MTX 500/512 SERVICE MANUAL

&

TECHNICAL INFORMATION

Memotech Limited
Witney
Oxon OX8 6BX
Tel: (0993) 2977
Tlx: UK83372 MEMTEC G

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INTRODUCTION

Overall Description

The MTX Series personal computer systems are high performance 8-bit computers uniquely designed to operate in memory intensive ROM-based or DISC-based environments. The choice of the Z80 A Microprocessor and the TMS 9929A series video processor as the key components of the hardware architecture is consistent with a low cost ROM-based system with colour TV output plus the capability to expand to accommodate a fully RAM-based Disc operating system such as CP/M, utilising a high quality 80 column colour monitor output.

The memory size can be either 32K or 64K Bytes as standard, expandable to 512K Bytes. There is a separate 16K Byte dedicated video memory. A 24K Byte ROM contains MTX - BASIC, the systems monitor, supplementary languages and utilities. The standard interfaces included are tape cassette (Read/Write to 2400 baud), Keyboard, Cartridge Port, Twin Joysticks, Parallel Centronics type printer port, uncommitted Parallel Input/Output port, colour TV output with sound, composite video output - monochrome or colour, and audio output. Optional interfaces include a completely independent twin RS232C with buffered bus extension, Colour 80 Column Board, Floppy Disc System, Silicon disc fast access RAM boards, and a Winchester Disc System.

The Keyboard consists of 79 full travel typewriter style keys mounted on a steel base plate which is fitted to the Aluminium enclosure. Aluminium was chosen for good heat dissipation, durability and RFI shielding.

CPU Board

Mounted in the lower chassis, the CPU board accommodates:

Z80A CPU operating at 4MHz.

24K of **ROM** which contains:

MTX BASIC - incorporating sophisticated MTX LOGO-type graphics 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 video-RAM.

USER-RAM - 32K on the MTX500 and 64K on the MTX512. User RAM size is constant under all display formats.

VIDEO BOARD - for television and sound signal encoding.

REAL TIME CLOCK

CHARACTER SETS - Numeric, upper case, lower case, user-definable characters and user-definable sprites. Resident international character sets and appropriate keyboard layouts for UK, USA, Finland, France, Germany, Spain,Denmark and Sweden.

Display

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

Display Facilities:

FULL SCREEN HANDLING
EIGHT USER DEFINABLE VIRTUAL SCREENS
SCREEN FORMATS
Text: 40 x 24 characters
Text with graphics: 32 x 24 text with 256 x 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.

Input/Output

Provided as standard:

1. CASSETTE PORT (variable rate, up to 2 400 baud)
2. UNCOMMITTED PARALLEL INPUT/OUTPUT PORT
3. TWO JOYSTICK PORTS with industry standard pin-outs
4. FOUR CHANNEL SOUND UNDER SOFTWARE CONTROL - three independent voices plus pink noise output through TV speaker, or through separate Hi-Fi output
5. MONITOR OUTPUT - composite video signal (1V peak to peak) CARTRIDGE PORT
6. PARALLEL PRINTER PORT (compatible with Centronics-type printers)

Expansions

Up to two expansion boards may be added internally. These may be Memory (RAM) 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. The Communications Board is required to run the FDX and HDX disc based systems and the MTX Node/Ring System.

NODE/RING SYSTEM

Communications software and interfacing enabling construction of MTX Ring Systems. The system is interrupt driven and runs in conjunction with the twin RS232 Communications Board.

Compatibility of the memory boards and Communications Board is given below.

Compatibility table of internal expansion boards

	RAM BOARDS				
	32k	64k	128k	256k	Comms Board
32k		*	*	*	*
64k	*	*	*	*	*
128k	*	*	*	*	*
256k	*	*	*	*	*
Comms Board	*	*	*	*	

ROM Expansions
Via the cartridge port or disc drive bus these provide:
MTX PASCAL
NODE SYSTEM software
Business, Education and Games software

Suitable Printers

Centronics-type parallel printers
RS232 serial printers (requires 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.
Dimensions in millimetres: Width 92 Depth 110 Height 70 Weight: 1.0 kilogram
The PSU is double insulated and has a side mounted rocker switch which is internally illuminated when the unit is on. The mains transformer is located between two groups of four anti-vibration noise absorbing rubber mount. Extensive strain relief

mouldings are incorporated in the PSU casing to support the input and output cables. The output cable terminates in a 240 degree, six pin DIN connector. The PSU is supplied as a sealed unit.

Z80 CPU

The instruction set contains 158 instructions. The 78 instructions of the 8080A are included as a subset; 8080A software compatibility is maintained.
Eight MHz, 6 MHz, 4MHz and 2.5 MHz clocks for the Z80H, Z80B, Z80A and Z80 CPU result in rapid instruction execution with consequent high data throughput.

The extensive instruction set includes string, bit, byte and word operations. Block searches and block transfers together with indexed and relative addressing result in the most powerful data handling capabilities in the microcomputer industry.
The Z80 microprocessors and associated family of peripheral controllers are linked by a vectored interrupt system. This system may be daisy-chained to allow implementation of a priority interrupt scheme. Little, if any, additional logic is required for daisy-chaining.
Duplicate sets of both general-purpose and flag registers are provided, easing the design and operation of system software through single-context switching, background-foreground programming and single-level interrupt processing. In addition, two 16-bit index registers facilitate program processing of tables and arrays.
There are three modes of high-speed interrupt processing: 8080 similar, non-Z80 peripheral device and Z80 Family peripheral with or without daisy chain.
On-chip dynamic memory refresh counter.

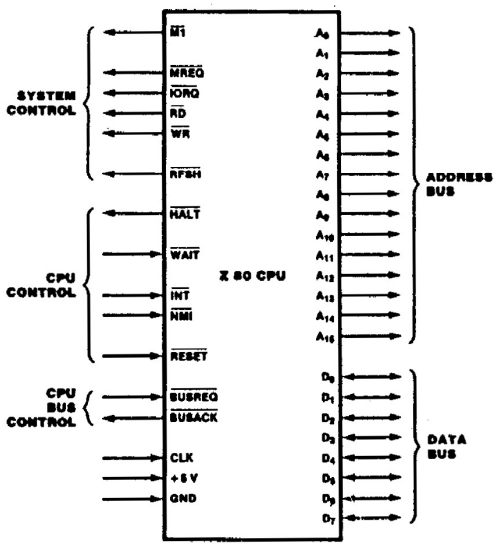


Figure 1. Pin Functions

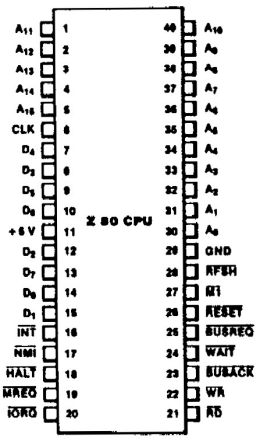


Figure 2. Pin Assignments

Pin description

A0-A15.
Address Bus (output, active High, 3-state). A0-A15 form a 16-bit address bus. The Address Bus provides the address for memory data bus exchanges (up to 64K bytes) and for I/O device exchanges.

BUSACK.
Bus Acknowledge (output, active Low). Bus Acknowledge indicates to the requesting device that the CPU address bus, data bus and control signals MREQ, IORQ, RD and WR have entered their high-impedance states. The external circuitry can now control these lines.

BUSREQ
Bus Request (input, active Low). Bus Request has a higher priority than NMI and is always recognized at the end of the current machine cycle. BUSREQ forces the CPU address bus, data bus, and control signals MREQ, IORQ, RD, and WR to go to a high-impedance state so that other devices can control these lines. BUSREQ is normally wire-ORed and requires an external pull up for these applications. Extended BUSREQ periods due to extensive DMA operations can prevent the CPU from properly refreshing dynamic RAMs.

D0-D7.
Data Bus (input/output, active High 3-state). D0-D7 constitute an 8-bit bidirectional data bus, used for data exchanges with memory and I/O.

HALT.
Halt State (output, active Low). HALT indicates that the CPU has executed a Halt instruction and is awaiting either a non-maskable or a maskable interrupt (with the mask enabled) before operation can resume. While halted, the CPU executes NOPs to maintain memory refresh.

INT.
Interrupt Request (input, active Low). Interrupt Request is generated by I/O devices. The CPU honors a request at the end of the current instruction if the internal software-controlled interrupt enable flip-flop (IFF) is enabled. INT is normally wire-ORed and requires an external pull up for these applications.

IORQ.

Input/Output Request (output, active Low, 3-state). IORQ indicates that the lower half of the address bus holds a valid I/O address for an I/O read or write operation. IORQ is also generated concurrently with M1 during an interrupt acknowledge cycle to indicate that an interrupt response vector can be placed on the data bus.

M1.

Machine Cycle One (output, active Low). M1, together with MREQ, indicates that the current machine cycle is the opcode fetch cycle of an instruction execution. M1, together with IORQ, indicates an interrupt acknowledge cycle.

MREQ.

Memory Request (output, active Low, 3-state). MREQ indicates that the address bus holds a valid address for a memory read or memory write operation.

NMI.

Non-Maskable Interrupt (input, negative edge-triggered). NMI has a higher priority than INT. NMI is always recognized at the end of the current instruction, independent of the status of the interrupt enable flip-flop, and automatically forces the CPU to restart at location 0066H.

RD.

Read (output, active Low, 3-state). RD indicates that the CPU wants to read data from memory or an I/O device. The addressed I/O device or memory should use this signal to gate data onto the CPU data bus.

RESET.

Reset (input, active Low). RESET initialises the CPU as follows: it resets the interrupt enable flip-flop, clears the PC and Registers I and R, and sets the interrupt status to Mode 0. During reset time, the address and data bus go to a high-impedance state, and all control output signals go to the inactive state. Note that RESET must be active for a minimum of three full clock cycles before the reset operation is complete.

RFSH.

Refresh (output, active Low). RFSH, together with MREQ, indicates that the lower seven bits of the system's address bus can be used as a refresh address to the system's dynamic memories.

WAIT.

Wait (input, active Low). WAIT indicates to the CPU that the addressed memory or I/O devices are not ready for a data transfer. The CPU continues to enter a Wait state as long as this signal is active. Extended WAIT periods can prevent the CPU from refreshing dynamic memory properly.

WR.

Write (output, active Low, 3-state). WR indicates that the CPU data bus holds valid data to be stored at the addressed memory or I/O location.

Z80 CTC

The Z-80 CTC four-channel counter/timer can be programmed by system software for a broad range of counting and timing applications. The four independently programmable channels of the Z-80 CTC satisfy common microcomputer system requirements for event counting, interrupt and interval timing, and general clock rate generation.

System design is simplified because the CTC connects directly to both the Z-80 CPU and the Z-80 SIO with no additional logic. In larger systems, address decoders and buffers may be required.

Programming the CTC is straightforward: each channel is programmed with two bytes; a third is necessary when interrupts are enabled. Once started, the CTC counts down, reloads its time constant automatically, and resumes counting. Software timing loops are completely eliminated. Interrupt processing is simplified because only one vector need be specified; the CTC internally generates a unique vector for each channel.

The Z-80 CTC requires a single + 5 V power supply and the standard Z-80 single-phrase system clock. It is fabricated with n-channel silicon-gate depletion-load technology, and packaged in a 28-pin plastic or ceramic DIP.

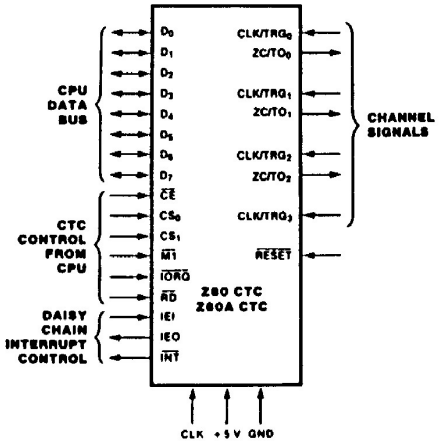


Figure 1. Pin Functions

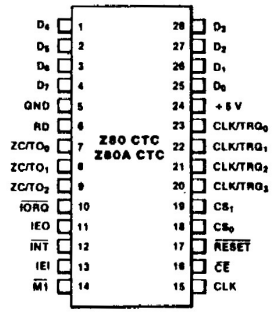


Figure 2. Pin Assignments

Pin Description

CE.

Chip Enable (input, active Low). When enabled the CTC accepts control words, interrupt vectors, or time constant data words from the data bus during an I/O write cycle; or transmits the contents of the down-counter to the CPU during an I/O read cycle. In most applications this signal is decoded from the eight least significant bits of the address bus for any of the four I/O port addresses that are mapped to the four counter-timer channels.

CLK.

System Clock (input). Standard single-phase Z-80 system clock.

CLK/TRGo-CLK/TRG3.

External Clock/Timer Trigger (input, user-selectable active High or Low). Four pins corresponding to the four Z-80 CTC channels. In counter mode, every active edge on this pin decrements the down-counter. In timer mode, an active edge starts the timer.

CSo-CS1.

Channel Select (inputs active High). Two-bit binary address code selects one of the four CTC channels for an I/O write or read (usually connected to A0 and A1).

Do-D7.

System Data Bus (bidirectional, 3-state). Transfers all data and commands between the Z-80 CPU and the Z-80 CTC.

IEI.

Interrupt Enable In (input, active High). A High indicates that no other interrupting devices of higher priority in the daisy chain are being serviced by the Z-80 CPU.

IEO.

Interrupt Enable Out (output, active High). High only if IEI is High and the Z-80 CPU is not servicing an interrupt from any Z-80 CTC channel. IEO blocks lower priority devices from interrupting while a higher priority interrupting device is being serviced.

INT.

Interrupt Request (output, open drain, active Low). Low when any Z-80 CTC channel that has been programmed to enable interrupts has a zero-count condition in its down-counter.

IORQ.

Input/Output Request (input from CPU, active Low). Used with CE and RD to transfer data and channel control words between the Z-80 CPU and the Z-80 CTC. During a write cycle, IORQ and CE are active and RD inactive. The Z-80 CTC does not receive a specific write signal; rather, it internally generates its own from the inverse of an active RD signal. In a read cycle, IORQ, CE and RD are active; the contents of the down-counter are read by the Z-80 CPU. If IORQ and M1 are both true, the CPU is acknowledging an interrupt request, and the highest priority interrupting channel places its interrupt vector on the Z-80 data bus.

M1.

Machine Cycle One (input from CPU, active Low). When M1 and IORQ are active, the Z-80 CPU is acknowledging an interrupt. The Z-80 CTC then places an interrupt vector on the data bus if it has highest priority, and if a channel has requested an interrupt (INT).

RD.

Read Cycle Status (input, active Low). Used in conjunction with IORQ and CE to transfer data and channel control words between the Z-80 CPU and the Z-80 CTC.

RESET.

Reset (input active Low). Terminates all down-counts and disables all interrupts by resetting the interrupt bits in all control registers; the ZC/TO and the Interrupt outputs go inactive; IEO reflects IEI; Do-D7 go to the high-impedance state.

ZC/TOo-ZC/TO2.

Zero Count/Timeout (output, active High). Three ZC/TO pins corresponding to Z-80 CTC channels 2 through 0 (Channel 3 has no ZC/TP pin). In both counter and timer modes the output is an active High pulse when the down-counter decrements to zero.

Z80 DART

The Z-80 DART (Dual-Channel Asynchronous Receiver/Transmitter) is a dual-channel multi-funtion peripneral component that satisfies a wide variety of asynchronous serial data communications requirements in micro-computer systems. The Z-80 DART is used as a serial-to-parallel, parallel-to-serial converter / controller in asynchronous applications. In addition, the device also provides modem controls for both channels. In applications where modem controls are not needed, these lines can be used for general-purpose I/O.

Zilog also offers the Z-80 SIO, a more versatile device that provides synchronous (Bisync, HDLC and SDLC) as well as asynchronous operation.

The Z-80 DART is fabricated with n-channel silicon-gate depletion-load technology, and is packaged in a 40-pin plastic or ceramic DIP.

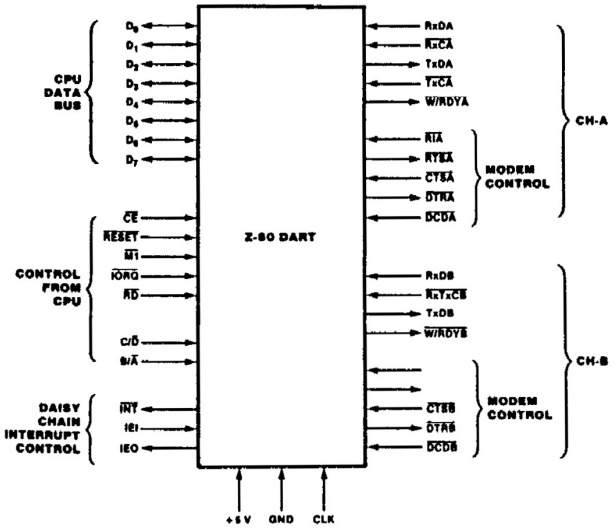


Figure 1. Z80 DART Pin Functions

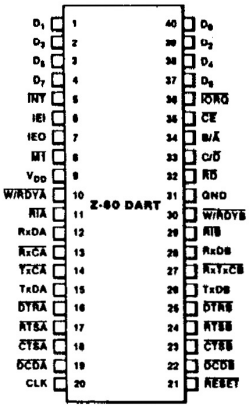


Figure 2. Pin Assignments

Pin Description

B/A.
Channel A Or B Select (input, High selects channel B). This input defines which channel is accessed during a data transfer between the CPU and the Z-80 DART.

C/D.
Control Or Data Select (input, High selects Control). This input specifies the type of information (control or data) transferred on the data bus between the CPU and the Z-80 DART.

CE.
Chip Enable(input, active Low). A Low at this input enables the Z-80 DART to accept command or data input from the CPU during a write cycle, or to transmit data to the CPU during a read cycle.

CLK.
System Clock (input). The Z-80 DART uses the standard Z-80 single-phase system clock to synchronize internal signals.

CTSA, CTSB.
Clear To Send (inputs, active Low). When programmed as Auto Enables, a Low on these inputs enables the respective transmitter. If not programmed as Auto Enables, these inputs may be programmed as general-purpose inputs. Both inputs are Schmitt-trigger buffered to accommodate slow-risetime signals.

Do-D7.
System Data Bus (bidirectional, 3-state) transfers data and commands between the CPU and the Z-80 DART.

DCDA, DCDB.
Data Carrier Detect (inputs, active Low). These pins function as receiver enables if the Z-80 DART is programmed for Auto Enables; otherwise they may be used as general-purpose input pins. Both pins are Schmitt-trigger buffered.

DTRA, DTRB.
Data Terminal Ready (outputs, active Low). These outputs follow the state programmed into the DTR bit. They can also be programmed as general-purpose outputs.

IEI.

Interrupt Enable In (input, active High) is used with IEO to form a priority daisy chain when there is more than one interrupt-driven device. A High on this line indicates that no other device of higher priority is being serviced by a CPU interrupt service routine.

IEO.

Interrupt Enable Out (output, active High). IEO is High only if IEI is High and the CPU is not servicing an interrupt from this Z-80 DART. Thus, this signal blocks lower priority devices from interrupting while a higher priority device is being serviced by its CPU interrupt service routine.

INT.

Interrupt Request (output, open drain, active Low). When the Z-80 DART is requesting an interrupt, it pulls INT Low.

M1.

Machine Cycle One (input from Z-80 CPU, active Low). When M1 and RD are both active, the Z-80 CPU is fetching an instruction from memory; when M1 is active while IORQ is active, the Z-80 DART accepts M1 and IORQ as an interrupt acknowledge if the Z-80 DART is the highest priority device that has interrupted the Z-80 CPU.

IORQ.

Input/Output Request (input from CPU, active Low). IORQ is used in conjunction with B/A, C/D, CE and RD to transfer commands and data between the CPU and the Z-80 DART. When CE, RD and IORQ are all active, the channel selected by B/A transfers data to the CPU (a read operation). When CE and IORQ are active, but RD is inactive, the channel selected by B/A is written to by the CPU with either data or control information as specified by C/D.

RxCA, RxCB.

Receiver Clocks (inputs). Receive data is sampled on the rising edge of RxC. The Receive Clocks may be 1, 16, 32 or 64 times the data rate.

RD.

Read Cycle Status. (input from CPU, active Low). If RD is active, a memory or I/O read operation is in progress.

RxDA, RxDB.
Receive Data (inputs, active High).

RESET.
Reset (input, active Low). Disables both receivers and transmitters, forces TxDA and TxDB marking, forces the modem controls High and disables all interrupts.

RIA, RIB.
Ring Indicator (inputs, Active Low). These inputs are similar to CTS and DCD. The Z-80 DART detects both logic level transitions and interrupts the CPU. When not used in switched-line applications, these inputs can be used as general-purpose inputs.

RTSA, RTSB.
Request to Send (outputs, active Low). When the RTS bit is set, the RTS output goes Low. When the RTS bit is reset, the output goes High after the transmitter empties.

TxCA, TxCB.
Transmitter Clocks (inputs). TxD changes on the falling edge of TxC. The Transmitter Clocks may be 1, 16, 32 or 64 times the data rate; however, the clock multiplier for the transmitter and the receiver must be the same. The Transmit Clock inputs are Schmitt-trigger buffered. Both the Receiver and Transmitter Clocks may be driven by the Z-80 CTC Counter Time Circuit for programmable baud rate generation.

TxDA, TxDB.
Transmit Data (outputs, active High).

W/RDYA, W/RDYB.
Wait/Ready (outputs,open drain when programmed for Wait function, driven High and Low when programmed for Ready function). These dual-purpose outputs may be programmed as Ready lines for a DMA controller or as Wait lines that synchronize the CPU to the Z-80 DART data rate. The reset state is open drain.

TMS 9929 VDP (Video Display Processor)

Introduction

This Preliminary Specification of the TMS 9929 is to be considered as an "ADD ON" to the basic TMS 9918 specification. The TMS 9929 is effectively identical to the TMS 9918 functionally and only has the color video section that is different.

The TMS 9918 provides a composite color video signal output that if driven by a suitable amplifier can go directly into any color video monitor. The color burst frequency is the VDP oscillator input frequency divided by three. External video mixing with an external reference source can also be achieved by inputting this external source directly into the TMS 9918.

In the TMS 9929 the color and luminance/sync information is provided on three pins rather than a single pin in the form of two color difference signals and one luminance signal with all the vertical and horizontal timing included. So we have R-Y, B-Y, and Y respectively. The two color difference signals are used then by an external quadrature modulator video encoder. It is outside the Video Display Processor that the composite color video signal is generated into a PAL or Secam compatible TV signal. The external video mixing is also done outside and it is the TMS 9929 to decide when this mode is entered. This is achieved by a special level distinction made by the R-Y and B-Y VDP outputs. When external video is entered these two outputs go to the equivalent of the sync percentage level of the black-white swing in the luminance output, i.e. the color difference outputs are normally swinging between the luminance black-white voltage levels and it is only in the external video mode that these outputs go to the reserved " sync" level.

Phase locking of the VDP to the external PAL burst frequency is desirable if inter-hum or crawl effects want to be minimized. The TMS 9929 oscillator clock must still, however, be maintained within its prescribed limits of oscillator operation. CPUCLK signal is no longer available in the European TMS 9929.

9918-9928-9929 VDP

TMS 9918 TEST PROGRAM

9928/29

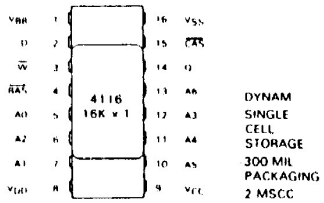
TYPE	PIN				PIN	TYPE
OUT	RAS	#	1	40	XIAL1	IN
OUT	CAS	#	2	39	XIAL2	IN
OUT	AD7	#	3	38	# R Y CCLK	OUT
OUT	AD6	#	4	37	# GCLK	OUT
OUT	AD5	#	5	36	# Y CVTD	OUT
OUT	AD4	#	6	35	# B Y XVTD	IN
OUT	AD3	#	7	34	# RSET/SYN	IN
OUT	AD2	#	8	33	# VCC	PWR
OUT	AD1	#	9	32	# RD0	IN
OUT	AD0	#	10	31	# RD1	IN
OUT	R/W	#	11	30	# RD2	IN
PWR	VSS	#	12	29	# RD3	IN
IN	MODE	#	13	28	# RD4	IN
IN	CSW	#	14	27	# RD5	IN
IN	CSR	#	15	26	# RD6	IN
OUT	INT	#	16	25	# RD7	IN
I/O	CD7	#	17	24	# CD0	I/O
I/O	CD6	#	18	23	# CD1	I/O
I/O	CD5	#	19	22	# CD2	I/O
I/O	CD4	#	20	21	# CD3	I/O

NSAG

4116 VRAM

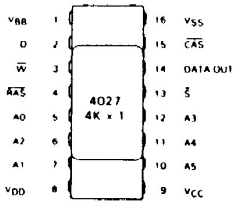
PIN NAMES

A0-A5	Address inputs
CAS	Column address strobe
D	Data input
DATA OUT	Data output
RAS	Row address strobe
S	Chip select
W	Write enable
VBB	-5 V power supply
VCC	+5 V power supply
VDD	+12 V power supply
VSS	0 V (ground)



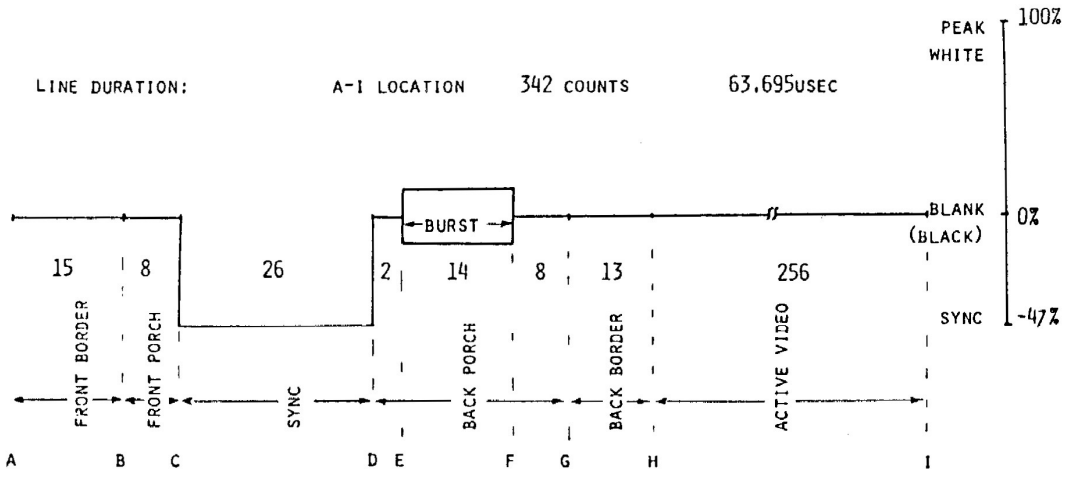
DYNAM
SINGLE CELL STORAGE
300 MIL PACKAGING
2 MSCC REFRECT
0°→70°C

NSAG



NSAG

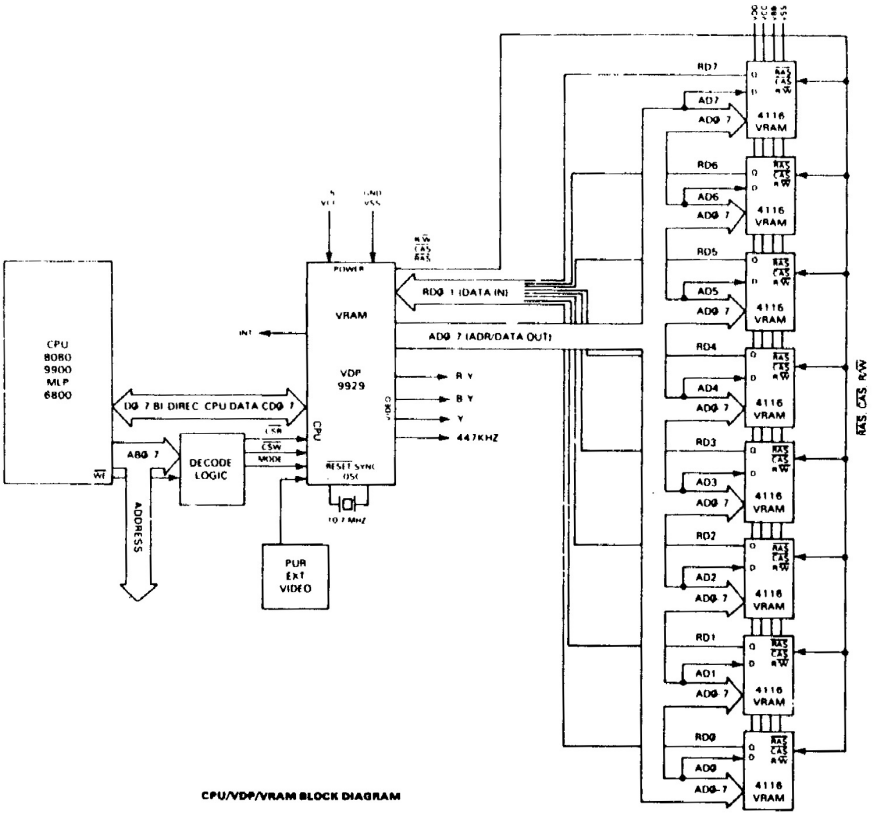
9928 PAL VDP HORIZONTAL TIMING



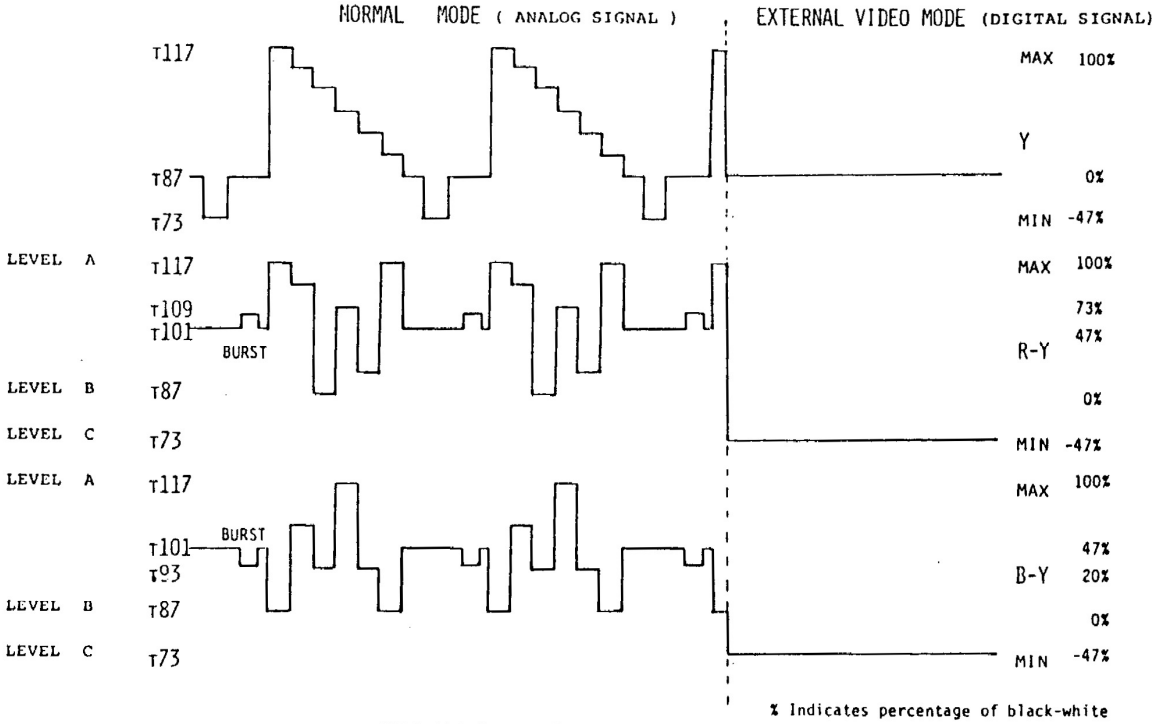
NAME	LOCATION	COUNTS *	TIME (USEC)
FRONT PORCH	B-C	8	1.49
SYNC	C-D	26	4.84
BACK PORCH	D-G	24	4.47
BURST	E-F	14	2.6
BLANKING	B-G	58	10.8
FRONT BORDER	A-B	15	2.8
BACK BORDER	G-H	13	2.42
ACTIVE AREA	H-I	256	47.67

* COUNT = 186.24NSEC

PREPARED BY:
CARLO HERRMANN



CPU/VDP/VRAM BLOCK DIAGRAM



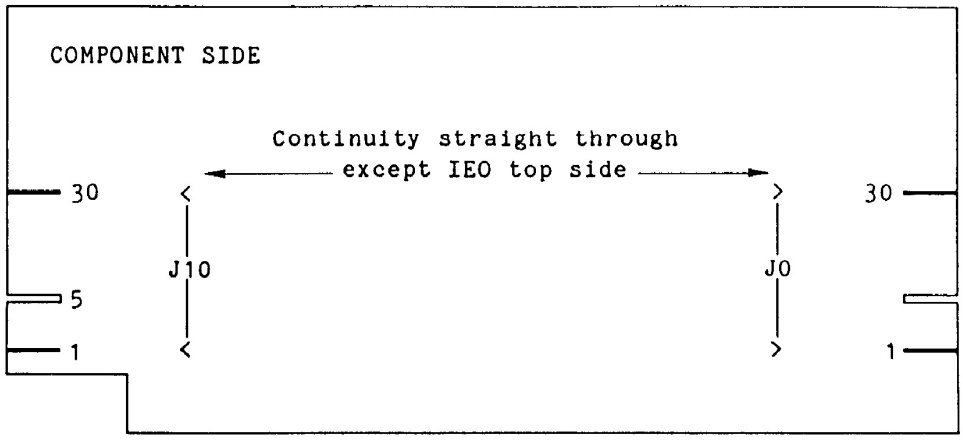
9928 SIGNAL WAVEFORMS

(AT 5 VOLTS)

% Indicates percentage of black-white (T117-T87) swing

PREPARED BY:
CARLO HERRMANN

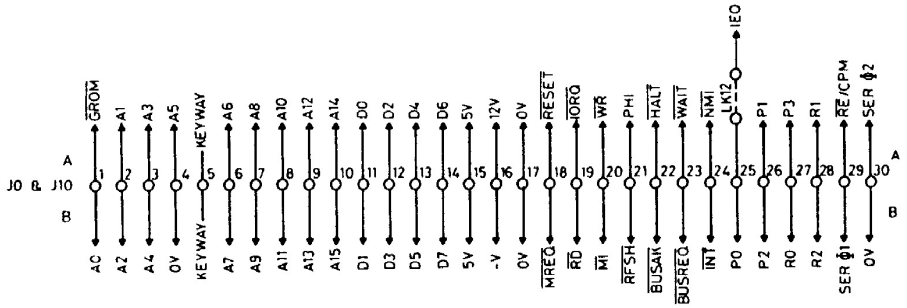
MTX SERIES BUS



The system Bus comprises the full Z80 A bus, power supply rails, ROMpak enable (GROM), ROM page ports R0 to R2, RAM page ports P0 to P3 and serial clock lines 01 and 02.

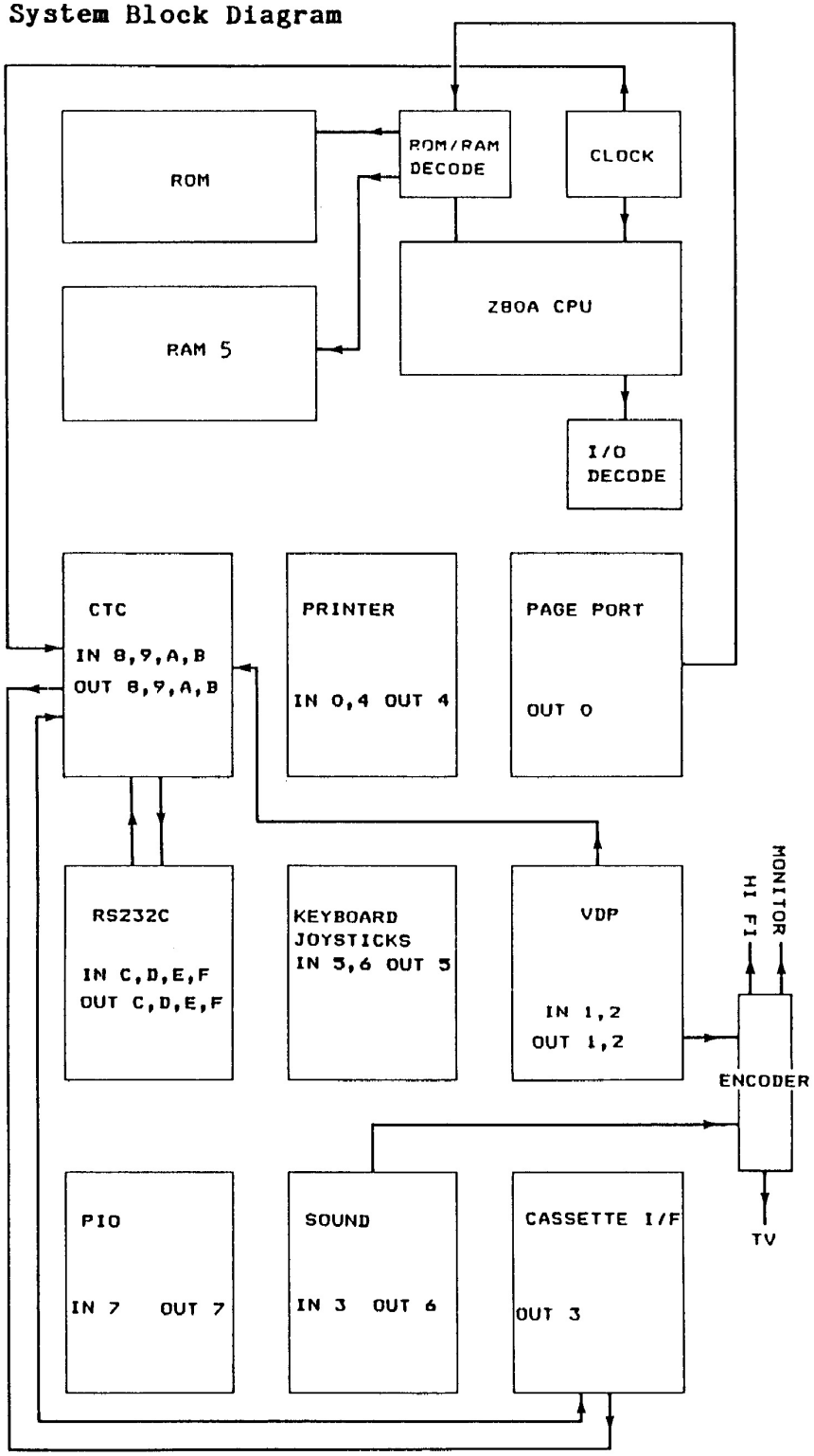
All lines are externally available on J1, which is a 60 way (30 + 30) 0.1" card edge plug, or internally on J0 which is also a 0.1" 60 way card edge plug.

Note:- J10 also has keyway between 26 and 27



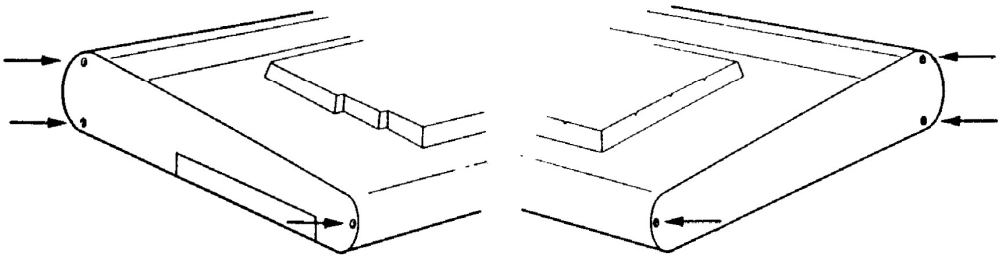
Note: (1) J10 is a mirror image of J0
(2) Component side = A
Solder side = B

System Block Diagram

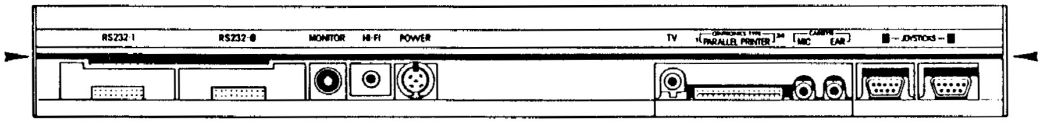


DISASSEMBLY INSTRUCTIONS

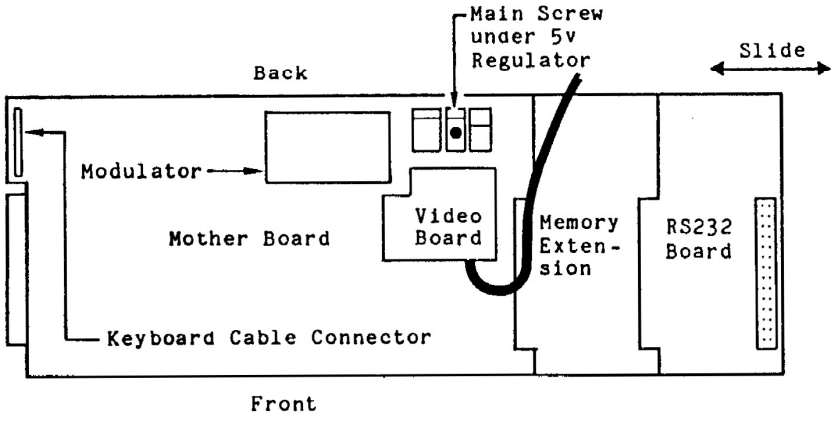
1. Using an Allen key, remove the three dome head screws from the right & left hand ends of the MTX.



2. Lift the MTX keyboard at the rear just above the plastic panel. Be careful not to damage the keyboard interconnecting cable.

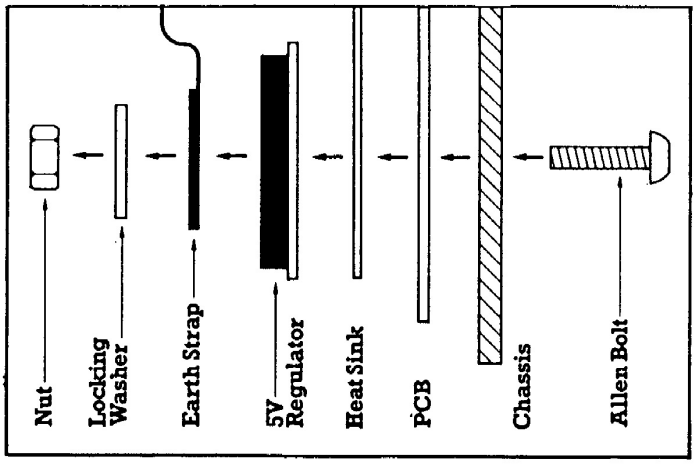


3. Gently ease the KBD (keyboard) interconnecting cable from the mother board and slide the top KBD to the left or right until detached.



4. Remove the video monitor cable (fig 3) and tape it to the plastic panel to prevent any unecessary damage.

The under side of the MTX reveals a single screw which secures the MTX mother board to the bottom chasis. By removing the main screw and earth strap the MTX Mother Board and Rear Plug panel will slide from the case bottom.



Faults are rarely complained about but nonetheless faults, include I/O ports that are insecurely soldered or not 'flush' with the main P.C.B. i.e. Power Supply socket, Printer port, cassette ear and mic and joy stick ports.

Any competent initial check of a returned MTX should include these ports. It should also include checking for the nylon washers on the solder side of the board (esp under the tip 2955 power transistor and the joystick port sockets) which stops RE/CPM shorting to earth - see Page 48 of assembly instructions of Power Transistor.

Also check power supply voltage....ideally about 22.5v to 24.5v and check to see that c56 and c51 - 4700 uf 16v capacitors are secure.

Introduction To Trouble Shooting Guide

Memotech products are all given a vigorous series of tests before despatch to the end user. These tests include:- Loading and saving functions, sound channel checks, compatibility with printers and other add ons, etc etc. Once the units have passed this stage of tests they are given 24 hour soak test, (burning in process). Any component that is faulty is generally weeded out at this stage. The units are then given a final check over before they are packed and despatched to the end user.

Occasionally you may find less serious faults occuring possibly due to heavy handling during transit.

The following trouble shooting guide is designed to give you a starting reference at which to start the fault finding procedure. After several weeks you will become confident enough to delve deeper into the MTX Circuitry. We hope that this guide will assist you to meet this end.

Symptom 1

On power up:- No display or only a black and white display.

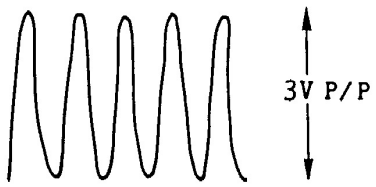
a)

Cause of Trouble

Black and White output.

Check Point

Video Board
Oscillation of Xtal 4.433619MHz or pin 17 of LM1889 IC47.



Time/cm = .5µs
Volts/cm = .1V

Repair Method

1 If pulse is present on P17 of LM1889 turn CVI until oscillation is at its optimum pitch 3v peek to peek. See fig no 1.

2 If pulse is absent LM1889 is faulty - or associated circuitry.

b)

Cause of Trouble

Rapid Fading of colours.

Check Point

Tantalum Capacitor on 5v pin 2 of the modulator

Repair Method

1 Check Tantalum is a 22uf -Ve leg is earthed and + Ve leg is sufficiently soldered to the 5v pin 2 of Modulator.
2 If still faulty replace pal board.

3 If still faulty replace the Modulator.

c)

Cause of Trouble

No video output, i.e. 'fuzzy screen'

Check Point

Pal board J11 and or Modulator

Repair Method

1 Check for pulse on pin 3 of J11 or Pin 3 of Modulator.

2 Check for short to 5v...or replace Modulator.

3 Check +12v - if absent replace 12v Regulator.

d)

Cause of Trouble

Monitor display faulty

Check Point

Pal board monitor connection cable

Repair Method

1 Check for pulse on Q6 - (2N3906 transistor) if absent Q6 is faulty.

2 Check for loose connections on monitor cable.

3 Is 47pf present on monitor output on back panel?

NB: BEFORE YOU START

Always check your monitor and or TV.

Always check your monitor leads and aerial leads.

SYMPTOM 2

When power is switched on: Blank screen - no humming sound.

a)

Cause of Trouble

Faulty video board

Check Point

Check to see if you have control G Note

Repair Method

1 If control G note is present video board is faulty-Replace video board.

b)

Cause of Trouble

Blank screen with no control G sound

Check Point

Check +5v -5v +12v 0v

Repair Method

1 If the +5 voltage is absent, 2nd stage fuse has blown.

2 If +12v and +5v are absent check both regulators and associated circuitry.

c)

Cause of Trouble

Blank screen with no control G sound

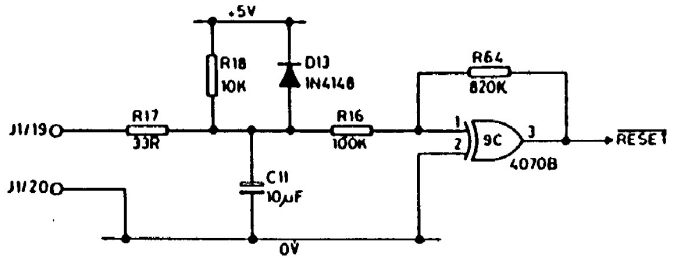
Check Point

If above voltages are present check 4Mhz Xtal - Also check RESET circuit

Repair Method

1 If pulse is absent on 4Mhz Xtal - follow associated circuitry until fault is apparent.

2 If RESET is held low-



follow associated circuitry until fault is apparent.

Also - see page 33.

d)

Cause of Trouble

Blank screen with no control G sound

Check Point

If above checks are o.k. check the 10.6875 MHz Xtal

Repair Method

1 If pulse is absent Xtal is likely to be faulty.

2 If pulse is present the TMS 9929 video processor is faulty.

NB: Before these tests are carried out, try switching the power on and off a few times to establish whether or not the problem is merely a fire up fault. See ref page 47 for timing modification.

SYMPTOM 3

Corrupt video display or characters

a)

Cause of Trouble

- 5v absent

Check Point

Pin 1 of any Video Ram (4116 16K) for -5v

Repair Method

1 If -5v is absent - check for short at J12 (monitor o/p) of video board - or repair open circuit. The -5v is generally shorted to 0v at this point.

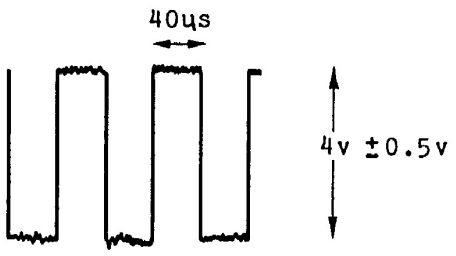
b)

Cause of Trouble

Faulty Video Ram

Check Point

Check for pulse on pin 2 of Video Ram.
Check for signal on P14 of any Video Ram.



Volts/cm=0.1v
Time/cm=0.5µs

Repair Method

1 Systematically disable the Video Rams by earthing pin 14. Continue with this process until corruption has reduced. The IC with the least corruption when earthing, is likely to be faulty...replace. See warning on Page 31.

2 If the corruption is very bad scopeing pin 14

may pick out the faulty component.

c)

Cause of Trouble

Faulty TMS 9929

Check Point

Check pins 3 to 10 and pins 25 to 32

Repair Method

1 If signal is absent replace TMS 9929 video processor.

WARNING:When you earth the Video Rams - make sure you earth them via a 10 OHM - 15 OHM Resistor. Do not earth them directly as this may damage the components.

SYMPTOM 4

When power is switched on: Very bad hum bars causing corruption of Display.

a)

Cause of Trouble

Faulty P.S.U.

Check Point

Check input voltage at J9. with Digital Volt Meter.

Repair Method

1 Voltage should read between 23v and 24.5v - if not change P.S.U.

b)

Cause of Trouble

Faulty Bridge Rectifier

Check Point

Check your +5v and +12v

Repair Method

1 If signal is poor trace fault from either the 7805 or 7812 Regulators to faulty component.

SYMPTOM 5

When power is switched on:- Green screen and humming noise.

Whilst testing the MTX during Manufacture the most common fault we find is:- On fire up - Blank screen and humming sound. Quite frankly these are the most difficult faults to repair due to the fact that just about any component can cause these symptoms. We find that solder shorts are responsible for the majority of these problems, but occasionally we do find faulty components.

Since all the MTX's are thoroughly tested before despatch, faults occuring such as green screen and humming, after despatch are more than likely going to be component break down.

The biggest problem is whether or not the ram chips are functioning correctly or not. The Memotech Ram Test Rig can pin point a fault either on the data bus or the memory page address lines. Whether or not the Rig detects a faulty Ram the fact remains that it will eliminate eight key components which is a great help. Without a Ram Rig Test the chances of finding a faulty Ram with only an oscilloscope are very slim indeed.

However, green screen and humming faults are not necessarily due to faulty Rams. When you have the symptom of green screen and humming there is a strict procedure to follow.....

a)

Cause of Trouble

Faulty voltages

Check Point

Check all your voltages 0v, 5v, 12v, -5v, -12v

Repair Method

1 If any signal is absent follow offending circuitry from source and repair.

b)

Cause of Trouble

Faulty RESET circuit - also see page 29.

Check Point

Check Points are:- Pin 3 of IC18 BCN4070 CMOS
Pin 26 of C.P.U.
Pin 34 of V.D.P.

1 If signal is low - Trace fault back from Pin 3 of IC18 4070CMOS (pay particular attention to C11 10uf cap).

2 If signal is high RESET circuitry is o.k.

NB. Signal should go low when shorting pins 19 and 20 of J1 - keyboard interconnection header plug.

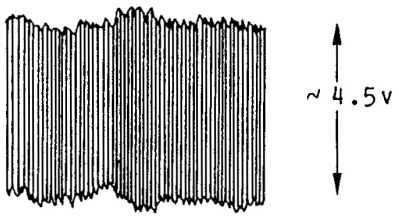
c)

Cause of Trouble

Fault on address bus

Check Point

Probe system address bus of C.P.U.



Volts/cm=0.1v
Time/cm=0.5μs

Repair Method

1 If any address signal is absent - Reset MTX whilst probing. If signal is still absent - start by replacing C.P.U.

2 Check both 74LS157's (PCB Location 6C and 6D) to see if they are multiplexing.

3 If 74LS157 pin 1 pulse is absent, check pin 14 of PAL14L4 and follow circuitry through pins 3,4,5 and 6 of the 74LS04 (PCB location 2B) to REF points MPX. faulty.

d)

Cause of Trouble

Faulty system data bus

Check Point

Probe pin 2 or 14 of all rams

Repair Method

1 If signal is absent reset MTX whilst probing. If signal is still absent refer to MTX Rig Ram Test.

NB: We find it helpful to replace all the socketed IC's with a known good set before attempting to rectify this fault.

* The fact that a signal is absent from the system data bus does not necessarily mean that there is a fault in Ram. It is very difficult to determine Ram faults with an oscilloscope alone. You really do need the Memotech Ram Rig Tester.

SYMPTOM 6

Problems with the load and saving functions

a)

Cause of Trouble

Faulty jack socket

Check Point

J2 Ear jack socket

Repair Method

1 Jack socket J2 may be loose or worn, also buzz across the socket ie 0v - CSTT out - to check for shorts - replace socket.

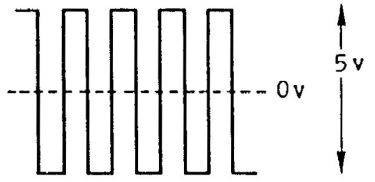
b)

Cause of Trouble

Faulty IC BCN4070 CMOS or associated circuitry

Check Point

By typing LO."" (RET) and loading in a long playing cassette tape start probing at J2 CSST out.



Volts/cm=0.1v
Time/cm=0.1µs

Repair Method

1 You can easily follow the signals from J2 through opamp 10E 314. (Remember pin 6 is normally -12v) and in to 4070 CMOS out at pin 4. - Replace faulty component.

2 If no fault found change CPU or CTC.

c)

Cause of Trouble

Incorrect PAL14L4 value link arrangement or timing

Check Point

Link 6 and link 7 + PAL14L4

Repair Method

1 See page 45 for link variations and pal colour codes

d)

Cause of Trouble

MTA 512 with internal expansions only

Check Point

Check right hand bus connector

Repair Method

1 Either make sure the bus connector is clean or...ideally hard solder the expansion board to the mother board.

NB: Before these tests are carried out always check that you have a good tape recorder that is set at the correct volume (between level 7 and 10). Check your cassette leads (remember ear to ear and mic to mic). Check that the cassette tape itself is working - and not damaged.

SYMPTOM 7

Problems with sound (Depress control key and G key together for note).

a)

Cause of Trouble

Faulty SN 76489 AN (5E)

Check Point

Start by probing I/O of (4E) 74LS374N

Repair Method

1 Press control G - you should be getting pulses from 4E 74LS374N outputs. If absent disable offending output from 5E SN76489.

2 If still absent 74LS374N is faulty.

3 If pulse is present on 74LS374N the 76489 is faulty.

4 If pulse is present on both 4E (374) and 5E (SN76489AN) check for pulse on pin 1 of J13 on pal board and pin 3 of J11 on pal board. If either are absent check for open circuit or replace pal board.

5 If pulse is present on J11 and J13 check the tuning of modulator. See ref Page 42.

b)

Cause of Trouble

Faulty SN76489AN or 74LS374N

Check Point

As above

Repair Method

1 Often the sound channels become distorted once the components have reached their optimum temperature. You can heat the SN76489AN and 74LS374N systematically with a soldering iron (whilst checking pulses on SN76489AN) to recreate several hours of use.

NB: For further information on modulator and video board fine tuning see page 42.

SYMPTOM 8

Faulty keyboard response

a)

Cause of Trouble

Key bounce

Check Point

Upper keyboard chassis

Repair Method

Generally key bounce is caused by faulty key board switches. Simply de-solder and replace the offending key(s).

b)

Cause of Trouble

Key(s) u/s

Check Point

J1-keyboard interconnection header plug

Repair Method

1. Check that the keyboard interconnection cable is secure and not torn.

2. Check that the offending keys work by buzzing across the terminals whilst depressing the switch.

3. Check for pulses on diodes DR0-DR7 (4148) Anode -> 74LS273N (3A) -> LCD lines.

c)

Cause of Trouble

Incorrect cnaracter displays

Repair Method

1 Check for correct language switch setting at PCB location - SWA.

2 Ensure GROM line is connected (piggyback Roms only).

3 Check links 1, 2, 4, 5 and 13 (4000/04 boards only).

4 Replace PAL14L4 chip.

SYMPTOM 9

Add on faults - e.g. Memory expansions, Rom boards, RS232, Printers etc.

a)

Cause of Trouble

Memory upgrade not obtaining Ram top

Check Point

Check for correct prom coding, see page 45, check rams in sockets (if any) for poor connection

Repair Method

1 If prom is o.k. make sure that both edge connector and upgrade connector is clean.

2 Check links on the upgrade are correctly soldered in the LO position.

3 R1 = 330 OHM.

4 R2 = 680 OHM.

5 If green screen fault refer to Rig Ram Test.

b)

Cause of Trouble

Rom Boards

Check Point

RE/CPM pin 9, 5A, 74LS273N of MTX

Repair Method

1 Type Rom 2 whilst probing pin 9 of main PCB - location SA. Look for pulse

2 If pulse is absent, check for washer on underside of board - under TIP 2955

3 Check pal chip on MTX.

4 Check links 6 and 7 on MTX.

5 Look closely at the 273 (5A) on mother board and associated circuitry.

c)

Cause of Trouble

RS232

Check Points

As above

Repair Methods

As above ->

1 If intermittant fire up modify timing chain -> see page 46.

d)

Cause of Trouble

Printer

Check Point

J6 Printer o/p

Repair Method

1 Be sure that the fault is not the printer itself or the interface cable.

2 STROBE should be Hi.

3 Check Printer data lines (PRD0-PRD7) on 74LS 374 and on J6.

4 Also check pins 11, 13, 15 and 17 of 1D the 74LS244.

5 Less likely-check the 74LS74 for STROBE.

Further information on the UM 1286 Modulator.

The Pal-Modulator is used to encode the R-Y, B-Y and Y signals from the MTX home computer and to modulate them together with the sound signal to a high frequency (591.250 MHz).

R-Y and B-Y are called the Chrominance signals.
All the information about the brightness is in the Y signal called the Luminance signal.

The Pal Encoder is built up around the LM 1889 and the UM1286. The LM 1889 integrated circuit receives the R-Y and B-Y signals from the video processor and provides the colour signal to the Modulator. This one also receives the Luminance signal (Y) from the video processor and the audio signal from the 76489 (SE) and provides a composite signal suitable for the antenna input terminal of a TV receiver.

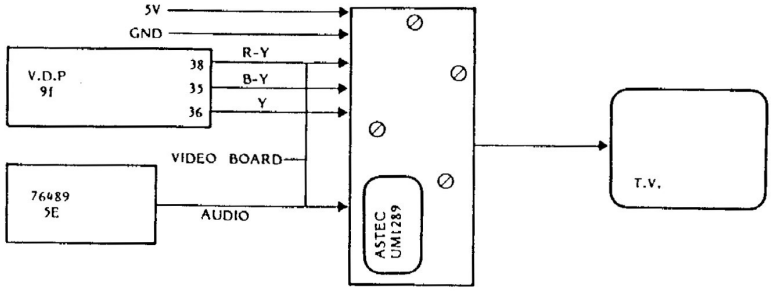
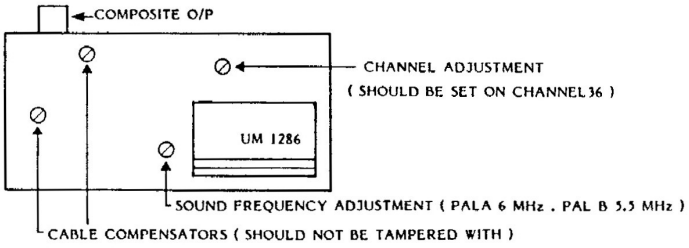


Fig i shows a functional block diagram of the system.



Test and setting procedure of UM 1286 and Video Board

1 Be sure that your TV set, MTX computer and any other test equipment is switched on at least half an hour before beginning the test.

2 Connect the MTX computer to the TV set by the aerial cable.

3 Set the TV set to channel 36 of the TV band (UHF) to obtain the best combination of sound and colour.

4 With the aid of a frequency meter, check the audio carrier; if (for PAL A Units) it is not 6 MHz (values allowed: 5.99 - 6..01 Mhz) turn the sound frequency adjustment coil (Fig ii) of the Modulator to set it.

5 The video carrier is now set by 2 resistors running in series at RV1 (a 10K OHM and 1K OHM). These resistors can be replaced with a 1K MHz variable resistor.

6 The two brass screws in the modulator (fig ii) are cable compensators and shouldn't really be tampered with.

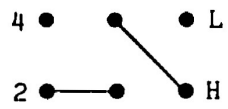
FOOTNOTE

Whilst carrying out any tests on the MTX it is advisable to detach the Mother P.C.B. from the bottom chassis. If after following the trouble shooting guide you still have problems - Replace the Mother board and refer to Manufacturers.

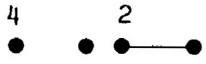
NB: Any channel adjustments carried out on the Modulator should be done with the automatic frequency switch of the TV turned off.
In the event of a TV not having an AFT switch disregard this footnote.

Link arrangements and Pal colour coding

1. MTX 500 - 4000/04 with 32k H Ram chips.

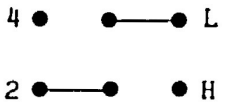


LINK 6

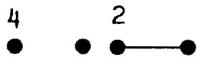


LINK 7

2. MTX 500 4000/04 with 32k L Ram chips.



LINK 6



LINK 7

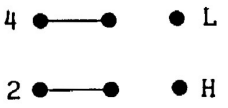
--BLUE PAL
212 FUSES
BLOWN

3. MTX 500 4000/05 with 32k H Ram chips.
Links 6 and 7 as point 1.

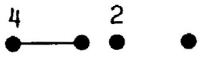
4. MTX 500 4000/05 with 32k L Ram chips.
Links 6 and 7 as point 2.

-WHITE PAL
194 FUSES
BLOWN

5. MTX 512 4000/04 - 64k.



LINK 6



LINK 7

-YELLOW PAL
212 FUSES
BLOWN

6. MTX 512 4000/05. Links 6 and 7
as point 5.

-RED PAL
212 FUSES

7. MTX 500 4000/06 - 32k. Links 6 and 7
as points 3 and 4.

WHITE PAL
FOR MTX500

8. MTX 512 4000/06 - 64k. Links 6 and 7
as point 6.

-
RED PAL
FOR MTX512

PROM CODE FOR MEMORY EXPANSION BOARDS

MTX 500	CODE DESCRIPTION
OLL (MAX 96K)	1 ROW OF 32K L OR 2 ROWS OF 32K L
OLH (MAX 96K)	1 ROW OF 32K L 1 ROW OF 32K L AND 1 ROW OF 32K H
OHH (MAX 96K)	1 ROW OF 32K H OR 2 ROWS OF 32K H
OL64 (MAX 128K)	1 ROW 32K L AND 1 ROW 64K
00128 (MAX 160K)	2 ROWS OF 64K
04128 (MAX 288K)	TO RUN IN CONJUNCTION WITH 00128 2 ROWS OF 64K
08128 (MAX 416K)	TO RUN IN CONJUNCTION WITH 00128 AND 04128 2 ROWS 64K

MTX 512	CODE DESCRIPTION
1LL (MAX 128K)	1 ROW OF 32K L OR 2 ROWS OF 32K L
1LH (MAX 128K)	1 ROW OF 32K L 1 ROW OF 32K L AND 1 ROW OF 32K H
1HH (MAX 128K)	1 ROW OF 32K H OR 2 ROWS OF 32K H
10128 (MAX 192K)	2 ROWS OF 64K
14128 (MAX 320K)	TO RUN IN CONJUNCTION WITH 10128 2 ROWS OF 64K
18128 (MAX 448K)	TO RUN IN CONJUNCTION WITH 10128 AND 14128 2 ROWS OF 64K
1C128 (MAX 512K)	TO RUN IN CONJUNCTION WITH 10128 AND 14128 AND 18128 1 ROW OF 64K

Timing chain modification

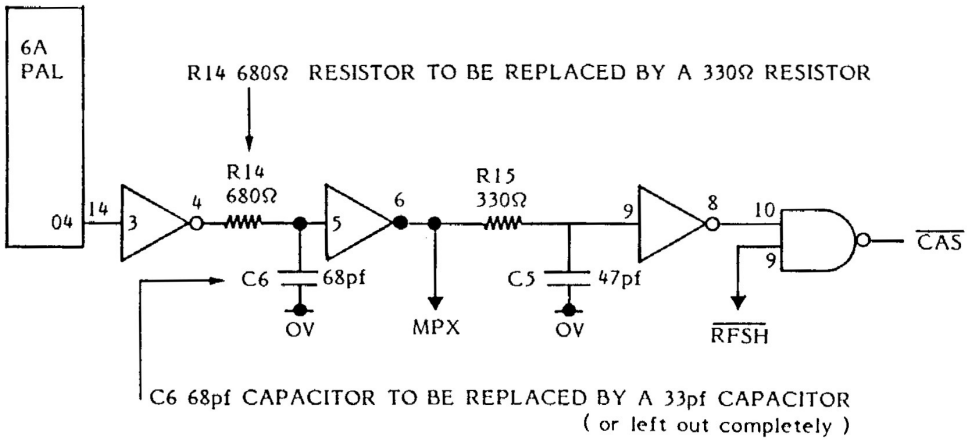
In October 1984 Memotech altered the timing chain circuitry due to occasional faults occuring after about 2 hours of use - and poor fire up response. (esp; when running in conjunction with F.D.X.

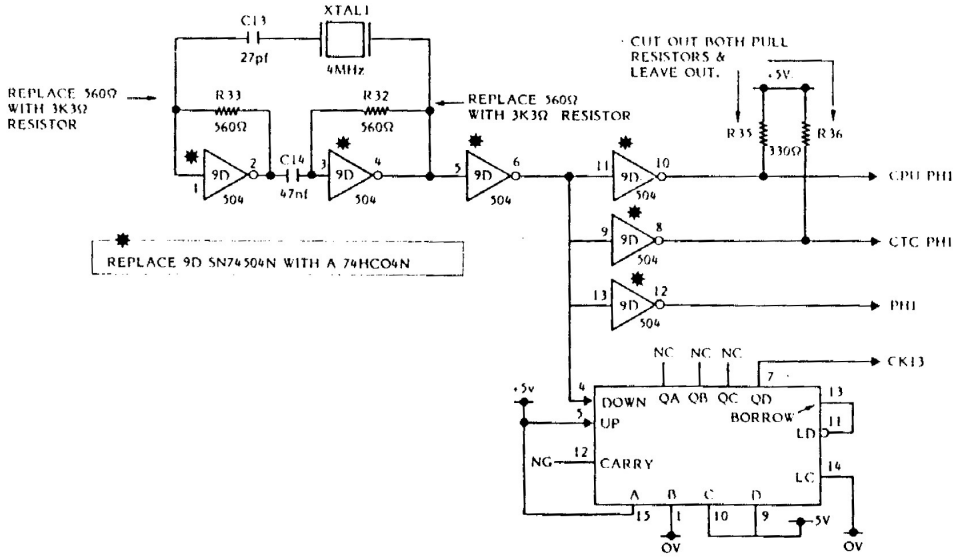
We have since up-dated all our units to incorporate this 'modification'. MTX 4000/06 P.C.B.'s are exempt from this modification due to the fact that multilayered boards are generally not affected.

However you may feel the need to replace the timing chain with the modified circuit if your MTX is suffering from intermittant fire ups (e.g. 1 fire up failure in less than 5 attempts constitutes a possible fault in the timing chain circuitry). The diagram below shows what components have to be changed and to what values:-

R14 680 Ohm resistor to be replaced by a 330 Ohm resistor.

C6 68pf capacitor to be replaced by a 33 pf capacitor (or left out completely).




C13
27pf
XTAL1
4MHz
REPLACE 560Ω WITH 3K3Ω RESISTOR
R33
560Ω
R32
560Ω
REPLACE 560Ω WITH 3K3Ω RESISTOR
CUT OUT BOTH PULL RESISTORS & LEAVE OUT.
+5V
R35
330Ω
R36
C14
47nf
9D
504
CPU PHI
CTC PHI
PHI
CK13
NC NC NC
DOWN
UP
CARRY
QA QB QC QD
BORROW
LD
LC
A B C D
0V
5V
REPLACE 9D SN74504N WITH A 74HC04N

Plastic back panel.

You will find that your TV/Monitor picture will tear or wobble if your plastic bak panel does not have:

a Earth straps
b 47pf capacitor

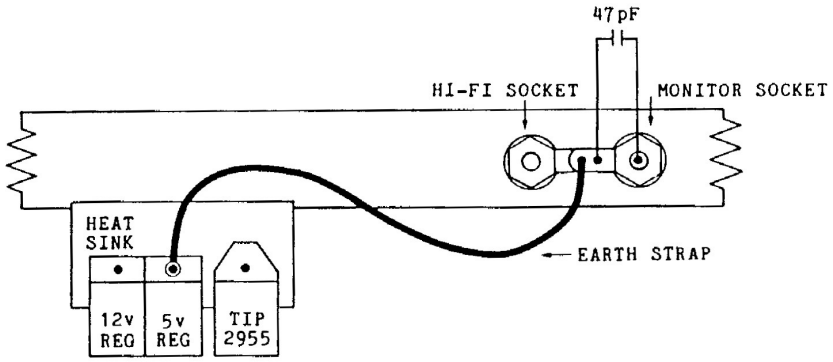


Illustration of assembly of power transistor.

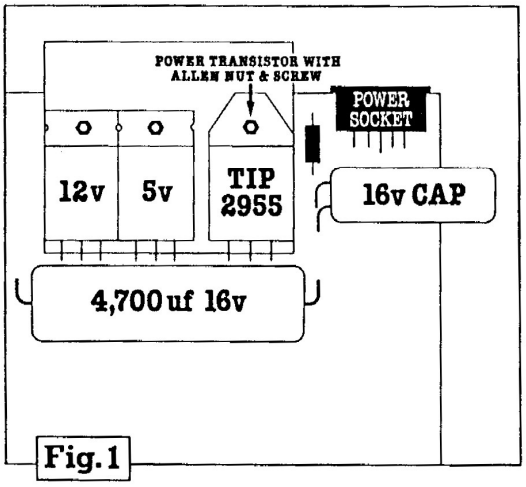


Fig.1

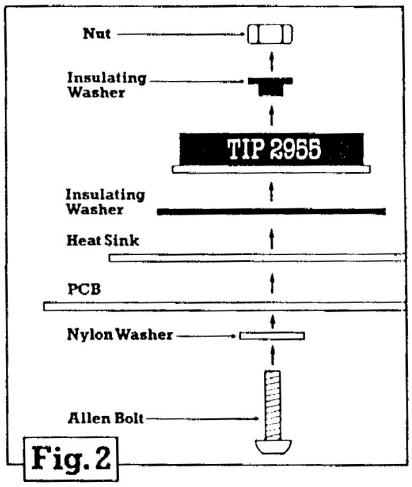


Fig.2

PARTS LIST FOR THE:

MTX 512 04

RS232 I/F

32K MEMORY EXPANSION

ROM EXPANSION

MTX LOADING STAGE 1.

MEMOTECH PART NO.		ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATIO / COMMENTS
CONS	CNOND9P	9 Way Canon D Type	2	J4,J5
HS	HS01	Heat Sink	1	HS01
INSU	BUSH	Insulating Bush	1	Q4
INSU	PAD	Insulating Pad	1	Q4
NUT	M3HEXH	M3 Hex Nut	3	Q4,RG1,RG2
NUT	M3HEXN	M3 Nylon Nut	4	J4,J5
PCB	4000-04	4000-04 PCB	1	
REG	UA7805	UA7805CKC 5v Regulator	1	RG2
REG	UA7812	UA7812CKC 12v Regulator	1	RG1
SCRW	M38BH	M38 Dome Head Screw	3	Q4,RG1,RG2
SCRW	M38N	M38 Nylon Pan Head Screw	4	J4,J5
TRL	TIP2955	TIP2955 Transistor	1	Q4
WSH	M3N	M3 Nylon Washer	1	Q4

MTX LOADING STAGE 2.

MEMOTECH PART NO.		ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATIO /COMMENTS
CAP	PF0027	27pf Ceramic Plate Cap	1	C13
CAP	PF0033	33pf Ceramic Plate Cap	1	C6
CAP	PF0047	47pf Ceramic Plate Cap	1	C5
CAP	PF0068	68pf Ceramic Plate Cap	1	C12
CAPC	NF0022	22nf Ceramic Disc Cap	4	C1-C4

CAPC NF0047	47nf Ceramic Disc Cap	1	C14
CAPE A470016	4700uf 16v Axial Cap	1	C56
CAPE R001016	10uf 16v Radial Cap	6	C11,C38-C40, C49,C57
CAPE R010025	100uf 25v Radial Cap	1	C53
CAPE R470016	4700uf 16v Radial Cap 10mm	1	C51
CAPP NF0100	100nf Polyester Cap	8	C17,C52,C54,C55, C58-C61
CAPS NF0047	47nf Sibitat Cap	4	C7-C10
CAPS NF0100	100nf Sibitat Cap	15	C16,C18,C21,C23, C24-C27
CAPT UF2216 C?????,+MOD 17,MOD 21	22uf Tantalum 16v Cap	3	
CONL SHUNT02	2 Way Shunt (Jumper)	1	LK9
CONL WIRE	Wire Link 39/24 SWG	11	LK1c,2c,3h,4c,5c, 6(2r4c)
			7(4),10,11,R28
CONP DIN6	6 Way DIN PCB MT	1	J9
CONP HDILR34	34 Way DIL R/A Header	1	J6
CONP HSIL02	2 Way SIL Header Tin	1	LK9
CONP HSIL06	6 Way SIL Header Tin	1	J11
CONP HSIL20	20 Way SIL Header Tin	1	J1
CONP HSILR05	5 Way SIL R/A Header	1	J13
CONS DIL20	20 Way DIL Socket	2	J7,IC4
CONS DIL28	28 Way DIL Socket	2	IC6,IC46
CONS DIL28L	28 Way DIL Socket L/P	1	IC45
CONS DIL40	40 Way DIL Socket	1	IC40
CONS DIL40L	40 Way DIL Socket L/P	1	IC7
CONS JK3.5	3.5mm PCB Mounting	2	J2,J3
CRXL 10.6875	10.6875 MHz Crystal	1	XTAL2

CRXL 4.000	4.000 MHz Crystal	1	XTAL1
DODE IN4004	IN4004 Silicon Diode	4	D14,D16,D18,D19
DODE IN4148	IN4148 Silicon Diode	12	D1-D11,D13
DODE IN5402	IN5402 Silicon Diode	2	D15,D17
DODE Z4V7	4V7 Zener Diode	1	ZD1
DODE Z5V1	5V1 Zener Diode	1	ZD3
DODE Z5V6	5V6 Zener Diode	1	ZD2
FB 01	Ferrite Bead	2	LK10,LK11
FUSE HLD5229	20mm Fuse holder PC MT	1	FS1
ICLS 000	SN74LS00N	1	IC9
ICLS 004	SN74LS04N	2	IC8,IC10
ICLS 008	SN74LS08N	1	IC32
ICLS 027	SN74LS27N	1	IC5
ICLS 074A	SN74LS74AN	1	IC31
ICLS 138	SN74LS138N	2	IC17,IC25
ICLS 157	SN74LS157N	2	IC16,IC24
ICLS 193	SN74LS193N	1	IC34
ICLS 244	SN74LS244N	3	IC1,IC19,IC28
ICLS 273	SN74LS273N	2	IC2,IC3
ICLS 373	SN74LS373N	1	IC11
ICLS 374	SN74LS374N	3	IC27,IC29,IC33
ICMC 4070B	CD407 BCN CMOS	1	IC18
ICMO SN76489AN	SN76489AN (Sound)	1	IC30
ICRA 164116	4116-3N 16K D RAM	8	IC36-IC39, IC41-IC44
ICRA 643764	3764-20 64K D RAM	8	IC12-IC15, IC20-IC23
ICS 74HC04	74HC04 CMOS	1	IC26

MDOR	UM1286	UM1286 Modulator.	1	MODULATOR
RES	033R	33 OHM 1/4W C/FILM RES	1	R17
RES	330R	330 OHM 1/4W C/FILM RES	2	R14,R15
RES	560R	560 OHM 1/4W C/FILM RES	2	R34,R40
RES	K001	1K OHM 1/4W C/FILM RES	6	R10,R11,R19,R20, R21,R60
RES	K002.2	2K2 OHM 1/4W C/FILM RES	1	R41
RES	K003.3	3K3 OHM 1/4W C/FILM RES	2	R32,R33
RES	K004.7	4K7 OHM 1/4W C/FILM RES	4	R9,R13,R26,R31
RES	K010	10K OHM 1/4W C/FILM RES	16	R1-R8,R18,R22-R25,R37-R39
RES	K047	47K OHM 1/4W C/FILM RES	1	R28a
RES	K100	100K OHM 1/4W C/FILM RES	2	R16,R30
RES	K820	820K OHM 1/4W C/FILM RES	1	R29
RESW	010W2.5	10R 1/2W C/FILM RES	1	R62
SCRW	4407/8	440 7/8 Nylon Screw	1	PAL BOARD SUPPORT
SLV	RUB	Rubber Sleeving 3/4"	4	C51,C56
SPCR	4401/2	440 1/2" Nylon Spacer	1	PAL BOARD SUPPORT
SW1	2WONOFF	2 Way on - off Switch	1	SWA
TRL	TL081CP	TL081CP	1	IC35

MTX LOADING STAGE 3.

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATIO / COMMENTS
FUSE	CVR5201	20mm Fuse Cover	1	FS1
FUSE	QB3.15A	3.15 AMP 20mm QBF	1	FS1
ICMO	TMS9929	TMS 9929 ANL VDP	1	IC40
ICMO	Z80ACPU	Z80A CPU	1	IC7

ICMO Z80ACTC	Z80A CTC	1	IC6
ICPA 14L4	PAL 14L4-2CN	1	IC4
ICRO 38128A	ROM 168 MSM38128A	1	IC46
ICRO 3864	ROM 88 MSM3864	1	IC45

MTX PAL VIDEO BOARD

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATION / COMMENTS
CAP PF0033	33pf Ceramic Plate Cap	3	C45,C46,C50
CAP PF0039	39pf Ceramic Plate Cap	1	C44
CAPC NF0022	22nf Ceramic Plate Cap	1	MOD 15
CAPE R001016	10uf 16v Radial Cap	2	C42,C62
CAPE R002235	22uf 35v Radial Cap	1	C34
CAPE R004716	47uf 16v Radial Cap	1	C43
CAPE R010025	100uf 25v Radial Cap	2	C41,C63
CAPP NF0100	100nf Polyester Cap	7	C29-C33,C35,C47
CAPT PF05540	5.5-40pf Trimmer Cap	1	CV1
CONL WIRE	Wire link 39/24 SWG	2	LKa,R66
CONP HSILR04	4 Way SIL R/A Header	1	J12
CONS DIL181L	18 Way DIL Socket L/P	1	IC3
CONS DRA2596	6 Way R/A PCB MT Header	1	J11
CONS HSIL05R	5 Way SIL R/A Socket	1	J13
CRXL 4.433619	4.433619 MHz Crystal	1	XTAL3
DODE Z5V1	5V1 Zener Diode	1	ZD4
ICMC 4013B	CD4013BCN CMOS	1	IC1
ICMC 4016B	CD4016BCN CMOS	2	IC2,IC4

ICMO	LM1889	LM1889	1	IC3
IDTA	UH004.7	4.7UH Axial Inductor	1	L1
IDTA	UH022	22UH Axial Inductor	1	L3
IDTA	UH033	33UH Axial Inductor	1	L2
IDTA	UH100	100UH Axial Inductor	1	L4
NUT	440HEXN	440 Nylon Nut	1	PAL BOARD SUPPORT
PCB	PAL	MTX PAL VIDEO Board	1	
RES	220R	220 OHM 1/4W C/FILM RES	1	R56
RES	330R	330 OHM 1/4W C/FILM RES	3	R45,R47,R54
RES	390R	390 OHM 1/4W C/FILM RES	2	R55,R67
RES	430RM	430 OHM 1/4W M/FILM RES	1	RV1
RES	560R	560 OHM 1/4W C/FILM RES	2	R59,R63
RES	K001	1K OHM 1/4W C/FILM RES	4	R41,R51,R52,
RES	K001.5	1K5 OHM 1/4W C/FILM RES	1	R44
RES	K001.8	1K8 OHM 1/4W C/FILM RES	1	R57
RES	K001M	1K OHM 1/4W M/FILM RES	1	R61
RES	K002.2	2K2 OHM 1/4W C/FILM RES	1	R58
RES	K002.7	2K7 OHM 1/4W C/FILM RES	3	R50,R53,R60
RES	K004.7	4K7 OHM 1/4W C/FILM RES	1	R43
RES	K010	10K OHM 1/4W C/FILM RES	2	RV1,R68
RES	K027	27K OHM 1/4W C/FILM RES	1	R48
RES	K120	120K OHM 1/4W C/FILM RES	1	R49
TRL	2N3904	2N3904 Transistor	2	Q1,Q3
TRL	2N3906	2N3906 Transistor	3	Q2,Q5,Q6
WSH	440WASH	440 Nylon Washer	1	PAL BOARD SUPPORT

MTX KEYBOARD

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATI / COMMENTS
CONL WIRE	Wire link 39/24 SWG	29	
CONP HSILR20	20 Way SIL R/A Header	1	
CONS SIL20AS	20 Way SIL KBD Assembly	1	
KBNT PNLMTX	KBDSwitch Mounting Plate	1	
PCB MKB104	KBD 01-04 PCB	1	
SW1 ML-3-CM	ML-3-CM Keyboard Switch	79	

MTX KEY TOPS

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATIO / COMMENTS
KYTP 0011F	0	1	
KYTP 0186F	0 - INS	1	
KYTP 1014F	! - 1	1	
KYTP 1138F	1 - ARROW LEFT	1	
KYTP 2014F	" - 2	1	
KYTP 2136F	2 - HOME	1	
KTYP 3017F	3 - £	1	
KTYP 3173F	3 - ARROW RIGHT	1	
KTYP 4011F	$ - 4	1	
KYTP 4163	4 - TAB	1	
KYTP 5011F	% - 5	1	
KYTP 5165F	5 - ARROW UP	1	

KYTP 6011F	% - 6	1
KYTP 6153F	6 - DEL	1
KYTP 7011F	' - 7	1
KYTP 7163F	7 - PAGE	1
KYTP 8011F	(- 8	1
KYTP 8163F	8 - EOL	1
KYTP 9012F	) - 9	1
KYTP 9163F	9 - BRK	1
KYTP A000F	A	1
KYTP A0033F	ALPHA LOCK	1
KYTP AA127F	. - ARROW DOWN	1
KYTP B000F	B	1
KYTP B033F	BS	1
KTYP BB00F	> - .	1
KYTP BB01F	< - ,	1
KYTP BLANKF	BLANK KEYTOP	2
KYTP C000F	C	1
KYTP C021F	CTRL	1
KYTP D000F	D	1
KYTP DD00F	+ - ;	1
KYTP E000F	E	1
KYTP E020F	ESC	1
KYTP E834F	ENT - CLS	1
KYTP F000F	F	1
KYTP F661F	F1	1
KYTP F662F	F2	1

KYTP F663F	F3	1
KYTP F664F	F4	1
KYTP F665F	F5	1
KYTP F666F	F6	1
KYTP F667F	F7	1
KYTP F668F	F8	1
KYTP FF00F	* - :	1
KYTP G000F	G	1
KYTP GG00F	? - /	1
KYTP H000F	H	1
KYTP HH000F	_	1
KYTP HH05F	= - -	1
KYTP I000F	I	1
KYTP J000F	J	1
KYTP JJ00F	{ - [	1
KYTP JJ03F	} -]	1
KYTP K000F	K	1
KYTP KK00F	~ - ^	1
KYTP KK16F	| - \	1
KYTP L000F	L	1
KYTP L054F	LINEFEED	1
KYTP LL00F	` - @	1
KYTP M000F	M	1
KYTP N000F	N	1
KYTP O000F	O	1
KYTP P000F	P	1

KYTP	Q000F	Q	1
KYTP	R000F	R	1
KYTP	R031F	RET	1
KYTP	S000F	S	1
KYTP	S020F	SHIFT	2
KYTP	SPACBRF	SPACE BAR	1
KYTP	T000F	T	1
KYTP	U000F	U	1
KYTP	V000F	V	1
KYTP	W000F	W	1
KYTP	X000F	X	1
KYTP	Y000F	Y	1
KYTP	Z000F	Z	1
SBK	GT8C	SPACE BAR KIT	1

MTX POWER SUPPLY UNIT

MEMOTECH PART NO.		ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATIO / COMMENTS
CBL	2M	2M Mains Cable UK	1	
CBL	100MM	10cm Mains Lead	1	
CBL	DIN6	6 Pin DIN Plug 1M Cable	1	
NPTE	PSU	PSU 220/240V Label	1	
PSU	CASE	Power Supply Case T & B	1	
RBR	FT	1/2" 3/8" Rubber Feet	4	
SWT	5296	Mains Switch	1	
TSF	220VMTX	220V MTX Transformer	1	
TSR	SPT	Rubber Transformer Support	8	

MTX REAR PLUG ASSEMBLY

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATI(/ COMMENTS
CAP PF0047	47pf Ceramic Plate Cap	1	
CONP EYE4BA	4BA Crimped Eyelets	1	
CONP BNCONT	BNC Chassis MT Socket	1	
CONP H1P1C	Phono Socket Nut Fixing	1	
CONS SIL04AS	4 Way Cable ASSY	1	
FACC W1R.5B	.5mm Black Wire	1	
MLD RPPMTX	MTX Rear Plug Moulding	1	
MLD RS232CV	RS232 Plastic Cover	2	

MTX FINAL ASSEMBLY/PACKING

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCATI(/ COMMENTS
EPLH MTX	Left Hand End Plate	1	
EPRH MTX	Right Hand End Plate	1	
EXTB MTX	Base Section MTX	1	
EXTT MTX	Top Section MTX	1	
FOOT RUBSM	Moulded Rubber Feet MTX	4	
NUT M3HEX	M3 Nut	7	
RBR FT	1/2" 3/8" Rubber Feet	3	
SCRW M38BH	M38 Dome Head Screw	6	
SCRW M310HX	M310 Hex - Head Screw	6	
SCRW M316PH	M316 Pan - Head Screw	1	

BOX	MTX512	MTX 512 Box	1
CONP	JP23.5	23.5 Cable Jack Plug	1
CONP	PNOCAX	Phono to Coax Cable	1
GUAR	512UK	512 UK Guarantee Card	1
MLD	MTXCVR	Plastic Cartridge Cover	1
PPK	MTX512	MTX 512 Polypack	1
STNP	029	MTX Series Manual	1
STNP	078	MTX 512 Serial No. Label	1
STNP	236	MTX Series Brochure	1
NPTE	MTX512	MTX 512 Label	1
NPTE	MTXREAR	Rear ID Label	1

MTX RS232 I/F

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCAT / COMMENTS
CAP PF560	560pf Ceramic Plate Cap	4	C1,C2,C12,C13
CAPE R001016	10uf 16v Radial Cap	2	C3,C4
CAPS NF0047	47nf Sibitat Cap	7	C5-C11
CONL SHUNT02	2 Way Shunt (Jumper)	1	Ja
CONP HSIL13	13 Way SIL Header	1	Jb
CONS EDGE60	30+30 Way Connector Key5	1	J0
CONS DIL14	14 Way DIL Socket	3	IC12-IC14
CONS DIL20	20 Way DIL Socket	1	IC8
CONS DIL40	40 Way DIL Socket	1	IC1
CONS HDIL60	60 Way DIL Header	1	J1
CONS HDIL02	2 Way DIL Header	1	Ja
DODE IN4148	IN4148 Silicon Diode	5	D1-D5
ICLS 004	SN74LS04N	1	IC10
ICLS 020	SN74LS20N	1	IC9
ICLS 241	SN74LS241N	1	IC6
ICLS 244	SN74LS244N	2	IC5,IC7
ICLS 245	SN74LS245N	3	IC2-IC4
PCB RS232	RS232 PCB	1	
RES K001	1KOHM 1/4W C/FILM RES	4	R1-R4
RES NETK001	1KOHM Resistor Network 9*8	1	RN1

RS232 I/F TESTING

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCAT / COMMENTS
IC 75188	SN75188N	1	IC13
IC 75189	SN75189N	2	IC12,IC14
IC Z80DART	Z80A DART	1	IC1
ICPA 14L4	PAL 14L4-2CN	1	IC8

RS232 I/F PACKING

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCAT / COMMENTS
ASSY CBL5WAY	5 Way Cable Assembly	1	
ASSY CBL8WAY	8 Way Cable Assembly	1	
BOX RS232	RS 232 Box	1	
FACC BAG21/4	Mini Grip Poly Bag 2 /14sq	1	
NUT M3HEXH	M3 Hex Head Nut	4	
PPK RS232	RS 232 Poly Pack Pair	1	
SCRW M38DH	M3 8MM Dome Head Screw	4	
STNP 111	RS 232 I/F -02 Book	1	
STNP 208	Serial No. Label	1	
TLS ALLK2MM	2MM Allen Key	1	
WSH M3WSH	M3 Spring Washer	4	

32K MEMORY EXPANSION

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCA / COMMENTS
CAP PF0047	47pf Ceramic Plate Cap	1	C1
CAP PF0068	68pf Ceramic Plate Cap	1	C2
CAPS NF0047	47nf Sibitat Cap	13	C1-C5,C15-C22
CONL WIRE	Wire Link	2	2Lo
CONS EDGE60	30+30 Way Connector	1	J1
CONS DIL16	16 Pin DIL Socket	9	IC15-IC22
ICLS 004	SN74LS04N	1	IC3
ICLS 157	SN74LS157N	2	IC5,IC6
ICLS 244	SN74LS244N	1	IC4
ICPR 6301	6301-1N PROM	1	IC1
ICRA 323732	32K Partial D Rams	8	IC7-IC14
ICS 74S37	SN74S37N	1	IC2
PCB MEMEXT	MTX Memory Expansion PCB	1	
RES 330R	330OHM 1/4W C/FILM RES	1	R1
RES 680R	680OHM 1/4W C/FILM RES	1	R2

32K MEMORY EXPANSION

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCA / COMMENTS
BOX RS232	RS232 Box	1	
FACC BAG21/4	Minigrip Polybag 2 1/4sq	1	
PPK RS232	RS232 Polypack	1	
STNP 164	Memory Expansion Booklet	1	

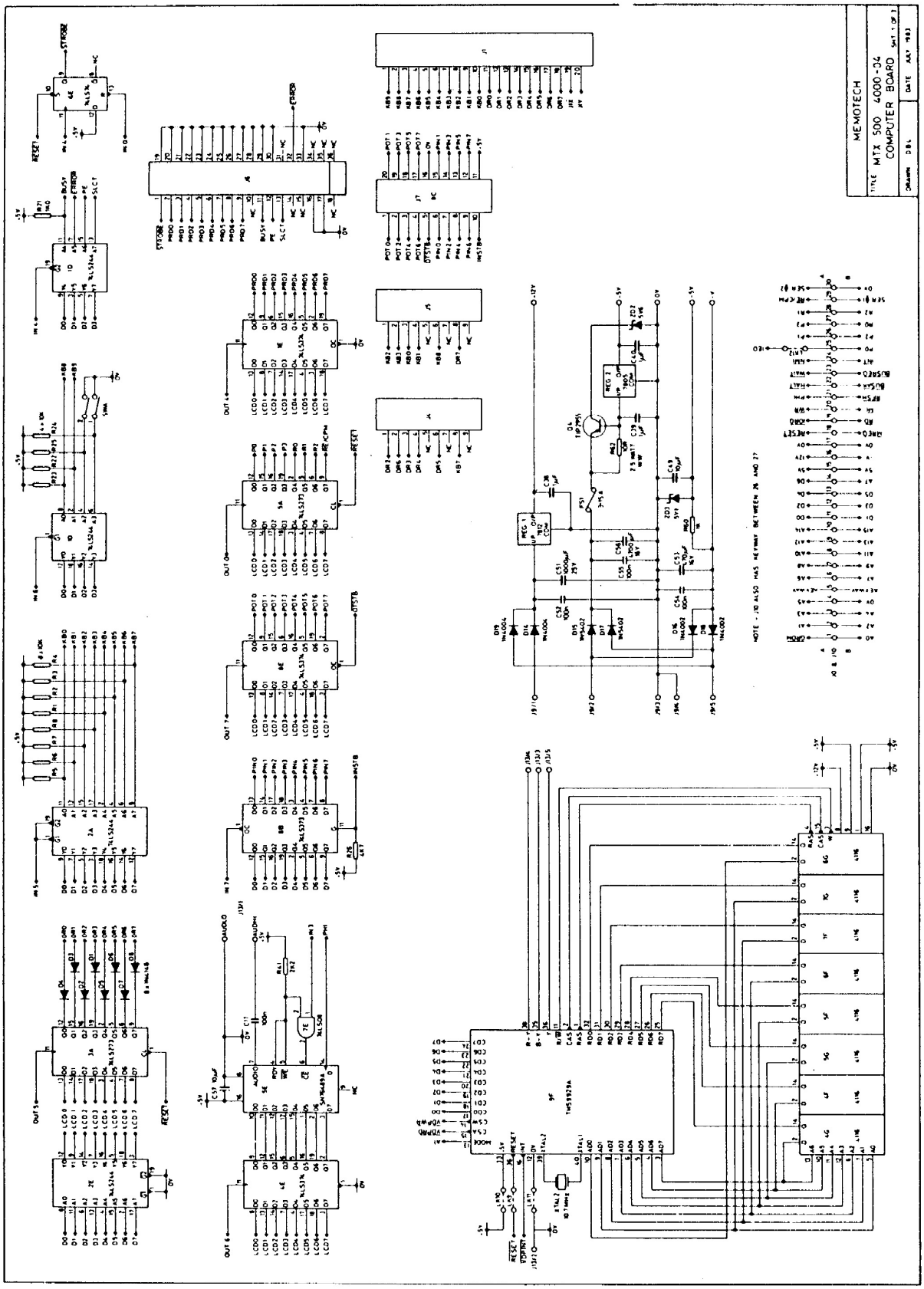
TLS ALLK2MM 2mm Allen Key

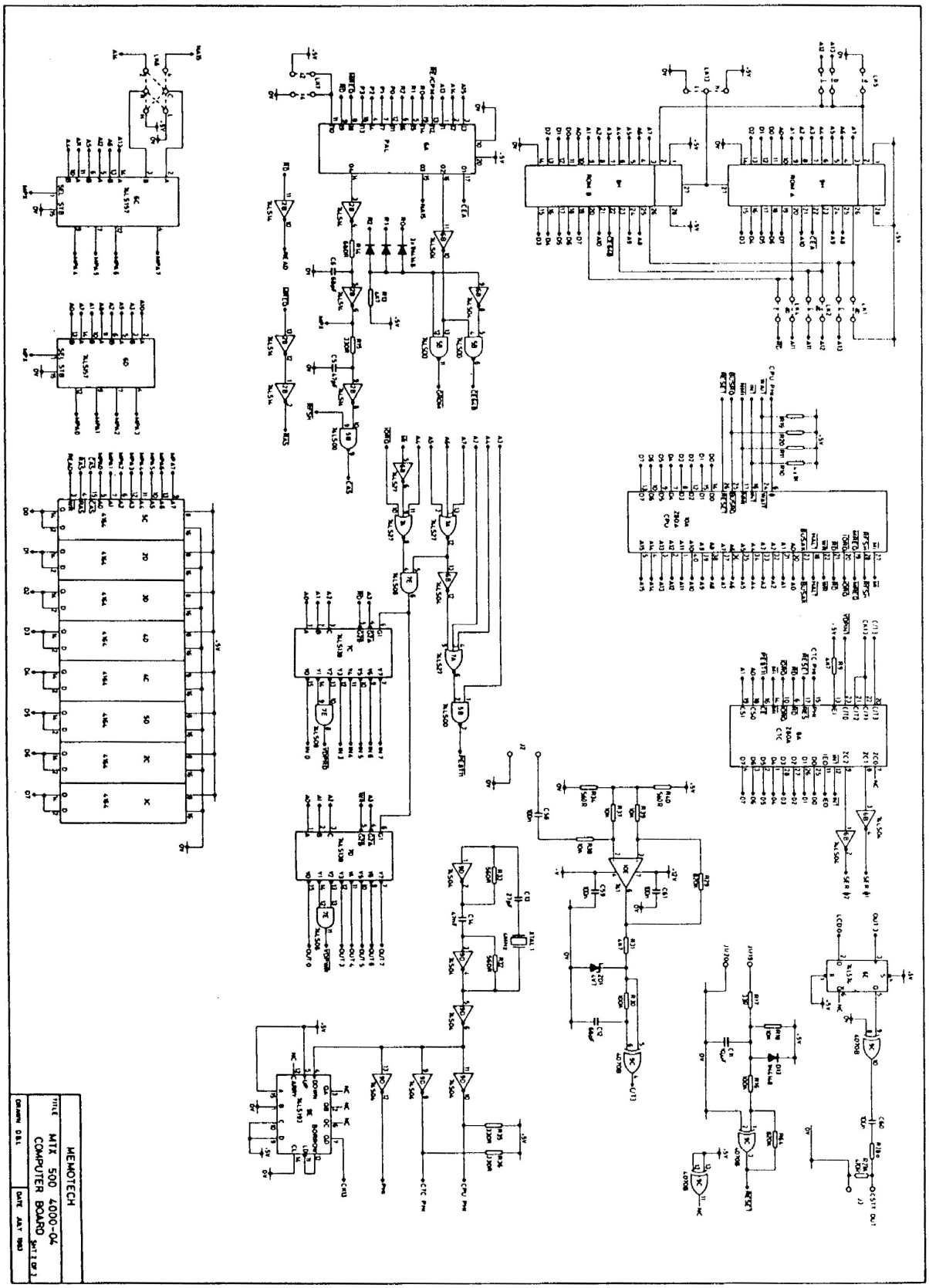
ROM EXPANSION

MEMOTECH PART NO.	ITEM DESCRIPTION	NO./ UNIT	PCB COMPONENT LOCA / COMMENTS
CAPS NF0047	47nf Sibitat Cap	7	C1-C7
CONP HSIL03	3 Way SIL Header	2	LK2,LK3
CONL SHUNT02	2 Way Shunt (Jumper)	2	Lo,Lo
CONL WIRE	Wire Link 39/24 SWG	5	41,51,61,71,16
CONS DIL20	20 Way DIL Socket	1	IC5
CONS DIL28	28 Way DIL Socket	4	IC1-IC4
CONS EDGE60	30+30 Way Connector	1	J0
DODE IN4148	IN4148 Silicon Diode	8	D1-D6,MOD 18
ICLS 004	SN74LS04N	1	IC7
ICLS 273	SN74LS273N	1	IC6
ICPA 14L4-2N	PAL 14L4-2N	1	IC5
PCB ROM0201	PCB ROM EXPANSION 02-01	1	
RES 330R	330 OHM 1/4W C/FILM RES	1	MOD 18
RES K047	47K OHM 1/4W C/FILM RES	1	R1

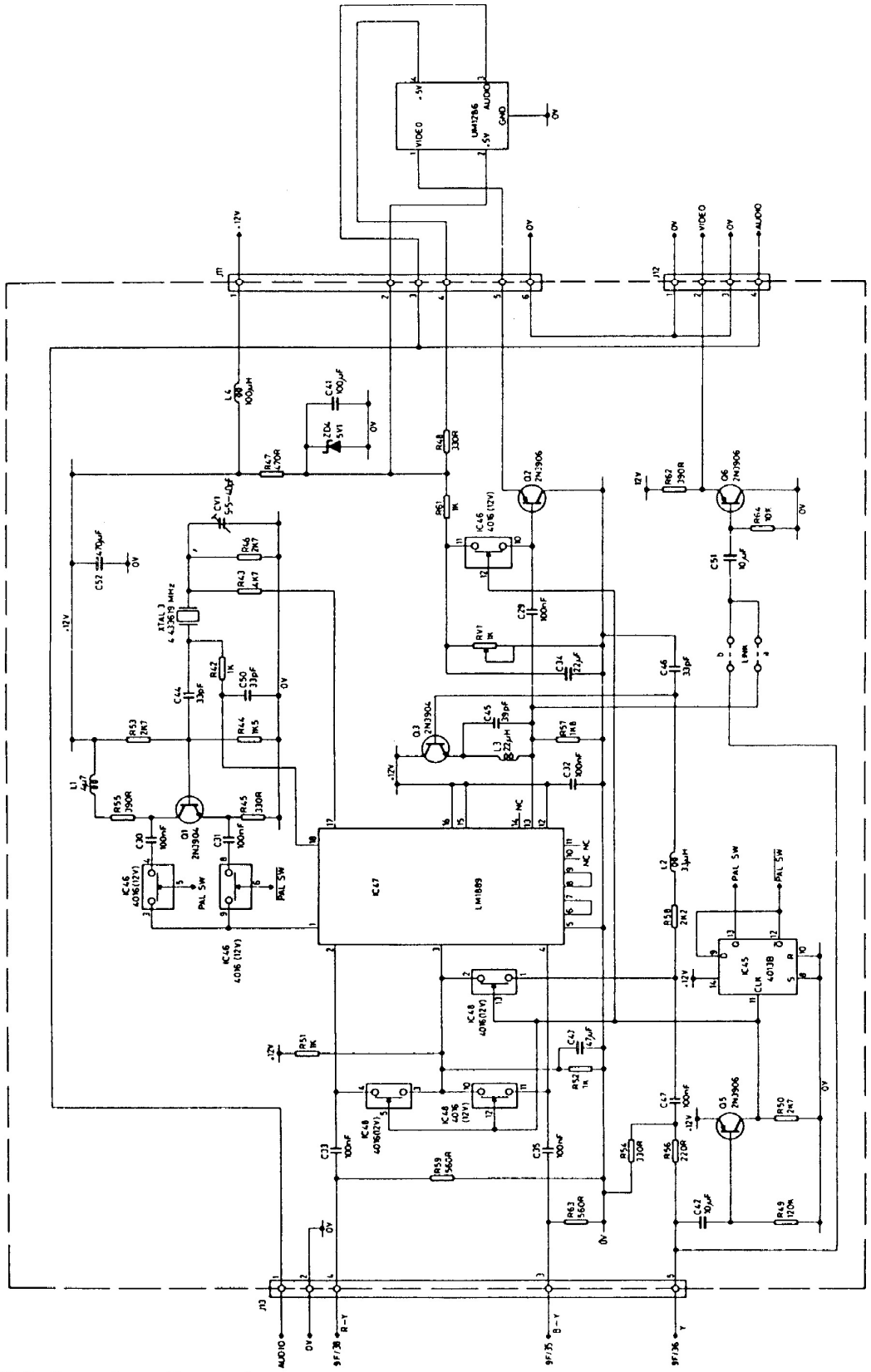
ELECTRONIC CIRCUIT SCHEMATIC

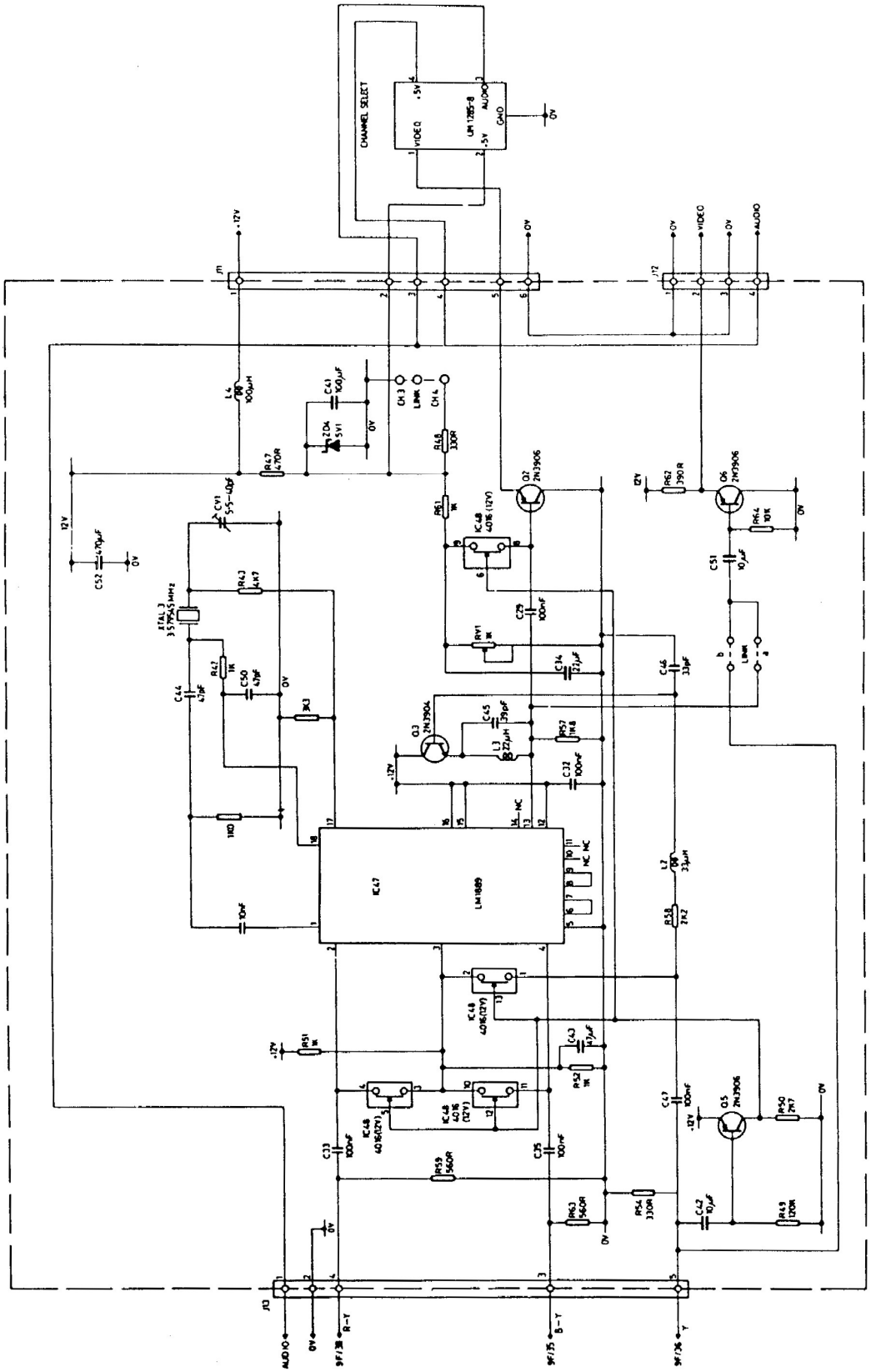
MTX 500 4000–04



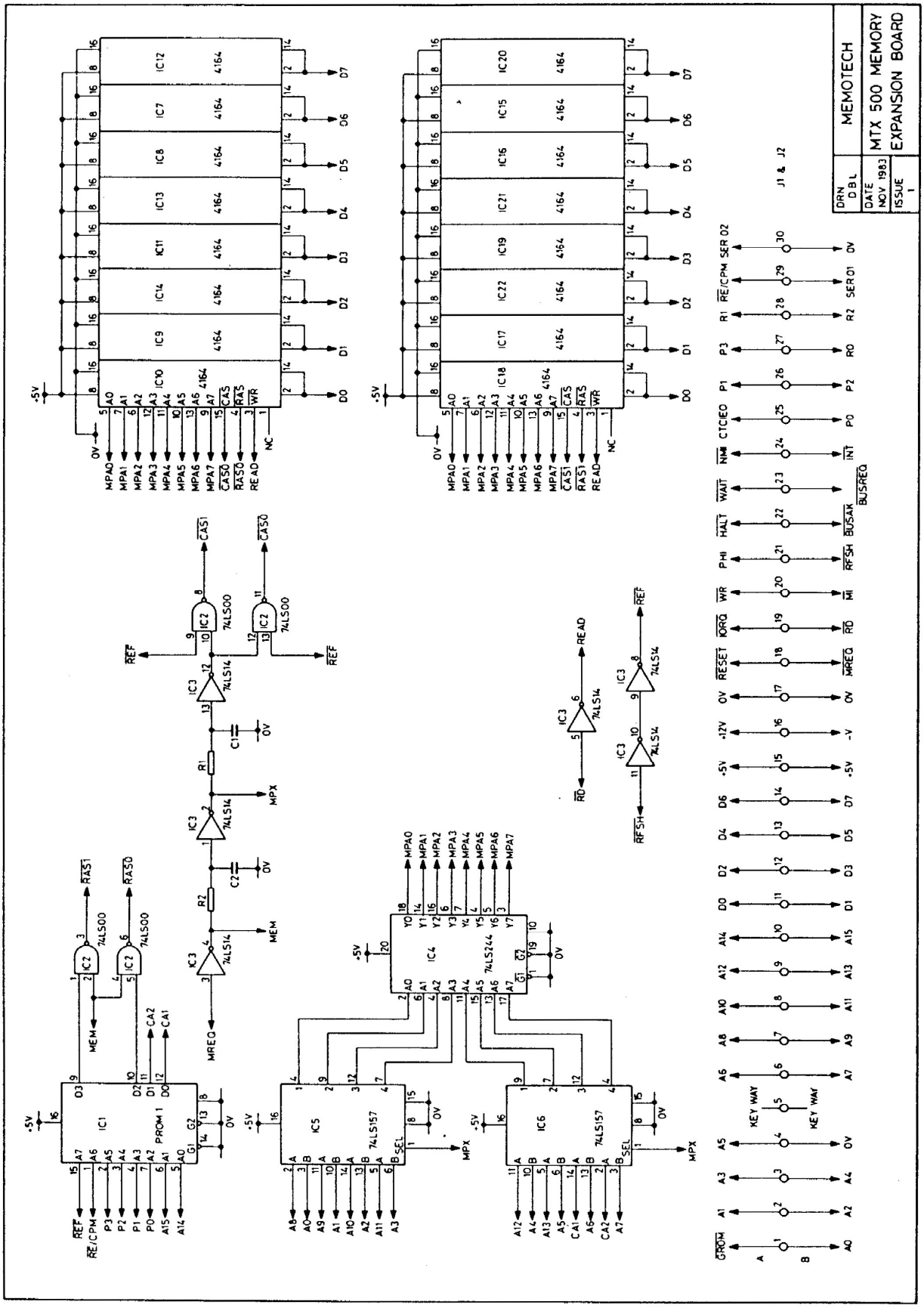

MEMOTECH
TITLE MTX 500 4000-04
COMPUTER BOARD
DRAWN DBL
DATE MAY 1983

PAL BOARD




CHANNEL SELECT
VIDEO
AUDIO
GND
+12V
0V
CH3
CH4
LINK
IC47
LM1889
IC48
4016 (12V)
Q2
2N3906
Q3
2N3904
Q5
2N3906
Q6
2N3906
XTAL3
3.579545MHz
J1
J2
J3
AUDIO
R-Y
B-Y
Y

MEMORY EXPANSION BOARD



RING SYSTEM

The MTX ring uses channel A of the dart. If the ring is installed, the baud command must not be used for either channel as the dart is initialised differently for the ring. Channel B is not used by the ring and is available as a serial I/O port. Node commands are provided to set the baud rate and data format for channel B.

COMMUNICATIONS BOARD CIRCUIT DIAGRAM