

**Advanced Disc Investigator**

**Computer**

**Products**

## NOTICE

Advanced Computer Products Limited reserves the right to make improvements to the product described in this manual at any time and without notice.

This manual is copyrighted, and may not in whole or part, be copied, photocopied, translated, or reduced to any electronic medium or machine readable form without the prior consent, in writing, from Advanced Computer Products Limited.

Advanced Computer Products Ltd,  
6 A/s House,  
High Street,  
CHOBHAM,  
Surrey GU24 8LZ.

Tel. (0276) 76545

Advanced Computer Products Limited cannot be held responsible for any loss of data or damage to equipment as a result of this product.

This product is not intended to operate in sideways RAM.

Electron, and Plus 1 are tradenames of Acorn Computers Limited.

### CONDITION OF SALE

This product is sold on the condition that it will not be used to break the copyright on computer software. The backup utility allows the creation of archival copies of computer software, it does NOT allow for giving away of copies of software. Nor does it allow selling copies made. It simply allows the owner of a computer program to make archival copies.

## CONTENTS

|   |                              |    |
|---|------------------------------|----|
| 1 | INTRODUCTION                 | 1  |
| 2 | FITTING ADI                  | 2  |
| 3 | USING ADI                    | 4  |
|   | COPY A DISC                  | 8  |
|   | VERIFY TWO DISCS             | 9  |
|   | EDIT A SECTOR                | 10 |
|   | SCAN A DISC                  | 11 |
|   | FORMAT TRACKS                | 12 |
|   | UNFORMAT TRACKS              | 13 |
|   | MODIFY FORMAT PARMS          | 14 |
|   | GET SECTORS FROM DISC        | 15 |
|   | PUT SECTORS TO DISC          | 16 |
|   | READ TRACK DATA              | 17 |
|   | WRITE TRACK DATA             | 18 |
|   | BUFFER EXAMINE               | 19 |
|   | ZERO BUFFER                  | 20 |
|   | TURN PRINTER ON/OFF          | 21 |
|   | INITIALISE STATUS            | 22 |
|   | * COMMAND                    | 23 |
|   | *OSWORD7F                    | 24 |
| 4 | DRIVE TYPES AND DISC FORMATS | 25 |

COPY KEY CHANGES SCREEN  
FOREGROUND COLOUR

DELETE KEY CHANGES SCREEN  
BACKGROUND COLOUR.



**A.D.I.**

# **The Advanced Disc Investigator Manual**

# 1 INTRODUCTION

ADI, the Advanced Disc Investigator is a very powerful tool for use with standard and non-standard discs. ADI is operated from a single menu with a permanent status window which is continually updated by the commands.

Besides the obvious use for backing up non-standard discs, ADI can be used to check and repair faulty tracks, recover data from a disc, create specially designed disc formats, operate in single and double density modes and examine the parts of discs other editors cannot reach!

Chapter 2 describes how to fit ADI into a BBC or Electron computer.

Chapter 3 describes how to use ADI and gives a description of the commands and parameters used by the command.

Chapter 4 gives a description of the various types of disc drive and explains in detail the format of a track.

In this manual FDC stands for Floppy Disc Controller. Early BBC computers used the Intel 8271 FDC, later machines like the B+ and Electron use the Western Digital 1770 FDC. They are very similar, with the 1770 also capable of operating in double density mode.

ADI can operate on double density discs only if the Acorn 1770 disc interface is fitted to the computer.

## 2 FITTING ADI

---

### For the BBC Computer

After turning off the power, take off the top cover of the computer by removing the four fixing screws located at the rear of the computer and on the underside near the front.

Now locate the ROM sockets. In the BBC B+ they are situated to the right of the power supply. The two sockets nearest the front of the computer are used by the speech synthesizer and should not be used. In the BBC B the ROM sockets are situated beneath the keyboard, so remove the four screws securing the keyboard to the computer and move carefully to one side just enough to expose the four ROM sockets located on the right side of the board.

Insert the ADI ROM into one of the empty ROM sockets, with the little notch on the end of the chip facing the back of the computer. Take care not to bend any of the legs on the chip. On the BBC B screw the keyboard back on to the computer. Replace the top cover.

Turn on the computer and type \*HELP. A list of ROM titles should appear on the screen. If 'Advanced Disc Investigator' does not appear in the list it is likely the ROM is not positioned correctly in its socket.

### For the Electron

The ADI ROM must be fitted to the Plus 1 via a suitable ROM carrier board, such as the ROM adaptor boards supplied by ACP. For ADI to operate correctly in the Acorn Plus 3 a small link, LK1 must be joined inside the unit. This may invalidate the warranty on the Plus 3. If necessary see your dealer.

### Checking LK1

The link in the Plus 3 may already be joined. This can be checked by performing the following task. First fit the ROM cartridge into the Plus 1 as described below. Turn on the computer and type \*ADI. Insert a formatted disc into the drive and select the command to EDIT A SECTOR, by pressing E. At this point, if a 'snow storm' effect appears on the screen then the link has been joined and nothing more need be done. If the storm effect does not appear then the link has not been joined. The storm effect is a result of temporarily turning off the screen display to provide the extra processing time while accessing the disc.

### Joining LK1

After turning off the power, isolate the Plus 3 by disconnecting the Plus 1 and Electron. Remove the top cover of the Plus 3, by unscrewing the 9 fixing screws on the bottom of the Plus 3, shown in the diagram below.

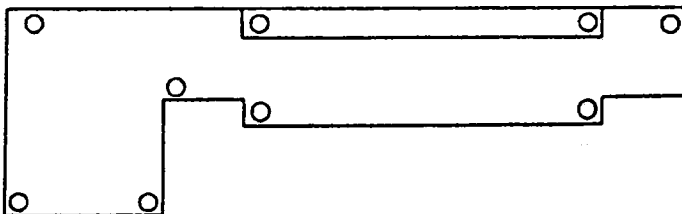
Locate LK1 situated to the top left of the disc drive between IC16 and IC10. If the link is not joined make the connection with a small

piece of wire, ideally soldering it to the board. Replace the cover to the Plus 3 and re-connect to the Electron and Plus 1. Fit the ROM cartridge to the Plus 1 as described below. To check the link has been properly joined follow the procedure above, 'Checking LK1'.

#### Fitting the ROM cartridge

Turn off the power and insert the ROM cartridge into one of the slots in the top of the Plus 1. Ensure the label on the cartridge faces the keyboard. If in doubt refer to 'Using cartridges' on page 16 of the Plus 1 User Guide. To check that the cartridge has been properly inserted turn on the power to the computer and type \*HELP. A list of ROM titles should appear on the screen. If 'The Advanced Disc Investigator' does not appear in the list it is likely the ROM cartridge is not correctly positioned in the Plus 1.

#### Plus 3 showing which fixing screws to remove





### 3 USING ADI

---

ADI is a utility ROM and is called from a single \* command. It is advisable to save any program in memory before using this command on a computer without a second processor, since the IO memory is used. ADI can be used with a second processor turned on, but will not use the memory in the second processor.

To use the COPY, FORMAT, UNFORMAT, READ and WRITE track commands in ADI in double density mode on a computer which does not have shadow RAM, as used on the BBC B+, it is necessary to 'unplug' the ADFS ROM, and if present the 1770 DFS ROM. When this is done PAGE should be &E00.

To enter ADI type \*ADI.

The screen will clear and after a short delay (about 5 seconds on the Electron) the ADI screen is displayed. The rectangle in the top left hand side of the screen is the MENU window from which the various commands can be selected. The rectangle at the bottom of the screen is the STATUS window showing all the current disc and drive parameters. The rectangle at the top right hand of the screen shows a serial number which is unique to your copy of ADI.

#### The MENU window

To select a command from the menu use the left and right cursor keys to move the inverse cursor over the letter corresponding to the command and press RETURN. The full name of the command is shown on the line below. Alternatively, just press the key which matches the command on the menu. A description of the commands follow later. To change the foreground display colour press the COPY key. To change the background display colour press the DELETE key.

To leave ADI press ESCAPE.

#### The STATUS window

To move the status cursor back or forward use the left and right SHIFT cursor keys. To change the value of the parameter under the cursor use the up and down SHIFT cursor keys. Press SHIFT down to add 1 to the parameter and SHIFT up to subtract one from the parameter. Alternatively, just type in the number of the parameter in decimal.

#### S/DRIVE

This parameter is the source drive number. It is the source drive from which data is read from when using a command which requires a source and destination drive, ie the COPY A DISC and VERIFY TWO DISCS commands. It is also used by commands which only require a single drive, such as the EDIT A SECTOR and SCAN A DISC commands.

This parameter consists of three parts. The drive number 0-3 for drives 0-3, the stepping size of the drive head and the density of the disc in the drive. The stepping size is only of use in 80 track drives. It controls whether the drive head is moved in single steps, 48 tpi (tracks per inch) or double steps, 96 tpi. Setting this

parameter to 48 will double step the drive head, and setting the parameter to 96 will step the head normally in single steps. When copying a 40 track disc in an 80 track drive set this parameter to 48. 40 track drives should leave this parameter set to 96.

The last part of S/DRIVE controls the density. If the disc in the drive is single density set this parameter to FM (frequency modulation) and if it is double density set it to MFM (modified frequency modulation). The 8271 FDC can only operate in single density.

To change the drive, stepping size and density use the up and down SHIFT cursor keys. Pressing a number 0-9 has the following effect:

|   |                        |
|---|------------------------|
| 0 | - drive 0, 96 tpi, FM  |
| 1 | - drive 1, 96 tpi, FM  |
| 2 | - drive 2, 96 tpi, FM  |
| 3 | - drive 3, 96 tpi, FM  |
| 4 | - drive 0, 48 tpi, FM  |
| 5 | - drive 1, 48 tpi, FM  |
| 6 | - drive 2, 48 tpi, FM  |
| 7 | - drive 3, 48 tpi, FM  |
| 8 | - drive 0, 96 tpi, MFM |
| 9 | - drive 1, 96 tpi, MFM |

#### WARNING

To avoid damage to a 40 track disc drive do not use 48 tpi.

#### TRACK

This parameter is the physical track number (0-79) of the disc. Set this parameter to the track number of the first track to be used by a command. For example, to edit a sector of a disc on track 20, set this parameter to 20.

#### WARNING

To avoid damage to a 40 track disc drive only use tracks 0-39.

#### SECTOR

This parameter is the physical sector number (0-30) of a track. Set this parameter to the sector number of the first sector to be used by a command. For example, to edit the first sector of a track, set this parameter to 0, to edit the second sector set it to 1, to edit the third set it to 2, etc.

#### BYTES

This parameter is the actual length of a sector in bytes. It is used by the FORMAT command to create sectors of this length.

## D/DRIVE

This parameter is the destination drive number. It is used by commands which require a source and destination disc, ie the COPY A DISC and VERIFY TWO DISCS command. If only a single drive is connected the destination drive should be the same as the source drive. Messages will be printed when to swap the source and destination discs.

See S/DRIVE for an explanation of the 48/96 and FM/MFM parameters.

## TRACKS

This parameter is the number of tracks (0-80) to be operated on by a menu command. For example, to SCAN 20 tracks starting from track 10, set TRACK to 10 and TRACKS to 20.

### WARNING

To avoid damage to a 40 track disc drive do not exceed track 39, ie TRACK plus TRACKS must not exceed 40.

## T/ID

This parameter is the track ID (0-255). A track ID is a number given to each sector when a disc is formatted. It is normally the same as the track number on which the track is formatted. This parameter is only used by the FORMAT command. It should normally be set to the same value as TRACK. Protected discs will often use a track ID different to its physical track number.

## H/ID

This parameter is the head ID (0-255). A head ID is a number given to each sector when a disc is formatted. A head number could be used to match up a disc with a particular drive number. The head number is redundant on the BBC and Electron disc systems. This parameter is only used by the FORMAT command. It should normally be set to zero. Protected discs sometimes use a head number other than 0.

## S/ID

This parameter is the sector ID (0-255, 0-239 on 1770). A sector ID is a number given to each sector of a track when it is formatted. Sector ID's in DFS are 0-9, and in ADFS 0-15. This parameter is only used by the FORMAT command. It should normally be set to zero. Protected discs often use a sector ID starting from a number other than 0.

## L/ID

This parameter is the length ID (0-255). A length ID is a number given to each sector when a disc is formatted, and used to indicate the length of the sector. The FDC recognises the lengths as follows:

## L/ID      SECTOR LENGTH in bytes

|   |   |                  |
|---|---|------------------|
| 0 | - | 128              |
| 1 | - | 256              |
| 2 | - | 512              |
| 3 | - | 1024             |
| 4 | - | 2048 (8271 only) |

This parameter is only used by the FORMAT command. It should normally be set to the value corresponding to the sector length as shown above. Some protected discs use a length ID which does not match the physical sector length. See Protected Disc Formats on page 28.

## SECTORS

This parameter is the number of sectors on a track (0-99). It is used by the format command as the number of sectors to be formatted on each track. It is also used by the GET SECTORS FROM DISC and PUT SECTORS TO DISC commands. This parameter should be set to the number of sectors to read or write. Protected discs can sometimes use less or more than the normal 10 or 16 sectors per track.

## OPERATION

This parameter shows the current command in operation by the FDC. This parameter will be blank when there is no command in operation.

| OPERATION | MEANING                          |
|-----------|----------------------------------|
| SEEK      | seek drive head to a track       |
| READ DD   | read a deleted data sector       |
| WRITE     | write a normal sector            |
| WRITE DD  | write a deleted data sector      |
| FORMAT    | format a track                   |
| READ ID   | read a tracks Sector ID field    |
| WRITE SR  | write to an FDC special register |
| READ T    | read track data (1770 FDC only)  |
| WRITE T   | write track data (1770 FDC only) |

## RESULT

This parameter shows the result of the last FDC command. Every command issued to the FDC returns a result (0-255). A successful completion of a command returns 0. The number and meaning of the result is shown by this parameter. This parameter is only used by the PUT SECTORS TO DISC command, to write deleted sectors to a disc. For a list of 8271 FDC results type \*HELP RESULT.

## COPY A DISC

### Purpose

To copy tracks from the source disc to the destination disc. The destination disc need not be formatted, since the format of the source disc is copied onto the destination disc. A YES/NO message is displayed before the tracks are copied. Press Y to continue or any other key to cancel the command.

This command uses the buffer to copy tracks from source to destination discs. Sectors are read into the buffer one at a time and the result is displayed on the screen. A result of 0 or 32 means the sector has been read successfully. A result is displayed when writing the sectors to the destination disc. A result of 0 means the sector has been written successfully.

Press any key to pause the command and again to continue.

### Parameters

S/DRIVE - source drive number, stepping size and density of disc.  
D/DRIVE - destination drive number, stepping size and density of disc.  
TRACK - first track to copy.  
TRACKS - number of tracks to copy.

### Examples

To backup a 40 track disc so it can be used in an 80 track drive, using a dual 80 track drive for the backup, set the parameters to:

S/DRIVE: 0 48  
D/DRIVE: 1 96  
TRACK: 00  
TRACKS: 40

This would also backup a non-standard 40 track disc. Some software publishers use a 40/80 disc format, which has a copy of the program in 40 track on side 0 and another copy in 80 track on side 2. Using this example it is possible to make a copy of side 0 in 80 track. This is useful for single sided drives which cannot read side 2.

### Notes

Using the 1770 FDC to copy early forms of non-standard discs may produce a result of 14, Data Field CRC Error when reading sectors. This means the sector cannot be read, and is due to a protective feature of the disc, which could only be used on the older 8271 FDC. Only the READ TRACK DATA command can be used to read the sectors from the disc. See Protected Disc Formats and the 1770 FDC on page 28 for more information.

## VERIFY TWO DISCS

### Purpose

To verify tracks on the source disc with the destination disc. This should be used after using the COPY command, to ensure a successful copy. A result is displayed after verifying each track. 'CORRECT' means the tracks are the same. Other possible results and their meanings are given below.

Press any key to pause the command and again to continue.

| Result                  | Meaning                                     |
|-------------------------|---|
| No Sectors Found        | - both S/DRIVE and D/DRIVE have no sectors  |
| ID Field Incorrect      | - a sectors ID field does not match         |
| S/DRIVE Read Error      | - cannot read sector from S/DRIVE           |
| D/DRIVE Read Error      | - cannot read sector from D/DRIVE           |
| Length Error            | - a sectors length does not match           |
| Data Address Mark Error | - data type (normal/deleted) does not match |
| Data Error              | - a sectors data does not match             |

### Parameters

S/DRIVE - source drive number, stepping size and density of disc.  
D/DRIVE - destination drive number, stepping size and density of disc.  
TRACK - first track to verify.  
TRACKS - number of tracks to verify.

## EDIT A SECTOR

### Purpose

To examine and edit disc sectors. The sector will be read from sector SECTOR, track TRACK, and drive S/DRIVE. The size of the sector in bytes, the sectors field ID's and number of sectors on the track will be shown in the status window.

The sector is displayed in the centre of the screen as hex data and ascii characters. A cursor will appear on the first byte of the sector. Moving the cursor is done using the four cursor keys. If the sector occupies more than one screen (more than 256 bytes) the cursor can be moved forward and back a page using the SHIFT up and down cursor keys. Press SHIFT left cursor to move to the left margin and SHIFT right cursor to move to the right margin. Editing a byte is done by overtyping the byte from the keyboard. The new byte will appear as hex inside the round brackets and as an ascii character above the flashing cursor. To enter numbers as hex bytes press the COPY key. The round brackets will change to square brackets. Now only hex numbers will be accepted, ie. 0-9 and A-F. Press COPY again to enter characters as ascii. Moving forward or back a track or sector is done using the four CONTROL cursor keys. If the sector has been altered a message is displayed for saving the sector back onto the disc. Press Y to save the sector, or any other key not to save it. The sector can be displayed as 65C02 disassembler by pressing the TAB key (CTRL I on an Electron)

Press ESCAPE to leave this command.

### Parameters

S/DRIVE - drive number, stepping size and density of disc to edit.  
TRACK - track number to edit.  
SECTOR - sector number to edit.  
TRACKS - number of tracks on disc.

### Editing Keys

|                          |                                  |
|--------------------------|----------------------------------|
| CURSOR keys              | - cursor movement                |
| SHIFT left cursor        | - move to left margin            |
| SHIFT right cursor       | - move to right margin           |
| SHIFT down cursor        | - move forward one page          |
| SHIFT up cursor          | - move back one page             |
| CTRL left cursor         | - move back one sector           |
| CTRL right cursor        | - move forward one sector        |
| CTRL down cursor         | - move forward one track         |
| CTRL up cursor           | - move back one track            |
| COPY                     | - swap cursor type, hex or ascii |
| TAB (CTRL I on Electron) | - swap display type              |
| CTRL P                   | - print screen                   |
| ESCAPE                   | - leave command                  |

## SCAN A DISC

### Purpose

To display the format of a disc. The information regarding the format of a track is the TRACK, HEAD, SECTOR and LENGTH ID's of each sector, the sectors length in bytes and also the result from reading each sector. It is possible to identify faulty sectors by reading the result. A result of 0 or J2 means the sector has been read successfully.

The SCAN command is a very important command, since without it, it would be virtually impossible to copy a disc with a non-standard format. A protected disc can quickly be identified by its unusual format, by using this command. See page 25 for more information on disc formats.

Press any key to pause the command and again to continue.

### Parameters

S/DRIVE - drive number, stepping size and density of disc to scan.  
TRACK - first track to scan.  
TRACKS - number of tracks to scan.



## FORMAT TRACKS

### Purpose

To format or reformat tracks to a specified format. This command can be used to reformat just one track, instead of the whole disc. This is useful when the rest of the disc contains important information which should not be formatted over. A YES/NO message is displayed before the tracks are formatted. Press Y to continue or any other key to cancel the command.

### Parameters

S/DRIVE - drive number, stepping size and density of disc to format.  
TRACK - first track to format.  
BYTES - length of each sector in bytes.  
TRACKS - number of tracks to format.  
T/ID - track ID of first track.  
H/ID - head ID for each sector.  
S/ID - sector ID of first sector on each track.  
L/ID - length ID of each sector.  
SECTORS - number of sectors on each track.

### Examples

To format an 80 track disc in DFS format in drive 0 use:

```
S/DRIVE=0 96 FM  
TRACK=0 TRACKS=80 BYTES=256 T/ID=0 H/ID=0 S/ID=0 L/ID=1 SECTORS=10
```

To format track 20 only in DFS format in drive 0 use:

```
S/DRIVE=0 96 FM  
TRACK=20 TRACKS=1 BYTES=256 T/ID=20 H/ID=0 S/ID=0 L/ID=1 SECTORS=10
```

To format an 80 track disc in ADFS format in drive 0 use:

```
S/DRIVE=0 96 MFM  
TRACK=0 TRACKS=80 BYTES=256 T/ID=0 H/ID=0 S/ID=0 L/ID=1 SECTORS=16
```

To format track 20 only in ADFS format in drive 0 use:

```
S/DRIVE=0 96 MFM  
TRACK=20 TRACKS=1 BYTES=256 T/ID=20 H/ID=0 S/ID=0 L/ID=1 SECTORS=16
```

Obviously by changing these parameters it is possible to create an almost infinite number of formats, even the IBM mini-floppy format, with:

```
S/DRIVE=0 96 MFM  
TRACK=0 TRACKS=40 BYTES=512 T/ID=0 H/ID=0 S/ID=1 L/ID=2 SECTORS=9
```

### Notes

Formatting a DFS or ADFS disc with this command does not write the catalogue information onto the disc.

## UNFORMAT TRACKS

### Purpose

To 'unformat' tracks on a disc. This actually formats the track in such a way that the FDC is unable to distinguish any sector on the track just like a blank track. This is useful for creating a disc which must be completely blank. A method of protection employed by some protected discs is to check for 'blank tracks'. A YES/NO message is displayed before the tracks are unformatted. Press Y to continue or any other key to cancel the command.

### Parameters

S/DRIVE - drive number, stepping size and density of the disc.

TRACK - first track to be unformatted.

TRACKS - number of tracks to be unformatted.

## MODIFY FORMAT PARMS

### Purpose

To change the default skew and field gaps used when formatting a track. A table of values for the skew and gaps 1 and 3 is printed in the centre of the screen. There is a value for each sector length in single (FM) and double (MF) density. To modify a value respond to the prompts that follow. To leave this command without modifying the table just press RETURN at the prompt.

Skew values can be both positive and negative. To enter a negative value use the following formula:

value = 256-x,

where x=value to be made negative.

A skew value should be chosen carefully. A disc with 10 sectors per track could have skew values of 0 to 9 or -1 to -9, any other values are meaningless. A value of 0 means no skew at all. See page 28 for more information on skew.

Gap sizes should also be chosen sensibly. The default gaps are the recommended sizes by the FDC designer, changing their sizes will effect the performance of the disc. For example, reducing the size of gap 3 will increase the speed of reading sectors from the disc, but will make writing sectors slower, possibly causing errors.

## GET SECTORS FROM DISC

### Purpose

To read sectors (0-99) from the source disc into the buffer. After the prompt Use STATUS ID's (Y/N) ? is displayed, press N or RETURN to read the sectors normally from the disc into the buffer. The maximum number of sectors able to be read into the buffer will depend upon the size of the buffer. The message No Room is displayed if the buffer is not large enough to hold all the sectors.

If Y is pressed after the prompt then the ID parameters in the status window are used to read the sectors from the disc. Only the sectors on track TRACK can be read into the buffer. The usefulness of this is limited. It is of most use on the 8271 FDC when it is required to issue a read sector command of a particular sector length on any sector. By setting L/ID to a length greater than the physical sector length, the sector can be read as well as the CRC's, gaps and sync bytes that follow the sector. This feature is not available on the 1770 FDC. Some protected discs make use of this feature to read the size of gap J. Use the MODIFY FORMAT PARMS command to change the size of this gap.

### Parameters

S/DRIVE - drive number, stepping size and density of the disc.  
TRACK - first track to start reading from.  
SECTOR - first sector to start reading from.  
SECTORS - number of sectors to read

### Parameters Using STATUS ID's

S/DRIVE - drive number, stepping size and density of the disc.  
TRACK - track to read.  
T/ID - logical track number.  
S/ID - first logical sector to read.  
L/ID - length of sector to read.  
SECTORS - number of sectors to read.

## PUT SECTORS TO DISC

### Purpose

To write sectors (0-99) from the buffer onto the source disc. A YES/NO message is displayed before the sectors are written. Press Y to continue or any other key to cancel the command. After the prompt Use STATUS ID's (Y/N) ? is displayed, press N or RETURN to write the sectors normally from the buffer to the disc. The message No Room is displayed if the number of sectors exceeds the size of the buffer.

If Y is pressed after the prompt then the ID parameters in the status window are used to write the sectors from the buffer. Only the sectors on track TRACK can be written from the buffer. The usefulness of this is limited. It is of most use on the 8271 FDC when it is required to issue a write sector command of a particular sector length on any sector. By setting L/ID to a length greater than the physical sector length, it is possible to mix physical sector lengths on one track. This feature is not available on the 1770 FDC.

It is possible to write deleted sectors to the disc by changing the result parameter before using this command, so it displays DELETED DATA. Normal sectors will be written if the result displays NORMAL DATA.

### Parameters

S/DRIVE - drive number, stepping size and density of the disc.  
TRACK - first track to start writing to.  
SECTOR - first sector to start writing to.  
SECTORS - number of sectors to write.

### Parameters Using STATUS ID's

S/DRIVE - drive number, stepping size and density of the disc.  
TRACK - track to write.  
I/ID - logical track number.  
S/ID - first logical sector to write.  
L/ID - length of sector to write  
SECTORS - number of sectors to write.

## READ TRACK DATA

### Purpose

To read all the bytes of a track into the buffer, which includes the sector ID's, CRC bytes and field gaps. The number of bytes read from the track is shown in the status window by the BYTES parameter. See What's on a track? on page 25 for more information.

A double density (MFH) track can only be read using the 1770 FDC. An MFH track uses about 6,300 bytes. If the buffer is not large enough the message No Room is displayed.

Type \*HELP TRACK for a table of the format of a track.

### Parameters

S/DRIVE - drive number, stepping size and density of the disc.

TRACK - track number from which the data is read.

### Notes

Although the 8271 FDC does not have a read track command, it is possible to read almost all of the track. This is done by reading the first sector on the track as a very large sector (4096 bytes) which reads everything after the first sector, including the other sectors and their gaps and CRC's etc. The sector ID field, post ID field gap and data address mark of the first sector and the post index field gap .(1) are not read into the buffer. The RESULT parameter will return error 14, Data Field CRC Error. The BYTES parameter will return a track length of 4096 bytes.

When this command is used to read an MFH track on the 1770 FDC or an FM track on the 8271 FDC, certain data patterns in the track's data field cause read errors to occur, making the contents of the buffer to be an inaccurate dump of the track. A formatted track which has not had sectors written to it can be read without errors.

## WRITE TRACK DATA

### Purpose

To format a track with the data in the buffer. The data must include the field addresses and field gaps. The correct format of the data for a track must be observed otherwise the track will be unreadable. See What's on a track? on page 25 for more information. A YES/NO message is displayed before the track is formatted. Press Y to continue or any other key to cancel the command.

This command can only be used if the Acorn 1770 disc interface is fitted in the computer. A double density (MFM) track uses about 6,300 bytes. If the buffer is not large enough the message No Room is displayed.

Type \*HELP TRACK for a table of the format of a track.

### Parameters

S/DRIVE - drive number, stepping size and density of the disc.  
TRACK - track number of the track to be formatted.

## BUFFER EXAMINE

### Purpose

To examine and edit the contents of the buffer.

Data from the buffer is displayed in the centre of the screen as hex bytes and ascii characters. A cursor will appear over the first byte in the buffer and can be moved by using the four cursor keys. Moving forward or back a page at a time is done using the SHIFT up and down cursor keys. Moving to the left or right margin is done using the SHIFT left and right cursor keys. Editing is done by typing the characters from the keyboard.

To enter numbers as hex bytes press COPY. The round brackets will change to square brackets. Now only hex numbers can be typed, ie. 0-9 and A-F. Press COPY again to enter characters in ascii. To display the contents of the buffer in 65C02 disassembler press the TAB key (CTRL I on the Electron).

Press ESCAPE to leave this command.

### Editing keys

|                          |                               |
|--------------------------|-------------------------------|
| CURSOR keys              | - cursor movement             |
| SHIFT left cursor        | - move cursor to left margin  |
| SHIFT right cursor       | - move cursor to right margin |
| SHIFT down cursor        | - move forward one page       |
| SHIFT up cursor          | - move back one page          |
| COPY                     | - swap cursor type hex/ascii  |
| TAB (CTRL I on Electron) | - swap display type           |
| CTRL P                   | - print screen                |
| ESCAPE                   | - leave command               |



## ZERO BUFFER

### Purpose

To fill the contents of the buffer with 0's. A YES/NO message is displayed before the buffer is cleared. Press Y to clear the buffer or any other key to cancel the command.

## TURN PRINTER ON/OFF

### Purpose

To turn the printer on or off. If the printer is turned on, output from the COPY, SCAN and VERIFY commands will be sent to the printer as well as the screen. If the printer is off output is sent to the screen only. To turn the printer ON if it is OFF or OFF if it is ON press Y at the YES/NO prompt or any other key to cancel the command.

## INITIALISE STATUS

### Purpose

To return the status parameters in the status window to their default values. The density of the S/DRIVE and D/DRIVE parameters is set according to the density of the current disc filing system, ie FM (single density) for DFS and MFM (double density) for ADFS. TRACKS is set to 80, BYTES to 256 and SECTORS to 10 in DFS and 16 in ADFS. The other parameters are set to 0.

## \* COMMAND

### Purpose

To send a command to the MOS. Type in the command after the \* prompt. Any output from the command will appear in the centre of the screen.

It would be possible to enter BASIC by typing \*BASIC, but this is not recommended. To leave ADI properly press ESCAPE from the menu.

## **\*OSWORD7F**

### **Purpose**

To send a command to the FDC. The parameters which follow the command are assembled in memory and passed to OSWORD &7F. <drive> is the drive number, <start> is the start memory address for reading or writing, <command> is the 8271 FDC command and <parm> is the parameter for the FDC command. <parm> can be repeated for commands which use more than one parameter. The parameters for OSWORD7F should be in hexadecimal. If this command is used with no parameters, then the result from the last OSWORD7F command is printed. Results and their meanings can be found on page 7.

If the 1770 disc interface is fitted, this command can be used on double density discs, by setting bit 3 of the <drive> parameter, ie add 8 to the drive number.

For a list of the 8271 FDC commands type \*HELP FDC. Only the commands marked with \* can be used with the OSWORD7F command on the 1770 FDC. Note, the READ and WRITE TRACK commands can only be used on the 1770 FDC.

### **Examples**

**\*OSWORD7F 0 1900 53 A 0 21**

Reads one sector from an FM disc in drive 0, track 10, sector 0 to memory address &1900.

**\*OSWORD7F 8 1900 53 A 0 21**

Reads one sector from an MFM disc in drive 0, track 10, sector 0 to memory address &1900.

### **Notes**

For the precise meaning of all 8271 FDC commands and their parameters, refer to the document on the 8271 FDC by Intel.

## 4 DRIVE TYPES AND DISC FORMATS

### 40 and 80 Track Drives

A 40 track drive is capable of moving its head over 40 track positions, so a maximum of 40 tracks can be written to the disc. 40 track drives can pack 48 tracks into 1 inch across the surface of the disc or 48 tracks per inch (48 tpi). This means 40 tracks occupy less than 1 inch across the surface of a disc.

An 80 track drive is capable of moving its head over 80 track positions, so a maximum of 80 tracks can be written to the disc. 80 track drives can pack 96 tracks into 1 inch across the surface of the disc or 96 tracks per inch (96 tpi). This means 80 tracks occupy less than 1 inch across the surface of a disc. Because 80 track drives have twice as many tracks per inch, the hardware of the drive must be more precise. Consequently, 80 track drives are usually more expensive than 40 track drives.

### Single and Dual Drives

A single drive means just one drive and a dual drive means two drives. Both single and dual drives can be single or double sided.

### Single Sided and Double Sided Drives

A single sided drive means only one side of the disc can be used, whereas a double sided drive means both sides of the disc can be used (providing the disc is double sided).

### Single Density and Double Density

Single and double density is the ability of the FDC, not the drive or disc, to write data onto the disc in FM (frequency modulation) or MFM (modified frequency modulation). MFM can pack twice as many bytes onto a track as FM, but because of the overhead in gaps and CRC etc, the number of bytes used as data is not quite double. DFS uses 10 sectors per track, and ADFS the double density system uses 16.

Double density discs should be used in a double density system. Quite often single density discs will work too, but these are less reliable than double density discs.

### What's on a Track?

Each track is divided into equal sized sectors, where the program data is stored. Each sector can store the same number of bytes, and will hold some or all of a program depending upon its size. DFS uses 10 sectors per track and ADFS uses 16. Each sector on DFS and ADFS can store upto 256 bytes.

A track contains not just program data but lots of other information which is not normally seen, although it is used everytime the track is accessed. About 75% of the track contains program data, the rest contains information about the track, gaps and CRC bytes.

### Post Index Gap

The post index gap (gap 1) is written starting from the index mark and consists of a specified number of &FF bytes followed by six bytes of 0's. The 0's are used during read and write operations to synchronise the data separation logic with the data to be read from the ID field. The post index gap is written only when a track is formatted.

### Sector ID Field

The sector ID field consists of 7 bytes and is written only when the track is formatted. The first byte is the ID address mark consisting of the data byte &FE. The next four bytes are the track, head, sector and length ID's respectively. These are used to identify a particular sector on subsequent read and write operations. The last two bytes are a 16 bit CRC (cyclic redundancy check) of the first five bytes of this field. The FDC can detect an ID Field CRC Error from this CRC.

### Post ID Field Gap

The post ID field gap (gap 2) in FM consists of 11 bytes of &FF and 6 bytes of 0. In MFM it consists of 22 bytes of &FF, six bytes of 0 and 3 bytes of &A1. Gap 2 is written initially when the track is formatted. During subsequent write operations, the drive's write circuitry is enabled at byte 12 in FM and byte 23 in MFM and the six bytes of 0's are rewritten each time the sector is updated. During subsequent read operations, the last six bytes are used to synchronise the data separation logic with the upcoming data field.

### Data Field

The length of the data field is determined when the track is formatted. DFS and ADFS use 256 bytes. The first byte of the data field is the data address mark which consists of the data byte &FB. When a deleted sector is to be written a deleted sector address mark is written which consists of the data byte &FB. The last two bytes of the data field are a 16 bit CRC. The FDC can detect a Data Field CRC Error from this CRC.

### Post Data Field Gap

The post data field gap (gap 3) is written when the track is formatted and in FM consists of a selectable number of &FF bytes followed by six bytes of 0. In MFM it consists of a selectable number of &4E bytes. The post data field gap separates the preceding data field from the next physical ID field on the track. Following a sector update operation, the drive's write logic is disabled during the first &FF bytes (&4E for MFM). A post data field gap is not written following the last physical sector on a track.

### Final Gap

The final gap (gap 4) is written when the track is formatted and consists of &FF's in FM and &4E's in MFM, extending from the last physical data field on the track to the end of the track.

**ADVANCED COMPUTER PRODUCTS LTD**  
**6 Ava House, High Street, Chobham, Surrey.** Tel: (0276) 76545