RCSL No: 99-1 10543

Edition: May 1986

Author: Flemming Biggas

Title:

RC8000/ADP
Flexible Disc Process
Reference Manual

RCSL Nr. 46-F 0087

ICL DATA A/S

Keywords:

RC8000, RC8000C, Attached Device Processor (ADP), Flexible Disc, External Process.

Abstract:

This reference manual discribes the mode and conventions for operating the Flexible Disc device, hosted by the RC8000 Attached Device Processor.

(26 printed pages)

RCSL Nr. 46-F 0087

Printed by A/S Regnecentralen af 1979, Copenhagen

Table of contents

THIS PAGE IS INTENTIONALLY

LEFT BLANK

1. Introduction.

The Flexible Disc process implements access to a floppy device hosted by the Attaced Device Processor (ADP).

The Flexible Disc is a sequential device which in one operation transfers at maximum the contents of one sector to or from RC8000.

The Flexible Disc operates on physical 5 1/4 inch diskettes in single/double sided mode and in single/double density mode , with different sector lengths.

A **diskette** is divided into 77 cylinders numbered from 0 to 76.

A **cylinder** may hold one or two tracks depending on mode (single/double sided).

A **track** may hold 26, 15 or 8 sectors depending on mode (track format, single/double density).

A **sector** may hold 128, 256, 512 or 1024 characters depending on mode (track format, single/double density).

Tracks are numbered 0 to 153 (double sided) or 0 to 76 (single sided) . If the diskette is double sided 'cyl n side 1' follows 'cyl n side 0' in respect to track numbering.

2. General rules.

Operations can be initiated by an internal process that has initialized or reserved the external process.

The external process can execute the following operations - sense , reset , input , output, setposition , setlimits , reformate , format and set mode.

In case of error (any status bit except write enable and the monitor results unintelligible and driver malfunction) the device enters a reject mode in which all messages except reset and sense are returned immediately with the erroneous status. A reset operation will make the device leave the reject mode.

3. Operations.

The Flexible Disc is organized as a sequential document divided into a number of sectors numbered from zero and upwards. The diskette is not necessarily equally formatted on all tracks , in fact several 'standards' prescribes certain patterns of formatting where this is not the case. Changing from one 'format' to another within the same diskette (see: Set Mode) , one should observe that the numbering of sectors changes with the changing of format , as the Flexible disc process regards the entire diskette as organized according to the current mode. However , since those tracks that most commonly deviate , with respect to formatting , are situated on cylinder zero , one has the possibility to operate the diskette in a 'logical positioning' mode (see: Set Mode) in which the diskette is regarded as beginning at cylinder '1' sector '0'.

In order to make the Flexible Disc process operational for input/output you must make certain initialization calls:

A **Reset** call clears a possible error state pending from previous use of the Flexible Disc process.

A **Reformat** call informs the Flexible Disc process of (possibly) bad cylinders that should be reallocated and , most important , cancels any previous reallocations from previous use of the Flexible Disc process.

A **Set Mode** call defines the mode of operation regarding format , conversion , read verification e.t.c.

A **Set Limits** call defines limits for input/output access with respect to sector numbering , or tracks to be formatted during a Format call.

A **Set Position** call defines the number of the first sector to be accesed in an input/output call.

The specifics of the above mentioned operations are elaborated in the following paragraphs.

3.1 Input operation.

	message	answer
0:	3 shift 12 + 0	status
2:	first storage address	halfwords transferred
4:	last storage address	characters transferred

The current position is checked against the limit registers (see: Set limits). The maximum amount of data that may be read is one sector. The data are transferred three characters per word. Possible unused positions in the last word are patched with binary zeroes. If conversion is active (see: Set Mode) a conversion takes place according to the table (EBCDIC to ISO) listed in Appendix D. After a succesfull input operation the current position will point to the next sector regardless of how much data was actually transferred in the operation.

Possible status bits are: intervention, paraity error, timer, data overrun, end document, write enable , sector erased and mode error (see: appendix B).

3.2 Output operation.

	message	answer
0:	5 shift 12 + 0	status
2:	first storage address	halfwords transferred
4:	last storage address	characters transferred

The current position is checked against the limit registers (see: Set limits). The maximum amount of data that may written is one sector. The data are transferred three characters per word. Possible unused space on the sector is patched with binary zeroes. If conversion is active (see: Set Mode) a conversion takes place according to the table (ISO to EBCDIC) listed in Appendix D. After a succesfull output operation the

current position will point to the next sector regardless of how much data was actually transferred in the operation. If verification is active (see: Set Mode) data are read and verified.

Possible status bits are: intervention, parity error, timer, data overrun, end document, write enable and mode error (see: appendix B). It should be stressed that write enable must be present to indicate the succesfull termination of the output operation.

3.3 Sense operation.

	message	answer
0:	0 shift 12 + 0	status
2:	irr.	0
4:	irr.	0
6:	irr.	current sector

The answer contains status and the current position. The position , current sector , is stated according to mode (see: Set Mode).

The status word may contain 0 or write enable.

3.4 Reset operation.

	message	answer
0:	2 shift 12 + 0	0
2:	irr.	0
4:	irr.	0

The device is forced to normal state leaving a possible reject mode. A possible write enable status is reset.

3.5 Setposition operation.

	message	answer
0:	6 shift 12 + 0	status
2:	irr.	0
4:	irr.	0
6:	sector number	0

The value of current position is changed according to sector number. **The position is NOT evaluated until the arrival of an input/output operation.** The position , sector number , is evaluated according to mode (see: Set Mode).

The status word may contain the write enable bit.

3.6 Set limits operation.

	message	answer
0:	8 shift 12 + 0	status
2:	lower limit	0
4:	upper limit	0

This operation inserts the two values , lower and upper limit , as limits for read/write acces to the diskette:

" lower limit <= current sector <= upper limit ".

It is checked that lower limit is less or equal to upper limit and that upper limit is within the physical capacity of the diskette. The values of lower and upper limit are evaluated according to the current mode (see: Set Mode). If the above mentioned check fails the operation is returned with result unintelligible and lower and upper limits are set to zero.

The status may contain the write enable bit.

3.7 Reformat operation.

	message	answer
0:	10 shift 12 + 0	status
2:	bad cylinder 1	0
4:	bad cylinder 2	0

This operation allocates at the maximum two cylinders to be used as alternative cylinders to bad ones. A value of zero indicates no replacement. A call of reformat will cancel any previous reallocations. The cylinder(s) indicated will be reallocated to cylinder(s) 75 (and 76). It is checked that the values , bad cylinder 1 and bad cylinder 2 , are both zero or have different values and that the values are within the range of 0 to 74. If the check fails the operation is returned with result unintelligible. It should be emphasized that a call of reformat does not affect any subsequent call of Set Limits with respect to data capacity , even if the actual data size has been reduced by the two cylinders used for reallocation purposes . Upon exit from the reformat operation the values of lower and upper limit are set to zero.

The status may contain the write enable bit.

It should be stressed that the reformate operation in itself does NOT perform any physical changes to the diskette in question. It is entirely a responsibility of the user (program).

3.8 Format operation.

	message	answer
0:	12 shift 12 + 0	status
2:	irr.	0
4:	irr.	0
6:	irr.	error track

The format operation formats a diskette or part of it according to the current mode and the values lower and upper limit defined by Set Mode and Set Limits. If the operation fails because of a read/write error the status will indicate the reason , and error track will indicate the number of the erroneous track.

The values of lower and upper limit must be set prior to a call of the format operation, and the diskette may be formatted using as many operations as suitable. As the values of lower and upper limit defines which tracks are to be formatted the values must comprise an integral number of tracks; i.e. lower limit must be the first sector on the first track to formatted and upper limit must be the last sector on the last track to be formatted. If the mentioned conditions are not met the operation is returned with the result unintelligible. Further more: should the driver program be unable to allocate a suitable buffer (app. 10K bytes) the operation is returned with result driver malfunction.

The following parameters set by the Set Mode operation have relevance for the performance of the format operation: sector length , sides , density and verify. If the verify bit is set all sectors on a formatted track are read and verified.

The values of current sector , lower and upper limits are undefined at exit from the format operation.

The status may contain the following bits: intervention , parity error , data overrun , timer and write enable. It should be stressed that the bit write enable must be present to indicate the succesfull termination of the format operation.

3.9 Set mode operation.

	message	answer
0:	14 shift 12 + mode	0
2:	irr.	0
4:	irr.	0

This operation is used to define the format of the diskette as well as the mode of operation. The mode comprises the following fields:

```
mode :=
            sector sequence shift 7
        +   sector length shift 5
        +   sides shift 4
        +   conversion shift 3
        +   logical position shift 2
        +   density shift 1
        +   verification shift 0;
```

Sector sequence (0..15) denotes the sequencing of sectors within a track. Given a sector sequence value of f.ex. '4' the first sector used on a track will be: 'physical sector 1' , the second: '5' , third: '9' and so forth. Sector sequencing that derives from the physical (sector sequence '1') , is used mainly to reduce acces time to physical sequential sectors , and may exist as 'standards' within systems operating on floppy diskettes.

The Set Mode operation checks that the sector sequencing is compatible with sector length , i.e. the values 'sector sequence' and 'sectors/track' may not have a common divisor and 'sectors/track' may not be a multiplum of 'sector sequence'. The default value of sector sequence is '1'; a value of zero indicates that the default value is to be used.

Sector length (0..3) defines the length of sectors and together with the density parameter it also defines the number of sectors that a track may hold. The default value is '2'.

The corelationship of sector size , sectors per track , density and sector length is shown:

sector length	density	bytes/sector	sectors/track
0	single	128	26
1	single	256	15
2	single	512	8
3	single	illegal combination	
0	double	illegal combination	
1	double	256	26
2	double	512	15
3	double	1024	8

Sides (0/1) defines whether the diskette is to be regarded as a single or double sided diskette , the value of sides beeing '1' for double sided , which is also the default value.

Conversion (0/1) defines whether conversion (from/to EBCDIC) should take place in connection with input and output operations . The default value is '0' for no conversion. The conversion tables are listed in appendix D.

Logical position (0/1) indicates whether logical numbering should be employed in operations that deals with positioning , i.e. Set Limits , Set Position and Sense. The effect of Logical positioning is that positions are interpreted as relative to cylinder 1 sector 0 , thus in this mode cylinder 0 may not be accessed. The default value is '0' which means no Logical positioning.

Density (0/1) specifies whether the diskette should be regarded as formatted in low (FM mode) or high (MFM mode) density. The effect of density with respect to data capacity , may be learned by inspecting the table listed under the sector length parameter paragraph. The default value of density is '1' i.e. high density.

Verification (0/1) specifies whether read check should be performed after any write type operation (Output and Format). The default value is '0' indicating no read check.

In case any of the above mentioned checks are not met the operation is returned with result unintelligible and default values are inserted for all parameters , also the effect of a previous reformat operation is canceled.

Appendix A.

Refferences:

1. Western Digital
   1983 Components Handbook

2. RCSL: 991 10227
   RC8000 Attached Device Processor
   Users Guide

Appendix B.

Result and status survey:

The following monitor result values may be returned by the floppy process:

```
result    1: ok
result    2: rejected
result    3: unintelligible
result    4: driver malfunction
result    5: does not exist
```

Result **ok** means that the operation was accepted , further information may be found in the status word (see below).

Result **rejected** indicates a violation of the reservation rules imposed by the monitor. The status word has no relevance.

Result **unintelligible** means that one of the rules/limits stated for the operation was violated. The status word has no relevance.

Result **driver malfunction** indicates some sort of driver/controller trouble. This result may be returned if the driver upon the reception of a format operation is unable to allocate a buffer of the necessary size (a format buffer is allocated and deallocated in connection with format operation calls because of it's relatively great size , app. 10K bytes).

Result **does not exist** means that a process with the given name is not visible to the calling process.

Provided the monitor result was ok the following status bits may be delivered by the floppy process:

bit	0	intervention	1 shift 23
bit	1	parity error	1 shift 22
bit	2	timer	1 shift 21
bit	3	data overrun	1 shift 20
bit	5	end of document	1 shift 18
bit	8	write enable	1 shift 15
bit	9	mode error	1 shift 14
bit	10	sector erased	1 shift 13

The **intervention** bit is set because a drive not ready status was reported by the floppy drive controller.

The **parity error** bit is set because that either of the status indications: record not found , crc error and write fault was reported by the floppy drive controller.

The **timer** bit is set when the controller fails to respond (interrupt) within a given time (app. 10 sec.) to a command.

The **data overrun** bit is set if the status indications: lost data or data request was reported by the controller.

The **end of document** bit is set if the current position is outside the limits defined by the set limits operation or placed on a cylinder that has been assigned as replacement cylinder in a Reformat call (see: Reformat).

The **write enable** bit is set upon succesfull completion of a write type operation (output and format). The write enable bit is cleared upon receiveing a reset operation or when the controller reports a write protect status as a result of a write type operation.

The **mode error** bit is set when the controller reports a status that indicates the diskette is not formatted according to the current mode of operation.

The **sector erased** bit is set as a response to an input operation when the controller reports that the actual sector has been erased. This status is not possible with diskettes initiated by this external process.

Appendix C.

Message answer survey:

Operation	Message	Answer
input	3 shift 12 + 0	status
	first address	halfwords transferred
	last address	characters transferred
output	5 shift 12 + 0	status
	first address	halfwords transferred
	last address	characters transferred
sense	0 shift 12 + 0	status
	irr.	0
	irr.	0
	irr.	sector number
reset	2 shift 12 + 0	0
	irr.	0
	irr.	0
set position	6 shift 12 + 0	status
	irr.	0
	irr.	0
	sector number	0
set limits	8 shift 12 + 0	status
	lower limit	0
	upper limit	0
reformat	10 shift 12 + 0	status
	bad cylinder 1	0
	bad cylinder 2	0

format	12 shift 12 + 0	status
	irr.	0
	irr.	0
	irr.	error track
set mode	14 shift 12 + mode	status
	irr.	0
	irr.	0

Appendix D.

ISO to EBCDIC conversion table (output operations):

```
                                                        /* ISO values */
  0,   1,   2,   3,  55,  45,  46,  47,  /*   0....7 */
 22,   5,  37,  11,  12,  13,  14,  15,  /*   8...15 */
 16,  17,  18,  19,  60,  61,  50,  38,  /*  16...23 */
 24,  25,  63,  39,  28,  29,  30,  31,  /*  24...31 */
 64,  90, 127, 123,  91, 108,  80, 125,  /*  32...39 */
 77,  93,  92,  78, 107,  96,  75,  97,  /*  40...47 */
240, 241, 242, 243, 244, 245, 246, 247,  /*  48...55 */
248, 249, 122,  94,  76, 126, 110, 111,  /*  56...63 */
124, 193, 194, 195, 196, 197, 198, 199,  /*  64...71 */
200, 201, 209, 210, 211, 212, 213, 214,  /*  72...79 */
215, 216, 217, 226, 227, 228, 229, 230,  /*  80...87 */
231, 232, 233, 173, 224, 198,  95, 109,  /*  88.. 95 */
121, 129, 130, 131, 132, 133, 134, 135,  /*  96..103 */
136, 137, 145, 146, 147, 148, 149, 150,  /* 104..111 */
151, 152, 153, 162, 163, 164, 165, 166,  /* 112..119 */
167, 168, 169, 192, 106, 208, 161,   7,  /* 120..127 */
  0,   1,   2,   3,  55,  45,  46,  47,  /* 128..135 */
 22,   5,  37,  11,  12,  13,  14,  15,  /* 136..143 */
 16,  17,  18,  19,  60,  61,  50,  38,  /* 144..151 */
 24,  24,  63,  39,  28,  29,  30,  31,  /* 152..159 */
 64,  90, 127, 123,  91, 108,  80, 125,  /* 160..167 */
 77,  93,  92,  78, 107,  96,  75,  97,  /* 168..175 */
240, 241, 242, 243, 244, 245, 246, 247,  /* 176..183 */
248, 249, 122,  94,  76, 126, 110, 111,  /* 184..191 */
124, 193, 194, 195, 196, 197, 198, 199,  /* 192..199 */
200, 201, 209, 210, 211, 212, 213, 214,  /* 200..207 */
215, 216, 217, 226, 227, 228, 229, 230,  /* 208..215 */
231, 232, 233, 173, 224, 198,  95, 109,  /* 216..223 */
121, 129, 130, 131, 132, 133, 134, 135,  /* 224..231 */
136, 137, 145, 146, 147, 148, 149, 150,  /* 232..239 */
151, 152, 153, 162, 163, 164, 165, 166,  /* 240..247 */
167, 168, 169, 192, 106, 208, 161,   7   /* 248..255 */
```

EBCDIC to ISO conversion table (input operations):

```
                                                    /* EBCDIC values */
  0,   1,   2,   3,  26,   9,  26, 127,  /*   0....7 */
 26,  26,  26,  11,  12,  13,  14,  15,  /*   8...15 */
 16,  17,  18,  19,  26,  26,   8,  26,  /*  16...23 */
 24,  25,  26,  26,  28,  29,  30,  31,  /*  24...31 */
 26,  26,  26,  26,  26,  10,  23,  27,  /*  32...39 */
 26,  26,  26,  26,  26,   5,   6,   7,  /*  40...47 */
 26,  26,  22,  26,  26,  26,  26,   4,  /*  48...55 */
 26,  26,  26,  26,  20,  21,  26,  26,  /*  56...63 */
 32,  26,  26,  26,  26,  26,  26,  26,  /*  64...71 */
 26,  26,  26,  46,  60,  40,  43,  33,  /*  72...79 */
 38,  26,  26,  26,  26,  26,  26,  26,  /*  80...87 */
 26,  26,  33,  36,  42,  41,  59,  94,  /*  88...95 */
 45,  47,  26,  26,  26,  26,  26,  26,  /*  96..103 */
 26,  26, 124,  44,  37,  95,  62,  63,  /* 104..111 */
 26,  26,  26,  26,  26,  26,  26,  26,  /* 112..119 */
 26,  96,  58,  35,  64,  39,  61,  34,  /* 120..127 */
 26,  97,  98,  99, 100, 101, 102, 103,  /* 128..135 */
104, 105,  26,  26,  26,  26,  26,  26,  /* 136..143 */
 26, 106, 107, 108, 109, 110, 111, 112,  /* 144..151 */
113, 114,  26,  26,  26,  26,  26,  26,  /* 152..159 */
 26, 126, 115, 116, 117, 118, 119, 120,  /* 160..167 */
121, 122,  26,  26,  26,  91,  26,  26,  /* 168..175 */
 26,  26,  26,  26,  26,  26,  26,  26,  /* 176..183 */
 26,  26,  26,  26,  26,  93,  26,  26,  /* 184..191 */
123,  65,  66,  67,  68,  69,  70,  71,  /* 192..199 */
 72,  73,  26,  26,  26,  26,  26,  26,  /* 200..207 */
125,  74,  75,  76,  77,  78,  79,  80,  /* 208..215 */
 81,  82,  26,  26,  26,  26,  26,  26,  /* 216..223 */
 92,  26,  83,  84,  85,  86,  87,  88,  /* 224..231 */
 89,  90,  26,  26,  26,  26,  26,  26,  /* 232..239 */
 48,  49,  50,  51,  52,  53,  54,  55,  /* 240..247 */
 56,  57,  94,  26,  26,  26,  26,  26   /* 248..255 */
```

RETURN LETTER

Title: RC8000/ADP Flexible Disc Process Reference Manual.

RCSL No.: 99-1 10543

A/S Regnecentralen af 1979/RC Computer A/S maintains a continual effort to improve the quality and usefulness of its publications. To do this effectively we need user feedback, your critical evaluation of this manual.

Please comment on this manual's completeness, accuracy, organization, usability, and readability:

Do you find errors in this manual? If so, specify by page.

How can this manual be improved?

Other comments?

Name: _____ Title: _____

Company: _____

Address: _____

Date: _____

Thank you

RCSL Nr. 46-F 0093

..... Fold here .....

..... Do not tear - Fold here and staple .....

Affix
postage
here

RC International

Information Department
Lautrupbjerg 1
DK-2750 Ballerup
Denmark