

# Low-cost 1-board computer includes printer, display and keyboard

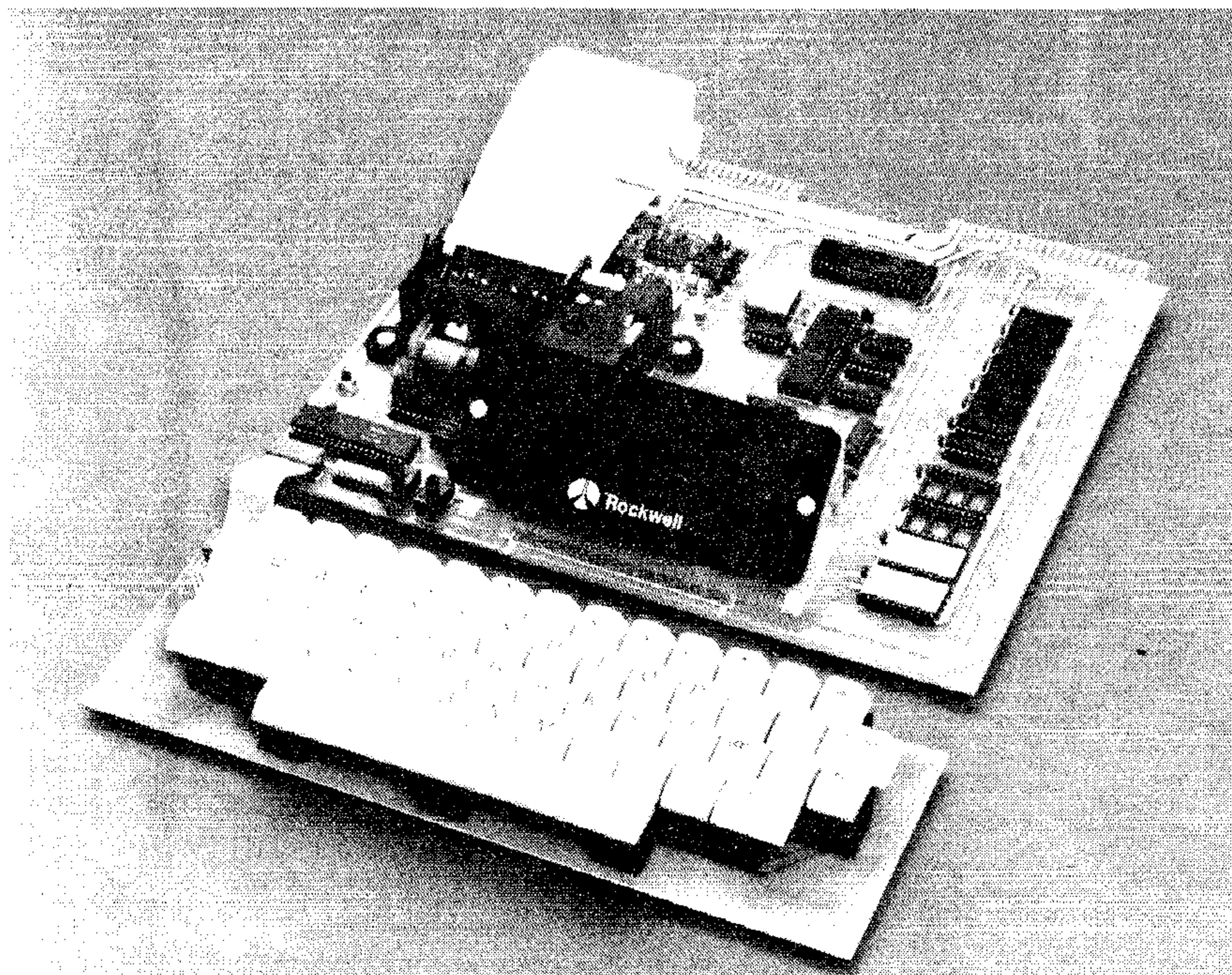
Developing software for microprocessor systems based on the 6500 series of 8-bit devices will cost a lot less with the AIM 65 development system from Rockwell International's Electronic Devices Division (Anaheim, CA). The price tag is just \$375—one-tenth the cost of current systems with similar features. What's more, it covers a keyboard, hard-copy output, and a one-line display, which enable the AIM 65 to serve as a low-cost training aid or even as a hobby computer.

Meanwhile, Rockwell, an alternate source for the 6500 microprocessor from MOS Technology (Norristown, PA), has been busy introducing a single-board system development tool, the XPO-1, for its PPS-4/1 one-chip microcomputer. And later this year, Rockwell will bring out a motherboard to connect the AIM, which is compatible with MOS Technology's 6502-based KIM-1 board, to both Rockwell's System-65 and Motorola's Exorcisor development system accessory boards.

To function as a development system, AIM requires an optional assembler that is housed in a 4-k ROM and goes for about \$100, and three power supplies: 5 V at 3 A, 12 V at 100 mA, and 24 V at 2 A. But once it's hooked up, the AIM can provide hard-copy records from its own 20-column thermal printer, which operates at up to 90 lines per minute and generates 64 ASCII alphanumeric characters in a 5 × 7 dot-matrix format. In addition, its one-line display handles 20 characters, and can generate the same 64 characters in a 16-segment format.

The AIM's keyboard has 54 keys to provide 26 letters, 10 numbers, 22 special characters, eight control functions, and three user-defined functions. To make use of the last three keys, the AIM debug/monitor has three Go To User Function commands.

The central processor, a 6502, operates at 1 MHz and can address up to 65 kbytes of random-access memory in



Alphanumeric printer, display and terminal-style keyboard are all housed with a 6502 central processor in Rockwell's AIM 65 single-board computer.

13 addressing modes. The AIM comes in versions that offer 1 kbyte or 4 kbytes of 2114 static RAM, for \$375 and \$450. Sockets on both versions provide for more RAM.

Program memory is stored in 4 kbytes of 2332 static ROM. But with sockets able to accept additional 2332 ROMs or 2716 EPROMs, on-board program memory, including the assembler and an 8-kbyte Basic interpreter option (about \$100), can be expanded to 16 kbytes.

For expansion, the AIM card's edge has two 44-pin connectors: an application connector for peripheral add-ons, and an expansion connector that includes the system bus. And since the AIM 65's interface is compatible with MOS Technology's KIM-1, it can use motherboards, memory-expansion cards and other accessories designed for the KIM-1.

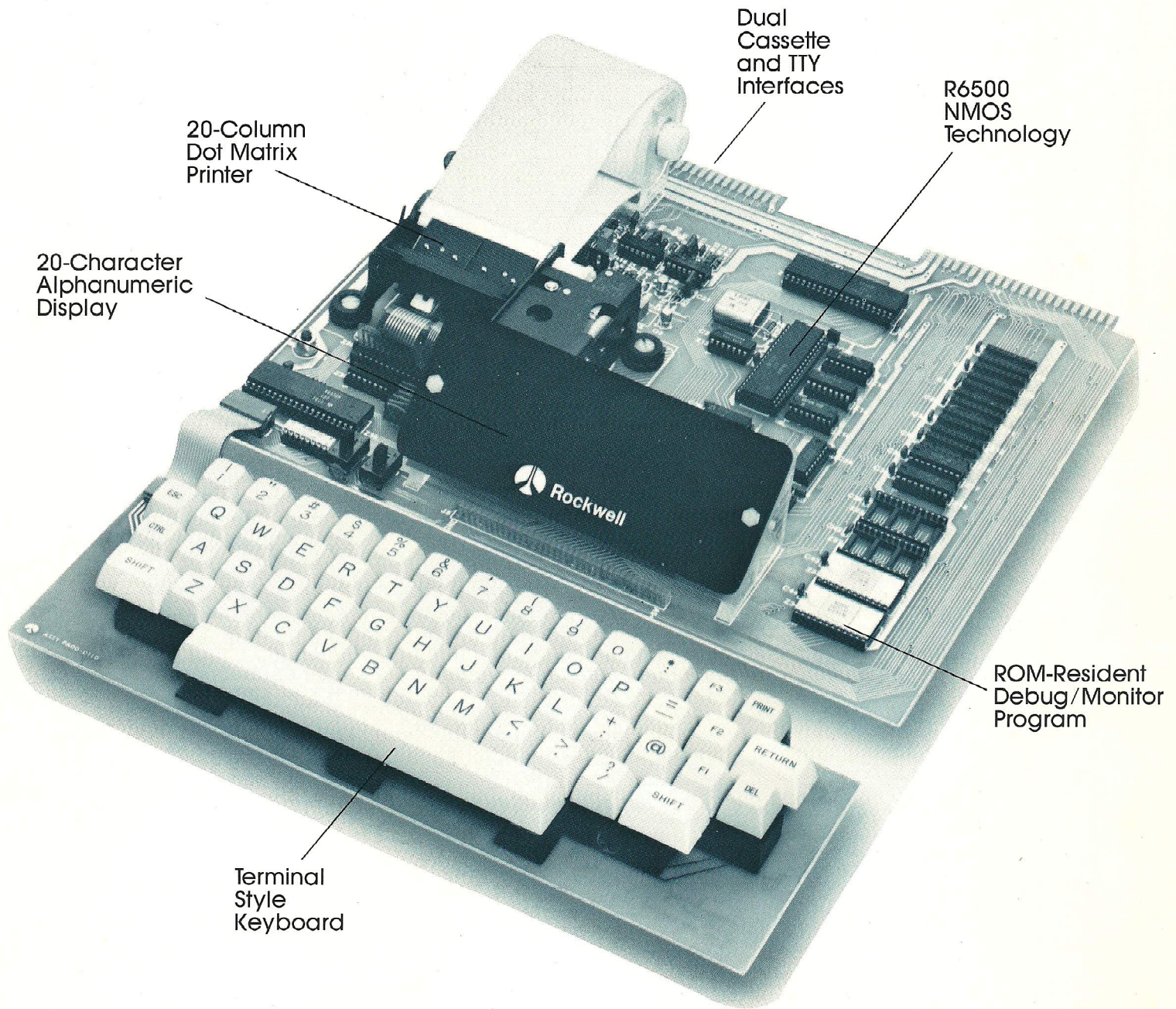
The XPO-1 single-board system de-

velopment tool also shares some features with the KIM-1. For \$495, the XPO-1 has a 20-key keypad and five 7-segment displays, like the KIM-1. But it also includes utility, debug and monitor programs that, with the appropriate development circuit, help with developing software for the PPS-4/1 one-chip microcomputer, and with real-time software testing. The development board can also produce a ROM-mask tape of the final software.

Another Rockwell motherboard, expected by October, will be like the one in its System 65 development system, and will accept the AIM interface as well as System 65 boards. The System 65 motherboard is already compatible with the bus structure of the Exorcisor development system from Motorola Semiconductor Products Inc. (Phoenix, AZ). One advantage is that many accessories, including analog I/O cards, are available for the Exorcisor. ■



For learning, designing, work or just plain fun...



# Rockwell AIM 65

## The Head-Start in Computers



Rockwell International



# On-Board Hardware, Microprocessor Architecture and Software Features Assure Your Computer Headstart.

## ROCKWELL'S AIM 65...

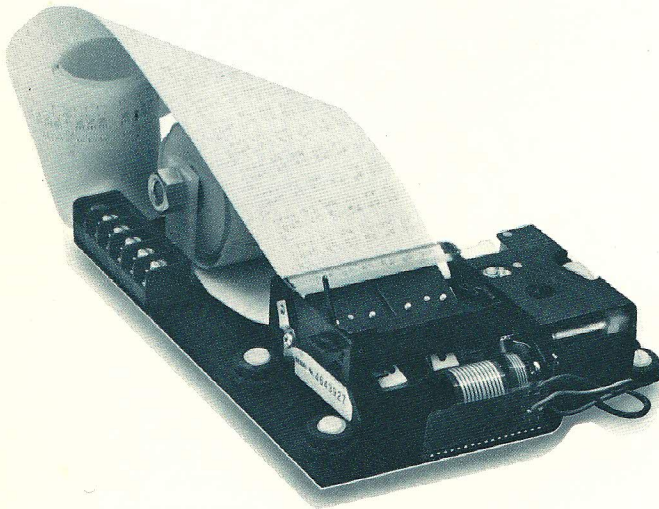
Rockwell's AIM 65 Advanced Interface Module can get you into the exciting world of microcomputers a lot easier and at a lot lower cost than you may have thought possible. And you'll be working with the 6500 family, the advanced state-of-the-art NMOS system that's an ever-increasing favorite for new commercial and hobbyist applications.

As a learning aid, AIM 65 gives you an assembled, versatile microcomputer system with a full-size keyboard, 20-character display and, uniquely, a thermal printer. An on-board Debug/Monitor program provides extensive control and program development functions. And our AIM 65 User's Manual will help you along each step of the way.

When you've mastered the fundamentals, you'll appreciate the fact that unlike the computer "toys" on the market, AIM 65 offers flexibility and expandability you would expect to find in a sophisticated microcomputer development system.

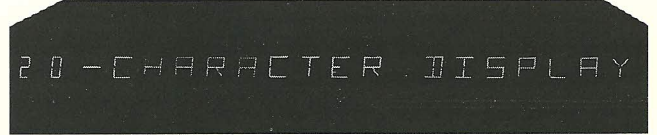
## THERMAL PRINTER GIVES YOU HARD COPY - FAST AND QUIET.

AIM 65's 20-column Thermal Printer prints on low-cost, heat sensitive roll paper at a fast 90 lines per minute. It produces all the standard 64 ASCII characters with a crisp-printing five-by-seven dot matrix. AIM 65's on-board printer is a unique feature for a low-cost computer.



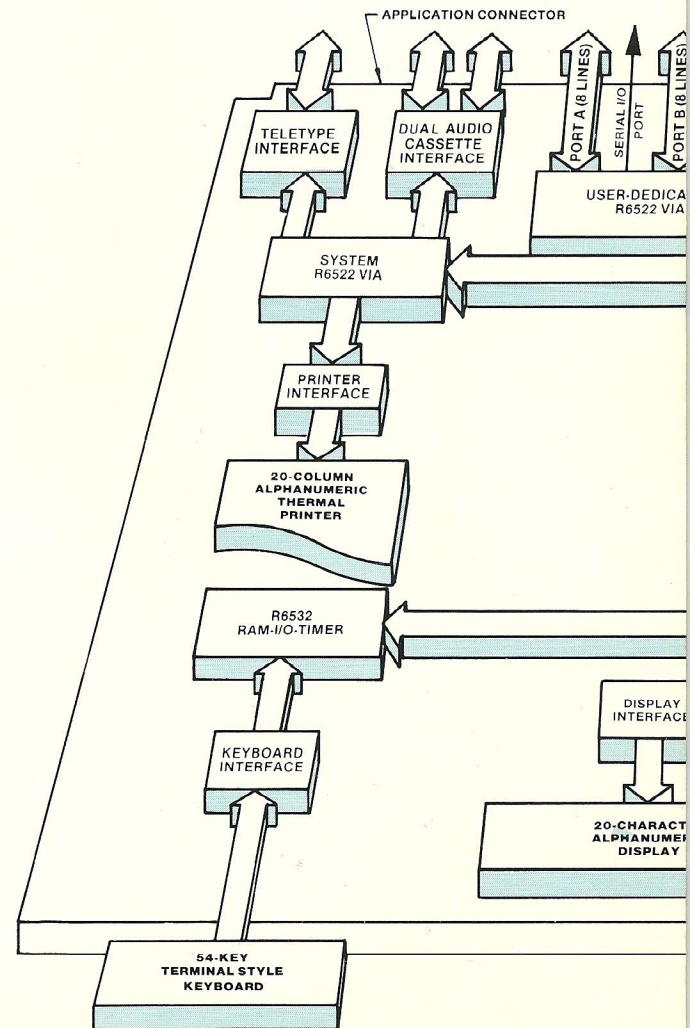
## EXTENDED ALPHANUMERIC DISPLAY IS BUILT FOR READING, NOT DECIPHERING.

AIM 65 comes with a 20-character true Alphanumeric Display. Information is displayed with bright, magnified 16-segment font monolithic characters. It's both unambiguous and easily readable.



## FULL-SIZE KEYBOARD IS DESIGNED FOR HUMANS, NOT ELVES.

AIM 65's terminal-style ASCII keyboard frees you from the hassles of fumbling around with a tiny calculator-type keypad. And its 54 keys provide 69 different alphabetic, numeric and special functions.





## ON-BOARD DEBUG/MONITOR PROGRAM GETS YOUR PROGRAMS UP AND RUNNING

The ROM-resident AIM 65 Debug/Monitor Program provides a comprehensive set of easy-to-use, single-keystroke commands for debugging your programs, and offers features normally available only in larger, expensive microcomputer development systems. And with the Debug/Monitor, there's no guesswork involved: the Debug/Monitor gives a self-explanatory prompt when it needs information and it will generate a meaningful error message if an error has occurred.

The Debug/Monitor Program includes commands to

- Display/alter registers
- Display/alter memory
- Set breakpoints, to trace program execution
- Control the Thermal Printer
- Transfer information to/from an attached TTY or cassette
- Execute programs in on-board or external RAM, ROM or EPROM memory

## AIM 65'S ADVANCED R6500 NMOS ARCHITECTURE

The R6502 Central Processing Unit is the heart of AIM 65. It provides demonstrated speed and simplicity, plus 65K addressability and the power of a 52-command, minicomputer-like instruction set.

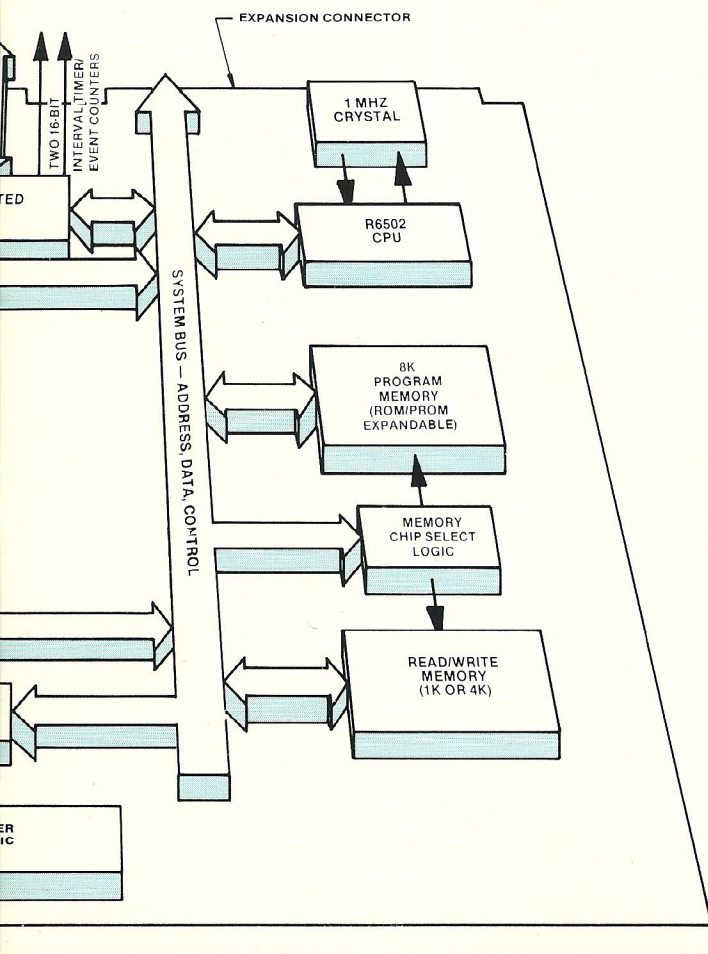
The R6532 RAM-Input/Output-Timer (RIOT) combination device is used by the Debug/Monitor for scratchpad memory and Keyboard operations.

Two R6522 Versatile Interface Adapter (VIA) devices are installed. One device supports AIM 65's Thermal Printer and the TTY and cassette interfaces, the other supports two user-dedicated 8-line data ports on the module's Application Connector.

AIM 65 comes with one R2332 4K-byte Read Only Memory (ROM) device installed, which holds the Debug/Monitor Program. Spare sockets allow the user to expand on-board ROM up to 16K bytes. These sockets will accept user programs on 2332 ROMs or 2716 EPROMs, or can be used to install the optional AIM 65 Assembler, Text Editor and BASIC Interpreter ROM devices.

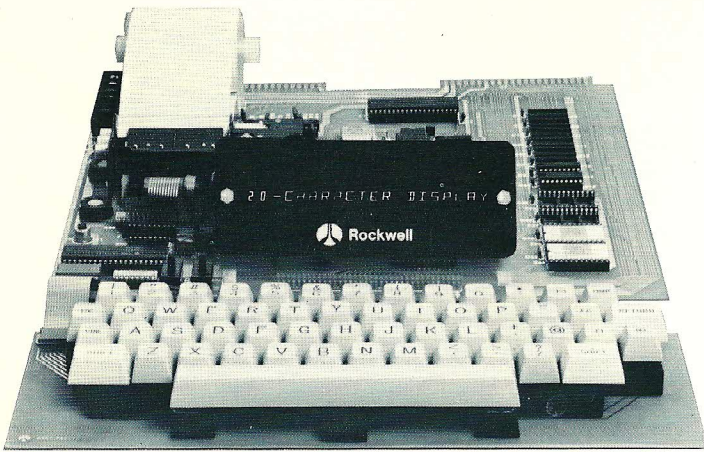
On-board Read/Write memory is totally user-dedicated, and is available in 1K-byte and 4K-byte configurations.

And to allow AIM 65 to grow the way you want it to, we've provided an Application Connector and an Expansion Connector. The Application Connector permits you to plug on an ASR-33 TTY, or equivalent, and one or two standard audio cassette recorders, and also has the pinouts for the VIA's two 8-line, bidirectional data ports. The Expansion Connector extends AIM 65's system bus — address, data and control — out to additional memory, or anything else you might attach. Both connectors are fully compatible with the earlier KIM-1 microcomputer.





# AIM 65 Technical Overview



AIM 65 is fully assembled, tested and warranted. With the addition of a low cost, readily available power supply, it's ready to start working for you.

AIM 65 features on-board thermal printer and alphanumeric display, and a terminal-size ASCII keyboard. It has an addressing capability up to 65K bytes, and comes with a user-dedicated 1K or 4K RAM (order AIM 65 or AIM 65-2, respectively). An installed 4K ROM holds a powerful Debug/Monitor program, and spare sockets are included to expand on-board ROM up to 16K bytes.

An Application Connector provides for attaching a TTY and one or two audio cassette recorders, and gives external access to two 8-bit bidirectional data ports. A separate Expansion Connector brings the full system bus — data, address and control — out to the connector pins.

Also included as standard are a comprehensive AIM 65 User's Manual, a handy pocket reference card, an R6500 Hardware Manual, an R6500 Programming Manual and an AIM 65 schematic.

AIM 65 is packaged on two compact modules. The circuit module is 12 inches wide and 10 inches long, the keyboard module is 12 inches wide and 4 inches long. They are connected by a detachable 4-inch cable.

## THERMAL PRINTER

Most desired feature on low-cost microcomputer systems...

- Wide 20-column printout
- Versatile 5 x 7 dot matrix format
- Complete 64-character ASCII alphanumeric format
- Fast 90 lines per minute
- Quiet thermal operation

## FULL-SIZE ALPHANUMERIC KEYBOARD

Provides compatibility with system terminals...

- Standard 54 key, terminal-style layout
- 26 alphabetic characters
- 10 numeric characters
- 22 special characters
- 8 control functions
- 3 user-defined functions

## TRUE ALPHANUMERIC DISPLAY

Provides legible and lengthy display...

- 20 characters wide
- 16-segment characters
- High contrast monolithic characters
- Complete 64-character ASCII alphanumeric format
- Built-in memory, decoder and driver circuitry

## PROVEN R6500 MICROCOMPUTER SYSTEM DEVICES

Reliable, high performance NMOS technology...

- R6502 Central Processing Unit (CPU), operating at 1 MHz.
- Has 65K address capability, 13 addressing modes and true index capability. Simple, but powerful 56 instructions.
- Random Access Memory (RAM)
- Read/Write Memory, using R2114 Static RAM devices. Available in 1K byte and 4K byte versions.
- 4K Program Memory, using R2332 Static ROM devices. Has sockets to accept additional 2332 ROM or 2716 EPROM devices, to expand on-board Program Memory up to 16K bytes.
- R6532 RAM-Input/Output-Timer (RIOT) combination devices. Multipurpose circuit for AIM 65 functions.
- Two R6522 Versatile Interface Adapter (VIA) devices. Supports AIM 65 and user functions. Each VIA has two 8-bit, bidirectional TTL ports, two 2-bit peripheral handshake control ports and two fully-programmable interval timer/counters.

## BUILT-IN EXPANSION CAPABILITY

- 44-Pin Application Connector for peripheral add-ons
- 44-Pin Expansion Connector has full system bus
- Both connectors are totally KIM-1 compatible

## TTY AND AUDIO CASSETTE INTERFACES

Standard interface to low-cost peripherals...

- 20 ma. current loop TTY interface
- Interface for two audio cassette recorders
- Two audio cassette formats: ASCII KIM-1 compatible and binary, blocked file assembler compatible

## ROM-RESIDENT DEBUG/MONITOR

Advanced features found only on larger systems...

- Monitor-generated prompts
- Single keystroke commands
- Address independent data entry
- Debug aids
- Error messages
- Option and user interface linkage

## DEBUG/MONITOR COMMANDS

### Invoke Assembler/Text Editor

- E — Enter Text Editor
- T — Re-enter Text Editor, to edit current source
- N — Invoke Assembler

### Display/Alter Registers

R — Display all registers (Program Counter, Accumulator, X, Y, Status and Stack Pointer)

\* — Alter Program Counter to (address)

A — Alter Accumulator to (byte)

X — Alter X Register to (byte)

Y — Alter Y Register to (byte)

P — Alter Processor Status to (byte)

S — Alter Stack Pointer to (byte)

### Display/Alter Memory

M — Display four memory locations, starting at (address)

(Space) — Display next four memory locations

/ — Alter current memory location

### Manipulate Breakpoints

C — Clear all breakpoints

K — Enable breakpoints

B — Set one to four breakpoint addresses

? — Display breakpoint addresses

### Control Instruction/Trace

G — Execute user's program, at current Program Counter address

Z — Toggle instruction trace mode on/off

V — Toggle register trace on/off

H — Trace Program Counter history

### Control Peripheral Devices

L — Load object code into memory from TTY or Cassette

D — Dump object code to Printer, TTY or Cassette

(Print) — Toggle Printer on/off

(Return) — Advance Printer

### Interface to User Functions

F1 — Go to User Function 1

F2 — Go to User Function 2

F3 — Go to User Function 3

## POWER SUPPLY SPECIFICATIONS

Low cost, readily available...

- Requires three voltages
  - +5 VDC @ 3.0 amps (max)
  - +12 VDC @ 100 milliamps (max)
  - +24 VDC @ 2.0 amps (max)
- All voltage levels  $\pm 10\%$

## LOW-COST OPTIONS

Just plug into on-board spare ROM sockets...

- 4K Assembler/Text Editor
- 8K BASIC Interpreter

## TEXT EDITOR COMMANDS

R — Read lines into text buffer from Keyboard, TTY or Cassette

K — Delete current line of text

L — List (count) lines of text on Printer, TTY or Cassette

U — Move up one line

D — Move down one line

T — Go to top line of text

B — Go to bottom line of text

F — Find (string), starting with current line

For more information: Marketing Services, D/727

RC55, Rockwell International, Microelectronic Devices

P.O. Box 3669, Anaheim, CA 92803 Phone (714) 632-3729



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