

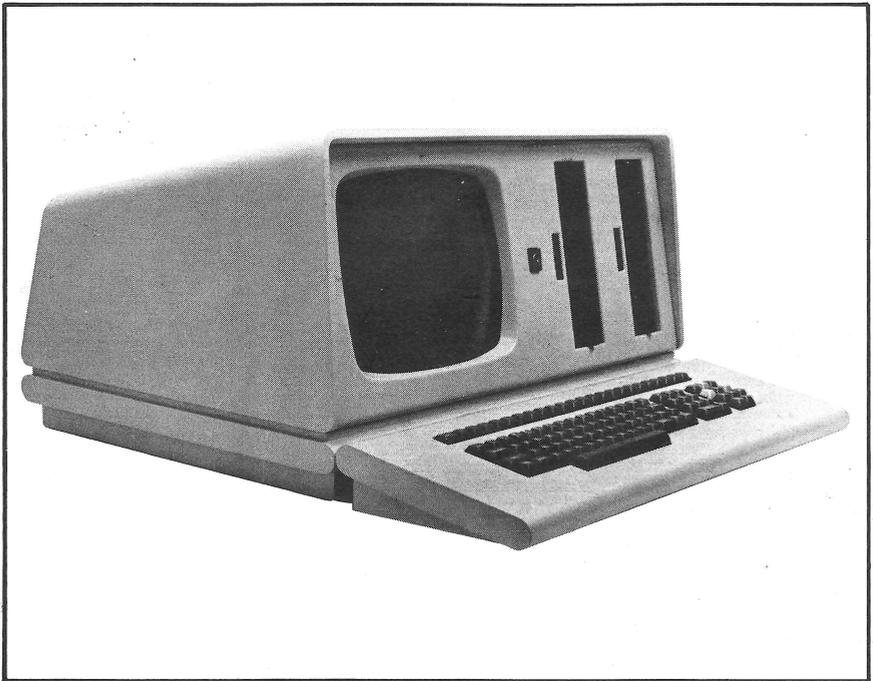
SYSTEM M-THREE
OPERATOR'S MANUAL





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The M-THREE Operator's Manual



This manual describes the operation of and available features on the M-THREE range of micro-computers. For additional information or technical assistance contact:

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SECTION 1 INTRODUCTION

1.1 GENERAL

The LSI SYSTEM M-THREE is a compact and versatile desk-top micro-computer system which has the capability to undertake complex tasks in differing fields, e.g. stock control, accounting, instrumentation control, etc.

Several different M-THREE models are available, enabling the user to match the system's intended function or functions with an efficient mass-memory configuration (see 10.8). These models all support CP/M, rendering them compatible with a wide range of software packages.

N.B. The complete functional specification of all M-THREE systems can be found in Section 10.

Physically all M-THREE systems separate into two parts:

- 1) The Main Control Unit.
- 2) The Keyboard.

1.2 THE MAIN CONTROL UNIT

Apart from the internal processing of data, the Main Control Unit performs some important functions which are more obvious to the operator:

- a) Disk Drive control.
- b) Visual Display control.
- c) Peripheral control.

1.2.1 Disk Drive Control

In order for the M-THREE system to function as a micro-computer, the Main Control Unit must have rapid access to quantities of data (which will exceed its internal memory capacity) and the necessary processing instructions (software) which will cause that data to be manipulated in a predetermined manner. The relevant data and software is stored on magnetic Disks/Diskettes (see 2.5) which can be 'read' from, or 'written' to, by the Main Control Unit. This 'reading' and 'writing' is achieved by controlling the

Disk Drives into which the Disks/Diskettes are placed or permanently held.

1.2.2 Visual Display control

The Visual Display is the most important operator aid in the system. It is the means by which the Main Control Unit communicates with the operator; a software controlled 'window' into the computer. The Visual Display, coupled with system familiarity (keyboard and software protocols etc.), will enable two-way communication between the operator and the M-THREE system.

The display area of the screen can contain a maximum of 24 lines, each one having up to 80 characters in it (1,920 characters in all). Each of these characters can be any one of the symbols shown in appendices A and B.

Any Further explanation as to the behaviour of the Visual Display at this point would be fruitless as it is entirely software dependant.

1.2.3 Peripheral Control

The M-THREE has the ability to control devices external to its own immediate system. These devices, whatever they may actually be, come under the heading 'Peripherals'.

The most common peripheral is a printer, which will be needed if the system is being used for anything that requires a printed output (hard-copy).

1.3 THE KEYBOARD

The Keyboard enables the operator to load data and instructions into the Main Control Unit. The actual 'language' used for this is entirely dependant on the system control software (Operating System) in use at the time, but most software interacts with the operator by using the Visual Display for 'prompt-messages' and thereby enhances the necessary two-way communication.

SECTION 2 INITIAL OPERATION

2.1 GENERAL

It is assumed that the M-THREE has been unpacked and is ready to be installed and switched on.

2.2 SWITCHING ON THE M-THREE

- 2.2.1** CHECK THAT THE VOLTAGE LABEL ON THE REAR OF THE M-THREE INDICATES THE CORRECT MAINS SUPPLY (see Fig. 2/1).
- 2.2.2** Plug the appropriate end of the mains lead provided into the Mains Supply connector on the rear of the M-THREE.
- 2.2.3** Plug the M-THREE's mains plug into a functional mains socket.
- 2.2.4** Ensure that a minimum distance of 3" is left clear at the rear of the M-THREE in order for its cooling system to function effectively.
- 2.2.5** Plug the lead from the keyboard securely into the connector on the front of the M-THREE (see Fig. 2/2a, b, or c as applicable) keeping the excess lead in the recess provided in the keyboard's base.
- 2.2.6** Insert the supplied 'switch-on' key into the keyswitch on the front of the Main Control Unit and turn it clockwise.
- 2.2.7** The following will occur:
 - a) A high pitched 'peep' will be heard.
 - b) The cooling fan will be heard.
 - c) The Disk Drive motors will be heard.
 - d) The red indicator on the left-hand Disk Drive (Disk Drive A) will illuminate.

2.3 THE CONTRAST CONTROL

To allow for differing ambient lighting conditions, a Contrast control has been provided at the front of the Main Control Unit (see Fig. 2/2a, b, or c). This control should be adjusted by the operator to suit his/her requirements.

N.B. The brightness of the display is present during manufacture for optimum operating conditions and therefore no provision has been made for user adjustment.

2.4 VISUAL DISPLAY PROMPT

At this point, according to which M-THREE System is being operated, either a flashing 'block' (the Cursor), or the message "Diskette Expected in Selected Drive." with a flashing Cursor at its right-hand end, will appear in the top left-hand corner of the Visual Display.* Either way, any keyboard operation will have no effect on the display.

A 'Diskette' is required.

* If the screen is blank, adjust the Contrast control at the front of the Main Control Unit (see Fig. 2/2a, b, c). If the screen is still blank, or extraneous data is present, switch the system off and wait at least 15 seconds before repeating the Switch-On procedure. If either of these conditions persist, switch the system off and call the manufacturer for service assistance.

2.5 THE DISKETTE

As previously mentioned, rapid access to large amounts of data and complex software is essential for a micro-computer to function.

The media which is most suited to this sort of storage and access is a magnetic disk. There are three types of magnetic disk or diskette used on the various M-THREE systems; the Mini-Floppy Diskette (5 1/4"), the Floppy Diskette (8"), the Winchester Disk.

Both types of diskette have a 'write-protect' facility whereby a protected diskette can be read from but not written to. On the 5 1/4" diskette this protection is achieved by placing the appropriate 'sticker' (normally supplied with the diskettes) over the Write Protect slot (see Fig. 2/3b), however, on the 8" diskette the sticker must be removed from the slot (see Fig. 2/3a).

Each of the M-THREE systems needs a Diskette of the appropriate size (diskettes are not interchangeable) to be placed into its left-hand Disk Drive in order to bring the system into operation. This Diskette must have Operating System software on it, making it a 'System Diskette'.

N.B. As the Winchester Disc is a rigid disc and permanently encased in its drive mechanism, it cannot be loaded and therefore is always a right-hand Disc Drive.

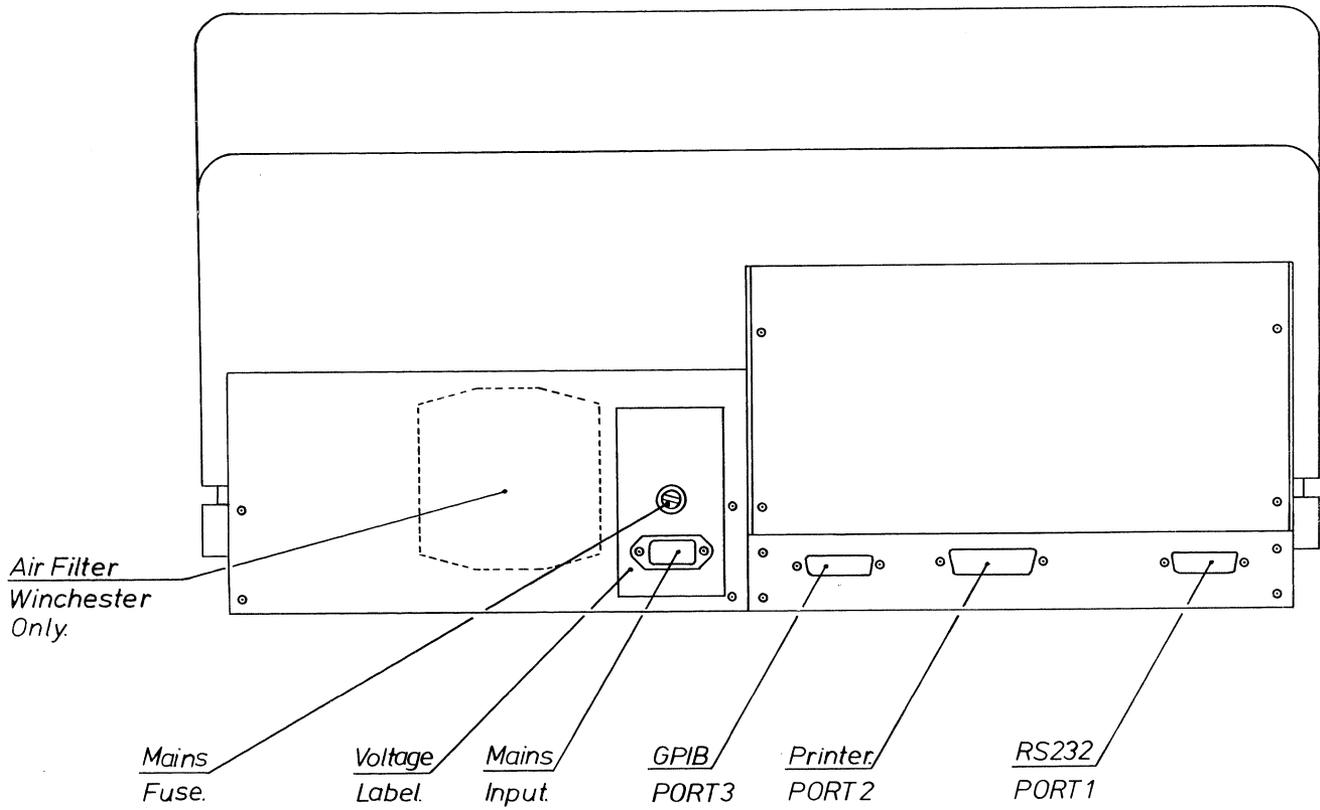


FIG 2/1

MAIN CONTROL UNIT (M-THREE / 100 SERIES)

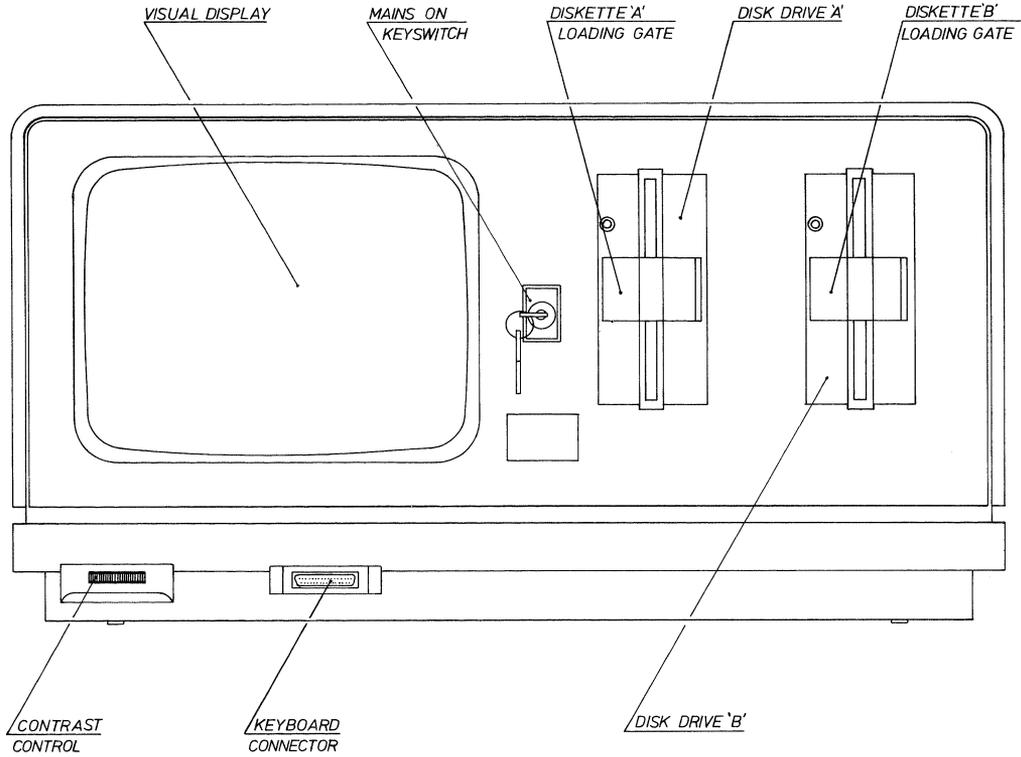


FIG 2/2a

MAIN CONTROL UNIT (M-THREE /200 SERIES)

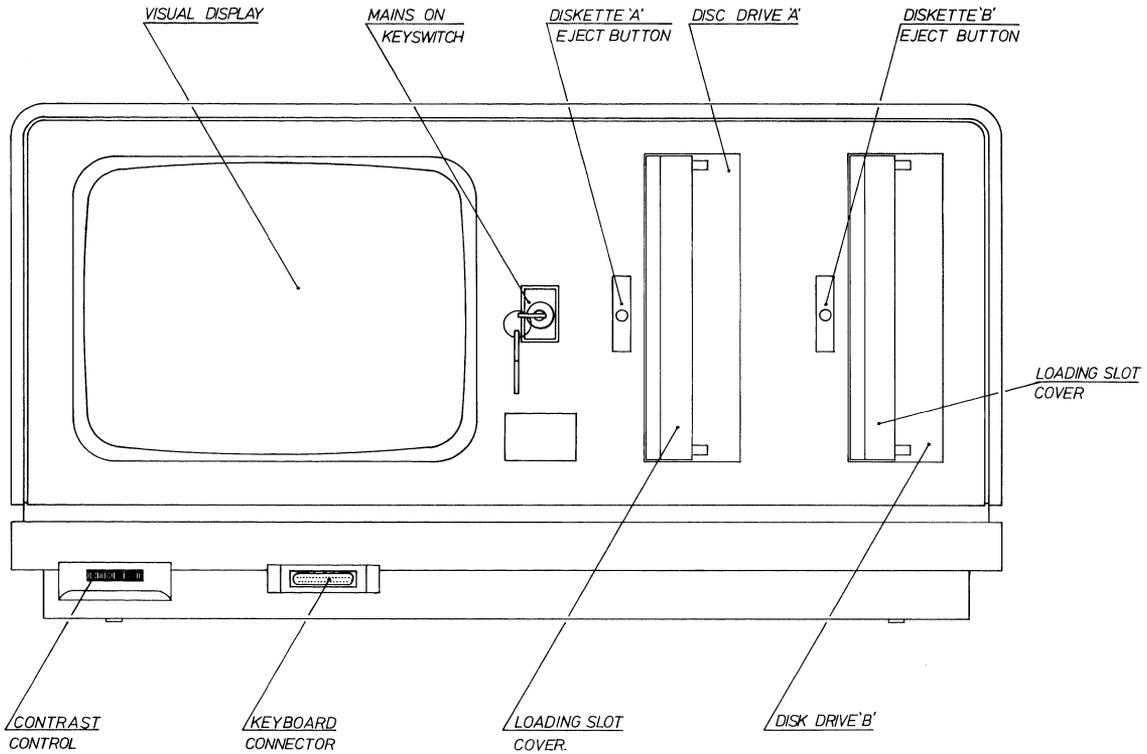


FIG 2/2b

MAIN CONTROL UNIT (M-THREE/300 SERIES)

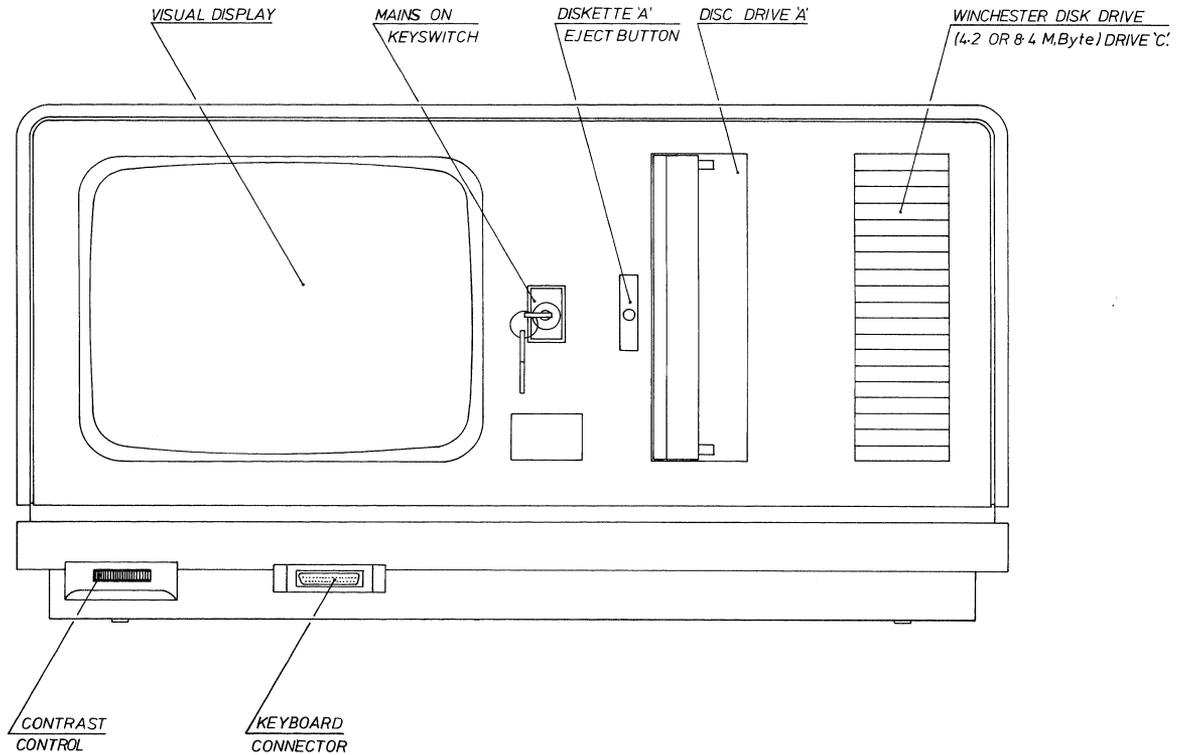
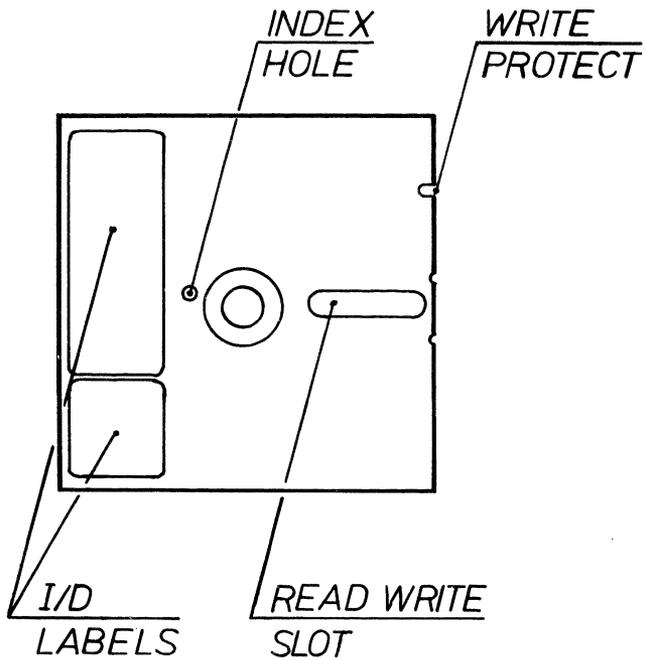
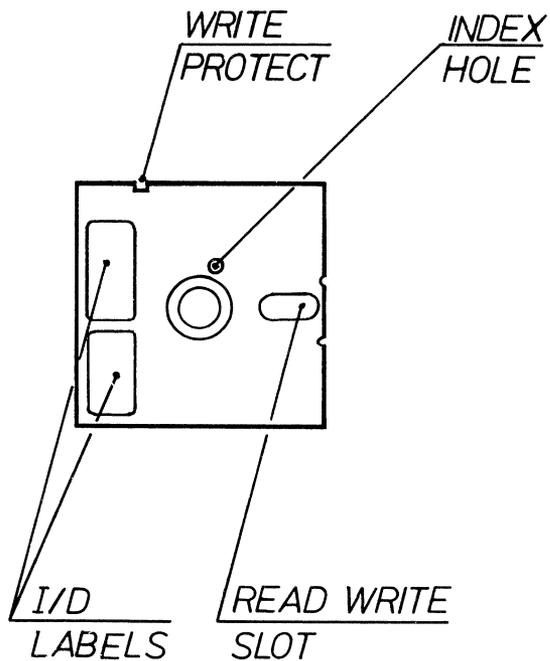


FIG 2/2c



8 INCH.

FIG 2/3a



5 INCH.

FIG 2/3b

2.6 DISKETTE HANDLING

The Diskette is a delicate object on which is stored invaluable data and therefore must be treated with the following appropriate respect:

- 2.6.1 DO NOT expose the Diskette to abrupt changes in temperature or humidity.
- 2.6.2 DO NOT expose the Diskette to excessive heat or sunlight.
- 2.6.3 DO NOT allow magnets or magnetised objects near the Diskette.
- 2.6.4 DO NOT place heavy objects on the Diskette.
- 2.6.5 DO NOT bend or fold the Diskette.
- 2.6.6 DO NOT spill anything on the Diskette.
- 2.6.7 DO NOT use a Diskette which has been contaminated with spillage.
- 2.6.8 DO NOT attempt to clean a Diskette.
- 2.6.9 DO NOT overlay the identification labels. Always place them in the correct position on the Diskette.
- 2.6.10 DO NOT write on the Diskette's labels with a ball-point or pencil. Use only a fibre-tip.
- 2.6.11 DO NOT touch the surface of the Diskette. Keep your fingers away from the Read/Write Slot.
- 2.6.12 DO NOT leave Diskettes lying about. Store them properly.

2.7 QUALIFIED VENDORS OF DISKETTES FOR M-THREE DISK DRIVES

Disk Drives	Shugart type no.	Maxell type no.	Verbatim C8 equiv.	Wabash equiv.	IBM equiv.
SA800	SA102	FD1-XD	NO	YES	YES
SA850	SA150	FD2-256D	NO	NO	YES
SA400	SA104	MD1	YES	NO	NO
SA450	SA154	MD2-D	NO	NO	NO

2.8 DISK DRIVES

SA800 = 8" single-sided Disk Drive (M-THREE/200-320-340)
SA850 = 8" double-sided Disk Drive (M-THREE/250-325-345)
SA400 = 5 1/4" single-sided Disk Drive (M-THREE/100)
SA410 = 5 1/4" single-sided Disk Drive (M-THREE/110)
SA450 = 5 1/4" double-sided Disk Drive (M-THREE/150)
SA460 = 5 1/4" double-sided Disk Drive (M-THREE/160)

2.9 LOADING THE M-THREE/100 SERIES (5 1/4" Disk Drives)

If the Mini-Floppy Diskette to be loaded is the first after the system has been switched on, the Visual Display should be blank except for a flashing Cursor in its top left-hand corner.

The Mini-Floppy Diskette should be loaded as follows:

- 2.9.1 If the Disk Drive's loading slot is blocked by the Loading Gate, pull the gate open from its left-hand side. (see Fig. 2/2a)
- 2.9.2 Hold the Mini-Floppy Diskette as shown in Fig. 2/4.
- 2.9.3 Slide the Mini-Floppy Diskette into the loading slot and push its rear edge until it is all the way in.
- 2.9.4 Close the Loading Gate by pulling it across from right to left.

The M-THREE is now under the control of the software on the 'System Diskette'. This software is known as the 'Control Program' or 'Operating System'. The standard Operating System for all M-THREE's is CP/M (see section 5), however, if another Operating System is to be used then the appropriate handbook should now be consulted.

2.10 LOADING THE M-THREE/200-300 SERIES (8" Disk Drives)

If the Floppy Diskette to be loaded is the first after the system has been switched on, the Visual Display should be blank except for the message "Diskette Expected in Selected Drive." with a flashing Cursor at its right-hand end.

The Floppy Diskette should be loaded as follows:

- 2.10.1 If the Disk Drive's loading slot is closed, press the illuminated indicator's back plate. The loading slot's cover should now spring open. (see Fig. 2/2b or c)

- 2.10.2** Hold the Diskette as shown in Fig. 2/4.
- 2.10.3** Slide the Diskette into the slot and push it in by its rear edge until a small 'click' is heard and the Diskette is held.
- 2.10.4** Pull the loading slot cover across until it latches shut.

The M-THREE is now under the control of the software on the 'System Diskette'. This software is known as the 'Control Program' or 'Operating System'. The standard Operating System for all M-THREES is CP/M (see section 5), however, if another Operating System is to be used then the appropriate handbook should now be consulted.

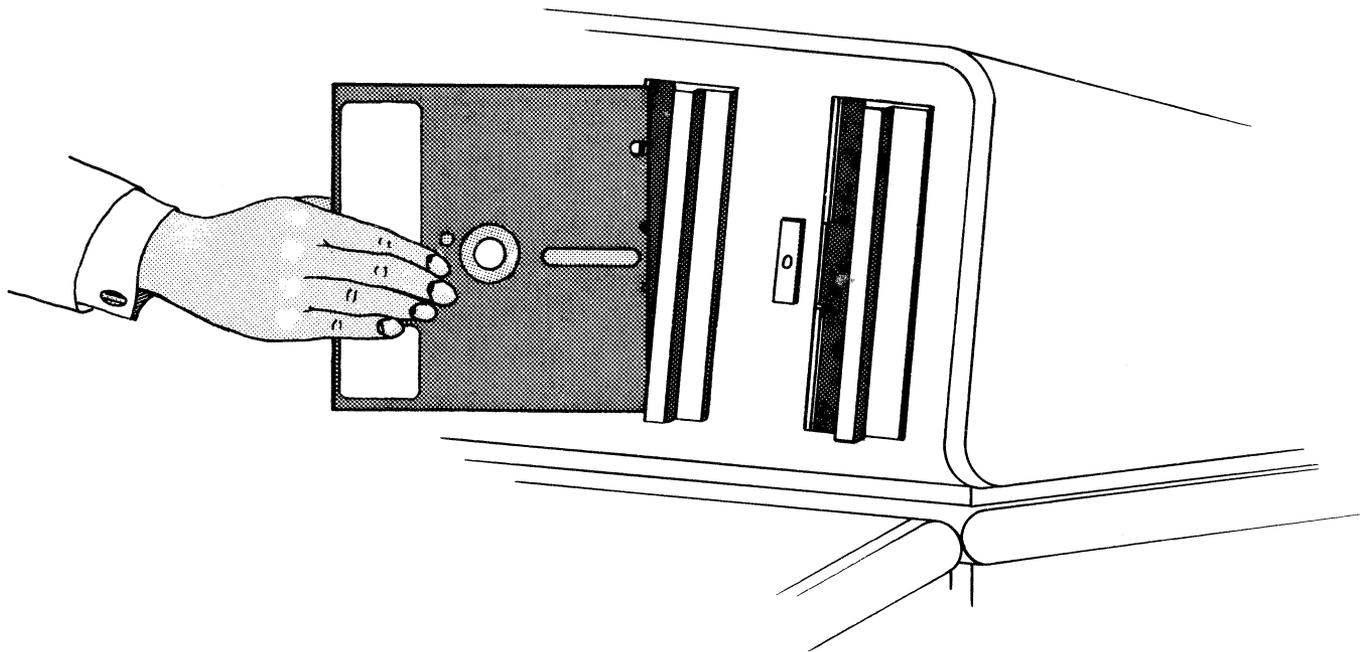


FIG 2/4

SECTION 3 KEYBOARD OPERATION

3.1 GENERAL

If, like most people, your experience of keyboards has been hitherto limited to typewriters, or is in fact non-existent, there is need for explanation.

As can be seen from Fig. 3/1 (or the real thing), there are many more keys on the keyboard than the average typewriter. These keys fall into three main groups:

- i) The 'QWERTY' Cluster.
- ii) The Numeric Pad.
- iii) The Special Function Keys.

3.2 THE 'QWERTY' CLUSTER

This section of the keyboard is very similar to a normal typewriter with the exception that it contains the following additional keys:

- 3.2.1 CONTROL:- When this key is held down during the depression of any of the 'alpha-keys' (the 26 alphabet keys) or the @, [, \,], ^ and _ keys, 32 separate 'control codes' will be produced. These codes can be assigned to functions as dictated by the resident software.
- 3.2.2 ESC (escape):- This key always generates the Control - '[' code and can be assigned a function as required.
- 3.2.3 CAPS LOCK (capitals lock):- This key is an alternate action locking key (press once and it stays down; press again and it comes back up). When it is in the 'down' position, the alpha-keys will only generate capital codes (upper-case).
- 3.2.4 DEL (delete):- This key is used to delete the individual character immediately preceding the Cursor. According to the resident software the required character will either disappear from, or be repeated on, the Visual Display, either way it will be considered by the system to have been erased.
- 3.2.5 LINE FEED:- This key always generates the Control-J code and can be assigned a function as required. A normal LINE FEED function raises the contents of the Visual Display up one line (scroll up).

3.2.6 BREAK:- This is a Special Function key in that it generates a code outside of the ASCII range. When the Main Control Unit receives this code, the appropriate function (which will be dependant on the resident software) will be executed.

3.3 THE NUMERIC PAD

The Numeric Pad is an 11-way key cluster to the right of the 'QWERTY' Cluster. These keys will cause the same ASCII codes to be generated as the numeric keys within the 'QWERTY' Cluster but are separated from it to facilitate fast data entry. In addition, the '5' key of the Numeric Pad has a raised 'pip' in its centre to allow 'touch-keying'.

3.4 THE SPECIAL FUNCTION KEYS

These keys are make up from the 12-way keypad to the right of the Numeric Pad and the row of 24 keys at the top of the keyboard. The function of each of these keys, as with the BREAK key in the 'QWERTY' Cluster, is entirely software dependant and can be assigned the required code or code sequence with the utility software program PROG (see 6.6).

The 24 Special Function keys at the top of the keyboard are each capable of generating two separate codes or code sequences; one code, or code sequence, for a normal key depression and one when the key is depressed in conjunction with the Shift key.

N.B. Although all of the keys on the keyboard are 'Typematic' (they will 'repeat' if they are held down for more than 0.5 secs.), there is a REPEAT key which, if depressed with any character key, will cause it to repeat immediately at approximately 3 times a second.

For specific keyboard operations, see either The Operating System section (5) or the appropriate Operating System handbook.

INIT	PROG	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	INS CHAR	DEL CHAR	INS LINE	DEL LINE	CLEAR FORE	CLEAR PAGE	PROT MODE	BLOCK MODE
------	------	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	----------	----------	----------	----------	------------	------------	-----------	------------

ESC	! |	|| 2	£ 3	\$ 4	% 5	& 6	' 7	(8) 9	∅	= -	~ ^	| \	BACK SPACE	TAB
CONTROL	Q	W	E	R	T	Y	U	I	O	P	@	{ [	-	RETURN
SHIFT LOCK	A	S	D	F	G	H	J	K	L	+ ;	* :	}]	DEL	LINE FEED	
CAPS LOCK	SHIFT	Z	X	C	V	B	N	M	< ,	> .	? /	SHIFT	REPEAT	BREAK	

7	8	9
4	5	6
1	2	3
0		

SEND LINE	SEND FORE	SEND PAGE
PAGE FWD	↑	PAGE BACK
←	HOME	→
SET TAB	↓	CLEAR TAB

FIG 3/1

SECTION 4 VISUAL DISPLAY: SOFTWARE CONTROL

4.1 GENERAL

Under normal circumstances the Visual Display will be under the control of the M-THREE's monitor firmware. However, it is possible for software to manipulate certain display functions e.g. absolute Cursor positioning and partial line erasure etc., by the use of escape sequences.

4.2 ESCAPE SEQUENCES

4.2.1 Erase Screen (ESC E)

Erase all data from the screen and position the cursor at the 'HOME' position.

4.2.2 Erase End-Of-Screen (ESC J)

The contents of the display from the current cursor position to the end of screen will be cleared. The cursor position will not be affected.

4.2.3 Erase Line (ESC X)

The row of the current cursor position is cleared and the cursor is moved to the first column.

4.2.4 Erase End-Of-Line (ESC K)

The contents of the display from the current cursor position to the end of line will be cleared. The cursor position will not be affected.

4.2.5 Cursor Up (ESC A)

The cursor will move up one row non-destructively. If the cursor is in the top row of the screen, it will wrap around to the last row.

4.2.6 Cursor Down (ESC B)

The cursor will move down one row non-destructively. If the cursor is in the last row of the screen, it will wrap around to the first row.

4.2.7 Cursor Right (ESC C)

The cursor will move right one column non-destructively. If the cursor is in the last column, it will wrap around to the first column of the same row.

4.2.8 Cursor Left (ESC D)

The cursor will move left one column non-destructively. If the cursor is in the first column, it will wrap around to the last column of the same row.

4.2.9 Cursor Home (ESC H)

The cursor is positioned in the first row and the first column non-destructively.

4.2.10 Cursor Address (ESC Y)

This code forms the function of direct cursor addressing. The next two characters following ESC Y will be treated as the Y-X co-ordinates on the display screen. Refer to Appendix C for explanation of these co-ordinates.

EXAMPLE:

Cursor to bottom left of screen — ESC Y 37H 20H
Cursor to bottom right of screen — ESC Y 37H 6FH

4.2.11 Graphics Mode (ESC F)

Subsequent entry of lower-case alpha, \backslash , $\{$, $!$, $/$, $\}$, \sim and 'DEL' key codes will produce one of 32 graphics symbols (see appendix B).

4.2.12 ASCII Mode (ESC G)

All subsequent characters will be displayed as normal.

4.2.13 Inverse Video Character (ESC R)

All subsequent characters received will be displayed reverse video until the next ESC R is received.

N.B. From switch-on the Cursor's behaviour will default to that described in 4.2.5 to 4.2.10, however, certain characteristics of its movement and physical appearance can be altered by the initialise program (INIT): see 6.7.

SECTION 5 THE OPERATING SYSTEM

N.B. This section is only a preliminary introduction to CP/M and is in no way intended as a substitute for the official and more complete CP/M manuals.

5.1 GENERAL

As previously mentioned, when an M-THREE system is switched on it will not function until a 'system diskette' (a diskette with Operating System software on it) is loaded into its left-hand Disk Drive.

The Operating System on the disk is a collection of inter-related system management programs which, when loaded, overlays the system's dynamic RAM with a memory mapped control program.

The standard Operating System for the M-THREE range is CP/M. This Operating System maps out the memory into the following areas:

- a) An area for each of the main system management program modules.
- b) An area reserved for system data.
- c) An area reserved for user programs and data. (TPA)

5.2 PROGRAM MODULES

There are three main system management program modules within CP/M, these are:

- a) Console Command Processor (CCP)
- b) Basic Disk Operating System (BDOS)
- c) Basic Input/Output System (BIOS)

When an M-THREE has had its system diskette loaded, the CCP module provides a message confirming that the Operating System in use is CP/M and a 'prompt' (A>).

This prompt shows that Disk Drive A has been selected (see 5.4) and an operator input is required, as follows:

```
CP/M Version *.*  
56K Version @.@  
A>
```

(*.* Operating System version number)
(@.@ M-THREE implementation version number)
(56K see 5.3)

The CCP module, which provides an interface between the operator and the system, thereafter interprets recognisable keyboard entries and initiates the appropriate program within the BDOS module. These keyboard entries must either be made at the correct time, i.e. when 'prompted', or be of a special kind which will cause the present activities of the M-THREE to be interrupted, e.g. Control-C. For more specific information regarding the actual CP/M commands, consult the CP/M manual available from Digital Research.

When the BDOS module is 'called' by CCP, it will execute the required program or programs internally. If, however, during the execution of such a program, access to external data is required, BDOS will in turn 'call' the BIOS module.

The BIOS module controls and communicates with, all hardware: the keyboard, the visual display, the disk drives and, via the input/output ports, all system peripherals. BIOS also controls an area of dynamic RAM reserved for system data; storing data retrieved from diskettes and supplying BDOS with the relevant data on request.

5.3 TRANSIENT PROGRAM AREA (TPA)

When any diskette-based program is to be executed or edited, it is first loaded into the TPA. This is an area of dynamic RAM which is reserved for user programs and data; its size being proportional to the total capacity of the system's dynamic RAM.

5.4 DISK DRIVE SELECTION

The left-hand disk drive on all M-THREE systems is always designated 'A' whilst the right-hand drive will be 'B' if it is a 'Floppy' drive (either 5 1/4" or 8"), or 'C' if it is a Winchester drive (either 5M byte or 10M byte).

When an M-THREE system is first switched on, drive A (the left-hand drive) will automatically be selected and therefore the prompt

A> is displayed (see 5.2). If the other disk drive is to be used, its selection can be achieved by adopting the following procedure:

- a) Key in the drive's designated letter (B or C).
- b) Key in a colon (:).
- c) Depress the RETURN key.

This procedure should be repeated when reselecting drive A. For a full description of drive procedures see CP/M manual.

5.5 DATA STORAGE FILES

All of the data stored on a disc or diskette is separated into 'files', irrespective of what kind of information these files contain (programs, program data, documentation, etc.). Each file has its own unique name and can therefore be handled by CP/M as a separate entity. The complete filename consists of two parts separated by a full-stop.

The first part of the filename can be up to any eight alpha-numeric characters and is usually chosen by the file's creator to be a pseudonym for the file's contents.

The second part of the filename is restricted to three alpha-numeric characters which should conform to the CP/M standard for the file's type, i.e. DOC for documentation files. For a full description of the CP/M recommendations, consult a suitable CP/M manual.

As an example of the filename structure, the CP/M file that contained the documentation for this manual was titled M3OPMAN1.DOC. This stands for M3 OPERator's MANual issue 1 and it is a DOCumentation file.

The maximum number of files allowable per disk or diskette is as follows:

64 Per single-sided 5 1/4" diskette

128 Per double-sided 5 1/4" diskette

128 Per single-sided 8" diskette

256 Per double-sided 8" diskette

512 Per Winchester disk

SECTION 6 UTILITY PROGRAMS

6.1 GENERAL

The software described in this section is only intended to aid system operation, e.g. diskette formatting, diskette verifying, system parameter initialisation, etc. All of these programs are CP/M based and will not function if another operating system is being used.

This section introduces both the presently available M-THREE utility software and some that will be available in the near future.

6.2 FORMAT

This program is used in order to form the 'soft sectors' and 'headers' on blank diskettes.

N.B. FORMATTING A DISKETTE WILL CORRUPT ANY PREVIOUSLY STORED DATA.

To Format a diskette, proceed as follows:

- a) Insert a diskette with the FORMAT program on it into one disk drive and the diskette to be formatted into the other.
- b) Select the disk drive which contains the diskette with FORMAT on it.
- c) Key in FORMAT.
- d) Depress the RETURN key.

A 'menu' will appear on the screen as follows:

```
_____  
FORMAT DISC Ver *.*
```

Options:

- "A" = Format disc in Drive A:
- "B" = Format disc in Drive B:
- "w" = Format Winchester Disc:
- "E" = Exit to CP/M on Drive A:

Enter Selection:

(*.* = appropriate version number)

- e) Enter selection as prompted and depress the RETURN key.

When the diskette formatting is complete, a 'Format completed' message will be displayed and the 'menu' will reappear. If another diskette is to be formatted then remove the formatted diskette and replace it with another blank diskette before making a further selection. To 'exit' from FORMAT, key in E as prompted and then depress the RETURN key.

6.3 VERIFY

When a diskette has been 'formatted' this program is used to check the diskette's read/write capability. This is achieved by writing a known pattern onto each track in turn, reading back the contents of the track and comparing it with the original pattern. If no errors are detected, the diskette is deemed 'good'.

Newly formatted diskettes must always be 'verified' before they are first used.

N.B. VERIFYING A DISKETTE WILL CORRUPT ANY PREVIOUSLY STORED DATA.

To Verify a diskette, proceed as follows:

- a) Insert a diskette with the VERIFY program on it into disk drive A.
- b) Select disk drive A, if necessary.
- c) Key in VERIFY.
- d) Depress the RETURN key.

A 'menu' will appear on the screen as follows:

```
VERIFY DISK VERSION *.*
```

OPTIONS:

```
A - VERIFY THE DISK IN DRIVE A  
B - VERIFY THE DISK IN DRIVE B  
E - EXIT TO CP/M ON DRIVE A
```

ENTER SELECTION:

(*.* = appropriate version number)

- e) Remove the diskette with the VERIFY program on it.
- f) Insert the diskette to be verified into the required disk drive.
- g) Enter selection as prompted and depress the RETURN key.

As each track on the diskette is being verified its number is displayed (e.g. 00H - 4CH for 8" diskettes). If an error is detected, the track and sector number is displayed along with the error-type; READ, WRITE or COMPARE.

When the diskette verification is complete, a 'VERIFY COMPLETED' message and either a 'NO VERIFY ERRORS WERE DETECTED' or 'VERIFY ERRORS WERE DETECTED' message will be displayed. These will be followed by the 'menu'. If another diskette is to be verified then remove the verified diskette and replace it with another blank diskette before making a further selection. To 'exit' from VERIFY, replace the diskette with VERIFY on it onto drive A (if necessary), key in E as prompted and then depress the RETURN key.

6.4 COPYDISC

This program enables the operator to copy the Operating System track (or tracks) only, the data tracks only, or all tracks from a system diskette to a formatted and verified diskette.

To use the Copydisc program, proceed as follows:

- a) Insert a diskette with the COPYDISC program on it into either disk drive (if this diskette contains the source material then insert it into drive A).
- b) Select the disk drive which contains the diskette with COPYDISC on it.
- c) Key in COPYDISC.
- d) Depress the RETURN key.

A 'menu' will appear on the screen as follows:

COPYDISC Ver *.*

OPTIONS:

"A" = Copy all Tracks

"O" = Copy Operating System Track(s)

"F" = Copy all Data Tracks

"E" = Exit to CP/M (Insert System Disc in Drive A first)

Put Source in Drive A, Destination in Drive B and enter Selection:

(*.* = appropriate version number)

e) If the COPYDISC diskette also contains the source material and is therefore in disk drive A, then insert the destination diskette into drive B, otherwise, insert the diskettes as instructed by the 'menu'.

f) Enter selection as prompted and depress the RETURN key.

As each track on the diskette is being copied its number is displayed (e.g. 00H - 4CH for 8" diskettes).

When the copying is complete, either a 'Copy Complete: no error(s) were detected' or a 'Copy Complete: error(s) were detected' will be displayed. These will be followed by the 'menu'. If COPYDISC is to be used again, insert the appropriate diskettes as instructed in the 'menu'. To 'exit' from COPYDISC, key in E as prompted and then depress the RETURN key.

6.5 BACKUP

This program is intended to 'backup' all, or selected files from a Winchester disk onto several floppy diskettes, in case the original file or files are corrupted during use.

Although, when copying from a Winchester disk, the backup diskette is usually blank (formatted and verified but containing no files), any diskette with files already on it can be used, as the existing files will not be over-written. In addition to this, if there is insufficient storage space for a file to be completely stored on one diskette, it is split and stored on two (or more if the file is very large).

To Backup a diskette proceed as follows:

- a) Insert a diskette with the BACKUP program on it into disk drive A.
- b) Select disk drive A.
- c) Key in BACKUP.
- d) Depress the RETURN key.

A 'menu' will appear on the screen as follows:

BACKUP DISK VERSION *.*

OPTIONS:

B - BACKUP WHOLE WINCHESTER
E - EXIT TO CP/M ON DRIVE A
P - RESTORE SELECTED FILES ON TO WINCHESTER
R - RESTORE ALL FILES ON TO WINCHESTER
S - BACKUP SELECTED FILES FROM WINCHESTER

ENTER SELECTION:

(*.* = appropriate version number)

- e) Unless the diskette with BACKUP on it is to be copied from or to, remove it from the system and replace it with the appropriate diskette.
- f) Enter selection as prompted and depress the RETURN key.

If option B is selected, the prompt messages 'REMEMBER TO NUMBER THE DISKETTES AS THEY ARE FILLED UP' and 'INSERT DISK NO. 1 IN DRIVE A, AND PRESS SPACE WHEN READY' will appear. Thereafter, proceed as prompted.

If option S is selected, the prompt message 'ENTER AMBIGUOUS FILE NAME' will appear. Enter filename as prompted, depress the RETURN key and proceed as for option B.

If option R is selected, the prompt messages 'REMEMBER TO INSERT THE DISKETTES IN THE CORRECT ORDER' and 'INSERT DISK NO. 1 IN DRIVE A, AND PRESS SPACE WHEN READY' will appear. Thereafter, proceed as prompted.

If option P is selected, the prompt message 'ENTER AMBIGUOUS FILE NAME' will appear. Enter filename as prompted, depress the RETURN key and proceed as for option R.

When the diskette is in place and the Space bar has been depressed, the filename of the file being copied will be listed below the prompt messages.

If the backup diskette that is being copied to runs out of storage space before a file has been completely copied (options B or S), the operator will be prompted to exchange the full diskette with a 'blank' one. The program will then copy the remainder of the file onto the newly inserted diskette.

In the event of a file corruption on the source disk, the Backup program will be used to restore the original information to the Winchester disk (options P or R). The operator will be prompted when to insert each backup diskette in turn if more than one is required. Care must be taken to load the backup diskettes in the correct order so that files which have been split are reloaded properly.

6.6 PROG (Program)

As mentioned in 3.4, the keyboard's function keys can be programmed to generate any desired code, or code sequence, when they are depressed. This programming is handled by PROG.

N.B. There are 208 (DOH) codes available to the function keys and although they do not have to be shared equally, a complex sequence for one key will deprive the remainder.

To use the PROG program, proceed as follows:

- a) Insert a diskette with the PROG program on it into either disk drive.
- b) Select the disk drive which contains the diskette with PROG on it.
- c) Key in PROG.
- d) Depress the RETURN key.

Once the PROG program is loaded some explanatory notes are displayed and the operator is given a choice of the following options:

Option "R"

This selection will enable the operator to call up a key function table file which has already been created using PROG. The operator will then be given a further option choice (see Programming Completion).

Option "I"

If the operator wishes to change some or all of the present key functions, but is unsure how this is achieved, this option will provide the necessary information.

Option "P"

This selection will cause the program to proceed directly into the key function programming mode.

Option "E"

As stated in option table, this selection will cause the M-THREE to exit from PROG and revert back to CP/M control.

Programming Completion

When programming is complete or a key function table file has been called up, further options will be offered as follows:

Option A

This option allows the altered key functions to be given a filename which can be called up when required (see Option "R").

Option B

This option will overwrite the existing key function table with the one just programmed. Key functions overwritten in this manner will remain so until the machine is either switched off and on again or reset (a 'cold-boot').

Option C

When this selection is made, Track 0 (the Operating System Track) of the diskette in drive A is altered so that the key function table just programmed will overlay the keyboard everytime the diskette in drive A is used to 'boot' the system.

N.B. Track 0 of the diskette in drive A will always be altered when option C is selected, irrespective of which drive the PROG program is being run from.

6.7 INIT (Initialise)

This program is used to set up the system's parameters, e.g. Tx/Rx baud rate, word length, cursor personality etc.

SECTION 7 M-THREE/NET

7.1 GENERAL

For users who require their M-THREE systems to incorporate a networking capability for inter-system communication, please contact the address below for information on the hardware and software options presently available:

LSI Computers Ltd.,
Cope Road,
St. Johns,
Woking,
Surrey. GU21 1SX
Tel. Woking (04862) 23411 Telex: 859592

SECTION 8 INTERFACES

8.1 GENERAL

The M-THREE has two standard interfaces and an optional third. These interfaces and their respective rear panel connectors are as follows:

- a) The RS232 and 20mA Current Loop interfaces which are accessible via a 25-way D-type connector marked 'RS232'. (PORT 1)
- b) A Parallel Printer interface which is accessible via a 36-way 'Delta' socket marked 'PRINTER'. (PORT 2)
- c) An optional General Purpose Interface Bus (GPIB) which is accessible via a 25-way 'D-type' plug marked 'GPIB' when fitted. (PORT 3)

8.2 RS232 INTERFACE

This interface is intended for serial communication between suitable printers (e.g. daisy wheels), remote terminals and other computers. The normal 'handshake' signals are incorporated for use if required.

8.2.1 Rear Panel Connections (25-way D-type Socket)

Pin No.	Signal
1	Protective Ground (Chassis)
2	Transmitted Data (From M-THREE)
3	Received Data
4	Request To Send [RTS]
5	Clear To Send [CTS] (From M-THREE)
6	Data Set Ready [DSR] (From M-THREE)
7	Signal Ground
17	Current Loop Tx+
18	Current Loop CL
20	Data Terminal Ready [DTR]
23	Current Loop Rx-
24	Current Loop Tx-
25	Current Loop Rx+

The minimum RS232 interface requirement from this connector is a standard 3-wire interface on Pins 2, 3 and 7 (Pins 4 and 5 [RTS + CTS] must be connected together).

8.3 RS232 'HANDSHAKE' PROTOCOLS

These Handshake signals are used for communication between the M-THREE (DCE) and a local Data Terminal Equipment (DTE) e.g. a VDU.

- 8.3.1 Request To Send [RTS]** (25-way RS232 SKT. Pin 4)
This input to the M-THREE goes 'high' when the DTE is ready for data transmission.
- 8.3.2 Clear To Send [CTS]** (25-way RS232 SKT. Pin 5)
This is output from the M-THREE as a 'high' level when it is ready to receive data and in response to an RTS.
- 8.3.3 Data Set Ready [DSR]** (25-way RS232 SKT. Pin 6)
This is output from the M-THREE as a 'high' level when it has attempted to establish a communications link with a remote DCE (e.g. another M-THREE). It does not necessarily indicate that a communications link actually exists between the local and remote DCE's, just the status of the local DCE when it has completed all of the timing functions and generated the necessary answer tones.
- 8.3.4 Data Terminal Ready [DTR]** (25-way RS232 SKT. Pin 20)
This input to the M-THREE goes 'high' when the DTE is ready to transmit data. This level must remain 'high' in order to maintain a communications link between the local and remote DCE's. If the signal goes 'low' the link will be aborted.

8.4 PARALLEL PRINTER PORT INTERFACE

The Parallel Printer Port provides an interface to any Centronics compatible parallel printer.

8.4.1 Rear Panel Connections

A standard 36 way, female Delta connector is provided on the rear panel for connection to a Centronics type printer. Pin connections are listed below:

PIN No.	SIGNAL
1	*DATA STROBE
2	DATA 1
3	DATA 2
4	DATA 3
5	DATA 4
6	DATA 5
7	DATA 6
8	DATA 7
9	DATA 8
10	*ACKNLG (Acknowledge)
11	BUSY
12	PE (Paper Empty)
13	SECT
14	OV
16	OV
19	*DATA STROBE RETURN
20	DATA 1 RETURN
21	DATA 2 RETURN
22	DATA 3 RETURN
23	DATA 4 RETURN
24	DATA 5 RETURN
25	DATA 6 RETURN
26	DATA 7 RETURN
27	DATA 8 RETURN
28	ACKNLG RETURN
29	BUSY RETURN
30	*INPUT PRIME RETURN
31	*INPUT PRIME
32	*FAULT

* Denotes negative true.

8.5 THE GENERAL PURPOSE INTERFACE BUS (GPIB)

The GPIB interface is normally used as an instrumentation bus i.e. for A.T.E. work and transfers byte-serial (bit-parallel) data to and from suitably equipped peripherals. This interface can cope with up to 15 such peripherals over a total cable length of 15 metres.

The 16 signal lines that comprise this bus are as follows:

- a) 8 Data lines for the 8-bit parallel data.
- b) 3 Data Byte Control lines :-
 - i) Data Valid [DAV])
 - ii) Ready For Data [NRFD] *) All signals negative
 - iii) Data Accepted [NDAC] *) true.

*The prefix 'N' indicates an inhibiting signal.

- c) 5 General Interface Management lines:-
 - i) Attention [ATN])
 - ii) Interface Clear [IFC])
 - iii) Service Request [SRQ]) All signals negative
 - iv) Remote Enable [REN]) true.
 - v) End-Or-Identify [EOI])

Rear Panel Connections

The GPIB is fully compatible with the IEC 625-1 standard and electrically compatible with IEEE 488 standard. The pin connections are listed below:

PIN No.	SIGNAL
1	DIO 1
2	DIO 2
3	DIO 3
4	DIO 4
5	REN
6	EIO
7	DAV
8	NFRD
9	NDAC
10	IFC
11	SRQ
12	ATN
13	SHIELD
14	DIO 5
15	DIO 6
16	DIO 7
17	DIO 8
18	REN RETURN
19	EIO RETURN
20	DAV RETURN
21	NFRD RETURN
22	NDAC RETURN
23	IFC RETURN
24	SRQ RETURN
25	ATN RETURN

SECTION 9 PREVENTIVE MAINTENANCE

9.1 GENERAL

There are two possible pieces of equipment in an M-THREE system that will need preventive maintenance:

- a) The Disk Drives in all M-THREE systems.
- b) The Air-Filter in the M-THREE/300 series.

9.2 DISK DRIVE MAINTENANCE

The inherent mechanical and electronic complexity of disk drives prohibits user maintenance and therefore it is recommended that with normal use, the disk drives are serviced annually by an LSI or authorised service engineer.

9.3 AIR-FILTER MAINTENANCE (M-THREE/300 SERIES)

The Air-Filter should be visually checked after every 2-3 months of continual operation. More frequent checks will be necessary if the system is being operated in an adverse environment e.g. in close proximity to excessive smoke or dust.

The Air-Filter is located on the rear panel of the M-THREE directly behind the Disk Drives.

9.3.1 Removal

Detach the complete Air-Filter assembly from the rear of the M-THREE by removing the four retaining screws. The Air-Filter can then be pushed out of its housing for inspection and cleaning if necessary.

9.3.2 Cleaning

- a) Flush the loose dirt from the filter with a stream of warm water.
- b) Place the filter in a warm solution of low foam domestic detergent.
- c) Rinse well in clean water.
- d) Shake and allow to drip-dry.
- e) Re-install the Air-Filter assembly.

SECTION 10 FUNCTIONAL SPECIFICATION

10.1 GENERAL

The following information is valid for all M-THREE systems unless otherwise stated:

10.2 PROCESSOR:

Z80 (2.5Mhz 8-bit)

10.3 MEMORY:

64K Bytes Dynamic RAM

2K Bytes Bootstrap Loader PROM

* 2K Bytes Winchester Drive Handler PROM

* M-THREE/300 series systems only

10.4 INTEGRAL DISPLAY MONITOR:

24 Rows of 80 Characters -

7 x 10 cell,
5 x 7 character,
5 x 9 with true descenders.

Upper/Lower Case Characters

Reverse Video

Blinking Cursor

10.5 KEYBOARD:

Standard 'QWERTY' cluster

Numeric Pad

31 Special Function Keys

Cursor Keys

10.6 INTERFACES:

Centronics Parallel Printer Port

RS232 and 20mA Current Loop Serial Port

General Purpose Interface Bus (GPIB) - (optional)
[Talker/Listener/Controller]

10.7 DISKETTES

10.7.1 M-THREE/100 series

M-THREE/100 -

5 1/4" Single Sided, Double Density
35 Tracks
5 Sectors/Track
1K bytes of Data Storage/Sector
Total Formatted Capacity: 175K bytes
CP/M requirement: 10K bytes

M-THREE/110 -

5 1/4" Single Sided, Quad. Density
80 Tracks
5 Sectors/Track
1K bytes of Data Storage/Sector
Total Formatted Capacity: 400K bytes
CP/M requirement: 10K bytes

M-THREE/150 -

5 1/4" Double Sided, Double Density
35 Tracks/Side
5 Sectors/Track
1K bytes of Data Storage/Sector
Total Formatted Capacity: 350K bytes
CP/M requirement: 10K bytes

M-THREE/160 -

5 1/4" Double Sided, Quad. Density
80 Tracks/Side
5 Sectors/Track
Total Formatted Capacity: 800K bytes
CP/M requirement: 10K bytes

10.7.2 M-THREE/200-300 series (Floppy Drives only)

M-THREE/200-320-340 -

8" Single Sided, Double Density
77 Tracks
8 Sectors/Track
1K bytes of Data Storage/Sector
Total Formatted Capacity: 616K bytes
CP/M requirement: 8K bytes

M-THREE/250-325-345 -

8" Double Sided, Double Density
77 Tracks/Side
8 Sectors/Track
1K bytes of Data Storage/Sector
Total Formatted Capacity: 1.2M bytes
CP/M requirement: 8K bytes

10.8 MASS STORAGE:

10.8.1 M-THREE/100 series -

M-THREE/100 -

2 x 5 1/4" Mini-Floppy Drives
Double Density
Single Sided
Total Formatted Capacity: 350K bytes

M-THREE/110 -

2 x 5 1/4" Mini-Floppy Drives
Quad. Density
Single Sided
Total Formatted Capacity: 800K bytes

M-THREE/150 -

2 x 5 1/4" Mini-Floppy Drives
Double Density
Double Sided
Total Formatted Capacity: 700K bytes

M-THREE/160 -

2 x 5 1/4" Mini-Floppy Drives
Quad. Density
Double Sided
Total Formatted Capacity: 1.6M bytes

10.8.2 M-THREE/200 series

M-THREE/200 -

2 x 8" Floppy Drives
Double Density
Single Sided
Total Formatted Capacity: 1.2M bytes

M-THREE/250 -

2 x 8" Floppy Drives
Double Density
Double Sided
Total Formatted Capacity: 2.4M bytes

10.8.3 M-THREE/300 series

M-THREE/320 -

1 x 8" Floppy Drive
Double Density
Single Sided
Formatted Capacity: 600K bytes
1 x Winchester Drive
Single Platter
Formatted Capacity: 4.2M bytes
Total Formatted Capacity: 4.8M bytes

M-THREE/325 -

1 x 8" Floppy Drive
Double Density
Double Sided
Formatted Capacity: 1.2M bytes
1 x Winchester Drive
Single Platter
Formatted Capacity: 4.2M bytes
Total Formatted Capacity: 5.4M bytes

M-THREE/340 -

1 x 8" Floppy Drive
Double Density
Single Sided
Formatted Capacity: 600K bytes
1 x Winchester Drive
Double Platter
Formatted Capacity: 8.4M bytes
Total Formatted Capacity: 9M bytes

M-THREE/345 -

1 x 8" Floppy Drive
Double Density
Double Sided
Formatted Capacity: 1.2M bytes
1 x Winchester Drive
Double Platter
Formatted Capacity: 8.4M bytes
Total Formatted Capacity: 9.6M bytes

10.9 PHYSICAL SPECIFICATIONS:

10.9.1 Environmental Limits

Ambient Temperature

Operating 10C to 30C (50F to 86F)

Storage -22C to 47C (7.6F to 117F)

Relative Humidity

Operating 20% to 80% (no condensation)

Storage 1% to 95%

10.9.2 A.C. Requirements

Voltage 200 to 253V A.C.

Frequency 50 Hz +/- 0.5 Hz

10.9.3 Power Consumption

M-THREE/100 series: 90 Watts

M-THREE/200 series: 144 Watts

M-THREE/300 series: 264 Watts

10.9.4 Mechanical Dimensions (Refer to Figure 10/1)

Main Control Unit:

Width	642mm (25 1/4")
Max. Height	350mm (14 3/4")
Depth	464mm (18 1/4")

Keyboard:

Width	642mm (25 1/4")
Max. Height	64mm (2 1/2")
Depth	219mm (8 1/2")

10.9.5 Weight (Main Control Unit + Keyboard)

M-THREE/100 series	27Kg (60 lbs)
M-THREE/200 series	35Kg (77 lbs)
M-THREE/320 series	39Kg (86 lbs)

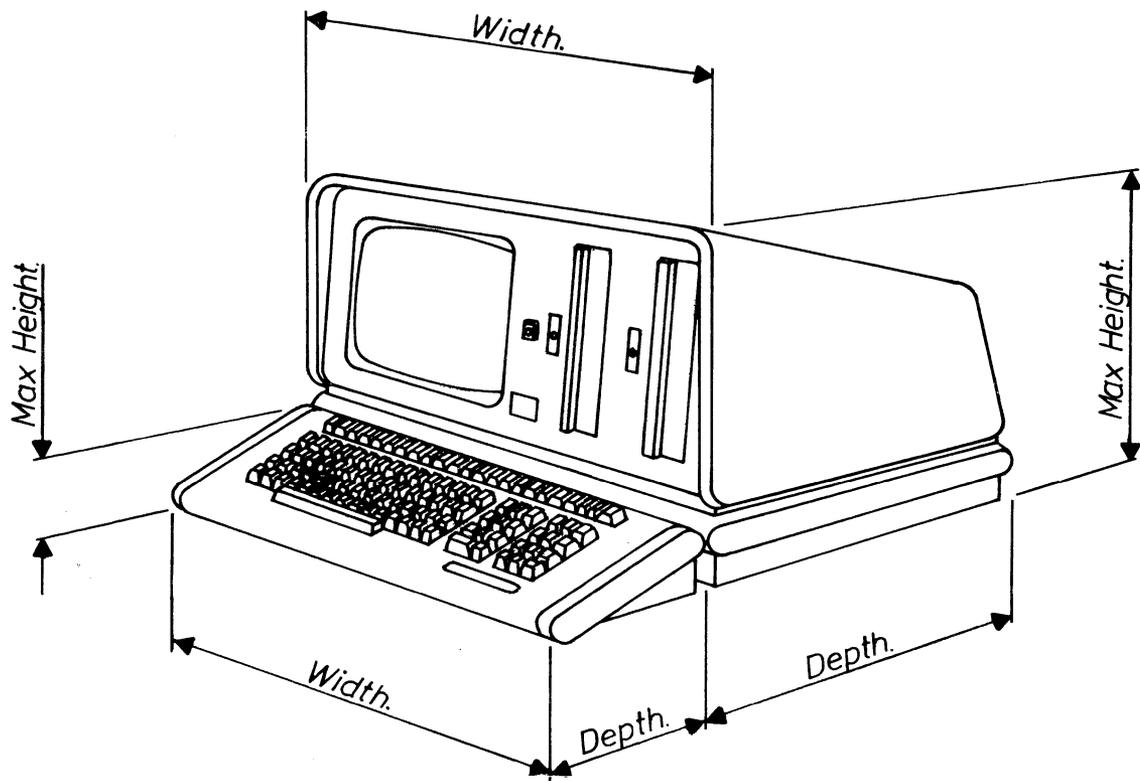


FIG 10/1

APPENDIX 'A'

MSD \ LSD		0	1	2	3	4	5	6	7
		0000	0001	0010	0011	0100	0101	0110	0111
0	0000	NUL	DLE	SP	0	@	P	\	p
1	0001	SOH	DC1	!	1	A	Q	a	q
2	0010	STX	DC2	"	2	B	R	b	r
3	0011	ETX	DC3	£	3	C	S	c	s
4	0100	EOT	DC4	\$	4	D	T	d	t
5	0101	ENQ	NAK	%	5	E	U	e	u
6	0110	ACK	SYN	&	6	F	V	f	v
7	0111	BEL	ETB	'	7	G	W	g	w
8	1000	BS	CAN	(	8	H	X	h	x
9	1001	HT	EM	)	9	I	Y	i	y
A	1010	LT	SUB	*	:	J	Z	j	z
B	1011	VT	ESC	+	;	K	[	k	{
C	1100	FF	FS	,	<	L	\	l	!
D	1101	CR	GS	-	=	M	]	m	}
E	1110	SO	RS	.	>	N	^	n	~
F	1111	SI	US	/	?	O	-	o	(DEL) ⋮

APPENDIX 'B'

\	◆
a	—
b	==
c	===
d	====
e	=====
f	=====
g	=====
h	=====
i	=====
j	└
k	┐
l	┌
m	└┐
n	+
o	↑

p	↓
q	—
r	→
s	←
t	└
u	┐
v	┌
w	└┐
x	|
y	≤
z	≥
{	π
/	≠
}	#
~	•
(DEL) ⋮	÷

APPENDIX C

Line Number v. Address Code

Line No.	Address Code	Line No.	Address Code	Line No.	Address Code
1	20H	9	28H	17	30H
2	21H	10	29H	18	31H
3	22H	11	2AH	19	32H
4	23H	12	2BH	20	33H
5	24H	13	2CH	21	34H
6	25H	14	2DH	22	35H
7	26H	15	2EH	23	36H
8	27H	16	2FH	24	37H

Column Number v. Address Code

Column No.	Address Code	Column No.	Address Code	Column No.	Address Code
1	20H	28	3BH	55	56H
2	21H	29	3CH	56	57H
3	22H	30	3DH	57	58H
4	23H	31	3EH	58	59H
5	24H	32	3FH	59	5AH
6	25H	33	40H	60	5BH
7	26H	34	41H	61	5CH
8	27H	35	42H	62	5DH
9	28H	36	43H	63	5EH
10	29H	37	44H	64	5FH
11	2AH	38	45H	65	60H
12	2BH	39	46H	66	61H
13	2CH	40	47H	67	62H
14	2DH	41	48H	68	63H
15	2EH	42	49H	69	64H
16	2FH	43	4AH	70	65H
17	30H	44	4BH	71	66H
18	31H	45	4CH	72	67H
19	32H	46	4DH	73	68H
20	33H	47	4EH	74	69H
21	34H	48	4FH	75	6AH
22	35H	49	50H	76	6BH
23	36H	50	51H	77	6CH
24	37H	51	52H	78	6DH
25	38H	52	53H	79	6EH
26	39H	53	54H	80	6FH
27	3AH	54	55H		

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