



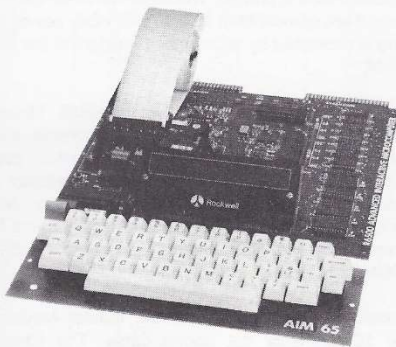
## A65-100 AND A65-400 AIM 65 MICROCOMPUTER

### PRODUCT OVERVIEW

The AIM 65 microcomputer is a complete, assembled microcomputer system featuring a 20-column thermal printer, a 20-character alphanumeric display, and a full-size terminal style keyboard. On-board memory sockets accept up to 20K bytes of PROM/ROM and 4K bytes of static RAM. A user R6522 Versatile Interface Adapter (VIA) dedicates 16 parallel I/O data lines and four handshaking control lines to application usage. The address, data, and control lines are also accessible for off-board memory, peripheral and I/O expansion. An 8K-byte ROM-resident debug monitor and text editor provides immediate interactive operation upon power turn-on.

With its self-contained printer and display, the AIM 65 microcomputer is ideal for educational and industrial desk-top applications. The on-board printer, unique to single-board microcomputers in its class, make the AIM 65 microcomputer a natural for any control and monitor application requiring hard copy output—such as equipment performance monitoring, data logging, test and evaluation, specialized data acquisition and reduction, laboratory measurements and analysis, and untold others.

The interactive monitor simplifies computer program checkout with single step functions which trace instruction execution and register contents as well as stop execution at specified breakpoint addresses. Memory and registers can be examined and altered to set up controlled execution conditions and to allow detailed analysis of program performance. The text editor allows computer program assembly and high level language instructions and data to be easily entered and edited at the source code level.



A65-400 AIM 65 Microcomputer

### FEATURES

- Single Board Computer with on-board RAM, ROM, and I/O
  - Powerful and Popular 6502 CPU
  - Up to 4K bytes of 2114 Static RAM
  - Up to 20K bytes of 2532 PROM or R2332 ROM
  - User-Dedicated Application Parallel I/O Interface
  - Low-Cost Audio Cassette Recorder Interface with 2 Recorder Remote Control Lines
  - 20 mA Current Loop Serial Interface
  - Expansion Bus Interface
- 20-Column Thermal Printer
  - 64 Character ASCII Format
  - 120 Lines per Minute
  - 5 × 7 Dot Matrix Character Font
- 20-Character Display
  - 64-Character ASCII Format
  - 16-Segment Font
  - High Contrast Monolithic Characters
- Full-Size 54-key Terminal Style Keyboard
  - 26 Alphabetic, 10 Numeric, and 22 Special Characters
  - 9 Control Functions and 3 User-Defined Functions
- ROM-Resident Interactive Debug Monitor
  - Monitor-Generated Prompts and Single Keystroke Commands
  - Single-Step Execution with Tracing and Breakpoints
  - Memory and Register Examine and Alter
  - Mnemonic Instruction Entry and Disassembly
- Text Editor
  - Line Oriented Commands (Read, Insert, Delete, List)
  - Character String Find and Change
- Parallel Application Interface
  - R6522 Versatile Interface Adapter (VIA)
  - Two 8-bit Parallel Bidirectional Data Ports
  - Two 2-bit Handshake Control Ports
  - Two Programmable 16-bit Counter/Timers
  - 8-bit Serial Interface
- Optional ROM-Based Languages
  - 4K Symbolic Assembler
  - 8K BASIC Interpreter
  - 8K PL/65 Compiler
  - 8K FORTH Compiler/Interpreter
  - 20K Pascal Compiler/Interpreter (16K Bytes Off-Board)

## ORDERING INFORMATION

Part No.	Description
A65-100	AIM 65 with 1K RAM
A65-400	AIM 65 with 4K RAM
A65-415	AIM 65 with 4K RAM & BASIC Interpreter ROMs
A65-420	AIM 65 with 4K RAM, BASIC Interpreter ROMs & Assembler ROM
A65-450	AIM 65 with 4K RAM & FORTH ROMs
Order No.	Description
209	AIM 65 Microcomputer User's Guide <sup>(1)</sup>
209L	AIM 65 Monitor Listing <sup>(1)</sup>
217	AIM 65 Reference Card <sup>(1)</sup>
219	AIM 65 Schematic (Wall Chart) <sup>(1)</sup>
201	R6500 Hardware Manual <sup>(1)</sup>
202	R6500 Programming Manual <sup>(1)</sup>
200	R6500 Programming Reference Card <sup>(1)</sup>
221	AIM 65 BASIC Language Reference Manual <sup>(2)</sup>
233	AIM 65 BASIC Reference Card <sup>(2)</sup>
265	AIM 65 FORTH User's Manual <sup>(2)</sup>
283	AIM 65 FORTH Reference Card <sup>(3)</sup>
Notes:	
1. Included with all models.	
2. Included with A65-0415 and A65-0420.	
3. Included with A65-0450.	

## FUNCTIONAL DESCRIPTION

The AIM 65 microcomputer consists of a Master Module (which includes the central processing and control circuitry, decoders, memory, I/O and printer control circuitry), an attached Display Module and a separate Keyboard Module. A thermal printer is mounted directly on the Master Module while the Display Module is mounted on angle brackets which are fastened to the Master Module.

## Central Processing and Control

The R6502 8-bit microprocessor, the central processing unit (CPU) of the AIM 65 microcomputer, provides the overall control and monitoring of all AIM 65 operations. The R6502 communicates with other AIM 65 elements on three separate buses. A 16-bit address bus allows the CPU to directly address 65,536 memory locations. An 8-bit bidirectional data bus carries data from the CPU to/from memory and interface devices. The control bus carries various timing and control signals between the CPU and interfacing peripherals, devices, and off-board elements.

The CPU operates at 1 MHz, which is derived from a 4 MHz crystal-controlled oscillator. The  $\phi 2$  system clock and read/write control signals are generated by the CPU, and are buffered and routed to other devices on-board and to the expansion connector.

A decoder circuit provides chip select signals to the on-board PROM/ROM and RAM sockets and to the I/O devices. 4K-byte chip selects are sent to the PROM/ROM sockets (\$BXXX-\$FXXX) while 1K-byte select signals are routed to the RAM sockets (\$00XX-\$XCXX). On-board I/O is also decoded to 1K-byte selects (\$A0XX-\$ACXX).

A pushbutton switch initiates RESET to the on-board devices and to interfacing equipment through the expansion connector. Installed terminal posts allow connection to a remote RESET switch. The STEP/RUN switch selects program execution in either the single-step mode or the run mode. In single-step mode, execution of all instructions in the address range 0-\$9FFF can be traced or can be stopped at any of four specified breakpoints. The KB/TTY switch selects operation using the AIM 65 keyboard and display or using a teletypewriter attached to the 20 mA current loop interface.

## Memory

Two 1024  $\times$  4 2114 static RAM devices are required for each 1K-byte of installed RAM. Both 1K and 4K versions are available. The 1K version may be expanded on-board in 1K increments up to 4K using the spare RAM sockets.

Five PROM/ROM sockets accept installation of the 4K-byte R2332 ROM, 2532 PROM, or smaller devices with compatible pinouts, e.g., 2K-byte 2516 PROM. The AIM 65 microcomputer comes with two R2332 ROMs containing the Debug Monitor/Text Editor installed at addresses \$E000-\$FFFF.

## I/O

The 16 bidirectional data lines and 4 handshake control lines of the user-dedicated R6522 VIA are routed directly to the application connector. The high current capacity of the VIA's eight "B" port lines can directly drive many industry-standard devices, such as solid state relays. One of the lines can be used as either a serial input or output line.

The audio recorder interface connects to one or two low-cost audio cassette recorders. Two remote control lines can control two separate recorders independently during read and write operations using the AIM 65 blocked audio recording format.

## Peripherals

The printer prints on heat-sensitive roll paper by means of ten thermal elements, mounted on a movable head, each of which can print two 5  $\times$  7 matrix dot characters. The printed characters are formed by dot patterns stored in the AIM 65 Monitor/Editor ROMs. A motor-driven platen advances the paper after each row of horizontal dots is printed. The motor and thermal element driver voltages are derived from an external +24V power supply. The printing is controlled by subroutines resident in the Monitor/Editor ROMs.

The AIM 65 display consists of five four-digit 16-segment alphanumeric displays and an R6520 Peripheral Interface Adapter (PIA) mounted on the Display Module which connects to the Master Module through two short solid-conductor ribbon cables. Each display quad contains internal memory, decoder, and driver circuitry. The display quads interface with the Master Module through the PIA. Data may be sent to the display using Monitor ROM subroutines.

The Keyboard Module connects to the Master Module by a removable 16-conductor flat ribbon cable. The interface is through an R6532 RAM, I/O, and Timer (RIOT) device which supports the Monitor with the RAM and timer. The key matrix is strobed by eight lines output through the RIOT with the matrix returns routed back through eight R6532 input lines.

OPTIONS

Optional hardware and accessory items are available which expand the functionality of the AIM 65 Microcomputer. The microcomputer can be easily installed in an attractive, professional, injection molded plastic enclosure for desk-top applications. Plug-in memory cartridges (A65-905 series) connect to the AIM 65 enclosure to expand memory in configurations of RAM and/or PROM/ROM. System expansion via RM 65 modules adds memory, input/output and peripheral (e.g., floppy disk and CRT display interface) functions to the on-board AIM 65 resources. Three different adapters/buffer modules connect the AIM 65 Expansion Connector to either one RM 65 module or to one of the multi-slot RM 65 motherboards. PROM programming can be performed using either the AIM 65 PROM Programmer or the RM 65 PROM Programmer Module (RM65-2901). The latter module has the advantage of being able to be used with other RM 65 modules connected to the system, e.g., RM 65 FDC module with AIM 65 DOS 1.0 (A65-090) firmware, to simplify source and object code handling.

Optional ROM-based languages support computer program development in both R6500 assembly language and high level languages. BASIC (by Microsoft) is the most popular microcomputer language used for computation and low speed control applications. FORTH is a highly efficient language in terms of memory utilization and execution speed—and also greatly shortens program development time. PL/65 provides structured control statements and compiles to 6500 assembly language to serve as an efficient system implementation language. The AIM 65 Pascal is a unique implementation of a substantial subset of standard Pascal which features interactive statement entry and execution with debug features at the source statement level.

OPTION ORDERING INFORMATION

Part No.	Description
<b>Accessories and Hardware</b>	
A65-002	AIM 65 Enclosure
A65-003	AIM 65 Service Test Board
A65-004	AIM 65 Power Supply & Cable
A65-006	AIM 65 Enclosure and Power Supply
A65-901	AIM 65 PROM Programmer
A65-905	AIM 65 Memory Cartridge
RM65-7101E	RM 65 Single Card Adapter for AIM 65
RM65-7104E	RM 65 Adapter/Buffer Module for AIM 65
RM65-7116E	RM 65 Cable Driver & Buffer Module for AIM 65
<b>Firmware</b>	
A65-010	AIM 65 Assembler ROM
A65-020	AIM 65 BASIC Interpreter ROMs
A65-030	AIM 65 PL/65 Compiler ROMs
A65-040	AIM 65 Math Package ROM
A65-050	AIM 65 FORTH Interpreter System ROMs
A65-060	AIM 65 Instant Pascal ROMs
A65-090	AIM Disk Operating System Version 1.0 (DOS 1.0) ROM <sup>(1)</sup>
<b>Software</b>	
A65-024	AIM 65 BASIC Compiler <sup>(1, 2, 3)</sup>
A65-052	AIM 65 FORTH Compiler <sup>(1, 2, 3, 4)</sup>

Notes:

1. Requires RM 65 Floppy Disk Controller (FDC) module. (RM65-5101NE).
2. Requires AIM 65 DOS 1.0 ROM (A65-090).
3. Provided on 5¼" double-density disk.
4. Requires AIM 65 FORTH Interpreter ROMs (A65-050).

Expansion Connector Pin Assignments

Top (Component Side)				Bottom (Solder Side)			
Signal Mnemonic	Signal Name	Input/Output	Pin	Pin	Signal Mnemonic	Signal Name	Input/Output
SYNC	SYNC	O	1	A	A0	Address Bit 0	O
RDY	Ready	I	2	B	A1	Address Bit 1	O
$\emptyset$ 1	Phase 1 Clock	O	3	C	A2	Address Bit 2	O
IRQ	Interrupt Request	I	4	D	A3	Address Bit 3	O
S.O.	Set Overflow	I	5	E	A4	Address Bit 4	O
NMI	Non-Maskable Interrupt	I	6	F	A5	Address Bit 5	O
RES	Reset	I	7	H	A6	Address Bit 6	O
D7	Data Bit 7	I/O	8	J	A7	Address Bit 7	O
D6	Data Bit 6	I/O	9	K	A8	Address Bit 8	O
D5	Data Bit 5	I/O	10	L	A9	Address Bit 9	O
D4	Data Bit 4	I/O	11	M	A10	Address Bit 10	O
D3	Data Bit 3	I/O	12	N	A11	Address Bit 11	O
D2	Data Bit 2	I/O	13	P	A12	Address Bit 12	O
D1	Data Bit 1	I/O	14	R	A13	Address Bit 13	O
D0	Data Bit 0	I/O	15	S	A14	Address Bit 14	O
-12V	*-12 Vdc	O	16	T	A15	Address Bit 15	O
+12V	*+12 Vdc	O	17	U	SYS $\emptyset$ 2	System Phase 2 Clock	O
CS8	Chip Select 8	O	18	V	SYS R/W	System Read/Write	O
CS9	Chip Select 9	O	19	W	R/W	Read/Write "Not"	O
CSA	Chip Select A	O	20	X	TEST	Test	O
+5V	+5 Vdc	O	21	Y	$\emptyset$ 2	Phase 2 Clock "Not"	O
GND	Ground		22	Z	RAM R/W	RAM Read/Write	O

Note: \*Not used on AIM 65.

Application Connector Pin Assignments

Top (Component Side)					Bottom (Solder Side)				
Signal Mnemonic	Signal Name	Type	I/O	Pin	Pin	Signal Mnemonic	Signal Name	Type	I/O
GND	Ground			1	A	+5V	+5V	Power	O
PA3	Port A Data Bit 3	NMOS	I/O	2	B		NC		
PA2	Port A Data Bit 2	NMOS	I/O	3	C	Ø2	CPU Phase 2 Clock	NMOS	O
PA1	Port A Data Bit 1	NMOS	I/O	4	D	R/W	CPU Read/Write	NMOS	
PA4	Port A Data Bit 4	NMOS	I/O	5	E	TAPE 1B RTN	Tape 1B Remote Control Return		I/O
PA5	Port A Data Bit 5	NMOS	I/O	6	F	TAPE 1B	Tape 1B Remote Control		I/O
PA6	Port A Data Bit 6	NMOS	I/O	7	H	TAPE 2B RTN	Tape 2B Remote Control Return		I/O
PA7	Port A Data Bit 7	NMOS	I/O	8	J	TAPE 2B	Tape 2B Remote Control		I/O
PB0	Port B Data Bit 0	NMOS	I/O	9	K		NC		
PB1	Port B Data Bit 1	NMOS	I/O	10	L	AUDIO IN	Audio Input Low		I
PB2	Port B Data Bit 2	NMOS	I/O	11	M	AUDIO OUT LO	Audio Output Low Level		O
PB3	Port B Data Bit 3	NMOS	I/O	12	N	+12V	+12 Vdc	Power	O
PB4	Port B Data Bit 4	NMOS	I/O	13	P	AUDIO OUT HIGH	Audio Output High Level		O
PA0	Port A Data Bit 0	NMOS	I/O	14	R	TTY KYBD RTN (+)	TTY Keyboard Return	20 mA (+)	
PB7	Port B Data Bit 7	NMOS	I/O	15	S	TTY PWR RTN (+)	TTY Power Return	20 mA (+)	
PB5	Port B Data Bit 5	NMOS	I/O	16	T	TTY KYBD	TTY Keyboard (Data In)	20 mA (-)	I
PB6	Port B Data Bit 6	NMOS	I/O	17	U	TTY PWR	TTY Power (Data Out)	20 mA (-)	O
CB1	Port B Control Bit 1	NMOS	I/O	18	V	TAPE 2A	Tape 2A Remote Control		I/O
CB2	Port B Control Bit 2	NMOS	I/O	19	W	TAPE 1A	Tape 1A Remote Control		I/O
CA1	Port A Control Bit 1	NMOS	I	20	X		NC		
CA2	Port A Control Bit 2	NMOS	I/O	21	Y	SERIAL IN	Serial Input		I
-12V	-12 Vdc*	Power	O	22	Z	+24V	+24 Vdc**	Power	O

Notes: \*Pin 22 jumpered to -12V through jumper.  
 \*\*Pin Z jumpered to +24V through jumper.

SPECIFICATIONS

Parameter	Value
Outside Dimensions*	
Master Module	
Width	11.5 in. (292 mm)
Depth	10.5 in. (267 mm)
Height**	2.35 in. (60 mm)
Weight	1 lb. 11 oz. (630 g)
Keyboard Module	
Width	11.5 in. (292 mm)
Depth	4.0 in. (102 mm)
Height	1.2 in. (30 mm)
Weight	1 lb. 3 oz. (443 g)
Environment	
Operating Temperature	0° to 50°C
Storage Temperature	0° to 70°C
Relative Humidity	0% to 85% (without condensation)
Power Connector	6-Post Terminal Block
Interface Connector	
J1 (Application) and J3 (Expansion)	44-pin edge connector (0.156 in. centers). Mates with Viking 2VH22/1AND5 or equivalent.
J2 (Printer)	17-pin flexible cable strip connector
J4 (Keyboard)	16-pin DIP connector
J5 (Display)	32-pin strip connector
Shipping Specifications	
Size (in box)	13 in. (330 mm) x 14 in. (355 mm) x 7.5 in. (190 mm)
Weight (in box)	8 lb. (3 kg)

Notes: \*Reference PA00-D010.  
 \*\*To top of the display.

ELECTRICAL CHARACTERISTICS

Power Requirements

Voltage	Typ	Max	Peak	Units
+5V ±5% Regulated				
1K RAM + 2 ROMs*	1.1	1.8	1.8	A
4K RAM + 5 ROMs	1.8	2.8	2.8	A
+24V ±15% Unregulated	0.5	1.5	2.5**	A

Notes:  
 \*For additional RAM and ROM, allow

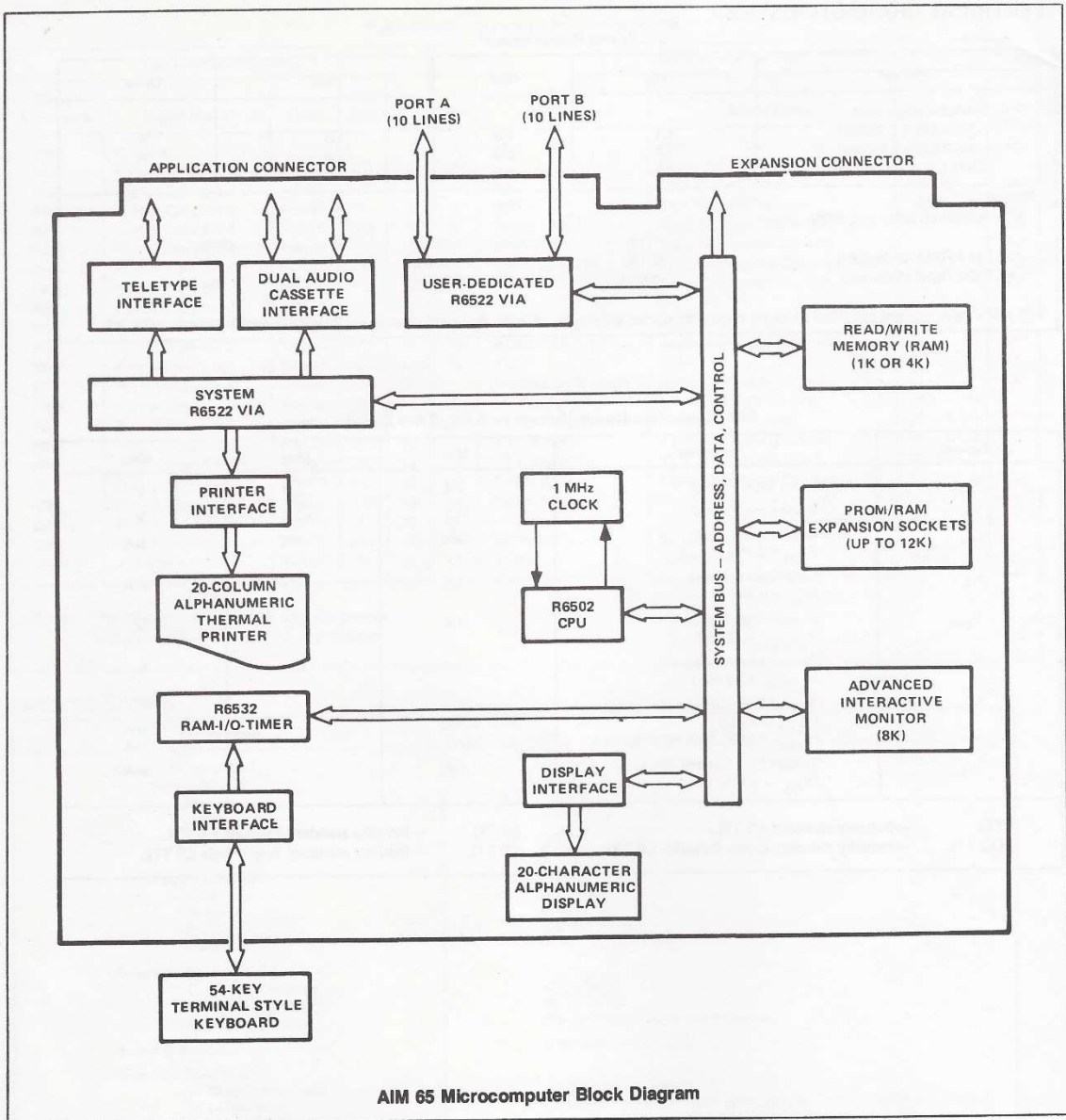
	Typ	Max	Units
1K 2114 RAM (2 devices)	0.160	0.200	A
4K 2332 ROM (1 device)	0.080	0.120	A

\*\* +24V peak current specified as worst case with printer duty cycle of 75%. For most cases, a +24V 2A power supply is sufficient.

NMOS Interface (Input Voltage = +5.0V, TA = 25°C)

Symbol	Parameter	Min	Max	Unit
V <sub>IH</sub>	Input High Voltage	2.4	5.0	V
V <sub>IL</sub>	Input Low Voltage	-0.3	+0.4	V
I <sub>IH</sub>	Input High Current (V <sub>IH</sub> = 2.4V)	-100	-300	μA
I <sub>IL</sub>	Input Low Current (V <sub>IL</sub> = 0.4A)	-1.0	-1.6	mA
V <sub>OH</sub>	Output High Voltage (I <sub>LOAD</sub> ≤ -100 A)	2.4	5.0	V
V <sub>OL</sub>	Output Low Voltage (I <sub>LOAD</sub> ≤ -3 mA)	-	0.4	V
I <sub>OH</sub>	Output High Current (Sourcing) (V <sub>OH</sub> ≥ 2.4V) (V <sub>OH</sub> ≥ 1.5V, VIA PB0-PB7 only)	-100 -1.0	-	μA mA
I <sub>OL</sub>	Output Low Current (Sinking) (V <sub>OL</sub> ≤ 0.4V)	1.6	-	mA

TTL —Industry standard LS TTL.      3S TTL —Industry standard Tri-State LS TTL.  
 OC TTL —Industry standard Open Collector LS TTL.      TP TTL —Industry standard Totem Pole LS TTL.



**MONITOR COMMANDS**

**Major Function Entry**

- (RESET Button)—Enter and Initialize Monitor
- ESC — Reenter Monitor
- E — Enter and Initialize Text Editor
- T — Reenter Text Editor
- N — Jump to D000
- 5 — Jump to B000
- 6 — Jump to B003

**Instruction Entry and Disassembly**

- I — Enter mnemonic instruction entry mode
- K — Disassemble memory

**Display/Alter Registers and Memory**

- \* — 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)
- R — Display all registers
- M — Display four memory locations, starting at (address)
- (SPACE) — Display next four memory locations
- / — Alter current memory location

**Manipulate Breakpoints**

- # — Clear all breakpoints
- 4 — Toggle breakpoint enable on/off
- B — Set one to four breakpoint addresses
- ? — Display breakpoint addresses

**Control Instruction/Trace**

- G — Execute user's program
- Z — Toggle instruction trace mode on/off
- V — Toggle register trace mode on/off
- H — Trace Program Counter history

**Control Peripheral Devices**

- L — Load object code into memory from peripheral I/O device
- D — Dump object code to peripheral I/O device
- 1 — Toggle Tape 1 control on/off
- 2 — Toggle Tape 2 control on/off
- 3 — Verify tape checksum
- CTRL PRINT — Toggle Printer on/off
- LF — Line Feed
- PRINT — Print Display contents

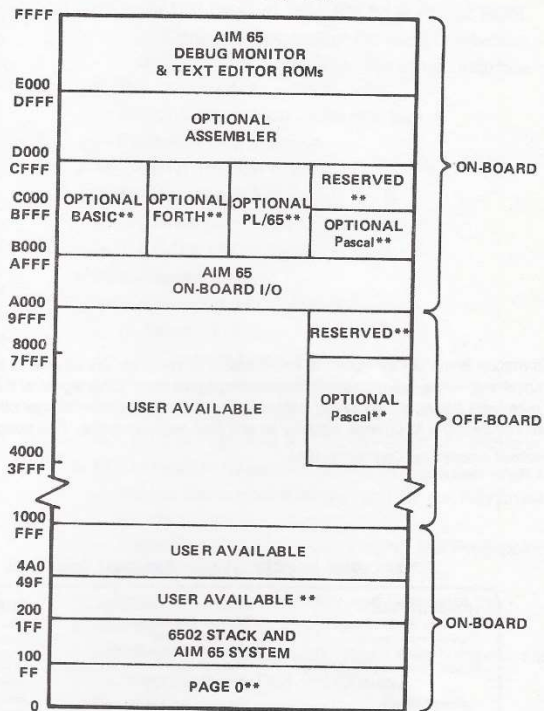
**Call User-Defined Functions**

- F1 — Call User Function 1
- F2 — Call User Function 2
- F3 — Call User Function 3

**TEXT EDITOR COMMANDS**

- R — Read lines into text buffer
- I — Insert line into text buffer
- K — Delete current line of text
- (SPACE) — Display current line of text
- L — List lines of text to peripheral I/O device
- 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 character string
- C — Change character string
- Q — Quit Text Editor, return to Monitor

**AIM 65 Memory Map**



NOTES: \*USER AVAILABLE IF MONITOR/EDITOR IS NOT USED.  
 \*\*USER AVAILABLE IF OPTIONAL LANGUAGE IS NOT USED:

LANGUAGE	PAGE 0	PAGE 2-4
Assembler	0-DE-	NOT USED
BASIC	0-D6	200 - 211
FORTH	0-A4	200 - 30A
PL/65	0-04	200 - 49F
Pascal	06-B4, FC-FF	200 - 2FF
Monitor/Editor	DF-FF	NOT USED

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