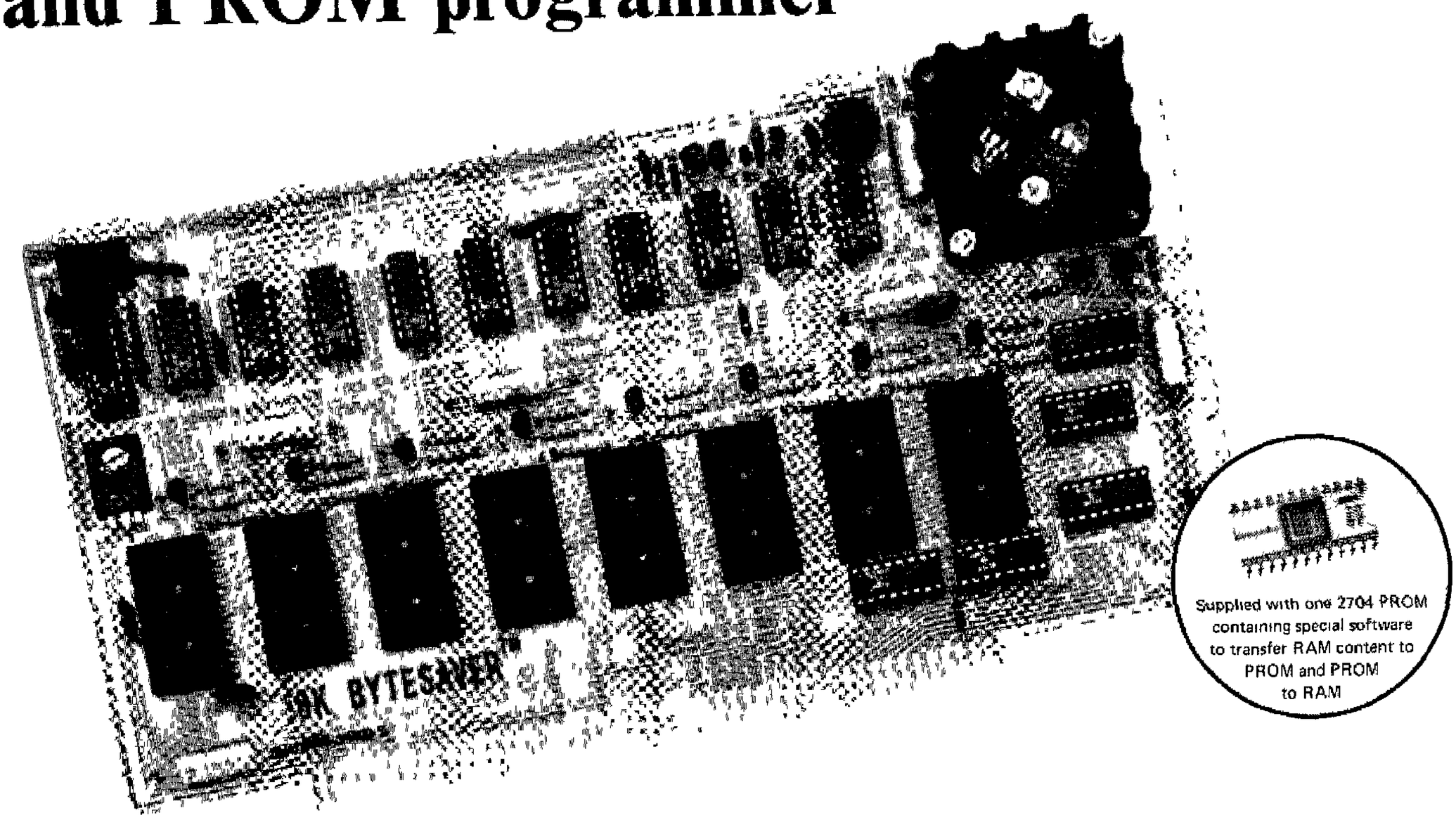
New CPU Card, p. 6

Cromemco

Cromemco

BYTESAVER memory board and PROM programmer



Supplied with one 2704 PROM containing special software to transfer RAM content to PROM and PROM to RAM

Cromemco's popular BYTESAVER™ memory board gives you two of the most-wanted features in microcomputer work·

(1) a simple, easy way to store your computer programs in programmable read only memory (PROM).

(2) a PROM memory board with the capacity for a full 8K bytes of PROM memory storage.

ECONOMICAL

The BYTESAVER™ is both a place and a way to store programs economically It transfers programs from the non-permanent computer RAM memory to the permanent PROM memory in the BYTESAVER™ . Once your program is in the BYTESAVER™ , it's protected from power turn-offs, intentional or accidental The PROMs used with BYTESAVER™ are UV erasable and can be used again and again.

The BYTESAVER™ itself plugs directly into your Altair 8800 or IMSAI 8080.

PROM PROGRAMMER

Many people are surprised to learn that in the BYTESAVER™ you also have your own PROM programmer. But it's so. And it saves you up to hundreds of dollars, since you no longer need to buy one separately.

The built-in programmer is designed for the 2704 and 2708 PROMs. The 2708 holds 1K bytes, four times the capacity of the well-known older 1702 PROM (yet cost-per-byte is about the same). The 2708 is also fast — it lets your computer work at its speed without a wait state And it's low-powered. With 2708's in all 8 sockets, the BYTESAVER™ is still within MITS bus specifications, drawing only about 500 mA from the +8V bus. A complement of 2708 PROMs gives the BYTESAVER™ its full 8K capacity

HOLDS LARGE PROGRAMS

The BYTESAVER's™ 8K-byte capacity lets you store the larger and more powerful programs 8K BASIC, for example, easily fits in the BYTESAVER™ capacity of 8 PROMs. One 1K PROM will hold many games such as Cromemco's DAZZLER-LIFE or DAZZLE-WRITER

NO KEYBOARD NEEDED

The BYTESAVER™ comes with special software programmed into a 2704 PROM. This software controls transfer of the computer RAM content to the BYTESAVER™ PROM.

So you are ready to go. You don't even need a keyboard. Just set the computer sense switches as instructed in the BYTESAVER™ documentation.

Transfer of memory content to PROM ("burning") takes less than a minute. The BYTESAVER™ software controls computer lights to verify complete and accurate transfer of memory content.

The software also programs any of the other 7 PROM positions in the BYTESAVER™ as readily as the first.

And when used to transfer information from the BYTESAVER™ PROMs to RAM, the special design of the software allows loading a large program such as 8K BASIC in one second.

AVAILABLE NOW — STORE/MAIL

BYTESAVER™ kit $195
(Model 8KBS K)

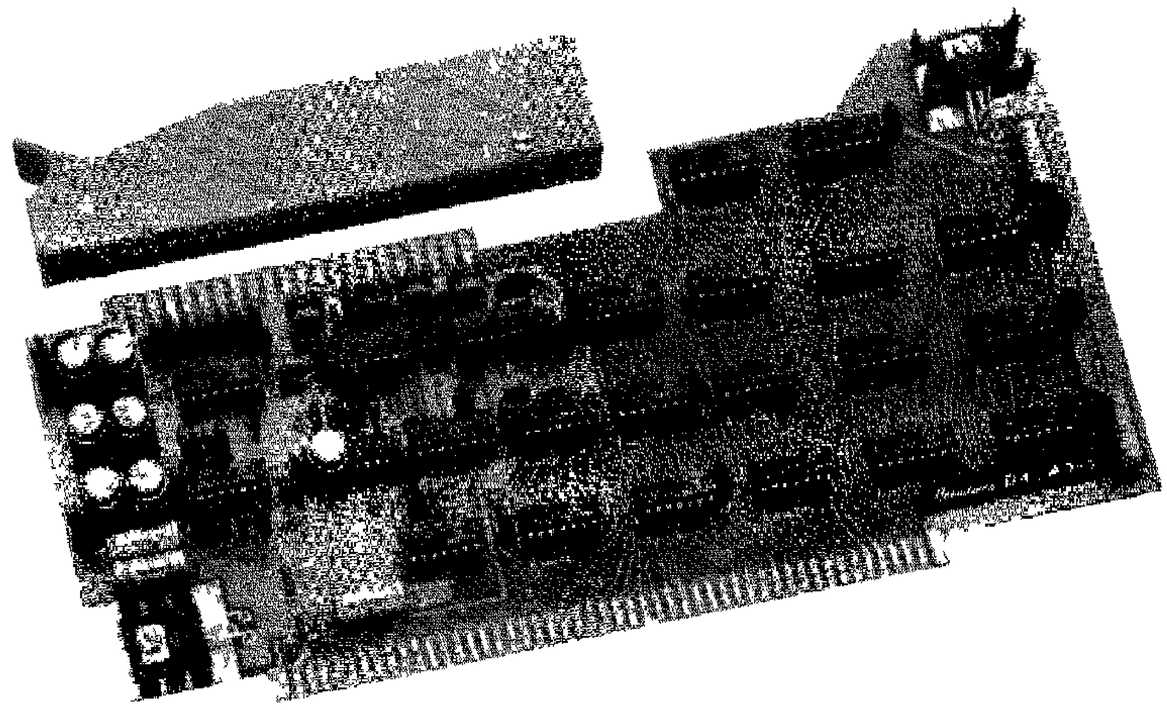
BYTESAVER™ assembled . $295
(Model 8KBS-W)

BYTESAVER™ also available with one software programmed 2708 PROM (instead of 2704) @ $220 (kit) or $320 (assembled) BYTESAVER with no PROMs is $145 (kit) or $245 (assembled) Additional 2704 is $50, additional 2708 is $75

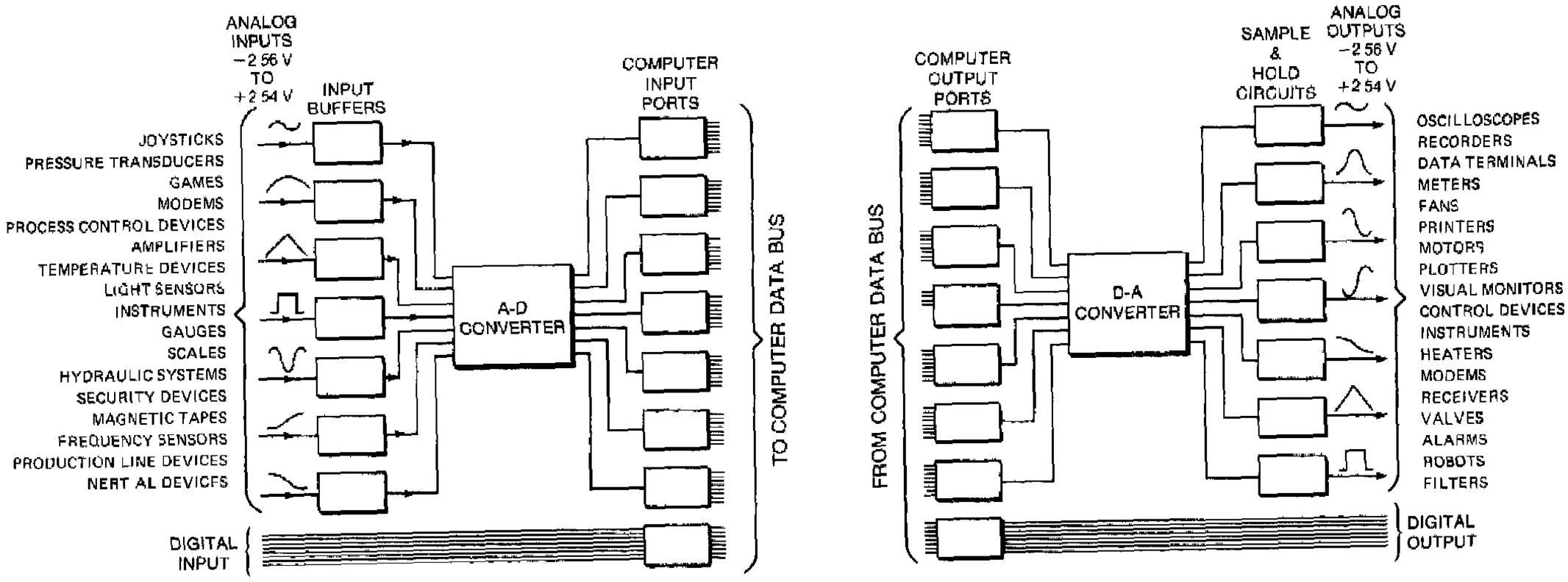
See "ordering info" on back cover.

Cromemco

D+7AI/O™ Multi-channel microcomputer analog interface



See p. 8 for special joystick console with audio output. Use with this analog I/O.



Now you have a way to get analog information into and out of your microcomputer It's an easy, fast, and unbelievably inexpensive way.

It's Cromemco's new D+7A™ high-performance I/O module which gives you:

- 7 channels of 8-bit analog-to-digital conversion (to input analog data to the computer)
- 7 channels of digital-to-analog conversion (to output computer data in analog form)
- an 8-bit parallel I/O port to input and output data in digital form
- a fast conversion time of 5.5 microseconds.

A MULTITUDE OF USES

The D+7A makes it easy to use your computer for the jobs you want it to do—such as process control, digital filtering, games, oscilloscope graphics, speech recognition, speech and music synthesis

The D+7A lets you input and output analog data with all sorts of devices: joysticks, ham radio gear, measurement instruments, machine tools, transducers, control systems, motors, recorders, and plotters, to name just a few.

NO FURTHER SOFTWARE NEEDED

The D+7A I/O plugs directly into the Altair 8800 or IMSAI 8080 microcomputers. Analog signal range is from −2.56 to +2.54 volts (20-millivolt increments) on both input and output sides.

Simple "Input" and "Output" instructions initiate A/D conversion and read in or out the ensuing 8 bits of data. No further software is required. During conversion the D+7A holds down the computer "Ready" line.

Addresses of the input and output ports are jumper-wire selectable in blocks of 8. Sample-and-hold circuitry is used to "latch" the analog outputs.

LOW-PRICED

The low price of the D+7A is a result of Cromemco's design leadership. The D+7A and all Cromemco peripherals are of advanced computer-grade quality. The D+7A is solder-masked and printed with full legend for easy, error-free assembly

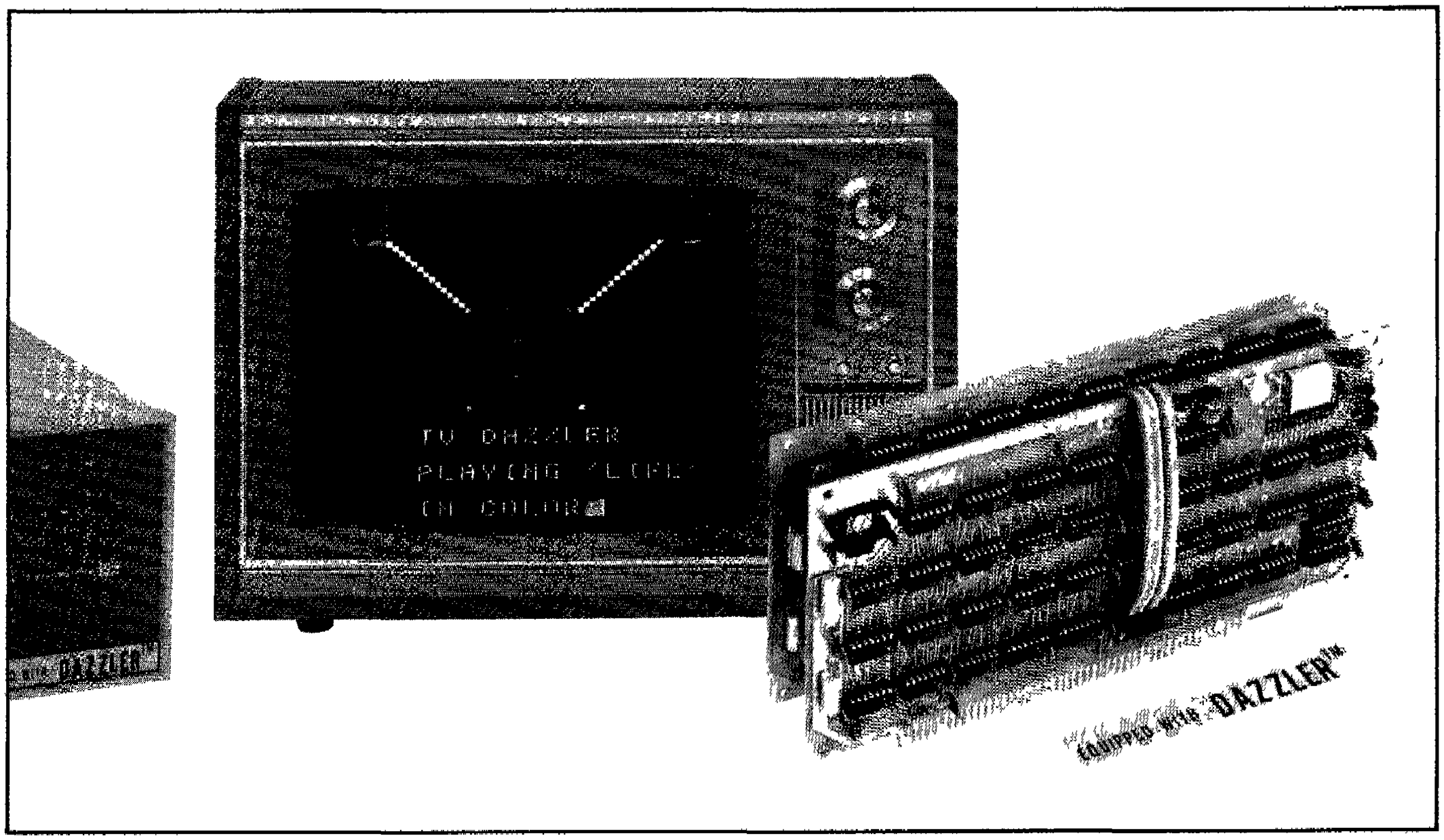
AT COMPUTER STORES/MAIL

You can get the D+7A at computer stores in either kit or assembled form.

Or order directly by mail from Cromemco. Delivery is from stock to 30 days. The D+7A is certain to be popular so order now.

D+7A™ I/O kit $145
D+7A™ I/O assembled $245

Each D+7A includes a connector to connect to the 8 input and 8 output ports.



TV Dazzler ™

. . . a microcomputer interface
that lets a color TV
be your computer display terminal

- **inexpensive**
- **unbelievably versatile**
- **beautiful displays of computer games**
- **for hobbyists**
- **for engineers**
- **for educators**
- **for business**

Cromemco's new computer/tv interface circuit lets you have a full-color computer display terminal for little more than a black-and-white terminal.

The Cromemco interface also lets you do vastly more with your color terminal than you can do with ordinary black-and-whites.

We call our interface the TV Dazzler™. It consists of two circuit boards that plug directly into your Altair 8800 or IMSAI 8080 computer.

ALPHANUMERICS PLUS ACTION, AND GRAPHICS

The Dazzler™ maps your computer memory content onto your color tv screen in full color.

That doesn't mean just that you see alphanumerics in color. You can display *any* information in memory. And do so in color.

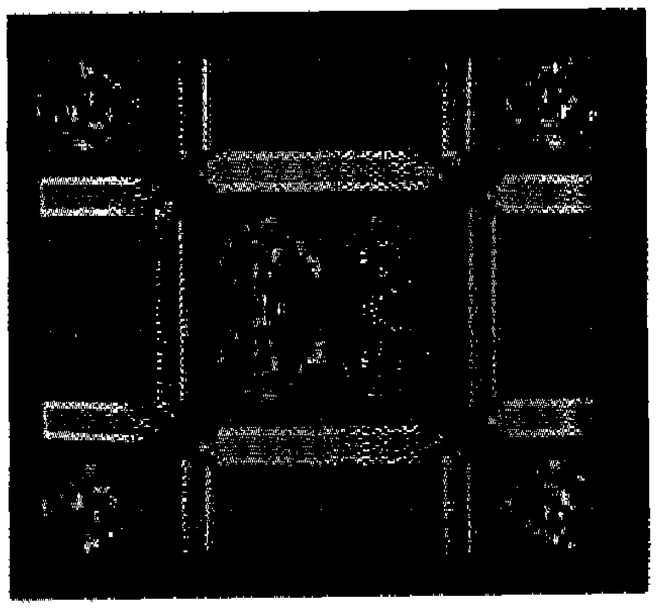
NEEDS ONLY 2K MEMORY

Technically, the Dazzler™ scans your computer memory using direct-memory access (DMA). It formats each memory bit into a point on the tv screen to give a 128 x 128-element picture. Only a 2K-byte computer memory is required (only 512 bytes for a 32 x 32 picture). The quality of the pictures is evident in the photos.

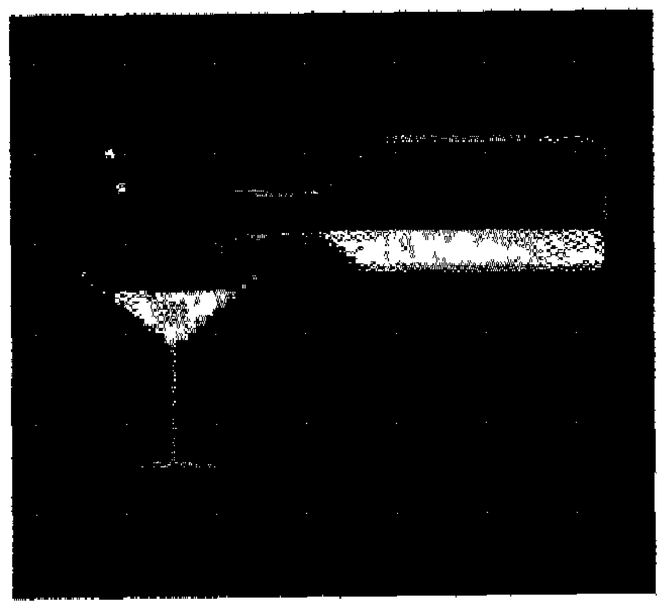
The Dazzler™ output is a video signal that goes directly to the tv video amp or to the antenna terminal through an inexpensive commercially-available device.

INEXPENSIVE – AND SO MUCH BETTER

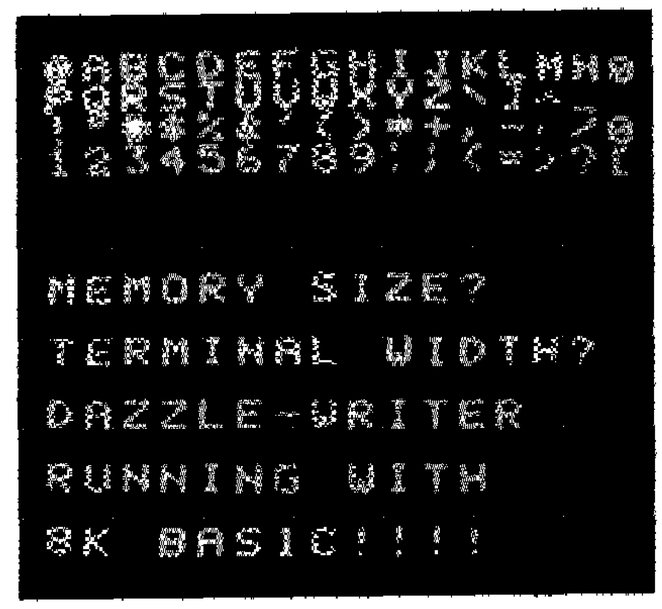
You can see from the list below that the Dazzler™ is little if any more in price than an ordinary b/w interface or tv typewriter. But it does much more.



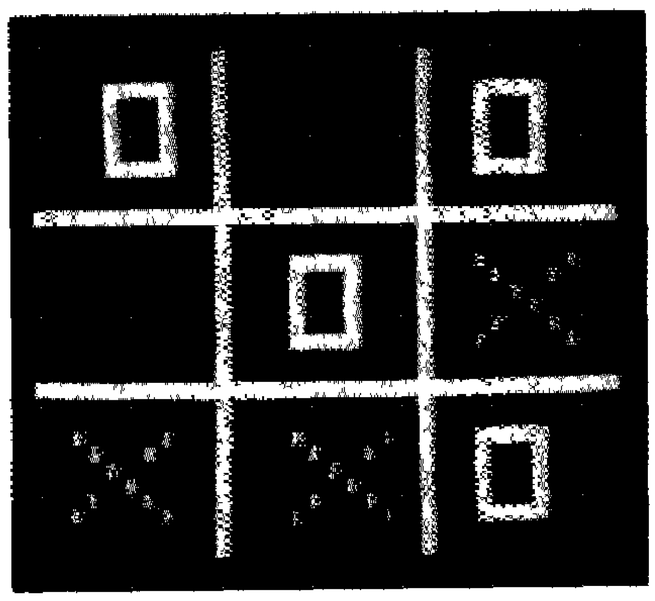
TV display pattern obtained during a sequence of the computer game LIFE from Cromemco software (below) Display is in beautiful color (see cover)



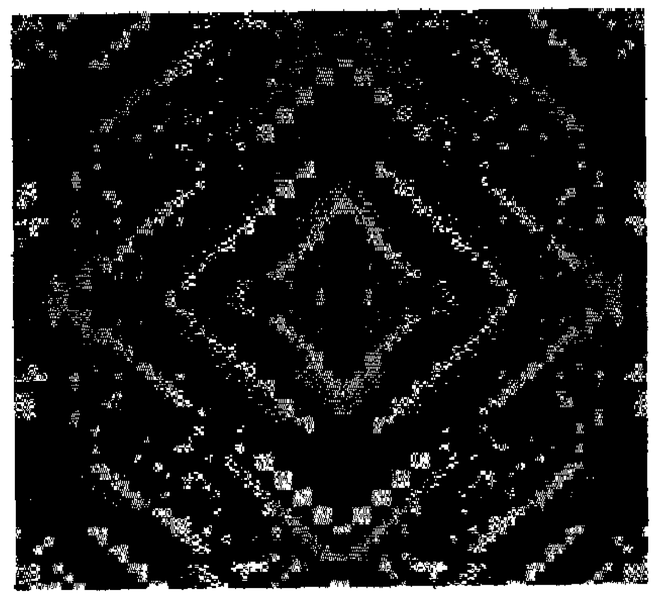
An example using Cromemco's DAZZLE MATION software A second tape ('Magenta Martini") was used to obtain above action display This tape is included with DAZZLE MATION as a use example.



Top four lines show range and style of alphanumerics obtainable with Cromemco's DAZZLE-WRITER software. Query lines are first two prompts from MITS BASIC.



Sequence from Cromemco's TIC-TAC-TOE software which lets you play the computer Don't be sure you'll always win we've made it rough



Sequence from Cromemco's KALEIDOSCOPE software This program runs without keyboard entry, gives you stunning color display.

ALL OF THE ABOVE ARE BEAUTIFUL COLOR DISPLAYS ON THE TV SET

DISPLAYS IN COLOR

You can display computer games or animated shows (rocket ships). What's more, you can display business or technical graphics — multi-colored charts, graphs, histograms, educational material — all from computer memory. Even light shows. Not even the biggest computer manufacturers offer all this in color.

ORDER NOW
BY MAIL OR AT YOUR COMPUTER STORE

If you're into computer (or want to be), if you want to invent these beautiful displays or games, or to plot colorful material inexpensively at home or in business, the Dazzler™ is for you.

Not only is it reasonable, but it's sold at computer stores from coast to coast.

Or order directly by mail on your bank card.

TV DAZZLER™ (complete kit) $215
TV DAZZLER™ (fully assembled and tested) $350

SOFTWARE

(punched paper tape with documentation)

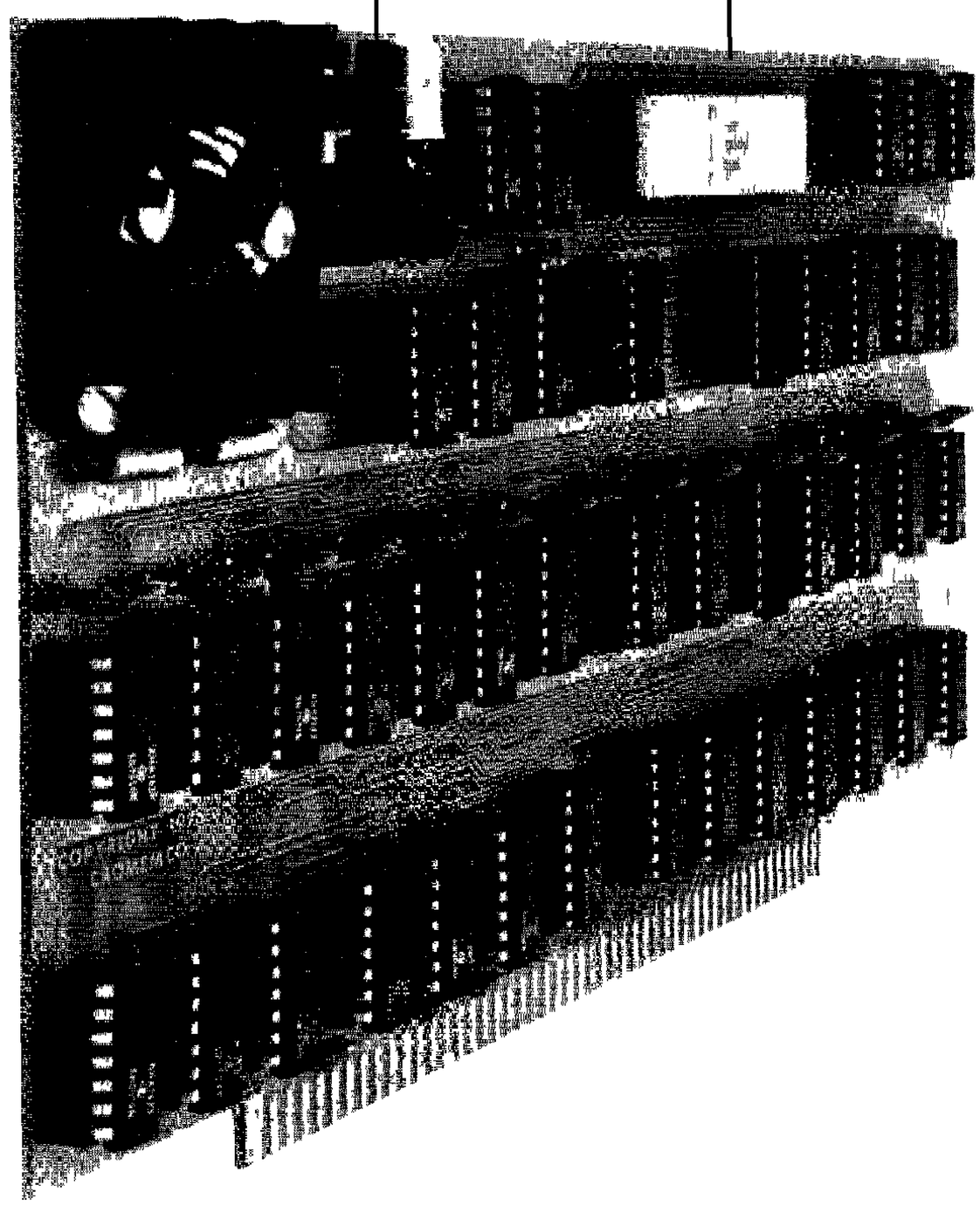
LIFE in full color $15
KALEIDOSCOPE in full color $15
DAZZLE-WRITER (for alphanumeric displays in color) $15
DAZZLE-MATION (for computer-generated animated displays $15
TIC-TAC-TOE (you play the computer) $15

See "ordering info" on back cover.

Cromemco

4 MHz CPU card

Available Nov. '76



2–5X MORE THROUGHPUT

Here is by far the most powerful CPU card now available.

It's Cromemco's new ZPU™ card. It uses the slick new Z-80 chip—in fact, it uses the even faster Z80/4 high speed version of the Z-80—and it's the *only* card that does. The Z80/4 is certified by its manufacturer for 4 MHz operation.

The Z80/4 has all the advantages of the 8080 and 6800—and enormously more

And Cromemco's new ZPU does enormously more

4 MHz CLOCK RATE

First, the ZPU lets you choose either a 2 or 4 MHz crystal-controlled clock rate. Right away that means you can have twice the throughput. Cuts program running time in half Then the instruction set of the Z80/4 reduces software even more.

The 2 or 4 MHz clock rate is switch-selectable as shown in the above photo.

POWER ON MEMORY JUMPS

Cromemco's ZPU also has some neat design innovations of its own.

For example, you'll like the simplified operation you get because upon power turn-on the ZPU will jump to any desired 4K boundary in memory. No switch flipping to go through to begin your program.

SELECTABLE WAIT STATES

Cromemco engineers have also arranged that your present systems will always be useful with the new ZPU. To do this, the ZPU has been designed to have jumper-wire-selectable wait states on the card.

These simplify interfacing with your present memory or I/O even at 4 MHz operation.

80 ADDITIONAL INSTRUCTIONS

You've probably heard that the Z-80 with its 80 new additional instructions is by far the most powerful chip around It's true.

That means with the ZPU you will be able to devise much more powerful (as well as faster) software than before.

ALTAIR/IMSAI COMPATIBLE WITHOUT MODIFICATION

Yes, the new ZPU is plug-compatible with the Altair 8800 and IMSAI 8080. Just remove the existing CPU, plug in the ZPU card, and you're up and running.

Further, the Cromemco ZPU is the only card guaranteed to work with all present and future Cromemco peripherals. (Cromemco manufactures the popular BYTESAVER™ memory, the TV DAZZLER™, the D+7A™ analog interface board, a joystick console, and others.

INCLUDES FREE SOFTWARE

The ZPU comes with our powerful Z-80 monitor, complete documentation, source code, and paper tape object code. The monitor is also available in PROM ($75) for use in our BYTESAVER memory board.

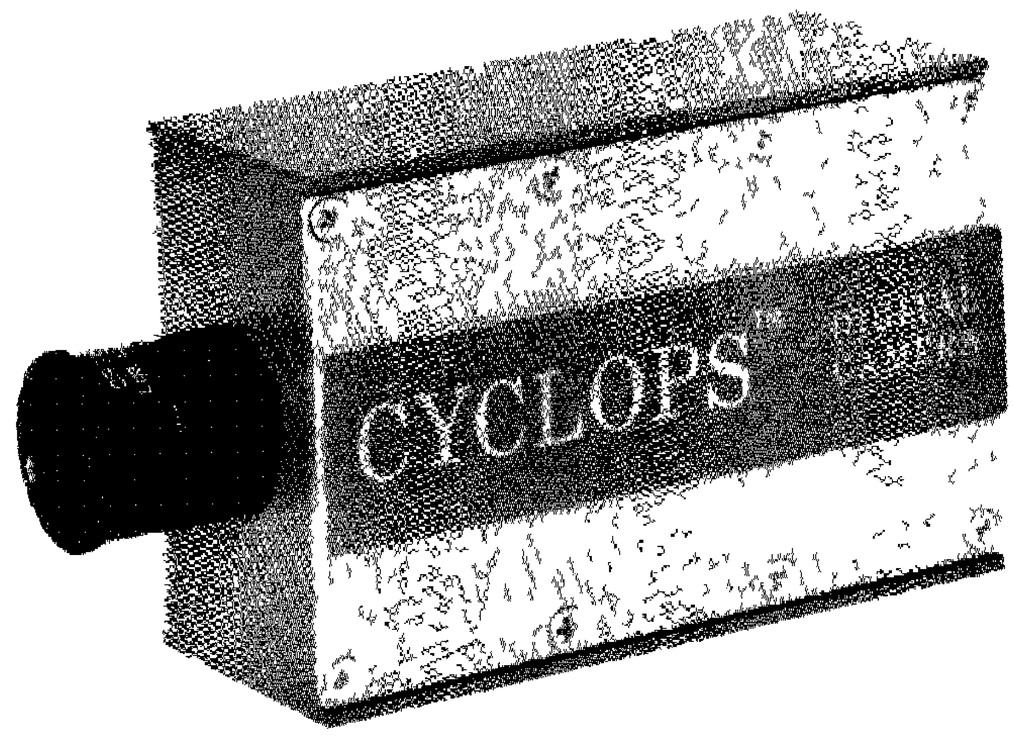
STORE/MAIL

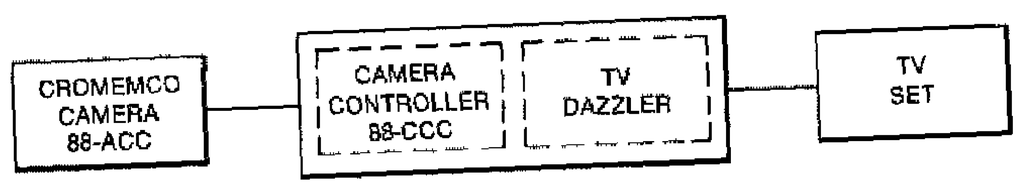
The new ZPU is available as a kit or assembled. Look into it now because you can see demand will be strong.

ZPU kit (Model ZPU-K) $295
ZPU assembled
(Model ZPU-W) $395

Cromemco
Low Cost Optical Data Digitizer

- for hobby work
- for security work
- for night viewing
- for pattern recognition
- for automated control systems
- for special-design projects





The Cromemco 88-ACC is an inexpensive general-purpose digital TV camera that can be used with the Altair 8800 or IMSAI 8080 computers. Signals from the camera are stored in the computer memory. Thus, by suitably programming the computer you have a wide range of possible uses for the camera-computer combination that are totally beyond the usual computer applications (see list above).

(If you then connect a TV Dazzler™ (pp 4-5) and an ordinary home TV set to your computer, you can see on your TV what the camera sees. The camera signal can be reformatted by the computer for the TV set with suitable software.)

USES IMAGE SENSOR

The camera uses an image sensor rather than the customary expensive vidicon tube. This sensor permits Cyclops™ to be much simpler (and much less costly) than the regular TV cameras. Yet it provides a 32-element x 32-element picture that can be used for many purposes such as surveillance or pattern recognition.

Cyclops™ is provided with a digital differential output so that you can connect it to virtually any digital circuitry.

All connections to the Cyclops™ 88-ACC camera are made to a connector on the camera rear. All necessary voltages and signals are provided by the 88-CCC interface accessory which plugs into the Altair 8800 or IMSAI 8080 computer.

SMALL AND LIGHT

The 88-ACC camera is pleasingly compact. Overall dimensions are only 4-1/2" x 2-3/4" x 1-3/4". The case is extruded aluminum finished in blue baked enamel.

The camera is equipped with a medium-fast f2.8 25-mm lens that is suited to general work.

For night viewing, the camera would require infrared light on the viewed scene.

AVAILABLE NOW

Cyclops™ Digital Camera kit (Model 88-ACC-K) $195

Cyclops™ Digital Camera assembled (Model 88-ACC-W) $295

CYCLOPS™ CAMERA CONTROLLER

This Cromemco circuit interfaces the Cyclops™ camera to the Altair 8800 or IMSAI 8800 computer.

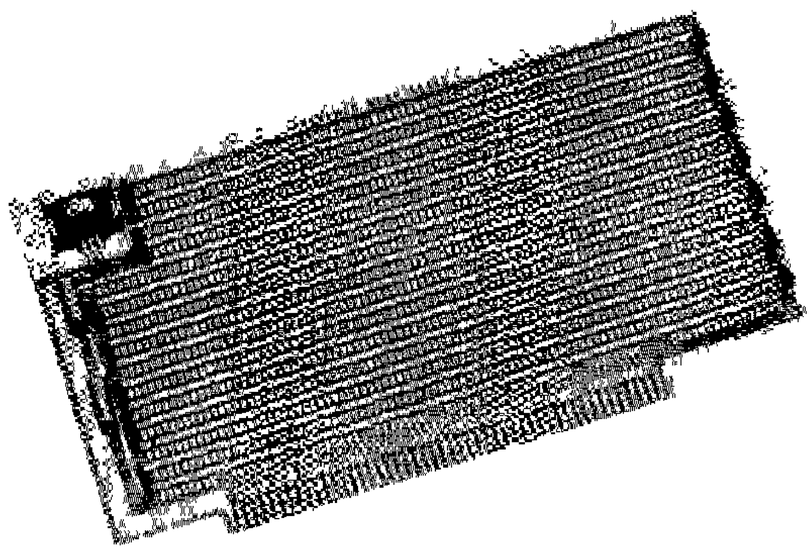
The 88-CCC Controller consists of two circuit boards that plug directly into the computers. The 88-CCC then supplies all needed signals and power for the Cyclops™ camera.

Using the Cyclops™ controller permits software control of exposure, frame rate, and memory allocations for picture storage. Direct Memory access (DMA) is used to store the picture in the computer memory.

Cyclops™ Camera Controller kit (Model 88-CCC-K) $195

Cyclops™ Camera Controller assembled (Model 88-CCC-W) $295

Wire Wrap Board



A high-quality wire wrap board for building your own cards for the Altair 8800 or IMSAI 8080 computers. Will hold over 70 integrated circuits. A 5-volt power supply is included on the board. Uses tantalum decoupling capacitors and disc ceramic bypass capacitors Edge contacts are gold-plated for long, trouble-free life.

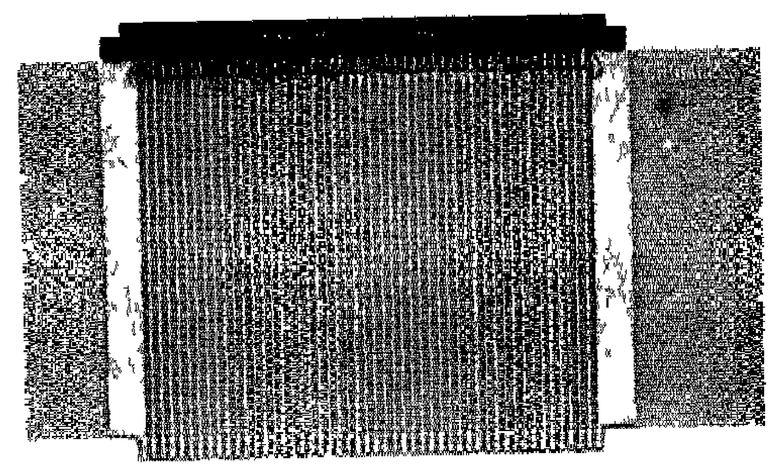
- Wire Wrap Board kit (Model WWB-2K) $35
- Wire Wrap Board assembled (Model WWB-2W). . $45

Extender Card

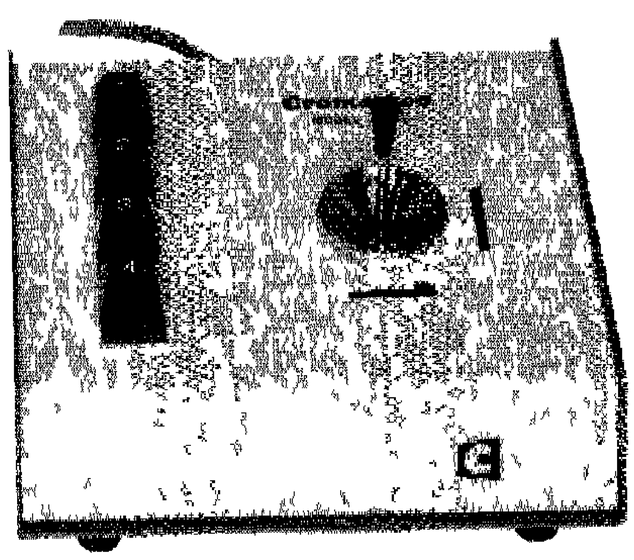
The card you need when experimenting with or trouble-shooting the Altair 8800 or IMSAI 8080 computers. Extends computer boards above case for easy connection of voltmeter, logic probe, or oscilloscope. Compatible with all Altair/IMSAI boards. Edge contacts are gold plated for long, trouble-free life.

Connector is included (photo).

- Extender Card kit (Model EXC-2K) $35
- Extender Card assembled (Model EXC-2W) . . . $45



Joystick console with speaker



This is not merely a joystick but a console with 4 pushbutton switches and a built-in speaker with speaker amplifier. Can be used for games, interactive graphics, cursor positioning, process control.

With this console you can also have an audio output—adds dramatic effect to the fun of games and gives another dimension in other applications.

Use with D + 7A analog I/O shown on p. 3. Two consoles use only about half of the channels of the D + 7A I/O.

- Joystick Console Kit (Model JS-1K) $65
- Joystick Console Assembled (Model JS-1W) $95

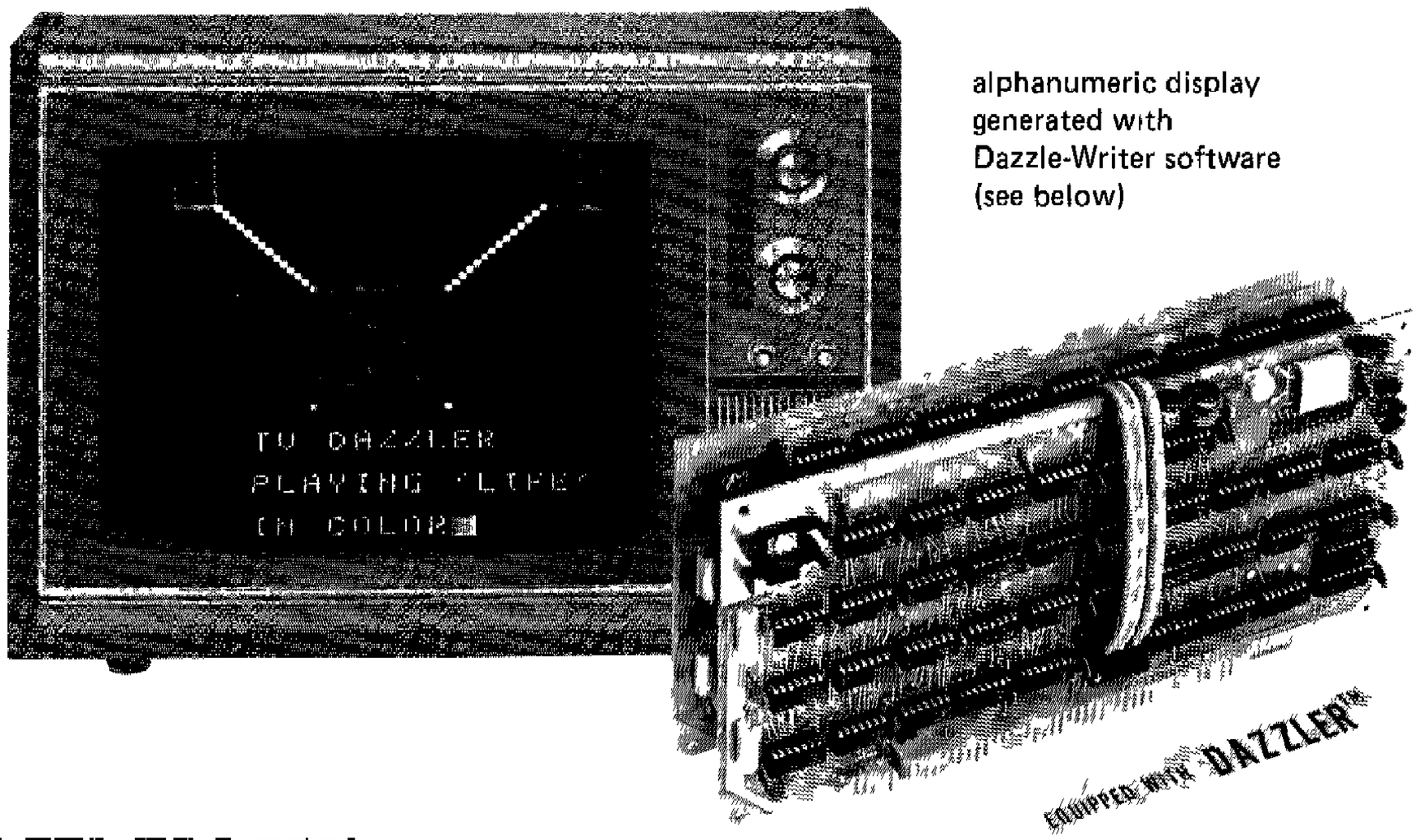
Ordering information

Cromemco's advanced peripherals are sold at computer stores from coast to coast.
Or you can order directly by mail from Cromemco.
Cromemco ships promptly — most of the time from stock.

- Mastercharge and BankAmericard are accepted with signed order. Please show complete card number and expiration date.
- Mail orders are shipped prepaid if fully paid with order.
- Purchase orders accepted subject to credit approval.
- Shipments to outside U.S. — Payment must accompany order and must include a 10% surcharge to cover additional shipping and handling charges.
- California users add 6% sales tax

Prices at stores may be slightly higher to cover stocking costs.

Cromemco
Specialists in computer peripherals
2432 Charleston Rd., Mountain View, CA 94043 • (415) 964-7400



alphanumeric display generated with Dazzle-Writer software (see below)

Now your color TV can be your computer display terminal

New capabilities, too

Cromemco's new computer/tv interface circuit lets you have a full-color computer display terminal for little more than a black-and-white terminal

The Cromemco interface also lets you do vastly more with your color terminal than you can do with ordinary black-and whites

We call our interface the TV Dazzler® It consists of two circuit boards that plug directly into your Altair 8800 or IMSAI 8080 computer

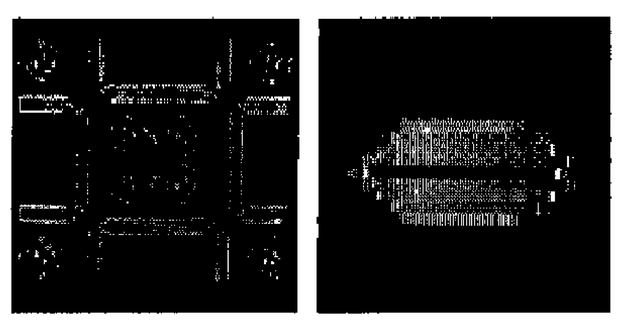
Alphanumerics plus action, and graphics

The Dazzler® maps your computer memory content onto your color tv screen in full color

That doesn t mean just that you see alphanumerics in color You can display *any* information in memory And do so in color

LIFE in color

You can display computer games or animated shows (rocket ships) What's more, you can display business or technical graphics — multi colored charts, graphs, histograms, educational material — all from computer memory Even light shows Not even the biggest computer manufacturers offer all this in color



Needs only 2K memory

Technically, the Dazzler® scans your computer memory using direct memory access (DMA) It formats each memory bit into a point on the tv screen to give a 128 x 128-element picture Only a 2K-byte computer memory is required (only 512 bytes for a 32 x 32 picture) The quality of the pictures is evident in the photos

The Dazzler® output is a video signal that goes directly to the tv video amp or to the antenna terminal through an inexpensive commercially-available device

Inexpensive — and so much better

You can see from the list below that the Dazzler® is little if any more in price than an ordinary b/w interface or tv typewriter But it does so much more

Order now

By mail or at your computer store

If you're into computers (or want to be), if you want to invent these beautiful displays or games, or to plot colorful material inexpensively at home or in business, the Dazzler® is for you

Not only is it reasonable, but it's sold at computer stores from coast to coast

Or order directly by mail on your bank card

TV DAZZLER® (complete kit)	$215
TV DAZZLER® (fully assembled and tested)	$350

SOFTWARE
(punched paper tape with documentation)

LIFE in full color	$15
KALEIDOSCOPE in full color	$15
DAZZLE WRITER (for alpha numeric displays in color)	$15

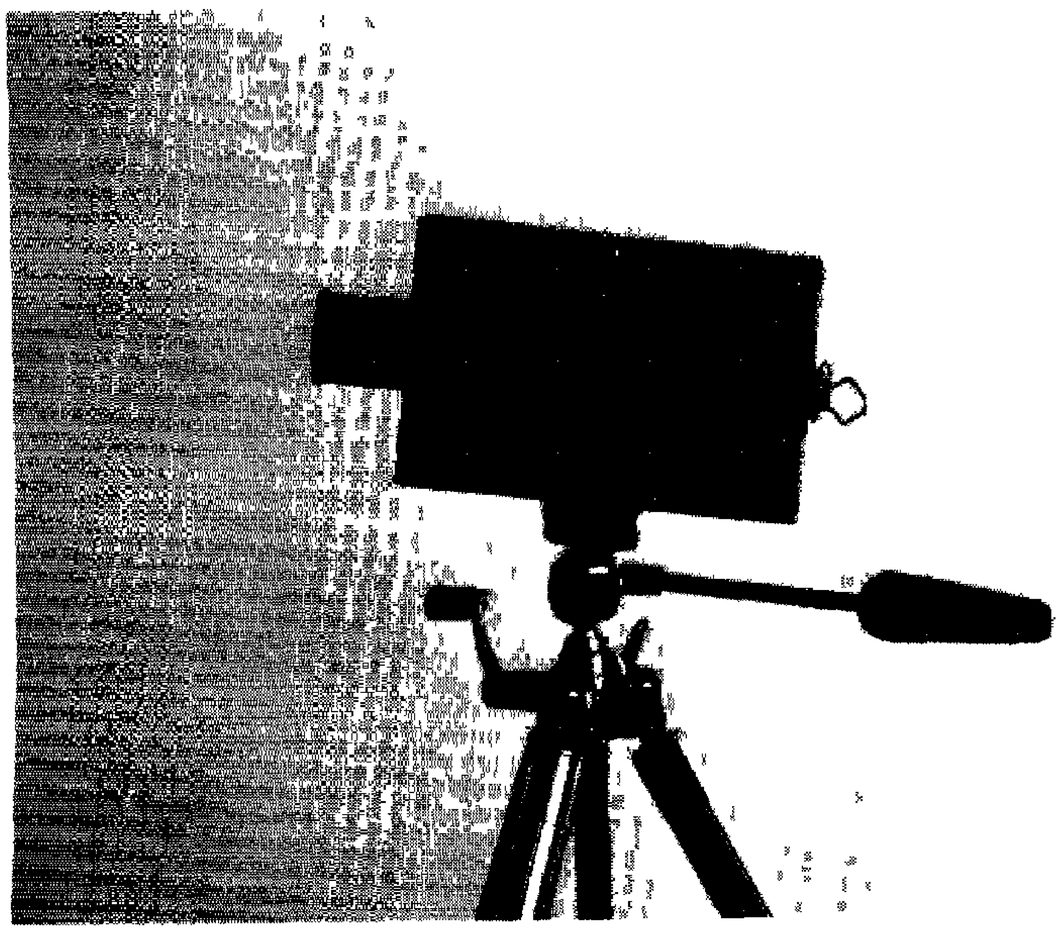
Shipped prepaid if fully paid with order
California users add 6% sales tax

Mastercharge and BankAmericard accepted with signed order

Delivery from stock for immediate shipment

Cromemco
Specialists in computer peripherals
One First St., Los Altos, CA 94022 • (415) 941-2967

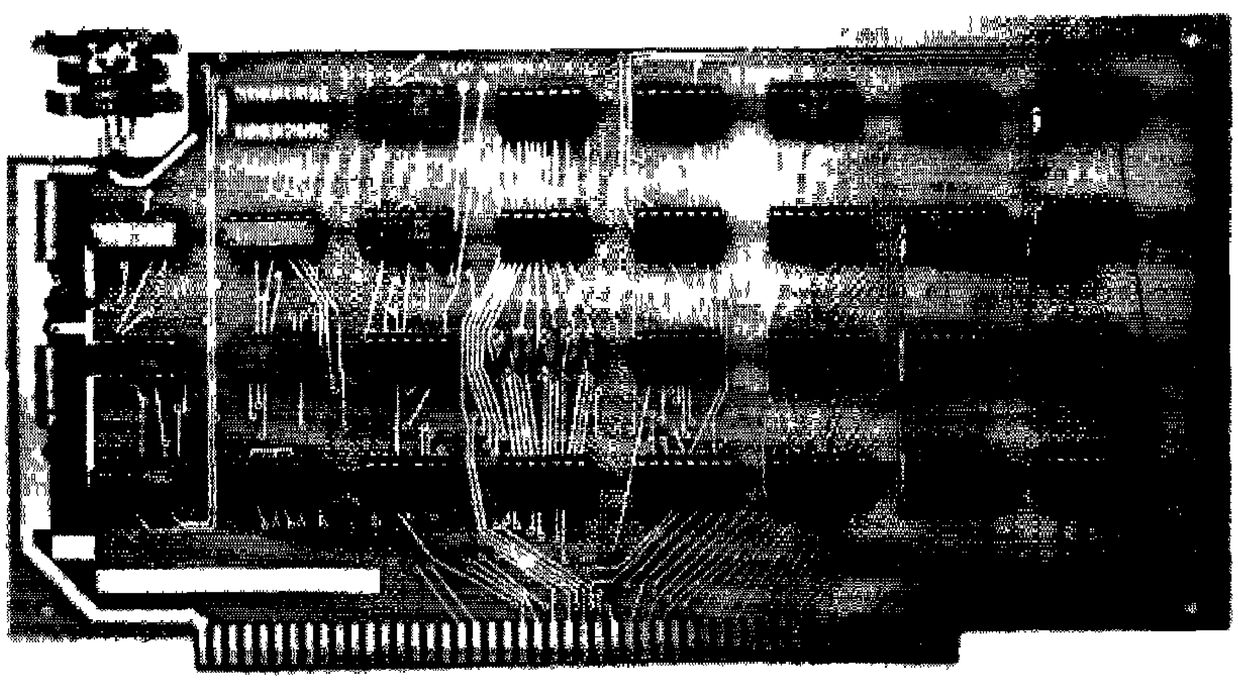
CROMEMCO ONE FIRST STREET • LOS ALTOS, CALIFORNIA 94022 • 415/941-2967

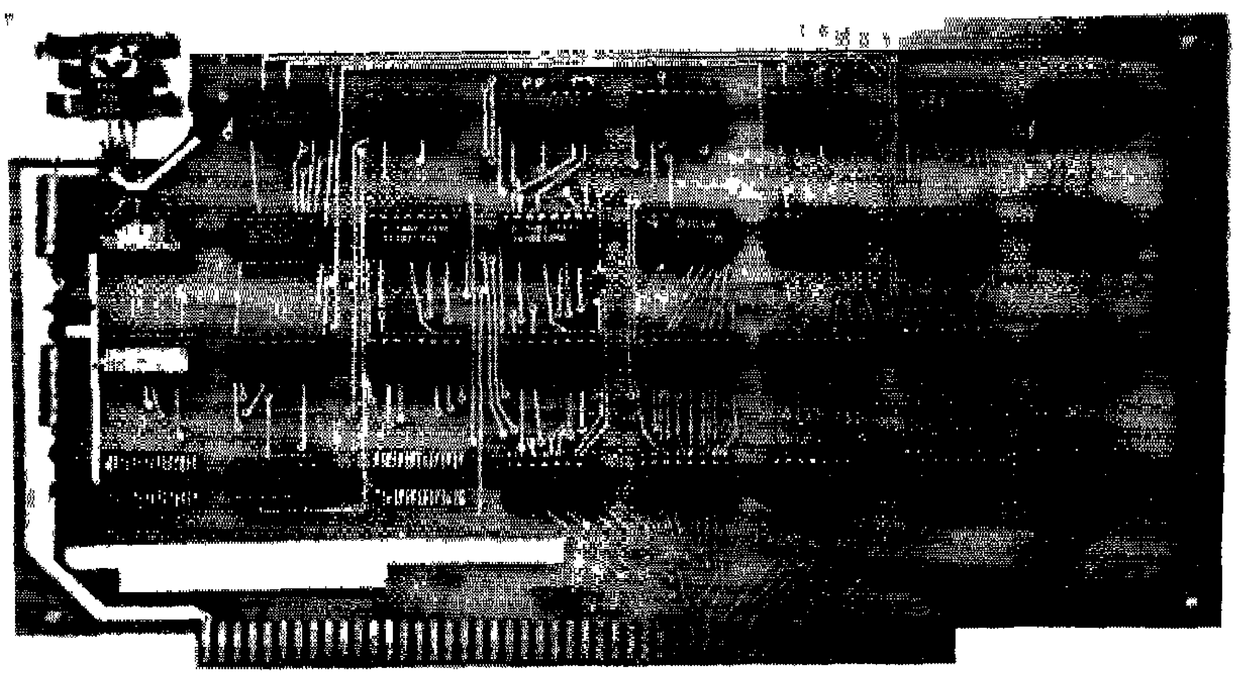


The Cyclops™ Digital Camera contains a 1024 element 32-by-32 image sensor and associated support circuitry. The camera is equipped with a 25mm, f-2.8 lens using a standard "D" mount. Digital differential output is provided for interfacing with digital systems.

Applications include security systems, image recognition systems, and automated control systems. Cyclops is available as a kit (model 88-ACC-K) or wired (model 88-ACC-W).

88-ACC-K $180
88-ACC-W $235





The Cyclops Camera Controller is designed to interface the Cyclops camera to the MITS Altair 8800 computer. The controller consists of two boards that plug directly into the Altair computer.

The controller supplies all clock and power supply signals required for Cyclops, and permits software control of exposure, frame rate, and memory allocation for picture storage. Direct Memory Access (DMA) is used to store the picture in the computer memory.

The controller is available as a kit (model 88-CCC-K) or wired (model 88-CCC-W).

88-CCC-K $260
88-CCC-W $340

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Specialists in computer peripherals
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NEWS RELEASE NEWS RELEASE NEWS RELEASE

FOR IMMEDIATE RELEASE August 1, 1976

A MAJOR NEW MICROPROCESSOR DEVELOPMENT SYSTEM BASED ON THE HOT NEW Z-80 CPU

- -

The industry's most advanced microcomputer with a 4 MHz clock rate and supported by a variety of practical peripherals is now available to hardware and systems engineers for use in their work with the Z-80

- -

Cromemco is introducing a major new development tool for a major new CPU chip, the Zilog Z-80. (The Z-80 is widely regarded as the most powerful microprocessor chip available and capable of generating a new level of 'smart' devices of all types. Cromemco is, in fact, basing its new system on the Z-80/4, an advanced version of this new CPU.)

Cromemco's new microprocessor development system, the Z-1, consists of what is certainly the industry's most powerful microcomputer supported by an array of well-known and often unique Cromemco peripherals. Specifically, the Z-1 is a ready-to-run system that includes this outstanding group of features:

- more -

* a Z-80/4 microprocessor chip
* 8K of RAM memory
* 8K of PROM capacity (for 2708 PROMs)
* a PROM programmer
* a resident monitor in PROM
* an RS232 serial I/O interface
* a rugged, proved mainframe with a full 22 card-sockets and a heavy duty 28-amp power supply
* a variety of peripheral support devices.

It is of particular interest to engineers that the Z-1 is a complete working system, as shown by the above group of features. When plugged into a 110-volt power line, it is ready to use. It can further be immediately used with such devices as a graphics terminal because of its RS232 I/O interface. No further connections are required.

An important aspect of the Cromemco Z-1 system is that it is a fully professional computer-grade system. For example, the Z-1 minimum instruction execution time is 1 microsecond and its memory is expandable to up to 64K bytes.

Despite this performance level, the $2495 price of the Z-1 is markedly below minicomputer level -- as is the price level of the support peripherals available for it.

THE MICROCOMPUTER

For the development engineer it is also of special significance that the Z-1 is provided with the 22 card-sockets in a rugged card cage. These 22 sockets give the engineer the convenience of just plugging in various peripherals and circuits to work with the microcomputer.

Cromemco also has available a wire-wrap board that fits these sockets, thus enabling the engineer to do prototype work on a physically isolated board free of other circuitry.

Since it uses the Z-80 chip, the Cromemco Z-1 (which is both a microcomputer and a system) has the Z-80 features such as 158 instructions including the 78 instructions of the previous-generation 8080. The instructions include unique memory block transfers that will transfer up to 64K bytes of memory in one instruction. They also include powerful register operation instructions and provide for indexed addressing, relative addressing, and bit addressing.

HIGHER THROUGHPUT

The powerful instruction set of the chip gives the Z-1 an increased system throughput of several times that of other microcomputers. In addition, the Z-1 has the provision (unique in microcomputers) of either a 2 or 4 MHz clock speed operation.

Selection is easily made by a switch on the CPU card. The 2 MHz operation is the same rate as that of the 8080. But at 4 MHz clock speed, the instruction execution time can be as low as 1 microsecond.

BROAD PERIPHERAL SUPPORT

Cromemco is already well-known for a variety of unique peripherals such as its color graphics interface that permits a color TV set to be a color graphics terminal (a low-cost $350 option).

But Cromemco also has a number of other support peripherals including:

* PROM board with integral PROM programmer
* BASIC firmware module
* 7-channel analog I/O interface with 5 microsecond conversion time
* 2-axis joystick with 4 pushbutton switches (two of these consoles can be fully interfaced by one of the analog I/O's listed above.)
* Optical data digitizing camera that uses a solid-state sensor to provide 32 X 32-element picture suited to image recognition, process control, and other industrial work. Interface also available.
* Wire-wrap board and extender card

In addition to these peripherals, more than a dozen other manufacturers produce peripherals that are plug-compatible with the Z-1.

OTHER FEATURES

The Cromemco Z-1 microcomputer is housed in the proven IMSAI mainframe. This mainframe provides 22 card-sockets in a rugged card cage to allow for system expandability. The 28-amp power supply easily accommodates expansion to many peripherals.

MICROPROCESSOR DEVELOPMENT SYSTEMS

It is perhaps not too generally realized as yet that a microprocessor development system such as the Z-1 should probably be regarded as a basic and essential laboratory tool, one that greatly facilitates the engineer in his work with microprocessors. Since the Z-1 is probably the first microcomputer to incorporate the powerful Z-80 chip, and since it has many powerful features in its own right, it is expected to find wide application as a laboratory tool.

PRICE/DELIVERY

The Cromemco Z-1 is priced at $2495 and is ready to use at that figure. A terminal can be directly plugged into its RS232 connector.

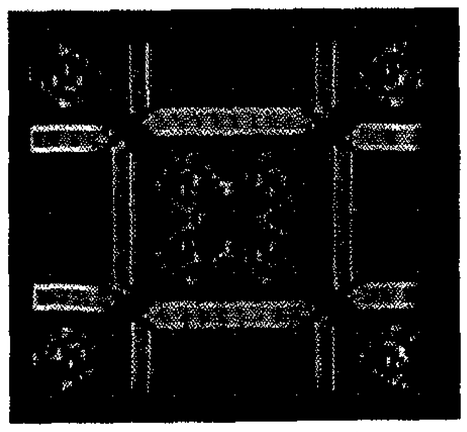
6 - 6 - 6

Delivery is from stock to 60 days. Cromemco has a well-established reputation for reliable deliveries.

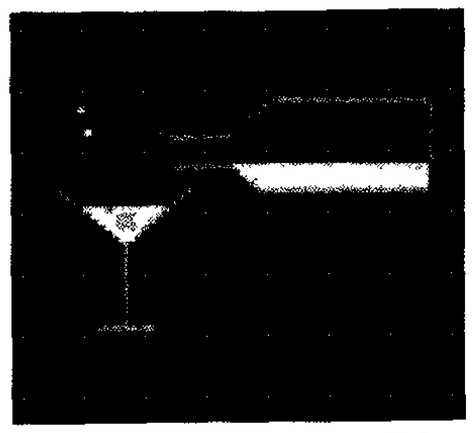
- end -

For more information, contact:

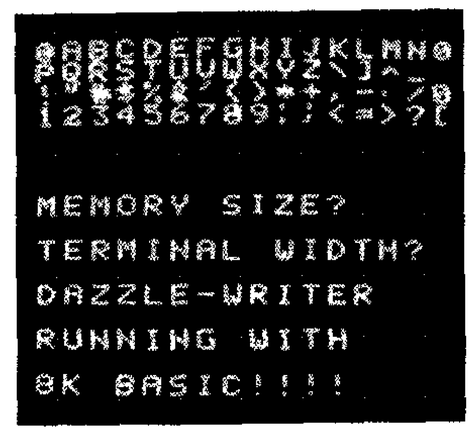
Mr. Joe McCrate
Cromemco
2432 Charleston Rd.
Mountain View, Calif. 94040
(415) 964-7400



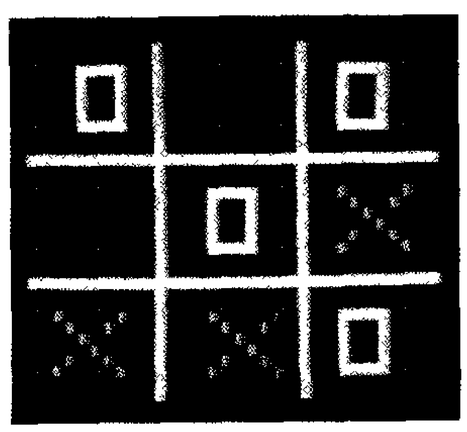
TV d splay pattern obta ned dur ng a sequence of the computer game LIFE from Cromemco software (below) D s play is in beaut ful color (see cover)



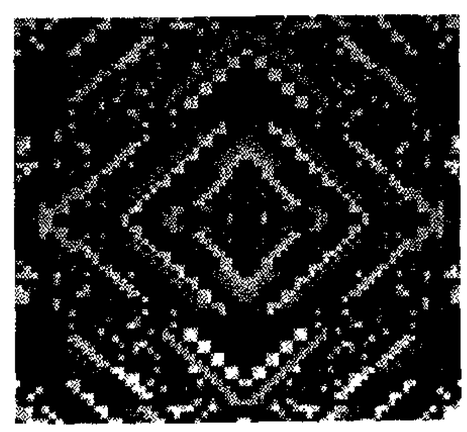
An example using Cromemco s DAZZLE MATION software A second tape (Ma genta Mart n) was used to obta r above act on display This tape s ncluded with DAZZLE MATION as a use example



Top four lines show range and style of alphanumer cs obta nable w th Cromem co s DAZZLE WRITER software Query t nes are f rst two prompts from MITS BASIC



Sequence from Cromemco s TIC TAC TOE software wh ch lets you play the computer Don t be sure you ll always win—we ve made t rough



Sequer ce from Cromemco s KALEIDO SCOPE software th s program runs without keyboard entry gives you stunn ng color d splay

ALL OF THE ABOVE ARE BEAUTIFUL COLOR DISPLAYS ON THE TV SET

DISPLAYS IN COLOR

You can display computer games or animated shows (rocket ships) What's more, you can display business or technical graphics — multi colored charts, graphs, histograms, educational material — all from computer memory Even light shows Not even the biggest computer manufacturers offer all this in color

ORDER NOW
BY MAIL OR AT YOUR COMPUTER STORE

If you're into computer (or want to be), if you want to invent these beautiful displays or games, or to plot colorful material inexpensively at home or in business, the Dazzler™ is for you

Not only is it reasonable, but it's sold at computer stores from coast to coast

Or order directly by mail on your bank card

TV DAZZLER™ (complete kit)	$215
TV DAZZLER™ (fully assembled and tested)	$350

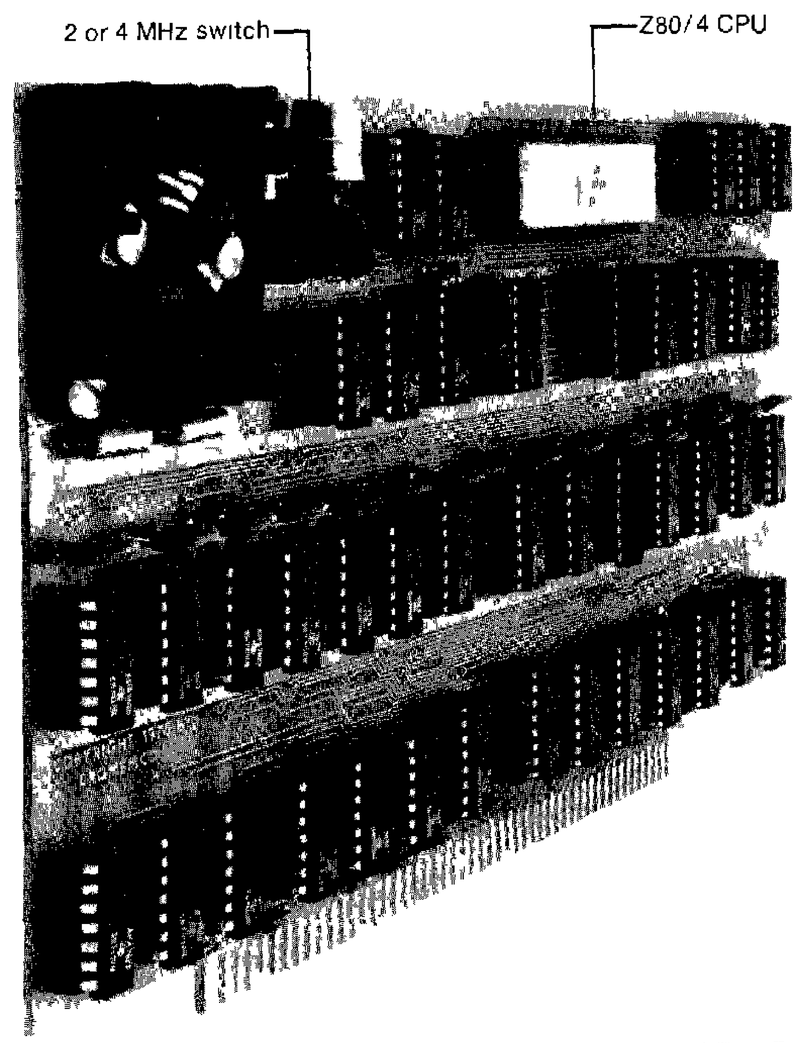
SOFTWARE
(Punched paper tape with documentation)

SPACEWAR (2 persons, 2 joysticks)	$15
LIFE in full color	$15
DAZZLE WRITER (for alphanumeric displays in color)	$15
DAZZLE MATION (for computer generated animated displays)	$15
TIC TAC TOE (you play the computer)	$15
CHASE! (2 persons Cross chases circle)	$15
DAZZLE DOODLE (1 person You draw pictures in 4 colors)	$15
TRACK (1 person Move the dot to center of spiral)	$15
KALEIDOSCOPE in full color	$15

See ordering info ' on back cover

Cromemco

4 MHz CPU card



2–5X MORE THROUGHPUT

Here is by far the most powerful CPU card now available

It's Cromemco's new ZPU™ card

It uses the slick new Z-80 chip—in fact, it uses the even faster Z80/4 high speed version of the Z 80—and it's the *only* card that does The Z80/4 is certified by its manufacturer for 4 MHz operation

The Z80/4 has all the advantages of the 8080 and 6800—and enormously more

And Cromemco s new ZPU does enormously more

4 MHz CLOCK RATE

First the ZPU lets you choose either a 2 or 4 MHz crystal controlled clock rate Right away that means you can have twice the throughput Cuts program running time in half Then the instruction set of the Z80/4 reduces software even more

The 2 or 4 MHz clock rate is switch selectable as shown in the above photo

POWER ON MEMORY JUMPS

Cromemco s ZPU also has some neat design innovations of its own

For example, you ll like the simplified operation you get because upon power turn-on the ZPU will jump to any desired 4K boundary in memory No switch flipping to go through to begin your program

SELECTABLE WAIT STATES

Cromemco engineers have also arranged that your present systems will always be useful with the new ZPU To do this the ZPU has been designed to have jumper wire selectable wait states on the card

These simplify interfacing with your present memory or I/O even at 4 MHz operation

80 ADDITIONAL INSTRUCTIONS

You've probably heard that the Z 80 with its 80 new additional instructions is by far the most powerful chip around It's true

That means with the ZPU you will be able to devise much more powerful (as well as faster) software than before

ALTAIR/IMSAI COMPATIBLE WITHOUT MODIFICATION

Yes, the new ZPU is plug-compatible with the Altair 8800 and IMSAI 8080 Just remove the existing CPU, plug in the ZPU card, and you re up and running

Further, the Cromemco ZPU is the only card guaranteed to work with all present and future Cromemco peripherals (Cromemco manufactures the popular BYTESAVER™ memory the TV DAZZLER™, the D+7A™ analog interface board, a joystick console, and others

4K STATIC RAM MEMORY BOARD

High Speed—Expandable beyond 64K

Operates at 4 MHz to be compatible with above 4 MHz CPU card Memory is also expandable to as much as 512 kilobytes using unique bank select feature 8 position switch selects bank(s) in which board resides

Kit (Model 4KZ K)	$195
Assembled (Model 4KZ W)	$295

INCLUDES FREE SOFTWARE

The ZPU comes with our powerful Z 80 monitor, complete documentation, source code, and paper tape object code The monitor is also available in PROM ($75) for use in our BYTESAVER memory board

STORE MAIL

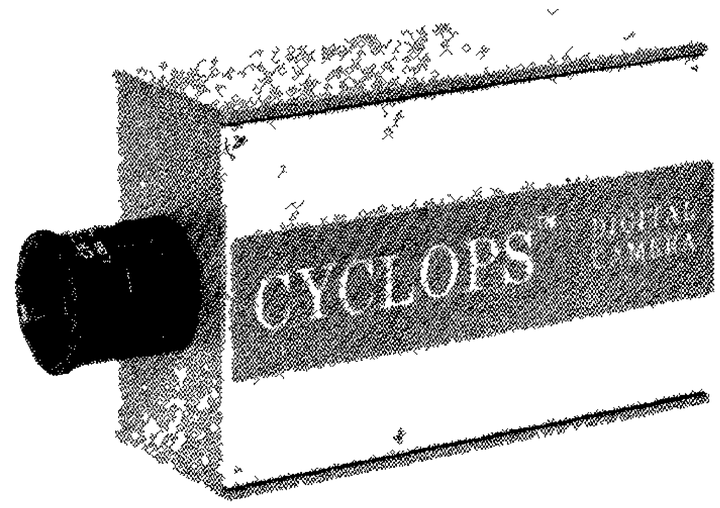
The new ZPU is available as a kit or assembled Look into it now because you can see demand will be strong

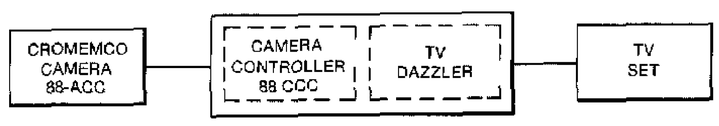
ZPU kit (Model ZPU K)	**$295**
ZPU assembled (Model ZPU W)	**$395**

Cromemco

Low Cost Optical Data Digitizer

- for hobby work
- for security work
- for night viewing
- for pattern recognition
- for automated control systems
- for special-design projects





The Cromemco 88 ACC is an inexpensive general purpose digital TV camera that can be used with the Altair 8800 or IMSAI 8080 computers Signals from the camera are stored in the computer memory Thus, by suitably programming the computer you have a wide range of possible uses for the camera computer combination that are totally beyond the usual computer applications (see list above)

(If you then connect a TV Dazzler^{tm} (pp 4 5) and an ordinary home TV set to your computer, you can see on your TV what the camera sees The camera signal can be reformatted by the computer for the TV set with suitable software)

USES IMAGE SENSOR

The camera uses an image sensor rather than the customary expensive vidicon tube This sensor permits Cyclops^{tm} to be much simpler (and much less costly) than the regular TV cameras Yet it provides a 32-element x 32-element picture that can be used for many purposes such as surveillance or pattern recognition

Cyclops^{tm} is provided with a digital differential output so that you can connect it to virtually any digital circuitry

All connections to the Cyclops^{tm} 88-ACC camera are made to a connector on the camera rear All necessary voltages and signals are provided by the 88 CCC interface accessory which plugs into the Altair 8800 or IMSAI 8080 computer

SMALL AND LIGHT

The 88 ACC camera is pleasingly compact Overall dimensions are only 4-1/2" x 2-3/4' x 1-3/4" The case is extruded aluminum finished in blue baked enamel

The camera is equipped with a medium fast f2 8 25-mm lens that is suited to general work

For night viewing, the camera would require infrared light on the viewed scene

AVAILABLE NOW

Cyclops^{tm} Digital Camera kit (Model 88-ACC-K)	$195
Cyclops^{tm} Digital Camera assembled (Model 88 ACC W)	$295

CYCLOPS^{tm} CAMERA CONTROLLER

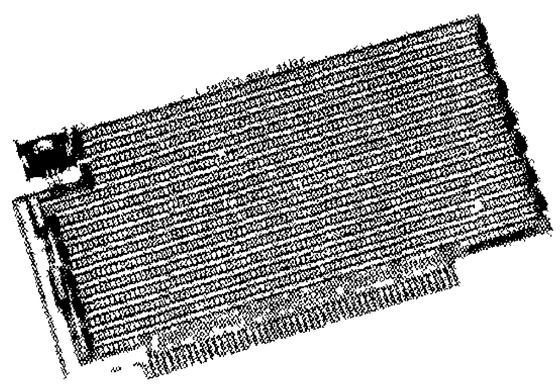
This Cromemco circuit interfaces the Cyclops^{tm} camera to the Altair 8800 or IMSAI 8800 computer

The 88-CCC Controller consists of two circuit boards that plug directly into the computers The 88 CCC then supplies all needed signals and power for the Cyclops^{tm} camera

Using the Cyclops^{tm} controller permits software control of exposure, frame rate, and memory allocations for picture storage Direct Memory access (DMA) is used to store the picture in the computer memory

Cyclops^{tm} Camera Controller kit (Model 88 CCC K)	$195
Cyclops^{tm} Camera Controller assembled (Model 88-CCC W)	$295

Wire Wrap Board



A high-quality wire wrap board for building your own cards for the Altair 8800 or IMSAI 8080 computers Will hold over 70 integrated circuits A 5-volt power supply is included on the board Uses tantalum decoupling capacitors and disc ceramic bypass capacitors Edge contacts are gold plated for long, trouble free life

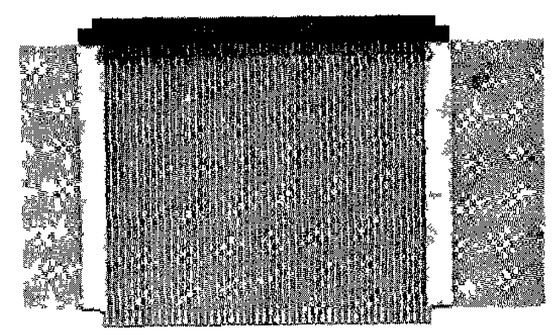
- Wire Wrap Board kit (Model WWB 2K) $35
- Wire Wrap Board assembled (Model WWB 2W) $45

Extender Card

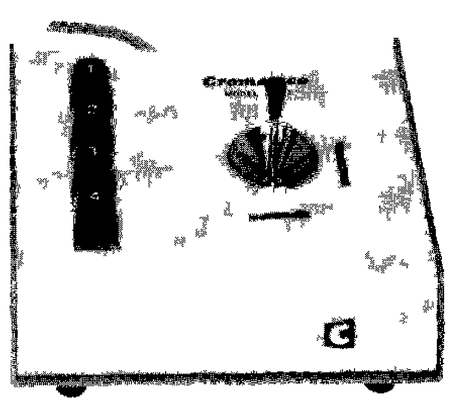
The card you need when experimenting with or trouble shooting the Altair 8800 or IMSAI 8080 computers Extends computer boards above case for easy connection of voltmeter, logic probe, or oscilloscope Compatible with all Altair/IMSAI boards Edge contacts are gold plated for long, trouble free life

Connector is included (photo)

- Extender Card kit (Model EXC 2K) $35
- Extender Card assembled (Model EXC 2W) $45



Joystick console with speaker



This is not merely a joystick but a console with 4 pushbutton switches and a built-in speaker with speaker amplifier Can be used for games, interactive graphics, cursor positioning, process control

With this console you can also have an audio output—adds dramatic effect to the fun of games and gives another dimension in other applications

Use with D + 7A analog I/O shown on p 3 Two consoles use only about half of the channels of the D + 7A I/O

- Joystick Console Kit (Model JS 1K) $65
- Joystick Console Assembled (Model JS 1W) $95

Ordering information

Cromemco's advanced peripherals are sold at computer stores from coast to coast

Or you can order directly by mail from Cromemco

Cromemco ships promptly — most of the time from stock

- Mastercharge and BankAmericard are accepted with signed order Please show complete card number and expiration date
- Mail orders are shipped prepaid if fully paid with order
- Purchase orders accepted subject to credit approval
- Shipments to outside U S — Payment must accompany order and must include a 10% surcharge to cover additional shipping and handling charges
- California users add 6% sales tax

Prices at stores may be slightly higher to cover stocking costs

Cromemco

Specialists in computer peripherals

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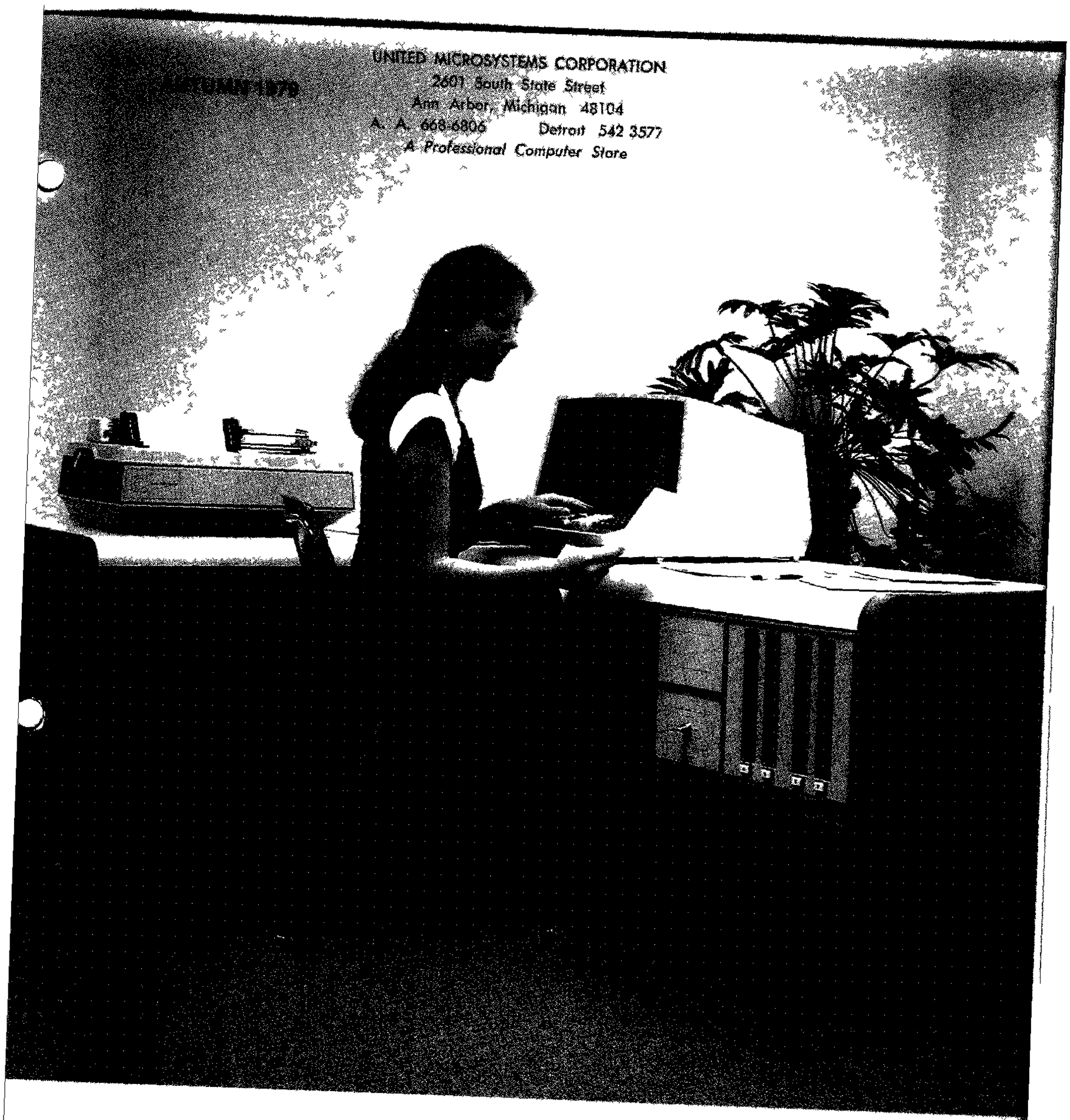
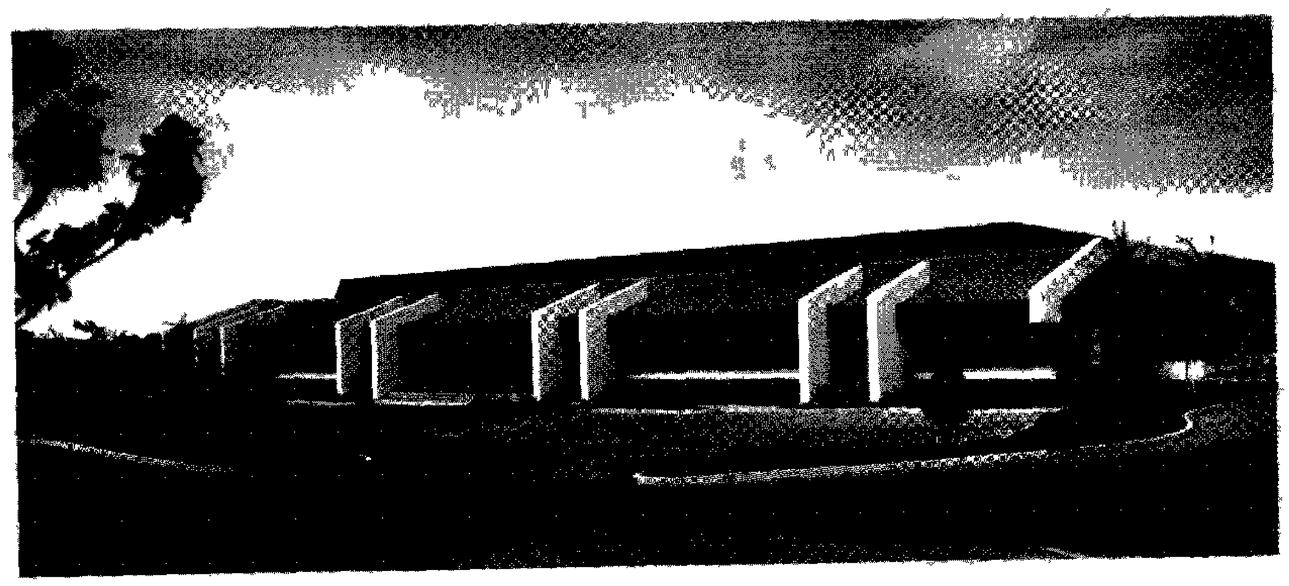


Microcomputer Systems

Cromemco

Tomorrow's computers today

© 1979 Cromemco, Inc.



Cromemco's offices, laboratory and manufacturing facility are located in this modern building in the heart of "silicon valley," the well-known electronics/semiconductor center on the San Francisco Peninsula. Up-to-the-minute production methods and automatic test equipment are used to achieve highest product reliability.

CROMEMCO FOR QUALITY AND PERFORMANCE

Cromemco specializes in quality computers and high-performance computer support products in the microcomputer field.

These products are designed around the industry-standard S-100 bus.

The products range from complete computer systems (see the System Two, System Three and Z-2H in this catalog) through add-on memory and I/O cards to system software.

Cromemco software support is, in fact, widely recognized as the best and strongest in the field. A full section of this catalog is devoted to our broad line of software, while more is coming all the time.

For applications where quality and performance count, you can depend on Cromemco. Cromemco is the industry leader in quality and reliability as determined by a recent independent industry-wide survey.

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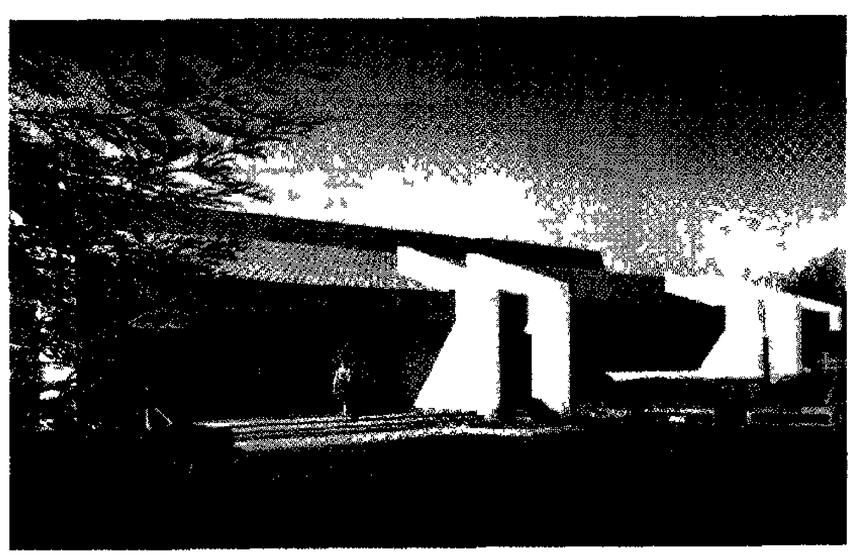
Cromemco computers in a multi-user setup in the Cromemco sales office provide immediate product availability and other information to staff answering telephone inquiries



Cromemco s offices, laboratory and manufacturing building

Section I

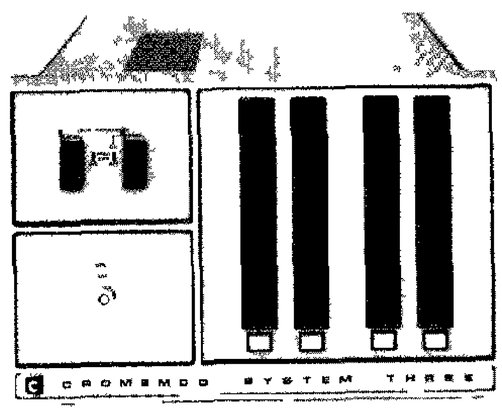
Computer Systems

Cromemco offers you a wide choice in high-capability computers with outstanding features such as high speed, many card slots to allow for broad system expansion, wide card support, fast memory and our much-admired Cromemco software

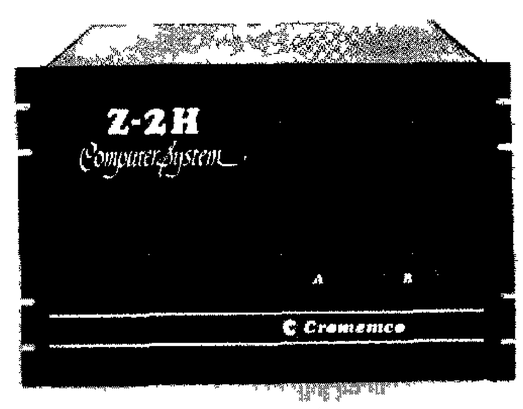
Further, Cromemco computers are of a rugged, all-metal construction that immediately tells you these computers are built to be dependable and long-lived

OBSOLESCENCE INSURANCE

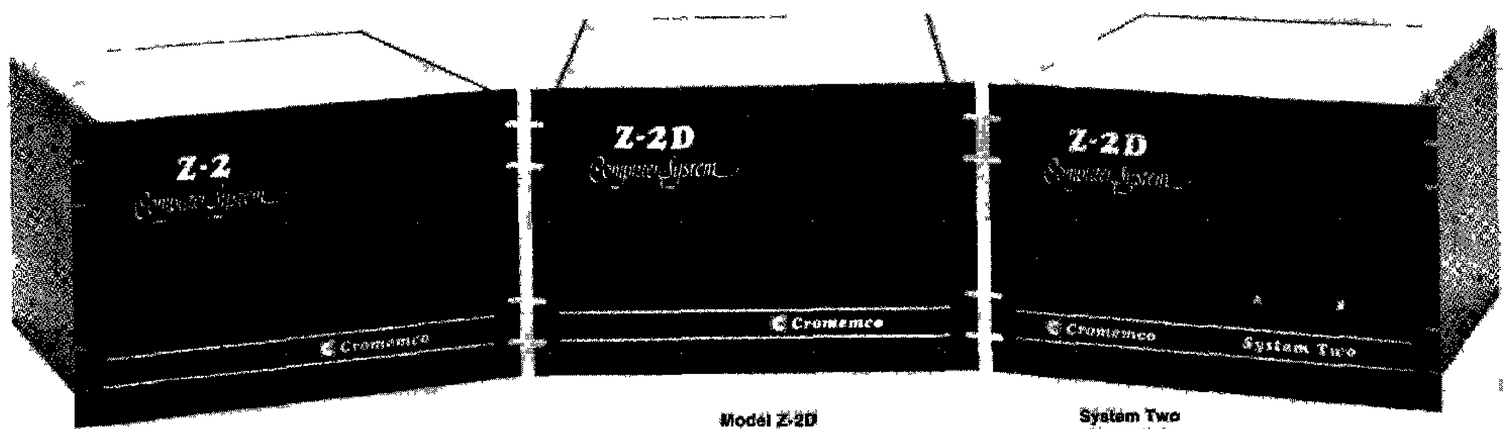
The nature of their construction also promises versatility and long life Built with easily-accessible card slots, these computers can be configured to meet the needs of an almost endless variety of applications.



System Three
Two to four disks
Up to 512K of RAM/ROM
Up to 1 megabyte of disk



Model Z-2H
11 Megabytes of hard disk storage
Up to 512K bytes of RAM/ROM
Dual floppy disks

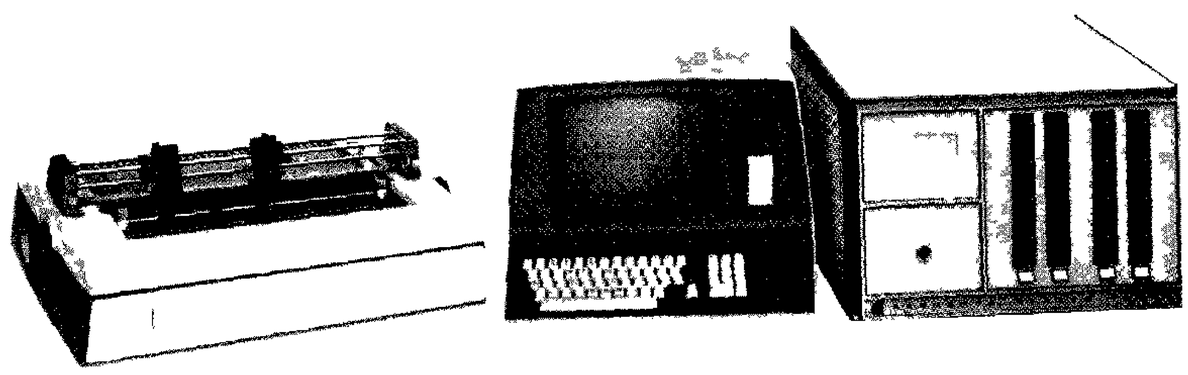


Model Z-2
Up to 512K of RAM/ROM

Model Z-2D
One or two disks
Up to 512K of RAM/ROM
Up to 184K of disk

System Two
Dual disk
Up to 512K of RAM/ROM
Up to 184K of disk

System Three
Disk Computer



The power, speed, and expandability you need for business, science, industry, education

Here s a microcomputer with the features you want and need to do professional work in almost any field engineering science business/accounting word processing data based management education medicine and others

In the microcomputer field the new Cromemco System Three stands alone in the range of features and capabilities it offers The System Three consists of a fast powerful Z80-based microcomputer with capability for enormous RAM memory expansion and with provision for up to four floppy disk drives No other microcomputer offers four drives

The computer has a large 21 slot motherboard to accept a large variety of memory and I/O to suit virtually any application

Further Cromemco offers a wide range of plug in memory and I/O for use with the computer

Large, expandable memory

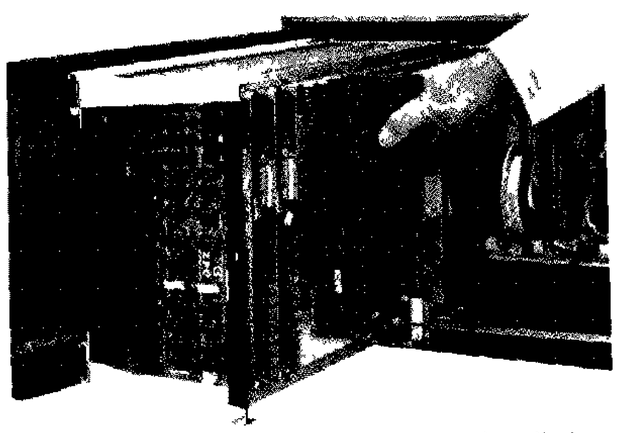
One of the most important aspects of a computer has proved to be its capability for memory expansion Experience has shown over and over that the need for memory capacity is often difficult to assess at the start of a project and is typically underestimated

Consequently Cromemco has designed the System Three with generous provision for memory both RAM and disk

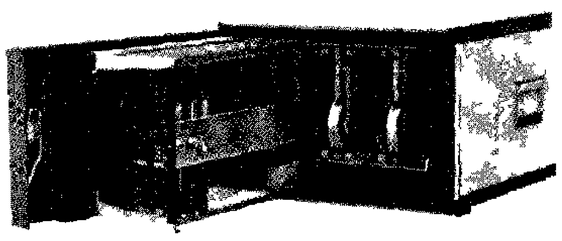
First the unit is supplied with 32 kilobytes of RAM This can be expanded to 512 kilobytes in 8 banks

Next the System Three is supplied with a dual disk drive providing 512 kilobytes of memory Using Option 002 this can be increased to 1024 kilobytes of magnetic storage

With the System Three you have the security inherent in an enormously-expandable memory (continued on p 7)



System Three computer is constructed so that hinged front panel swings open and mother board/card cage slide out for easy insertion of circuit boards



Retainer bar keeps circuit cards firmly in sockets

System Three Disk Computer (cont'd)

System Three Features

- Z 80A microprocessor
- 32-kilobyte RAM (two 16K cards)
- Dual disk drive (four drive controller)
- Power on jump circuitry to begin automatic program execution when power is turned on
- RS 232 interface
- S 100 bus
- Heavy duty 30 ampere power supply
- All metal chassis and dust case
- Rack or optional bench cabinet mounting
- 110 or 220 volt operation

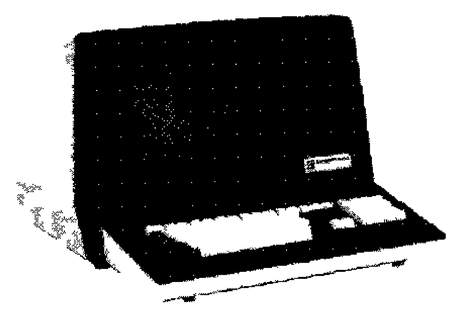
Capacitive-keyboard CRT terminal

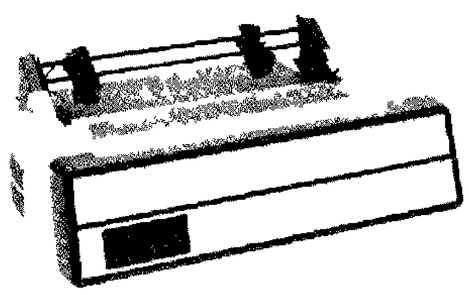
Here is a high capacity CRT terminal for use with your Cromemco computer system

The terminal has a solid state capacitive keyboard for long reliable life and quiet operation

It also has a separate numeric keypad and a cursor keypad

Other features in the Model 3102 terminal include 16 software assignable function keys and a local editing mode





Fast line printer

The Model 3703 line printer available for the System Three prints at a maximum speed of 180 characters/second using its bi directional printing

Printing line width is 132 columns Paper feed is tractor type

MULTI USER VERSIONS OF SYSTEM THREE COMPUTER

The System Three is available in a multi user system that lets you do the tasks usually associated with much more expensive time sharing computers

You can have up to seven terminals a fast printer a large RAM memory expandable to one half megabyte and many more features Check this system for speed—you ll be surprised

Multi user versions of the System Three are available to support from two to seven users In the accompanying price list the number following the slash indicates the number of users supported by the system Prices include our BASIC Multi User Operating System

CS3/2 – $9 465	CS3/5 – $13 330
CS3/3 $11,250	CS3/6 – $13,625
CS3/4 – $11,545	CS3/7 – $15,410

System Three
Disk Computer (cont'd)

Disk protection

The System Three has several provisions for protection of disks from damage

- The computer provides for ejection of disks under software control if desired
- When the key switch is in the LOCK position the eject buttons under the disks are disabled—an unknowing person can t eject the disks while they are running Disks and programs are thus prevented from damage and loss
- Disk loading and unloading are motor driven pro viding gentle handling of these long life disks

PROM programmer option for development work

Easy PROM programming is provided (option 001) right on the front panels of the System Three In fact *two* sockets are provided so that the memory in one PROM can easily be duplicated in a second one

BROAD SOFTWARE SUPPORT

Following is some of the outstanding software support available to you for the System Three More becomes avail able all the time

These disk software packages comprise a totally integrated system running under our CDOS Operating system

• CROMEMCO DISK OPERATING SYSTEM (CDOS) This is the framework through which all disk file management is handled The primary purpose of CDOS is to perform disk Input and Output It is designed to allow users of Cromemco microcomputer systems to create and manipulate both random and sequential access disk files using symbolic file names

• DATA BASE MANAGEMENT SYSTEM This advanced software package can be used for inventory control mailing lists personnel records order entry and other important business applications

To create a data base an operator simply specifies the field attributes then the sorts by which the data can be retrieved (e g by state by name by state by city by name etc)

• MULTI USER BASIC Up to 7 users can independently run BASIC Programs with Cromemco s new multi user software

• CROMEMCO 16K DISK EXTENDED Z 80 BASIC This disk or PROM based Extended BASIC was specifically designed to meet the most demanding requirements of business firms while also providing the flexibility and speed necessary for real time control applications It fully utilizes the extensive 158 instruction set of the Z 80 microprocessor to maximize computational precision (a full 14 digits) programming power and speed of execution

• COBOL The Cromemco compiler contains all the features of level 1 COBOL as defined by the 1974 ANSI standards as well as the most useful options of Level 2

• FORTRAN IV Cromemco FORTRAN IV provides new capabilities for users of Z 80 based microcomputer systems This is a complete implementation of ANSI standard FORTRAN X3 9 1966 except for complex data types Therefore users can take advantage of the large number of application programs already written in FORTRAN

• TRACE SYSTEM SIMULATOR TRACE is a powerful software system simulator designed to facilitate assembly language program development

Virtually all aspects of system operation can be simulated including interrupts and I/O operations A historical record of the program execution is maintained in a 100 instruction circular queue

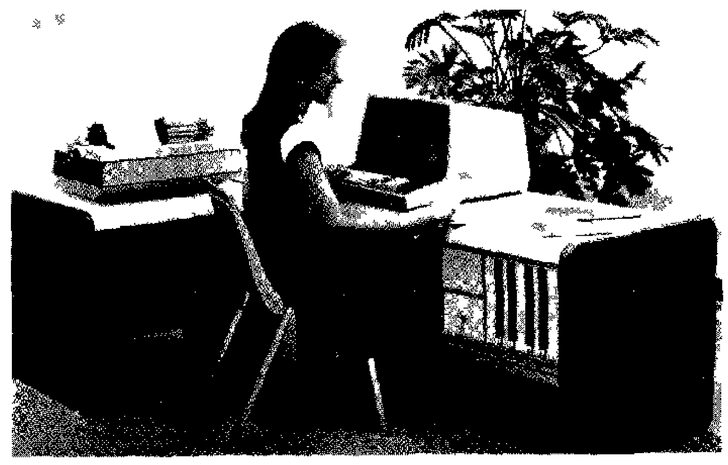
The advanced features of TRACE enable it to be used as a software substitute for logic analyzers or in circuit emulators when debugging assembly language programs

• WORD PROCESSING SYSTEM The Cromemco word processing system is a combination Screen Editor and Formatter for the quick preparation of professional looking documents

Lines of text may be left or right justified or centered Key words can be noted an alphabetical index may be auto matically prepared

• Z 80 RELOCATABLE MACRO ASSEMBLER This is a two pass assembler which reads source code from a disk file assembles it and produces an object file either in relocatable format or in Intel hex format It is both a Macro and Conditional Assembler LINK the Cromemco Relocating Linking Loader may then be used to load the assembled relocatable code into memory and resolve any external references The completely assembled and linked machine code may then be saved in a disk file for execution The assembler and linking loader allow

System Three Disk Computer (cont'd)



DESKS AVAILABLE

Two handsome desks are available for your System Three The larger desk accommodates the computer and terminal and provides extra work surface as well

The smaller desk is useful for a printer or terminal Styling of both is suited to the nicest of office surroundings

- Larger desk (Model Z3 MDSK) $695 00
- Smaller desk (Model Z3-SDSK) $395 00

METAL DESK CABINET AVAILABLE

All metal brown trimmed beige cabinet for System Three Computer (Model Z3 CAB) $195

TECHNICAL SPECIFICATIONS AND PRICES

SYSTEM THREE COMPUTER (Model CS-3)

Processor 4 MHz version Z 80A
Cycle Time 250 nanoseconds
Minimum Instruction Execution Time 1 microsecond
Instruction Set 158 nstructions including the 78 instructions of the 8080
System Bus Industry standard S 100
Board Capacity 21 boards
Disk Drive Capacity 4 drives (supplied with two drives)
Disk Storage Capacity 256K bytes each disk
PROM Firmware 1K bytes (2708 PROM)
Serial Interface RS 232 or current loop 110 to 76 800 baud Supports Cromemco CRT Terminal
Printer Interface Supports Cromemco Model 3709 3703 or 3355 Printers
RAM Memory 32K bytes
Power Supply +8 volts @ 30A +18 volts @ 15A −18 volts @ 15A
Power Operates from 110 220 volts 50 60 cycle
Operating Environment 0 40°C
Dimensions 12 ¼ H x 19 W x 20¾ D 31 1 x 48 3 x 52 7 cm)
Weight 65 lbs
Mounting For rack mounting (optional cabinets available)
Price, Model CS 3 $5990

CRT TERMINAL (Model 3102)

Format 80 characters line 24 lines upper and lower case solid state capacitive keyboard
Additional Capabilities line editing block mode transfer 16 software assignable function keys
Price $1995

LINE PRINTER (Model 3703)

Format 180 characters sec 132 cols 18 platen impact printer Bidirectional printing tractor feed
Price $2995

FULL-FORMED LETTER PRINTER (Model 3355A)

Format 55 characters/sec 15 inch platen tractor feed and friction platen quality impression suited to camera copy
Price $3195

LINE PRINTER (Model 3779)

Format 60 characters/sec up to 132 ch line 12 platen impact printer tractor feed
Price $1495

OPTION 001 2708 PROM PROGRAMMER

Sockets Two sockets for ease of PROM duplicating
Price $495

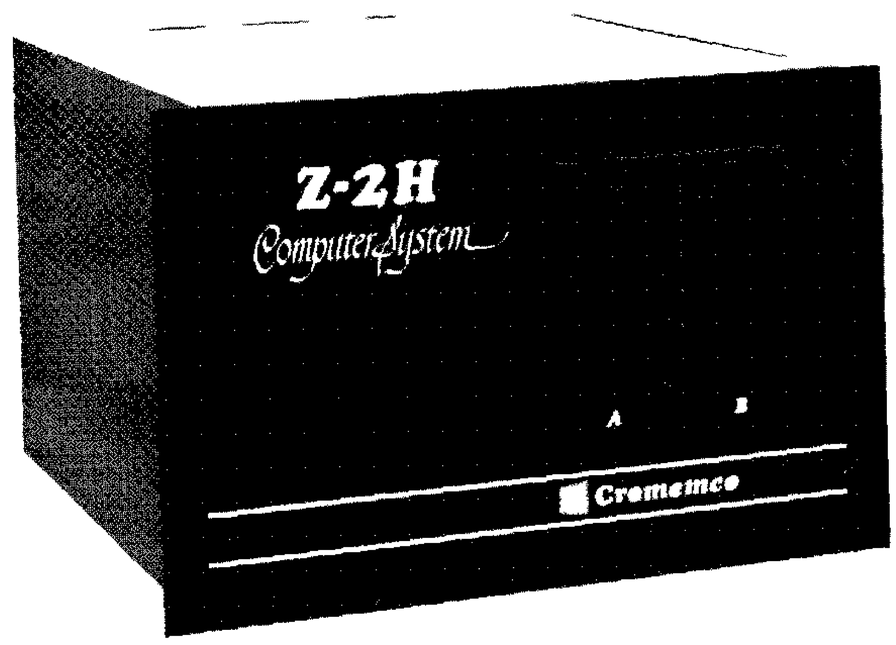
OPTION 002 DUAL DISK DRIVE

Capability Provides for a total of four disk drives
Price $2395

OPTION 004 64K MEMORY

Capability System supplied with 64K instead of 32K RAM This option must be specified at time system is ordered
Price $595

Z-2H Hard Disk Storage Computer System



THE FIRST COMPUTER TO OFFER AN INTEGRAL 11-MEGABYTE HARD DISK SYSTEM

- 11 Megabytes of hard disk storage
- Under $10 000
- Fast transfer rates
- Two floppy disk drives
- 64K RAM memory

Cromemco s new Model Z-2H not only incorporates an 11-megabyte hard disk drive but also offers the other features you have come to expect from Cromemco These include large and expandable memory fast Z-80A processor rugged construction and broad software support

This S100 bus computer has a motherboard with 12 slots 5 of which are occupied by the cards supplied with the computer Thus you have 7 slots to use for additional Cromemco cards (such as for additional RAM and interface cards) or for special cards suited to your particular application

The power supply in the Z 2H is more than ample for nearly any card complement providing more than 15A at +18V 15A at −18V and 30A at +8V

FEATURES

Model Z 2H Computer

- Fast Z 80A 4 MHz processor
- 11 megabyte hard disk drive
- Two floppy disk drives
- 64K RAM memory
- RS 232 special interface
- Printer interface
- Extensive software available

ADVANCED HARD DISK SYSTEM

The hard disk system in the Model Z-2H both has large storage and is extremely fast Eleven megabytes unformatted can be stored File transfers to and from the hard disks occur from 6 to 10 times faster than is commonly seen in floppy disk systems

The information transfer rate to and from the disk is 5 6 megabits/second using the fast DMA controller supplied in the Z-2H computer

64K RAM SUPPLIED

The Model Z-2H is provided with a full 64K of high speed RAM memory using one of our highly praised 64KZ RAM memory cards With 64K of RAM memory you are sure to have enough for most any application whether it be in business scientific engineering or process control applications

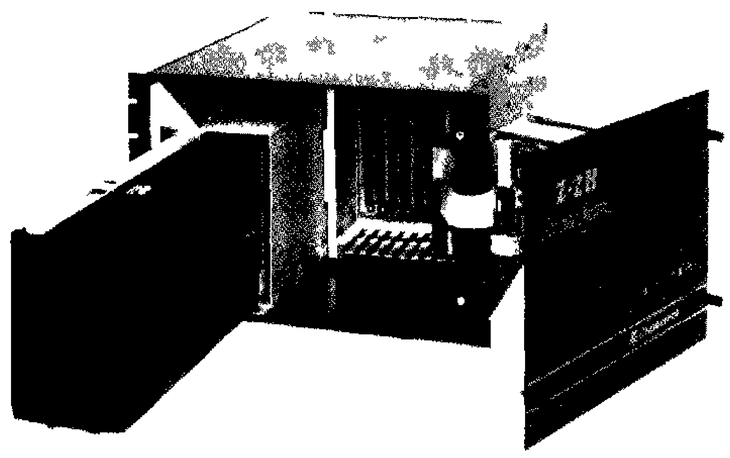
RAM EXPANDABILITY

Even the 64K RAM is greatly expandable however since you can add additional RAM to give you as much as 512K bytes of RAM using our Cromemco Model 64KZ RAM cards

PRINTER INTERFACE STANDARD

Every Z 2H is also supplied with a Cromemco Model PRI printer interface card This card supports the Cromemco dot matrix printers as well as our fully-formed character printer

Z-2H Hard Disk Storage Computer System (cont'd)



SOFTWARE SUPPORT

With the Z 2H you receive a copy of our new extended CDOS operating system This CDOS has been extended to support the system floppy disks as well as the integral hard disk With extended CDOS you have access to the full range of Cromemco software — software widely regarded to be the finest in the industry including

- FORTRAN IV
- Extended BASIC
- Structured BASIC
- COBOL
- RATFOR
- Z 80 Macro Assembler
- Word Processing System
- Data Base Management System

RELIABILITY/CONSTRUCTION

The disks and drive are housed in a sealed chamber (photo) so that the user has no need to provide filtered air for the unit The chamber holds two rotating disks that provide 3 data surfaces

To achieve fast transfer rates the disks rotate at 3600 rpm and have a rotational latency of just 8 3 milliseconds Head positioning is done with a linear actuator mechanism which is much faster than stepping motors and which achieves an average disk access time of only 50 msec

Precise head positioning is achieved by using a servo track follower which is located on the fourth disk surface Head positioning is thus maintained precisely despite temperature or humidity variations

Servo track following also permits the system to operate in various orientations — there is no need to level the unit before using

Head tracking pressure is very light—just 10 grams—thereby virtually eliminating the source of head crashes common with other disk drives

The 11 megabytes of storage in this compact drive is achieved by using a low head flying height of 19 microinches This low height coupled with the precise servo track positioning allows a radial data density of 5868 bits per inch and an axial density of 300 tracks per inch

PRICE

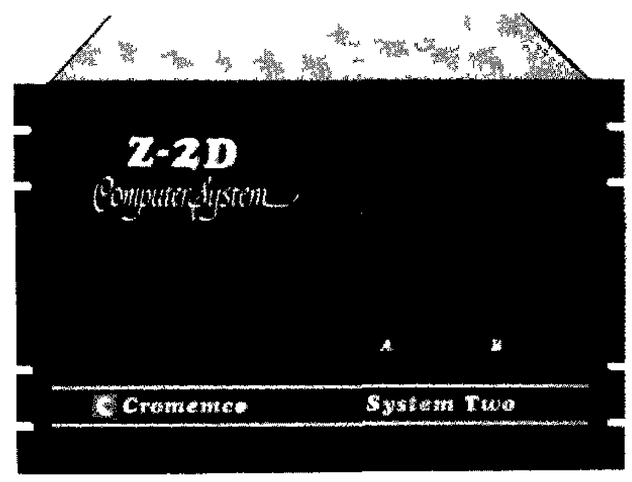
Hard Disk Computer System (Model Z 2H)	$9 995

TECHNICAL SPECIFICATIONS
Model Z 2H Hard Disk Computer System

Processor 4 MHz Z 80A
Cycle time 250 nanoseconds
Minimum instruction execution time 1 microsecond
Instruction set 158 instructions including the 78 instructions of the 8080
System bus Industry Standard S 100
Card capacity 12 cards
Standard card complement Cromemco ZPU 4FDC 64KZ PRI and WDI
Number of floppy disk drives 2
Hard disk drive capacity 11 Megabytes
PROM firmware 1K Bytes
Serial interface RS 232 or current loop 110 76 800 baud Supports Cromemco CRT terminal
Printer interface Supports Cromemco dot matrix or fully formed character printer
RAM memory 64K Bytes
Power Operates from 110/220 volts 50/60 cycle 600 watts
Dimensions 12¼ H x 19 W x 20¾ D (31 1 x 48 3 x 52 7 cm)
Weight 90 lbs (41 kg)
Mounting For rack mounting (optional cabinets available)

Data subject to change without notice
Prices f o b Mountain View CA

System Two Disk Computer



A COMPLETE TWO DISK DRIVE COMPUTER SYSTEM AT A SUBSTANTIAL SAVINGS

A $500 SAVINGS

When you want a complete factory assembled and tested ready to go version of our Z 2D Disk Computer you should consider the System Two shown here

The System Two is the money saving way to have a high-capability Z-2D Computer You save $500 over the same components obtained individually

Here is some of what you get in the System Two

- Cromemco Z 2D computer with two 5-inch disk drives (see previous page)
- RS 232 interface for use with Cromemco terminals
- 64 kilobytes of memory in the form of our Cromemco 64KZ memory card
- Printer interface (Model PRI) for use with Cromemco printers

Then of course you get such Z-2D features as the 21 slot motherboard heavy-duty power supply and our disk controller card This card handles up to 4 disk drives and also interfaces your CRT terminal

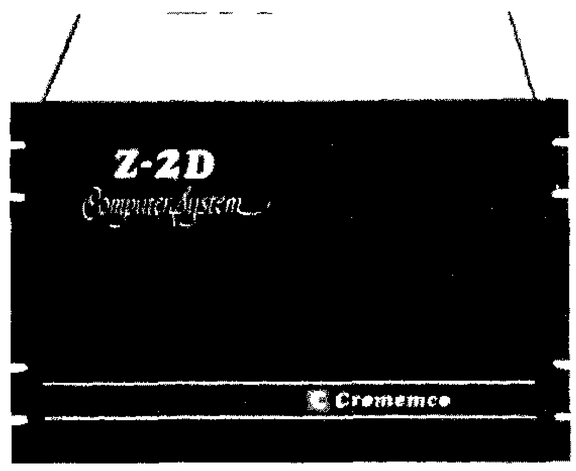
PRICE

Model CS-2 Computer System fully tested as a unit after our standard burn in procedure $3990

TECHNICAL SPECIFICATIONS
System Two Disk Computer System

Processor 4 MHz version Z 80
Cycle time 250 nanoseconds
Minimum instruction execution time 1 microsecond
Instruction set 158 instructions including the 78 instructions of the 8080
System bus Industry standard S 100
Board capacity 21 boards
Disk drive capacity 2 drives (supplied)
Disk storage capacity 92K bytes each disk
RAM memory 64K bytes
PROM firmware 1K bytes (2708 PROM)
Printer interface Supports Cromemco dot matrix or fully formed character printers
Serial interface RS 232 or current loop 110 to 76 800 baud Supports Cromemco CRT terminal
Parallel interface 8 bit TTL levels
Power supply +8 volts @ 30A +18 volts @ 15A −18 volts @ 15A
Power Operates from 110/220 volts 50/60 cycle
Operating environment 0 55°C
Dimensions 12¼ H x 19 W x 20¾ D (31 1 x 48 3 x 52 7 cm)
Weight 49 lbs (22 kg)
Mounting For rack mounting (optional cabinets available)

Z-2D Disk Computer System



Model Z 2D Computer System is supplied for rack mounting Optional bench and floor model cabinets are available

ADVANCED CONTROLLER CARD

The new Z-2D is a professional system that gives you professional performance

In the Z-2D you get our well known 4 MHz CPU card the proven Z-2 chassis with 21-slot motherboard and 30 amp power supply that can handle 21 cards and dual floppy drives with ease

Then there s our new disk controller card with special features

- Capability to handle up to 4 disk drives
- A disk bootstrap Monitor in a 1K 2708 PROM
- An RS 232 serial interface for interfacing your CRT terminal or teletype
- LSI disk controller circuitry

We re able to put all of this including a UART for the CRT interface on just one card because we ve taken the forward step of using LSI controller circuitry

LOW PRICED

Contact your computer store now about the Z-2D It s a real workhorse that you can put to professional or OEM use now

Z-2 USERS:

Your Z 2 was designed with the future in mind It can be easily retrofitted with everything needed to convert to a Z 2D Model Z2 RPW retrofit package $995

RAM MEMORY

4K 16K or 64K RAM memory cards are available for this computer See Section III of this catalog

Cromemco Model Z-2D Computer System fully assembled and tested	$1990
Additional Disk Drive (Model Z2D FDD)	$495

SOFTWARE

(On standard IBM format soft sectored mini diskettes)

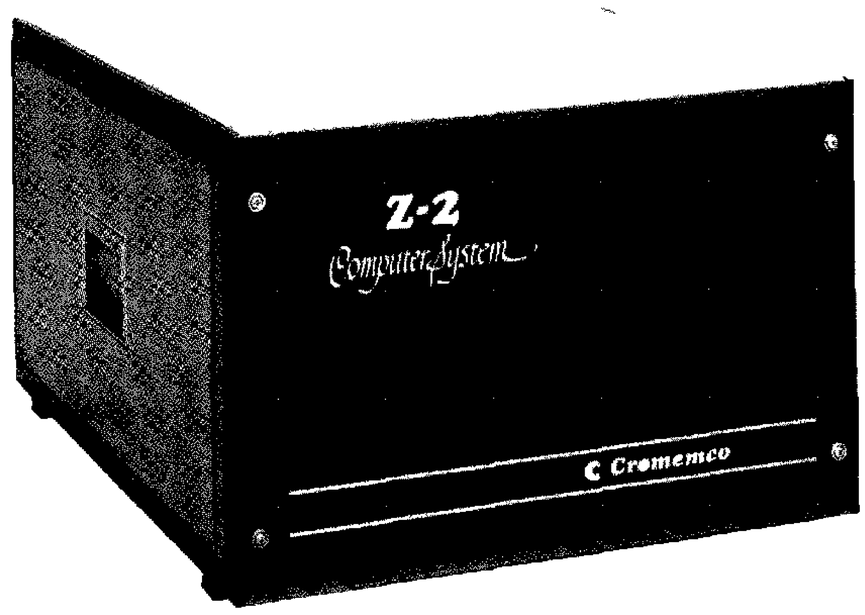
16K BASIC (Model TDB S)	$95
32K Structured BASIC (Model STB S)	$295
FORTRAN IV (Model FDF S)	$95
RATFOR with FORTRAN IV (Model FDR S)	$195
Z 80 Assembler (Model FDA S)	$95
COBOL (Model FDC S)	$95
TRACE System Simulator (Model TSS S)	$95
Data Base Management System (Model DBM S)	$95
Word Processing System (Model WPS S)	$95

TECHNICAL SPECIFICATIONS
Z 2D DISK COMPUTER SYSTEM

PROCESSOR 4 MHz version Z 80
CYCLE TIME 250 nanoseconds
MINIMUM INSTRUCTION EXECUTION TIME 1 microsecond
INSTRUCTION SET 158 instructions including the 78 instructions of the 8080
SYSTEM BUS Industry standard S 100
BOARD CAPACITY 21 boards
DISK DRIVE CAPACITY 2 drives (supplied with one drive)
DISK STORAGE CAPACITY 92K bytes each disk
PROM FIRMWARE 1K bytes (2708 PROM)
SERIAL INTERFACE RS 232 or current loop 110 to 76 800 baud
PARALLEL INTERFACE 8 bit TTL levels
POWER SUPPLY +8 volts @ 30A +18v @ 15A 18v @ 15A
POWER operates from 110/220 volts 50/60 cycle
OPERATING ENVIRONMENT 0 55°C
DIMENSIONS 12 1/4 H X 19 W X 20 3/4 D (31 1 X 48 3 X 52 7 cm)
WEIGHT 49 lbs (22 kg)
MOUNTING For rack mounting (optional cabinets available)

Data subject to change without notice
Prices fob factory

Z-2 Computer System



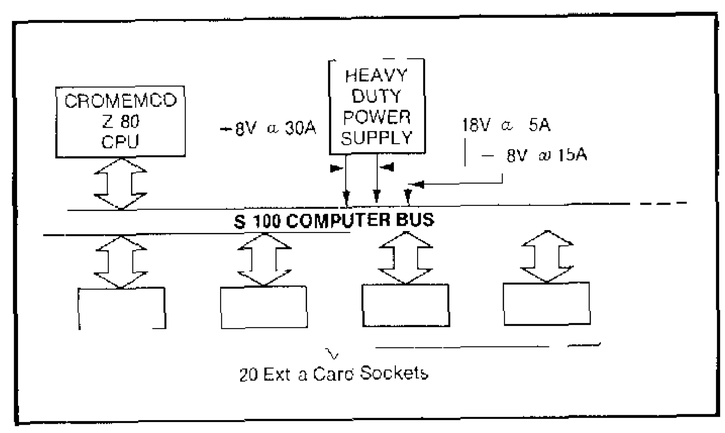
An advanced professional microcomputer

The Z 2 makes available Cromemco s fast Z 80 micro processor card and a 21 card motherboard in a form such that an almost endless variety of memory I/O and other peripherals can easily be plugged in — there by forming a computer tailored to your particular job whether in the laboratory on the production line or in an educational time sharing setup

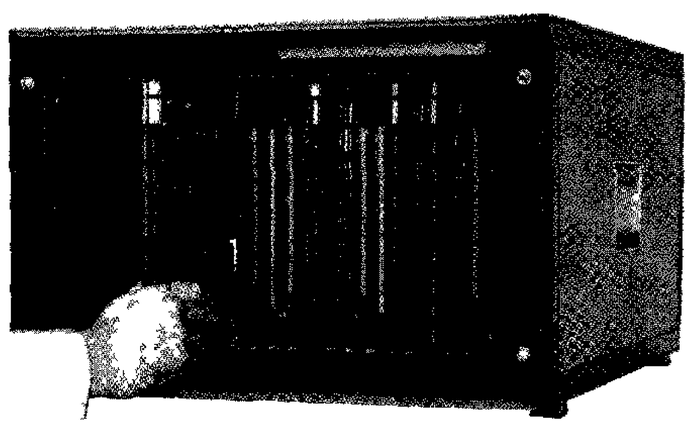
Z-2 System

Here are some of the leading features you get in the new Cromemco Z 2 Computer System

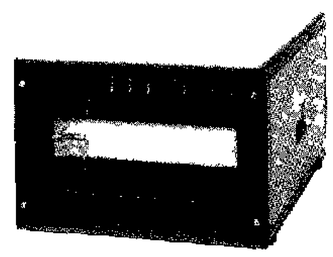
- The industry s fastest μP board (4 MHz or 250 nanosecond cycle time)
- The power and convenience of the well known Z 80 microprocessor chip
- A full-length *shielded* motherboard with 21 card slots to let you plug in almost any conceivable com bination of memory I/O or your own custom circuits
- An extremely heavy duty power supply providing 30A from +8V and 15A from +18 and −18V This will not only power a full set of 21 cards but also has ample additional power for other peripherals such as a floppy disk drive
- Power on jump circuitry to begin automatic program execution when power is turned on
- S 100 bus — important because it is widely supported by a host of peripherals manufacturers Thus you get the widest possible array of compatible peripherals
- All metal chassis and dust case
- Card retainer that secures cards in sockets
- Standard rack mount style construction suited to ded icated applications Upward compatible with larger systems Usable with a variety of cabinets Bench cabinet optional
- 110 or 220 volt operation



Z-2 Computer System (cont'd)



Full width motherboard has slots for 21 cards



Rack/Cabinet Mounting

The basic Z 2 is supplied in a black finished metal case for mounting in a standard 19 inch relay rack

A quality stylized bench cabinet in an attractive blue color is also available

TECHNICAL SPECIFICATIONS
Z-2 COMPUTER SYSTEM

Processor 4 MHz version Z 80
Cycle time 250 nanoseconds
Minimum instruction execution time 1 microsecond
Instruction set 158 instructio is including the 78 instructions of the 8080
System bus ndustry standard S 100
Board capacity 21 boards
Power supply +8 volts ( ) 30A +18 volts (1 5A −18 volts (1 5A
Power Operates from 110 220 volts 50 60 cycles
Operating environment 0 55°C
Dimensions 12¼ H x 19 W x 20 4 D (31 1 x 48 3 x 52 7 cm)
Weight 39 lbs (18 kg)
Mounting For rack mounting optional bench cabinet ava lable)
Price Model Z PW C omputer Sy stem assembled $995

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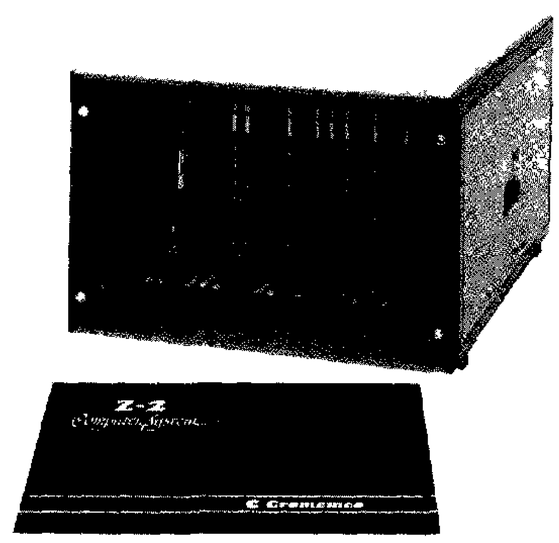
Prices fob factory



Z 2 is supplied for rack mounting
Attractive bench cabinet shown is also available

Z-2 Accessories

- **CABINET** High quality all aluminum cab net with blue finish Fold away handles Outside dimensions 13 x 20 x 26 Weight 25 lbs Model Z2 CAB $195
- **BLANK FRONT PANEL** Black finished blank front panel for your custom zed computer system Model Z2 BFP $35

Buyer's Guides

SYSTEM THREE BUYER'S GUIDE

Model	ROM	RAM	CRT Terminal Serial Ports	Floppy Disk Drives	Printer Interface	PROM Programmer	Price
CS-3	1K	32K	1	2	yes	no	$ 5 990
CS-3 w/option 001	1K	32K	1	2	yes	yes	6,485
CS-3 w/option 004	1K	64K	1	2	yes	no	6 585
CS3/2	1K	128K	2	2	yes	no	9 465
CS3/3	1K	192K	3	2	yes	no	11,250
CS3/4	1K	192K	4	2	yes	no	11 545
CS3/5	1K	256K	5	2	yes	no	13 330
CS3/6	1K	256K	6	2	yes	no	13 625
CS3/7	1K	320K	7	2	yes	no	15,410

NOTES Any of the above systems can be increased to four floppy disk drives by adding option 002 ($2 395 additional)

All Multi-User systems include 32K of RAM memory per user All RAM memory has Exended Bank Select capability for future system expansion

Z2 BUYER'S GUIDE

Model	ROM	RAM	CRT Terminal Serial Ports	Printer Interface	11-Megabyte Hard Disk	Disk Drives	Price
Z2-W	0	0	0	no	no	0	995
Z2D-W	1K	0	1	no	no	1	1 990
CS-2	1K	64K	1	yes	no	2	3 990
Z-2H	1K	64K	1	yes	yes	2	9 995
CS2/2	1K	128K	2	yes	no	2	6,870
CS2/3	1K	192K	3	yes	no	2	8 655
CS2/4	1K	192K	4	yes	no	2	8 950
CS2/5	1K	256K	5	yes	no	2	10 735
CS2/6	1K	256K	6	yes	no	2	11 030
CS2/7	1K	320K	7	yes	no	2	12 815

NOTE All Multi User systems include 32K of RAM memory per user All RAM memory has Extended Bank Select capability for future system expansion

Z-2H price includes integral 11-megabyte hard disk drive An 11 megabyte hard disk drive may be added to other systems by ordering Cromemco Model HDD-11 (price $6 995)

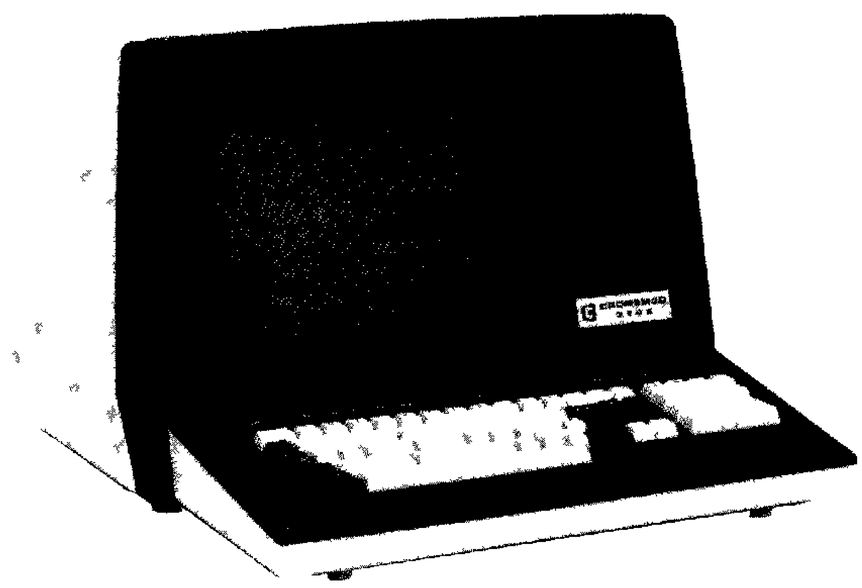
Section II

Computer Peripherals

Cromemco peripherals include a choice of:

- A crt terminal with such features as capacitive keyboards and software-assignable function keys
- Three printers with speeds up to 180 characters/second and up to 132 columns.
- 5-inch and 8-inch disk drives
- 11 Megabyte Hard Disk Drive

CRT Terminal



Model 3102

- Capacitive keyboard
- Many special features

Here is a high capability CRT terminal for use with your Cromemco computer systems

The terminal has a solid state capacitive key board for long reliable life and quiet operation

It also has a separate numeric keypad and a cursor keypad

Other features in the Model 3102 terminal include 16 software assignable function keys and a local editing mode

COMPUTER INTERFACING

The terminal is interfaced to the computer bus either by a Cromemco TU ART or Cromemco Model 4FDC interface card using a standard RS 232 interface

PRICE

Model 3102 CRT Terminal includes 10 foot cable terminated in DB 25P connector $1995

TECHNICAL SPECIFICATIONS

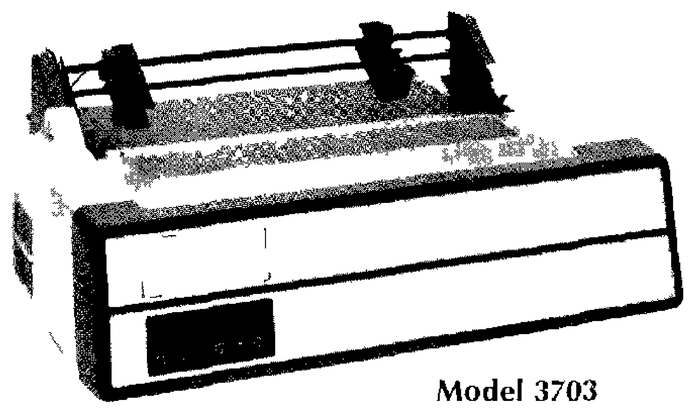
Model 3102

CRT Terminal

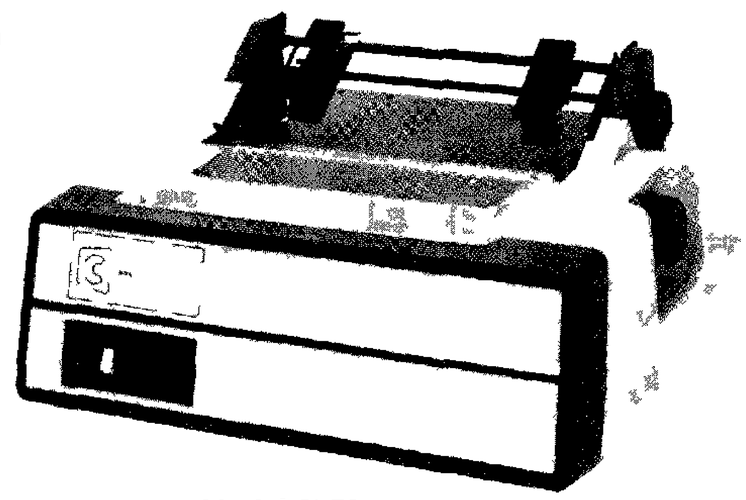
Format 80 characters/line 24 line display upper and lower case

Special features Addressable cursor 10 key numeric pad remote video output jack auxiliary I/O port RS 232 interface with selectable baud rates to 19 200 baud 16 software assignable function keys local editing mode screen formatting including dual intensity characters blinking characters and protected fields Block transfer mode permits transmission of entire screen of characters to the computer

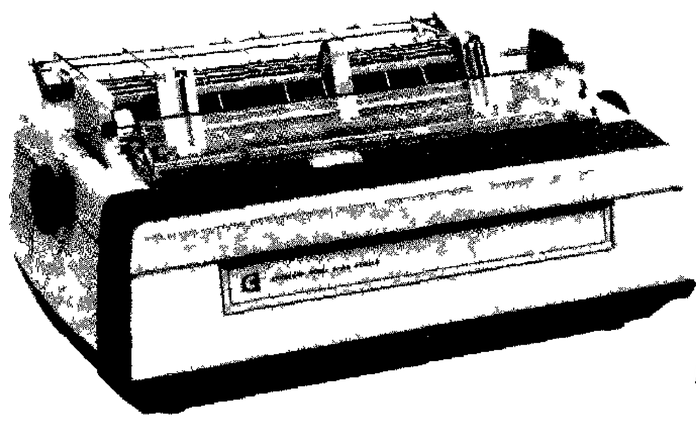
Printers



Model 3703



Model 3779



Model 3355A

DOT-MATRIX OR FULL-LETTER

Here s a choice of three printers to use with your computer system

Two dot matrix units offer up to 180 characters/second print speed

The full letter printer gives you high quality printing comparable to quality electric typewriters and suitable for camera copy

You can use this printer in applications such as printing business letters guides manuals etc where you wish the printed material to have a finished look

WORD PROCESSING SOFTWARE

In many cases you will want to use the printer with our Word Processing System software See the software section of this catalog

PRICES

(All printers are supplied with a 10 foot cable terminated in a DB 25P connector)

Model 3779 Dot Matrix Impact Printer 12 inch platen 60 ch/sec	$1495
Model 3703 Dot Matrix Impact Printer 18 inch platen 180 ch/sec	$2995
Model 3355A Full-Letter Impact Printer 55 ch/sec	$3195

TECHNICAL SPECIFICATIONS

Model 3779 Dot-Matrix Printer

Format 60 characters/sec 12 inch platen con t nuously variable character pitch allows up to 132 ch/line

General tractor feed accommodates roll paper and forms

Model 3703 Dot-Matrix Printer

Format 180 characters/sec 18 inch platen 132 columns

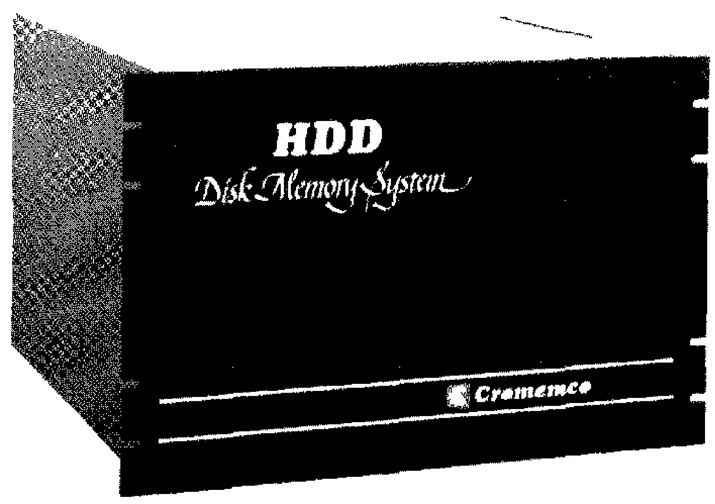
General form feed bi directional printing and double buffering for high speed performance tractor fed accommodates roll paper and forms

Model 3355A Full Letter Printer

Format 55 characters/sec 15 inch platen

General tractor feed and friction platen quality impression suited to camera copy

HDD Hard Disk Memory System



- One or two drives (11 or 22 megabytes of storage)
- Fast transfer rates

LARGE, FAST-TRANSFER STORAGE

The large storage capability of this advanced new hard disk drive provides 11 megabytes unformatted or more than 10 megabytes of formatted data for each drive

In addition this drive has a fast information transfer rate of 5 6 megabits/second when used with the Cromemco DMA controller (provided)

File transfers to and from the disk occur from 6 to 10 times faster than is commonly seen with floppy disk systems

RELIABILITY

The rotating disks are housed in a sealed chamber so that air filtering is not required Servo track following is used to achieve precise head positioning under temperature and humidity variations Further leveling of the unit is not normally required

Combining the new Model HDD Disk Drive with the Cromemco System Two Computer gives you a fast, powerful system with a Z-80A microprocessor two floppy disk drives, up to 512 kilobytes of RAM and up to 22 megabytes of hard disk storage

The low head tracking pressure of only 10 grams virtually eliminates a source of head crashes common with other disk drives

SOFTWARE SUPPORT

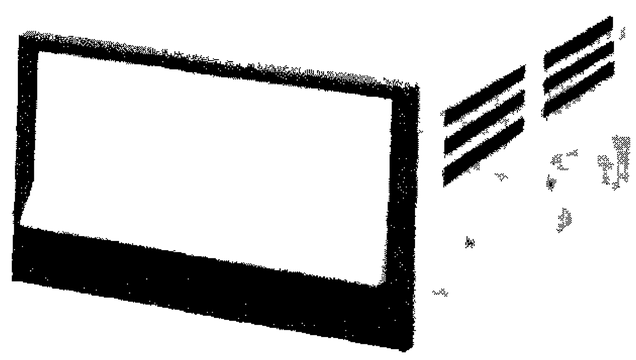
With the HDD you receive a copy of our new extended CDOS operating system With extended CDOS you have access to the full range of Cromemco software—software widely regarded to be the finest in the industry

TECHNICAL SPECIFICATIONS
Model HDD Hard Disk Drive

Storage capacity each drive 11 megabytes (unformatted)
Data transfer rate 5 6 megabits sec
Head positioner linear actuator
Tracking mechanism servo track following
Interface card S 100 DMA interface
Rotational speed 3600 RPM
Rotational latency 8 3 msec
Number of data surfaces 3 surfaces sealed environment
Tracks per surface 350
Head flying height 19 microinches
Head tracking pressure 10 grams
Average access time 50 msec
Power dissipation (each drive) 100 watts
Power requirements 110/220 volts 50/60 cycle
Operating environment 0 40°C 10% 80 o humidity (non condensing)
Weight (w/one drive) 55 lbs (25 kg)
Weight (w/two drives) 88 lbs (40 kg)

Price w/one drive (Model HDD-11) $6 995
Price w/two drives (Model HDD 22) $11 995

Mini Disk Drive



5″ SINGLE DISK DRIVE

This 5 inch single disk drive gives you a large amount of disk storage (92 kilobytes on each diskette side) at a moderate price

Recording is done in a soft sectored IBM format

The drive can be used with our Z 2 Computer or any S 100 bus computer that uses our Z 80 CPU card

The drive operates from our Model 4FDC Disk Controller

SOFTWARE

Cromemco also offers advanced programs such as FORTRAN IV RATFOR 32K Structured BASIC COBOL 16K BASIC and others on 5 inch disks

PRICES

Model WFD Single 5″ Disk Drive assembled	$495

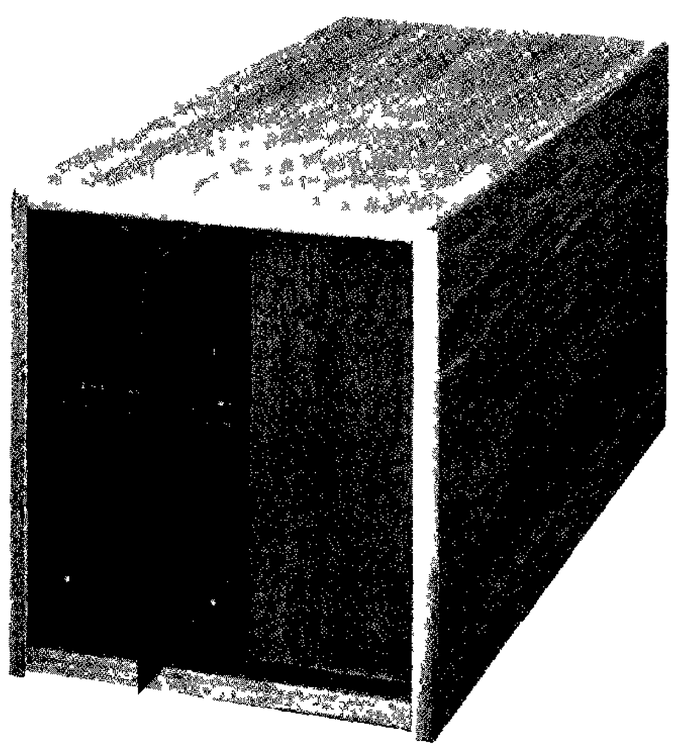
See Section III for disk controller information

SOFTWARE

Purchasers of Cromemco computers or drives may purchase software on 5′ diskettes as follows

FORTRAN IV (Model FDF S)	$95
16K BASIC (Model FDB S)	$95
COBOL (Model FDC S)	$95
Z 80 Assembler (Model FDA S)	$95
TRACE (Model TSS S)	$95
Data Base Management (Model DBM S)	$95
Word Processing System (Model WPS S)	$95
Dazzler Games (Model FDG S)	$95
RATFOR (Model FDR S)	$195
32K Structured BASIC (Model STB S)	$295
Multi User BASIC (Model FDM S)	$800

8″ Dual Disk Drive



8″ DUAL DISK DRIVE

Here is a convenient unit to use for cases where you want a large disk memory

This Model PFD dual drive holds two 8 inch disks which will each hold 256 kilobytes for a total of 512 kilobytes for the unit

Recording is done using a soft sectored IBM format

The drive can be used with our Z 2 Computer or any S 100 bus computer using our Z 80 CPU card

The drive operates from our Model 4FDC Disk Controller

The drive is complete with power supply and cables to connect to the interface on the Model 4FDC Controller

The unit is supplied in the oiled wanut case shown here

SOFTWARE

Software such as our FORTRAN IV and other programs is *available on 8″ diskettes*

PRICES

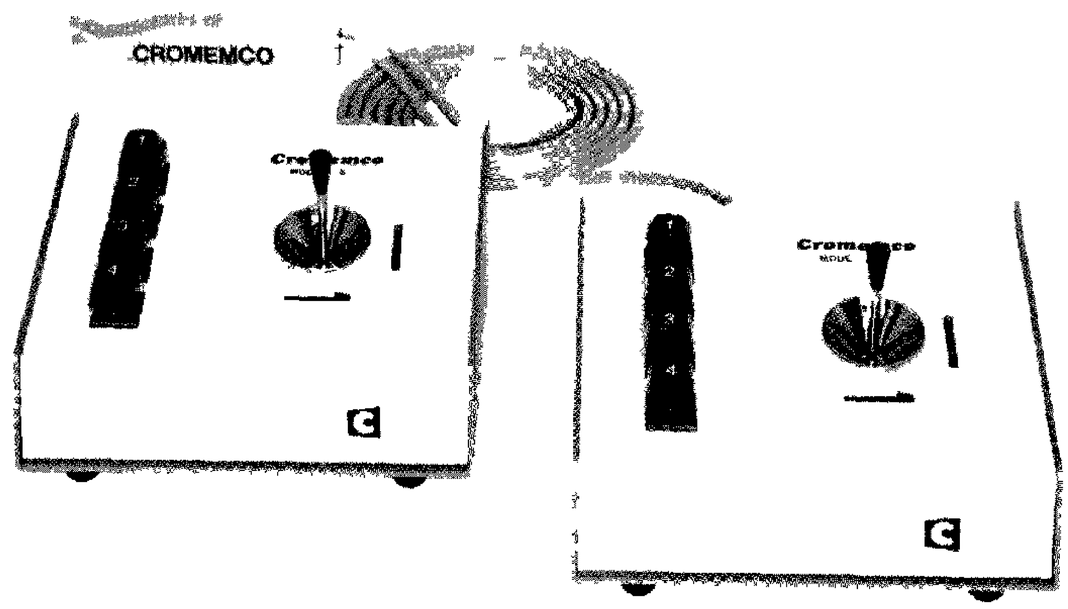
Model PFD W 8 Dual Disk Drive Assembled	$2495

SOFTWARE

Purchasers of our computers or drives may purchase soft ware on 8 diskettes as follows

FORTRAN IV (Model FDF L)	$95
16K BASIC (Model FDB L)	$95
COBOL (Model FDC L)	$95
Z 80 Assembler (Model FDA L)	$95
TRACE (Model TSS L)	$95
Data Base Management (Model DBM L)	$95
Word Processing System (Model WPS L)	$95
Dazzler Games (Model FDG L)	$95
RATFOR (Model FDR L)	$195
32K Structured BASIC (Model STB L)	$295
Multi User BASIC (Model FDM L)	$800

Joystick console with speaker

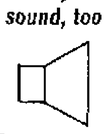


EASY TO INPUT IT TO YOUR COMPUTER

You'll get a lot more use out of your computer with this new joystick

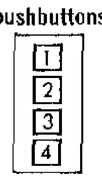
But note that it is not just an ordinary joystick—it is a *console* It has a 2 axis joystick *and* contains a *speaker* and *speaker amplifier* You can have *sound* with your games or say warning sounds in other applications Or have your computer talk to you

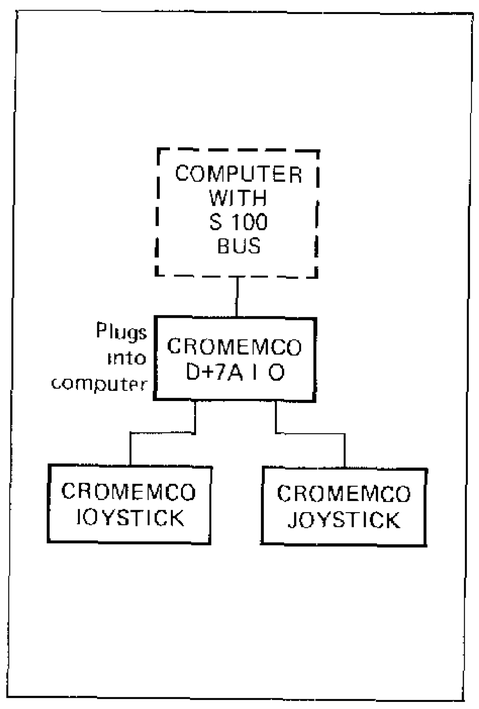
Gives you sound, too



A third feature you get is *four pushbutton switches* These give you even more possible uses such as selecting various colors on a color graphics terminal

Four pushbuttons





EASY TO COUPLE

To couple the new joystick to your computer just use our D+7A™ I/O board (see page 30) It will couple not only one but *two* consoles And you'll still have several analog channels left over (and one 8 bit output port)

The D+7A plugs into the Standard 100 (S-100) bus of your computer

ORDER TODAY

Cromemco wishes you more use from your computer Get this new joystick console and other Cromemco peripherals at your computer store

PRICE

Joystick console assembled (Model JS 1W) $95

TECHNICAL SPECIFICATIONS
JS-1 Joystick Console

JOYSTICK

Degrees of freedom 2 axes (X and Y) spring return to center
X axis output voltage ±2 volts center 0 volts
Y axis output voltage ±2 volts center 0 volts

SWITCHES

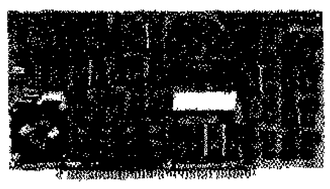
Number of switches 4
Output switch depressed 0 volts
Output switch open +5 volts

AMPLIFIER/SPEAKER

Input voltage range −2 56 to +2 54 volts
Output 47 ohm internal speaker

GENERAL INFORMATION

S 100 bus interface use Cromemco D+7A I/O
Power requirements + 5 volts @ 50 mA
+18 volts @ 40 mA
−18 volts @ 40 mA
Operating environment 0 55°C



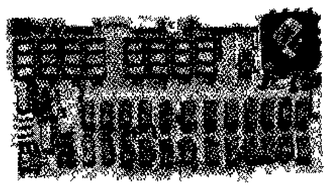
Z-80 Single Card Computer

Z-80 CPU card

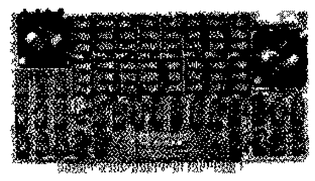
4K RAM card

16K RAM card

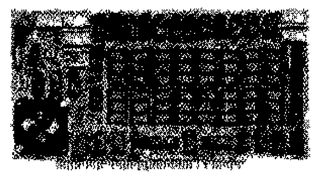
64K RAM card



8K BYTESAVER PROM card and programmer



16K PROM card



32K BYTESAVER PROM card and programmer

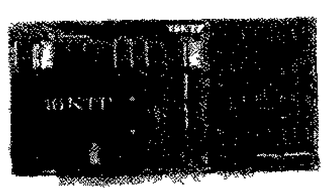
Section III

Computer Cards

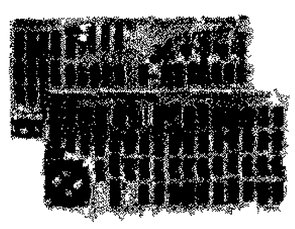
Cromemco offers a variety of computer cards including a Z 80 based single card computer, several memory cards including a fast 64-kilobyte memory our extremely well known BYTESAVER cards and several interface cards

Our RAM memory cards can be greatly expanded using our Bank Select feature described on p 25

Cromemco-assembled cards are tested on automatic check out equipment and thoroughly burned-in in temperature chambers



16K Two-port RAM card



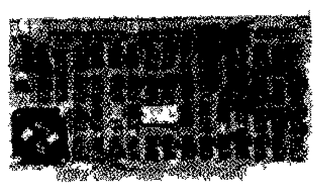
Graphics interface

8-port parallel interface card

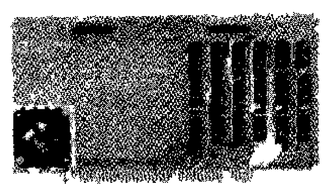
4-port isolated parallel interface card

7-channel A/D and D/A card

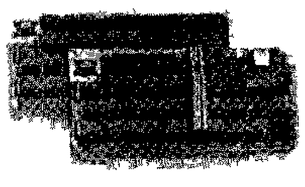
TU-ART I/O interface



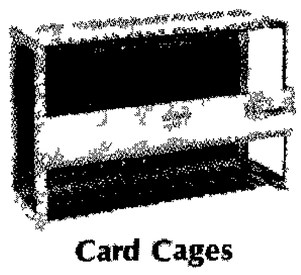
Disk Controller



Printer interface card

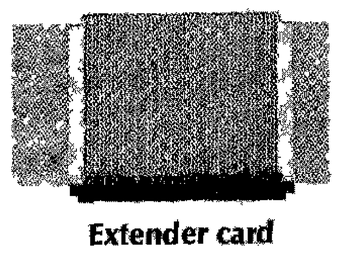


TV DAZZLER color graphics interface



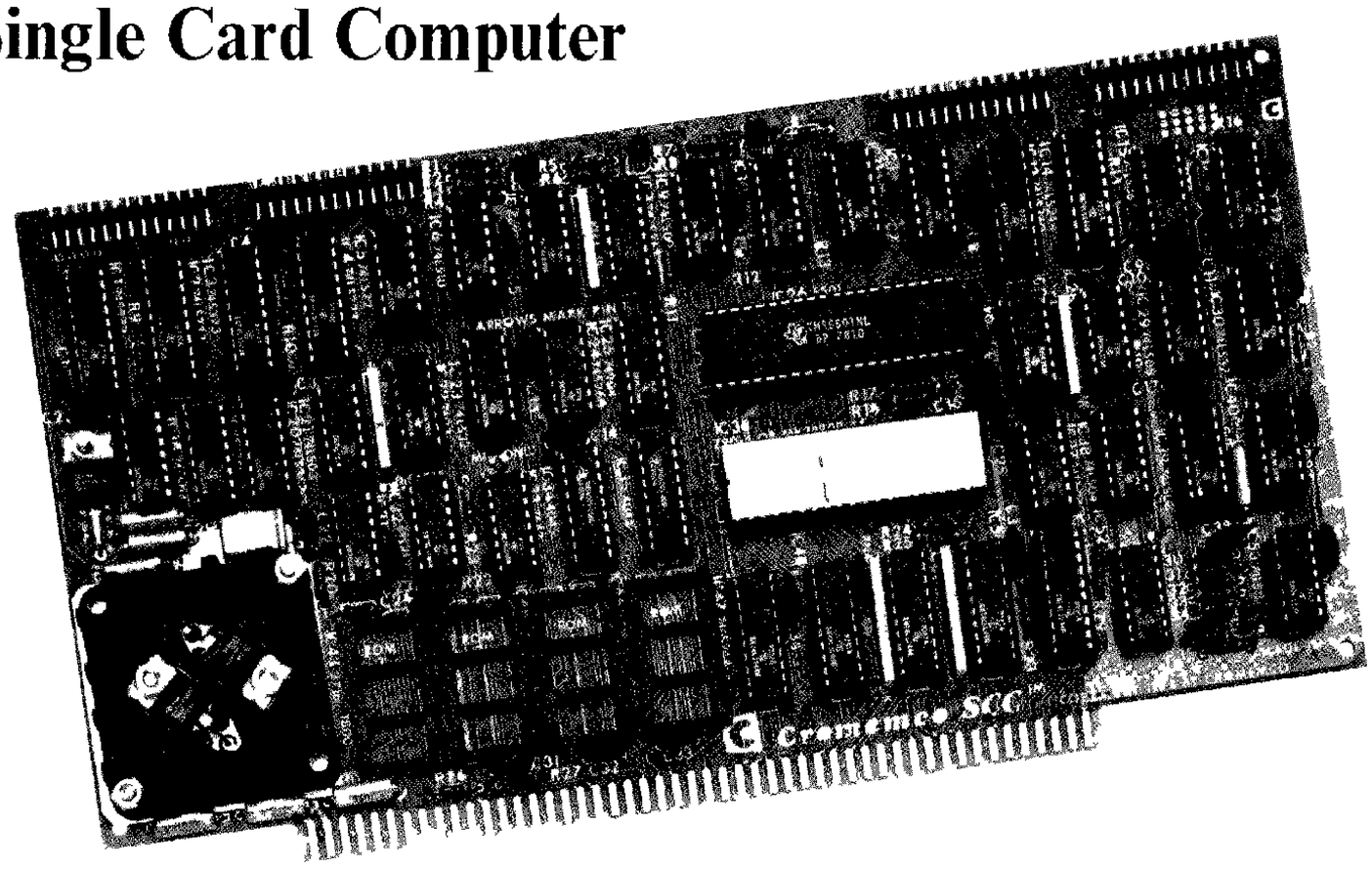
Card Cages

Wire Wrap card



Extender card

4 MHz
Single Card Computer



A COMPLETE 4 MHz COMPUTER

With our new Single Card Computer Cromemco brings the power of the Z 80 and the flexibility of the S 100 bus to the dedicated computer environment

This card was designed to get your application up and running fast Naturally you get a 4 MHz operation You also get up to 8K bytes of on-board 2716 PROM and 1K byte of static RAM memory Interfacing is a snap through the RS 232 (or 20 mA current loop) serial interface with programmable baud rates to 76 800 baud This stand alone card also gives you 24 bits of bidirectional parallel I/O 5 programmable timers vectored interrupts and complete compatibility with all Cromemco cards

Our Single Card is a complete computer Only a power supply and your PROM software are required for operation Yet the Single Card can be the core of an enormously expandable S 100 bus system since you can add additional memory I/O or even floppy disk drives as your application requires

MONITOR/3K BASIC

Our well known Z 80 Monitor and our 3K Control BASIC are available in 2316 ROM for use in your Single Card Computer With this two ROM set you are ready to begin using a single Card right away — no other memory or I/O is required The monitor has 12 commands to aid you in program development Our Control BASIC has 36 commands/functions and can directly access I/O ports and memory locations as well as call machine language subroutines

PRICES

Single Card Computer assembled (Model SCC)	$450 00
Monitor and Control BASIC in two ROMs (Model MCB 216)	$90 00

TECHNICAL SPECIFICATIONS
SCC Single Card Computer

Processor 4 MHz Z 80
Instruction Set 158 instructions including the 78 instructions of the 8080
ROM Capacity 8K Bytes located from address 0000 to 1FFF
ROM Type Intel 2716 PROM or equivalent
RAM Capacity 1K Bytes located from address 2000 to 23FF
RAM Type 4045 Static
Serial I/O Ports
- **I/O levels** RS 232 or 20 mA current loop
- **Baud rate** 110 to 76 800 (software selectable)

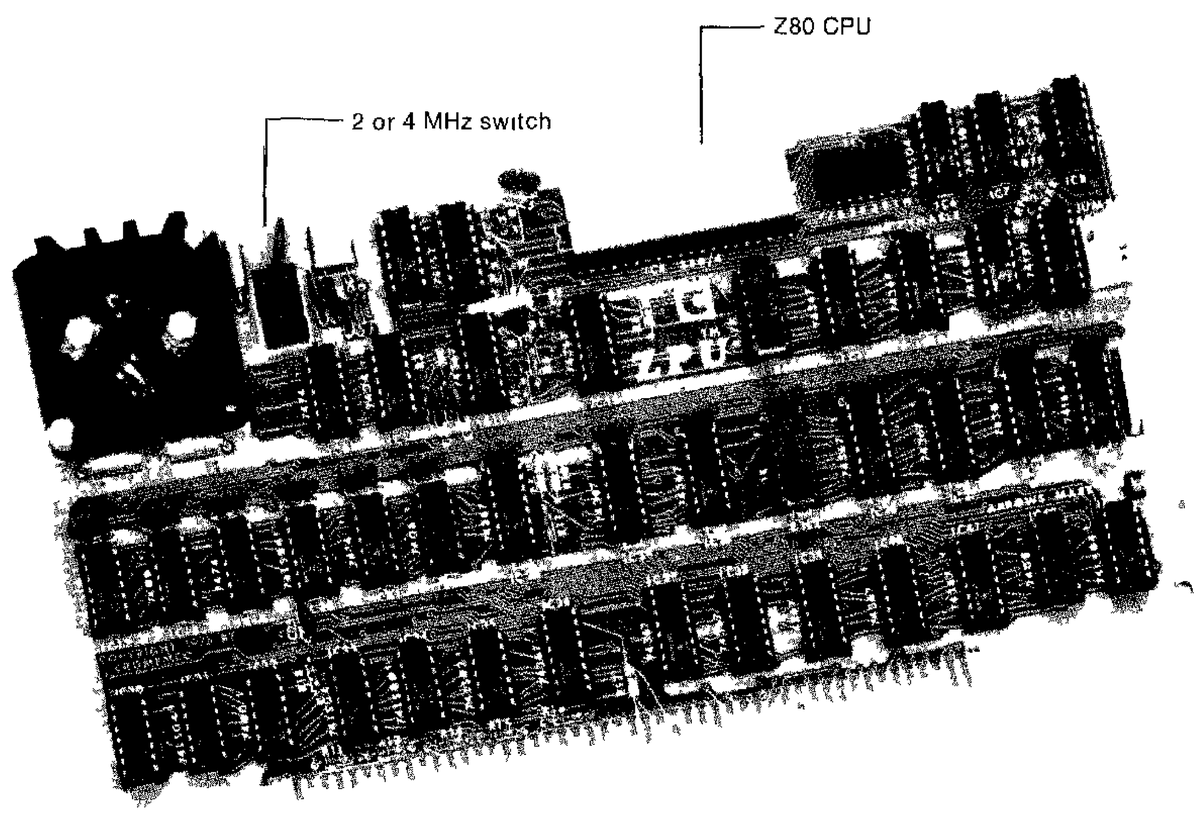
Parallel Ports
- **Input Port** 24 bits bidirectional
- **Output Port** 24 bits bidirectional
- **Input Load** One TTL equivalent
- **Output Drive** 20 TTL loads

Interval Timers
- **Number of timers** 5
- **Timer Range** 0 16 32 milliseconds (software selectable)
- **Timer resolution** 64 microseconds

Vectored Interrupts
- **Number of restart locations (Z 80 mode)** 65 536

General Information
- **UART type** 5501
- **Bus** S 100
- **Power requirements** + 8 volts at 1 4 A; +18 volts at 70 mA; −18 volts at 25 mA
- **Operating environment** 0 55°C

4 MHz CPU card



- Uses special Z 80 microprocessor
- Fast—4 MHz clock rate
- Does not require front panel for operation

2-5X MORE THROUGHPUT

Here is by far the most powerful CPU card now available (It is the heart of our computer systems)

It uses the Z 80 chip — in fact it uses a high speed version of the Z 80 certified by its manufacturer for 4 MHz operation

The Z-80 has all the advantages of the 8080 and 6800—and enormously more

And Cromemco s new Z 80 CPU card does enormously more

4 MHz CLOCK RATE

First this CPU lets you choose either a 2 or 4 MHz crystal controlled clock rate Right away that means you can have twice the throughput Cuts program running time in half Then the instruction set of the Z 80 reduces software even more

The 2 or 4 MHz clock rate is switch selectable as shown in the above photo

POWER-ON MEMORY JUMPS

Cromemco s CPU also has some neat design innovations of its own

For example you ll like the simplified operation you get because upon power turn on the CPU will jump to any desired 4K boundary in memory No switch flipping to go through to begin your program So you can also use this CPU card in stand alone systems — and it can be operated without need of a front panel

80 ADDITIONAL INSTRUCTIONS

You ve probably heard that the Z-80 with its 80 new additional instructions is by far the most powerful chip around It s true

That means with our CPU you will be able to devise much more powerful (as well as faster) software than before

INCLUDES FREE SOFTWARE

The CPU comes with our powerful Z-80 monitor complete documentation source code and paper tape object code The monitor is also available in PROM ($25) for use in our BYTE SAVER or 16 KPR memory boards

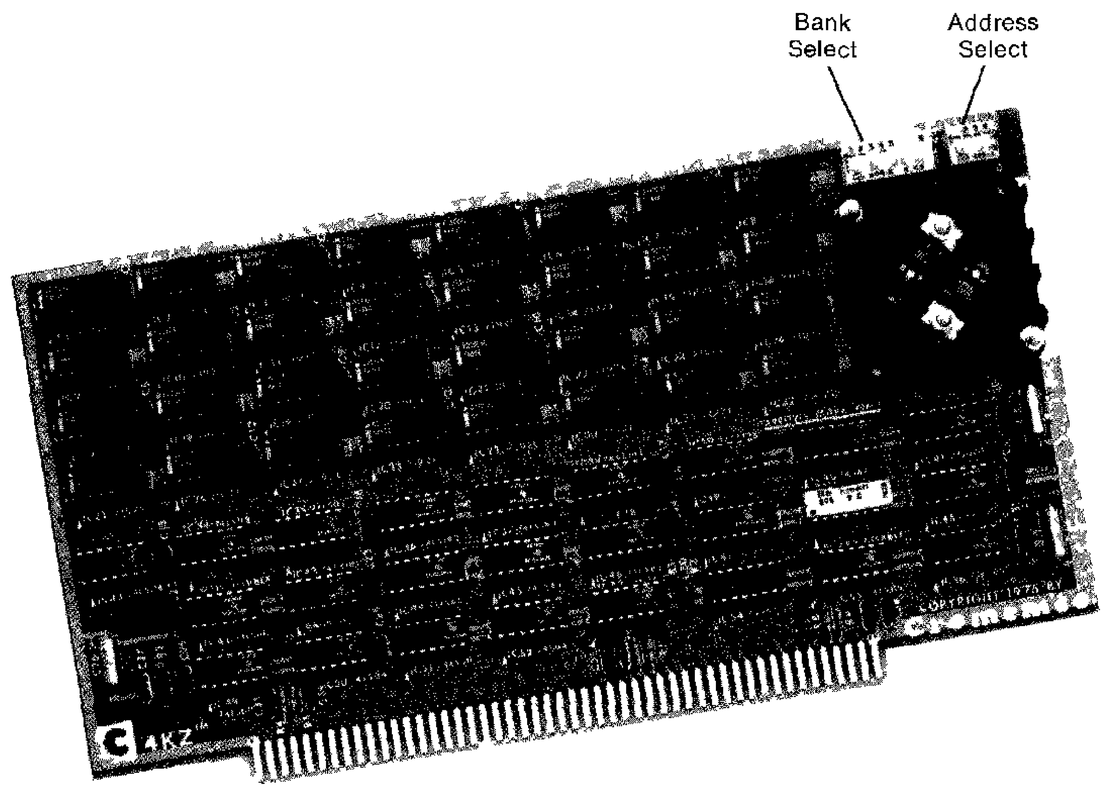
PRICE

Z 80 CPU assembled (Model ZPU) $395

TECHNICAL SPECIFICATIONS
Z-80 Microprocessor Card

Processor 4 MHz version of the Z 80
Clock rate 2 4 MHz (switch selectable)
Instruction set 158 instructions including the 78 instructions of the 8080
Power on jump jumper wire enabled
Power-on jump locations 16 locations switch selectable
Wait State generation 0 4 wait states jumper wire selectable
M1 Wait State Jumper wire selectable
BUS S 100
Power requirements +8 volts @ 1 1 A
Operating environment 0 55°C

4K RAM card
with address anticipation and Bank Select



See information about Memory Bank Select on p 25

- 4 MHz speed
- Memory Bank Select feature

As you would expect with a Cromemco product our Model 4KZ gives you advanced performance at low cost

It achieves its 4 MHz speed while using proven reliable low power memory chips (21L02s) in a novel design involving address anticipation

EXPANDABILITY

You get an unusual degree of expandability in the Model 4KZ — to 512 kilobytes if you d like

To achieve this the 4KZ is arranged so you can organize memory into as many as 8 banks of 64K bytes each

Then an 8 position switch on the card selects a given bank

With memory expandability like that Cromem co s CPU and RAM cards are the basic hardware for a broad range of jobs — even jobs that until now were only for large computers

LOW PRICED

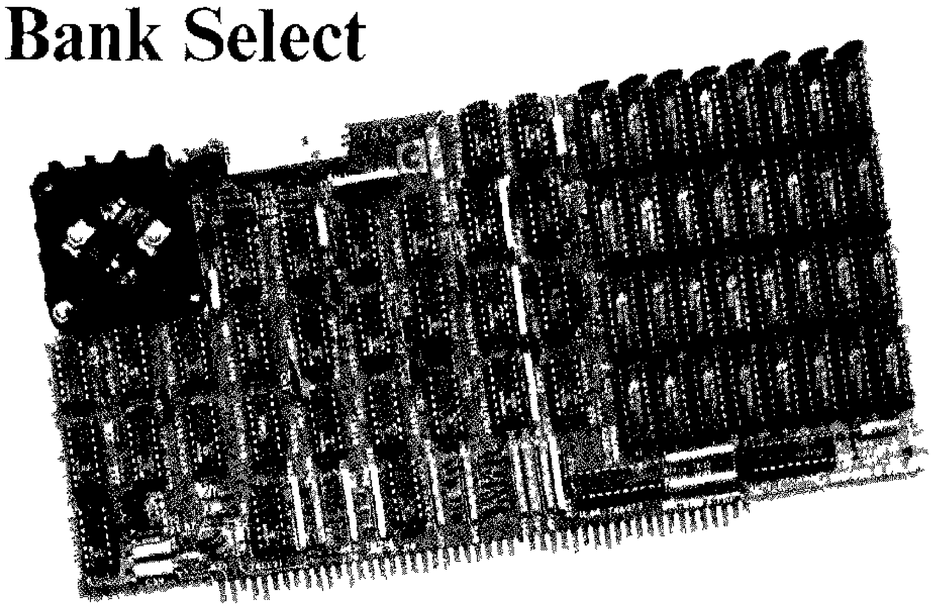
The Model 4KZ has the quality Cromemco is known for Get it at your computer store

4K Static RAM Memory assembled burned in and tested (Model 4KZ) $295

TECHNICAL SPECIFICATIONS
Model 4KZ RAM Card

Memory capacity 4K bytes
Memory type 21L02 RAM
Memory access time 450 nanoseconds
Wait States at 2 MHz none required
Wait States at 4 MHz on non sequential addresses only
BUS S 100
Power requirements +8 volts @ 0 8 A
Operating environment 0 55°C

16K RAM card with Bank Select



- The fastest available
- No wait states required at either 2 or 4 MHz operation
- Offers expandability to a half megabyte with Bank Select
- Can be used for time sharing
- Dynamic refresh fully transparent

FAST, EXPANDABLE

Not only is this the fastest 16K RAM card available but it is expandable to a half megabyte

It will operate at 4 MHz *with no wait states*

TIME SHARING

One of the best examples of the power of the Bank Select feature is that it will let you achieve a time share system with minimum software overhead

Each user (there can be up to 7) will be confined to his own bank of memory

S-100 BUS COMPATIBILITY

This memory can be plugged into any S 100 bus computer That includes the entire family of Cromemco computer systems

START WITH THE BEST

Sooner or later you'll inevitably want larger memory So start with Cromemco and be sure you'll have the expandability and high speed performance you'll need

PRICES

16K RAM Memory assembled burned in and tested (Model 16KZ) $595

TECHNICAL SPECIFICATIONS
Model 16KZ RAM Card

Memory capacity 16K bytes
Memory type 4050 2 RAM
Memory access time 200 nanoseconds
Wait States at 2 MHz none required
Wait States at 4 MHz none required
BUS S 100
Power requirements + 8 volts @ 0 8 A
+18 volts @ 0 5 A
−18 volts @ 10 mA
Operating environment 0 55°C

MEMORY BANK SELECT

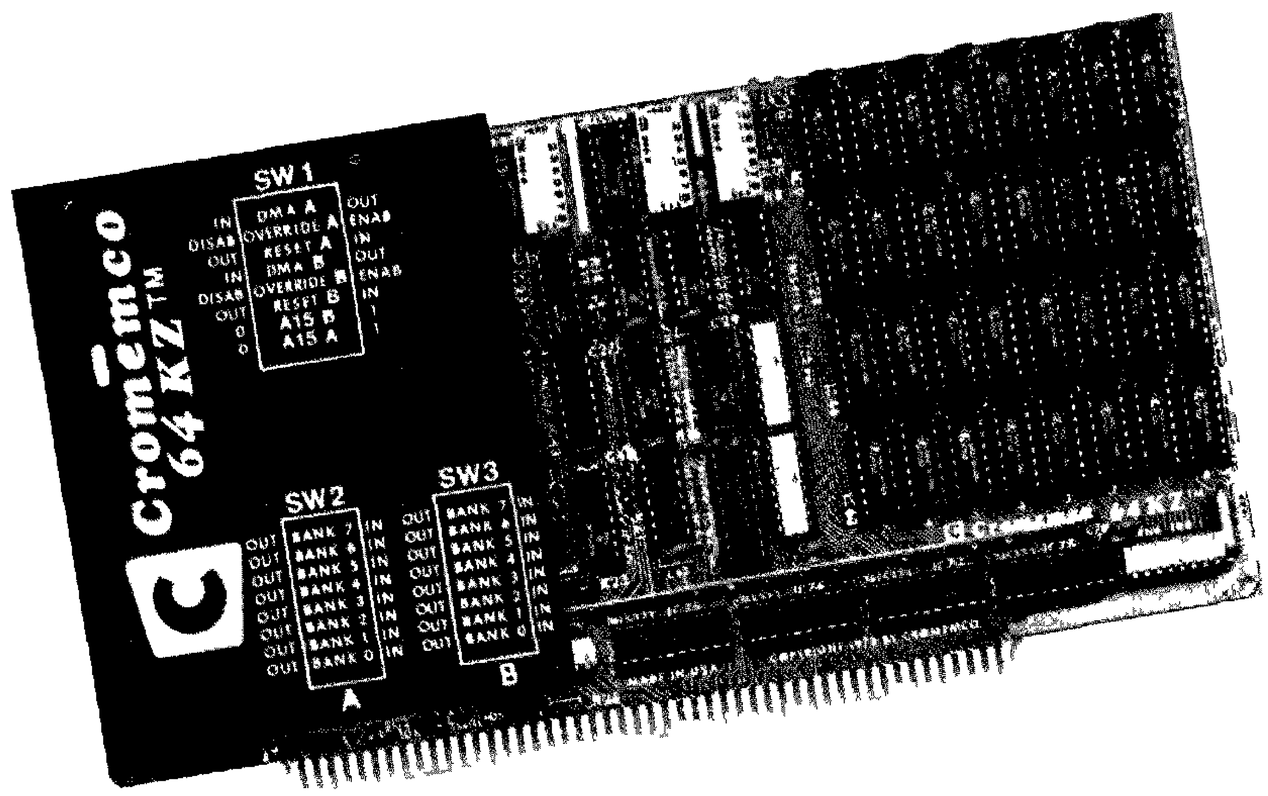
Memory bank select is a feature incorporated on Cromemco memory boards that allows the expansion of memory-space beyond 64K bytes With bank select memory space may be organized into 8 banks of 64K bytes each for a total of one half megabyte memory

With bank select each memory board may reside in one or more of the 8 possible memory banks An 8-position DIP switch on the board is used to select each of the banks in which the board resides

The active bank or banks of memory are selected under software control Output port 40H is dedicated to this function Each of the 8 bits of data of output port 40H is used to turn on or off the corresponding bank of memory A 1 in the corresponding bit position will turn on the memory bank A 0 will turn it off All circuitry required to detect the output of port 40H is included on the memory card itself

Bank select provides a convenient method by which to expand system memory space beyond 64K Bank select also permits the implementation of time-sharing systems with a minimum of software overhead — up to 7 users can use the system simultaneously with each confined to his own bank of memory

64K RAM card with Extended Bank Select



- Enormously expandable
- Guaranteed 4 MHz operation from 0 55 C
- Low power

This new 64-kilobyte RAM card is fast and tremendously expandable in keeping with Cromemco s objective of providing you with obsolescence insurance

The Model 64KZ is organized as two 32K blocks of memory Each block can be placed either in high memory space (address 8000 FFFF) or low memory space (address 0000 7FFF)

Each block can further be placed in any of 8 different memory banks Address and bank assignment of each 32K block is switch selectable

Another feature is that each 32K block can be independently switched to be selected or deselected after reset

ENORMOUSLY EXPANDABLE

With our Bank Select feature you can expand memory space from 64K to 512K in eight banks

Now with the Extended Bank Select feature in this new card you can expand to as much as 16 megabytes

The 64KZ is fully tested to be compatible with all Cromemco products

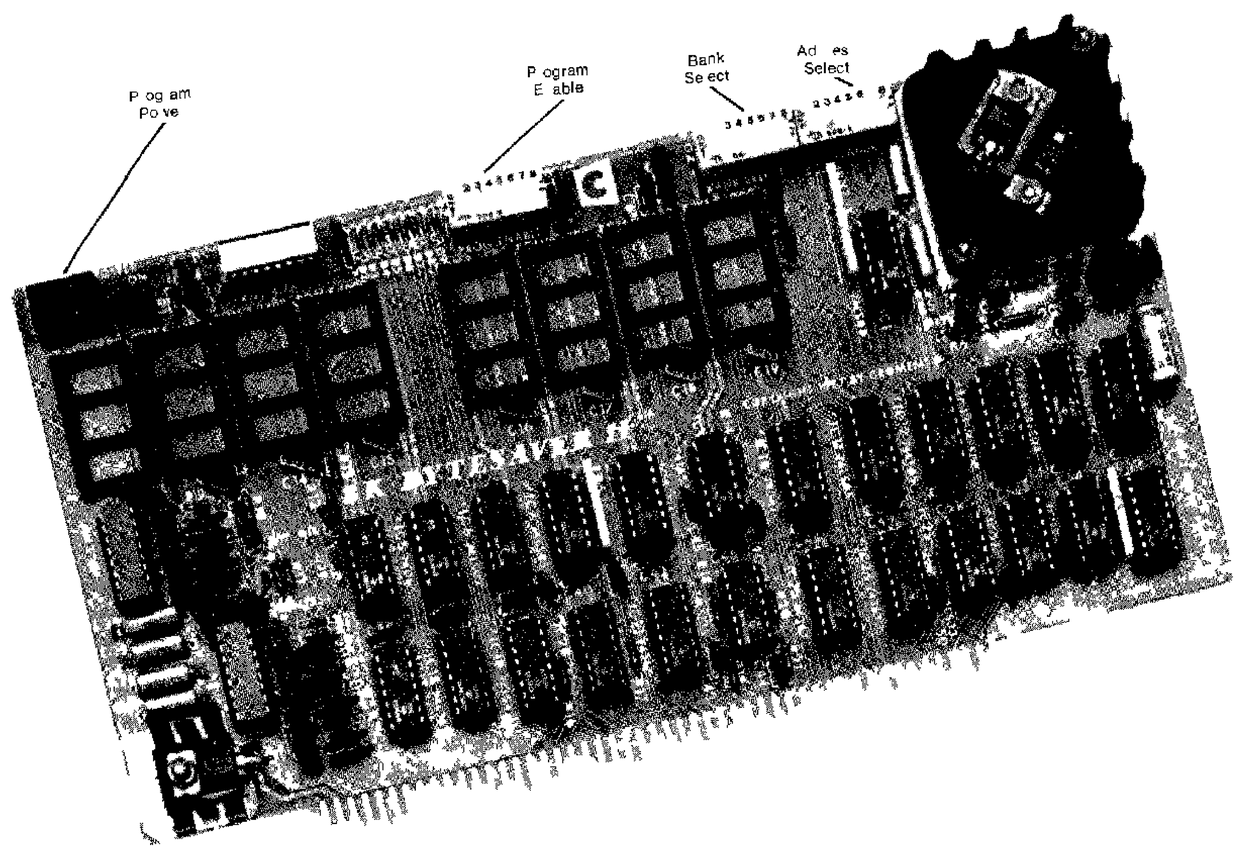
PRICE

64KZ High Speed RAM Memory factory assembled burned in and tested (Model 64KZ) $1785

TECHNICAL SPECIFICATIONS
Model 64KZ RAM Card

Memory capacity 64K bytes
Memory type 4116
Memory access time 150 nanoseconds
Wait States at 2 MHz none required
Wait States at 4 MHz none required
BUS S 100
Power requirements + 8 volts @ 1 5 A
+18 volts @ 0 2 A
Operating environment 0 55°C

8K BYTESAVER II memory board with 2708 PROM programmer



You re probably well acquainted with Cromemco s original BYTE SAVER since it is the industry standard PROM board on the S-100 bus

Now this new BYTESAVER II gives you even more features As with the original BYTESAVER you get these two important features

(1) A simple easy way to store your programs in 2708 pro grammable read only memory (PROMs))
(2) A PROM board with the capa city for a full 8K bytes of PROM memory storage

Here are the features the new BYTESAVER II gives you

(1) Convenient switch selection of board address
(2) Memory bank selection
(3) Fully buffered address lines
(4) Digitally timed programming pulses
(5) Individual program enable switches for each of the eight PROM positions

PROM PROGRAMMER

Many people are surprised to learn that in the BYTESAVER II you also have your own PROM programmer But it s so

And it can save you hundreds of dollars since you no longer need to buy one separately

The built in programmer is de signed for the popular 2708 PROM Each 2708 holds a full 1K bytes of memory And the 2708 is UV erasable so that it can be used again and again A 2708 PROM can be programmed in any of the 8 sockets on the BYTE SAVER II Individual program enable switches assure that PROMs not selected for programming cannot be accidentally programmed

RESIDES IN MEMORY

Note that the BYTESAVER II card resides in 8K of memory PROMs are programmed using conventional memory write instructions To further simplify PROM programming several Cromemco software packages con tain special Program commands to transfer code from RAM memory into the BYTESAVER II PROM memory These program commands are found in our Z 80 Monitor (ZM 108) Con trol BASIC (CB 308) ROS (ZA 808) and DEBUG in our disk assembler packages (FDA-S/L)

Once your program is written into BYTESAVER II PROMs it s protected from power turn-offs intentional or accidental And since the BYTE SAVER II resides in memory PROM resident programs can be directly executed from this card

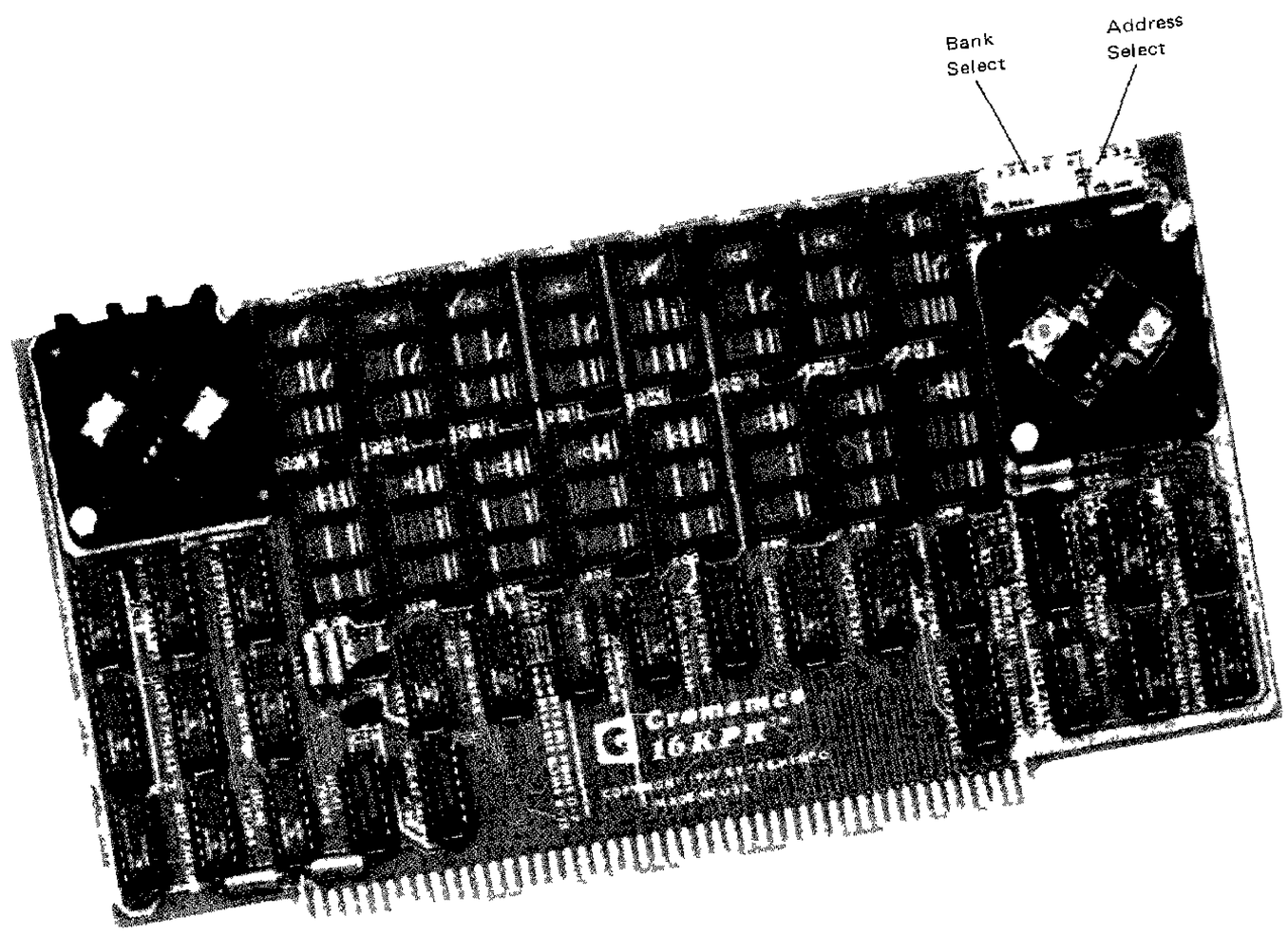
PRICE

BYTESAVER II assembled burned in and tested (Model 8KBS)	$245

TECHNICAL SPECIFICATIONS BYTESAVER II Model 8KBS

Memory capacity 8K bytes
Memory type 2708 PROM or equivalent
Memory access time 450 nano seconds
Wait States at 2 MHz none required
Wait States at 4 MHz one per machine cycle
BUS S 100
Power requirements
+ 8 volts @ 0 8 A
+18 volts @ 0 4 A
−18 volts @ 0 2 A
Operating environment
0 55°C

16K PROM card with address anticipation and Bank Select



HOLDS UP TO 16 HIGH-SPEED, ERASABLE 2708 PROMs

Here s what you need when you want the capa bility for a sizable PROM memory

The 16KPR holds up to 16 type 2708 or equiv alent PROMs (You can program these with the BYTESAVER discussed on p 27)

BANK SELECT

And the 16KPR has our bank select feature That lets the board be part of large memory systems of up to 8 banks of 64K each See additional infor mation on p 25

FAST

The 16KPR will operate with the fastest micro computers because of its address anticipated fea ture This means that there are no wait states required in the usual sequential addressing type of operation

See information about Memory Bank Select on p 25

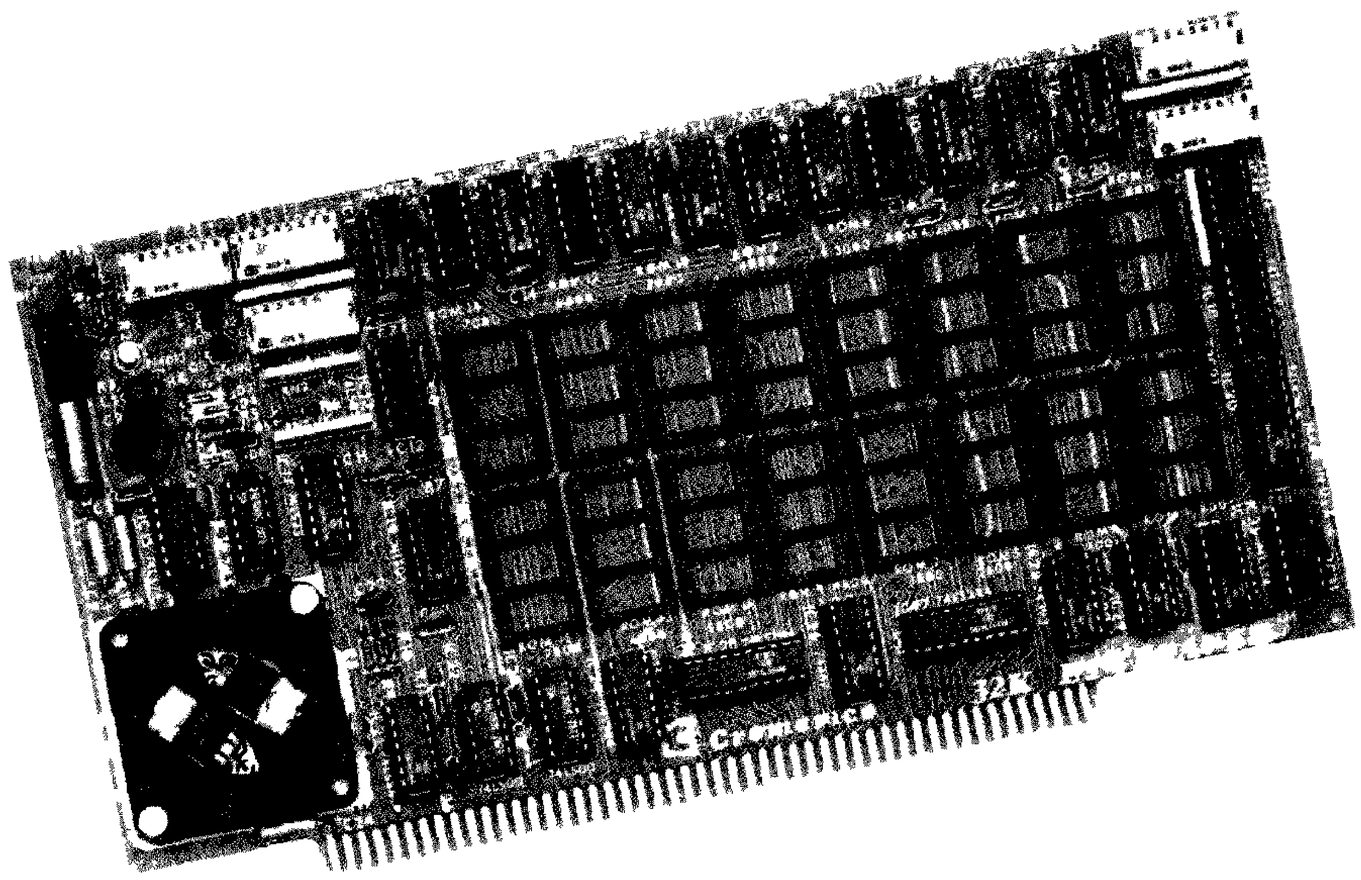
PRICES

16K PROM card assembled burned in and tested (Model 16KPR)	$245

TECHNICAL SPECIFICATIONS
Model 16KPR PROM Card

Memory capacity 16K bytes
Memory type 2708 PROM or equivalent
Memory access time 450 nanoseconds
Wait States at 2 MHz none required
Wait States at 4 MHz on non sequential addresses only
BUS S 100
Power requirements + 8 volts @ 0 4 A
+18 volts @ 0 8 A
−18 volts @ 0 5 A
Operating environment 0 55°C

32K BYTESAVER® memory board with 2716 PROM programmer



32K BYTESAVER® PROGRAMS THE NEW, HIGH DENSITY 2716 PROM

Many customers have asked for a card that has the ease of use and high flexibility of our popular BYTESAVER® 2708 PROM card but one that could use the new 2716 2 kilobyte PROM

Now Cromemco s 32K BYTESAVER® card gives you a full 32 kilobyte capacity of non volatile stor age for those ROM intensive applications

You also get the convenience of an on board 2716 programmer

The new 32K BYTESAVER® holds up to 16 of the 2716 PROMs Switches are provided to (1) protect and un protect PROMs individually or in groups for programming (2) shadow ROM socket pairs (allows external RAM to overlap portions of ROM address space) (3) select card address and (4) con trol the powerful Bank Select and DMA IN OUT features

NO SPECIAL SOFTWARE NEEDED

A simple one time write of the desired data into an erased PROM with the on board programmer turned on is all that is required to store information quickly and permanently

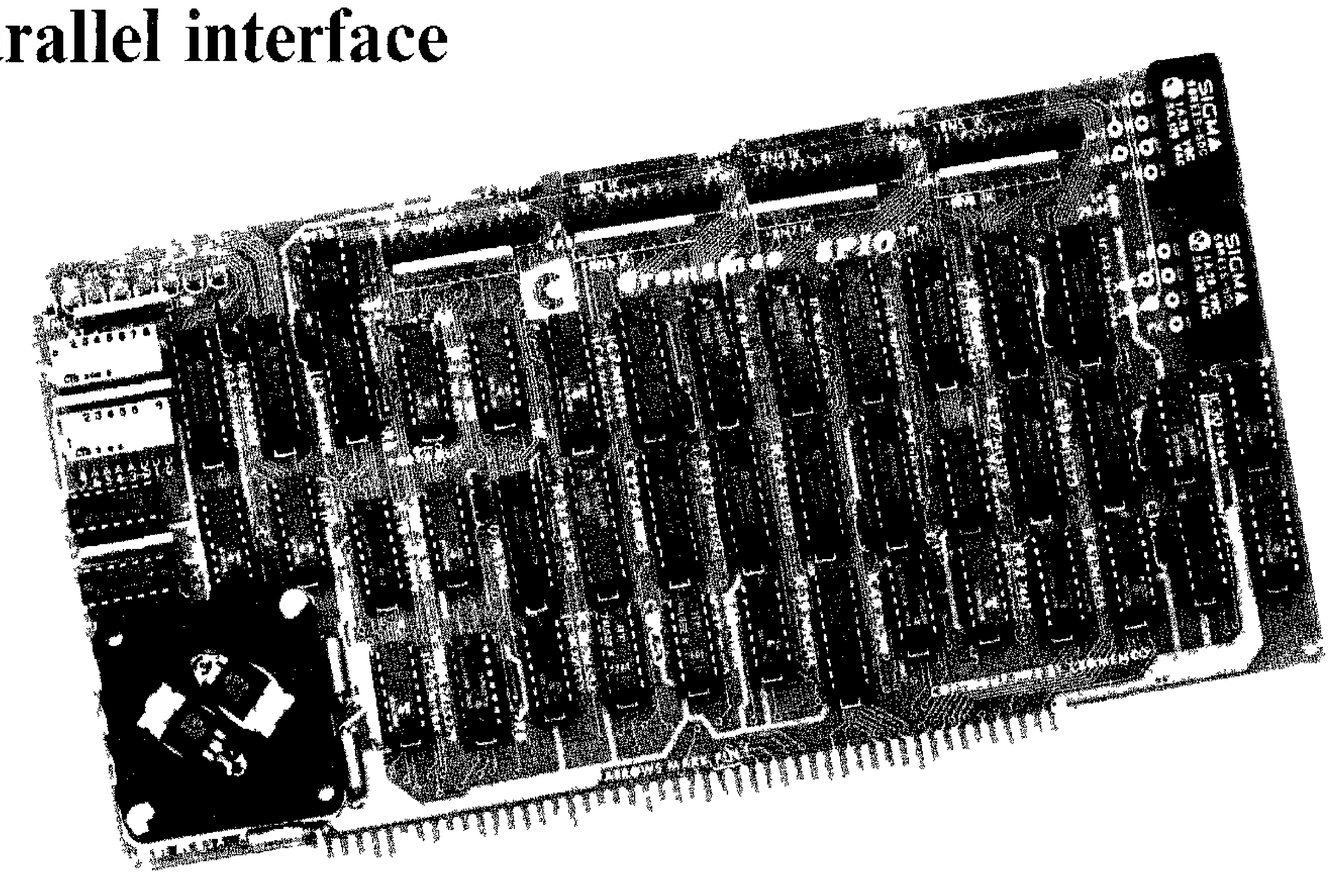
PRICE

32K BYTESAVER® PROM card assembled burned in and tested (Model 32KBS)	$295

TECHNICAL SPECIFICATIONS 32K BYTESAVER® PROM Card Model 32KBS

Memory capacity 32K bytes
Memory type Intel 2716 PROM or equivalent
Memory access time 450 nanoseconds
Wait States at 2 MHz none required
Wait States at 4 MHz one per machine cycle
BUS S 100
Power requirements +8 volts @ 2 1 A max
Operating environment 0 55°C

8 Port I/O Multi-channel microcomputer parallel interface



SIMPLIFIED PARALLEL INTERFACING

Parallel interfacing was never easier than with the Cromemco 8PI/O Parallel Interface Card

You get 8 bidirectional 8-bit I/O ports that can be used either singly or coupled together to form longer word lengths

For convenience input and output status flags for handshake purposes are grouped together on one port and may be accessed with one input or output statement

Strobe pulses can be issued after each 8-bit transfer or may be delayed until the proper word length has been formed

Other features include 8 sense switches and 8 LEDs on the highest selected I/O port on the card and 2 bits of opto-isolated input and 2 bits of relay driven output

The 8 I/O ports may be located on any 8 port I/O boundary

PRICE

8PI/O assembled (Model 8PIO)	$295

TECHNICAL SPECIFICATIONS
Model 8PI/O
8 Channel Parallel Interface

Parallel I/O Ports
- **Number of bidirectional ports** 8
- **I/O port width** 8 bits wide
- **Input load** 4 TTL loads
- **Output drive** 4 TTL loads

Input strobes latched

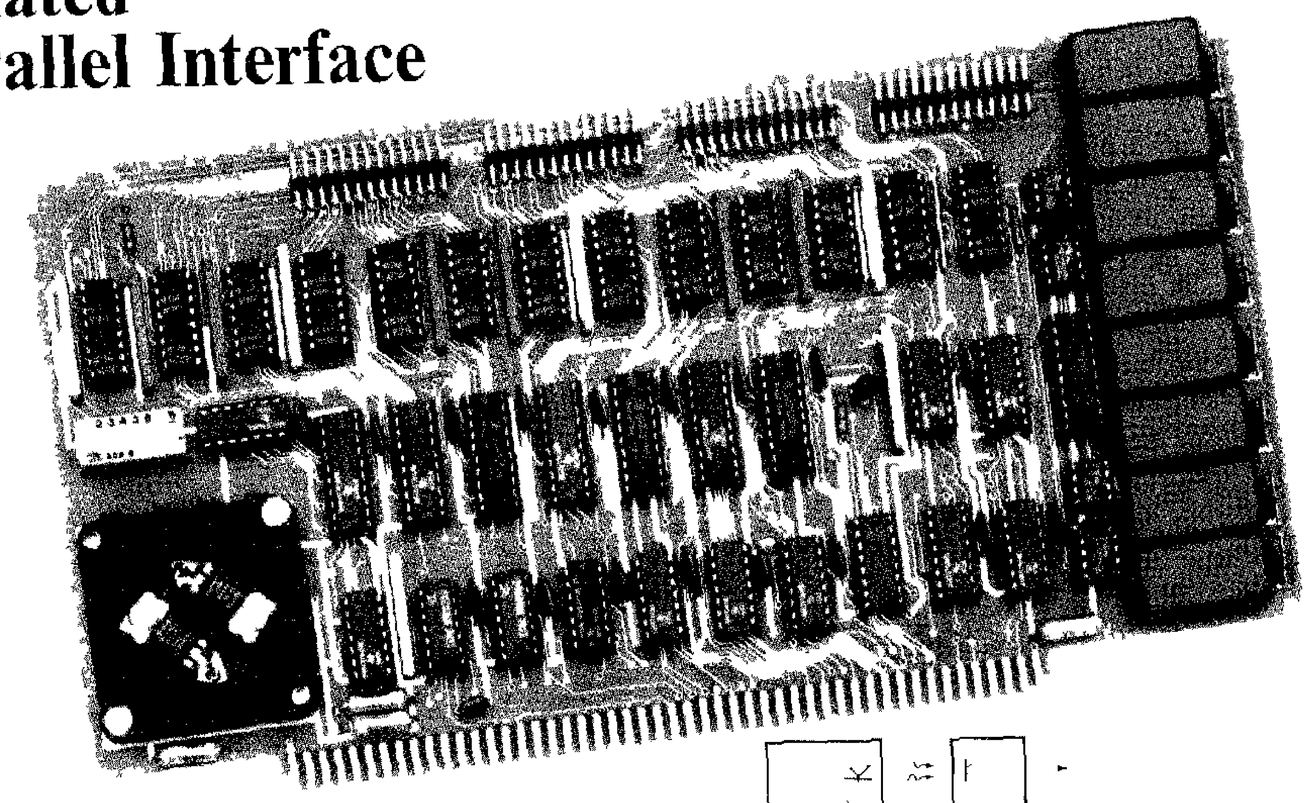
Output strobes
- **Delay** 1 μsec after new data valid
- **Width** 1 5 μsec negative true
  1 strobe pulse per port

Opto-Isolator input
- **Number of Opto inputs** 2 bits
  TTL level inputs

Relay Outputs
- **Number of relay outputs** 2 bits
- **Contact voltage** 28 V AC or DC
- **Contact current** 1 amp
- **Contact type** SPDT

General information
- **BUS** S 100
- **Power requirements** +8 volts @ 1 5 A
- **Operating environment** 0 55°C

4 Port I/O Isolated Parallel Interface



- Complete electrical isolation
- Eliminates ground loop problems

Now your interfacing can be achieved with complete electrical isolation from your microcomputer

Electrical isolation means that problems with ground noise and ground loops can be completely eliminated in your instrumentation communications or process control systems

Electrical isolation also means that potentially damaging transients can be safely isolated from your computer system

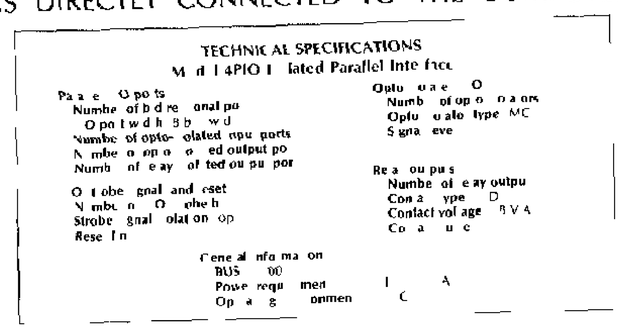
The new Cromemco 4PIO parallel interface card includes

24 opto isolated input channels
16 opto isolated output channels
8 relay isolated output channels
11 opto isolated strobe/handshake lines
1 opto isolated reset line

The 4PIO services these isolated I/O channels through four parallel 8 bit I/O ports The addresses of these I/O ports are switch selectable (in blocks of four) by means of a switch located conveniently on the 4PIO interface card

ISOLATED CONNECTOR PINS

The isolated I/O channels of the 4PIO are brought to four connectors on the top edge of the card NO PIN ON ANY OF THESE CONNECTORS IS DIRECTLY CONNECTED TO THE COMPUTER



TECHNICAL SPECIFICATIONS
M d l 4PIO I lated Parallel Inte fce

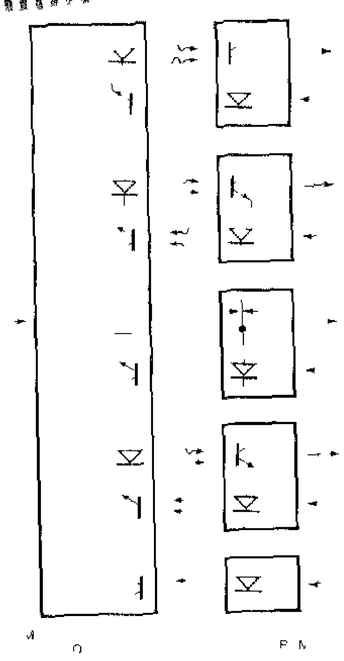
Pa a e O po ts
Numbe of b d re onal po
O po t w d h 8 b w d
Numbe of opto- olated npu ports
N mbe o op o o ed output po
Numb of e ay of ted ou pu por

O t obe gnal and eset
N mbe n O ohe h
Strobe gnal olat on op
Rese In

Opto u a e O
Numb of op o o a ons
Opto u alo type MC
S gna eve

Re a ou pu s
Numbe of e ay outpu
Con a ype D
Contact vol age 8 V A
Co a u c

Gene al nfo ma on
BUS 00
Powe requ men I A
Op a g onmen C



Cromemco 4PIO interface Note that all lines are either optically or magnetically isolated from the computer circuitry

CIRCUITRY Every active pin is electrically isolated either by means of an opto-isolator or relay

Cables are available in two convenient lengths to couple from these top connectors to a standard DB 25S socket Cable model CBL 2 is 62 cm in length and can be used in our Z 2 computer Cable model CBL-3 is 110 cm in length for use in our System Three computer

Like all Cromemco cards the 4PIO is designed to meet the most demanding standards of industrial performance

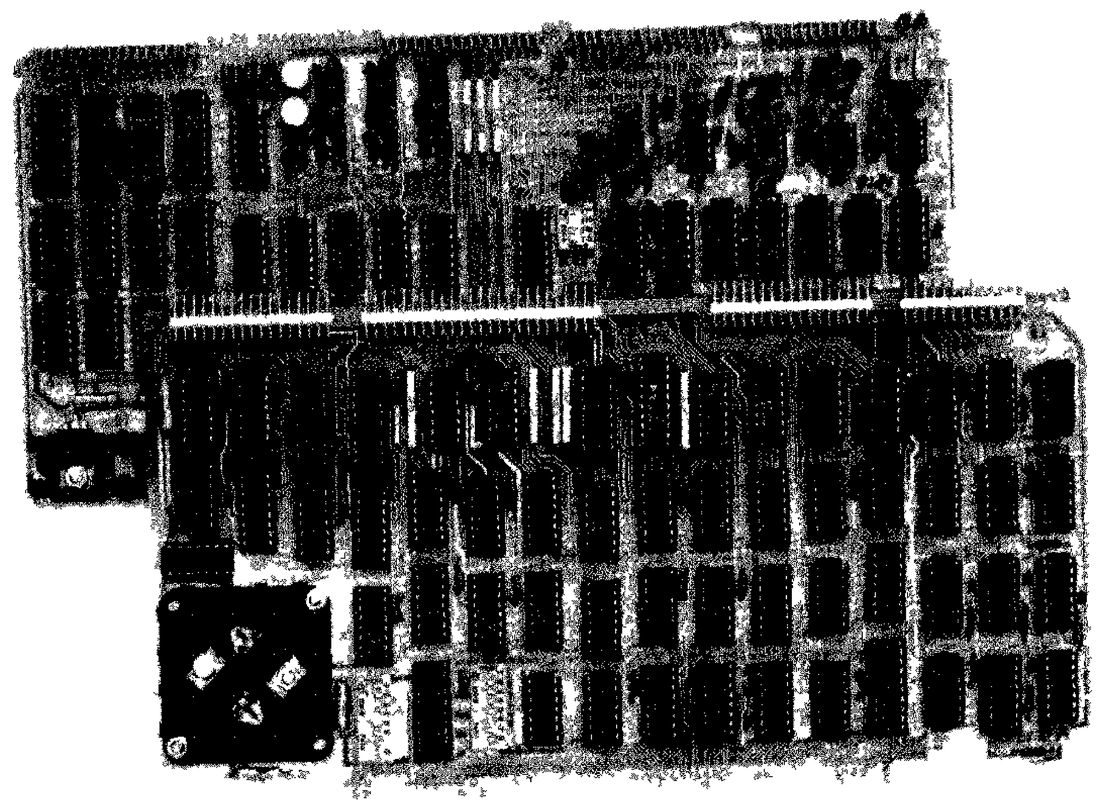
PRICES

4PIO assembled burned in and tested (Model 4PIO)	$395

CABLES

CBL-2 (62 cm long)	$15
CBL-3 (110 cm long)	$15

Model SDI
Color Graphics Interface

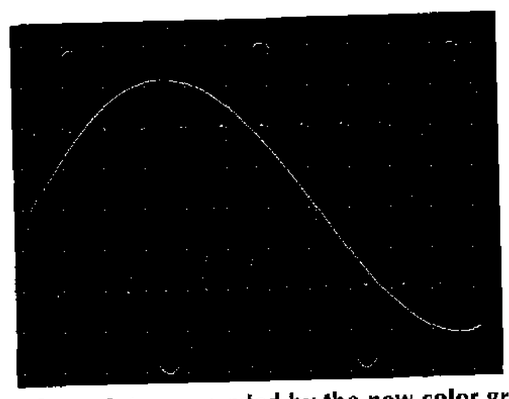


Here s a graphics interface that gives you high resolution simplicity and an enormous range of color choices unmatched in the industry

The new Cromemco Model SDI Color Graphics interface is a fully integrated way to display the memory content of Cromemco computer systems in beautiful and meaningful color choices Use of color and the high resolution of the image facilitate reading the display by researchers in the field To simplify examination or discussion various parts of the scan can be displayed in any of a wide range of colors — 4096 to be specific

The interface consists of two circuit cards that plug directly into any Cromemco computer No alteration of the computer is required All necessary outputs to the monitor are provided by the interface

The display device is typically an RGB Monitor used in the industry or available from Cromemco (Model RGB-19)



Very high resolution provided by the new color graphics interface is apparent in this plot of sinusoids

HIGH RESOLUTION

The new SDI interface can be used to display images with up to 756 x 484-point resolution As discussed later this resolution is at least the equal of a high quality broadcast TV picture

COLOR OR B/W

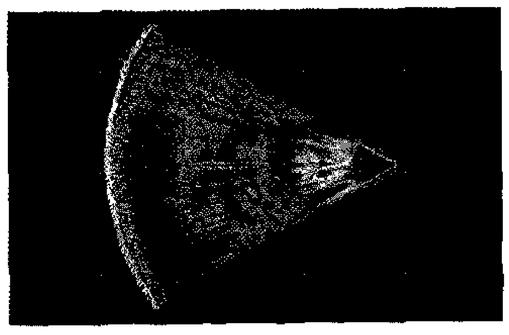
The new interface can be used to display an image in either color or black-and white — or in both simultaneously

In color any 16 colors from a palette of 4096 colors can be used in the picture In black-and white any 16 shades of gray can be used

HOW THE SDI MAPS

The SDI uses direct memory access to display the content of a display memory Each pixel of the display may be mapped either from one nybble (4 bits) or one bit of the display memory The mapping mode (nybble or bit) is software-selectable — in fact part of a picture may be displayed in one mode and part in the other

The display memory may consist of either a 12K or 48K memory



Display of cross section of human heart imaged by a 2 25 MHz ultrasonic sector scan through body s intra-costal space. The image is displayed using the new SDI interface on an RGB Monitor This medical application involving the new interface was done at Stanford Uni versity

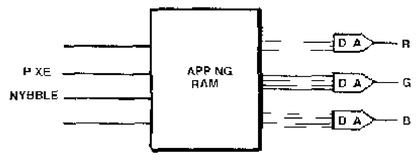
The combination of mapping modes and memory result in four basic modes of operation as shown below

MODEL SDI RESOLUTION (HORIZONTAL x VERTICAL) IN EACH OF FOUR MODES OF OPERATION

	Display Memory Size	
	12K	**48K**
Nybble-Mapped	189 x 121	378 x 242
Bit-Mapped	378 x 242	756 x 484

SDI OUTPUTS

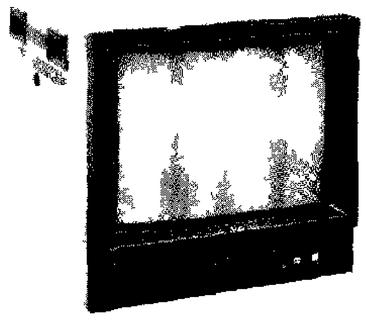
The Model SDI provides three separate analog output signals to drive the Red Green and Blue guns of a high-quality RGB monitor The three separate outputs rather than one composite output are used to preserve the full resolution of the picture



In nybble mapped operations each 4 bit nybble can select one of 4096 colors as determined by a mapping RAM The contents of the mapping RAM can be changed dynamically, under software control, by issuing OUTPUT instructions to the SDI

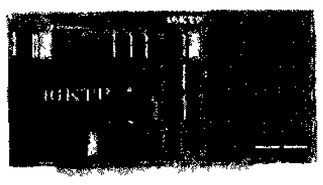
TV COMPATIBILITY

The Model SDI also provides all signals required to serve as input to a colorizer or color modulator in a TV broadcast studio



RGB MONITOR

New Cromemco RGB (red/green/blue) Color Monitor is specially adapted for use with SDI Interface Photos shown herein are from this monitor



DISPLAY MEMORY

A new 16K two port memory card has been developed for use with the SDI Three of these memories thus hold a full 48K picture Picture information is accessible by the SDI through a connector on the top of the memory cards The cards plug directly into the Cromemco computer See Section III of this catalog

The computer resident memory may also be used as the display memory although at the expense of mapping speed This reduction occurs because the CPU must suspend operation when the SDI accesses the resident memory The result is approximately 5o% CPU utilization for a 12K memory picture and 6% utilization for a 48K memory picture

Use of the special two port memory however assures 75% to 100% CPU utilization depending on the appli cation software

DESIGNED TO SURPASS TV QUALITY FOR LONG-TERM APPLICATION

In its high resolution mode the SDI* displays a picture having a 756 x 484 pixel resolution This format corre sponds to and is compatible with NTSC TV systems practice in that 484 lines are normally displayed in a nominal 525 line system The 756 points in the horizontal direction give a resolution equal or better than that of the vertical direction

The horizontal resolution itself far exceeds that of con ventional TV displays which have relatively limited band width

The result of the above approach is that the high resolution picture displayed using the SDI interface is at least equal in resolution to a 525 line color TV picture

TECHNICAL SPECIFICATIONS

Model SDI
Color Graphics Interface

Mapping modes Bit or nybble software selected
Resolution 756 x 484 pixels maximum using 48K display memory 12K display memory may also be used at lower resolution see text
Color Any 16 of 4096 colors or any 16 shades of gray may be displayed
Outputs Three analog outputs for R G B monitor
Recommended Display Memory Cromemco 16KTP two port memory
Sync signal Composite Sync signal is switch selectable Separate RS 170 Sync signal available
System Bus Industry Standard S 100
Operating Environment 0 55°C
Price $595

Prices f o b Mountain View CA
Data subject to change without notice

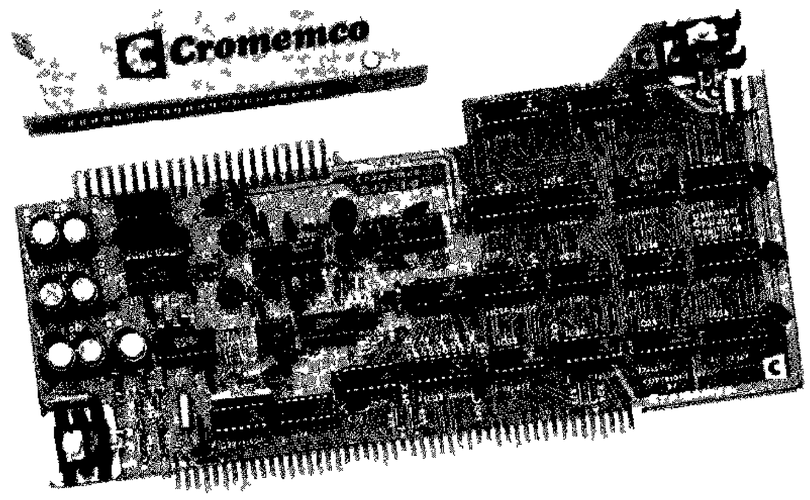
Cromemco Model RGB-19 Color Monitor

Max effective screen size 396 mm x 297 mm
Technology All solid state except for CRT
CRT 19 shadow mask delta gun
Video signal output RGB 0 3 2 0 v 75 ohm Fully com patible with Cromemco model SDI interface outputs
Video amplifier bandwidth 50 Hz to 15 MHz ± 3 db
Power requirements 100 110 120 220 or 240 volts 50/60 Hz
Power consumption 250 VA
Dimensions 444 mm x 482 mm x 545 mm
Weight 45 kg
Operating environment −5° to 40°C
Price $6995

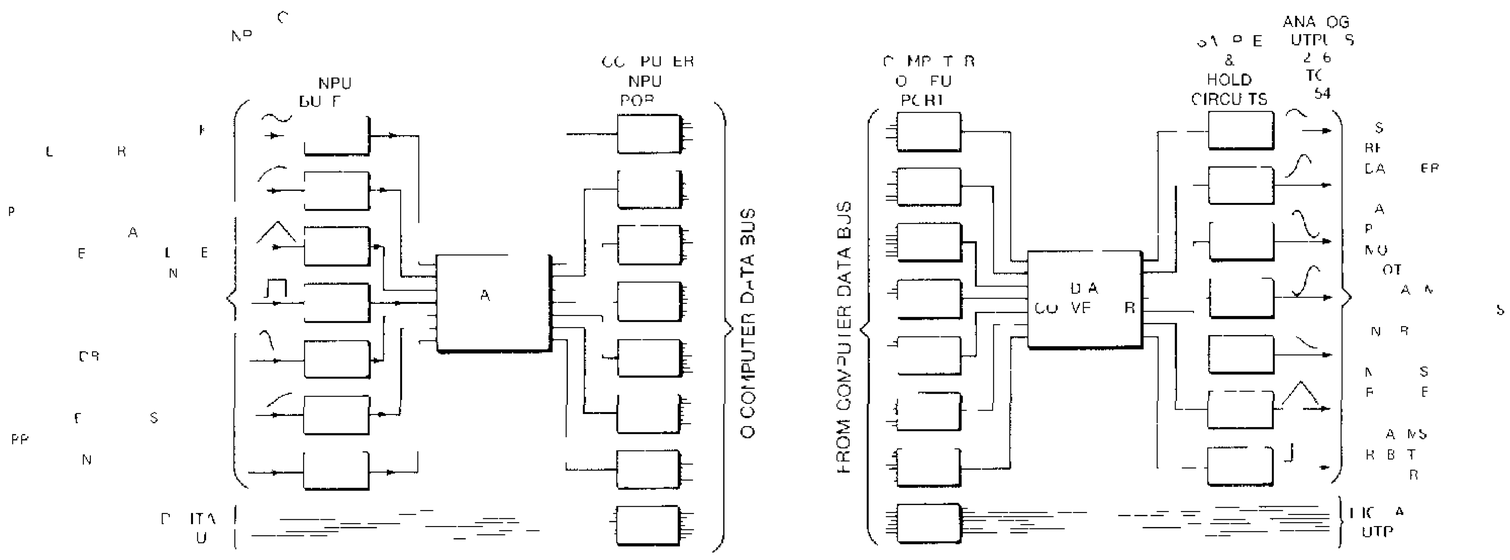
Model 16KTP
Two-Port Memory

Memory Capacity 16K bytes
Bus Industry standard S 100
Operating environment 0 55°C
Price $795

D+7AI/O™ Multi-channel microcomputer analog interface



See p 20 for special joystick console with audio output Use with this analog I/O



Now you have a way to get analog information into and out of your microcomputer It s an easy fast and unbelievably inexpensive way

It s Cromemco s new D+7A® high performance I/O module which gives you

- 7 channels of 8 bit analog to-digital conversions (to input ana log data to the computer)
- 7 channels of digital to analog conversion (to output computer data in analog form)
- an 8 bit parallel I/O port to input and output data in digital form
- a fast conversion time of 5 5 microseconds

A MULTITUDE OF USES

The D+7A makes it easy to use your computer for the jobs you want it do — such as process control digital filtering games oscilloscope graphics speech recognition speech and music synthesis

The D+7A lets you input and out put analog data with all sorts of devices joysticks ham radio gear measurement instruments machine tools transducers control systems motors recorders and plotters to name just a few

NO FURTHER SOFTWARE NEEDED

The D+7A I/O plugs directly into the Cromemco microcomputers Analog signal range is from −2 56 to +2 54 volts (20 millivolt increments) on both input and output sides

Simple Input and Output in structions initiate A/D conversion and read in or out the ensuing 8 bits of data No further software is required During conversion the D+7A holds down the computer Ready line

LOW-PRICED

D+7A I/O assembled burned in and tested
(Model D+7A) $245

Each D+7A includes a connector to connect to the 8 input and 8 output ports

TECHNICAL SPECIFICATIONS
D+7A A/D & D/A Interface

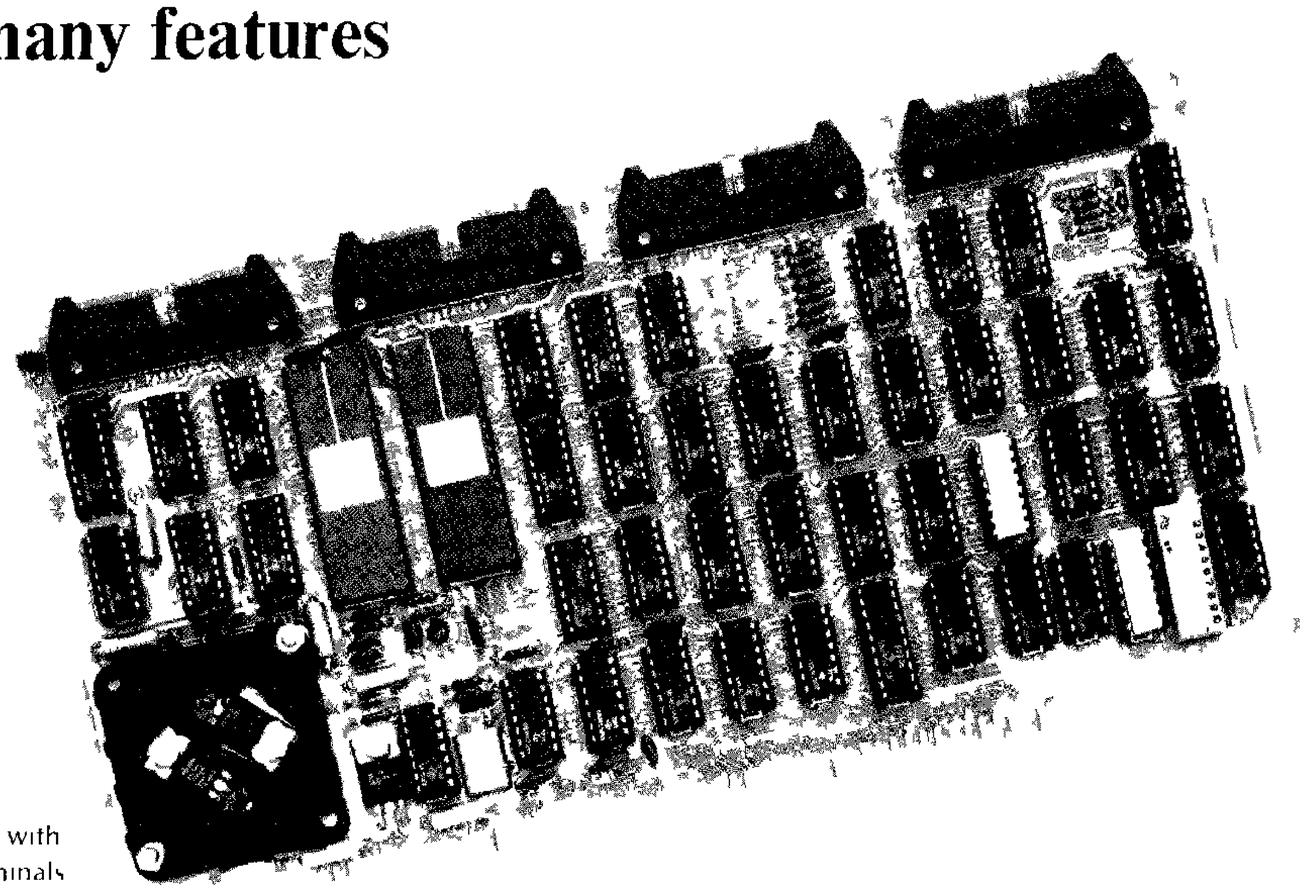
Analog input ports
- **Number of input ports** 7
- **Input voltage range** −2 56 to +2 54 volts
- **Input bias current** 2 micro amps max
- **Input impedance** 20 Megohms 001 μF 1 KHz sample rate; 2 Megohms 001 μF 10 kHz sample rate
- **Resolution** 8 bits
- **Conversion time** 5 5 micro seconds
- **Accuracy** ±20 millivolts

Analog Output Ports
- **Number of output ports** 7
- **Output voltage range** −2 56 to +2 54 volts
- **Output impedance** 0 25 ohm
- **Maximum load current** 1 5 mA
- **Resolution** 8 bits
- **Conversion time** 5 5 micro seconds
- **Accuracy** ±20 millivolts
- **Drift rate** Less than 10 mV/sec at 25°C

Parallel I/O Port
- **Input port** 8 bits
- **Output port** 8 bits
- **Input load** one TTL equivalent
- **Output drive** 10 TTL loads

General Information
- **BUS** S 100
- **Power requirements** + 8 volts @ 0 4 A +18 volts @ 30 mA −18 volts @ 60 mA

TU-ART digital interface with many features



For interfacing with
- CRT terminals
- line printers
- modems
- other devices

FAST — SOFTWARE SELECTABLE BAUD RATES UP TO 76,800 BAUD

Here s a very convenient interface to let you couple not to one but to two terminals or other devices So we call it a TU-ART

It has two serial I/O ports two 8-bit parallel I/O ports and 10 independent programmable interval timers

Baud rates are software selectable from 110 to 76 800 baud

VECTORED INTERRUPTS

Yet another special convenience of the TU-ART is its vectored prioritized interrupts Is able to sup port powerful vectored interrupt structure of the Z 80 microprocessor

INTERVAL TIMERS

The 10 interval timers since they have real time clock capability offer a very wide range of control possibilities

Each timer range is from 0 16 32 milliseconds and is software selectable

PRICES

TU ART assembled burned in and tested (Model TRT)	$295

CABLE

CBL-2 for Z2 computers 62 cm long	$15
CBL 3 for System Three computer, 110 cm long	$15

TECHNICAL SPECIFICATIONS
Model TRT
TU-ART Digital Interface

Serial I/O ports
- **Number of ports** 2
- **I/O levels** RS 232 or 20 mA current loop
- **Low baud range** 100 9600 baud (software selectable)
- **High baud range** 880 76 800 baud (software selectable)

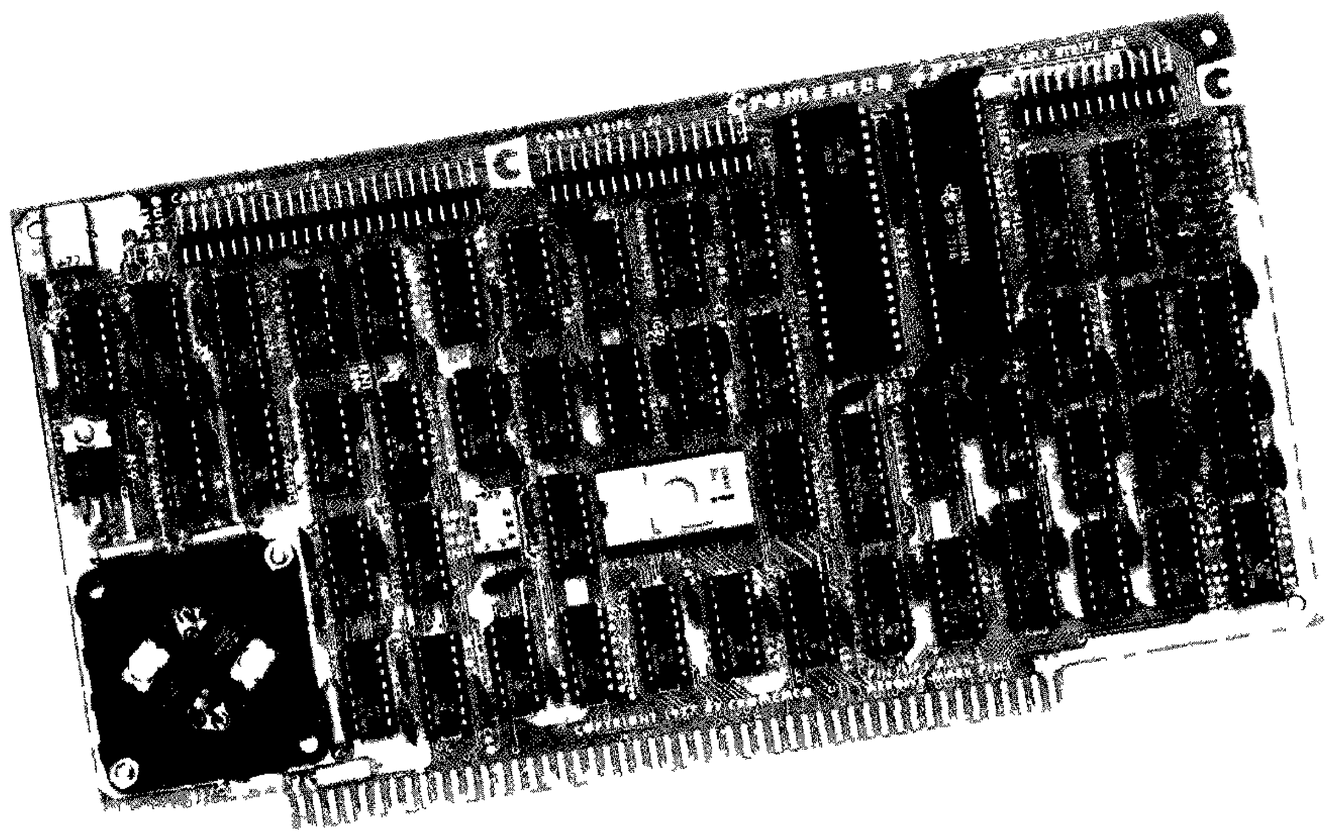
Parallel I/O ports
- **Number of ports** 2
- **Input ports** 8 bits
- **Output ports** 8 bits
- **Input load** one TTL equivalent
- **Output drive** 20 TTI loads

Interval timers
- **Number of timers** 10
- **Timer range** 0 16 32 msec (software selectable)
- **Timer resolution** 64 m croseconds

Vectored interrupts
- **Number of restart locations (8080 mode)** 8
- **Number of restart locations (Z-80 mode)** 65 536
- **Prioritization of TU ART ports** internally prioritized
- **Prioritization for multiple TU ARTs** daisy chaining

General Information
- **UART type** 5501
- **BUS** S 100
- **Power requirements** + 8 volts @ 1 0 A; +18 volts @ 80 mA; −18 volts @ 40 mA
- **Operating environment** 0 55°C

Disk Controller



DISK CONTROLLER

- Many functions on one card
- Includes disk bootstrap monitor
- RS 232 interface

SIMULTANEOUSLY INTERFACES UP TO FOUR DISK DRIVES

This card is not only a disk controller but also an I/O interface

Placing many functions on this one card is possible because we have taken the step of using LSI circuitry

The card is capable of simultaneously interfacing up to three 5″ drives or four 8′ drives

Its interface provisions include an RS 232 serial interface with a baud range up to 76 800 baud

The bootstrap monitor is contained in a 1K 2308 ROM

PRICE

Disk Controller card assembled burned in and tested (Model 4FDC) $495

8″ DUAL DISK DRIVE

Cromemco also offers a dual Persci floppy disk drive complete with case power supply and cables to connect to the controller card S 100 bus interface Dual 8′ Disk Drive assembled (Model PFD) $2495

TECHNICAL SPECIFICATIONS
Model 4FDC
Disk Controller and I/O Interface

Disk controller
- **Maximum number of 5″ drives** 3
- **Maximum number of 8″ drives** 4
- **Bootstrap/monitor firmware** 1K byte PROM
- **Controller circuitry** MOS LSI

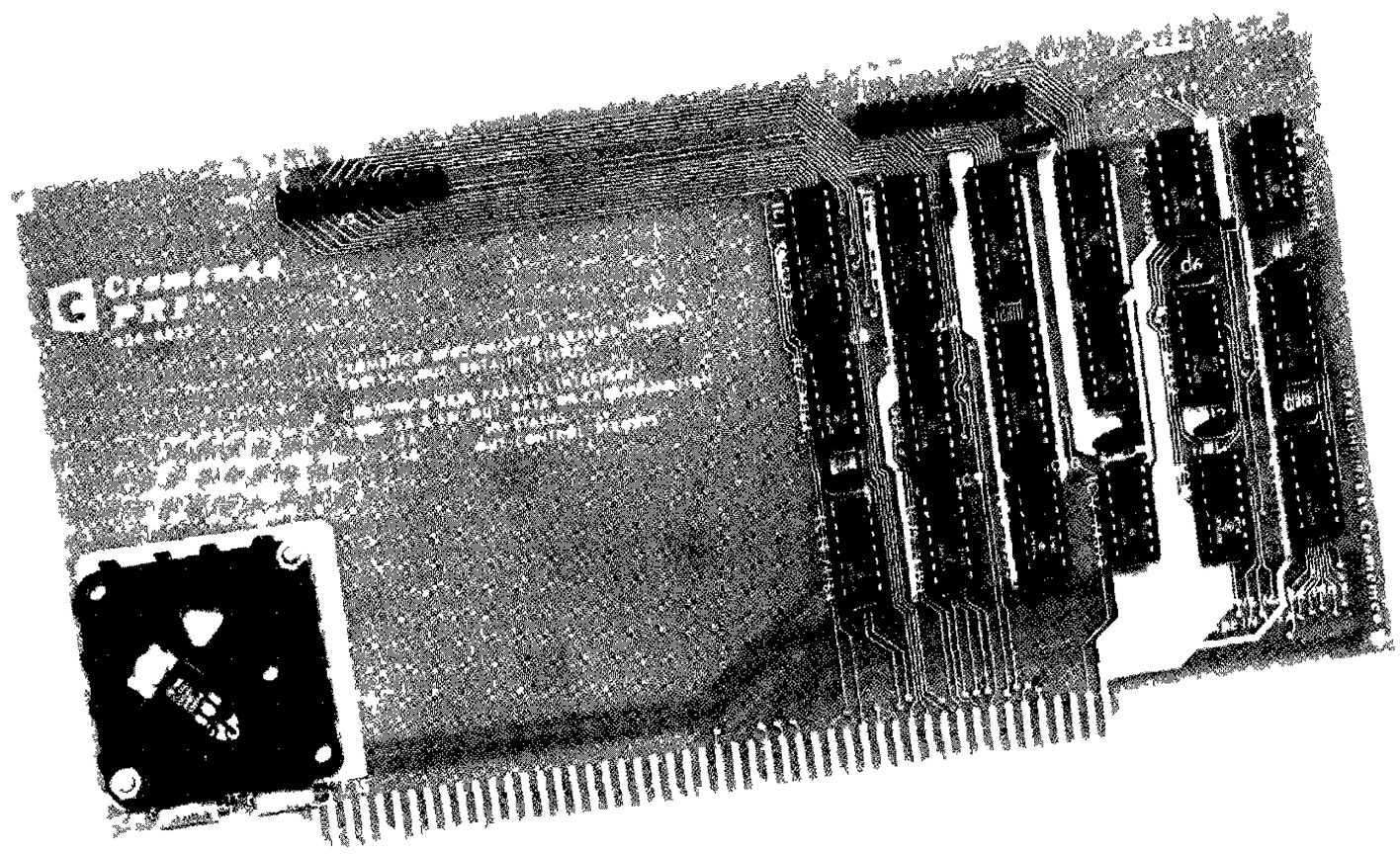
Serial I/O port
- **I/O levels** RS 232 or 20 mA current loop
- **Low baud range** 110 9600 baud (software selectable)
- **High baud range** 880 76 800 baud (software selectable)

Parallel port
- **Input port** 8 bits
- **Output port** 8 bits
- **Input load** one TTL equivalent
- **Output drive** 20 TTL loads

Interval timers
- **Number of timers** 5
- **Timer range** 0 16 32 msec (software selectable)
- **Timer resolution** 64 microseconds

General Information
- **Disk controller type** 1771 1
- **UART type** 5501
- **ROM type** 2308
- **BUS** S 100 (one slot only)
- **Power requirements** + 8 volts @ 1 0 A; +18 volts @ 100 mA; −18 volts @ 100 mA
- **Operating environment** 0 55°C

Printer Interface



- Use with all Cromemco printers

A VERSATILE CARD WITH TWO INTERFACES ON ONE CARD

With this new interface card it s easy for you to interface either dot-matrix or full letter printers to your computer system

To be suited to these printers this card is designed with two actual interfaces One uses the Centronix parallel convention and interfaces the Cromemco Models 3779 or 3703 dot matrix printers

The card s second interface interfaces the Cromemco Model 3355A Full Letter printer

This second interface has built-in ribbon lift and ribbon lowering circuitry to free the software overhead normally required for this function

NOTE TO CROMEMCO SYSTEM TWO AND SYSTEM THREE PURCHASERS:

The Model PRI interface card described here is now supplied as standard equipment in your system

You need not purchase this card separately unless you are adding additional printers to your system

See Cromemco PRINTERS on page 17

Each of the two interfaces has an individual cable connection on the top edge of the card

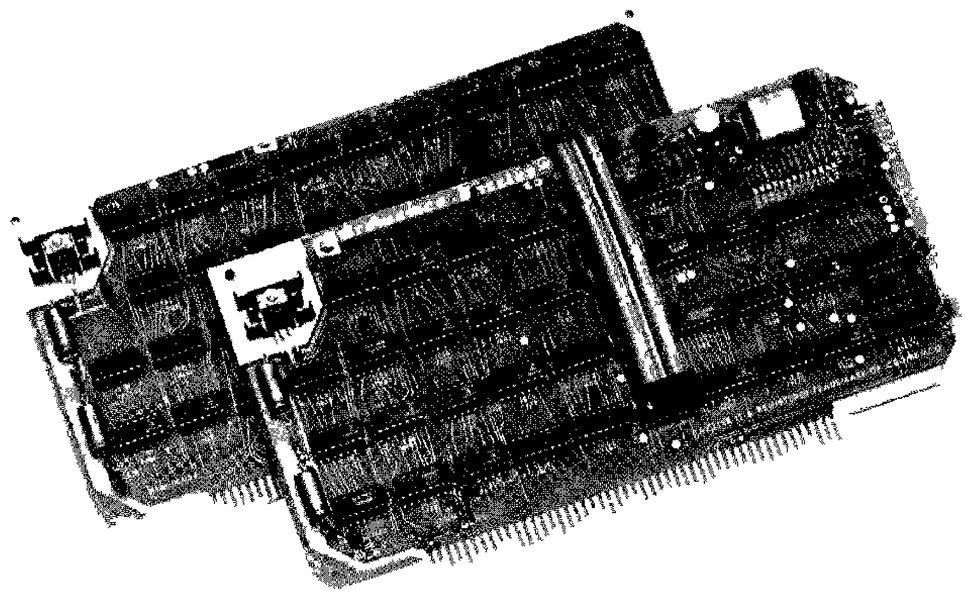
PRICES

Printer Interface Card assembled burned in and tested (Model PRI)	$195
Cables for PRI interface 25 conductor ribbon cable connects from top card connector to DB 25S socket Lengths as follows	
Cable 62 cm in length for use in Cromemco computers (Model CBL 2)	$15
Cable 110 cm in length for use in Cromemco System Three computer (Model CBL 3)	$15

TECHNICAL SPECIFICATIONS
Model PRI
Printer Interface

Output port addresses 54 5A 5B 5C
Input port addresses 54 5A
Alternate port addresses Optional DIP switch
Software support Cromemco CDOS
BUS S 100
Power requirements +8 volts @ 0 7 A
Operating environment 0 55°C

TV Dazzler



ALPHANUMERICS PLUS ACTION, AND GRAPHICS

The Dazzler® maps your computer memory con tent onto your color TV screen in full color

That doesn t mean just that you see alphanumerics in color You can display any information in memory And do so in color

The Dazzler® consists of two circuit boards that plug directly into your Cromemco Computer Systems

NEEDS ONLY 2K MEMORY

Technically the Dazzler® scans your computer memory using direct memory access (DMA) It formats each memory bit into a point on the TV screen to give a 128 x 128 element picture Only a 2K-byte computer memory is required (only 512 bytes for a 32 x 32 picture) The quality of the pictures is evident in the photos

The Dazzler® output is a video signal that goes directly to the TV video amp or to the antenna terminal through an inexpensive commercially-available device

PRICE

TV Dazzler assembled burned in and tested (Model CGI) $350

DAZZLER GAMES

A set of over a dozen games you can play with the Dazzler Available on either 5′ or 8″ diskettes Each diskette includes CHESS SPACE WAR 4D TIC TAC TOE TANK WAR DAZZLE-MATION CHASE TRACK DAZZLE DOODLE GOTCHA LIFE KALEIDOSCOPE DOG FIGHT MAGENTA MAR TINI and AMBUSH

PRICES

Dazzler Games on 5″ diskette (Model FDG S) $95
Dazzler Games on 8″ diskette (Model FDG L) $95

DAZZLER GRAPHICS

A program to use the Dazzler to display graphs graphics and alphanumeric displays in color on a TV set Available on either 5″ or 8″ diskettes

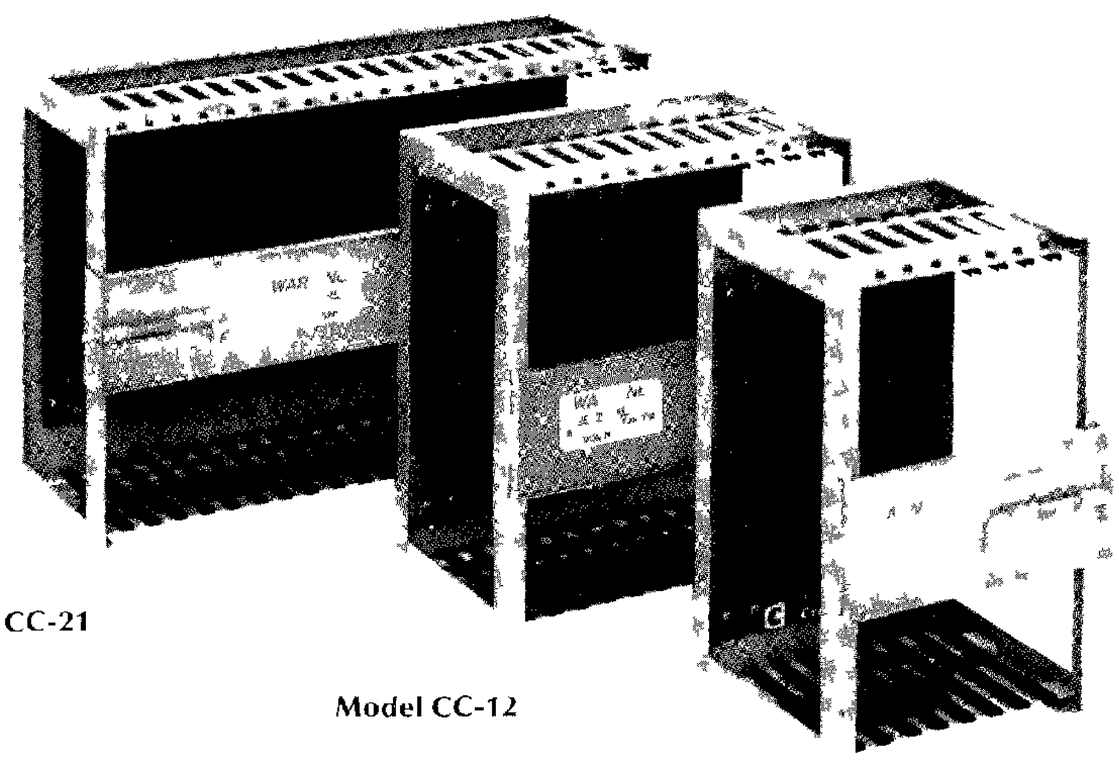
PRICES

Dazzler Graphics on 5 diskette (Model DGR S) $95
Dazzler Graphics on 8 diskette (Model DGR L) $95

TECHNICAL SPECIFICATIONS
Model CGI
TV Dazzler

Display format 128 x 128 64 x 64 or 32 x 32 (software selectable)
Colors available (color mode) Red green blue cyan magenta yellow white black
Gray scale available (B&W mode) 16 intensities
System memory required 2K bytes (512 bytes for low resolution mode)
Memory access DMA
DMA rate 1 megabyte/second
Video output composite video TV signal
BUS S 100 (two slots required)
Power requirements + 8 volts @ 1 4 A
− 18 volts @ 50 mA
Operating environment 0 55°C

Card Cages



Model CC-21

Model CC-12

Model CC-8

8-, 12-, OR 21 SLOT VERSIONS

Ideal for your OEM or Home brew system requirements these S 100 bus card cages are built with the quality you've come to expect from Cromemco

The card cages themselves are of sturdy steel construction and include a rugged retaining bar to insure that cards cannot be shaken from their sockets

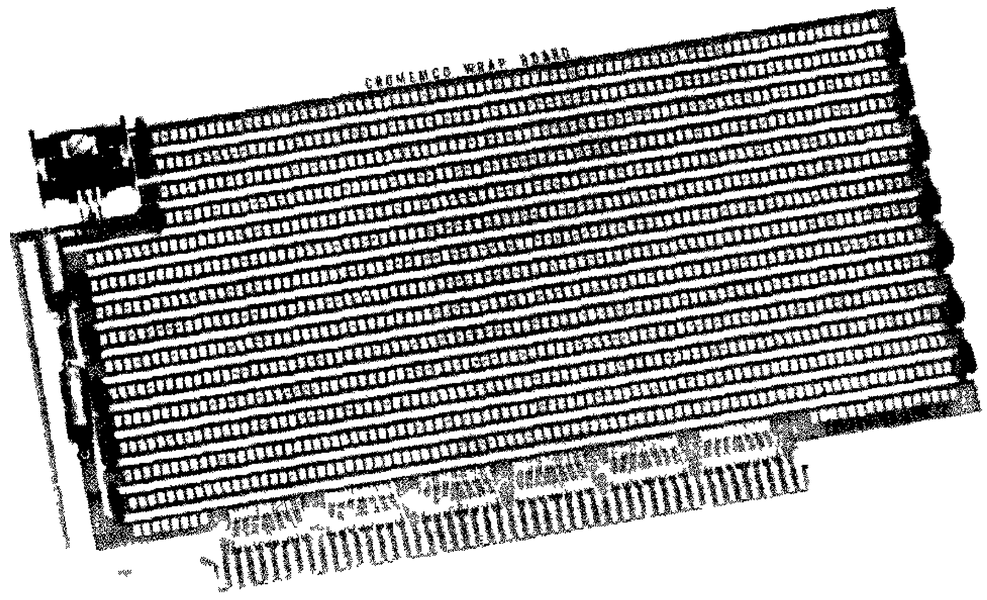
The back planes include a full set of edge connectors which are wave soldered in place on our exclusive shielded mother board that we call the Blitz Bus

Available in an 8- 12 or 21 slot version

CARD CAGE BUYER'S GUIDE

Model	Dimensions (Inches) H	W	L	Number of Slots	Price
CC 8	6	10	7	8	$ 195
CC 12	6	10	10¹	12	$ 245
CC 21	6	10	16¾	21	$ 395

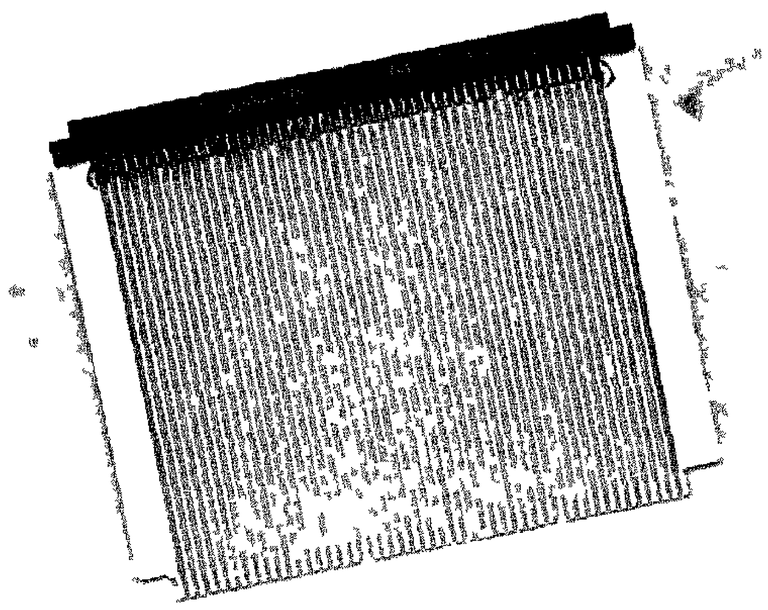
Wire wrap
Extender cards



Wire Wrap Card

A high quality wire wrap board for building your own cards for your computer Will hold over 70 integrated circuits A 5 volt power supply is included on the board Uses tantalum decoupling capacitors and disk ceramic bypass capacitors Edge contacts are gold plated for long trouble free life

PRICE	
Wire Wrap Board assembled (Model WWB)	$45



Extender Card

The card you need when experimenting with or troubleshooting your computer Extends computer boards above case for easy connection of voltmeter logic probe or oscilloscope Compatible with all S-100 boards Edge contacts are gold plated for long trouble free life

Connector is included (photo)

PRICE	
Extender Card assembled (Model EXC)	$45

Section IV
Software

Cromemco has an impressive reputation for the quality of our software and thoroughness of our documentation

We support our computers with what is unquestionably some of the finest software available Our Multi-User BASIC for example, is fast, yet maintains 14 decimal digits of precision while not introducing any round-off error That's important in financial work, of course, and it's obtained by using binary-coded decimal arithmetic

At the same time Cromemco ingenuity and thoroughness have made this a fast-operating BASIC Just benchmark its speed for yourself

Notice, too, in the following pages the substantial range of software currently available, including COBOL, FORTRAN IV, RATFOR with FORTRAN, and many others,

CROMEMCO DISK OPERATING SYSTEM (CDOS)

Cromemco disk-based software packages comprise a totally integrated system running under our CDOS Operating System

CDOS is the framework through which all disk file management is handled CDOS features include

(1) SYSTEM I/O System Input/Output processing for the console, printer, disk, etc

(2) FILE MANAGEMENT Symbolically-named files can be created, erased opened, and closed Files can be written to and read from both sequentially and randomly

(3) CONSOLE PROCESSOR The Console Processor allows the user to display the disk directory, log on new disks, save new disk files, and rename existing files Executable files may be run from the console, in batch mode or from other programs

(4) READ-AFTER-WRITE After each record is written to the disk, it is read back to assure data integrity A disk write error message is displayed if the data is not written properly

(5) CDOS GENERATOR The user can generate an operating system to match a particular hardware configuration In addition to the amount of memory in the system, the user can specify the number, location, and types of disk drives

The Console Processor includes a number of commands which are intrinsic to CDOS These are useful for manipulating disk files from the console

(1) ATTRIBUTES — establishes or changes the allowable file access modes Erase, Write, and/or Read protection may be specified

(2) DIRECTORY — lists all or specific disk file names and sizes

(3) ERASE — deletes files from the disk directory and releases the disk space which the files occupied

(4) RENAME — changes the file name of an existing file.

(5) SAVE — causes the user area to be saved as a disk file

(6) TYPE — displays an ASCII disk file on the console (and printer)

CDOS is supplied on all system disks and is automatically loaded into RAM during boot-up Also supplied with all systems software disks are a number of CDOS utility programs.

(1) BATCH — allows the user to execute a file of commands from CDOS

(2) DUMP — displays the contents of an ASCII or binary file in hexadecimal on the console (and printer) A column on the right of the listing is devoted to the ASCII translation of the dump

(3) INITIALIZE — is used to format disks

(4) STATUS — displays any errors in the disk directory as well as a summary of the use of disk and RAM space

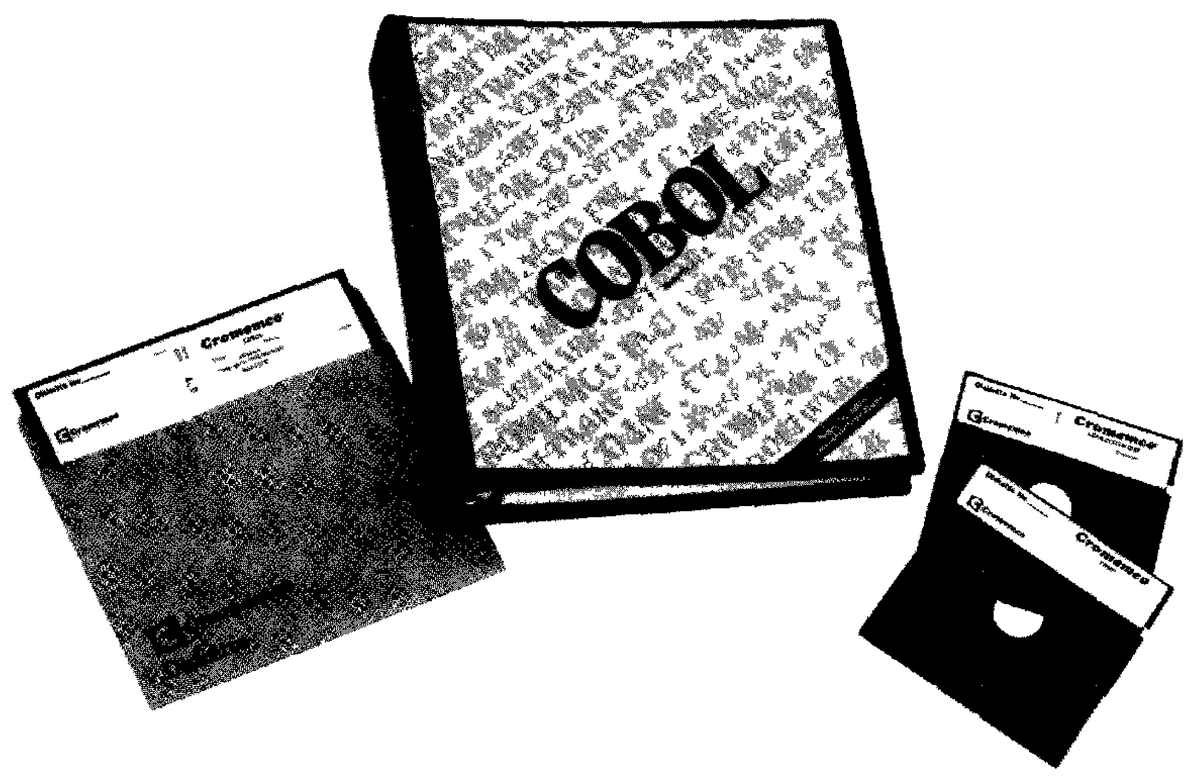
(5) WRITE SYSTEM — is used to transfer the boot file from/to the front of the system disk

(6) TRANSFER — is used to transfer files from a disk or other device to another disk or other device

(7) SCREEN EDITOR—is an easy-to-use screen-oriented text editor SCREEN is ideal for those who are not familiar with the use of a computer, since it continuously prompts the user with the available commands always displaying a full screen of text SCREEN may be used in conjunction with the Cromemco FORMATTER to yield a powerful Word Processing System Note that SCREEN is designed for use *only* with Cromemco terminals

(8) TEXT EDITOR—is a conventional character oriented text editor It incorporates many powerful features and allows conditional as well as multiple replacements throughout the file being edited

COBOL Compiler



COBOL

The Cromemco COBOL compiler contains all of the features of Level 1 COBOL as required by the 1974 American National Standard (ANSI) X3 23 1974 as well as the most useful options of Level 2

The Level 1 features include the standard Nucle us Sequential Files and Table Handling RELATIVE INDEXED and SEQUENTIAL files may be used The COPY statement speeds program development by allowing the programmer to include source librar ies Our COBOL also supports COMPUTATIONAL-3 data to give more compact storage of decimal data on a disk (by packing 2 digits per byte)

Powerful Level 2 features of Cromemco COBOL are

- COMPUTE — simplifies computations by combining multiple arithmetic statements
- OPEN EXTEND — permits you to add records to an existing sequential file without first copying all previous records to a new file
- CALL — to execute your standard pre-compiled routines with a single statement
- STRING—easily combines several data items into one field
- UNSTRING — easily separates one data item into several fields

For rapid error isolation our COBOL also includes EXHIBIT READY TRACE and RESET TRACE

Another important feature is that the compiled code is relocatable and uses the same relocatable code format as our FORTRAN IV and our Macro Assembler This means that segments of programs written in FORTRAN or Assembly Language may be easily called from a COBOL program

Since COBOL is the most popular language now in use for business application programming Cro memco computers with COBOL are particularly well suited to business applications

PRICES

COBOL Compiler on 5′ diskette (Model FDC S)	$95
COBOL Compiler on 8″ diskette (Model FDC L)	$95

ANSI-Standard FORTRAN IV Compiler

CROMEMCO FORTRAN IV

Cromemco FORTRAN IV provides new capabil ities for users of Z-80 based microcomputer sys tems This is a complete implementation of ANSI standard FORTRAN X3 9 1966 except that there is no complex data type and specification statements must appear in a specific order Users can therefor take advantage of the large number of application programs already written in FORTRAN

Cromemco FORTRAN IV operates under the CDOS Operating System and provides both sequen- tial and random disk file access Files may be named at run time by use of the CALL OPEN state ment The ENCODE and DECODE statements pro vide the user with formatted data transfer within memory

Variables may be declared as DOUBLE PRE CISION for full 16 decimal digit precision Other available data types include BYTE LOGICAL*1 LOGICAL*2 INTEGER*1 INTEGER*2 REAL*4 and REAL*8 For ease in coding our FORTRAN allows the literal form of Hollerith data that is literals may be enclosed in apostrophes

Since Cromemco FORTRAN IV produces relo- catable code FORTRAN modules may be linked with the code produced by the Cromemco Relo catable Assembler and the Assembler can access scientific and arithmetic routines located in the FORTRAN IV library This library is searched by the linker to resolve any undefined subroutine calls This means that only the specific subroutines and system routines required to run a Cromemco FOR TRAN program are loaded before execution

PRICES

All disk software packages include manual and complete documentation

FORTRAN IV on 5′ disk (Model FDF S)	$95
FORTRAN IV on 8″ disk (Model FDF L)	$95

RATFOR/FORTRAN IV

RATFOR WITH FORTRAN IV

Cromemco RATFOR (an acronym for RATional FORtran) is a FORTRAN preprocessor that brings the advantages of structured programming techniques to the widely used FORTRAN language

The new structures allowed in RATFOR include

- BREAK — exits from a loop
- NEXT — skips remainder of a loop
- IF-ELSE — branch implementation
- REPEAT UNTIL — loop with test at end
- WHILE — loop with test at beginning

The RATFOR preprocessor produces FORTRAN IV code that can be compiled by the Cromemco FORTRAN compiler included with this software package

The FORTRAN code produced by the RATFOR preprocessor is indented for easily readability in accordance with block structured principles

The RATFOR software package includes

(1) A copy of the RATFOR preprocessor and support programs
(2) The RATFOR reference manual
(3) The RATFOR book *Software Tools* by Kernighan and Plauger
(4) Cromemco s FORTRAN IV compiler with LINK the linking loader
(5) The Cromemco FORTRAN IV instruction manual

PRICES

On 5″ disk (Model FDR S)	$195
On 8″ disk (Model FDR L)	$195

Z-80 Relocatable Macro Assembler

Z-80 MACRO RELOCATING ASSEMBLER

The Cromemco Z 80 Macro Assembler is a two pass assembler which reads source code from a disk file assembles it and produces listings and an object file either in relocatable or in Intel hex format It is both a Macro and Conditional Assembler

LINK the Cromemco Relocating Linker/Loader may then be used to load the assembled code into memory and resolve any external references The completely assembled and linked machine code may then be saved in a disk file for execution The assembler and linking loader allow one to create and assemble a number of different modules separately and then link them together as desired at run time These modules may include FORTRAN Library routines as well as those generated by the FORTRAN and COBOL computers

Also included on the assembler disk is DEBUG a support program which allows machine language programs to be traced disassembled patched or programmed into PROM DEBUG also allows the user to establish break points display and alter the Z 80 registers and initiate normal or step by step program execution

PRICES

All disk software packages include manual and complete documentation

Z 80 Assembler on 5 disk (Model FDA S)	$95
Z 80 Assembler on 8″ disk (Model FDA L)	$95

16K Disk Extended BASIC

CROMEMCO 16K DISK-EXTENDED Z-80 BASIC

Cromemco 16K Disk Extended BASIC was specifically designed to meet the most demanding requirements of business firms while also providing the flexibility and speed necessary for real-time control applications It fully utilizes the extensive 158 instruction set of the Z-80 microprocessor to maximize computational precision (a full 14 digits) programming power and speed of execution

Some additional features are extended string and sub string handling capability PRINT USING for Cobol like formatted output TRACEing of program execution dynamic error trapping random and sequential disk file access through CDOS program chaining and overlays multiple statements per line renumbering of lines and direct machine language interaction with INP OUT PEEK POKE and USR commands

Other features of this powerful BASIC include

- A semi compiling design which combines the best features of both an interpreter and a compiler This yields exceptionally fast execution times
- Three types of variables
  (1) Integer (2 bytes) range +32767 to −32768
  (2) Short Floating Point (4 bytes) range ±9 99E+62 to 9 99E−65 accuracy to 6 digits
  (3) Long Floating Point (8 bytes) range ±9 99E+62 to ±9 99E−65 accuracy 14 digits
- Advanced floppy disk I/O capabilities
- Binary and ASCII storage for both programs and data
- Sequential and random access files
- English language error messages
- Syntax error checking as program is entered
- Dynamic error trapping
- TRACE and immediate mode to facilitate debugging
- Advanced output formatting capabilities
- Advanced string handling capabilities
- Chaining of programs
- Direct machine language interaction

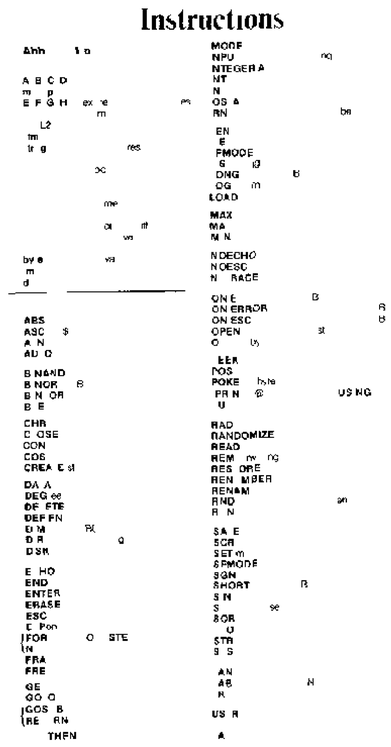
PRICES

16K BASIC on 5″ disk (Model FDB-S)	$95
16K BASIC on 8″ disk (Model FDB-L)	$95

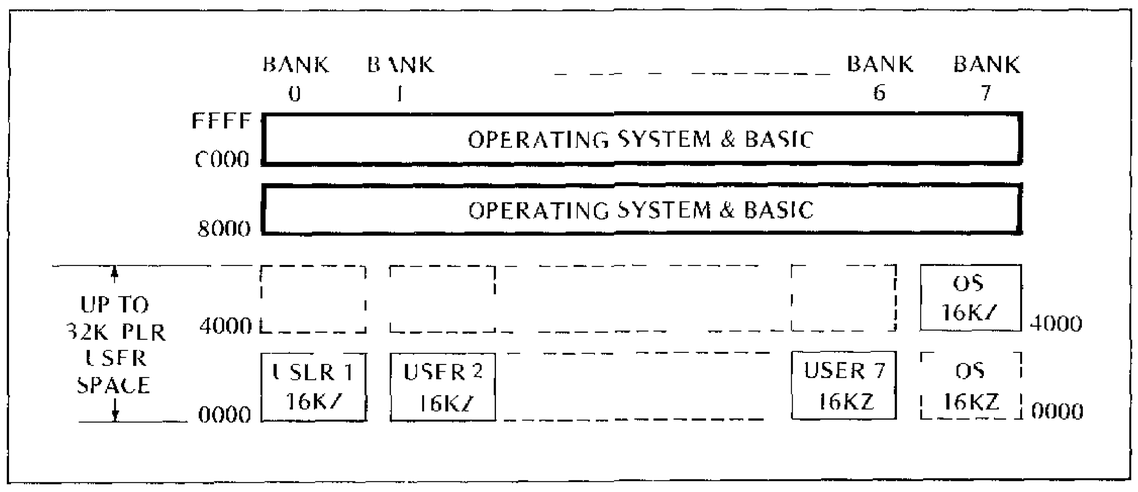
A complete list of our 16K BASIC instructions set is given below

• • • •

Instructions



Multi-User BASIC



Memory Allocation in Cromemco Multi-User BASIC

MULTI USER BASIC

Up to 7 users can independently run BASIC programs with Cromemco's new multi user software

Multi-user BASIC is supplied as software only or as a combination hardware/software package to upgrade a Cromemco System Two or System Three to a 2-user system

The package includes three 16KZ memory cards with Bank Select one TRT interface TU-ART cable priority interrupt cable software on diskette and documentation

To expand beyond two users order one 16KZ for each additional user and one TRT for each additional two users

PRICES

MULTI USER BASIC on 5″ diskette with documentation (Model FDM-S)	$800	MULTI USER BASIC hardware/software package with 5″ disk (Model MUB S)	$2895
MULTI-USER BASIC on 8″ diskette with documentation (Model FDM L)	$800	MULTI-USER BASIC hardware/software package with 8″ disk (Model MUB-L)	$2895

32K Structured BASIC

FEATURES OF CROMEMCO 32K STRUCTURED BASIC

In addition to all of the commands found in Cromemco 16K BASIC the following features and commands will be found in 32K BASIC This BASIC is designed to run in a Cromemco system with not less than 64K of memory

Variable names and label names may contain up to 31 characters and may start with an alphabetic character and contain any combination of alphabetic and numeric characters including the apostrophe ( ) Line numbers may also be used as label names

SOPHISTICATED KSAM

A highly sophisticated KSAM (Keyed Sequential Access Method) has been incorporated in Cromemco s 32K BASIC This feature is very useful in establishing data bases for various applications

STRUCTURED PROGRAMMING

With the introduction of WHILE and REPEAT loops and the IF THEN ELSE instruction group structured programming in BASIC becomes a reality This leads to better more readable code which in turn leads to faster debugging and easier maintenance of programs and systems

The interactive program Editor allows the programmer to perform the following functions on one or more program lines

FIND all occurrences of a string
CHANGE all or selected occurrences of a specified string and
EDIT selected lines by inserting or deleting characters

PROCEDURES are called from memory or a PROCEDURE library and may include both global and local variables PROCEDURE names may contain up to 31 characters and many start with a period (•) and contain any combination of alphabetic and numeric characters including the apostrophe ( ) A PROCEDURE is defined by

PROCEDURE name (optional calling parameters)
•
code
•
ENDPROC (optional return parameters)—returns from procedure
or
ERRPROC—sets BASIC error flag and returns from procedure

PRICES

32K Structured BASIC on 5″ disk (Model STB-S)	$295
32K Structured BASIC on 8″ disk (Model STB L)	$295

SPECIAL STRUCTURED BASIC COMMANDS

EXIT — dele es al ac ve contro structures (GOSUB FOR WHILE DO F THEN ELSE and REPEAT on the un t me s ack up to the mos ecen p ocedu e ca o f no p ocedure has been ca ed up to the beg nn ng of the prog am

DELREM — deletes REMa k s atemen s o mo e e c ent sto age of sou ce les and o a ow g ea e conf den al ty of source code

LVAR — l sts a l va ab es and the ype as we as he values o scala a thmetic va iab es

IF THEN DO ELSE ENDDO sequence allows the p og amme to mp emen a fu F THEN ELSE st uc tu e

COMMON — al ows va ables o rema n n memo y as new rout nes a e oaded nto memo y dur ng execut on

EXPAND — wl inse t nul cha acters n a st ng va able so that the programme can se cha acters n he midd e of a s ng

NOLIST — causes sect ons o code to become **executable only** code he eby protec ng the secur ty o some sec ons of code wh e allow ng he user o f eely access othe sec t ons of code

CLEAR — v l ecover use space memory f om p ev ous y de eted l nes

WHILE ENDWHILE oops a e an mplemental on o condit onal oops w h a test a he s a t of he oop It s poss b e for he WHILE loop to be execu ed ze o mes the cond t on s no me when he loop s en e ed

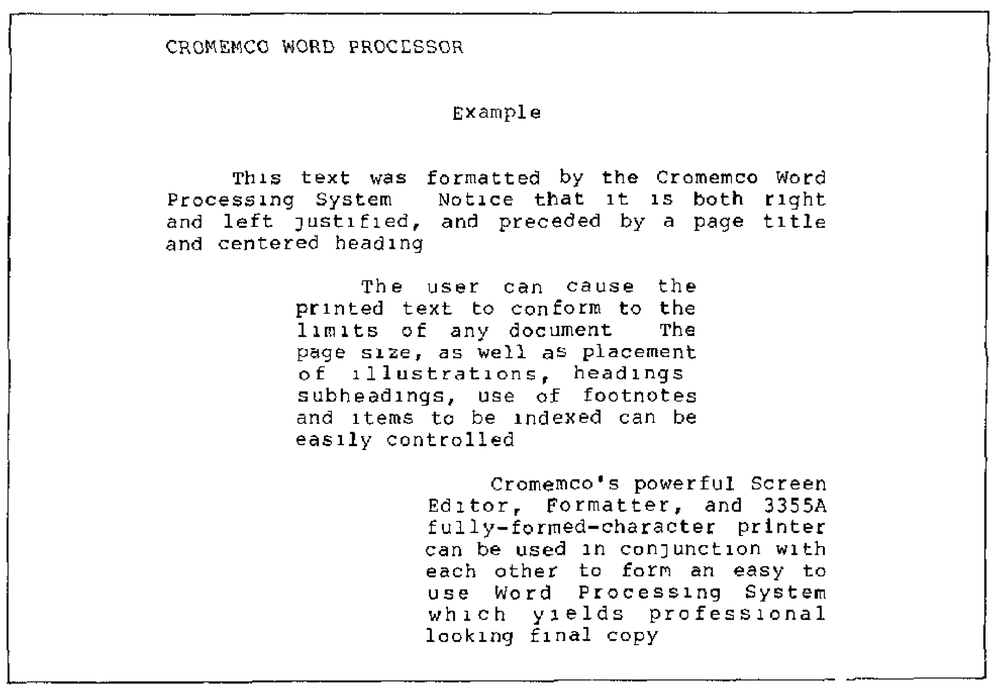
REPEAT UNTIL oops are an mp ementa on o a con d ona oop v th he test at the end of the loop The con ents of a REPEAT oop w a ways be execu ed a least once

KSAM ROUTINES

pf — p mary f e
f — nve s on a so cal ed a seconda y or alternate f le
fname — f le name may be a str ng o s ng va able
pfn — f le numbe may be a constant o a thme c va iab e
fn — nve s on e numbe
pkey — p ma y key may be a s r ng or s ng va able
skey — seconda y key

n al ze and prefo ma a KSAM e
KCREATE pf eco d ength key length K oad space [#volumes] fname **KALTCREAT** pfn skey length skey d splacemen [#volumes] name
Rename a segments of a file
KRENAME old fname new fname
Erase al segmen s o) a e
KERASE fname
Open a f le o fu the process ng
KOPEN pfn name
KALTOPEN i n n name
Close a f le
KCLOSE pfn
Ge he next cu ent or prev ous ecord based on the co la ng sequence o he p ma y keys
KGETFWD pfn [tem lst
KGETCUR p n tem l st
KGETBACK pfn [em l s]
Read a random record based on he pr ma y key va ue
KGETKEY p n pkey [em l s]
Read he nth reco d of the f le relat ve to the st
KGETREC pfn eco d numbe [em l s]
Read add t ona data f om eco d al eady ele enced
KGET pfn [em l st
Add a e o d lo the p ma y e the p ope sequence by p mary key
KADD pfn pkey [em list
Add a eco d o he pr mary f le preserv ng tho le spac ng
KLOAD p n pkey [tem l st
Add add onal da a o an a eady e erenced ecord
KPUT pfn em l s]
Change data n a eco d w hout chang ng the p mary key
KUPDATE p n pkey tem st]
Dele e a reco d f om the p mary e
KDEL p n pkey
Add de e e and ve lfy secondary f e ent ies
KALTADD fn
KALTDEL fn
KALTVER fn
Read a pr ma y le eco d based on he seconda y key
KALTCUR lfn em st]
KALTFWD fn em l s]
Spec fy a new secondary key and ead he f st co respond ng p mary e reco d
KALTFIRST n skey [em l st]
Read the p imary key of the cu en ecord
KRETRIEVE p n s ng va able

Word Processing System



CROMEMCO WORD PROCESSOR

Example

This text was formatted by the Cromemco Word Processing System Notice that it is both right and left justified, and preceded by a page title and centered heading

The user can cause the printed text to conform to the limits of any document The page size, as well as placement of illustrations, headings subheadings, use of footnotes and items to be indexed can be easily controlled

Cromemco's powerful Screen Editor, Formatter, and 3355A fully-formed-character printer can be used in conjunction with each other to form an easy to use Word Processing System which yields professional looking final copy

The accompanying illustration gives you an example of the variety of styles the Cromemco Word Processor will give you from wide to narrow justified columns placed anywhere across the page

WORD PROCESSING SYSTEM

The Cromemco word processing system is a combination Screen Editor and Formatter for the professional preparation of documents

Lines of text may be left or right-justified or centered

Key words can be noted and included in an alphabetized index which is automatically prepared

The Word Processing system supports multiple columns per page tabs footnotes and user inserted text (for form letters) Page numbers can go as high as 9999 for long documents

This word processing system is designed for use on Cromemco System Two or System Three computers with 48K or more of memory

PRICES

WORD PROCESSING SYSTEM on 5" disk (Model WPS S)	$95
WORD PROCESSING SYSTEM on 8" disk (Model WPS L)	$95

Data Base Management System

DATA BASE MANAGEMENT SYSTEM

Cromemco s data base management system is a disk based system designed to run on Cromemco System Two or System Three computers with at least 48K of memory

This advanced software package can be used for mailing lists inventory control personnel records order entry or other important business applica tions

To create a data base an operator simply specifies the field attributes and then specifies the sorts by which the data can be retrieved (e g by state by name by state by city by name etc)

The system overcomes the limitations of key access methods in that multiple keys to the data base can be defined and redefined at any time Storage space for the key files can be deleted as desired and recreated at a later time

PRICES

DATA BASE MANAGEMENT SYSTEM on 5″ disk (Model DBM S)	$95
DATA BASE MANAGEMENT SYSTEM on 8″ disk (Model DBM-L)	$95
MULTI USER DATA BASE MANAGEMENT SYSTEM for use with Cromemco System Two Computers on 5′ disk (Model MDBM S)	$195
MULTI USER DATA BASE MANAGEMENT SYSTEM for use with Cromemco System Three Computers on 8″ disk (Model MDBM-L)	$195

TRACE System Simulator

TRACE SYSTEM SIMULATOR

TRACE is a powerful software system simulator designed to facilitate assembly language program development

Virtually all aspects of system operation can be simulated including interrupts and I/O operations A historical record of the program execution is maintained in a 100 instruction circular queue

The advanced features of TRACE enable it to be used as a software substitute for logic analyzers or in-circuit emulators when debugging assembly language programs

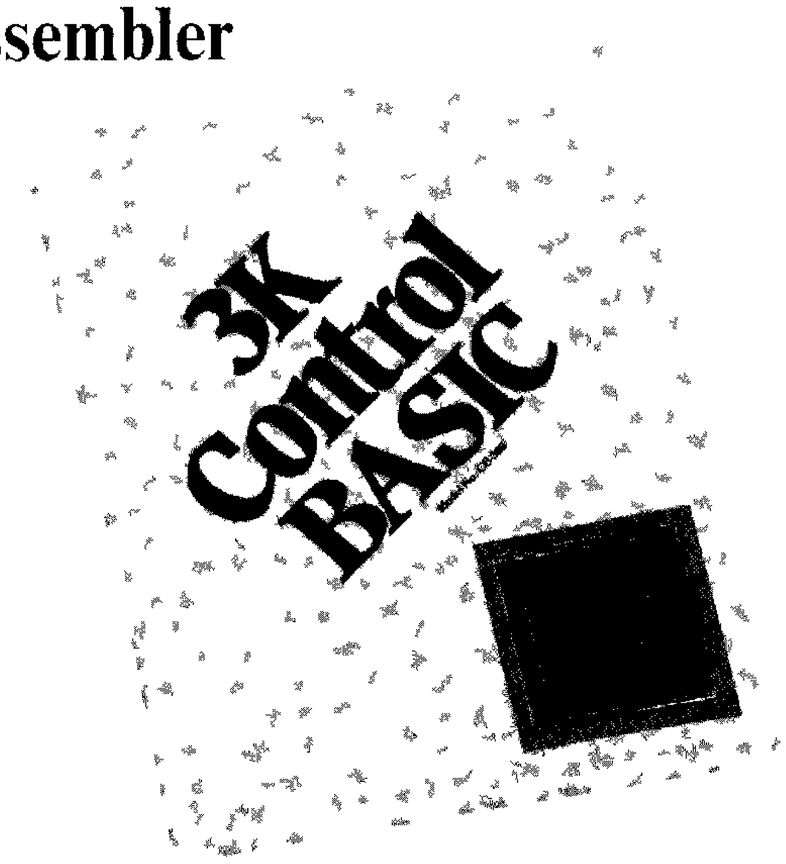
PRICES

All disk software package include manual and complete documentation

TRACE System Simulator on 5″ disk (Model TSS-S)	$95
TRACE System Simulator on 8′ disk (Model TSS L)	$95

Resident Software

- 16K Extended BASIC
- 3K Control BASIC
- Monitor
- Resident operating system/assembler



• CROMEMCO 16K Z 80 BASIC This memory-resident version of our powerful 16K BASIC gives you all the features of our disk based version (except for disk I/O)

This is a complete BASIC with 14 digits of precision high execution speed Print Using Trace and many other capabilities

16K resident BASIC occupies memory from 8000 through BFFF and is ideal for use as a stand alone system

• CROMEMCO 3K CONTROL BASIC This is a compact integer-only BASIC interpreter designed specifically for microcomputer control applications Control BASIC allows the user to read and write specific memory and I/O locations and call machine language subroutines

There are 36 commands and functions available

Control BASIC requires 3K of memory space beginning at location E400 hex

• CROMEMCO Z 80 MONITOR This Monitor is a powerful tool for use in software development It allows the user to examine and alter register and memory contents set program breakpoints move blocks of memory program PROMs (using the Cromemco BYTESAVER II) and read and punch paper tapes — all under keyboard control

The Monitor resides in memory space from E000 to E3FF hex and includes 12 commands

• ASSEMBLER / RESIDENT OPERATING SYSTEM The Cromemco assembler and resident operating system allows the user to create and edit Z-80 source code assemble the source code and create object code files

There are 43 operating system commands

The assembler/resident operating system resides in memory space from address A000 to BFFF hex

PRICES

16K BASIC in PROM (Model 16KB-1608)	$400
3K Control BASIC (Model CB 308)	$75
Model ZM 108 in 2708 PROM	$25
Assembler/Resident Operating System in 8 2708 PROMs (Model ZA 808)	$200