Micro Technology Unlimited

6502 PERIPHERALS AND PRODUCTS

CATALOG A3 **Fall 1979**

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NEW PRODUCTS

K-1008-3C PET GRAPHICS SOFTWARE

(Page 19)

Graphics Software for the PET. This software package allows the PET BASIC user to make full use of the Visible Memory for the PET at *machine language speed* without learning any machine language. X and Y coordinates are simply assigned to special variables and an appropriate GOSUB is executed to plot points, draw lines, or display text. The package includes two demonstration programs.

K-1008-5C AIM-65 GRAPHICS SOFTWARE

(Page 20)

Graphics Software for the AIM-65. This package is essentially a combination of the two Visible Memory graphics packages (K-1008-1 and K-1008-2) previously available for the KIM-1. A BASIC interface routine allows easy access to graphics and text functions from AIM-65 BASIC without having to contend with machine language. The assembly language graphic subroutine portion allows easy integration of high speed graphics and text operations into assembly language application programs. Two machine language demonstration programs that will run on a 2K AIM are included.

K-1009-1C AIM-65 GRAPHICS PRINTOUT PROGRAM

(Page 21)

A breakthrough software package that allows full Visible Memory graphics to be printed on the AIM-65 printer! The program simply prints a screen image in either a one-piece "quick print" mode or a two piece "quality" mode. An additional print routine prints full 80 character text lines directly from the AIM-65 text editor text buffer. Memory requirements are modest; only 500 bytes for graphics print and 1500 bytes for text print.

K-1012A-1 12K ROM ONLY BOARD

(Page 22)

Many customers have requested a ROM-only board for incorporation into their own KIM, SYM, or AIM based systems. This board has the same flexible addressing features of our K-1012 board, takes even less power, and uses the same, easy to get 2708 and TMS 2716 PROM's.

MICRO TECHNOLOGY UNLIMITED

Micro Technology Unlimited (MTU) was founded to bring high technology products and technical information to the market in easy to use form. Our present step towards this goal involves the design and sale of products based around the 6502 microprocessor. The price and performance of this processor are excellent while its advanced technical features allow us to build sophisticated products at very competitive prices. Our accessories in combination with any of the several excellent 6502 based systems on the market give computing/teaching power heretofore unavailable to those on restricted budgets. The principals of the company are Howard (Hal) A. Chamberlin and David B. Cox. These men have been cooperating in a synergistic manner for over a decade and have designed microcomputer based systems ever since the first microprocessor was introduced in 1972. The products offered in this catalog were developed with the above goal in mind. In addition to the advanced design concepts, thorough testing, and high performance of hardware and software products, we pride ourselves in detailed, accurate documentation. Our hardware products manuals include an extensive theory of operation section with timing diagrams and complete, easy to read schematic and parts list.

MANUALS — ADDITIONAL INFORMATION

For technical information beyond the product description sheets in this catalog we suggest purchase of the manual for the product in question. Its price will be credited toward purchase of the associated product hardware. Manuals include schematics, parts list and layout, principles of operation, troubleshooting guide, specifications, and a diagnostic program listing. If the manual does not answer a specific question or if you feel that your question is unlikely to be answered by the manual, please contact us. *Our manuals have been classed — BEST IN THE INDUSTRY.*

WARRANTY

All products of MTU are warranted for 6 months from date of shipment from the factory to be free of defective parts and workmanship. Any other damages including but not limited to: misuse, abuse, fire, flood, or other acts of God are not covered by this warranty. Units under warranty requiring repairs are to be returned to the factory postpaid. These will be returned postpaid within 2 weeks from the date of receipt. No statements other than these printed specifications are made or implied. Liability of MTU is limited to repair or replacement of faulty unit(s) and does not extend beyond the purchase of the unit(s).

Out of warranty repairs are available on the same schedule as listed above. Minimum charge for factory repairs is *$20.00* plus parts.

BARE BOARDS

Please note that bare boards are intended only for experienced persons with adequate test equipment. Although the technical documentation is excellent, it is not in the form of kitbuilding instructions. In all cases the availability of a triggered sweep oscilloscope is necessary to bring up a bare board. If after receipt of a bare board you feel that it is beyond your skill level, it may be returned (postpaid) for full credit toward purchase of the assembled and tested version. We offer bare boards as a service for those who cannot afford the assembled and tested units and are capable of performing their own purchasing, assembly, and debug.

DELIVERY

All products are normally available off-the-shelf for one week delivery. Occasionally we may be out of stock on a particular item in which case notification will be sent if delivery is expected to exceed 30 days. The severe shortage of 74LSXX integrated circuits now being experienced by everyone in the industry has caused us problems in obtaining parts.

WARNING

DO NOT PLUG OR UNPLUG *ANY* COMPUTER BOARDS WITH POWER ON. ALWAYS MAKE SURE THAT BOARDS ARE PLUGGED IN SECURELY PRIOR TO TURNING ON THE POWER TO THE SYSTEM. FAILURE TO DO SO WILL USUALLY BLOW CIRCUITS ON THE BOARD.

PET-2001 USE PRODUCTS

The following products require no modification to function on the PET-2001 (OLD) microcomputer from COMMODORE.

PRODUCT NUMBER	DESCRIPTION	MORE INFO ON CATALOG PAGE
K-1002A-2	8 BIT DAC MUSIC BOARD FOR FREQUENCY/MUSIC GENERATION	6
K-1002-3C	4 VOICE ADVANCED MUSIC SOFTWARE FOR THE PET	7
K-1005-P	5 SLOT CARD FILE FOR K-1007-1 AND 4 EXPANSION BOARDS	9
K-1005-3-AP	APPLICATION BACKPLANE FOR CUSTOM CONNECTIONS	9
K-1008A-P	320 X 200 BIT MAP GRAPHICS DISPLAY BOARD W/8K RAM	16
K-1008-3C	ASSEMBLY LANGUAGE GRAPHIC/TEXT S/W WITH BASIC CALLS	19
K-1012A	SYSTEM EXPANSION BOARD WITH PROM, I/O, PROGRAMMER	22
K-1012A-1	SUPER LOW POWER PROM ONLY BOARD	22
K-1016A	16K SUPER LOW POWER RAM MEMORY BOARD	23
K-1020A	PROTOTYPING BOARD WITH VOLTAGE REGULATORS AND MANUAL	24

AIM-65 USE PRODUCTS

The following products require no modification to function on the AIM-65 microcomputer from ROCKWELL.

PRODUCT NUMBER	DESCRIPTION	MORE INFO ON CATALOG PAGE
K-1000-5	AIM-65 POWER SUPPLY FOR EDUCATIONAL/TABLE TOP USE	5
K-1002A	8 BIT DAC MUSIC BOARD FOR FREQUENCY/MUSIC GENERATION	6
K-1005-AIM	5 SLOT CARD FILE FOR AIM-65 AND 5 EXPANSION BOARDS	9
K-1005-3-AP	EXPANSION BACKPLANE FOR CUSTOM CONNECTIONS	9
K-1008A	320 X 200 BIT MAP GRAPHICS DISPLAY BOARD W/8K RAM	15
K-1008-5C	GRAPHIC/TEXT SOFTWARE INTERFACED TO AIM BASIC	20
K-1009-1	GRAPHIC PRINT ROUTINE FOR AIM-65 PRINTER	21
K-1012A	SYSTEM EXPANSION BOARD WITH PROM, I/O, PROGRAMMER	22
K-1012A-1	SUPER LOW POWER PROM ONLY BOARD	22
K-1016A	16K SUPER LOW POWER RAM MEMORY BOARD	23
K-1020A	PROTOTYPING BOARD WITH VOLTAGE REGULATORS AND MANUAL	24

The following product requires minor modifications, which are explained in the manual, to function on the AIM-65.

PRODUCT NUMBER	DESCRIPTION	MORE INFO ON CATALOG PAGE
K-1002-1C	4 VOICE ADVANCED MUSIC SOFTWARE FOR THE KIM-1	7

KIM-1 AND SYM-1 USE PRODUCTS

The following products require no modification to function on the KIM-1 microcomputer from COMMODORE.

PRODUCT NUMBER	DESCRIPTION	MORE INFO ON CATALOG PAGE
K-1000	KIM-1 POWER SUPPLY FOR EDUCATIONAL/TABLE TOP USE	5
K-1002A	8 BIT DAC MUSIC BOARD FOR FREQUENCY/MUSIC GENERATION	6
*K-1002-1C	4 VOICE ADVANCED MUSIC SOFTWARE FOR THE KIM-1	7
**K-1005-K	5 SLOT CARD FILE FOR KIM-1 AND 4 EXPANSION BOARDS	9
K-1005-3-AP	EXPANSION BACKPLANE FOR CUSTOM CONNECTIONS	9
K-1008A	320 X 200 BIT MAP GRAPHICS DISPLAY BOARD W/8K RAM	15
*K-1008-1C	ASSEMBLY LANGUAGE GRAPHIC/TEXT UTILITY SUBROUTINES	17
*K-1008-2C	K-1008-1C WITH PATCHES TO MICROSOFT BASIC + ADDITIONS	18
K-1012A	SYSTEM EXPANSION BOARD WITH PROM, I/O, PROGRAMMER	22
K-1012A-1	SUPER LOW POWER PROM ONLY BOARD	22
K1016A	16K SUPER LOW POWER RAM MEMORY BOARD	23
K-1020A	PROTOTYPING BOARD WITH VOLTAGE REGULATORS AND MANUAL	24

*THESE PRODUCTS REQUIRE SOME MASSAGING TO GET THEM TO WORK WITH THE SYM-1.
**THIS PRODUCT SHOULD BE THE K-1005-S FOR THE SYM-1.

SYSTEM COMPATIBILITY OF MTU PRODUCTS

KIM BUS Systems: All MTU products have been carefully optimized for ease of use with the original KIM-1. The newer SYM-1 (formerly VIM-1) from Synertek and the AIM-65 from Rockwell International both utilize expansion and application connectors that are essentially identical to the corresponding KIM connectors and are generically referred to as the KIM BUS systems. All of our hardware products interface to these systems with no additional effort.

All software packages are written for direct execution on KIM-1 based systems. Since the I/O port addresses and memory arrangement is different in the other KIM BUS systems, the software packages must be patched to run successfully on the SYM or AIM. The high level of documentation supplied with the software packages greatly simplifies this task. Cassettes are written in both standard speed KIM format and HYPERTAPE and are guaranteed to be readable by a standard KIM-1. The current version of the SYM-1, although advertised as being able to read KIM format tapes, is quite sensitive to recorder differences and may not be able to read our KIM cassettes.

PET 2001: We now are supporting the PET computer from Commadore. Our K-1007-1-PET interfaces the PET to the KIM BUS. In particular, the **VISIBLE MEMORY** is now directly interfaced to the **PET.** This interface system allows any one of our bus interface boards to be attached to the PET and if the K-1005 card file is used, up to 4 of our boards may be attached.

OTHER 6502 Systems: Many of our products are useful on other systems which utilize the 6502 microprocessor. Examples are the Apple II and OSI. In particular our K-1002 DAC may be directly connected to parallel input/outputs ports that may be available on the basic system or an I/O expansion. As with alternate KIM-bus systems, software will require a small amount of patching to match I/O and memory addresses.

Products designed for direct bus interface such as the Visible Memory graphic display and other memory boards can also be used if the customer is willing to bring the necessary bus signals out from the processor. Since the KIM bus is essentially the unbuffered 6502 processor bus (except for a couple of TTL inverters), virtually all of the required signals will be available right at the pins of the microprocessor.

6800 Based Systems: The K-1002 DAC board can be used directly on any 6800 based system. Bus interface boards may be connected in a manner similar to the Apple or OSI however the 6800 bus signal, VMA, must be handled. The simplest method is to AND VMA and A15 together and use the result as A15 to the MTU bus interface board. It is important that the Phase 2 clock to our memory boards **not** be ANDed with VMA. Note that all software must be rewritten to run on a 6800 CPU.

The Visible memory requires a 1.0MHz system clock in order to generate correct scanning frequencies and the K-1016 is adjusted for a 1.0MHz system clock. Either board can be adjusted to synchronize to clock frequencies down to 750KHz however the nonstandard scanning frequencies that result when the K-1008 is readjusted will require the use of a high quality video monitor to avoid image waver from 60Hz hum. SWTP 6800 systems, which use an 875KHz clock, can in most cases be upgraded to 1.0MHz speed by replacing the crystal thus gaining a 15% speed improvement as well as compatibility with the Visible Memory.

Systems Using Other Processors: Boards using parallel I/O such as the DAC can connect to the parallel ports of any computer. The software must however be rewritten in the machine language of the host CPU. Since the music software is speed sensitive, its capabilities will be reduced when rewritten for slower microprocessors such as the 8080 or Z-80. Because of the significant differences in the bus operation, MTU bus interface boards are not recommend for use with other processors.

K-1000 SERIES POWER SUPPLIES

The K-1000 series power supplies offer the user the following advantages:

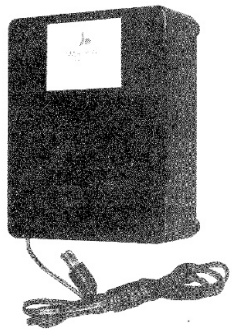
- AC line cord already provided for ready to use operation
- Fused primary circuit for safety and protection
- Barrier terminal strip for DC voltage connections
- Totally enclosed electrical components to prevent shock hazard
- Attractive design and package to help "show off' your project
- Internal current limit and thermal shutdown on hybrid voltage regulators

These models are totally enclosed in black bakelite boxes, 5-5/16" wide by 6-13/16" long by 2-13/16" high overall. The line cord and voltage output terminal strip are mounted to the bottom (top on the -5 model) plate of brushed aluminum which is at DC ground potential. The regulated outputs (except +24V) have both internal current limit and thermal shutdown for failsafe operation.

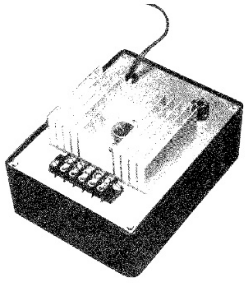
LINE VOLTAGE RANGE All units are tested at full current specifications over an input range of 110 to 125 volts 60Hz AC.

REGULATED VOLTAGES	UNREGULATED VOLTAGES
MODEL K-1000	
+5 volts at 1.2 Amps (KIM-1 maximum specified requirements.)	+8.0 volts nominal, +7.5 to +12 depending on load (sufficient for external "5 Volt chip" voltage regulators). Draw .75 Amps with other outputs fully loaded.
+12 volts at 100 ma (KIM-1 maximum specified requirements.)	+16 volts nominal, +14 to +20 volts depending on load variations. Draw .25 Amps with other outputs fully loaded.
MODEL K-1000-5	
+5 volts at 3 Amps Maximum (no other loads) 2 Amps with all other voltages loaded.	+8.0 volts nominal, +7.5 to +12 depending on load (sufficient for external "5 Volt chip" voltage regulators). Up to .75 Amps
+24 volts at 2.5 Amp max, .5 Amp continuous draw (to power AIM-65 printer).	+16 volts nominal, +14 to +20 volts depending on load variations. Up to .25 Amps

MODEL K-1000



MODEL K-1000-5



DIGITAL TO ANALOG MUSIC HARDWARE
K-1002A

Give your microcomputer a singing voice, in fact, give it 4 voices! The K-1002 music boards are complete audio output systems for microcomputers. They connect to any parallel I/O port for data and require 5 volts only to operate. With 6502 based systems, up to four quality musical tones may be generated simultaneously. Tones are generated using a sampling technique with waveform tables stored in memory..

In operation, a string of 8 bit bytes is sent to the 8 bit digital-to-analog converter section at a rate of 8KHz or greater. The converted output voltage is fed to a sharp cutoff low-pass filter to remove switching spikes and alias distortion thus generating a smooth waveform. The filtered output is then routed to a low power high-fidelity amplifier capable of driving any 4, 8, or 16 ohm speaker.

These systems are capable of audio quality that far surpasses other software based microcomputer music systems. A wide variety of tone colors may be generated by changing waveform tables. Even dynamic waveform changes and amplitude envelopes are possible by rapidly switching among a number of tables. Although software is the key to this level of performance, a microcomputer with 4K of memory available is sufficient to realize virtually the full potential of the technique.

The K-1002 board has been redesigned to mount in the MTU K-1005 card file The K-1002-2 is designed specifically for the PET computer from Commodore. The circuitry has been redesigned from the earlier K-1002 board with an improved low noise filter and operation from a single 5 volt power supply.

MANUALS: Complete hardware schematic, parts list, layout, and an article reprint describing the theory of operation and containing a listing of a 4 part harmony music program. Purchase of the K-1002 series music software package is recommended for ease of use and full realization of the capabilities of the board.

POWER REQUIRED: Regulated +5 volts @ 30MA quiescent, 200MA peak at maximum volume with a 16 ohm speaker load, 300MA peak with at 8 ohms, and 500MA peak with 4 ohms

DIGITAL-TO-ANALOG SECTION: 8 bits guaranteed monotonic, straight binary input code, 0 to +5 volts output, 5K source impedance, uses 5 volt input as a reference after heavy filtering.

LOW PASS FILTER SECTION: 6 poles, 0.5dB Chebyshev response, 3.5kHz cutoff, unity gain.

POWER AMPLIFIER SECTION: 20Hz to 20KHz response ±3dB, load impedance 4 ohms or more, maximum power output is 130MW RMS into 16 ohms, 250MW into 8 ohms, and 400MW into 4 ohms.

K-1002 STANDARD HARDWARE BOARD

PHYSICAL SIZE: The size has been changed to 3" deep by 5.5" wide with 22 position edge fingers (contact spacing of 0.156") on the 5.5" dimension. This allows the board to fit into the K-1005 card files instead of separate mounting outside.

K-1002-2 HARDWARE BOARD FOR THE PET

The K-1002-2 music board is a complete audio output system for the Commodore PET-2001 computer. This board simply plugs into the user port and second cassette port (for power) on the rear of the PET. All signals from both ports are fed through the board to a set of edge fingers on the opposite side making them available for other uses. As a service, the CB2 signal used by many PET games is also routed to the audio amplifier allowing its continued use with the DAC amplifier and speaker. The basic 8K PET memory is sufficient to realize virtually the full potential.

PHYSICAL SIZE: 4.0" Wide by 5.0" Long. Includes two edge connectors, two sets of edge fingers, and phono jack for connection to a speaker.

KIM-1 ADVANCED MUSIC SOFTWARE
K-1002-1

The advanced music software package is a collection of several programs designed to further enhance the educational and musical value of the 6502 processor and K-1002 music board. It is designed to run on the Commodore KIM-1 computer.

Simplified music interpreter: This interpreter is essentially the same as the one described in BYTE Magazine Sept., 1977. Musical "subroutine" (refrains) capability has been added with nesting to over 10 levels depending on stack allocation. This program runs in the basic KIM-1 memory.

Fourier series program: This program accepts a table of up to 16 harmonic amplitudes and phases and computes a 256 point waveform table usable with either the simplified music interpreter or the advanced interpreter. All arithmetic is double precision and the resultant waveform is normalized in amplitude. A package of double precision arithmetic subroutines is part of the program. This program runs in the basic KIM-1 memory.

Advanced music interpreter: This interpreter allows a more compact and flexible song table than the simplified interpreter while retaining 4 voice compatibility. Each musical event requires as little as 1 byte rather than the constant 5 bytes needed by the simplified interpreter. Provisions for separate waveforms for each voice, variations in tempo, changes in timbre, and "musical subroutines" are included. The interpreter resides in 1K memory with an additional 4K recommended for song and waveform storage.

Music complier: This program accepts an ASCII string from the teletype serial port (or other device with user supplied I/O routines) and produces interpretive code in memory for the advanced music interpreter and a printed listing. The compiler requires 2.5K of memory plus storage for interpretive song data.

The K-1002-1L is a set of fully assembled source listings which are heavily commented.

4 VOICE MUSIC SOFTWARE FOR THE PET BY COMMODORE
K-1002-3C

This software program generates 4 voices simultaneously and is designed to run on the Commodore PET computer. It is a completely rewritten version of the K-1002-1 four voice music software package. It allows the user to compose and/or playback songs with up to four part harmony. Each part may have a different tone color (waveform) and a six octave (C_0 to C_6) range is possible. Many of the run-time features of the NOTRAN music compiler interpreter have been incorporated while maintaining compatibility with the original 5 byte per event song table format as proposed by Hal Chamberlin in BYTE magazine, Sept. 1977. A very powerful feature of the system utilizes a separate SEQUENCING TABLE which is used to control dynamic tempo, create or change waveforms, change voice assignments and the number of active voices, perform repeats, and call refrains. A fast Fourier series routine allows new waveform tables to be computed on the fly during natural pauses in the music as short as a fraction of a second.

A special routine in the music interpreter swaps out page 0 data normally used by the PET BASIC monitor and stores it in a save area for later automatic return to page 0.

INCLUSIONS: The software package is supplied on a standard PET cassette and comes with several songs already encoded. A user's manual gives complete instructions for coding song and sequencing tables and includes coding form masters. In addition a complete assembled listing of the music interpreter source code program is available by request for $15.00 and signing of a copyright agreement. The music interpreter will function in the basic 8K PET.

NOTE: This software package was written by Dr. Frank Covitz, an active PET user. We are constantly looking for software of exceptional quality that works with our hardware. Conpensation is arranged on an individual basis.

CARD FILES AND MOTHERBOARDS
K-1005 SERIES

The K-1005 card file system was designed to answer the need for a quality, compact, mechanical support and electrical connection system for the KIM BUS family of microprocessors. The system consists of a card file frame, custom processor board mounting brackets, and two types of connector backplanes.

FRAME:

The card file frame is "U" shaped and is constructed of black anodized aluminum with insulating plastic card guides for mechanical support of the cards. It holds up to five boards inside the frame. The bottom of the "U" has cutouts at the "Expansion" and "Application" positions of KIM, SYM and AIM processor boards. This allows mounting individual connectors or the K-1005 series of motherboards with connectors. The top and bottom edges of the frame are bent in for 1/2 inch and contain holes for mounting to adjacent surfaces. The frame mechanical dimensions are: 11.25 inches wide, 4.75 inches high, and 8.5 inches deep (less motherboards). The frame is designed for cards 11.0" wide and any depth up to 8.5". All direct bus interface cards listed in this catalog meet this specification.

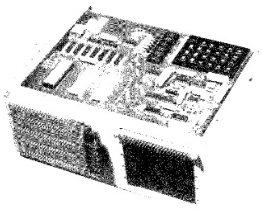
BRACKETS:

The processor brackets are specifically designed to mount their associated processor to the card file. The KIM-1 and Sym-1 brackets mount the processors in the top slot of the card file to allow access to the keyboards. The AIM-65 brackets extend the card file depth and mount the AIM on top of the card file frame by plugging into a motherboard (mandatory) and screw mounting to the two brackets at the back. The AIM keyboard is mounted by the brackets at an 11.5 degree angle (standard typewriter keyboard angle) and is positioned in front of the AIM display, opposite the motherboard side. There are then 5 slots in the AIM card file, 4 serviced by the motherboard.

BUS MOTHERBOARD: K-1005-3-BUS

The bus motherboard is a double sided, plated through, glass epoxy printed circuit board. It is supplied assembled with five connectors which are parallel wired. The signals are bus connected on the "inside" and the outside is covered with ground plane copper to shunt noise. The topmost connector plugs onto the processor EXPANSION CONNECTOR fingers. This socket does not have lines running to all the pins (left out are: 2, 3, 16, 17, 18, 19, 20, X) because MTU boards use some of these pins for power, and the different processors use them for other uses not pertaining to bus operation. There is no buffering on the motherboard, thus, it draws no power. The short bus and proper attention to shielding and grounding allows the full 4 low power Schottky load capability of the processsor-bus to be realized. A five screw terminal strip on the motherboard provides power connections to the processor (+5 and +12 volts regulated) and expansion boards (+7.5 and +16 volts unregulated). The board size is 3.8" high by 5.1" wide by 1.0" deep. The connectors are 0.156 inch contact spacing, 44 pin double sided, gold contact surfaces.

K-1005A-KIM



CARD FILES con't

APPLICATION MOTHERBOARD: K-1005-3-AP

For a system to be flexible for most any desired task, it is necessary to allow customization. This coupled with the need to bring signals outside the computer "box" was the driving force for the development of this motherboard. It fulfills these needs by providing a one piece mounting for 5 application edge connectors and four standard 24 pin dual in line interface sockets. The board uses printed circuit tab connectors and sockets for solder wiring of custom connections. With either version, the printed wiring is ground plane only, no wire interconnects. Thus, 5 boards can mate with the motherboard to interchange signals and 96 signals can be brought to the outside world. The standard 24 pin DIP socket was chosen because of the easy availability of mating ribbon cables with 24 pin plugs.

The edge of the Application Motherboard extends beyond the edge of the card file to allow room for the I/O cables to plug into the I/O sockets. Holes are provided for strapping the I/O cables down to the sockets so they do not pull out. Specialized card files may be constructed using a second Application Motherboard rotated 180 degrees and mounted on the expansion side of the card file. The board is 6.5 inch by 3.8 inch. Five connectors and four 24 pin DIP sockets (mounted on the same side of the PC board) are supplied. Mounting hardware is supplied.

The following preassembled card files are available by ordering the associated number.

CARD FILE NUMBER	CONTAINING
K-1005A-K	**CARD FILE FOR KIM-1** K-1005-1 Frame K-1005-2-KIM Bracket K-1005-3-BUS Bus Motherboard Application connector prewired for memory expansion KIM processor mounting hardware
K-1005A-S	**CARD FILE FOR SYM-1** K-1005-1 Frame K-1005-2-SYM Bracket K-1005-3-BUS Bus Motherboard SYM processor mounting hardware
K-1005A-A	**CARD FILE FOR AIM-65** K-1005-1 Frame K-1005-2-AIM Bracket K-1005-3-BUS Bus Motherboard AIM processor and keyboard mounting hardware
K-1005A-P	**CARD FILE FOR PET-2001** K-1005-1 Frame K-1005-2-KIM Bracket K-1005-3-BUS Bus Motherboard

REDESIGNED

PET INTERFACE TO MTU BUS
K-1007A-1

Now the PET user with an "old" PET can expand the system using a bus structure *DESIGNED* for the 6502 processor rather than kludged up to match 8080 based bus structures. The K-1007A-1 converts the PET expansion port into a buffered bus that is in turn compatible with the 6502 industry standard KIM-1 bus serviced by the MTU K-1005 card file system. The K-1007A-1 includes video processing circuits for use with the K-1008A-P Visible Memory graphic display board.

The K-1007A-1 consists of two printed circuit boards, a small board that plugs onto the PET expansion port on the right side of the cabinet and a larger board connected by a 12" ribbon cable to the first. The small board includes the following connectors; a 7 pin post connector for the PET CRT monitor video cable, a 6 wire video cable to mate with the PET main logic board video connector pins, 3 wires to connect to power, an 80 pin connector for the expansion edge fingers and a 60 pin ribbon cable connector.

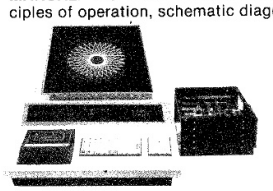
The larger board is connected to the smaller by a 60 wire ribbon cable which may be disconnected at each end. The board contains all the electronic interface components: power supply, sync processor circuitry, video switcher between PET and the Visible Memory, and address combination logic to re-encode the upper 4 address bits into KIM BUS standard form. This board has one 22/44 position connector to accept any single MTU bus interface board and a set of edge fingers which can be used to mate with the K-1005-P card file for up to 4 board expansion (which can be powered by the power supply on the K-1007-1).

POWER SUPPLY: Utilizes PET low voltage AC via 3 wires to provide +8 and +16 volts unregulated to the expansion boards.

VIDEO CIRCUITS: Sync processor controls include horizontal position, vertical position, and height to center the Visible Memory image on the PET screen. The video switch selects PET video after reset or if memory location BFFF is accessed, and selects the Visible Memory image if location BFFE is accessed. Access to PET video and video monitor inputs is via connectors and cables provided.

ADDRESS ENCODER: Encodes PET addresses from 2000 through 7FFF and 9000 through AFFF into a contiguous range from 2000 through 9FFF. PET addresses from B000 through BFFF are translated to F000 through FFFF to take care of the MTU standard I/O page at FE.

MANUAL: The manual contains installation instructions, principles of operation, schematic diagrams, and connector pinouts.



SHOWN WITH:
K-1007-1 INTERFACE
K-1008-P VISIBLE MEMORY
K1005-P 5 SLOT CARD FILE
K-1008-3C DRIVER SOFTWARE

K1007-A

POSTAL AIR MAIL SHIPPING CHARGE COMPUTATION SHEET
AS OF OCTOBER 1, 1979
ALL PRICES IN U.S. DOLLARS

COUNTRY	K-1000	ALL K-1000-5	ALL K-1002	K-1007 K-1005	K-1012 K-1008	K-1016	K-1020	SOFTWARE OR SINGLE MANUAL	BARE BOARD & MANUAL
BELGIUM	10.57	13.51	3.97	8.23	5.89	7.81	4.63	3.06	5.29
CANADA	4.00	5.01	2.75	3.68	3.35	4.23	2.75	3.06	2.75
DENMARK	10.96	14.14	3.78	8.38	5.80	7.84	4.48	3.06	5.20
ENGLAND	10.24	13.18	3.64	7.90	5.56	7.48	4.30	3.06	4.96
FINLAND	11.76	15.22	3.86	8.90	6.04	8.22	4.65	3.06	5.44
FRANCE	11.14	14.08	4.54	8.80	6.46	8.38	5.20	3.06	5.86
ITALY	12.22	16.07	4.32	9.36	6.50	8.68	5.11	3.06	6.56
JAPAN	11.89	15.39	3.89	8.99	6.09	8.29	4.69	3.06	5.49
NETHERLANDS	10.52	13.46	3.92	8.18	5.84	7.76	4.58	3.06	5.24
NORWAY	10.96	14.14	3.76	8.38	5.80	7.84	4.48	3.06	5.20
SWEDEN	10.96	14.14	3.76	8.38	5.80	7.84	4.48	3.06	5.20
SWITZERLAND	10.66	13.64	3.96	8.28	5.90	7.84	4.63	3.06	5.30
WEST GERMANY	10.70	13.80	3.70	8.20	5.70	7.70	4.40	3.06	5.10
ALL OTHERS	11.60	14.23	3.92	8.49	5.94	7.97	4.63	3.06	5.40

UNITED STATES SHIPMENTS WILL BE VIA UPS, NO CHARGE, UNLESS OTHERWISE INSTRUCTED. AIR MAIL OR UPS BLUE WILL CARRY A CHARGE OF $2.00

NOTE:

1. FOR MULTIPLE ITEM SHIPMENTS, ADD THE SHIPPING CHARGES FOR EACH PRODUCT FOR THE TOTAL SHIPPING CHARGE TO PAY.
   EXAMPLE: THREE K-1008A TO SWITZERLAND WOULD BE 3 X $5.90 = $17.70
   ONE K-1000, ONE K-1005, ONE K-1008A SHIPPED TO ITALY WOULD BE $12.22 + $9.36 + $6.50 = $28.08
2. BE SURE TO GIVE FULL AND UNDERSTANDABLE SHIPPING ADDRESS AND **COUNTRY** IF OUTSIDE U.S.A.
3. WE PREFER THAT OUR ORDER FORM BE USED AND FILLED OUT TO INSURE THE PROPER INFORMATION.

ORDER FORM

NAME/COMPANY _____

SHIPPING ADDRESS: _____

CITY: _____ STATE: _____ ZIP: _____

BUYER: _____ PHONE: _____ PURCHASE ORDER #: _____

QUANTITY	MTU PART NUMBER	DESCRIPTION OF PART	PRICE EACH	PRICE TOTAL
		COLUMN TOTAL		
		SHIPPING & HANDLING (INTERNATIONAL OR UPS BLUE)		

Please include payment with order, if not, shipment will be made COD.

MICRO TECHNOLOGY UNLIMITED
OCTOBER 1, 1979 PRICE LIST

PRODUCT	DESCRIPTION	AVAILABILITY	PRICE
K-1000A	KIM-1 POWER SUPPLY ASSEMBLED	STOCK	35.00
K-1000-5A	AIM-65 POWER SUPPLY ASSEMBLED	STOCK	80.00
K-1002A	8 BIT DAC MUSIC BOARD ASSEMBLED W/ MANUAL (FITS K-1005)	STOCK	40.00
K-1002B	8 BIT DAC MUSIC BARE BOARD W/ MANUAL (FITS K-1005)	STOCK	20.00
K-1002M	8 BIT DAC MANUAL	STOCK	6.00
K-1002-1L	KIM-1 ADVANCED MUSIC SOFTWARE SOURCE LISTING	STOCK	15.00
K-1002-1C	K-1002-1L WITH KIM CASSETTE	STOCK	20.00
K-1002-2A	PET 8 BIT DAC MUSIC BOARD ASSEMBLED W/ MANUAL	STOCK	50.00
K-1002-2B	PET 8 BIT DAC MUSIC BARE BOARD W/MANUAL	STOCK	23.00
K-1002-2M	PET 8 BIT DAC MUSIC MANUAL	STOCK	10.00
K-1002-3C	PET ADVANCED MUSIC SOFTWARE CASSETTE W/USER MANUAL ONLY	STOCK	20.00
K-1005A-A	CARD FILE W/MOTHERBOARD AND AIM-65 MOUNT BRACKET	STOCK	95.00
K-1005A-K	CARD FILE W/MOTHERBOARD AND KIM-1 MOUNT BRACKET	STOCK	75.00
K-1005A-P	CARD FILE W/MOTHERBOARD FOR PET-2001	STOCK	75.00
K-1005A-S	CARD FILE W/MOTHERBOARD AND SYM-1 MOUNT BRACKET	STOCK	80.00
K-1005-3-BUS	CARD FILE BUS MOTHERBOARD ONLY	STOCK	38.00
K-1005-3-AP	CARD FILE APPLICATION MOTHERBOARD ONLY	STOCK	29.00
K-1007-1	PET TO MTU BUS INTERFACE	STOCK	99.00
K-1008A	VISIBLE MEMORY ASSEMBLED W/MANUAL	STOCK	240.00
K-1008B	VISIBLE MEMORY BARE BOARD W/MANUAL	STOCK	42.00
K-1008M	VISIBLE MEMORY MANUAL	STOCK	10.00
K-1008A-P	PET VISIBLE MEMORY ASSEMBLED W/MANUAL	STOCK	243.00
K-1008-1L	KIM TEXT/GRAPHICS DISPLAY SOFTWARE LISTING	STOCK	22.00
K-1008-1C	K-1008-1L WITH KIM CASSETTE	STOCK	27.00
K-1008-2L	KIM PATCHES FOR MICROSOFT BASIC W/GRAPHICS AND SDTEXT-LIST	STOCK	22.00
K-1008-2C	K-1008-2L WITH KIM CASSETTE	STOCK	27.00
K-1008-3C	GRAPHIC/TEXT S/W FOR ALL PETS WITH BASIC INTERFACE, W/CASS.	STOCK	20.00
K-1008-5C	GRAPHIC/TEXT S/W FOR AIM-65 WITH BASIC INTERFACE, W/CASS.	NOV. 1	25.00
K-1008-5CS	GRAPHIC/TEXT S/W SOURCE ON AIM-65 CASSETTE	NOV. 1	20.00
K-1009-1C	GRAPHIC PRINT ROUTINE FOR THE AIM-65 PRINTER, W/CASS.	NOV. 1	25.00
K-1012A	PROM-I/O BOARD ASSEMBLED W/MANUAL	STOCK	295.00
K-1012A-1	PROM ONLY BOARD ASSEMBLED W/MANUAL	STOCK	165.00
K-1012B	PROM-I/O BARE BOARD W/MANUAL	STOCK	60.00
K-1012M	PROM-I/O MANUAL	STOCK	10.00
K-1016A	16K MEMORY ASSEMBLED W/MANUAL	STOCK	340.00
K-1016B	16K MEMORY BARE BOARD W/MANUAL	STOCK	60.00
K-1016M	16K MEMORY MANUAL	STOCK	10.00
K-1020A	PROTOTYPING BOARD ASSEMBLED W/MANUAL	STOCK	42.00

MTU APPLICATION NOTES

In order to simplify some of the less common applications of our products we offer application notes. Currently there are three such notes with more being added on a continuing basis. If you have an unusual applicaton that you think may be of interest to other people, ask about it. If we don't yet have a note covering it you may convince us to write one. Conversely, we will consider selling well written, application oriented literature written by customers.

AN-1 Battery power for the KIM-1. Describes how the K-1000 power supply in conjunction with a standard 12 volt storage battery can be used to power a KIM-1.

AN-2 Using the Visible Memory for Grey Scale and Color. Describes how two or more Visible Memory boards may be synchronized together and their outputs combined to provide a grey scale or color video display with full 320 by 200 resolution.

AN-3 Operation of the Visible Memory on 50Hz Power. Describes several ways to successfully operate the Visible Memory in areas where primary power is 50Hz.

K-1008 8K MEMORY/RASTER GRAPHIC DISPLAY GENERATOR

The MTU Visible Memory is a unique concept in microcomputer memory systems. The board is an 8K memory add-on to KIM-bus systems which includes the circuitry to simultaneously display the memory contents as 64,000 dots on a TV monitor. Unlike many other add-on memory boards, this one is designed for the KIM-bus and is merely connected in parallel with the expansion connector. The processor continues to run at full speed with no wait states, no software overhead or CPU time required to refresh the display. There is no snow or other visible interference on the screen when the display memory is being accessed by the processor (or any other time). Logic on the Visible Memory automatically refreshes the display.

The basic display format is 200 lines of 320 dots per line. This format coupled with the K-1008-1 software package makes the Visible Memory an exceptionally versatile mixed text and graphics display. The high resolution graphics capabilities make interaction possible with a degree of realism never before available on a microcomputer.

Extensive use of "LS" IC's and 4K dynamic memory IC's is responsible for the low power consumption and small size of the board. Problems experienced with dynamic memory in other systems are absent in this board due to the superior bus control architecture of the 6502 processor and MTU advanced circuit design. The circuitry that generates the display pattern also refreshes the memory automatically as it scans.

The memory address can be jumper selected at any 8K boundary with the 8K memory block contiguous from the selected address. An extra jumper selectively disables the top or bottom half of the display thus allowing 4K to be used for program storage without showing up as a random pattern on the screen. The "Decode Enable" and "K7" signals needed for the KIM-1 to expand beyond 4K memory are generated by the board and need simply be connected to the proper pins of the KIM application connector. These signals are not used on the SYM and AIM processors. Up to four Visible Memory boards may be connected directly to an unbuffered KIM-bus.

Manual: Complete hardware schematics, principles of operation, timing diagram, programming instructions, and troubleshooting guide.

Sockets: All memory chips and decode enable IC.

Display Format: 200 lines, 320 dots per line, non-interlace.

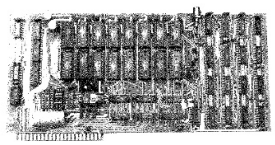
Scanning Frequencies: (derived from 1 MHz processor clock) Horizontal: 15,625 Hz, Vertical: 60.1 Hz. Required video bandwidth: 4 MHz. For 50 Hz operation, request MTU APPLICATION NOTE 3.

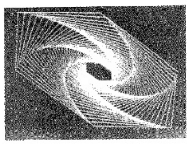
Output: 1.25 V p-p composite video into 75 ohms, sync negative.

Adjustments: dot sync (prealigned on assembled units).

Power Requirements: unregulated + 7.5V @ .25 amp, + 16V @ .25 amp. (– 5V for the memory chips is generated on board).

Size: 5" high by 11" wide exclusive of edge fingers.

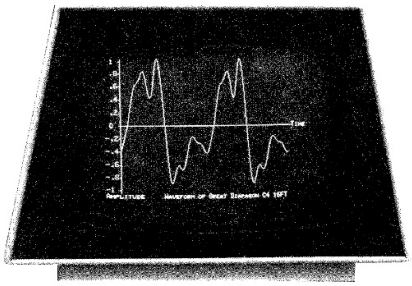




VISIBLE MEMORY FOR THE PET
--320 x 200 DOT MATRIX--
K-1008-PET

Have you ever wanted to work with **real** graphics like high resolution mathematical plots or three dimensional line drawings in perspective or arbitrary character sets on your PET? And of course you would like to display these graphics directly on the PET display screen. We now have available a modified version of our K-1008 Visable Memory which brings out the separate sync and video signals required by the PET video monitor. Easy connection to the PET's expansion connector is provided by the K-1007-1 bus adapter which converts the PET bus into a KIM bus.

All of the capability of the Visible memory is retained. The display format is 320 dots across and 200 dots high. This resolution is in fact identical to that of the PET character display but with the K-1008-PET you can control the on/off state of each of the 64,000 dots individually and independently. Unlike the PET screen, there is no snow or other visible interference when the K-1008-PET image is being updated. When not being used for graphics, the 8K of memory is available for use by PET BASIC which more than doubles the size of BASIC programs that can be run. For additional details about the K-1008-PET, see the K-1008 description elsewhere in this catalog.



KIM-1 TEXT/GRAPHICS DISPLAY SOFTWARE
K-1008-1

The display software package for the K-1008 Visible Memory is designed to provide the user with a library of utility display oriented subroutines written in assembly language. By incorporating calls to these routines, the user can create and manipulate text and graphic images whose complexity is limited only by the 320 by 200 display matrix size. Most routines operate on X and Y coordinate arguments stored in page 0. In addition to the subroutine library, two demonstration programs are provided.

SUMMARY OF MAJOR SUBROUTINES

Set pixel, clear pixel, flip pixel, write accumulator contents to pixel address, load pixel address contents to accumulator. Pixel location is at X1:Y1 coordinates.

DRAW/ERASE: Draw white lines or erase (draws black lines) between X1:Y1 and X2:Y2 coordinates.

PIXADR: Load to the accumulator the pixel address and bit address of the pixel at X1:Y1 coordinate. (500 bytes for all graphic routines.)

DCHAR: Displays a character whose upper left corner is at X1:Y1 coordinate. Character code is full ASCII and matrix is 5x7 with lower case descenders making it effectively 5x9.

DTEXT: Accepts ASCII characters and formats them into text. Interprets ASCII control codes, CR, LF, BS, DC1-DC4 (cursor movement), and SI/SO (baseline shift for sub/superscript). Text starts at X1-Y1 coordinates which are updated following each call. Underline cursor at current location is provided. The font is a 5x9 matrix in a 6x11 field providing 18 lines of 53 characters, with sub/superscript operation allowed on the full character set. (2500 bytes with all features, includes DCHAR.)

SDTEXT: Simplified version of DTEXT. Interprets CR, LF, BS, FF, Underline cursor provided. Uses a less sophisticated method of addressing. The font is a 5x7 matrix in a 6x9 field providing 22 lines of 53 characters. This subroutine requires less program memory that DTEXT. (1200 bytes with lower case, 1000 bytes without.)

The subroutine documentation package is supplied assembled at location 5B00 (SDTXT) and 5500 (GRAPHICS and DTEXT). The subroutines on cassette are assembled at the same location. The casette contains the subroutines encoded in HYPERTAPE **and** in standard KIM-1 format.

SUMMARY OF DEMONSTRATION PROGRAMS
(Run in standard 1K byte KIM-1 memory)

LIFE: Implements the game of Life in the full 320 by 200 matrix. The KIM keyboard may be used to set the initial colony pattern and control the evolution of the generations.

SWIRL: Produces and infinite variety of patterns under the control of two parameters. Uses a simple difference equation algorithm.

The demonstration programs reside in the standard KIM RAM and assume that the Visible Memory starts at 2000.

MICROSOFT BASIC PATCHES
K-1008-2

Maximum utiliztion of a pixel (bit mapped) graphics display board like the K-1008 is enhanced by the use of a high level language such as BASIC. The K-1008-2 software package contains the text and graphic assembly level routines of the K-1008-1 software and in addition, contains patches to the cassette version of Microsoft BASIC as sold by Johnson Computer for the Commadore KIM-1 computer. The enhanced keyboard routines included allow full control of BASIC program execution. The package is complete and uses the Visible Memory both for textual communication with BASIC and as a graphics display device. The user need only have a Visible memory, sufficient additional memory (12K minimum) to hold BASIC and this package, and a keyboard to form an extremely powerful microprocessor graphic system.

The display is addressed in terms of X and Y coordinates. X can vary from 0 to 319 and Y can vary from 0 to 199. Four graphic variables called X1%, Y1%, X2% and Y2% are set up at the beginning of the program using a special BASIC statement. A point may then be plotted anywhere on the screen by assigning the desired coordinates to X1% and Y1% and executing the statement "Z = USR(1)". A line may be plotted from X1%, Y1% to X2%,Y2% merely by assigning coordinates and executing "Z = USR(2)". Other plotting functions available are erase point, erase line, clear screen, read the state of a point, and set, move, and clear the text cursor. The latter text control functions allow text printed by BASIC PRINT statements to be placed wherever desired for axis labeling, etc.

The text display routine is a slightly modified version of SDTXT from the K-1008-1 software package, It displays full upper and lower case (using small caps for lower case) in a 5x7 matrix and gives a screen capacity of 22 lines and 53 characters each. The point and line plotting routines are identical to the K-1008-1 software package. All coordinates and cursor locations are verified and corrected if necessary thus giving fail-safe entry and execution of commands. Plotting and character generation speed is such that less than 10% of the execution time of a typical program is spent creating the display.

In addition to display handling routines, two keyboard routines are provided. These are greatly enhanced routines that allow full user control of program execution and text printing. They also allow effective use of upper and lower case keyboards with BASIC which normally cannot handle lower case letters. One keyboard routine allows the use of a very inexpensive unencoded keyboard while the other supports an ASCII encoded upper and lower case keyboard. In addition, an instructive BASIC demonstration program is included.

REQUIRED HARDWARE: Standard KIM-1, a K-1008A Visible Memory board, a K-1016A or equivalent 16K memory board, a keyboard, power supply, a CRT composite video monitor, and connection between the KIM-1, K-1008A and K-1016A boards (suggest K-1005 card file).

REQUIRED SOFTWARE: Microsoft 9 Digit BASIC assembled at location 2000. This is available from Johnson Computer, /Box 523, Medina, OH 44256.

MEMORY REQUIREMENTS: Microsoft BASIC uses locations 2000-4260. The K-1008-2 text and graphics routines use locations 4261-49D7. The keyboard routines use locations 0200-03E1 for the unencoded keyboard and 0200-02BC for the ASCII encoded keyboard. Page zero locations E3-FF are used by graphics and text routines.

INCLUSIONS: Cassette tape containing the graphics, two keyboard routines, and the BASIC demonstration program. A user's manual with full explanation and a reprint of the KILOBAUD magazine article by Hal Chamberlin explaining the low cost matrix encoded keyboard.

NEW PRODUCT

PET GRAPHICS/TEXT SOFTWARE
K-1008-3C

Maximum utilization of a pixel (bit mapped) graphics display board like the K-1008 is enhanced by the use of a high level language such as BASIC. The K-1008-3C software package contains the text and graphic assembly language routines of the K-1008-1 software and in addition, contains an interface to PET BASIC. The user need only have a K-1008A-P Visible Memory, K-1007A-1 PET interface, and A standard 8K PET to have a powerful graphic computer system.

The graphic subroutines are callable from BASIC as GOSUB statements preceded by variable quantities input. For instance, to plot a line, the user would enter the following statements in the program:

```
GM% = 1    (0 = FLIP, 1 = ON, 2 = OFF)
X1 = A     (where A,B is the coordinates of the beginning
Y1 = B     endpoint and C,D is the coordinates of the ending
X2 = C     endpoint)
Y2 = D
GOSUB 106
```

Other plotting functions available are set, clear, or flip points and lines, clear screen, display PET video or graphic video, read the state of a point, move or turn on/off the text cursor and place a character string at the present cursor position. The latter text control functions allow text to be placed wherever desired for axis labelling, etc.

The text display routine displays upper case in a 5X7 matrix and gives a screen capacity of 22 lines of 53 characters each. Failsafe operation from invalid X and Y values can be accomplished by the user either through BASIC checking or modification of the assembly language program (both given in the manual). Plotting and character generation speed is such that less than 10% of the execution time of a typical program is spent creating the display.

REQUIRED HARDWARE: Standard 8K PET, a K-1008A-P Visible Memory board and a K-1007A-1 PET interface board.

MEMORY REQUIREMENTS: The graphics routines alone require 1K byte of memory and when the text routines are also used, 2K is required. A relocation program is supplied to load the machine language routines anywhere desired.

INCLUSIONS: Users manual and cassette tape containing the graphics and text routines, two demonstration programs and the configuration program.

NEW PRODUCT

AIM-65 GRAPHICS/TEXT SOFTWARE
K-1008-5C, K-1008-5CS

This software package is a combination of the K-1008-1C and K-1008-2C packages but especially configured for the AIM-65 microcomputer. When used with a Visible Memory and our unique graphics printout program (see next page), the AIM becomes one of the most capable graphics processors available.

The BASIC interface portion of the package offers the AIM-65 user the same features as the K-1008-2C package offers the KIM-1 Microsoft BASIC user. Simple commands are used to establish X and Y coordinates and to specify the plotting function to be performed. Text output from BASIC will appear on the Visible Memory screen as well and direct cursor positioning commands allow text to be placed anywhere for convenient labelling of graphs. The graphics and text software requires 2.5K of RAM which means that a 4K AIM has about 1K available for the BASIC program. Addition of a K-1016 multiplies this by 17 thus allowing very sophisticated graphics software to be written.

The assembly language portion of the package is similar to the K-1008-1C package and includes SWIRL, LIFE, SDTXT, DTEXT, and a package of graphics routines. The SWIRL and LIFE demonstration programs require a 2K minimum AIM to run while the subroutine package is supplied assembled into the upper 3K of a 4K AIM.

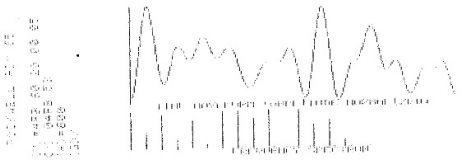
The K-1008-5CS is a cassette containing the assembly language source statements of SDTXT, DTEXT, and the graphics subroutines. The cassette is written in a format acceptable to the AIM-65 assembler and thus allows the assembly language programmer to easily incorporate the software into application programs.

REQUIRED HARDWARE: AIM-65 with 4K, K-1000-5 power supply, K-1008A Visible Memory board, and a K-1005-A card file. Also BASIC ROM if BASIC interface is used and assembler ROM if the K-1008-5CS is purchased.

MEMORY REQUIREMENTS: BASIC interface — 2.5K, machine language demo programs — 2K, SDTXT — 1.2K, DTEXT — 2.5K, graphics subroutines — 1K.

INCLUSIONS: K-1008-5C — Cassette tape containing BASIC interface, BASIC demo program, SWIRL and LIFE machine language demo programs, DTEXT, SDTXT, and graphics subroutines object code. Also a user's manual with full explanation of the commands and source listings of all software.

K-1008-5CS — Cassette tape containing AIM-65 format source for SDTXT, DTEXT, and the graphics routines.



NEW PRODUCT

TEXT/GRAPHICS PRINTOUT PROGRAM FOR THE AIM-65
K-1009-1C

The most unique feature of the Rockwell AIM-65 microcomputer is its built-in printer. The most unique feature of the AIM-65 printer is that it is software controlled and therefore capable of any print format desired. With this breakthrough software package the AIM-65 user can now print high resolution graphics images and 80 character lines of text with **NO** modification to the AIM or its printer. If you don't believe us just look at the unretouched print samples below!

SCREEN PRINT ROUTINE. This program will print an exact image of the Visible Memory graphics display screen as a 320 wide by 200 high dot matrix on the AIM-65 printer. The user need only load the page number of the Visible Memory into the accumulator and then jump to the screen print program for a fast, accurate printout. The program operates either in a "quick print" mode in which the entire 320 x 200 image is printed in one piece or in a "quality" mode in which the image is printed as two strips of 320 x 100 which can be taped together for a complete, properly proportioned image. The K-1008-5C software package is recommended for creating the graphics image which may also contain text. Any contiguous 8K block of memory may be used to hold the image although we suggest a Visible Memory for previewing the image on a video monitor.

TEXT PRINT ROUTINE. This program will print the contents of the AIM-65 Text Editor text buffer as full 80 character lines. The text is printed sideways as strips of 10 lines each thus making program listings very easy to read and even allowing word processing to be done on the AIM. The full 96 character ASCII font with lower case descenders is supported.

REQUIRED HARDWARE: To perform screen print — AIM-65 with 2K, K-1000-5 power supply, a K-1008 or other 8K of contiguous memory to hold the image. To perform text print — AIM-65 with 2K or more, K-1000-5 power supply.

MEMORY REQUIREMENTS: Screen Print — 500 bytes, Text Print — 1.5K bytes.

INCLUSIONS: Cassette tape containing Screen Print and Text Print programs, and user's manual containing use instructions, theory of operation, and assembled source listings of the software. **IMPORTANT:** This breakthrough software package is a tremendous enhancement to the AIM-65 and is considered proprietary. A license must be obtained to use the package in systems intended for resale. Please contact us regarding license arrangements.

K-1012 PROM-I/O-PROM PROGRAMMER SYSTEM BOARD

This system oriented expansion board converts the KIM BUS processors into powerful yet easy to use turn-key systems. The board handles up to 12/24 Kbytes of 2708/2716 PROM (Multivoltage type), four 8 bit parallel ports, a UART controlled serial port and—a 2708/2716 PROM programmer. Each of the 12 PROM sockets may be individually jumpered for 2708 or 2716 operation for any mix of the two types. The 12/24 Kbytes of industry standard PROM capacity is sufficient to hold MICROSOFT BASIC in addition to input/output routines (such as text/graphics routines for the Visible Memory video display), or other application programs as desired. Four 8 bit parallel input/output ports with full handshaking and interrupt capability as well as a UART controlled serial port open I/O bottlenecks in expanded systems. This board may be connected directly to a KIM BUS system (1 "LS" TTL load on the bus); no modification of any kind and no external interface circuitry is required. Special signals required by the KIM-1 when memory is expanded beyond 4K (Decode Enable and K7) are generated onboard.

Although standard and available 2708 and 2716 (multivoltage type) PROM's are utilized, the K-1012 continues the MTU tradition of low power consumption and operation from standard KIM-1 power supply voltages. Because the PROM's require -5 volts, it is supplied onboard by a high efficiency inverter circuit. A unique power down circuit for each PROM disconnects its power when not accessed for longer than one microsecond. Because only one PROM can be accessed at a time, the total power consumption for twelve PROMs is scarcely more than that for one.

Parallel input/output is expanded to an additional 32 ports through the use of two 6520 PIA circuits. Each of the 32 ports is individually programmable as input or output. In addition, 4 pairs of handshaking control lines are available for positive verification of data transfer to and from external devices or additional I/O functions. Also 4 independently maskable interrupts, each associated with 8 I/O lines and one pair of handshaking lines, are included. This interrupt capability is fully compatible with the KIM-1 monitor or may be disabled with jumpers.

Serial input/output is provided by a type 6850 Asynchronous Communications Interface Adapter. True RS-232 with proper positive and negative output voltages is the interface method with all of the important modem control signals provided. Full maskable interrupt operation for transmitted data, received data, and modem control is provided. Standard baud rates from 75 to 4800 may be selected by plugable jumpers or user supplied dipswitch.

A PROM programmer with jumpers for 2708 or 2716 operation is provided as a standard feature. This socket in conjunction with two of the parallel ports (connections onboard) provided programming and verification functions. The parallel ports may be used for I/O when not actually programming a PROM. Again following MTU tradition, an on-board inverter supplies the +26 volts needed for PROM programming.

Power Requirement: (with all PROM sockets full) unregulated +7.5 volts .35 amp, +16 volts .25 amp typical, .35 amp peak during programming

Addressing: 8K of PROM must be contiguous on an 8K address boundary, remaining 4K may be scattered in a second 8K block. I/O requires 16 contiguous addresses in the next to last page of any 4k block. Sockets provided for address jumpers.

Buffering: Maximum of 1 LS TTL load on address and data bus.

Manual: Contains detailed principles of operation, complete schematic, parts list and layout and loopback diagnostic and PROM programmer program listing. PROM's are not included.

NEW PRODUCT

THE K-1012A-1 VERSION HAS ALL THE FEATURES ABOVE BUT WITHOUT THE I/O AND PROM PROGRAMMER OPERATIONS. IT GIVES THE USER A SUPER LOW POWER FIRMWARE SYSTEM.

K-1016 16K BYTE MEMORY BOARD

This 16K byte memory board may be connected directly to any KIM-bus processor with no modifications and no additional external interface circuitry. The K-1016 is connected in parallel with the expansion connector containing the KIM-bus signals. Special signals required by the KIM-1 when memory is expanded beyond 4K (Decode Enable and K7) are generated by the K-1016 memory board. These are available at otherwise unused expansion connector pins and are simply wired to the corresponding pins on the KIM's application connector.

The memory uses standard 22 pin dynamic memory IC's for low power operation. The refreshing is totally transparent and performed by logic on the board. Refreshing is done during Phase 1 when the processor is setting up for the next memory cycle which means that no wait states or processor overhead is required. Memory timing is precisely generated and synchronized to the 1.0mHz processor clock by means of a phase-locked loop frequency multiplier and countdown state generator.

The power consumption of the board is less than 1/5 that of typical 8K memory boards for the KIM. On-board regulators allow operation from unregulated +8 and +16 volt sources or with a simple jumper change regulated +5 and +12 volt sources. Since the memory chips require −5 volts, it is generated on-board to allow use of standard KIM power supplies which do not generate this voltage.

Access Time: The data is stable greater than 100 nanoseconds prior to fall of system phase 2 clock which latches the data bus.

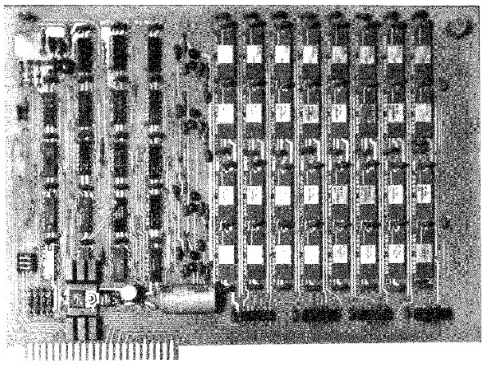
Cycle Time: Internally synchronized to 1 mHz system Phase 2 clock as used in 6502 and 6800 systems.

Buffering: Maximum of 1 LS TTL load on address and data bus.

Power requirement: unregulated +7.5V 0.2 amp, +16V 75 milliamp standby, 200 milliamp maximum with 100% access (−5V required for the memory IC's is generated onboard).

Addressing: The 16K bytes must be contiguous but may start at any 4K boundary. A socket is provided for jumpers or user supplied dip switch for address selection.

Size: 7½" high by 11" wide exclusive of edge fingers.



K-1020 PROTOTYPING BOARD

As many of our customers have requested, we now offer a prototyping board for KIM-bus systems. It is assembled with on-board +5 Volt and +12 Volt regulators and mounts in the K-1005 card file. Both Expansion and Application edge fingers are provided with gold plating and pads for wire-wrap post or direct wiring. The board has power bussing on both sides, all holes are plated through and it is constructed of standard glass epoxy material.

A universal hole pattern covers part of the board which allows 8, 14, 16, 18, 20, 22, 24, 28, 40 and even 64 pin IC's to be used. The maximum capacity is seventy-five 14 and 16 pin dips or up to sixteen 40 pin dips with space left for 14 smaller dips.

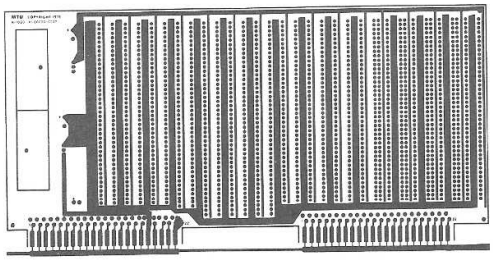
A heavy ground plane occupies most of the bottom side of the board while separate power planes for +5V and +12V intermesh on the top side. Bypass and input filter capacitors for the regulators are provided.

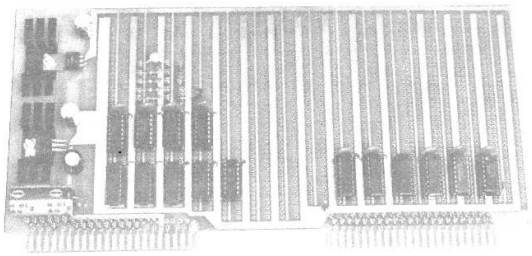
Size: 5" high by 11" wide exclusive of edge fingers.

Regulators: +5 volts 1.2 Amp, volts .250 Amp.

Manual: The manual for this product is designed to allow the user to fully document the circuit which has been built on this board for future reference. The manual is bound and includes: 5 strips of paper 2" wide for glueing custom schematics in (once they are in final form), Expansion and Application bus signal names that are used, assembly layout sheet for component location and identification, and parts list sheet. In addition, an example schematic of an interface circuit to the KIM BUS and a schematic of the on-board power supply are provided.

Inclusions: Example schematic of interface circuit to the KIM-bus, layout assembly sheets, and power schematic and pinout designations.





THINGS TO COME

New product development is a continuous process at MTU and we have several exciting products at various stages of development. Although exact introduction dates have not yet been set, they are listed in approximate order of introduction.

ANALOG-TO-DIGITAL CONVERTER — This board is designed to convert an audio signal into a stream of 8 bit bytes which in turn can be sent to our K-1002 digital-to-analog converter boards to recreate the sound with good quality (50dB signal/noise). The board will contain a full 8 bit ADC with a conversion time of 20 microseconds, a 3.5kHz sharp-cutoff lowpass filter, and a microphone preamplifier. Companion software will do sound digitizing, storage, and spectral analysis.

FLOPPY DISK CONTROLLER — This will be **THE** definitive answer to the floppy disk storage needs of KIM/SYM/AIM microcomputers. The disk controller board will also have 16K of RAM on-board with 8K protectable for DOS and 8K available for the user. Disk data transfers are via direct memory access to the on-board memory. Selection between 8 inch standard and 5 inch minifloppy is by jumpers on the board. Selection between single density and double density is under program control. The controller will support up to 4 drives and **simultaneous** seek on all 4 drives is provided for. A powerful, custom designed disk operating system will be included in the disk controller price.

ULTRA GRAPHICS DISPLAY BOARD — Not just a better Visible Memory but a complete graphics display system with on-board microprocessor. The on-board processor will be a **3mHz** 6502 with high-speed hardware arithmetic and up to 16K of its own high-speed RAM. The board will have an additional 32K of 1mHz display memory which may be displayed as a 640x400 black and white super resolution image, 320x200 movable window, 320x200 sixteen level gray, or 320x200 full color. A compatible KIM/MTU bus and I/O ports makes the board into a stand-alone processor, slave processor, or without microprocessor, the ultimate display/memory expansion board.

UNIVERSAL MUSIC SYNTHESIZER — The first intelligent music synthesizer. This will be a packaged system with its own power supply and case and will be able to synthesize 6 voices with independent amplitude and timbre control of each voice. It will interface to virtually any computer — even a time-sharing service — via a serial interface. The on-board 6502 microprocessor will buffer and interpret **high level** music commands directly on-the-fly for real-time music generation of high quality.