June 04, 1983

Micro-Minutes

NEWSLETTER OF THE HEWLETT-PACKARD MICRO-COMPUTER INTEREST GROUP

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M BUTTERWORTH	11L	T WATANABE	47U
M PIRAMOON	11U	T BOYLE	47U
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H WILSON	42L	D HARDING	52U
J YOUDEN	42U	R BURRELL	53U
K HICKOX	42L	R FROID C/O B GARCIA	5L
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JO ANNE ENGLEHARDT	20BR	N LYONS	5M
W HINTON (IBM)	20CH	P ZANDER	5M
R RANDALL	20BD	J SOCHA C/O C FRANK	5M
G HARKINS	25U	G THOMAS C/O P ZANDER	5M
L CUTLER	25	PHIL GRAY	5U
DOUG WEIGEL	25U	J VADEBONCOEUR	5U
L KIYAMA	25	K LANE	5U
D LIDDEL	28B	S THOMAS	5U
D MOBERLY	28B	LLOYD STAFFORD	6L
K BATES	28C	DAVE NELSON	30
B KNAPP	28A	RICK PINGER	30
ERWIN LITTAU	1U	DOUG PUNG	90U
STEVE HESSEL	3U32	BARRY LEWIS	90-2T
RICK WALKER	3U32	RAY WONG	9E
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GENERAL NEWS: June 1, 1983

As promised, we are offering two video boards for purchase this month. The deadline for orders is June 17. The attached information should answer most questions about the two boards being offered.

Doug Pocious will be the board manager for the CRT-1 board. There is, however, no manager yet for the CAT-100 board. The job of board manager carries the following responsibilities:

1) order parts
2) organizing loading parties
3) testing of boards
4) cost control

If no manager is found by July 22, then the CAT-100 offer will be cancelled and the money will be refunded. If you would like to volunteer for the position, contact Barry Lewis.

Several other items to note:

The CAT board must be hand soldered individually.

If you have a terminal then you do not need either board.

If you buy either offered board, you will also require a keyboard and a monitor.

Extra money left over from past projects will be returned on a board by board basis. These refunds will apply to the I/O, MEMORY, and DISK boards. The amount of the refund will be published in a future MICROMINUTES.

HP MICROCOMPUTER INTEREST GROUP OFFICERS:

Moderator	Rick Pinger	30 969-0880
Treasurer	Doug Pung	90 1-263-2655
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Meeting Coordinator		
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VIDEO BOARD OFFERING

Both the WAMECO CRT-1, and the DIGITAL GRAPHICS CAT-100 will be offered at this time. If you wish to participate in either board offering; the lower half of this page, together with your check should be returned to Doug Pung in building 90 before June 17, 1983.

WAMECO CRT-1

To allow the maximum ordering flexibility for this board, three separate part sets will be offered. For those who want a completely assembled and tested board, order all three part sets. Those who may already have some of the parts may order only those sets they need (in this case the club is not obligated to assemble or to debug and test your board). The three sets are:

1)	Bare board, a blank pc card and a manual.	$ 40. ea
2)	The LSI parts, includes Z80A, HD6845, SMC8002A, 4-2147, 3-6116, 2716, 2732.	$ 90. /set
3)	The TTL, and other misc. parts, including sockets and hardware.	$ 50. /set
	Total cost	$ 180. ea

DIGITAL GRAPHICS CAT-100

This board set will be offered in two parts, the bare boards (which many members already have), and the parts. If you already have purchased the boards under club auspices, just order the part set.

1)	The boards, 2 blank pc cards and a manual.	$ 140. /set
2)	The parts, includes all parts to populate these boards.	$ 170. /set
	Total cost	$ 310. /set

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return this half with payment

VIDEO BOARD ORDER FORM

WAMECO CRT-1 Board

_____	Bare Boards	@ $ 40. ea	_____
_____	LSI Part Sets	@ $ 90. /set	_____
_____	Misc Part Sets	@ $ 50. /set	_____

DIGITAL GRAPHICS CAT-100

_____	Bare Board Sets	@ $ 140. /set	_____
_____	Part Sets	@ $ 170. /set	_____
		Total amount enclosed $	_____

Name_____, Build_____

Make checks payable to HPMCIG, and remit to Doug Pung, build 90 before June 17, 1983.

WAMECO CRT-1 Video Board

Although the club remains commited to the CAT-100 video board, the hardware committee decided that many club members would not need or want the full potential of this very complex board set. To allow members a choice, the CRT-1 board was selected as an alternative. This board, although it has fewer features than the CAT-100 board set, will satisfy the needs of any member desiring a video system suitable for text (non graphics) uses.

BOARD DESCRIPTION

The WAMECO CRT-1 is an intellegent video board. The board contains a Z-80 processor (identical to our main processor), and a 6845 video generator chip. The interface to the S-100 bus is implimented as 2 I/O ports.

This board is not intended as a high resolution graphics board. Members interested in high resolution graphics should consider the CAT-100 board. Instead the CRT-1 video board is intended for character oriented applications (ie, a console).

This board is suited for use as:

a system console
a text oriented display

RESOLUTION

Text mode

A display of 24 lines of 80 characters each (this may be modified if the firmware is rewritten).

Characters are 7 x 18 (7 x 9 noninterlaced) with decenders, within an 8 x 20 pixel frame (may be modified if the firmware is rewritten). This provides readable characters.

4 K of memory (approx. 2 pages) are provided, this could be used for multiple pages or for roll down features.

256 element character set contained within a 2732 EPROM, (the font may be changed by reprogramming the 2732).

Inverse video, underline, and blinking characters may be mixed with normal mode characters.

DIGITAL GRAPHICS CAT-100 Video System

Some time ago the hardware committee selected the CAT-100 as the club system contingent upon demonstration of proper operation. That demonstration has been made. Increasing the club's commitment to the CAT, fifteen bare board sets have already been purchased under club auspices.

BOARD SET DESCRIPTION

The CAT-100 board set consists of 2 S-100 compatable boards, these boards are filled with approximatly 100 chips, mostly SSI and MSI circuits. The interface to the S-100 bus is through a bank of memory whose contents are also used to generate a video signal. This method of interfacing allows for maximum flexibility, but it requires that the main processor handle much of the video overhead.

The CAT-100 is a combined text and graphics display system. Functionally it resembles the memory mapped display systems found in most modern desk top computers (ie, the HP 9836). It provides unusually legible text and extremely flexible graphics.

This board set is suited for use as:

a system console
a text oriented display
a graphics display
a digital video imaging system

RESOLUTION

Text mode

A display of 29 or 33 lines of 64, 72, or 80 characters each.

Characters are 7 x 11, with decenders; within an 8 x 15 or an 8 x 17 pixel frame. This generates well formed characters which are easily read even for equations or computer notation. They are not squeezed together. This is possible because full interlace is supported.

32 K characters (over 12 pages), this could be used for multiple pages or for roll down features.

Standard ASCII character set (128 characters).

Inverse video.

Graphics mode

Limited 'character' graphics is supported. This is not a high resolution graphics board, but some capability is provided (resolution is approximatly 160 x 72).

Interlace

The current firmware generates a non interlaced video signal, this allows for a very stable (flicker free) screen. Future versions of the firmware could support an interlaced screen (the necessary hardware is there).

SOFTWARE/FIRMWARE

The majority of the driver program for this board is contained within a 2716 EPROM that is accessable only to the on board Z-80 (this means that the main processor does not even need to know it is there).

The firmware may be changed by reprogramming the on board 2716 EPROM. Since the on board processor is a Z80, the main system may be used to aid firmware development.

The current firmware (supplied by John Youden) will support all necessary console like functions, future versions will include far more features.

MAIN PROCESSOR INTERFACE

This board is interfaced to the main processor through 2 I/O ports.

Transfer rates in excess of 19.2 Kbaud are possible.

Due to it's I/O mapped nature this board takes up no system memory space.

This board can emulate a terminal with no additional software overhead for the main processor (it can look exactly like a terminal to the main processor).

Graphics mode

High resolution (512 to 640 pixels horizontally, 480 to 408 pixels vertically) graphics facilitates the generation of graphs, etc. under software control.

Interlace

The very high resolution of this unit is obtained by using interlaced video. This causes a flicker problem which can be minimized as follows:

A. use a low level of ambient light and a medium setting for brightness.
B. use a 30% to 50% neutral gray plastic filter sheet in front of the monitor. This is economical, and brings spectacular results.
C. use a slow phosphor tube: P7 blue, P39 green, or P40 light blue. P39 provides a minimum of eye fatigue for day-long use.

SOFTWARE/FIRMWARE

All of the software driver program is in user accessable memory. The bank selection designed into the system should be invoked if the driver is embellished to the point that it's size becomes a problem.

Since all of the software is accessable to the user, the full software development capability of the system can be used to fix 'bugs' and to add to the display driver.

No driver routine exists currently, Bob Wells, an experienced programmer, has offered to write one.

MAIN PROCESSOR INTERFACE

This board is memory mapped, which means that to the main processor it looks like a bank of memory.

Transfer rates of 2 M bits/sec. are possible.

Data in video memory can be read, an exellent feature for text editors, etc. where no second copy is needed.

Takes up system memory only when it is used (at other times it is phantomed out).

This board can emulate a terminal with the proper driver program in CP/M.

OTHER FEATURES

Monochrome display

Outputs for both composite, and separated video are provided. Some monitors like separated video.

May be used with either a standard monitor, or a TV set modified for direct video entry.
A keyboard port is provided, a parallel keyboard may be interfaced to the main system through the video board.
The circuitry for a light pen interface is included. No light pen is included, and the current firmware does not support this feature; but both could be added later if sufficient interest was shown.
This board, together with some simple additional hardware, can be made into a stand alone terminal.
Several simple modifications to the MAMECO board are to be made.

This board has been tested, showing no problems (after necessary modification were made).

This board is to be wave soldered, with no back loading necessary.

PRICE

Total cost of this board is $ 180.

OTHER FEATURES

Color graphics.

Gray scale.

TV / TV camera image capture, display (the basics of an image processing system).
Composite video output, separated video signals must be jumpered out if they are needed. Most monitors require composite video.
RGB color video output.

Uses standard monitor, color monitor, or modified TV set.

Uses IO/4 board for keyboard input.

The circuitry for a light pen is included.

No change from the Digital Graphics design is necessary (although bypass capacitors appear desirable).
Digital Graphics has a reputation for producing trouble free systems. Memory tests have been run in a club system at speeds greater than 6 MHz.
Due to the high density layout, with closely spaced traces, the boards must be hand soldered.

PRICE

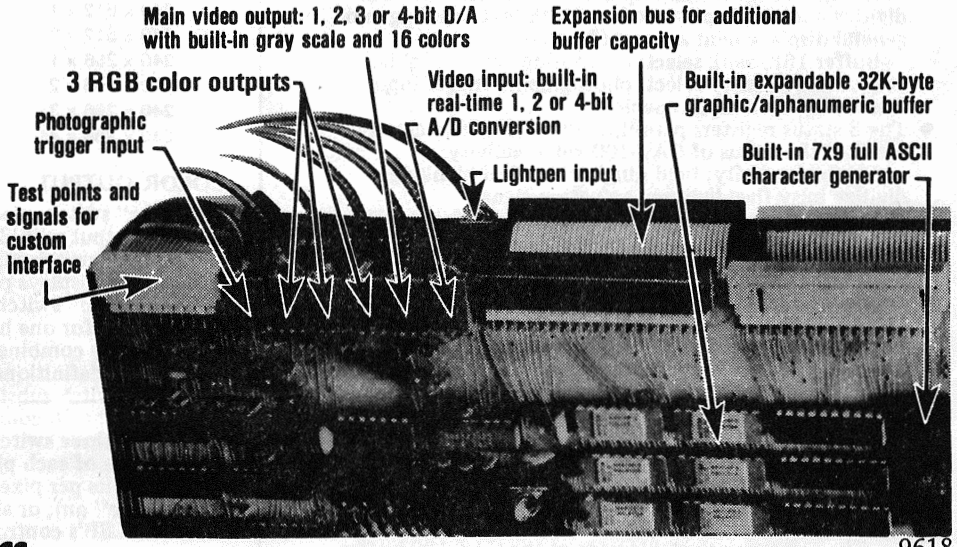
Total cost of video system $ 310.

Note: These two boards are not mutually exclusive; a system with two video boards, and two CRT monitors is possible.

CAT-100

DIGITAL GRAPHIC SYSTEMS, INC.

A COMPLETE COLOR IMAGING SYSTEM ON TWO S-100 BOARDS with video frame grabber.



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FUNCTIONAL CHARACTERISTICS

The CAT-100 is a powerful, integrated, expandable, general-purpose digital video imaging system for S-100 bus microprocessors. It consists of two standard-size S-100 boards in its basic configuration. It offers three fundamental functions: a video frame digitizer, an image memory, and an output video generator.

The digitizer can capture a video frame in 1/60th of a second and store it in the on-board 32K-byte image memory. The image memory is accessible for image generation or processing in the address space of the S-100 bus through a window which can be selected or deselected by software. The video generator displays the digitized image in 16 shades of gray or 16 colors on standard black and white or color TV monitors, or high-resolution RGB monitors.

The CAT-100 provides a variety of synchronization choices; it can generate its own RS-170 video sync, extract sync from any external video source, or lock onto a separately supplied external sync signal. Two types of video A/D conversion circuits provide a choice of 1, 2 or 4 bits per pixel at maximum video rate. The first circuit is a conventional converter yielding 16 gray levels, the other is a contouring circuit useful for reducing images to outlines. The software-selectable system parameters include a variety of image formats, video output controls, digitization commands, addressing modes, vertical image offset, photo trigger and lightpen controls. Fifteen formats using the entire buffer capacity are selectable for digitization as well as for display and offer resolutions ranging from 256 to 1280 pixels per TV line.

The text mode, with a high definition 7x9 character generator, can display up to 2,640 characters on a screen organized as 33 lines of 80 characters. A smooth scrolling feature allows the user to scan the entire text file at a variable speed while the characters remain perfectly legible. A lightpen can be connected directly to the CAT-100, and the interaction provides 18 bits of coordinates resolving one pixel in the 480x512 format. A photo trigger synchronizes the display of a single frame with the shutter of a photographic camera.

CAT-100 SPECIFICATIONS

CONDENSED TECHNICAL SPECIFICATIONS

CONTROL AND STATUS REGISTERS

- 5 control and 3 status registers accessed as I/O ports.
- Switch-selected I/O address boundaries.
- Can be located anywhere in I/O address space.
- The 5 control registers allow a large variety of functional modes to be selected by software:
  - General system timing: choice of 3 fundamental clock speeds; for each speed, choice of 2 shift clock ratios and 3 pixel clock ratios for graphics formatting; interlace enable; digitize/display command; graphics/text mode; text formatting and smooth vertical scrolling displacement.
  - Main video output mixer control: live video view switch; dot mode; gray scale/equal weight summation control; general video output polarity; 4 individual pixel bit masks.
  - Graphic buffer addressing: internal page select (6 bits) for 128K-byte total capacity; window select/deselect flag; video synchronization source select.
  - Graphic image initial displacement address for both the digitize and the display modes; rough text scrolling and general displacement address (12 bits).
  - Buffer 16K-bank select; contouring circuit enable; contouring polarity select; photographic trigger input enable; lightpen input enable.
- The 3 status registers permit S-100 software to closely monitor the status of CAT-100 video activity:
  - TV field activity; field number; vertical blanking; digitize busy flag; lightpen actuation signal.
  - Lightpen "seen" flag; lightpen X-Y coordinates (18 bits).

GRAPHIC MEMORY BUFFER

- On-board 32K-byte capacity in basic CAT-100 system.
- Organized in 2 banks of 16K bytes of dynamic memory.
- Expandable up to 256K of capacity in 32K increments on extension boards for better gray scale or color resolution.
- 2-port design for a totally snow-free and clean display:
  - internal port for fast video access;
  - external port for S-100 bus. Access time: 1 microsecond average, 25 microseconds maximum during 0.2% of the time.
- Convenient addressing scheme:
  - Fixed access window in S-100 memory address space.
  - Window size (2K/8K) and location are switch-selectable.
  - The software-selectable page of the CAT-100 buffer appears to the CPU as regular memory located in the window.
  - Allows large buffers to be addressed without consuming a large fraction of the S-100 address space.

VIDEO INPUT

- On-board 4-bit A/D converter yields 16 gray-scale levels.
- Full video-rate digitization: 1/60th of a second for a resolution of 240 x 256 x 4 or equivalent.
- Can be set to generate 1, 2 or 4 bits per pixel.
- Conversion speed: better than 76 nanoseconds for 4 bits.
- Accepts standard 1.4 volt composite B/W video; Z=75 ohms.
- Automatic composite sync extractor.
- Accepts EIA RS-170 or "random interlace" synchronization.
- No equalization requirements: will sync on a video tape or a video cassette recorder output.
- Also accepts/generates external sync (selectable by software).
- On-board proprietary 2-threshold slicing/contouring circuit as an alternative to the A/D converter.
- Maximum output rate: 26 Mbits/sec. for both the A/D converter and the contouring circuit.
- Accepts external digital data from higher performance converters or real-time video processing equipment.
- Direct view of live contoured image before digitization.
- Large number of input formats matching the output formats.

VIDEO OUTPUTS

- One main and 3 auxiliary standard composite video outputs.
- All 4 video outputs are 1.4 volt p-p; Z=75 ohms.
- Each output may display an independent digital image.
- The main output is driven by a 3-source video mixer which will show any combination of up to 3 simultaneous images: the live video input, the real-time contoured video input, and a digitized image or a text stored in the buffer.

GRAPHIC MODE

- On-board 4-bit D/A converter; 4 individual bit switches.
- Can be set to generate 2, 4, 8 or 16 levels of gray scale.
- Dot mode available for 256, 288 and 320 pixels per line.
- When dot mode is selected, the main output display is composed of discrete square dots and shows a pleasant homogeneous texture horizontally and vertically.
- Variety of output mapping formats, fully compatible with all the input formats.
- 3 aspect ratios: square, standard rectangular, compressed.
- For each aspect ratio, an image can be mapped into 3 interlaced formats and 7 non-interlaced formats.
- 30 software-selectable GRAPHIC FORMATS, listed in the form:

Lines/frame x Pixels/line x Bits/pixel

SQUARE	RECTANGLE	CONDENSED*
480 x 512 x 1	454 x 576 x 1	408 x 640 x 1
480 x 256 x 1	454 x 288 x 1	408 x 320 x 1
480 x 256 x 2	454 x 288 x 2	408 x 320 x 2
240 x 1024 x 1	227 x 1152 x 1	204 x 1280 x 1
240 x 512 x 1	227 x 576 x 1	204 x 640 x 1
240 x 512 x 2	227 x 576 x 2	204 x 640 x 2
240 x 256 x 1	227 x 288 x 1	204 x 320 x 1
240 x 256 x 2	227 x 288 x 2	204 x 320 x 2
240 x 256 x 3	227 x 288 x 3	204 x 320 x 3
240 x 256 x 4	227 x 288 x 4	204 x 320 x 4

* OPTIONAL

COLOR OUTPUT

- "Color" switch selects B&W output when off, composite color output with 3.58MHz burst and subcarrier when on.
- "Palette" switch superimposes gray scale to colors when on, displays plain colors when off.
- "Saturation" switch decreases the amplitude of the subcarrier for one half of the displayed colors, and can be combined with "Palette" to offer 4 different definitions of the 16 available colors.
- "B/W" switch substitutes a dark gray and a light gray for 2 of the 16 colors by suppressing their subcarrier.
- The last three switches present 8 different ways of mapping the 4 bits of each pixel into 16 colors.
- With 4 bits per pixel, either the MSB controls the luminance ("Palette" on), or all 4 bits control the luminance ("Palette" off). 3 LSB's control the hue.

TEXT MODE

- A software-selectable alternative to the graphic mode.
- Makes efficient use of the buffer as a text file: 32,768 characters are stored, with up to 2,640 visible at one time.
- High quality full ASCII 7x9 character generator.
- Any character can be individually inverted by software.
- Instant scanning through the 32K-character text file by setting appropriate base address in control register.
- Smooth scrolling at raster line level permits variable scanning speed; text always remains perfectly legible.
- No wrap-around at end of buffer.
- 6 software-selectable TEXT FORMATS, listed in the form:

Text lines/frame x Characters/text line

29 x 64 | 29 x 72 | 29 x 80 | 33 x 64 | 33 x 72 | 33 x 80

LIGHTPEN INPUT

- Enabled by software; interaction flagged in status.
- 18 bits of X-Y coordinates available in status.
- CAT-100 timing must be restarted by software within one millisecond after interaction occurs.
- Input specs: active-high TTL pulse > 100 nanoseconds.

PHOTOGRAPHIC TRIGGER INPUT

- Armed by software; screen blanks and waits for signal.
- Photo input designed to be grounded by closure of the "X" flash contacts of a photographic camera.
- A complete frame is then displayed and photographed. This technique avoids partial or multiple exposures and yields clean individual pictures or animated films.

POWER • DC voltages unregulated per S-100 specs.
+8V, 2.5A typical; +16V, 0.8A typical; -16V, 0.3A typical.

TEMPERATURE +10°C to +40°C ambient, operating.

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