14	209	20A	20B	20C	20D	20E	20F	210	211	212	213	214	215	216	217	218	219	21A	21B	21C	21D	21E	21F	220	221	222
15	223	224	225	226	227	228	229	22A	22B	22C	22D	22E	22F	230	231	232	233	234	235	236	237	238	239	23A	23B	23C
16	23D	23E	23F	240	241	242	243	244	245	246	247	248	249	24A	24B	24C	24D	24E	24F	250	251	252	253	254	255	256
17	257	258	259	25A	25B	25C	25D	25E	25F	260	261	262	263	264	265	266	267	268	269	26A	26B	26C	26D	26E	26F	270
18	271	272	273	274	275	276	277	278	279	27A	27B	27C	27D	27E	27F	280	281	282	283	284	285	286	287	288	289	28A
19	28B	28C	28D	28E	28F	290	291	292	293	294	295	296	297	298	299	29A	29B	29C	29D	29E	29F	2A0	2A1	2A2	2A3	2A4
1A	2A5	2A6	2A7	2A8	2A9	2AA	2AB	2AC	2AD	2AE	2AF	2B0	2B1	2B2	2B3	2B4	2B5	2B6	2B7	2B8	2B9	2BA	2BB	2BC	2BD	2BE
1B	2BF	2C0	2C1	2C2	2C3	2C4	2C5	2C6	2C7	2C8	2C9	2CA	2CB	2CC	2CD	2CE	2CF	2D0	2D1	2D2	2D3	2D4	2D5	2D6	2D7	2D8
1C	2D9	2DA	2DB	2DC	2DD	2DE	2DF	2E0	2E1	2E2	2E3	2E4	2E5	2E6	2E7	2E8	2E9	2EA	2EB	2EC	2ED	2EE	2EF	2F0	2F1	2F2
1D	2F3	2F4	2F5	2F6	2F7	2F8	2F9	2FA	2FB	2FC	2FD	2FE	2FF	300	301	302	303	304	305	306	307	308	309	30A	30B	30C
1E	30D	30E	30F	310	311	312	313	314	315	316	317	318	319	31A	31B	31C	31D	31E	31F	320	321	322	323	324	325	326
1F	327	328	329	32A	32B	32C	32D	32E	32F	330	331	332	333	334	335	336	337	338	339	33A	33B	33C	33D	33E	33F	340
20	341	342	343	344	345	346	347	348	349	34A	34B	34C	34D	34E	34F	350	351	352	353	354	355	356	357	358	359	35A
21	35B	35C	35D	35E	35F	360	361	362	363	364	365	366	367	368	369	36A	36B	36C	36D	36E	36F	370	371	372	373	374
22	375	376	377	378	379	37A	37B	37C	37D	37E	37F	380	381	382	383	384	385	386	387	388	389	38A	38B	38C	38D	38E
23	38F	390	391	392	393	394	395	396	397	398	399	39A	39B	39C	39D	39E	39F	3A0	3A1	3A2	3A3	3A4	3A5	3A6	3A7	3A8
24	3A9	3AA	3AB	3AC	3AD	3AE	3AF	3B0	3B1	3B2	3B3	3B4	3B5	3B6	3B7	3B8	3B9	3BA	3BB	3BC	3BD	3BE	3BF	3C0	3C1	3C2
25	3C3	3C4	3C5	3C6	3C7	3C8	3C9	3CA	3CB	3CC	3CD	3CE	3CF	3D0	3D1	3D2	3D3	3D4	3D5	3D6	3D7	3D8	3D9	3DA	3DB	3DC

26	3DD	3DE	3DF	3E0	3E1	3E2	3E3	3E4	3E5	3E6	3E7	3E8	3E9	3EA	3EB	3EC	3ED	3EE	3EF	3F0	3F1	3F2	3F3	3F4	3F5	3F6
27	3F7	3F8	3F9	3FA	3FB	3FC	3FD	3FE	3FF	400	401	402	403	404	405	406	407	408	409	40A	40B	40C	40D	40E	40F	410
28	411	412	413	414	415	416	417	418	419	41A	41B	41C	41D	41E	41F	420	421	422	423	424	425	426	427	428	429	42A
29	42B	42C	42D	42E	42F	430	431	432	433	434	435	436	437	438	439	43A	43B	43C	43D	43E	43F	440	441	442	443	444
2A	445	446	447	448	449	44A	44B	44C	44D	44E	44F	450	451	452	453	454	455	456	457	458	459	45A	45B	45C	45D	45E
2B	45F	460	461	462	463	464	465	466	467	468	469	46A	46B	46C	46D	46E	46F	470	471	472	473	474	475	476	477	478
2C	479	47A	47B	47C	47D	47E	47F	480	481	482	483	484	485	486	487	488	489	48A	48B	48C	48D	48E	48F	490	491	492
2D	493	494	495	496	497	498	499	49A	49B	49C	49D	49E	49F	4A0	4A1	4A2	4A3	4A4	4A5	4A6	4A7	4A8	4A9	4AA	4AB	4AC
2E	4AD	4AE	4AF	4B0	4B1	4B2	4B3	4B4	4B5	4B6	4B7	4B8	4B9	4BA	4BB	4BC	4BD	4BE	4BF	4C0	4C1	4C2	4C3	4C4	4C5	4C6
2F	4C7	4C8	4C9	4CA	4CB	4CC	4CD	4CE	4CF	4D0	4D1	4D2	4D3	4D4	4D5	4D6	4D7	4D8	4D9	4DA	4DB	4DC	4DD	4DE	4DF	4E0
30	4E1	4E2	4E3	4E4	4E5	4E6	4E7	4E8	4E9	4EA	4EB	4EC	4ED	4EE	4EF	4F0	4F1	4F2	4F3	4F4	4F5	4F6	4F7	4F8	4F9	4FA
31	4FB	4FC	4FD	4FE	4FF	500	501	502	503	504	505	506	507	508	509	50A	50B	50C	50D	50E	50F	510	511	512	513	514
32	515	516	517	518	519	51A	51B	51C	51D	51E	51F	520	521	522	523	524	525	526	527	528	529	52A	52B	52C	52D	52E
33	52F	530	531	532	533	534	535	536	537	538	539	53A	53B	53C	53D	53E	53F	540	541	542	543	544	545	546	547	548
34	549	54A	54B	54C	54D	54E	54F	550	551	552	553	554	555	556	557	558	559	55A	55B	55C	55D	55E	55F	560	561	562
35	563	564	565	566	567	568	569	56A	56B	56C	56D	56E	56F	570	571	572	573	574	575	576	577	578	579	57A	57B	57C
36	57D	57E	57F	580	581	582	583	584	585	586	587	588	589	58A	58B	58C	58D	58E	58F	590	591	592	593	594	595	596
37	597	598	599	59A	59B	59C	59D	59E	59F	5A0	5A1	5A2	5A3	5A4	5A5	5A6	5A7	5A8	5A9	5AA	5AB	5AC	5AD	5AE	5AF	5B0
38	5B1	5B2	5B3	5B4	5B5	5B6	5B7	5B8	5B9	5BA	5BB	5BC	5BD	5BE	5BF	5C0	5C1	5C2	5C3	5C4	5C5	5C6	5C7	5C8	5C9	5CA
39	5CB	5CC	5CD	5CE	5CF	5D0	5D1	5D2	5D3	5D4	5D5	5D6	5D7	5D8	5D9	5DA	5DB	5DC	5DD	5DE	5DF	5E0	5E1	5E2	5E3	5E4
3A	5E5	5E6	5E7	5E8	5E9	5EA	5EB	5EC	5ED	5EE	5EF	5F0	5F1	5F2	5F3	5F4	5F5	5F6	5F7	5F8	5F9	5FA	5FB	5FC	5FD	5FE
3B	5FF	600	601	602	603	604	605	606	607	608	609	60A	60B	60C	60D	60E	60F	610	611	612	613	614	615	616	617	618
3C	619	61A	61B	61C	61D	61E	61F	620	621	622	623	624	625	626	627	628	629	62A	62B	62C	62D	62E	62F	630	631	632
3D	633	634	635	636	637	638	639	63A	63B	63C	63D	63E	63F	640	641	642	643	644	645	646	647	648	649	64A	64B	64C
3E	64D	64E	64F	650	651	652	653	654	655	656	657	658	659	65A	65B	65C	65D	65E	65F	660	661	662	663	664	665	666
3F	667	668	669	66A	66B	66C	66D	66E	66F	670	671	672	673	674	675	676	677	678	679	67A	67B	67C	67D	67E	67F	680
40	681	682	683	684	685	686	687	688	689	68A	68B	68C	68D	68E	68F	690	691	692	693	694	695	696	697	698	699	69A
41	69B	69C	69D	69E	69F	6A0	6A1	6A2	6A3	6A4	6A5	6A6	6A7	6A8	6A9	6AA	6AB	6AC	6AD	6AE	6AF	6B0	6B1	6B2	6B3	6B4
42	6B5	6B6	6B7	6B8	6B9	6BA	6BB	6BC	6BD	6BE	6BF	6C0	6C1	6C2	6C3	6C4	6C5	6C6	6C7	6C8	6C9	6CA	6CB	6CC	6CD	6CE
43	6CF	6D0	6D1	6D2	6D3	6D4	6D5	6D6	6D7	6D8	6D9	6DA	6DB	6DC	6DD	6DE	6DF	6E0	6E1	6E2	6E3	6E4	6E5	6E6	6E7	6E8
44	6E9	6EA	6EB	6EC	6ED	6EE	6EF	6F0	6F1	6F2	6F3	6F4	6F5	6F6	6F7	6F8	6F9	6FA	6FB	6FC	6FD	6FE	6FF	700	701	702
45	703	704	705	706	707	708	709	70A	70B	70C	70D	70E	70F	710	711	712	713	714	715	716	717	718	719	71A	71B	71C
46	71D	71E	71F	720	721	722	723	724	725	726	727	728	729	72A	72B	72C	72D	72E	72F	730	731	732	733	734	735	736
47	737	738	739	73A	73B	73C	73D	73E	73F	740	741	742	743	744	745	746	747	748	749	74A	74B	74C	74D	74E	74F	750
48	751	752	753	754	755	756	757	758	759	75A	75B	75C	75D	75E	75F	760	761	762	763	764	765	766	767	768	769	76A
49	76B	76C	76D	76E	76F	770	771	772	773	774	775	776	777	778	779	77A	77B	77C	77D	77E	77F	780	781	782	783	784
4A	785	786	787	788	789	78A	78B	78C	78D	78E	78F	790	791	792	793	794	795	796	797	798	799	79A	79B	79C	79D	79E
4B	79F	7A0	7A1	7A2	7A3	7A4	7A5	7A6	7A7	7A8	7A9	7AA	7AB	7AC	7AD	7AE	7AF	7B0	7B1	7B2	7B3	7B4	7B5	7B6	7B7	7B8
4C	7B9	7BA	7BB	7BC	7BD	7BE	7BF	7C0	7C1	7C2	7C3	7C4	7C5	7C6	7C7	7C8	7C9	7CA	7CB	7CC	7CD	7CE	7CF	7D0	7D1	7D2

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