
MEMOTECH
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MTX512
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Memotech began life as the manufacturer of Memopaks, which are high quality hardware peripherals for the ZX81. At the height of the ZX81 market Memotech was producing nine different Memopaks, and achieved an overall total production of 250,000 units. In anticipation of the gradual decline of the ZX81 market Memotech devoted its time and resources to the design and development of a new type of computer – the MTX Series.

The key to the whole range of home and business machines that make up the Series is the Memotech MTX512, not only because it is the Series' starting point, but because its overall quality of design and construction is reflected throughout the MTX Series as a whole.

Aluminium Construction

In contrast to the impact styrene covers of the Spectrum, Commodore 64 and Atari machines, the MTX's extruded aluminium casing serves as more than a mere status symbol, because it performs three important functions simultaneously. It very effectively protects the PCBs inside the machine, it acts also as a heat sink, and it serves as a Faraday cage, completely sealing off radio frequency interference that can impair picture quality. (Unlike some of its competitors the MTX512 sailed through the stringent American FCC approval procedures with flying colours – the first time around.)

The processor used in the MTX512 is the Zilog Z80A. The Z80A was chosen because it has a productive and respected past – as well as future. The chip performs quickly and can address 64K of RAM directly. It also gives the MTX Series CP/M compatibility – CP/M was written around the Zilog Series. And the Z80A inside the 512 operates at 4MHZ.

64K User RAM – and not a bit less

The MTX512 comes with 64K RAM, expandable to 512K. Add to this another 16K VideoRAM dedicated solely to handling the screen memory, and you've got 80K. But how much user RAM is left when you're running high resolution graphics programs? Unlike other machines, the answer is still 64K, because the MTX512 uses the 16K VideoRAM plus a second CPU – the Texas TMS9929 – to take care of screen graphics. Try using 32 Sprites on the Commodore 64 and see how much memory is left.

What about expansion?

Expansion is no problem with the MTX Series, precisely because it is designed as an interlocking system – from the MTX512 up to the powerful HRX Graphics and Video processing system.

Starting with the MTX512, included as standard are the following ports: variable rate cassette port (up to 2400 baud), two joystick ports using Atari configuration, Centronics parallel printer port, ROM cartridge port, uncommitted parallel port, Internal ROM board port, HI-Fi output port – three independent tone generators and pink noise channel for percussion on sound effects, (four-channel sound is also directed to the TV speaker) and PAL composite colour video Monitor port.

If that's not enough, the RS232 communications board can be added to provide two independent RS232 ports, plus a 60-way Disc Drive Bus, which supports up to four 5¼- and/or 8-inch floppy disc drives, plus instant access Memotech Silicon Discs, and Hard Discs.

RAM memory is optionally expandable to 512K, RAM can be added in increments of 32, 64, 128 or 256K.

In addition to RAM for the main processor and screen display, the MTX512 contains 24K of ROM with four major functions. These are: MTX BASIC; 'Noddy', a simple, text-handling language; an assembler/disassembler; and the sophisticated 'Front Panel' program. All four languages can be used interactively with each other, and with the user.

ROM expansions can be added internally or through the ROM cartridge port to a maximum of 72K. Currently available ROM expansions are: MTX NewWord, a 32K word processing package that uses the CP/M operating system (without discs!) and PASCAL, written specially for the MTX Series by Hisoft. Existing games and Business software is currently being transferred to ROM.

The Keyboard

The 79-key, full-stroke, professional quality keyboard is supported on its own PCB, and would not disgrace the most modern electronic typewriter or professional Word Processing terminal. The F and J keys are recessed for easy fingertip location and homing.

The separate numeric/editor keypad is standard, and incorporates the cursor directional arrow keys. Eight programmable function keys are on yet another keypad on the far right of the main keyboard. Used in conjunction with the Shift key, another set of eight functions becomes available. All alphanumeric keys offer full autorepeat.

Graphics and more Graphics

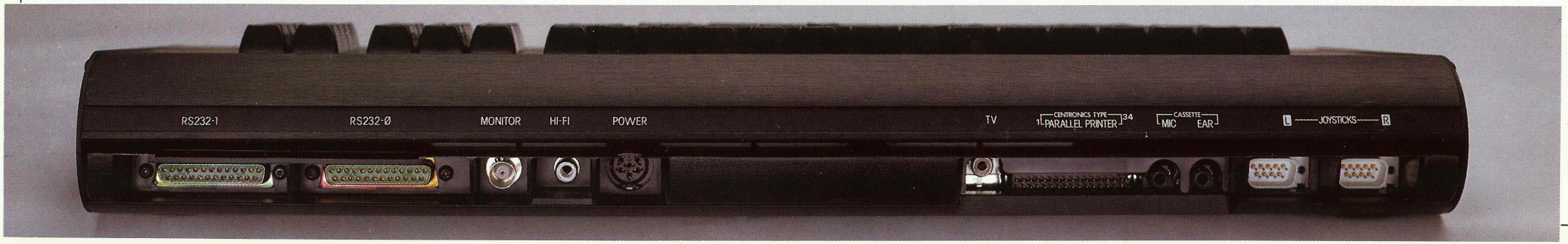
Graphics resolution is 256 × 192 pixels plus 32 × 24 Text in 16 foreground and background colours. All 16 colours (i.e. 15 colours plus transparent) are available on the screen together – there is no restriction on usable colours whatsoever. Text resolution is a standard 40 × 24 characters in a unique and pleasing fount, with the same wide choice of colours that the Graphics screens have.

The MTX512 offers 32 user-definable sprites – which are controllable through high-level BASIC commands. This means that sprites and sprite movement can be defined easily from BASIC without recourse to cryptic POKE commands. Up to 128 separate GENPAT statements provide a huge range of user defined character patterns which can be called at any time.

Eight user-definable virtual screens or 'windows' are controlled through special BASIC commands. The size, shape, position, and format (i.e. Text or Graphics) of these windows are all user-definable. The result is BASIC programmable text or graphics windows with remarkable ease of control.

The Multilingual Computer

All four major Languages incorporated in the MTX ROM, i.e. BASIC, Noddy, Z80 Assembler/ Disassembler and the Front Panel are completely interacting.
Noddy allows screens to be named, constructed, incorporated into a separate Noddy program, and then called from BASIC programs. Sections of machine code can also be created and run by calling the Assembler from within BASIC. On exit from Noddy or the Assembler to BASIC, all Noddy



screens and Assembly language programs are left intact.

As a result, machine code programs may be included within a BASIC program and assembled as the program is run – there is no need to define fixed areas for the machine code to reside – and no USR addresses to calculate or miscalculate, because the machine code created is truly relocatable.

The MTX Front Panel is an interactive program which allows manipulation of the contents of memory and Z80 registers. It is useful for tracing the internal interaction of the computer while a simple program runs, and is also obviously a big help in debugging machine code programs. It displays the contents of all registers (including the F flag register) and pointers during program execution. Breakpoints which call the Front Panel can be set within machine code routines, so that you can see what is happening at any point in a program.

Disc Expansion Options

The MTX512 is upgradable to Disc level easily and with great flexibility. A notable feature of the Memotech Floppy Disc expansions is their ability to run a TV and a Monitor simultaneously under CP/M, so that a program can be listed on the monitor, whilst the display the program produces appears on the TV.

A total of four different disc configurations are offered as 'off-the-shelf' packages, and these are:

Single 5¼ inch Floppy

This system is the simplest disc expansion offered, and comprises one Qume double sided, double density 500K drive, Memotech Floppy Disc Controller Board, plus power supply, expansion sockets, and aluminium case.

Software provided includes MTX Single Disc BASIC, Tape to Disc transfer, Renumber, 40 Column Text and Graphics Screen, Binary to Hex to Decimal Converter, Data save and load plus five games.

Twin 5¼ inch Floppies

This configuration provides two Qume drives as above, and two boards, which are the 80 column screen board, and Floppy drive controller board, allowing each of the Qume drives to be configured, through CP/M 2.2 (which is provided), as any of thirteen CP/M types. An uprated power supply, and disc drive bus support software are also included.

Software provided with this and the packages below is Digital Research CP/M 2.2, the industry standard microcomputer operating system and utility package, NewStar Associates NewWord Word Processing Program, a powerful and effective Business tool which has all the major features of Wordstar, plus several refinements and enhancements. Also included is Sorcim Inc's SuperCalc Spreadsheet, invaluable for financial forward planning and cashflow analysis, and Memotech FDX Disc BASIC, which contains all the high level graphics and window commands in MTX ROM BASIC, plus powerful file handling routines. Explicit manuals are included for each item.

Single 5¼ inch Floppy plus 256K Silicon Disc

The Memotech Silicon Disc offers unparalleled speed and convenience of data access. Because of this, files can be copied into the Silicon Disc, manupulated at high speed, and then recopied back on to floppies. Find and replace commands, used within MTX NewWord for example, are virtually instantaneous. Also provided is Sispool, a Silicon Disc print Spooler, which allows files on the Silicon Disc to be printed out in 'background', so that the computer can be used for other purposes and printing out at the same time.

Single 5¼ inch Hard Disc plus Single 1Mb Teac 5¼ inch Floppy

This configuration, designated the Memotech HDX, offers mass storage facilities of either 10 or 20 Megabytes. The HDX Hard Disc System runs at a processor speed of 8 Megahertz, and is consequently much faster than other commonly available systems, (including the 16 Bit Olivetti M20).The high speed and large storage capacity make it ideal for Database management and large capacity Accounts Packages.

HRX – High Resolution Graphics Processor

The HRX system is a computer graphics package which has been developed for picture and image processing. The system uses three colour planes to provide 16 million colours per pixel. This is more than is required for the display of a colour TV picture (250,000 colour shades). Extra storage space allows for picture processing which can enhance or point out previously indistinguishable features of a picture.

Once a picture is held in the HRX frame memory, software allows the processing of the picture in many ways, for example you can:

zoom	in on an area of a picture
shrink	a picture to a smaller size
rotate	a picture
detect edges	within a picture
filter	perform two-dimensional filtering on a picture
average	two pictures together
change	the contrast and brightness of a picture
enhance	the edges of a picture
change	the colour cast or complete colour of a picture
save	a picture on disc
retrieve	a picture from disc

The HRX Graphics Computer uses a new type of computer graphics program which opens up avenues which are currently closed to conventional graphics systems.

Memotech DMX80 Printer

The DMX80 provides an ideal means of producing hard copy from any of the MTX Series computers. It prints at a speed of 80 characters per second, has fully programmable hi-res graphics capabilities, seven character sets and selectable tractor/friction feed. A Centronics type parallel interface is provided as standard, which makes the DMX80 compatible with the majority of currently available computers, although an RS232 interface can be supplied on request. The DMX80 comes with its own manual, which includes a section on the Escape Sequence codes used to program it from BASIC.

Technical Specification

Hardware

Chassis

Two front-hinged black anodised brushed aluminium extrusions are separated at the rear by a black plastic moulding.

Keyboard

A 1mm mild steel sheet is bolted to the upper chassis and supports 79 keys which are interconnected by an independent p.c.b. The keys are arranged as: Standard U.K. QWERTY layout with 57 professional typewriter keys, standard pitch and spacing. Foreign language keyboards are available. Twelve dual function keys are arranged as a separate numeric keypad. Eight function keys (16 with shift). Two unmarked reset keys.
Auto repeat is standard on the alpha-numeric keys.

CPU Board

Zilog Z80A CPU operating at 4MHz.
24K of ROM which contains: MTX BASIC – incorporating sophisticated GRAPHICS and WINDOW COMMANDS. MTX NODDY – interactive screen manipulation routines. FRONT PANEL DISPLAY – incorporating Z80 Assembler/Disassembler plus Z80 Register, Memory and Program display and manipulation routines.
VIDEO DISPLAY PROCESSOR – with 16K dedicated RAM.
USER-RAM – 32K on the MTX500 and 64K on the MTX512.
VIDEO BOARD – for television and sound signal encoding. Real Time Clock.
CHARACTER SETS – Numeric, upper case, lower case, user-definable characters and 32 user-definable sprites. Resident international character sets and appropriate keyboard layouts for UK, USA, France, Germany, Spain and Sweden. Character sets for Denmark and Italy are also available.

Expansions

Up to two expansion boards may be added internally. These may be Memory (RAM) Boards ROM boards or the Communications Board.
MEMORY BOARDS
RAM may be increased by the addition of boards which provide 32K, 64K, 128K or 256K of memory, up to a maximum of 512K.
COMMUNICATIONS BOARD
Available as an internal expansion, this board carries two completely independent RS232 interfaces (running at up to 19 200 baud) with full handshaking and modem communication lines, and also the disc drive bus.
NODE/RING SYSTEM – Communications software and interfacing enabling construction of MTX Ring Systems containing up to 255 MTX computers.

Input/Output

Provided as standard:
Cassette Port (variable rate, default 2 400 baud)
Uncommitted parallel input/output port
Two joystick ports with industry standard pin-outs
Four channel sound under software control
Hi-Fi output
Monitor output – composite video
Z80 Bus expansion port
Parallel printer port (compatible with Centronics-type printers)
Available as an expansion:
Communications board with two RS232 interfaces and disc drive bus

ROM Expansions

MTX PASCAL NODE SYSTEM software MTX NewWord Business, Education and Games software.

Display

Colour TV and/or Video Monitor
40 column × 24 line display as standard, with optional Colour 80 column board. (FDX or HDX disc system required)

Display Facilities:

FULL SCREEN HANDLING
EIGHT USER DEFINABLE WINDOWS
Text: 40 × 24 characters. Text with graphics: 32 × 24 text with 256 × 192 pixels in 16 colours.

Graphics Facilities

Up to 32 independently controllable user definable sprites, plus pattern plane and backdrop plane. High level sprite-orientated graphics commands.

Suitable Printers

Centronics-type parallel printers
RS232 serial printers (with Communications Board)

Power Supply Unit

Input: 220/240 VAC 50/60 Hz. or 110/115 VAC 50/60 Hz.
Output: 22.5 VAC, 1A tapped at 18V and 9V.
The PSU is double insulated and has a side mounted rocker switch which is internally illuminated.

Software

MTX BASIC

The BASIC resident in ROM contains the standard commands offered by most microcomputers, and in addition is extended with a number of reserved words designed to: a) allow easy manipulation of the display, b) enable a highly structured form of programming, and c) enable assembly language programs to be run from within BASIC programs.

MTX Graphics Commands

Sophisticated graphics manipulation commands are incorporated. These commands do not replace, but are in addition to the normal graphics commands offered by BASIC.

MTX NODDY

NODDY provides a method of programming to display information or ask questions and then move on to another display, depending on the previous response. Complete screens may be named and constructed and later called from within BASIC programs.

Assembler/Disassembler

An assembler/disassembler is included to enable fast and efficient development of machine code programs. Machine code may be included within a BASIC program and is assembled as the program is run.

Front Panel Display

The Front Panel Display is an interactive program which displays and allows manipulation of the contents of the computer's memory and registers. Allows simple and effective machine code debugging.

Command Words

MTX BASIC

BAUD	ELSE	LIST	MVSPR
CLOCK	STEP	LOAD	SPRITE
INK	CSR	PRINT	CTLSPR
PAPER	DIM	OUT	NODE
EDIT	GOSUB	POKE	GENPAT
GOTO	LLIST	READ	PHI
IF	NEW	SOUND	VIEW
LET	ON	PLOT	RESTORE
LPRINT	PANEL	TO	ROM
NEXT	RETURN	REM	EDITOR
NODDY	SAVE	CLS	DSI
PLOD	DRAW	ASSEM	ANGLE
PAUSE	THEN	AUTO	SNDBUF
RAND	CONT	VS	ARC
RUN	CLEAR	CRVS	LINE
STOP	DATA	ATTR	
VERIFY	FOR	COLOUR	
CIRCLE	INPUT	ADJSPR	

MTX Operands

+	/	>	< =
–	^	<	< >
*	=	> =	

MTX Functions

AND	ASC	PI	SQR
ABS	RND	OR	USR
EXP	NOT	ATN	LEN
SGN	COS	LN	MOD
TAN	INT	SIN	
VAL	PEEK	INP	

MTX Strings

CHR$	RIGHT$	TIME$
LEFT$	INKEY$	GR$
MID$	STR$	SPK$

Front Panel Display Commands

B followed by Y (i.e. BASIC, then Y/N) returns user to BASIC
C clears the List screen
D displays memory contents in hexadecimal
G (go) runs a block of code defined by the user
I cycles the display between ASCII characters or code
L lists memory contents from a given hex address
L. lists memory contents from Program Counter address
M moves a block of memory to a given address
R alters contents of a given Register
S single steps through code from Program Counter address
T as above but treats Calls as one instruction
X displays alternate Register set

MTX Assembler Commands

E (line number) allows you to edit the line number entered
L (line number) lists from the line number entered
T moves to top of code
T <return> followed by L lists from top of code
P prints to printer
B returns to BASIC and assembles the code

MTX Series Disc Based Systems

FDX Floppy Disc Systems

HDX Winchester Disc Systems

Both systems have the following features:
A 19 inch wide chassis comprising four black anodised brushed aluminium extrusions. The chassis contains a card cage which can accommodate:
One computer expansion board
One Colour 80 coloumn board
Four Silicon Disc memory boards
One floppy disc controller board
An integral power supply
Inputs can be 240/220 VAC or 110/115 VAC 50/60 Hz.
Parallel port for bus expansion
A license to use the Digital Research Inc. CP/M 2.2 operating system is provided with the FDX and HDX systems, as is NewWord word processing and SuperCalc spreadsheet analysis.

Colour 80 column board

Mounted in the FDX or HDX systems the board permits the use of colour programs requiring an 80 column screen.
RGB monitor output with selectable positive/negative sync.
Monochrome video output.
Single channel sound Light pen input

Screen display formats:

80 columns × 24 lines text (max) 160 × 96 graphics mode
Two alternate 96 element character sets
ROM based graphics characters Teletext compatibility
High speed glitch-free screen update (average 25 000 baud)
The Colour 80 column board provides a complete emulation of a CP/M terminal via ROM software, and features:
Full cursor control Vector plot, point plot
Powerful editing facilities with screen dump
Complete attribute control for colour and monochrome displays

Silicon Discs

These are a quarter or one megabyte fast access RAM boards which are full emulators of CP/M drives 0 to 13. Four Silicon Discs may be mounted within the HDX or FDX chassis, providing from one to four megabytes per card frame. However, the Silicon Disc controllers can supervise four logical drives, of up to eight megabytes each giving a maximum silicon storage of 32 megabytes. This is in addition to the 4 five and a quarter and/or eight inch conventional floppy disc drives handled by the floppy disc controller board. Numerous advantages include:
Speed – up to five times faster than a Winchester disc, and fifty times faster than a floppy disc.
A dramatic increase in efficiency of proven eight bit CP/M software to 16/32 bit software levels, obviating the need for complex and costly memory management techniques. Permits single floppy disc CP/M system which is ideal for database manipulation, word processing and compilation. Greatly reduces disc wear and prolongs life of mechanical disc drives, enhancing reliability.

Floppy Disc Controller Board

This board uses the full Western Digital 1791 chip set and supports most CP/M floppy drives, types 0 to 13, which range from single sided single density five and a quarter inch floppies to double sided double density eight inch floppies.

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