Cromemco
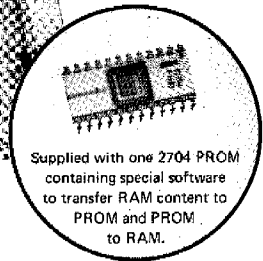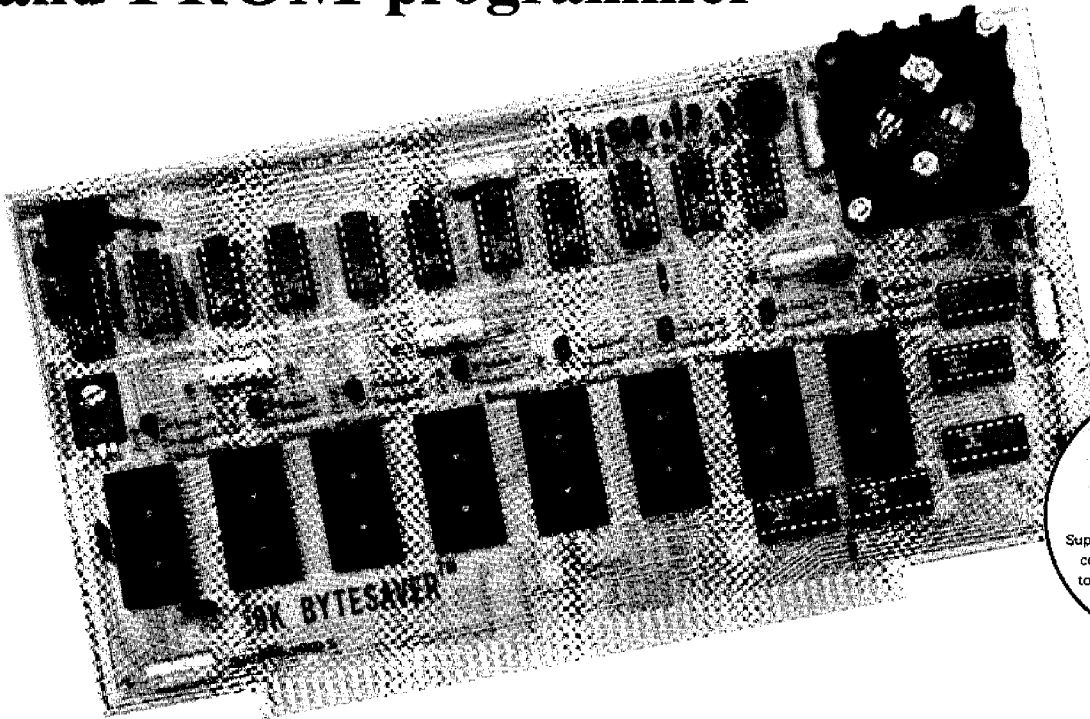
Specialists in computer peripherals

Advanced peripherals for your microcomputer

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 BYTE-SAVER™, 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.

Cromemco

D+7AI/O ™
Multi-channel microcomputer analog interface
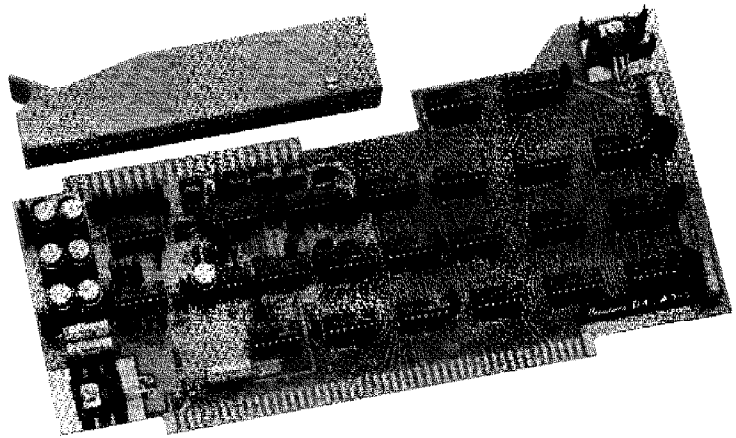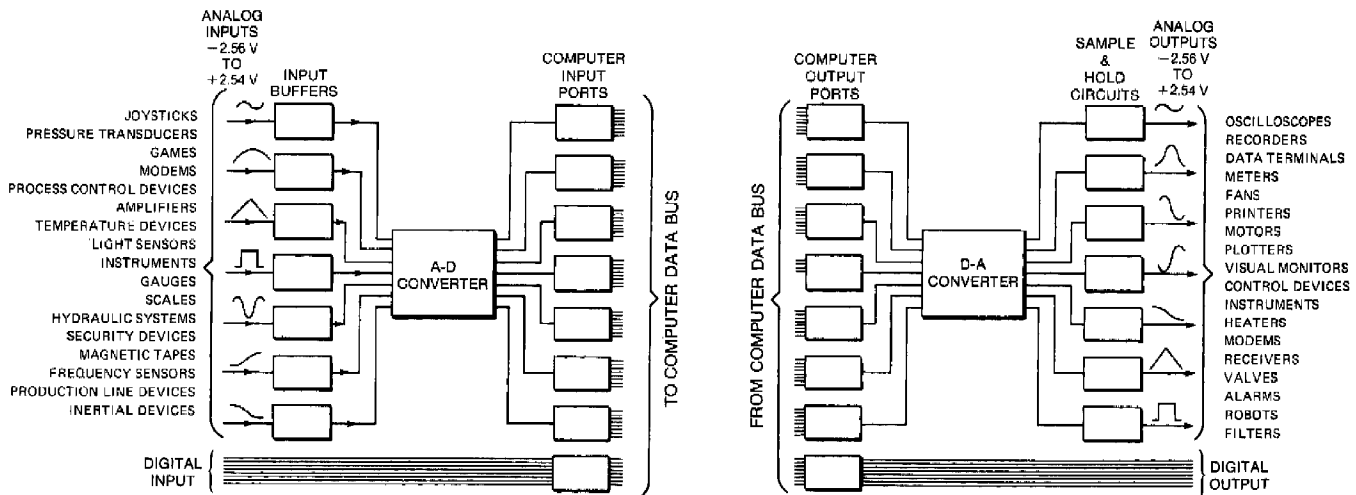
Now you have a way to get analog information into and out of your microcomputer. It's an easy, fast, and unbelievably inexpensive way.

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.
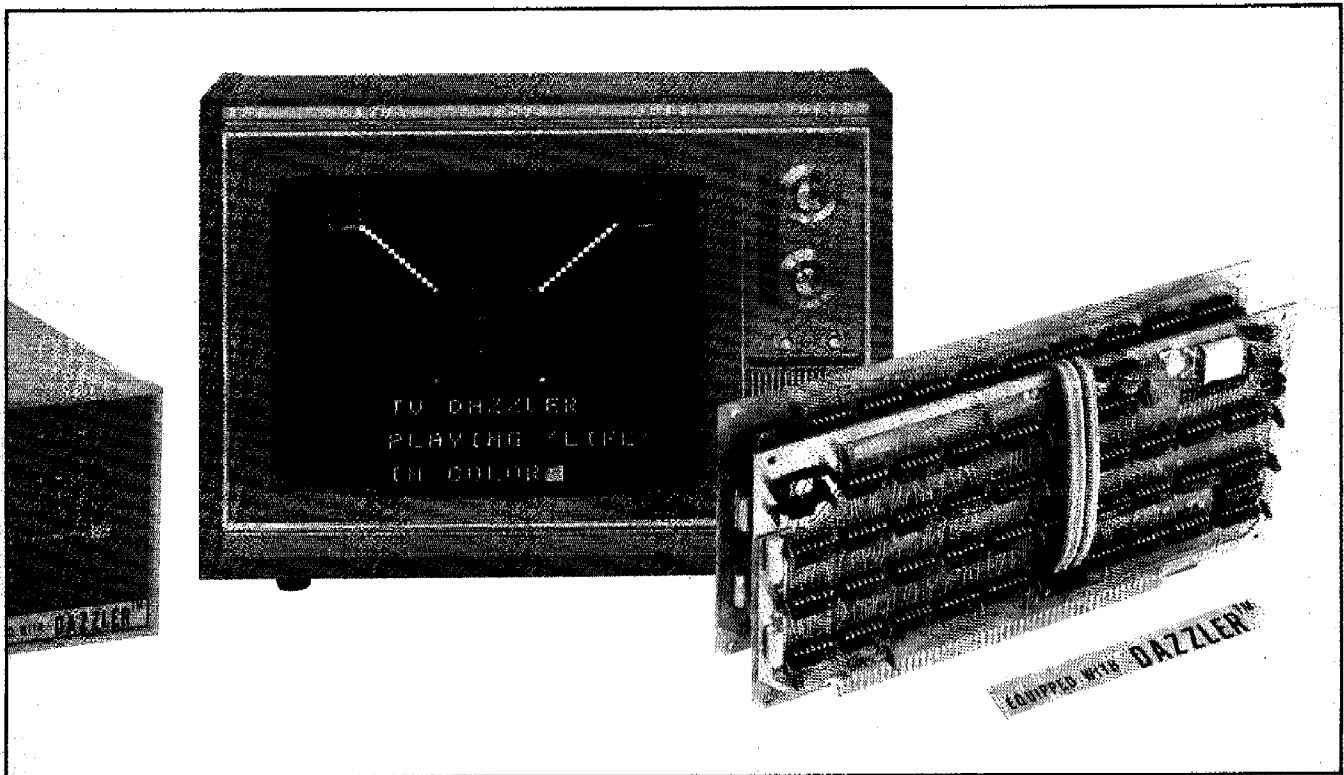
AT COMPUTER STORES/MAIL

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.
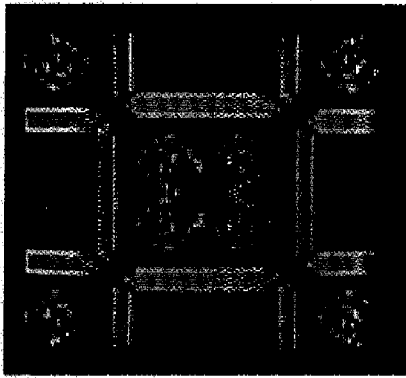
NEEDS ONLY 2K MEMORY

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.

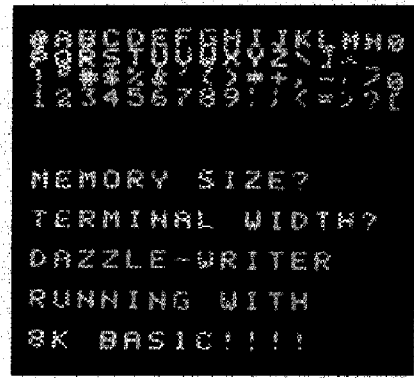## INEXPENSIVE — AND SO MUCH BETTER

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.
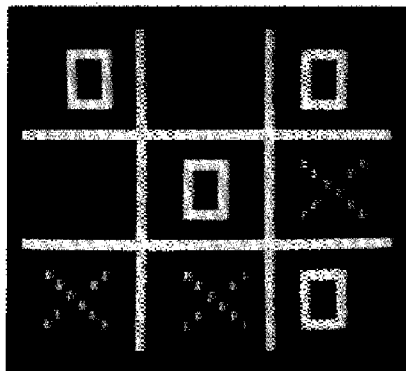
TV display pattern obtained during a sequence of the computer game LIFE from Cromemco software (below). Display is in beautiful color (see cover).
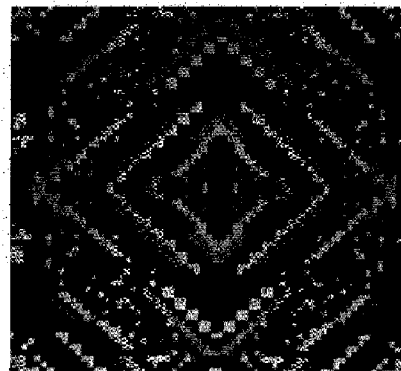
An example using Cromemco's DAZZLE-MATION software. A second tape ("Magenta Martini") was used to obtain above action display. This tape is included with DAZZLE-MATION as a use example.

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 KALEIDO-SCOPE 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 or 4 MHz switch ⎯⎯⎯

⎯⎯ Z80/4 CPU

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.
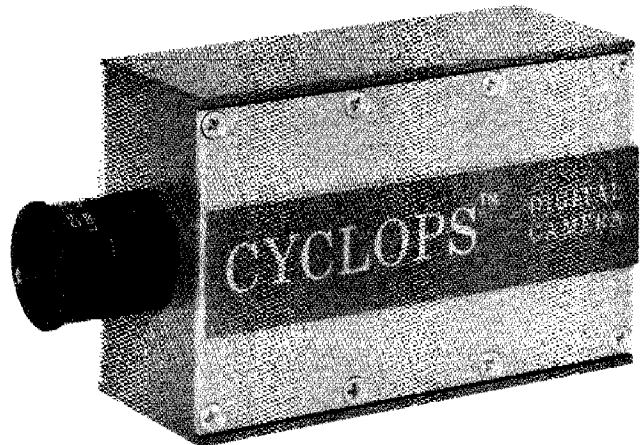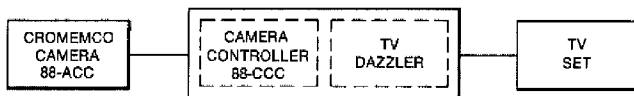
STORE/MAIL

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

```
┌──────────┐   ┌──────────────┐ ┌──────────┐   ┌──────────┐
│ CROMEMCO │   │   CAMERA     │ │    TV    │   │    TV    │
│  CAMERA  │───│ CONTROLLER   │ │ DAZZLER  │───│   SET    │
│  88-ACC  │   │   88-CCC     │ │          │   │          │
└──────────┘   └──────────────┘ └──────────┘   └──────────┘
```

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
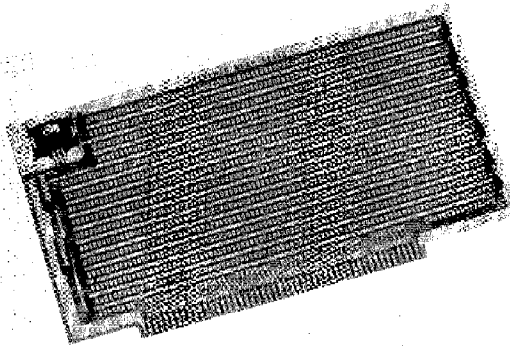
CYCLOPS^{tm} CAMERA CONTROLLER

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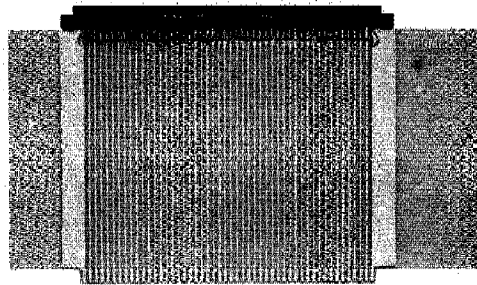
- Wire Wrap Board kit (Model WWB-2K) $35
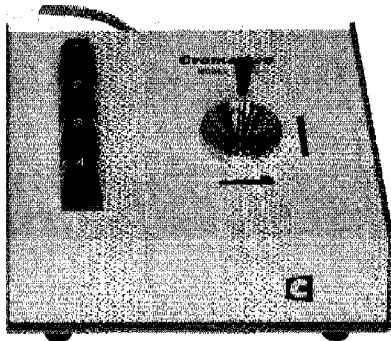- Wire Wrap Board assembled (Model WWB-2W) . . $45

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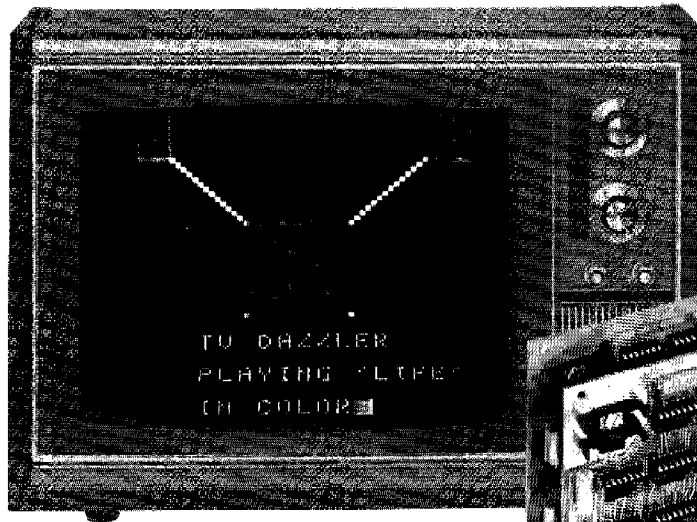
- Mail orders are shipped prepaid if fully paid with order.
- Purchase orders accepted subject to credit approval.
- Shipments to outside U.S. — Payment must accompany order and must include a 10% surcharge to cover additional shipping and handling charges.
- California users add 6% sales tax.

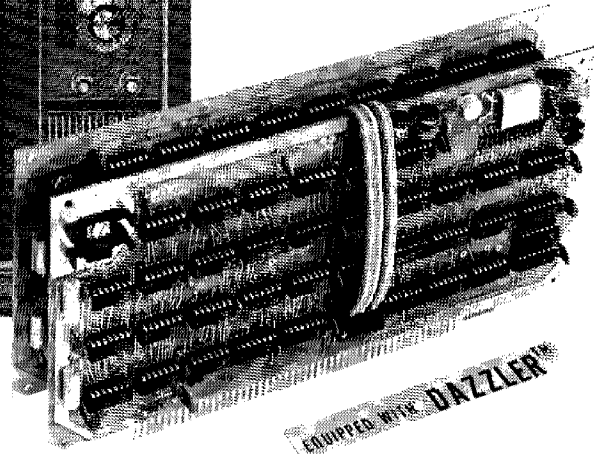Prices at stores may be slightly higher to cover stocking costs.

C Cromemco

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

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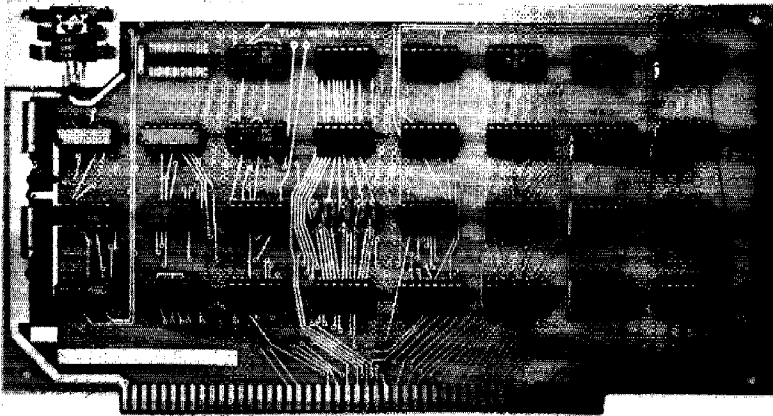
The Cyclops Camera Controller is designed to interface the Cyclops camera to the MITS Altair 8800 computer. The controller consists of two boards that plug directly into the Altair computer.

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

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 develop-
ment 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 gener-
ating 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.

3 - 3 - 3

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 micro-computer.

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.

- more -

4 - 4 - 4

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 instruc-
tion 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 inter-
face 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 inter-
   faced 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 recog-
   nition, process control, and other in-
   dustrial work. Interface also available.

* Wire-wrap board and extender card

5 - 5 - 5

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.

- more -

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 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.

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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 tm is for you.

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Or order directly by mail on your bank card.

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

See "ordering info" on back cover.

Cromemco

4 MHz CPU card

2 or 4 MHz switch ⎯⎯┐   ┌⎯Z80/4 CPU

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

```
┌──────────┐   ┌──────────┐ ┌──────────┐   ┌──────────┐
│ CROMEMCO │   │  CAMERA  │ │          │   │          │
│  CAMERA  │───│CONTROLLER│─│    TV    │───│    TV    │
│  88-ACC  │   │  88-CCC  │ │  DAZZLER │   │   SET    │
└──────────┘   └──────────┘ └──────────┘   └──────────┘
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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.
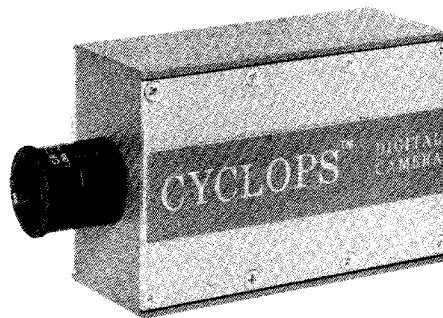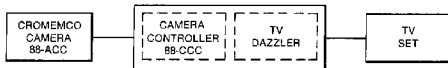
All connections to the Cyclops tm 88-ACC camera are made to a connector on the camera rear. All necessary voltages and signals are provided by the 88-CCC interface accessory which plugs into the Altair 8800 or IMSAI 8080 computer.

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.

Microcomputer Systems

ꓛ Cromemco

Tomorrow's computers today

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.

CONTENTS

Cromemco computers in a multi-
user setup in the Cromemco
sales office provide immediate
product availability and other
information to staff answering
telephone inquiries.
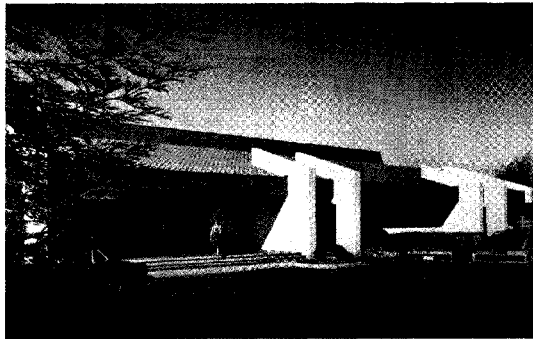
Cromemco's offices, laboratory and
manufacturing building

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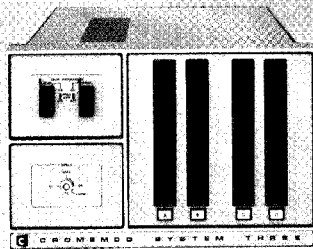
System Three
Two to four disks
Up to 512K of RAM/ROM
Up to 1 megabyte of disk

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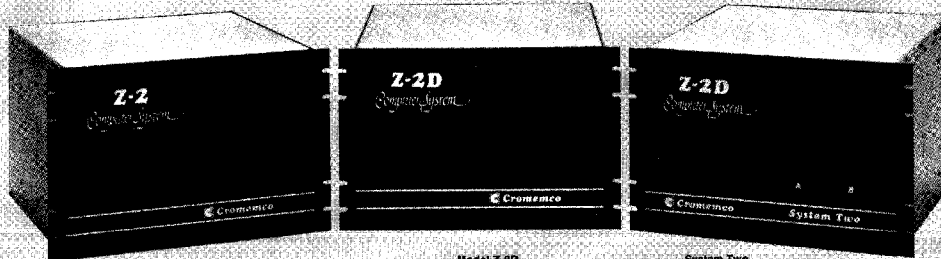
Model Z-2
Up to 512K of RAM/ROM

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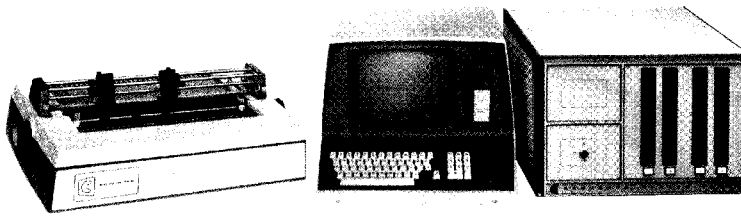
The power, speed, and expandability you need
for business, science, industry, education

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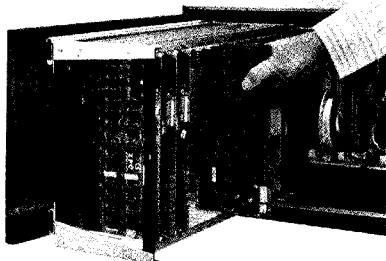
System Three computer is constructed so that hinged front panel swings open and motherboard/card cage slide out for easy insertion of circuit boards.

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.
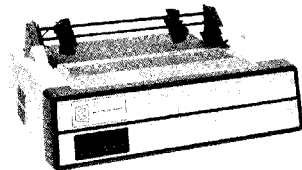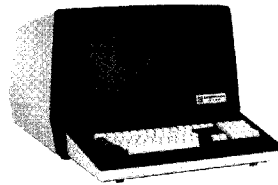
Fast line printer

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, providing gentle handling of these long-life disks.
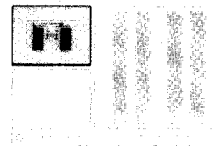
PROM programmer option for development work

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 available 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 automatically 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)

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 instructions 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: 12¼" 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)
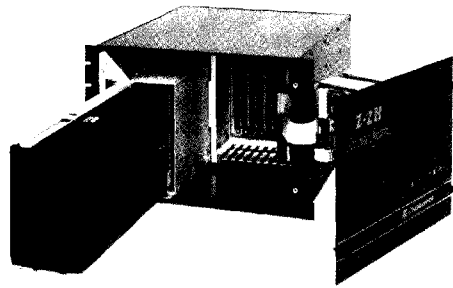
SOFTWARE SUPPORT

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 micro-inches. 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
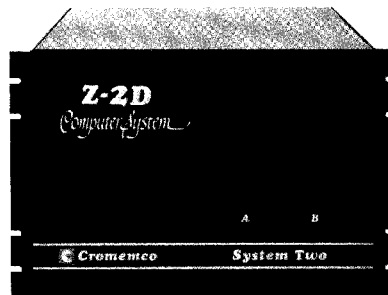
A COMPLETE TWO DISK DRIVE COMPUTER SYSTEM
AT A SUBSTANTIAL SAVINGS

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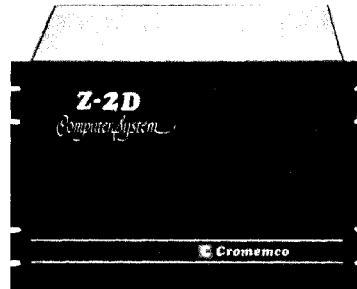
Model Z-2D Computer System is supplied for rack mounting. Optional bench and floor-model cabinets are available.

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

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.

- 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.

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 FDB-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 microprocessor 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 — thereby 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 combination 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 dedicated applications. Upward compatible with larger systems. Usable with a variety of cabinets. Bench cabinet optional.
- 110 or 220-volt operation.

CROMEMCO Z-80 CPU — −8V @ 30A — HEAVY DUTY POWER SUPPLY — +18V @ 15A / −18V @ 15A

S-100 COMPUTER BUS

20 Extra Card Sockets
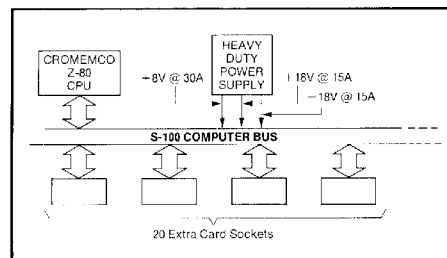
Z-2 Computer System (cont'd)
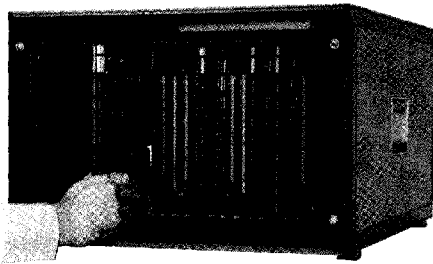
Full-width motherboard has slots for 21 cards.
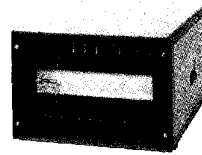
Rack/Cabinet Mounting

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 instructions including the 78 instructions of the 8080
System bus: industry standard S-100
Board capacity: 21 boards
Power supply: +8 volts @ 30A, +18 volts @ 15A, −18 volts @ 15A
Power: Operates from 110/220 volts; 50/60 cycles.
Operating environment: 0-55°C
Dimensions: 12¼" H x 19" W x 20¼" D (31.1 x 48.3 x 52.7 cm)
Weight: 39 lbs (18 kg)
Mounting: For rack mounting (optional bench cabinet available)
Price: Model Z-2W Computer System assembled: $995.

Data subject to change without notice
Prices fob factory
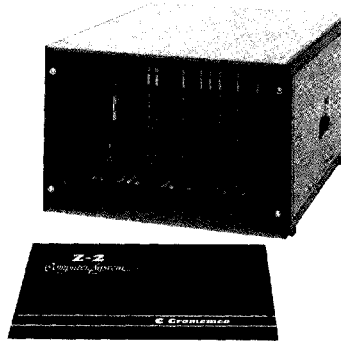
Z-2 is supplied for rack mounting.
Attractive bench cabinet shown is also available.

Z-2 Accessories

- **CABINET.** High quality all-aluminum cabinet 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 customized 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	6,465
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
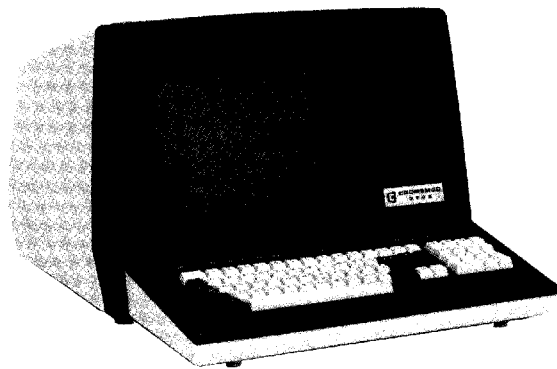
Model 3102

- 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 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.

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
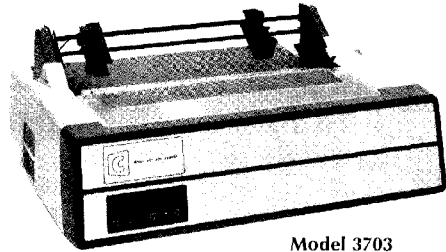
Model 3703
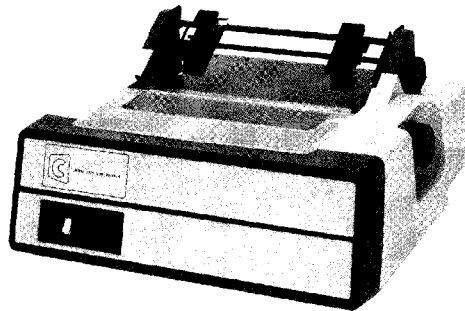
Model 3779
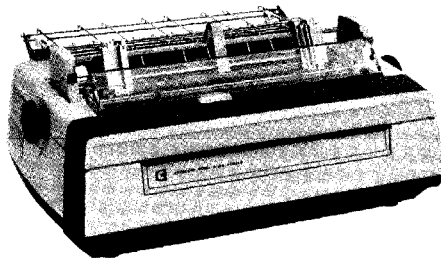
Model 3355A

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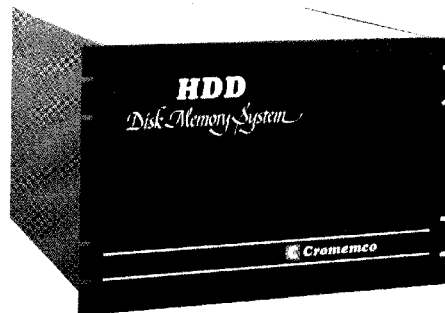
- One or two drives
  (11 or 22 megabytes of storage)
- Fast transfer rates

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% 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
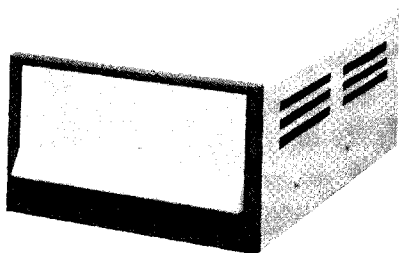
5″ SINGLE DISK DRIVE

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
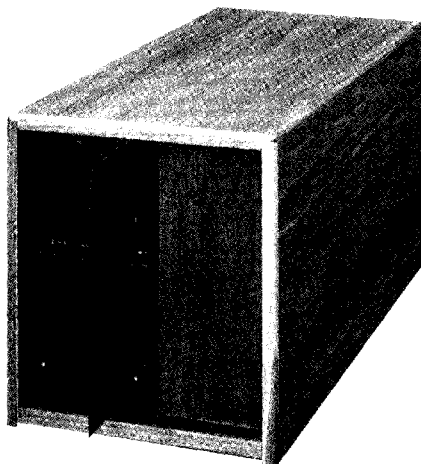
8″ DUAL DISK DRIVE

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 software 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
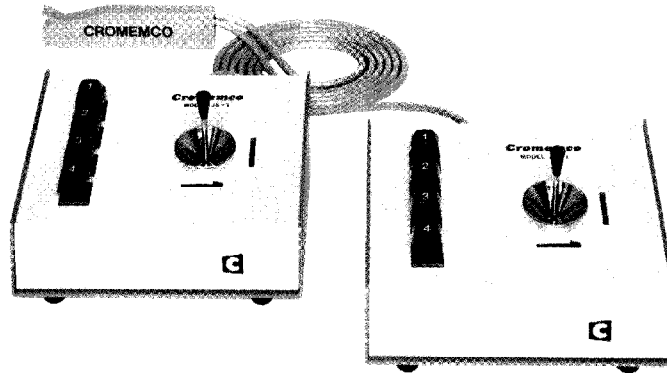
EASY TO INPUT IT
TO YOUR COMPUTER

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

```
┌─────────────┐
│ COMPUTER    │
│   WITH      │
│   S-100     │
│   BUS       │
└──────┬──────┘
       │
  Plugs│ CROMEMCO
  into │ D+7A I/O
computer
    ┌──────┴──────┐
┌───┴────┐   ┌────┴───┐
│CROMEMCO│   │CROMEMCO│
│JOYSTICK│   │JOYSTICK│
└────────┘   └────────┘
```
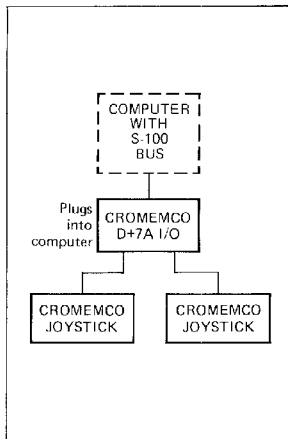
EASY TO COUPLE

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
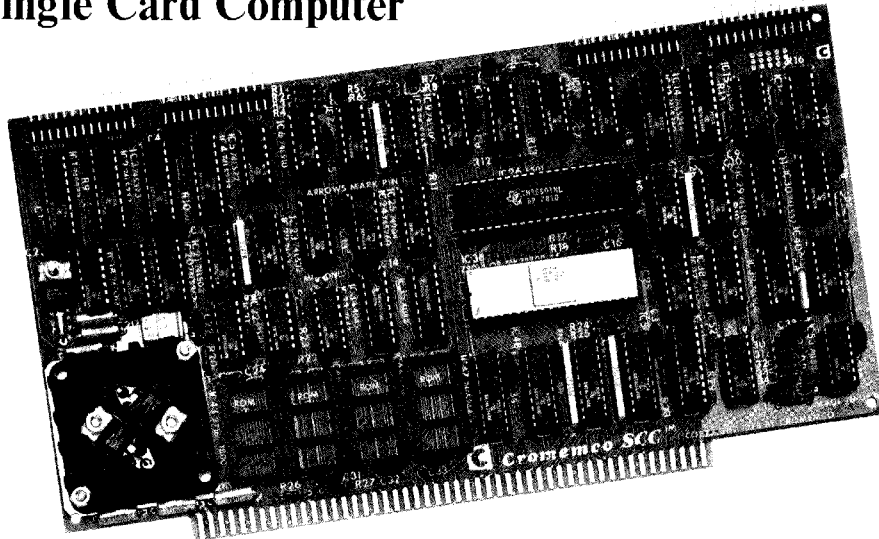

A COMPLETE 4 MHz COMPUTER

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

─── 2 or 4 MHz switch

─── Z80 CPU
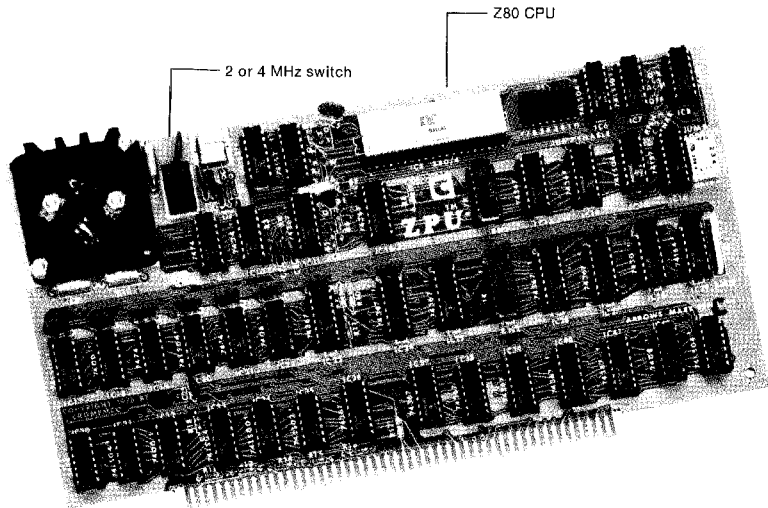
- Uses special Z-80 microprocessor
- Fast—4 MHz clock rate
- Does not require front panel for operation

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

Bank
Select

Address
Select
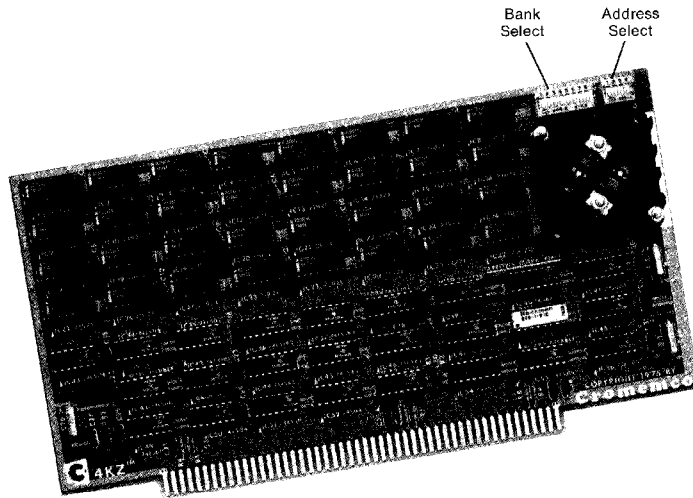
- 4 MHz speed
- Memory Bank Select feature

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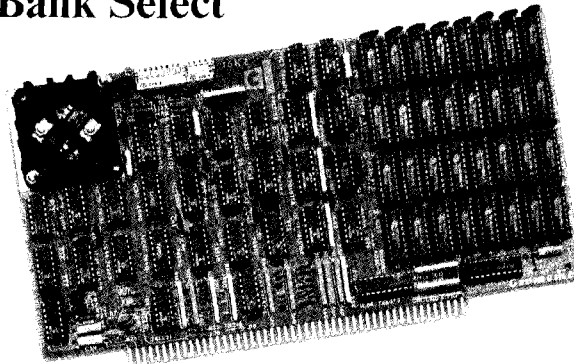
- The fastest available
- No wait states required at either 2 or 4 MHz operation
- Offers expandability to a half megabyte with Bank Select
- Can be used for time-sharing
- Dynamic refresh fully transparent

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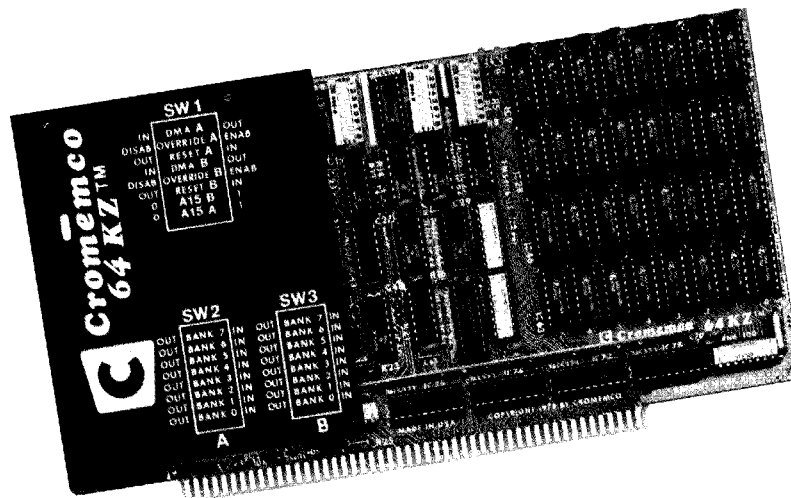
- Enormously expandable
- Guaranteed 4 MHz operation
  from 0-55°C
- Low power

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.
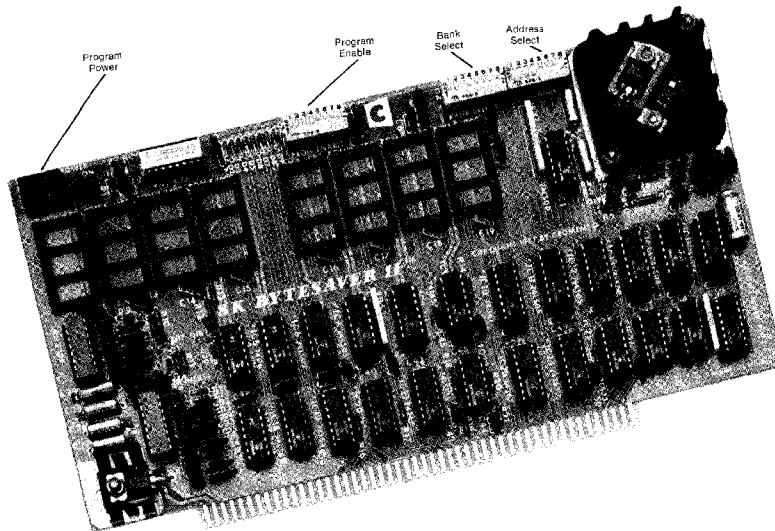**Power requirements:**   + 8 volts @ 1.5 A
                           + 18 volts @ 0.2 A
Operating environment: 0-55°C

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 programmable read only memory (PROMs)).

(2) A PROM board with the capacity 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 designed 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 contain 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), Control 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 nanoseconds.
Wait States at 2 MHz: none required.
Wait States at 4 MHz: one per machine cycle.
BUS: S-100.
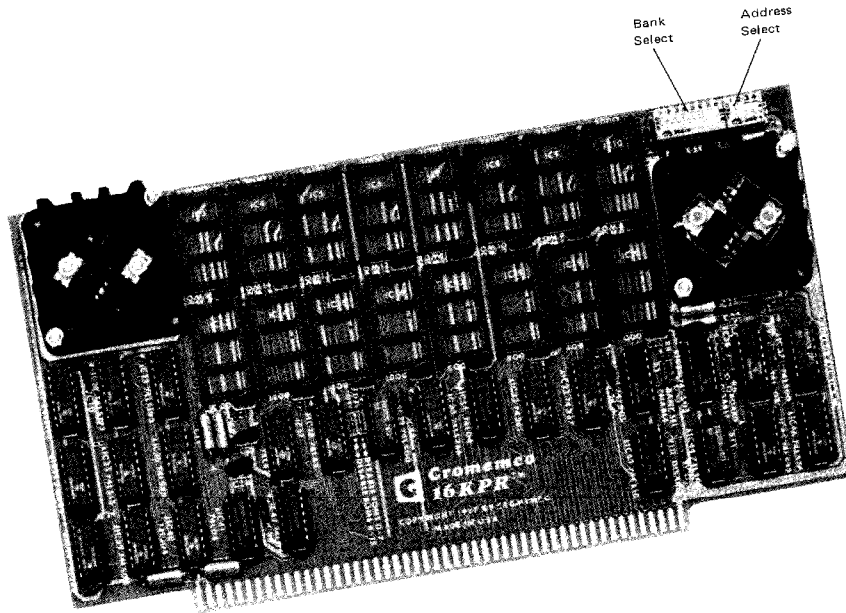**Power requirements:**
  + 8 volts @ 0.8 A
  + 18 volts @ 0.4 A
  − 18 volts @ 0.2 A
Operating environment:
  0-55°C

16K PROM card
with address anticipation
and Bank Select

Bank
Select

Address
Select

HOLDS UP TO 16 HIGH-SPEED, ERASABLE 2708 PROMs

Here's what you need when you want the capability for a sizable PROM memory.

The 16KPR holds up to 16 type 2708 or equivalent 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 information on p.25.

FAST

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

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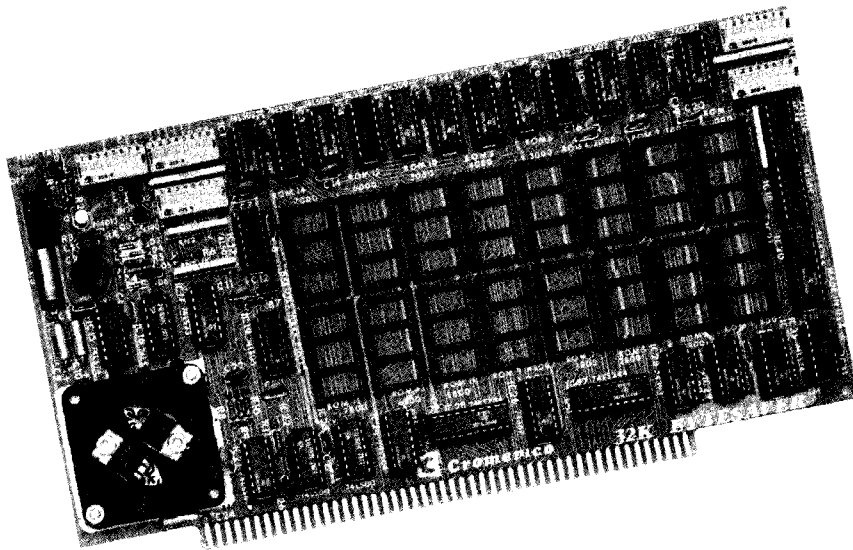
32K BYTESAVER®
PROGRAMS THE NEW, HIGH DENSITY
2716 PROM

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 storage 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) control 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.

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8 Port I/O
Multi-channel
microcomputer
parallel interface
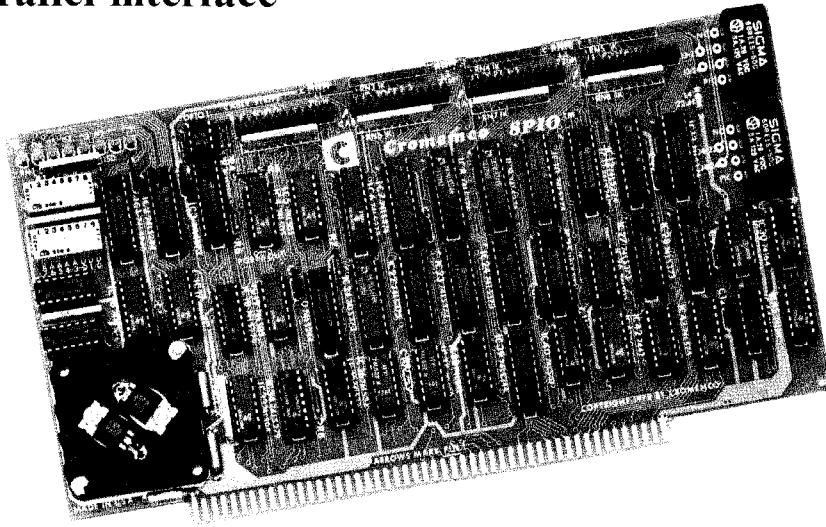
SIMPLIFIED PARALLEL INTERFACING

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

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

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

TECHNICAL SPECIFICATIONS
Model 4PIO Isolated Parallel Interface

Parallel I/O ports:
Number of bidirectional ports: 4
I/O port width: 8 bits wide
Number of opto-isolated input ports: 3
Number of opto-isolated output ports: 2
Number of relay-isolated output ports: 1

I/O strobe signals and reset:
Number of I/O strobe bits: 11
Strobe signal isolation: opto-isolated
Reset line: opto-isolated

Opto-isolated I/O:
Number of opto-isolators: 52
Opto-isolator type: MCT66
Signal levels: TTL

Relay outputs:
Number of relay outputs: 8
Contact type: SPDT
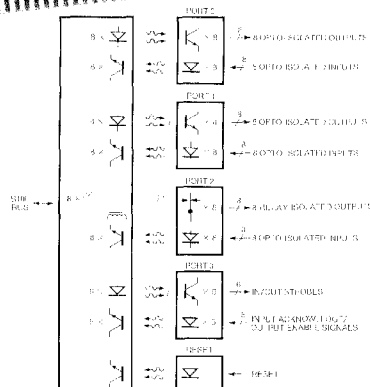Contact voltage: 28 V AC or DC
Contact current: 2 A

General Information:
BUS: S-100
Power requirements: +8 volts @ 2.5 A
Operating environment: 0-55°C

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.

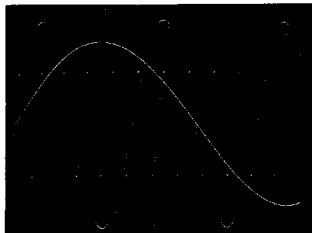In color any 16 colors from a palette of 4096 colors can be used in the picture. In black-and-white any 16 shades of gray can be used.

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.
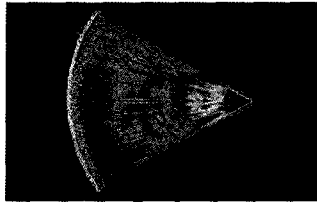
Display of cross section of human heart imaged by a 2.25 MHz ultrasonic sector scan through body's intra-costal space. The image is displayed using the new SDI interface on an RGB Monitor. This medical application involving the new interface was done at Stanford University.

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.
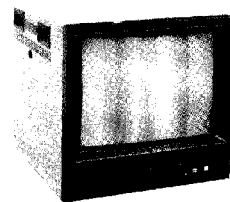
TV COMPATIBILITY

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 55% 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 application 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 corresponds to and is compatible with NTSC TV systems practice in that 484 lines are normally displayed in a nominal 523-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 conventional TV displays which have relatively limited bandwidth.

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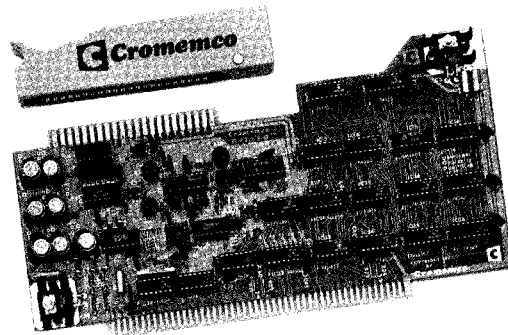
Now you have a way to get analog information into and out of your microcomputer. It's an easy, fast, and unbelievably inexpensive way.

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 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 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 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" instructions initiate A/D conversion and read in or out the ensuing 8 bits of data. No further software is re-quired. 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 microamps 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 microseconds.
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 microseconds
  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
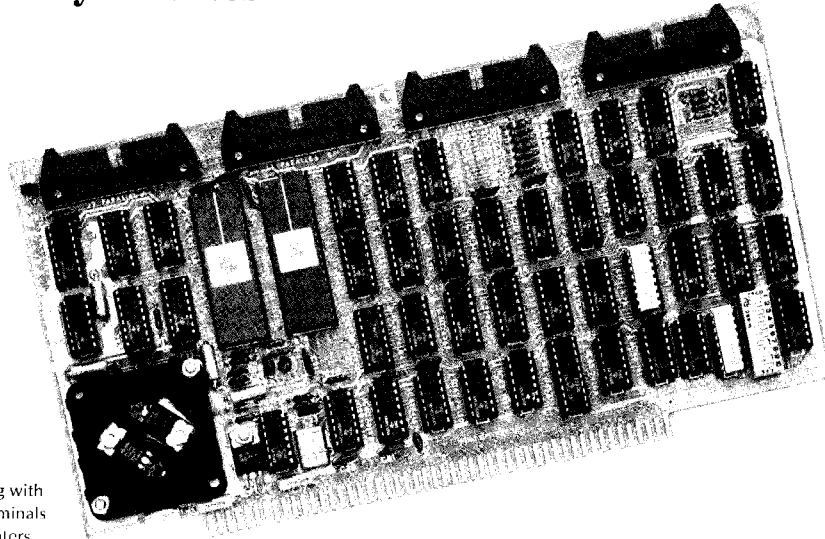
For interfacing with
- CRT terminals
- line printers
- modems
- other devices

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 support 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 TTL loads.

Interval timers:
Number of timers: 10.
Timer range: 0-16.32 msec (software selectable).
Timer resolution: 64 microseconds.

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
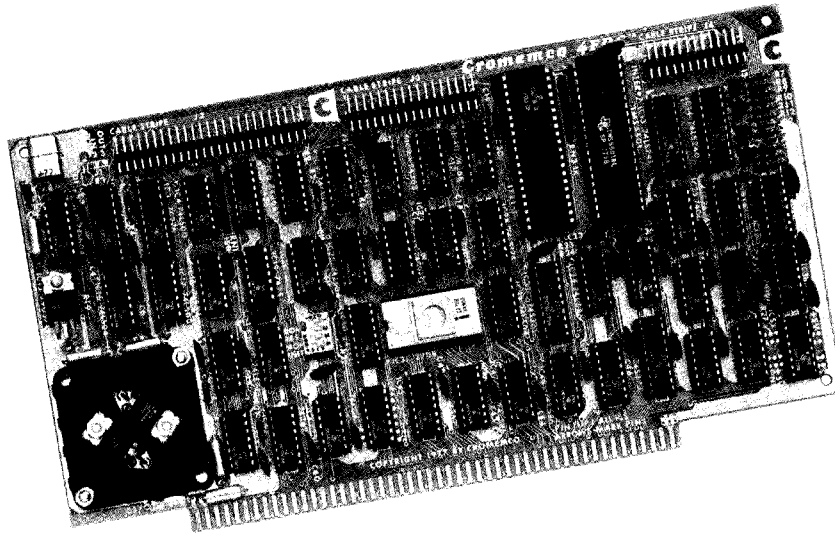Prioritization for multiple TU-ARTs: daisy-chaining

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)
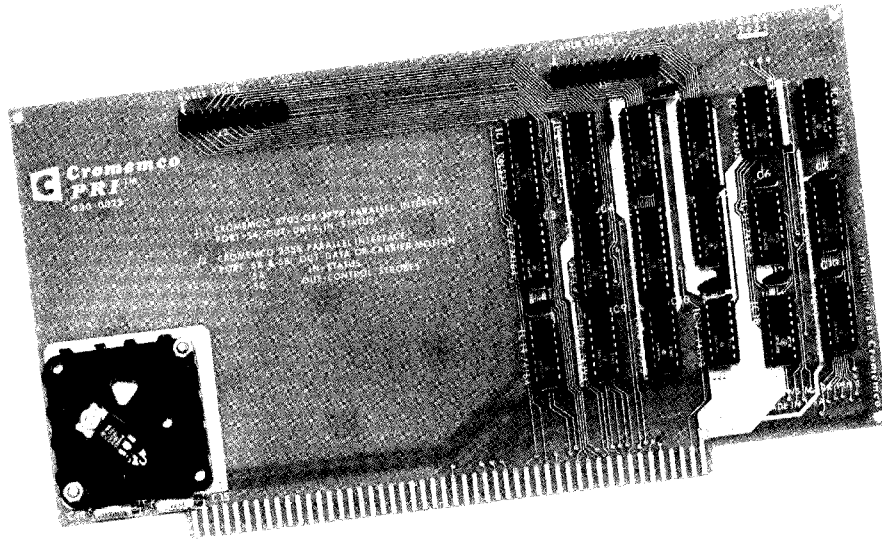 Power requirements: + 8 volts @ 1.0 A
                        +18 volts @ 100 mA
                        −18 volts @ 100 mA
  Operating environment: 0-55°C

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.

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
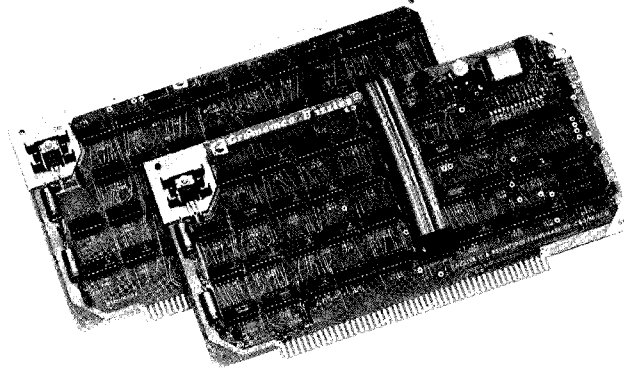
ALPHANUMERICS PLUS ACTION, AND GRAPHICS

The Dazzler* maps your computer memory 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.

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 MARTINI, 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
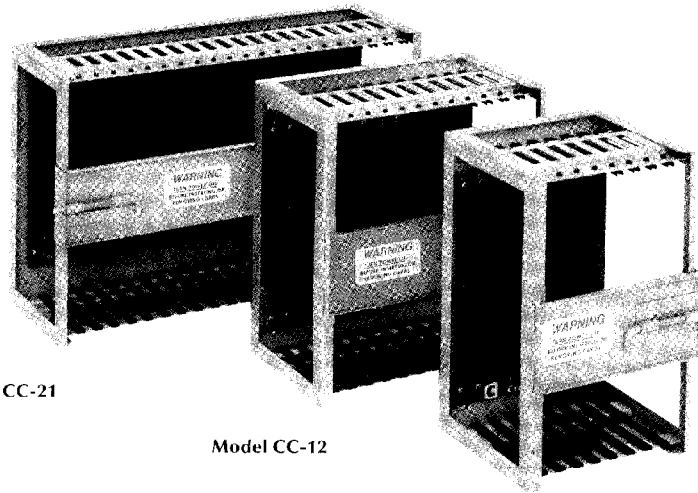
Model CC-21

Model CC-12

Model CC-8

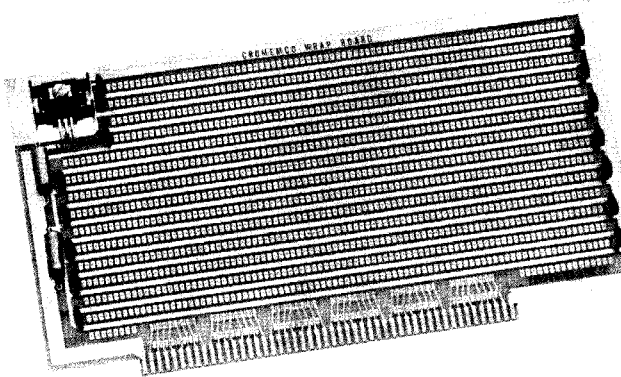## 8-, 12-, OR 21-SLOT VERSIONS

Ideal for your OEM or Home-brew system require-
ments, 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 con-
struction and include a rugged retaining bar to in-
sure that cards cannot be shaken from their sockets.

The back planes include a full set of edge con-
nectors 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)			Number of Slots	Price
	H	W	L		
CC-8	6⅝	10⅞	7	8	$ 195
CC-12	6⅝	10⅞	10½	12	$ 245
CC-21	6⅝	10⅞	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
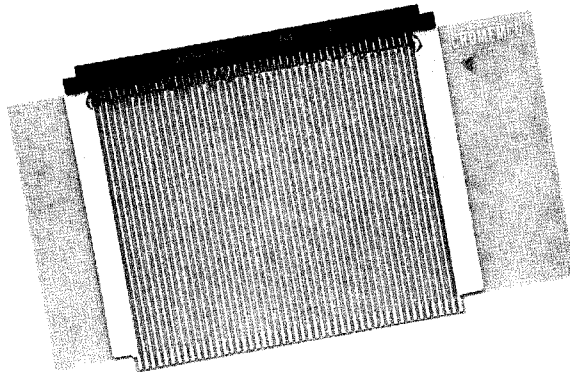
Extender Card

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
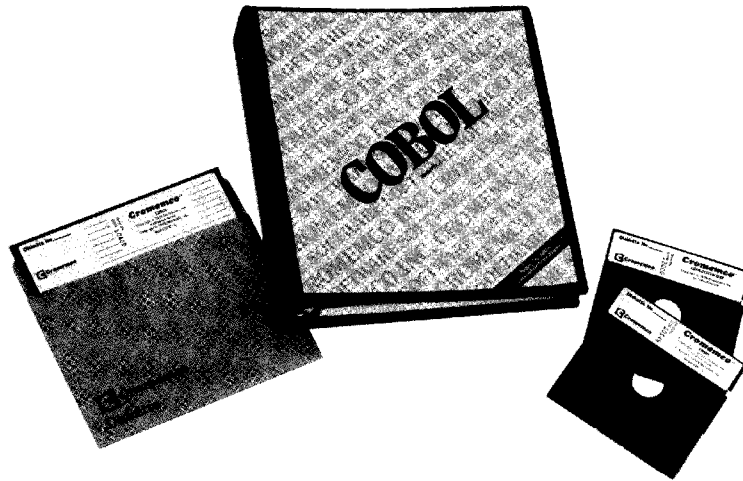
COBOL

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 Nucleus, 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 libraries. 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, Cromemco 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
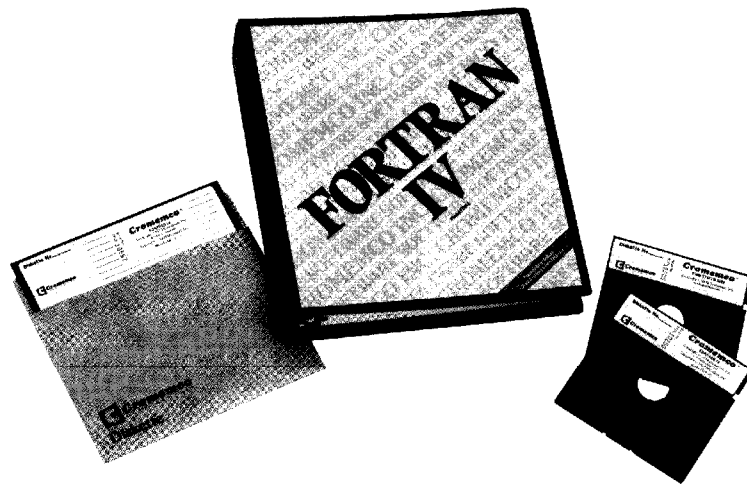
CROMEMCO FORTRAN IV

Cromemco FORTRAN IV provides new capabilities for users of Z-80 based microcomputer systems. 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 sequential and random disk file access. Files may be named at run time by use of the CALL OPEN statement. The ENCODE and DECODE statements provide the user with formatted data transfer within memory.

Variables may be declared as DOUBLE PRECISION 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 relocatable code, FORTRAN modules may be linked with the code produced by the Cromemco Relocatable 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 FORTRAN program are loaded before execution.

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.
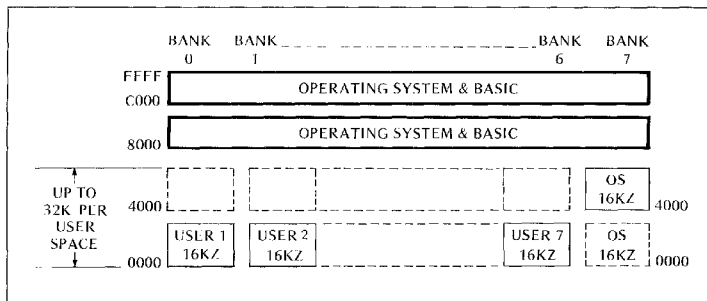
Also included on the assembler disk is DEBUG, a support program which allows machine language programs to be traced, disassembled, patched, or programmed into PROM. DEBUG also allows the user to establish break points, display and alter the Z-80 registers, and initiate normal or step-by-step program 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 on 8" diskette with
documentation (Model FDM-L) $800

MULTI-USER BASIC: hardware/software
package with 5" disk (Model MUB-S) $2895

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

— 48 —

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, i.e., wide or narrow justified columns placed at any point 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 applications.

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