# 8:16 OPERATOR'S GUIDE (MS-DOS)

**for Attache 8:16 and Attache 8:16S**

**Portable Computer Systems**

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## Radio Frequency Interference Statement

**WARNING:** This equipment generates and uses radio frequency energy and if not installed and used properly -- that is, in strict accordance with the manufacturer's instructions -- may cause interference to radio and television reception.

It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna.
- Relocate the computer with respect to the receiver.
- Move the computer away from the receiver.
- Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet, prepared by the Federal Communications Commission, helpful:

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

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## 5. Printer and Communications Ports



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**7. Appendixes**

# How to USE this Guide

This User's Guide contains instructions for setting up and using Attache 8:16 with the MS-DOS operating system.

- The Introduction section contains general information about computer system requirements, the Attache 8:16 computer, IBM-PC compatibility, Attache 8:16 power cords, voltage selection and fuses, clock batteries, maintenance, and operating environment considerations.

- The Getting Started section describes procedures for setting up the unit, turning on the power, inserting diskettes, loading MS-DOS programs for operation, changing diskettes and the logged disk drive, and displaying the file directory.

- The Diskettes section describes which diskettes to use, diskette handling procedures, formatting programs, MD-DOS and CP/M diskette formats, diskette copying programs, and IBM-PC diskette compatibility issues.

- The Keyboard section describes the Attache 8:16 keyboard, modes of operation, templates, multi-function keys, Set-Up Mode, 10-Key Mode, WordStar Mode, and IBM PC Mode.

- The Ports section describes the Attache 8:16 serial ports, cable and peripheral connection, baud rate selection, pin connections for connecting to the two serial ports, and technical IBM-PC port interface information.

- The Programmer's Reference section contains reference information for programmers using MS-DOS to access Attache 8:16's programmable features and also includes reference tables for converting IBM keyboard functions on the Attache keyboard.

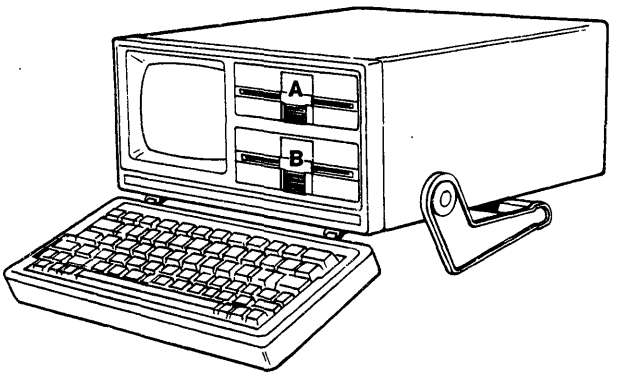
- The appendixes contain Attache 8:16 technical specifications, a comprehensive glossary, and a cross-referenced index.

NOTE: Procedures for using Attache 8:16 with the CP/M operating system are described in the Attache Operator's Guide.

# Operator's Guide

## Introduction

# Introduction




Welcome to Attache 8:16, the computer designed for applications requiring compactness, portability, and power. The entire system is only half a cubic foot in size and weighs less than 20 pounds. For transport, the keyboard flips up to form a lid that protects the disk drives and CRT display, and the multi-position handle and detachable keyboard allow a choice of operating positions.

Attache 8:16's standard features make it suitable for many sophisticated applications:

- The dual processors allow you to run software programs using either CP/M or MS-DOS.
- The CRT display features high quality screen resolution with an extended character set, medium and high resolution graphics capabilities, and many programmable attributes.
- The floppy disk drive system is capable of transferring data concurrently with main processor activities.
- The two universal serial ports are designed to handle most common printers and asynchronous protocols, and an auxiliary video jack allows connection of external monitors.

Attache 8:16 also includes a full function keyboard, a time and date clock, and a programmable three-channel sound synthesizer. A number of useful software packages are included, and additional CP/M and MS-DOS compatible software is available from your dealer.

This combination of innovative hardware and software makes Attache 8:16 a truly versatile and unique computing system. Welcome to the world of portable computing with Attache 8:16!

## Basic Computer Concepts

If you're new to computers and computing, this introduction provides an overview of basic computer concepts and how they apply to Attache 8:16.

**Hardware and Software** - There are two requirements for all computer systems: hardware and software. Hardware refers to the physical components of the system and software refers to the programs and data.

**Programs and Files** - Programs are the sequence of coded instructions for the computer to follow. The computer manipulates data (letters and numbers) according to these instructions.

Each program and collection of data is stored separately as a unique "file." Groups of related programs are called a "system" and are either "operating" systems or "applications" systems.

**Operating System Software** - The operating system controls the internal operation of the computer by coordinating system and user programs and directing the operation of system input and output from the keyboard, processor, display screen, disk drives, and peripheral attachments (i.e., printers, modems, plotters).

The operating system also interprets and processes information that is entered at the keyboard, provides the structure for file storage and retrieval, finds mistakes and displays error messages to indicate system or user errors, and provides utility programs for system and file maintenance functions.

Attache 8:16 uses both the CP/M and MS-DOS operating systems, though not simultaneously.

**Application System Software** - Applications systems are the set of programs used for a specific function or application, such as word processing, spreadsheet analysis, or data base management.

Applications software that is included with or purchased for use with Attache 8:16 must be compatible with either the CP/M or MS-DOS operating system and Attache 8:16 disk format. This disk format is compatible with the IBM-PC disk format for 16-bit operation using MS-DOS.

**Data Storage** - To use the programs, there must be some form of storage. Attache 8:16 accesses program and data files stored on diskettes. The disk drives "read" stored information from diskette or "write" new information to diskette.

**Processors** - A processor (known as the Central Processing Unit or CPU) is the "brains" of the computer. Attache 8:16 features dual processors for computing in either 8-bit or 16-bit environments.

**Memory** - For temporary storage during processing, computers have "internal memory" which is either random access memory (RAM) or read only memory (ROM). Both are transparent to the casual user.

Attache 8:16 contains three RAM memories: one for 8-bit processing with CP/M, one for 16-bit processing with MS-DOS, and one for high resolution graphics processing.

Copies of programs are transferred from diskette to RAM when the program is called. This temporary storage becomes available for other programs when the program is terminated.

Attache 8:16 also contains memory called ROM (Read-Only-Memory), which is permanent internal memory used for storing diagnostic programs and system configuration parameters. The program stored in ROM remains the same even when the computer is turned off.

**Input and Output Devices** - Input devices (such as the keyboard) are where information is input to the computer. Output devices (such as the CRT screen) are where information is output from the computer. The floppy disk drives and serial ports serve as dual input/output (I/O) devices since data may be both input and output.

## Attache 8:16's Dual Processors

The Attache 8:16 is actually two computers in one. As a 16-bit computer, the 8:16 uses an 8086 processor and 256K bytes of RAM with the MS/DOS 2.0 operating system. As an 8-bit computer, the 8:16 uses a Z-80A processor and 64K bytes of RAM with the CP/M 2.2.4 operating system.

CP/M and MS-DOS cannot be run simultaneously. Either system is selected automatically by simply loading the appropriate software. If a disk containing MS-DOS is loaded, the computer is in 16-bit mode running MS-DOS. If a disk containing CP/M is loaded, the computer is in 8-bit mode running CP/M.

Attache 8:16 automatically configures the keyboard, disk format, graphics format, and input/output structure for the selected mode of operation each time a system is loaded.

## CP/M and MS-DOS Compatibility

While the CP/M and MS-DOS operating systems are similar in concept, application programs that are written for one cannot be used with the other. For example, a version of the Multiplan spreadsheet program that is written for MS-DOS cannot be used under CP/M and vice versa.

You may, however, convert data files that were created under a CP/M version of the application program to an MS-DOS format and vice versa. This is accomplished with the MS-DOS "Convert" utility, which is described in the MS-DOS Guide.

## IBM-PC Compatibility

When operated as a 16-bit computer with MS-DOS, Attache 8:16 is software-compatible with the IBM 5150 Personal Computer (PC). This means that most software written for the IBM PC can be run on the Attache 8:16.

Attache 8:16 provides IBM-PC compatibility in the following ways:

**Operating System** - Attache 8:16's enhanced version of Microsoft's MS-DOS 2.0 is fully compatible with the IBM PC-DOS 2.0.

The differences between IBM's PC-DOS and the Microsoft "generic" MS-DOS result from the IBM PC's physical and logical architecture. Many operations that would normally be handled by the operating system (such as logical input/output instructions) are reduced to microcode instructions in the PC's ROM.

Since IBM's ROM is proprietary, Attache's MS-DOS handles these functions in the portion of the operating system known as the BIOS (Basic Input Output System). This section of MS-DOS (IO.SYS) has been customized for Attache 8:16 to emulate the PC's microcode.

Attache 8:16's BIOS for MS-DOS is completely PC-compatible. Any program written for the PC that performs all input/output operations through IO.SYS will run without modification.

For programs that are written to the IBM ROM rather than the BIOS, Attache 8:16's BIOS emulates PC I/O port routines. This allows Attache 8:16 to run most applications software that is written for the IBM-PC.

**Diskettes** - Attache 8:16 reads and writes disks in the same format as the PC, so data disks can be freely exchanged between the two machines.

You cannot actually boot a PC-DOS operating system diskette on Attache 8:16, but you can insert the disk and run the programs after you have loaded MS-DOS from the Attache DOS diskette.

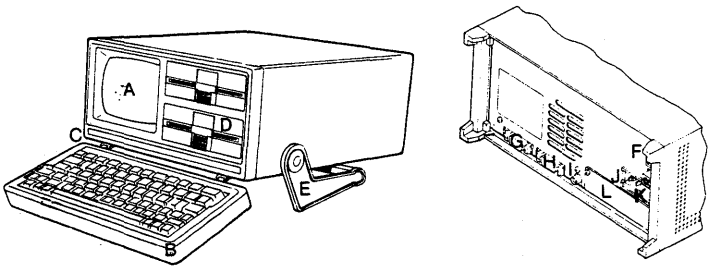
**Keyboard** - Attache 8:16's keyboard has been mapped to support all functions available on the PC keyboard. When MS-DOS is loaded, several Attache keys can be pressed at the same time or in sequence to duplicate IBM-PC keyboard functions. These keyboard conversions are shown on Attache 8:16's keyboard template.

**Display Screen** - Attache 8:16 contains PC-compatible screen RAM, graphics RAM, and alphanumeric RAM. When MS-DOS is loaded, Attache 8:16 selects either PC-compatible medium-resolution (320 x 200 pixels) or high-resolution (640 x 250 pixels) graphics mode. Both modes are organized as 24 lines of 80 characters plus a 25th status line.

**Peripherals** - Most printers, plotters, and modems that can be attached to the PC can be connected to Attache 8:16.

**Languages** - Most compilers, debuggers, link editors, interpreters, and callable subroutines that run on the PC will run on Attache 8:16.

## Attache 8:16 Components




A - Display Screen

B - Keyboard

C - Detachable Keyboard Cable

D - Disk Drives

E - Multi-Position Handle

F - On-Off Switch

G - Communications Port

H - Printer Port

I - Auxiliary Video Jack

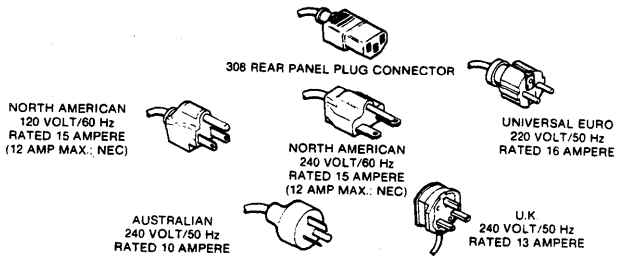
J - AC Outlet and Power Cord

K - Fuse and Voltage Selector

L - Option Board Plate

## Power Cords

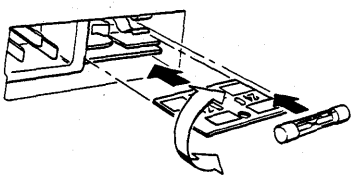
Operation outside of North America may require a custom power cord or international adaptor to fit electrical outlets. Voltage settings may also be different than standard North American settings. Power cords are illustrated below.




## Voltage Selection

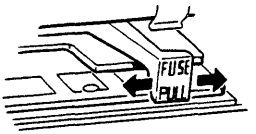
Voltage is factory set at 120 VAC but may be easily changed to 100, 220, or 240 when used in an environment requiring those voltages. Remove the fuse and then remove the small P.C. Board at the base of the fuse box.

The side of the card facing you will read "120." Turn the card so the required voltage setting (100, 120, 220, 240) is facing you. Return the P.C. Board to its place in the fuse box with the new setting facing you. Then reinstall the fuse. Be sure the fuse has the same rating as your new voltage selection.



## Fuses

Use either Slo-Blo 2A 115V or Slo-Blo 1A 230V, depending upon your voltage selection. Disconnect the power cord and slide the fuse box door to the left. Then slide the fuse pull to the left and remove the fuse. Insert the new fuse. Then slide the fuse pull and the fuse box door to the right.




## Batteries

Attache 8:16's real-time clock uses two 1.5 volt silver oxide batteries (Duracell MS76 or equivalent), which are located on the right rear side of the processor board module.

Instructions for replacing the clock batteries are included in the Attache Service Guide.

## Maintenance and Service

Clean the unit with a mild non-abrasive household cleansing product. Be gentle - do not scrub. Do not spray the cleansing agent into the drive area or keyboard.

Use a cotton swab to clean around the drives and keyboard. Do not attempt to clean inside of the drive mechanism. Do not attempt to manually clean the drive heads.

Use a commercial solvent-type disk head cleaning kit to clean the drive heads. These kits contain a special cleaning diskette and are available from your dealer.

## Environmental Considerations

Even the best computer designs can malfunction if environmental specifications are exceeded. Improper power cords, fuses, and voltage selection can cause the machine to malfunction.

Use only those voltage selections, fuse sizes, and power cords that are recommended in this guide.

Temperature extremes can also cause problems. Diskettes, for example, will only function properly in the temperature range (50 to 125 degrees F and 10 to 51 degrees C).

If diskettes are exposed to temperatures outside of these ranges for extended periods, let them acclimate at room temperature for a short time prior to using them.

While Attache 8:16 is not as temperature sensitive as the diskettes, the unit may not boot following exposure to extreme temperatures. If this occurs, let the unit acclimate at room temperature for a short time.

# Operator's Guide

## Getting Started

# Getting Started

## Overview

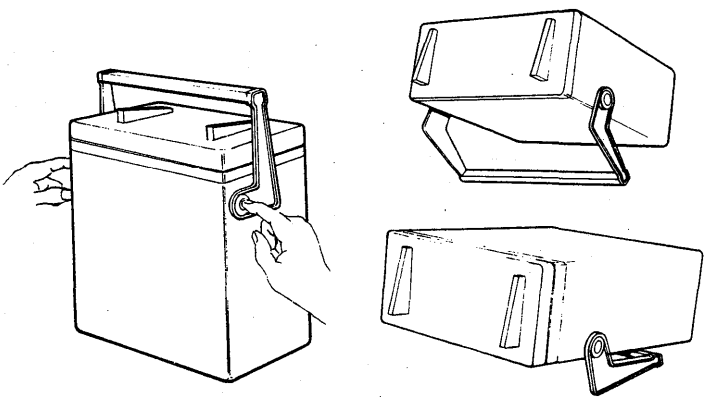
This chapter provides instructions for setting up Attache 8:16 and getting started with basic computer operation. The following types of information are included:

- Set the Handle
- Release the Keyboard and Connect the Keyboard Cable
- Connect the Power Cord and Turn the Power On
- Insert Diskettes and load the MS/DOS system
- Change the Logged Drive and Change Diskettes
- Display the File Directory

## Set the Handle

Begin the set-up procedure with Attache 8:16 placed vertically on a flat surface. Release the handle by pressing the tabs on both sides where the handle meets the unit.

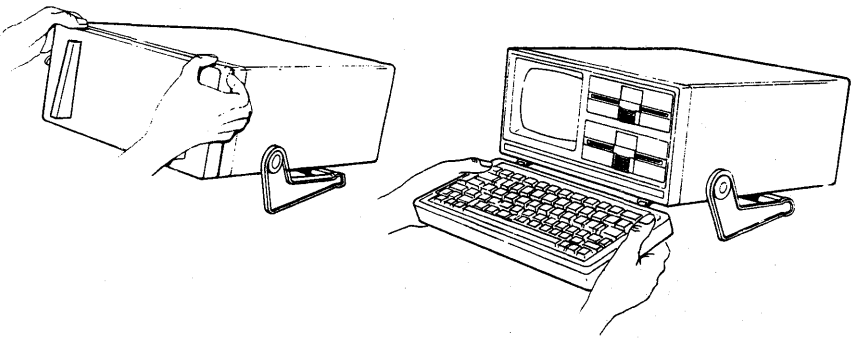
Set the handle to one of its two operating positions as illustrated below. Then place the unit horizontally in its normal operating position.



## Release the Keyboard

With Attache 8:16 in a horizontal position, release the keyboard by pressing the two tabs at the top of the casing.

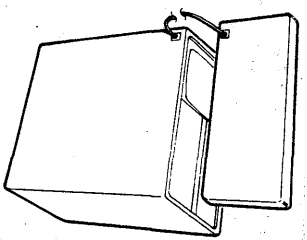
The keyboard is automatically detached from the unit if the handle is in the position shown at the left below, or may easily be detached in the position shown at the right below by lifting the rear of the keyboard from the hinges that attach it to the unit.



## Connect the Keyboard Cable

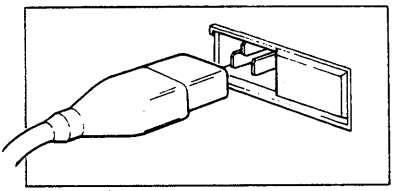
Connect the keyboard cable to the standard telephone jacks below the left front corner of the unit and below the left rear corner of the keyboard, as illustrated below.

To release the cable, press the tab on the side of the connector.



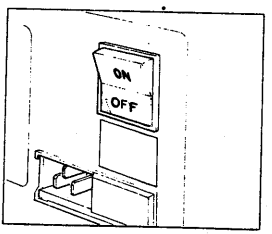
## Connect the Power Cord

Connect the female end of the power cord firmly to the plug at the rear of the unit. Connect the male end of the power cord to a three-prong wall outlet. Do not connect the power cord to a two-prong outlet unless you are also using a three-prong adaptor that is properly grounded.



## Power Up Attache

Power on Attache by flipping the ON-OFF switch on the rear panel to the ON position. Power off Attache by flipping the ON-OFF switch to the OFF position.



## Inserting Diskettes in the Drives

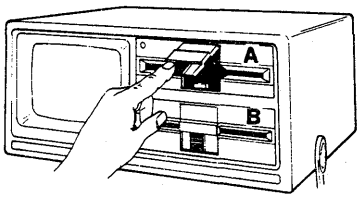
Attache 8:16 is equipped with two dual-sided dual-density 5-1/4-inch diskette drives for storing or retrieving data from diskettes. The 8:16S model is equipped with one of these drives.

Several diskettes are shipped with your unit. These diskettes contain Attache's software programs. You will need additional diskettes for recording data files, and also for making duplicate copies of program and data files.

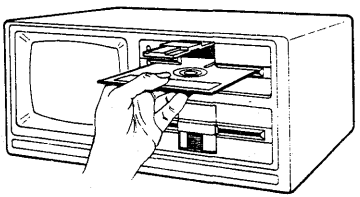
Diskettes are inserted with the label facing up in the Attache drives. The top or upper drive is Drive A. The bottom or lower drive is Drive B. If you are unfamiliar with diskette handling, refer to the next section in this manual before you proceed.

Note: Several different drive configurations are shipped with Attache. For drives with a latch mechanism, turn the latch on the drive door to open the door. For other drives, press the louvered area on the drive door and the drive will open.

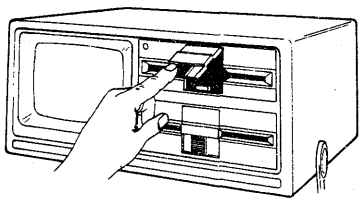
### Open the Drive Door




### Insert the Diskette



### Close the Drive Door



## Loading the MS-DOS Operating System

To use the computer, you must "load" a copy of the operating system from a diskette into memory. This is called a "bootstrap" operation, or simply "booting." When the operating system has been booted, you may activate applications programs.

Attache 8:16 can be booted using either the CP/M operating system or the MS-DOS operating system. CP/M is used for programs that are designed for 8-bit operation and CP/M, while MS-DOS is used for programs that are designed for 16-bit operation and MS-DOS.

Procedures for booting CP/M are described in the Attache Operator's Guide in the User's Guide Volume 2. Procedures for booting MS-DOS are described here on the next several pages.

Note that application programs that are designed for CP/M will not run if MS-DOS is booted, and MS-DOS programs will not run if CP/M is booted. You may, however, convert data files from MS-DOS format to CP/M format and vice versa using the MS-DOS "Convert" command.

## Booting MS-DOS

Attache 8:16 uses an enhanced version of the Microsoft Disk Operating System (MS-DOS) as its operating system for 16-bit operation. MS-DOS (also called DOS) manages a variety of internal functions and also allows you to control the resources of the computer through maintenance or "housekeeping" programs.

To boot MS-DOS:

1. Turn the power on. The following message is displayed:

   **Otrona Attache**

   **No Disk or Disk Not Readable**
   **Now in Terminal Mode**

   This is the Terminal Mode prompt. DOS will be loaded from this mode.

2. Insert the Attache DOS diskette in Drive A (the upper drive) and close the drive door.

3. Press the **RESET** key and the **SHIFT** key on the right side of the keyboard at the same time to boot the system. Booting takes approximately 10 seconds. The message "Otrona Attache" is displayed during this time.

4. When DOS has been loaded, the following message is displayed:

```
Attache MS-DOS version 2.0
Copyright 1981, 82, 83 Microsoft Corp.

Command v. 2.xx

Current Date is DAY DATE
Enter new date:
```

The displayed day and date are from Attache 8:16's real-time clock. If the displayed day and date are correct, press **RETURN**. If not, enter the correct date and press **RETURN**. If you change the date here, the real-time clock is automatically reset to that day and date.

The date is entered in "mm-dd-yy" format, where "mm" is a one or two digit number from 1-12 for the month, "dd" is a one or two digit number from 1-31 for the day of the month, and "yy" is a two digit number from 80-99 for the year (the 19 is assumed). Separators between the numbers can be either hyphens (-) or slashes (/).

5. When the date has been entered, the following message is displayed:

```
Current Time is TIME
Enter new time:
```

The displayed time is from Attache 8:16's real-time clock. If the displayed time is correct, press **RETURN**. If not, enter the correct time and press **RETURN**. If you change the time here, the real-time clock is automatically reset.

The time is entered in "hh:mm" format, where "hh" is a one or two digit number from 0-23 for the hour (in military time) and "mm" is a one or two digit number from 0-59 for the minutes of the hour. Use a colon (:) to separate the hours and minutes.

6. When the time has been entered, the following characters are displayed:

```
A>
```

This is the DOS prompt, which indicates that DOS is loaded into memory and waiting for a command. The DOS prompt is a symbol that DOS displays when it is ready for instructions.

The letter "A" indicates the logged disk drive, which is the drive currently being used for reading and writing information. Drive A (the upper drive) is always the logged disk drive when DOS is booted, and remains as the logged drive until you change to the alternate drive (B).

The small highlighted rectangle to the right of A> is the "cursor." This is "you" on the screen and indicates where "you" are at. With the DOS prompt displayed on the screen, you are now ready to activate MS-DOS utility programs (such as FORMAT) or application programs (such as WordStar-Plus or Multiplan).

## Rebooting MS-DOS

MS-DOS may be "rebooted" at any time by pressing **RESET** and the right **SHIFT** key at the same time. If a program is running, it is immediately terminated when the system is reset and the contents of memory are lost. Under normal circumstances, save your current file prior to rebooting the operating system.

## Turning the System Off

MS-DOS does not require a "logoff" command. When you are finished with your session and the DOS prompt (A> or B>) is displayed on the screen, remove your diskettes and turn the computer off by flipping the ON-OFF switch to the "OFF" position.

## Using the Dual Processors

Attache 8:16's dual processors allow you to operate in an 8-bit environment with CP/M or in a 16-bit environment with MS-DOS, depending upon which system was contained on the diskette that you booted. These systems may not be run concurrently.

If you boot the system with the Attache DOS diskette in Drive A, you are in DOS. Only programs written for 16-bit operation under MS-DOS will be recognized.

If you boot the system with the Attache Software diskette in Drive A, you are in CP/M. Only programs written for 8-bit operation under CP/M will be recognized.

To change operating systems, you must insert the diskette containing the desired operating system in Drive A and reboot the system.

## When to Change Diskettes

Many software programs (including WordStar-Plus and Multiplan) allow you to change data diskettes without returning to the DOS prompt. When using these programs, change data diskettes when the system is at the application's main menu (such as the No-File menu in WordStar-Plus).

To use different program diskettes, return the system to the DOS prompt (A> or B>) and then change diskettes as required. Do not change diskettes when one of the drives is being used and the red drive light is on.

## Changing the Logged Drive

The logged or "default" disk drive is the drive containing the diskette from which programs are being loaded and executed. Drive A is the default logged drive.

Change the logged drive by typing **B:** and pressing **RETURN** when the cursor is at A>. Program execution will then be initiated from the diskette in Drive B. Change back to Drive A by typing **A:** when the cursor is at B>.

## Displaying the File Directory

After the operating system has been loaded, you can display on the screen a listing of the files contained on the diskette. To display the directory, type **DIR** and press **RETURN**. The directory shows all files on the currently logged disk.

## File Naming Conventions

Programs and data that you buy or create are stored in "files" on the diskette. Each file is given a unique "filename" for identification. Filenaming conventions are the same for both MS-DOS and CP/M.

Filenames consist of a "primary" name (up to eight characters) and an "extension" (up to three characters). A period separates the primary name from the extension. The primary name describes the file and the extension describes the file type.

Filenaming conventions and file maintenance program commands are described in detail in the MS-DOS Guide and CP/M Guide.

# Operator's Guide

## Diskettes

# Diskettes

## Overview

This section describes diskettes to use with Attache 8:16, formatting procedures, MS-DOS and CP/M diskette formats, procedures for making duplicate copies of diskettes, and naming conventions for files that you create on diskettes.

## Which Diskettes to Use

Diskettes that you purchase must be compatible with Attache, as described below. Blank diskettes that you purchase must be "formatted" by you before data can be written to them. This is done with a format program.

Standard diskettes for use with Attache are 5-1/4-inch floppies with 360K byte capacity each (after formatting). These diskettes can store more than 360,000 characters of information.

Several diskettes are shipped with your unit. These diskettes contain Attache's software programs. You will need additional diskettes for recording data files, and also for making duplicate copies of program and data files.

Blank diskettes may be purchased through your dealer; always specify double-sided double-density soft-sectored diskettes. Remember that blank diskettes you purchase must be formatted before they may be used with Attache 8:16.

Remember that diskettes are extremely fragile and must be handled with care. Old worn diskettes and mishandled diskettes may become unreadable and valuable information might be lost. As a precaution, make copies of the Attache Software diskette and Attache DOS diskette and always maintain a backup diskette for data files and software programs that you purchase or create.

## Handling Diskettes

Diskettes are fragile and should be handled carefully. The following guidelines will help you keep your diskettes in top condition.

- Do not leave diskettes in the disk drives when moving Attache. The diskettes could become damaged by movements in the head assemblies during transport.
- Keep diskettes away from magnetic areas, including all electrical equipment and screwdrivers. Do not put diskettes on top of the computer during operation.

- Do not expose diskettes to direct sunlight. Do not store diskettes in an automobile on hot days.

- Mark the diskette label before you attach it to the diskette whenever possible. Always use felt-tip pens for marking on the diskette label, especially if it is already applied to the diskette. Do not use ball point ink pens or pencils. Ink pens may dent the media, and pencil graphite particles or erasure residue may contaminate the diskette.

- Do not expose diskettes to temperatures outside the recommended range (50 degrees F to 125 degrees F or 10 degrees C to 51 degrees C) for extended periods.

- Diskettes that have been exposed to temperatures outside the recommended range should be allowed to acclimate to room temperature for thirty minutes before they are inserted in the drives.

- Do not fold or bend diskettes. Do not use paper clips, rubber bands, or tape on the diskette.

- Handle diskettes by the protective sleeve area only. Do not touch exposed mylar areas of the diskette.

- Protect diskettes from grease, dirt, smoke, and dust. Store diskettes in their protective envelopes when not inserted in the disk drives. Always store diskettes in a diskette box when not in use.

- Do not attempt to "clean" a diskette.

- Do not place heavy objects on the diskette.

## Formatting Blank Diskettes

New blank diskettes must be formatted for use with a specific operating system, in this case either CP/M or MS-DOS. Formatting prepares the diskette to accept data in a physical format determined by the operating system.

**Warning: Format erases the previous contents of the diskette. Do not attempt to format diskettes containing software programs or data files that you want to keep.**

MS-DOS and CP/M each have unique formats for diskettes. A format program is used to prepare a new blank diskette for use with Attache 8:16 and either MS-DOS or CP/M. Failure to format the diskette will result in an error when the drive head attempts to read or write to the diskette.

The MS-DOS format program is described in the MS-DOS Guide. The CP/M format program is described in the Software Guide.

## MS-DOS and CP/M Diskette Formats

Attache's dual processors provide separate diskette formats for MS-DOS diskettes and CP/M diskettes. This is required because of the difference in the way the two operating systems write and read information on diskettes. Both formats provide 360K bytes of diskette storage capacity.

When formatted for CP/M, diskettes are written and read in the standard Attache format of 48-tracks-per-inch, dual-sided, dual-density, 10-sectors per track.

When formatted for MS-DOS, diskettes may be written and read in all IBM PC-DOS formats, including 8-sector DOS 1.x and 9-sector DOS 2.0 formats at 48-tracks-per-inch with both single/dual-sided single/dual-density media.

While MS-DOS cannot read and write CP/M diskettes and vice versa, the MS-DOS utility program "Convert" can be used to convert data files between Attache-CP/M and Attache-MS-DOS/IBM-PC-DOS formats. This program is discussed in the MS-DOS Guide.

## Making Duplicate Copies of Diskettes

Diskettes will occasionally become unusable. Always keep a duplicate or "backup" copy of diskettes containing important programs and data files that you wish to keep.

Rather than use the Attache Software diskette and Attache DOS diskette for everyday operation, make duplicate copies of each diskette and store your "master" copies in a safe place. You may need to duplicate them again if your copies become unusable.

You should also make duplicate copies of diskettes containing application programs that you purchase and store your "master" copies for future duplication. It is also wise to maintain a backup copy of diskettes containing important data files.

MS-DOS diskettes can be copied using the MS-DOS "Diskcopy" command, which is described in the MS-DOS Guide.

Procedures for using the MS-DOS "Convert" utility program for copying MS-DOS data files to a diskette with the CP/M format and vice versa are described in the MS-DOS Guide.

## Using IBM-PC Compatible Diskettes

Most software programs written in PC-DOS for the IBM-PC can be loaded and run on Attache 8:16. Depending upon the individual software package, you can load the program directly from its shipping diskette, or you can copy it to a diskette containing the Attache MS-DOS files and then load it.

Do not attempt to "boot" the diskette containing the PC-compatible software. Since the IO.SYS portion of MS-DOS is hardware-dependent, Attache 8:16 cannot boot the IBM-PC diskette.

Instead, insert the Attache DOS diskette in Drive A and the application diskette in Drive B. Boot the system and then change the logged drive to Drive B. Follow the software manufacturer's instructions for activating the program.

Some programs may instruct you to perform installation procedures prior to activating the program. Follow the manufacturer's instructions for installation except where instructed to copy the operating system onto that diskette.

Do not attempt to copy the Attache MS-DOS operating system onto the application diskette. Attache's IO.SYS file is larger than the IBM-PC's IO.SYS file and will not be copied in its entirety.

Instead, insert the Attache DOS diskette in Drive A and a blank diskette in Drive B. Then format that diskette with the command:

```
FORMAT B:/S
```

The /S switch in the Format command copies the operating system to the newly formatted diskette.

Next insert the newly formatted diskette in Drive A and the diskette containing the application program in Drive B. Copy the files from the application diskette in Drive B to the newly-formatted diskette in Drive A using the command:

```
COPY B:*.* A:
```

The diskette in Drive A will now contain the application software and the Attache MS-DOS operating system. This diskette can be booted in Attache 8:16. Insert this diskette in Drive A and boot the system. Then activate the application program.

Note: Do not use DISKCOPY to copy the application program to the Attache-formatted diskette. DISKCOPY makes a blind copy of the entire diskette including the PC-DOS operating system. Additionally, DISKCOPY does not allow for different formats among diskettes in the copy operation.

## Attache 96 TPI Drive Option

Attache's 96 tpi (tracks-per-inch) drive option allows you to store more than twice the information on a CP/M-formatted diskette as the standard 48 tpi drive. In addition, the 96 tpi drive can be configured via software to read and write diskettes in both the 48 tpi and 96 tpi formats. The default configuration is 96 tpi for both drives.

The CONFIG96.COM program, which is supplied with the 96 tpi drive option, allows you to configure each diskette drive for either 48 tpi or 96 tpi diskettes at any time.

## 96 TPI Format Specifications

When formatted for CP/M, disketes are written and read in the standard Attache format of either 48 or 96 tracks-per-inch, dual-sided, dual-density, 10 sectors per track.

## Configuring 96 TPI Diskette Drives

To use 48 tpi diskettes, one or both of your 96 tpi drives must be configured for 48 tpi diskettes. This is done with the CONFIG96 program. Instructions for using CONFIG96 are as follows:

1. Insert a diskette containing CONFIG96.COM in Drive A and boot the system.

2. With the cursor at A>, type **CONFIG96** and press **RETURN**.

3. The following menu is displayed:

```
M A I N   M E N U  USE ARROW KEYS TO MAKE SELECTION

A:/B:=96     A:/B:=48     A:=96 B:=48     A:=48 B:=96     EXIT


BEFORE CONTINUING, MAKE SURE THAT DRIVE A: CONTAINS A DISK
OF THE CORRECT TYPE AND THAT IT HAS A SYSTEM ON IT.

PRESS RETURN AFTER YOU ARE SURE OF THIS.
```

4. The current configuration (in this case the default A:/B:=96) is highlighted. Use the left and right arrow keys to select an option.

   The selected configuration remains in effect until the system is rebooted. The default configuration (A:/B:=96 tpi) is set when the system is rebooted.

   To configure both drives for 48 tpi diskettes, select A:/B:=48. Insert a 48 tpi diskette containing CP/M in Drive A and press **RETURN**.

   To configure Drive A for 96 tpi diskettes and Drive B for 48 tpi diskettes, select A:=96 B:=48 and press **RETURN**.

   To configure Drive A for 48 tpi diskettes and Drive B for 96 tpi diskettes, select A:=48 B:=96. Insert a 48 tpi diskette containing CP/M in Drive A and press **RETURN**.

   To exit the program without changing the drive configuration, select EXIT and press **RETURN**.

   Drives may be reconfigured as needed by following the same procedure.

## 96 TPI Restrictions

Only 48 tpi diskettes may be used in a drive that has been configured to 48 tpi. Only 96 tpi diskettes may be used in a drive that has been configured to 96 tpi. A disk error will occur if the diskette format does not correspond to the drive configuration. If this occurs, boot the system to return to a 96 tpi drive configuration and execute CONFIG96 if necessary.

The DISKCOPY and BACKUP programs cannot be used to copy a diskette from a drive with one configuration to a diskette in a drive with a different configuration. SYSDUP may not be used to copy the operating system from a diskette with one format to a diskette with a different format. Files may be copied one at a time, however. Wild cards, such as PIP A:=B:*.*, are also acceptable.

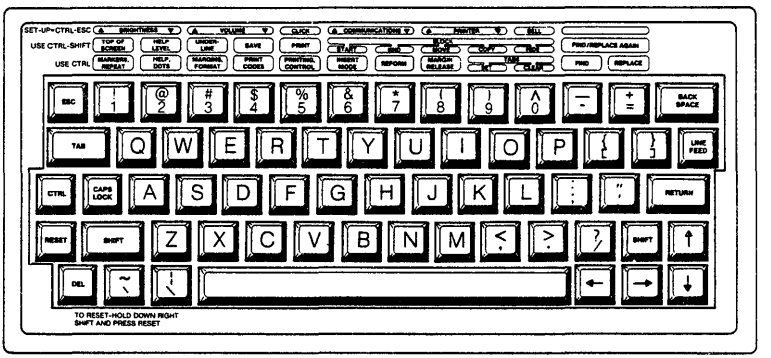
When files are copied from a 96 tpi diskette to a 48 tpi diskette, information may be lost if the files will not fit on the 48 tpi diskette. Check the size of the files and the available space on the 48 tpi diskette before attempting to copy the files.

Some diskettes may not be capable of handling 96 tpi formats. Consult your dealer before using a particular type of diskette in your 96 tpi drive.

# Operator's Guide

## Keyboard

# Keyboard




Attache 8:16's keyboard includes all of the standard ASCII typewriter keys laid out in the IBM Selectric™ configuration, plus additional keys for cursor control, text deletion, and keyboard multi-functions. Most keys enter an auto-repeat mode if depressed for more than 1/2 second.

In addition to standard ASCII keyboard functions, Attache 8:16 keys can be switched to alternate modes. This allows each key to perform different functions for specific software programs.

For example, the keyboard can be used as a standard ASCII keyboard, a dedicated WordStar-Plus word processing keyboard, or a simulated IBM-PC keyboard. All three are loadable device drivers under MS-DOS.

Keyboard modes include the default ASCII Mode for standard typewriter keys, WordStar Mode for dedicated word processing functions, IBM-PC Mode to simulate the IBM-PC keyboard in MS-DOS, 10-Key Mode for a simulated 10-key numeric and mathematical function pad, and Set-Up Mode to access Valet programs, change screen brightness, keyboard volume, and serial port baud rates.

10-Key Mode and Set-Up Mode can be activated at any time when either CP/M or MS-DOS are loaded. WordStar Mode is automatically activated whenever WordStar-Plus software is loaded. IBM-PC Mode is active any time MS-DOS is loaded (except when WordStar Mode is active). The default ASCII Mode is always active except when another mode has been activated.

## Attache 8:16 Keys

The Attache 8:16 keyboard contains the full alphanumeric key set augmented with cursor direction, delete, and other keys required to implement the full set of ASCII communication codes.

Attache 8:16's keyboard contains the following keys:

**Alphanumerics** Standard ASCII letter keys, number keys, and typographical keys.

**SHIFT** Types in upper case when an alphanumeric key is pressed at the same time. **SHIFT** keys are also used as modifiers with other keys.

**CTRL** Used as a modifier key in conjunction with other keys to activate keyboard multi-functions or commands. Specific functions for the **CTRL** key are dictated by each individual software package, but the **CTRL** key is always pressed at the same time as another key to activate a function.

**RETURN** "Enters" keyboard commands and is used as a typewriter carriage return or line feed.

**ESC** Used by software to interrupt processing, answer a system prompt, or escape from an error condition. **ESC** is also used with other modifier keys to activate keyboard multi-functions.

**CAPS LOCK** Locks and unlocks upper case. Letter keys (but not number and symbol keys) are locked into upper case when the **CAPS LOCK** key is depressed. Pressing **CAPS LOCK** again returns the letter keys to lower case. **CAPS LOCK** is also used with **CTRL** to activate or deactivate 10-Key Mode.

**LINE FEED** Used by software that differentiates carriage returns and line feeds, and also takes Attache from Terminal Mode into Monitor Mode.

**TAB** Similar to the standard typewriter tab, and also used as a command key by some software.

**RESET** Used with the **SHIFT** key on the right side of the keyboard to reinitialize or "reboot" the system.

**BACK SPACE** Moves the cursor to the left one position.

**DEL** Moves the cursor to the left one position and deletes the character at that position. **DEL** is also used with **CTRL** and **SHIFT** to perform word processing delete functions.

**ARROW keys** Move the cursor on the screen.

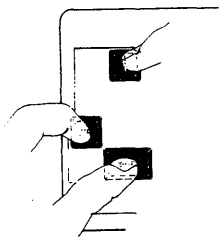
## Multi-Function Keys

Keyboard modes are activated when modifier keys such as **CTRL**, **SHIFT**, **CAPS LOCK**, and **ESC** are pressed at the same time as an alphanumeric typewriter key.

Different combinations of these keys cause the alphanumeric keys to perform functions in addition to those functions that are performed when the keys are pressed alone.

This "multi-function" capability allows each key to have more than one function.

To activate a keyboard multi-function, press down on the modifier key or keys (such as **CTRL** and **SHIFT**).



Then press the alphanumeric key (such as **1**) while the modifier keys are still depressed.

For example, if you press **CTRL** and **ESC** at the same time, Valet's Set-Up Mode is activated and the number keys are used to modify the screen brightness, keyboard sound, and serial port baud rates. The number keys remain in Set-up Mode until you press **CTRL** and **ESC** simultaneously again.

If you are using WordStar-Plus and press **CTRL** and **6** at the same time, WordStar's Insert Mode is activated for word processing until you press **CTRL 6** again.

Similarly, pressing **CTRL SHIFT** and **6** at the same time during word processing activates a block start command at the cursor position on the display screen.

If you are using MS-DOS, pressing **CTRL** and **1** at the same time activates the IBM-PC "F1" key function. All IBM-PC keyboard commands and functions can be activated with multi-function keys whenever you are working with programs using MS-DOS.

However, if you using WordStar-Plus under MS-DOS, WordStar-Plus multi-function commands are active and IBM-PC multi-function commands are deactivated until you exit from the word processing system.

Keyboard multifunctions for Attache 8:16 are listed on the following page.

Keyboard multi-functions are as follows:

| | |
|---|---|
| **SHIFT + <any alphanumeric key>** | Types upper case. |
| **SHIFT + RESET** | Reboots the operating system. |
| **CTRL + CAPS LOCK** | Activates and deactivates 10-Key Mode. |
| **CTRL + ESC** | Activates the Valet Set-up Mode. Pressing a number key activates the function for that number as described on the top row of the keyboard template. |
| **CTRL + <any numeric key>** | When pressed while the computer is under MS-DOS, activates the corresponding IBM-PC key function as described on the PC keyboard template (F1-F10).<br><br>When pressed during WordStar, activates the corresponding word processing function as described on the Attache keyboard template. |
| **CTRL + SHIFT + <any numeric>** | When pressed while the computer is under MS-DOS, activates the corresponding IBM-PC key function as described on the PC keyboard template (F11-F20).<br><br>When pressed during WordStar, activates the corresponding word processing function as described on the Attache keyboard template. |
| **CTRL + TAB + <any numeric>** | When pressed while the computer is under MS-DOS, activates the corresponding IBM-PC key function as described on the PC keyboard template (F21-F30). |
| **SHIFT + ESC + <any numeric>** | When pressed while the computer is under MS-DOS, activates the corresponding IBM-PC key function as described on the PC keyboard template (F31-F40). |

Note: Additional keyboard multi-functions that are used for IBM-PC keyboard emulation are discussed in the Programmer's Reference section of this manual.

## Keyboard Templates

Keyboard templates are command tables that can be attached to the keyboard for quick reference. Attache keyboard templates provide command references for activating and using Set-Up Mode, WordStar Mode, and IBM-PC Mode.

Attache 8:16 includes two keyboard templates: the Attache keyboard template, which is molded to the keyboard, and the Attache PC keyboard template, which attaches to the keyboard. These templates are described on the following pages.

## 10-Key Mode - Using the 10-Key Pad

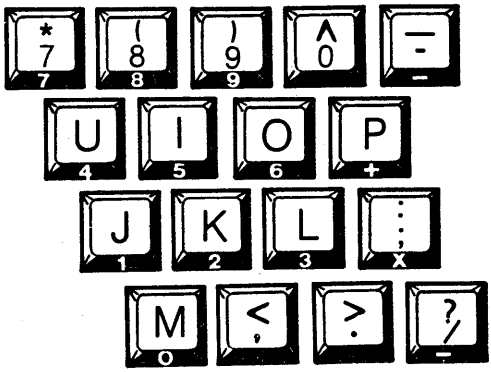
The Attache keyboard may be used as a 10-key pad for entering numerical figures. Certain letter keys are converted to numbers when 10-Key Mode is activated and the letter keys are used in lower case. Upper case letters are not affected by 10-Key mode.

10-Key Mode is activated by pressing **CTRL** and **CAPS LOCK** at the same time, and deactivated by pressing **CAPS LOCK** to return to upper case or **CTRL** and **CAPS LOCK** to return to lower case.

Note: Decals are provided with Attache 8:16 to mark the appropriate keys for 10-Key Mode, as illustrated below. To apply these decals, insert a piece of wire under the key, pull to remove the key, apply the decal to the front of the key, and reinstall the key.

**m = 0**
**j = 1**
**k = 2**
**l = 3**
**u = 4**
**i = 5**
**o = 6**
**7 = 7**
**8 = 8**
**9 = 9**

**- = - (minus)**
**p = + (plus)**
**; = * (multiply)**
**/ = / (divide)**



## Set-up Mode

Set-up Mode controls functions on the top row of the keyboard template, displays the date and time, and provides access to the Valet Main Menu. Set-up Mode may be activated at any time when the unit is powered up and the operating system has been booted, even while other programs are being used.

The program that is interrupted remains on the screen while Set-Up Mode is activated. The screen returns to its previous function when you exit from Set-up Mode.

Values that you set in Set-Up Mode remain constant until you change them, even if the unit is powered down.

## Activating Set-Up Mode

Set-up Mode may be activated at any time when the unit is powered up and the operating system has been booted, even while other programs are being used.

To activate Set-Up Mode:

1. Press **CTRL** and **ESC** at the same time. The Set-Up Mode display will appear on the bottom two rows of the screen.

| TIME | DATE | BRIGHT | VOLUME | KEY | COMM | PRINTER | BELL |
|---|---|---|---|---|---|---|---|
| 13:52:26 | 10/14 | 27 | 8 | BEEP1 | 2400 | 1200 | ON |

2a. Press the number key that corresponds to the specific operation you want to perform, as described on the top row of the keyboard template and displayed at the bottom of the Set-Up Mode screen,

or...

2b. Press **TAB** if you want to display the Valet Menu.

3. Press **ESC** to exit Set-Up Mode and return the screen to its previous function.

## Display Time and Date

The date and time are displayed whenever Set-up Mode is activated. Press **ESC** to exit Set-Up Mode and return to the interrupted program. Note: Time and date may be changed when MS-DOS is booted or by using the MS-DOS "Time" and "Date" commands.

## Activate Valet Programs

Valet's Main Menu is displayed by activating Set-Up Mode and pressing the **TAB** key. Valet functions are activated from this menu. Valet functions are discussed in the Valet Guide.

## Vary Screen Brightness

Activate Set-up Mode. Press **1** to increase the brightness of the screen display or **2** to decrease the brightness. Keep pressing for more or less brightness. Press **ESC** to exit Set-Up Mode.

## Vary Keyboard Volume

Activate Set-up Mode. Press **3** to increase the volume of the keyboard click or **4** to decrease the volume. Keep pressing for more or less volume. Press **ESC** to exit Set-Up Mode.

## Vary Keyboard Click Sound

Activate Set-up Mode. Press **5** to change the click sound. A different sound is heard each time the key is pressed. Four different clicks (or "off") are available. Press **ESC** to exit Set-Up Mode.

## Modify Communications Baud Rate

Activate Set-up Mode. Press **6** to increase the baud rate or **7** to decrease the baud rate. The setting is increased or decreased by one increment each time the key is pressed. Press **ESC** to exit Set-Up Mode.

## Modify Printer Baud Rate

Activate Set-up Mode. Press **8** to increase the baud rate or **9** to decrease the baud rate. The setting is increased or decreased by one increment each time the key is pressed. Press **ESC** to exit Set-Up Mode.

**Baud Rate Selections for Attache Serial Ports**

| 19200 | 9600 | 4800 | 2400 | 1200 | 600 | 300 | 150 | 134.5 | 110 | 75 |
|---|---|---|---|---|---|---|---|---|---|---|

## Turn Keyboard Bell On or Off

Activate Set-up Mode. Press **0** to turn the bell on or off. Press **ESC** to exit Set-Up Mode.

## WordStar Mode

WordStar Mode converts the top row of the keyboard to perform word processing functions that are identified on the Attache keyboard template. This template is molded to the keyboard.

Word processing functions are activated in WordStar Mode by pressing **CTRL** and a number key at the same time, or by pressing **CTRL** and **SHIFT** and a number key at the same time.

WordStar Mode is active when you are using either MS-DOS or CP/M to process a data file with WordStar-Plus.

## IBM-PC Mode

IBM-PC Mode converts Attache 8:16 keys to perform equivalent IBM-PC keyboard functions that are identified on the Attache PC keyboard template. This template attaches to the Attache keyboard for reference.

All IBM-PC keyboard functions can be performed on Attache 8:16's keyboard when this mode is active. Most of these functions are performed with simple multi-function commands.

For example, the IBM-PC function key F1 is activated on Attache 8:16 by pressing **CTRL** and **1**. Where the F11 function is activated with **SHIFT** F1 on the IBM-PC, it is **CTRL SHIFT 1** on Attache 8:16.

IBM-PC Mode is active whenever you are operating under MS-DOS (except during WordStar).

Note: Additional keyboard multi-functions that are used for IBM-PC keyboard emulation are discussed in the Programmer's Reference section of this manual.

## The Attache Keyboard Template

The Attache keyboard template, which is molded to the keyboard, identifies Valet Set-Up Mode functions and WordStar-Plus word processing functions that may be activated with multi-function keys.

The function described on the template is activated with the number key directly below it. The required modifier keys (**CTRL**, **SHIFT**, or **ESC**) for the function are identified on the left side of the template.

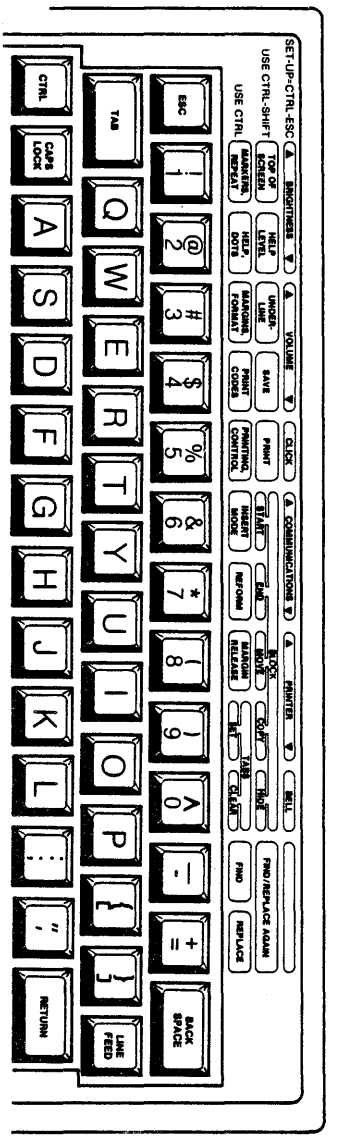
Valet Set-Up Mode functions are described on the top row of the template.

These functions are activated by pressing **CTRL** and **ESC** at the same time, and then pressing the appropriate number key for the function identified on the template. Pressing **ESC** again returns the system to its previous operation.

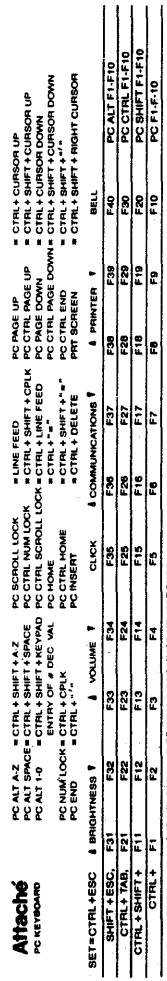
WordStar-Plus functions are described on the lower two rows of the template.

Functions described on the bottom row of the template are activated by pressing **CTRL** and the appropriate number at the same time.

Functions described on the middle row of the template are activated by pressing **CTRL** and **SHIFT** and the appropriate number at the same time.



# The Attache PC Keyboard Template




The Attache PC keyboard template provides a quick reference for key sequences that emulate IBM-PC keyboard functions when operating under MS-DOS.

The Attache PC template can be attached to the keyboard by inserting the template over the keyboard latches at the top of the keyboard.

An example of the IBM-PC keyboard emulation is when a software program written for the IBM-PC tells you to press the F1 key.

There is no such key on the Attache 8:16, but the F1 function is performed when you press **CTRL** and 1 at the same time.

Note: IBM-PC keyboard functions that can be emulated on the Attache 8:16 keyboard are listed and described in the IBM-PC keyboard conversion tables in the Programmer's Reference section in this manual.

# Operator's Guide

## Ports

# Serial Ports

## Overview

Two serial ports are located on the back of Attache 8:16 labeled Printer and Communications. Both are 15-pin RS-422/423 connector standard ports, but they provide signal lines for asynchronous connection to RS-232C devices.

Peripheral equipment may be quickly attached to the unit through these ports. However, some software requires that you run a separate software installation program to configure the ports for the specific peripheral that is attached.

Since most peripheral equipment currently uses the RS-232C interface, Attache is delivered with jumpers installed for RS-232C. The Attache Cable Set (available from your dealer) allows quick interface with RS-232C serial peripherals.

Within the next several years, many peripherals will be developed to interface with the new RS-422 and RS-423 standards. These new interfaces allow much higher baud rates than RS-232C.

Attache 8:16 provides optimum flexibility for attaching peripheral equipment because RS-422/RS-423 and RS-232C interfaces are already built into the unit. Your dealer can change jumpers on the processor board to configure RS-232C, RS-422, or RS-423.

## Connecting Cables and Peripherals

The Attache Cable Set, available from your dealer, consists of three cables. Two of the cables are labeled "RS-232 Local" and the other cable is labeled "RS-232 Comm."

The local cables are typically connected to the Printer port so that Attache 8:16 appears as a Data Communications Equipment (DCE) device to the peripheral and the peripheral appears as a Data Terminal Equipment (DTE) device to Attache.

The one-foot local cable (RS-232 female) connects Attache 8:16 to any standard RS-232 cable and to any serial device with RS-232 male connectors (such as the NEC Spinwriter-type printer). The ten-foot local cable (RS-232 male) connects to local peripheral devices with female connectors (such as the TI-810 or Epson MX series of printers).

The Comm cables are typically connected to the Communications port so that Attache appears as a DTE device to the communicating device, and the communicating device appears as a DCE device to Attache. Two Attache's may be interconnected for communications by connecting the Comm cable on one system to the Local one-foot cable on the other system.

## Accessing the Printer Port

The printer port on the Attache 8:16 is an RS232-C serial port. Because the IBM-PC is designed to work with a parallel printer port, the Attache 8:16 software emulates a Centronics-compatible parallel printer port. This enables software programs that incorporate print jobs expecting a parallel printer to run without modification on an Attache 8:16. Note that you still must attach a serial printer (not a parallel printer) to the printer port.

## Selecting Baud Rates for Transmission

Baud rates for signal transmission are software selectable for each port from the keyboard Set-up Mode. Once set, the baud rates remain constant until they are reset, even if the unit is turned off.

To select baud rates from the keyboard, activate Set-Up Mode by pressing **CTRL** and **ESC** at the same time. Then use the appropriate number keys to increase or decrease the baud rate setting for each port.

Baud rate selections are shown below. After you have selected the desired baud rate, exit Set-Up Mode by pressing **ESC**.

**Baud Rate Selections for Attache Serial Ports:**

| | | | | | |
|---|---|---|---|---|---|
| 19200 | 9600 | 4800 | 2400 | 1200 | |
| 600 | 300 | 150 | 134.5 | 110 | 75 |

## Wiring Cables for Attache Ports

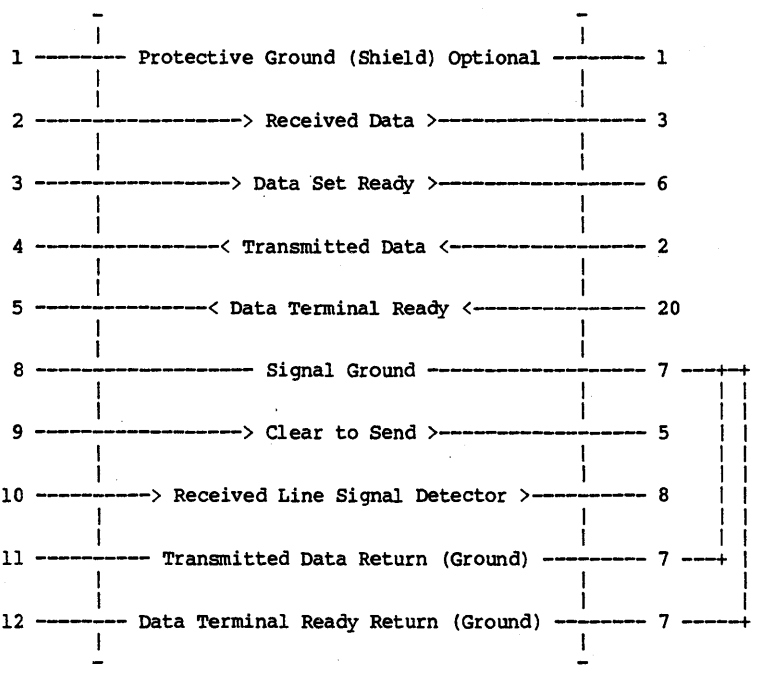
If you are making your own cables for Attache and not using the standard cable set available from your dealer, the diagrams on the following pages represent the necessary pin connections required for the standard RS-232 connector and a 15-pin male connector.

Note that connections for the Local (printer) port are not the same as for the Comm (communications) port.

## Local (Printer) Cable Pin Connections

**Local RS-232 (attachment for printers and other local devices)**

**Note:** Signal names are referenced to DTE. For example, "Received Data" refers to DTE (RS-232C) input.



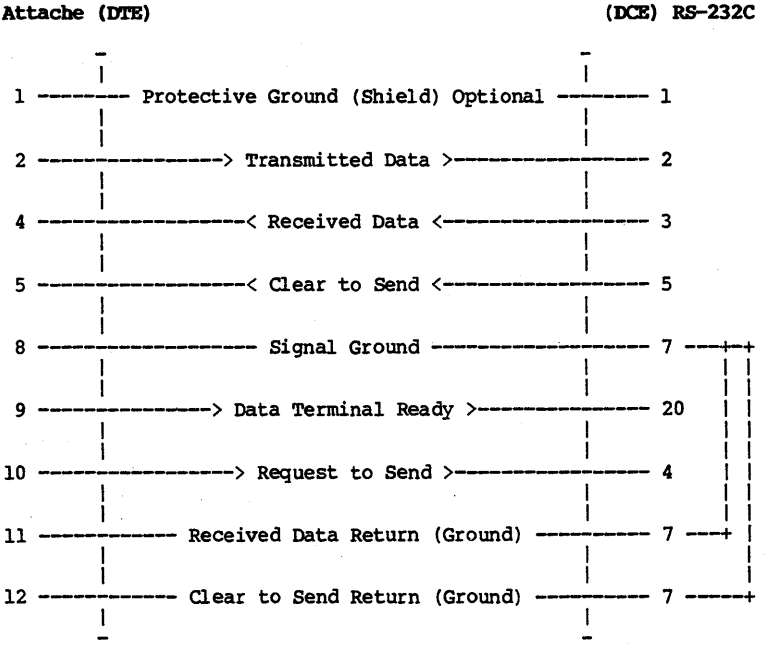

**15 Pin Male Connector** (DE-15P)

**RS-232 Connector** (DB-25P)

## Comm (Communications) Cable Pin Connections

**Communications RS-232 (attachment to another computer or modem)**

**Note:** Signal names are referenced to DTE. For example, "Received Data" refers to DTE (Attache) input.



## IBM-PC Compatibility

IBM uses the Interrupt 17H and Interrupt 14H software routines to interface with the printer and communications ports. Parameters and options for each interrupt are described below.

## Printer Port - Interrupt 17H

The routine to access the printer port is Interrupt 17 (INT 17H). The 8086 registers identify the following options:

**AH = 0** **Print the character in AL.** On return, AH = 1 if a time out occurred after 10 seconds and the character did not print. Other bits are set as described in AH = 2.

**AH = 1** **Initialize the printer port (i.e., flush print buffer).** On return, AH is set with the printer status.

**AH = 2** **Read the printer status into AH.** Bits are as follows:

7 - Busy: Equal to one if output buffer full (either full, or XON/XOFF enabled and XOFF received)
6 - Acknowledge: Always equal to zero
5 - Out of Paper: Always equal to zero
4 - Selected: Always equal to one
3 - I/O error: Always equal to zero
2 - not used
1 - not used
0 - Time out: Usually equal to zero, unless a time-out occurs after 10 seconds and the character has not printed.

**DX = 0** **Printer to be used.** Only DX = 0 (one printer) is supported.

## Communications Port - Interrupt 14H

Communications through the serial port is handled through the Interrupt 14H routine. Serial device protocols are described at the end of this section.

Interrupt 14H (INT 14H) accesses the RS-232 communications port. The 8086 registers identify the following options:

**DX = 0** **Parameter indicating the RS-232 port.** DX = 0 (one Comm port) and DX = 1 (printer port serving as a second Comm port) are supported; other DX codes are ignored.

**AH = 0** **Initialize the communications port.** AL contains the following initialization parameters:

| Bit: 7 6 5 | 4 3 | 2 | 1 0 |
|---|---|---|---|
| --Baud Rate-- | --Parity-- | --Stopbit-- | --Word Length-- |
| 0 0 0 = 110 | x 0 = none | 0 = 1 | 1 0 = 7 bits |
| 0 0 1 150 | 0 1 odd | 1 = 2 | 1 1 = 8 bits |
| 0 1 0 300 | 1 1 even | | |
| 0 1 1 600 | | | |
| 1 0 0 1200 | | | |
| 1 0 1 2400 | | | |
| 1 1 0 4800 | | | |
| 1 1 1 9600 | | | |

AL returns status in AX (see AH = 3 below).

**Note:** Use of Baud rate 75, 134.5, or 19200 is not IBM-compatible and must be handled through Set-up Mode.

**AH = 1** **Send character in AL over the communications line.** This preserves the AL register.

On exit, bit 7 of AH is set if the routine was unable to transmit the byte of data over the line. If bit 7 of AH is not set, the rest of AH is set as a status request reflecting the current status of the line.

**AH = 2** **Receive a character in AL from the communications line before returning to caller.**

On exit, AH has the current line status as set by the status routine. The only bits left on are error bits 7, 4, 3, 2, and 1. If AH has bit 7 on, the remaining bits are unpredictable. AH is non-zero only if an error occurred.

**AH = 3** **Return communications port status in AX.** AH contains line status in bits and AL contains modem status in bits as shown in the following tables.

AH contains line status in bits:

| | |
|---|---|
| 7 | Time out |
| 6 | Transmit shift register empty (always = 0) |
| 5 | Transmit buffer empty (TBE) |
| 4 | Break detect |
| 3 | Framing error |
| 2 | Parity error |
| 1 | Overrun error |
| 0 | Data ready |

| AL contains modem status in bits: | | | Always: |
|---|---|---|---|
| 7 | RLSD | - received line signal detect | 0 |
| 6 | RI | - ring indicate | 0 |
| 5 | DSR | - data set ready | 1 |
| 4 | CTS | - clear to send | |
| 3 | DSLSD | - delta receive line signal detect | 0 |
| 2 | DRD | - trailing edge ring detector | 0 |
| 1 | DDSR | - delta data set ready | 0 |
| 0 | DCTS | - delta clear to send | 0 |

## Serial Device Protocols

The three protocols for the two serial devices PRN: and AUX: are CTS, NONE, and XON/XOFF. The defaults are CTS for PRN: and NONE for AUX:. To change these, use the following ANSI ESC sequence:

**ESC]<number><port>**

where <number> is 0 for NONE, 1 for CTS, and 2 for XON/XOFF. The <port> may be a greater-than sign (>) or a right arrow to indicate the printer port, or a less-than sign (<) or a left arrow to indicate the communications port.

For example, to enable XON/XOFF protocol for the printer port, specify the following ESC sequence:

**ESC]2>**

XON/XOFF causes data output to stop if a CTRL S (XOFF) is sent to the input side of PRN:. Any other character causes output to resume. CTS causes data output to stop whenever the CTS line is false. NONE outputs data blindly.

If XON/XOFF is enabled, it affects the Transmit Buffer Empty (TBE) bit. The TBE bit is shown as AH bit 5 under the Interrupt 14H AH=3 option above. You do **not** want XON/XOFF enabled when transferring binary data (XON/XOFF is disabled by default). If XON/XOFF is enabled and XOFF is received, the transmit buffer fills up and returns TBE false. When an XON character is received, character transmission is resumed and TBE is reset to true.

AH bit 7 under the Interrupt 17H AH=2 option operates the same as TBE, but is opposite in polarity. For example, when an XON character is received, character transmission is resumed and BUSY is set to false.

# Operator's Guide

## Programming

# Programmer's Reference

## Overview

This chapter is designed for use as a reference by programmers and includes the following types of information:

- Accessing the Display Driver - Interrupt 10H
- Compatibility with Color Monitors and the IBM-PC
- Accessing the Display with ESC Codes
- Cursor Functions
- Keyboard Functions, including Keyboard Modes, Special Key Sequences, Interrupt 16 Options, and Keyboard Reassignment
- The Attache 8:16 Keyboard, including an ASCII Mode chart, ASCII Character Codes chart, Special Key Combinations, IBM-PC Mode chart, and an IBM-PC Keyboard Conversion Table
- Accessing the Sound Generator
- MS-DOS Interrupts and Function Requests

## Accessing the Display Driver - Interrupt 10H

Interrupt 10 (INT 10H) is a routine which handles the CRT interface. The routine contains 16 function choices. Load the AH register with the appropriate byte identified in the following list, then call INT 10H.

**AH = 0** **Set Mode.** Sets the display's mode of operation. Load the AL register with the value that specifies one of the following options. Choosing any of the color options selects the Black and White counterpart:

```
AL = 0  40x25 (double-size character) B/W display
AL = 1  40x25 color (automatically selects 40x25 B/W)
AL = 2  80x25 (alphanumeric character) B/W display
AL = 3  80x25 color (automatically selects 80x25 B/W)
AL = 4  320x200 pixel color display (selects 320x200 BW)
AL = 5  320x200 pixel (medium resolution) B/W display
AL = 6  640x200 pixel (high resolution) B/W display
```

**AH = 1** **Set cursor type.** Not supported.

**AH = 2** **Set cursor position.**
DH = the row 0 - 24
DL = the column 0 - 39 (double-size) or 0 - 79
BH = the page number 0 - 3 (must be zero for graphics)

**AH = 3** **Return cursor position.** Returns the cursor position in the following registers, with 0,0 the upper left corner:
BH = page number (you supply). Must be 0 for Graphics mode. The system returns:
DH = the row
DL = the column
CH = cursor start line
CL = cursor end line

**AH = 4** **Read light pen.** Not supported. Returns zeros in registers DH, DL, CH, and BX.

**AH = 5** **Set page number.** Selects the page number placed in AL. Valid entries are 0 - 3, alpha modes only.

**AH = 6** **Scroll up.** Scrolls an area of the screen up.
AL = number of lines to scroll. Input lines blanked at bottom of window (0 means blank entire window)
CH,CL = row,column of upper left corner of scroll
DH,DL = row,column of lower right corner of scroll
BH = attribute to be used on blank line

**AH = 7** **Scroll down.** Scrolls an area of the screen down.
AL = number of lines to scroll. Input lines blanked at top of window (0 means blank entire window)
CH,CL = row,column of upper left corner of scroll
DH,DL = row,column of lower right corner of scroll
BH = attribute to be used on blank line

**AH = 8** **Read character at current cursor position.**
BH = the page number (you supply). Valid for alpha modes only. The system returns:
AL = the character read upon return
AH = the attribute of the characterread upon return (alpha modes only)

**AH = 9** **Write character at current cursor position.**
BH = the display page (valid for alpha modes only)
CX = the count of characters to write
AL = the character to write
BL = the attribute of the character

**AH = 10** **Write character only at current cursor position.**
BH = the display page (valid for alpha modes only)
CX = the count of characters to write
AL = the character to write

**AH = 11** **Set color palette.** Not supported.

**AH = 12** **Write dot.** Writes a dot to the graphics display.
DX = the row number
CX = the column number
AL = the color value

**AH = 13 Read dot.** Reads a dot from the graphic display.
DX = the row number
CX = the column number
AL = contains the dot upon return

**AH = 14 Write teletype to active page.** Writes an ASCII character to the active display page.
AL = the character to write
BL = the color value (note: the screen width is controlled by the previous mode set)

**AH = 15 Current video state.** Returns the current video state.
AL = the current mode (as described in AH = 0)
AH = the number of character columns on the screen
BH = the current active display page

Alphanumeric modes support four pages numbered from zero to three. This allows you to paint a display page in memory.

Graphic modes support only one page (page 0). If you attempt to select a display or reference page that is too large for the current video mode, an error message is displayed on the selected screen.

"Write character" in graphics mode only works for characters contained on the same row. Continuation to succeeding lines does not work. For "read/write" character, only the first 128 characters (0-127) out of 256 may be output in any graphics mode. To read or write the second 128 characters (128-255), you must initialize the pointer at Interrupt 1FH (currently at location 0007CH) to point to the 1K byte table that contains the pointers for the second 128 characters.

## Compatibility with Color Monitors

Attache 8:16 does not support color modes. The following information is provided to assist in writing IBM-compatible programs.

The IBM-PC has eight video modes, as follows:

| Mode: | Description: |
|---|---|
| 0 => | Text, 25 rows by 40 columns, monochrome |
| 1 => | Text, 25 rows by 40 columns, color |
| 2 => | Text, 25 rows by 80 columns, monochrome |
| 3 => | Text, 25 rows by 80 columns, color |
| 4 => | Graphics, 200 dot rows by 320 dot columns, color |
| 5 => | Graphics, 200 dot rows by 320 dot columns, monochrome |
| 6 => | Graphics, 200 dot rows by 640 dot columns, color |
| 7 => | Wrap-around mode enabled |

Attache 8:16 video modes 0 through 3 support four pages numbered from 0 to 3. The remaining modes support only one page (page 0). If you attempt to select a display or reference page that is too large for the current video mode, an error message is sent to the selected screen.

### Eight-Bit Code for Video Attributes

An eight-bit code defines video attributes as follows:

**bit 0-2 — Foreground color code**
**bit 3 — Intensity**
**bit 4-6 — Background color code**
**bit 7 — Blink**

### IBM Color Codes

The IBM color adaptor recognizes a 5-bit code for the background color, with the bits defined as follows:

**bit 0 => Blue**
**bit 1 => Green**
**bit 2 => Red**
**bit 3 => Intensity**
**bit 4 => Blink**

| LOW INTENSITY COLORS: | | HIGH INTENSITY COLORS: | |
|---|---|---|---|
| 00H | 00000 -- 0 -- BLACK | 08H | 01000 -- 8 -- BLACK |
| 01H | 00001 -- 1 -- BLUE | 09H | 01001 -- 9 -- BLUE |
| 02H | 00010 -- 2 -- GREEN | 0AH | 01010 -- 10-- GREEN |
| 03H | 00011 -- 3 -- YELLOW | 0BH | 01011 -- 11-- YELLOW |
| 04H | 00100 -- 4 -- RED | 0CH | 01100 -- 12-- RED |
| 05H | 00101 -- 5 -- MAGENTA | 0DH | 01101 -- 13-- MAGENTA |
| 06H | 00110 -- 6 -- CYAN | 0EH | 01110 -- 14-- CYAN |
| 07H | 00111 -- 7 -- WHITE | 0FH | 01111 -- 15-- WHITE |

Bits 3 and 4 of the 5-bit code are not recognized by all color monitors. Bit 3 is used to specify intensity. Bit 4 specifies blink: if Bit 4 is 1, the character blinks; if Bit 4 is 0, the character is steady. Monochrome display screens produce the following results:

| Colornum | Color | Result |
|---|---|---|
| 0 | 0 | BLACK |
| 0 | 1 | UNDERLINE |
| 0 | 7 | WHITE |
| 0 | 15 | HIGH INTENSITY WHITE |

Bit 4 can also be used with the color codes listed above to specify the blinking option. For example, 31 (1F hex) produces high intensity white, blinking characters.

**IBM Color Palettes**

The IBM color adaptor provides two palettes, each of which contains four colors. The palettes are defined as follows:

| Color | Palette 0 | Palette 1 |
|---|---|---|
| 0 | Background | Background |
| 1 | Green | Cyan |
| 2 | Red | Magenta |
| 3 | Yellow | White |

## Accessing the Display with ESC Codes

An ANSI escape sequence consists of an **ESC** key followed by a series of characters and numbers. It can be used to define functions to MS-DOS. For example, an escape sequence can allow you to reassign keys, change graphics functions and modes, erase lines or screens, or affect cursor movement as shown below.

**Notes:**

1. Spaces appear between the characters of the escape sequence for purposes of readability only. Do not include spaces when you type these escape sequences.

2. The default value is used when no explicit value or when a value of zero is specified.

3. <n> represents a "numeric parameter." This is a decimal number specified with ASCII digits (0 - 9). The maximum value that can be specified is 255.

4. <s> represents a "selective parameter," which is a decimal number that can be used to select a subfunction. Multiple subfunctions may be selected by separating the parameters with semicolons. Up to 16 semicolons may be used at one time. A semicolon not preceded by a number is equivalent to the default value.

## Cursor Functions

The following escape sequences affect the cursor position on the screen.

**Scrolling Region - Set Margins**

ESC [ <t> ; <b> ; r

Sets the scrolling region (margins) to the lines specified for the top of the region <t> and the bottom <b>. The region must be two or more lines. Once set, the cursor cannot be moved beyond the margins except with the absolute cursor position command (see below) unless origin mode has been selected (see "Modes of Operation" below). If <t> and <b> are not specified or are 0 and 1, they default to the physical top and bottom of the screen. The sequence **ESC[r** effectively clears the margins.

**CUP - Absolute Cursor Position**

ESC [ <l> ; <c> H

**HVP - Horizontal and Vertical Position**

ESC [ <l> ; <c> f

CUP and HVP move the cursor to the position specified by the parameters, where the first parameter <l> specifies the line number and the second parameter <c> specifies the column number. The default value is 1. If no parameters are specified, the cursor is moved to the home position.

If a scrolling region has been specified and origin mode is in effect (see "Scrolling Region" above), the cursor position is relative to the set margins (where the top margin is line 1). If the line <l> is beyond the margin, the cursor does not move. If the column <c> is beyond the margin, it is placed at the end of the (new) line.

**CUU - Cursor Up**

ESC [ <n> A

**CUD - Cursor Down**

ESC [ <n> B

These sequences move the cursor up or down one line without changing columns. The value of <n> determines the number of lines moved. The default value for <n> is 1. If wrap has not been specified, the sequence is ignored when the cursor is already on the top line (for CUU) or bottom line (for CUD). If wrap is in effect, the cursor will wraparound as necessary.

**CUF - Cursor Forward**

ESC [ <n> C

**CUB - Cursor Backward**

ESC [ <n> D

These sequences move the cursor forward or back one column without changing lines. The value of <n> determines the number of columns moved. The default value for <n> is 1. The sequence is ignored when the cursor is already in the far right column (for CUF) or far left column (for CUB) if wrap is not specified. If wrap is in effect, the cursor will wraparound as necessary.

**DSR - Device Status Report**

ESC [ 6 n

The console driver outputs a CPR sequence (see below) on receipt of the DSR escape sequence.

**CPR - Cursor Position Report (from console driver to system)**

ESC [ <l> ; <c> R

The CPR sequence reports current cursor position via standard input. The first parameter <l> specifies the current line and the second parameter <c> specifies the current column.

**SCP - Save Cursor Position**

ESC [ s

The current cursor position is saved. This cursor position can be restored with the RCP sequence (see below).

**RCP - Restore Cursor Position**

ESC [ u

This sequence restores the cursor position to the value it had when the console driver received the SCP sequence (see above). If no SCP was specified, the cursor moves to the home position.

## Erase Functions

The following escape sequences affect erase functions for the screen display or various lines.

**ED - Erase Display**

ESC [ <n> J

where <n> may be:

0 - erase to end of screen (default)
1 - erase to beginning of screen
2 - erase entire screen and place the cursor in the home position

Origin or margins do not affect this sequence. 0 and 1 options do not change the cursor position.

**EL - Erase Line**

ESC [ <n> K

where <n> may be:

0 - erase to end of line (default)
1 - erase to beginning of line
2 - erase entire line

The 0 option erases from the cursor to the end of the line (including the cursor position). None of the options affect the cursor position.

## Adding or Deleting Lines

**Insert Blank Lines**

ESC [ <n> L

This sequence inserts <n> blank lines in front of the cursor. It does not affect cursor position. <n> defaults to one. The current line and all following lines are scrolled down to make room for the new line(s). Scrolling is affected by set margins.

**Delete Lines**

ESC [ <n> M

This sequence deletes <n> lines starting at the cursor. It does not affect the cursor position. Subsequent lines are scrolled up, overwriting the current line. Blank lines are inserted at the bottom of the screen. <n> defaults to one.

## Modes of Operation

The following escape sequences affect screen graphics.

**SGR - Set Graphics Rendition**

ESC [ <s> ; ... ; <s> m

The SGR escape sequence invokes the graphic functions specified in the following table, where <s> is the number of the desired subfunction. The graphic functions remain in effect until the next occurrence of an SGR escape sequence. If no arguments are given, all attributes are cleared.

| Parameter | Parameter Subfunction | |
|---|---|---|
| 0 | All Attributes off | |
| 1 | Bold on | |
| 4 | Underscore on | (monochrome displays only) |
| 5 | Blink on | (not available) |
| 7 | Reverse Video on | |
| 8 | Concealed on | (ISO 6429 standard)* |
| 30 | Black foreground | (ISO 6429 standard)* |
| 31 | Red foreground | (ISO 6429 standard)* |
| 32 | Green foreground | (ISO 6429 standard)* |
| 33 | Yellow foreground | (ISO 6429 standard)* |
| 34 | Blue foreground | (ISO 6429 standard)* |
| 35 | Magenta foreground | (ISO 6429 standard)* |
| 36 | Cyan foreground | (ISO 6429 standard)* |
| 37 | White foreground | (ISO 6429 standard)* |
| 38 | Superscript on | |
| 39 | Subscript on | |
| 40 | Black background | (ISO 6429 standard)* |
| 41 | Red background | (ISO 6429 standard)* |
| 42 | Green background | (ISO 6429 standard)* |
| 43 | Yellow background | (ISO 6429 standard)* |
| 44 | Blue background | (ISO 6429 standard)* |
| 45 | Magenta background | (ISO 6429 standard)* |
| 46 | Cyan background | (ISO 6429 standard)* |
| 47 | White background | (ISO 6429 standard)* |
| 100 | Highlight on | |
| 101 | Strikethrough on | |

* Ignored

**SM - Set Mode**

ESC [ <s> h

**RM - Reset Mode**

ESC [ <s> l

The SM and RM escape sequences change the screen width or type (see notes below). "l" is a lowercase "L." <s> is one of the following parameters:

| Parameter | Parameter Subfunction |
|---|---|
| 0 | 40 black and white |
| 1 | 40 x 25 color |
| 2 | 80 x 25 black and white |
| 3 | 80 x 25 color |
| 4 | 320 x 200 color* |
| 5 | 320 x 200 black and white* |
| 6 | 640 x 200 black and white* |
| 7 | Wrap at end of line |
| 11 | Origin mode |

* Ignored

**Notes:**

1. 0 or 1 -- Selects 40-column mode (default). The screen is cleared and all remaining characters are displayed in double-width.

2. 2 or 3 -- Selects 80-column mode. The screen is cleared and an 80-character screen is used.

3. 4, 5, or 6 -- Ignored.

4. 7 -- Autowrap is set with **ESC[7h** to allow the cursor to wrap around the screen to the following line. To cancel the wraparound, use the sequence **ESC[7l**.

5. 11 -- The sequence **ESC[11h** enables origin mode, which causes absolute cursor positions to become relative to the set margins (if any). To disable origin mode, specify **ESC[11l**.

## Keyboard Functions

Keyboard functions include keyboard modes, special key sequences, Interrupt 16 options, and keyboard reassignment as described below. Detailed charts of the Attache 8:16 keyboard appear at the end of the keyboard section.

## Keyboard Modes

The Attache 8:16 has three different keyboard modes: ASCII, WordStar, and IBM-PC. To choose a mode, send the proper escape code as shown below:

ESC[<n>.

where <n> may be: 0 = ASCII mode
1 = WordStar mode
2 = IBM-PC mode

When MS-DOS is loaded, the default mode is IBM-PC. Each mode is briefly described below.

**ASCII Mode** -- Shows the character codes generated by keystrokes in base state (a key pressed without any modifying keys). It also shows characters produced in the SHIFT, CTRL, 10-Key Mode, and CAPS LOCK shift states.

**IBM-PC Mode** -- Shows the keystrokes on the IBM-PC and the keystrokes on the Attache 8:16 which produce the same code(s). IBM-PC mode is the default mode when MS-DOS is loaded.

**WordStar Mode** -- Shows the mapping of the Attache keyboard to WordStar command character sequences. Single keystrokes may send more than one character sequence depending on the mapping.

## Special Key Sequences

The following key sequences perform the described function at all times, regardless of the keyboard mode. A + indicates that these keys must be pressed simultaneously.

| | |
|---|---|
| **RESET + RIGHT SHIFT** | This always performs a cold boot of the machine. |
| **CTRL + ESC** | This activates VALET and places you in Set-up Mode. |
| **CTRL + CAPS LOCK** | This activates or deactivates 10-Key Mode. |

## Keyboard Options - Interrupt 16H

The Interrupt 16 routines provide a keyboard interface with the following options contained in the AH register:

**AH = 0** **Read next ASCII character from the keyboard.** Results are returned in AL, and the scan code is returned in AH.

**AH = 1** **Console input status.** Indicates if an ASCII character is available to be read.
ZF = 0 if no code is available in buffer.
ZF = 1 if a code is available in buffer. The next character in the buffer is in AX and the entry remains in the buffer.

**AH = 2** **Return the current shift status in AL.** AL bits are defined as follows:
AL bit 7 = insert is active
AL bit 6 = CAPS LOCK toggled
AL bit 5 = NUM LOCK toggled
AL bit 4 = SCROLL LOCK toggled
AL bit 3 = ALT (CTRL + SHIFT) SHIFT pressed
AL bit 2 = CTRL SHIFT pressed
AL bit 1 = left SHIFT pressed
AL bit 0 = right SHIFT pressed

## Keyboard Reassignment

Although not part of the ANSI 3.64-1979 or ISO 6429 standard, the following keyboard reassignments are compatible with these standards:

```
     ESC [ <n> ; <n> ; ... <n> p
or   ESC [ "string" ; p
or   ESC [ <n> ; "string" ; <n> ; <n> ; "string" ; <n> p
or   any other combination of strings and decimal numbers
```

The final code in the control sequence (p) is one reserved for private use by the ANSI 3.64-1979 standard.

The first ASCII code in the control sequence defines which code is being mapped. The remaining numbers define the sequence of ASCII codes generated when this key is intercepted. There is one exception: if the first code in the sequence is zero (NUL), the first and second code make up an extended ASCII redefinition.

**Examples:**

1. Reassign the "Q" and "q" key to the "A" and "a" key (and vice versa). All numbers in this example are decimal:

| | |
|---|---|
| **ESC[65;81p** | A becomes Q |
| **ESC[97;113p** | a becomes q |
| **ESC[81;65p** | Q becomes A |
| **ESC[113;97p** | q becomes a |

2. Reassign the **CTRL 0** key to a DIR command followed by a return:

```
ESC[0;68;"dir";13p
```

. The 0;68 is the extended ASCII code for the **CTRL 0** key; 13 decimal is a carriage return.

## The Attache 8:16 Keyboard

In normal operating modes, the Attache keyboard returns ASCII to the processor. During IBM-PC emulation mode, Attache 8:16 emulates the IBM keyboard and returns make and break scan codes.

The IBM-PC keyboard typewriter keys return make scan codes of 1 through 58. Code 1 is the upper left key (ESC) and 58 is the lower right key (CAPS LOCK). Function keys F1 through F10 comprise scan codes 59 through 68, and keypad keys (beginning with NUM LOCK and SCROLL LOCK) produce codes 69 through 83. Break codes are determined by adding hex 80 to make codes.

The following charts describe keys and codes used by the Attache 8:16. ASCII mode, ASCII character codes, IBM-PC mode, and an IBM-PC keyboard conversion table are described in turn.

## ASCII Mode

ASCII mode returns character codes as designated by ASCII. All entries in the table are actual characters except for the two columns containing the decimal and hexadecimal codes. A blank spot means no code is generated.

## ASCII Mode Key Codes

| ATTACHE KEY | Base State ASCII CODE dec | hex | BASE CHAR | Shift States (ASCII Characters) SHIFT | CTRL | CTRL SHIFT | 10-KEY MODE | CAPS LOCK |
|---|---|---|---|---|---|---|---|---|
| 0 | 48 | 30H | 0 | ^ | | | 0 | 0 |
| 1 | 49 | 31H | 1 | ! | | | 1 | 1 |
| 2 | 50 | 32H | 2 | @ | | | 2 | 2 |
| 3 | 51 | 33H | 3 | # | | | 3 | 3 |
| 4 | 52 | 34H | 4 | $ | | | 4 | 4 |
| 5 | 53 | 35H | 5 | % | | | 5 | 5 |
| 6 | 54 | 36H | 6 | & | | | 6 | 6 |
| 7 | 55 | 37H | 7 | * | | | 7 | 7 |
| 8 | 56 | 38H | 8 | ( | | | 8 | 8 |
| 9 | 57 | 39H | 9 | ) | | | 9 | 9 |
| A | 97 | 61H | a | A | ^A | | A | A |
| B | 98 | 62H | b | B | ^B | | B | B |
| C | 99 | 63H | c | C | ^C | | C | C |
| D | 100 | 64H | d | D | ^D | | D | D |
| E | 101 | 65H | e | E | ^E | | E | E |
| F | 102 | 66H | f | F | ^F | | F | F |
| G | 103 | 67H | g | G | ^G | | G | G |
| H | 104 | 68H | h | H | ^H | | H | H |
| I | 105 | 69H | i | I | ^I | | 5 | I |
| J | 106 | 6AH | j | J | ^J | | 1 | J |
| K | 107 | 6BH | k | K | ^K | | 2 | K |
| L | 108 | 6CH | l | L | ^L | | 3 | L |
| M | 109 | 6DH | m | M | ^M | | 0 | M |
| N | 110 | 6EH | n | N | ^N | | N | N |
| O | 111 | 6FH | o | O | ^O | | 6 | O |
| P | 112 | 70H | p | P | ^P | | P | P |
| Q | 113 | 71H | q | Q | ^Q | | Q | Q |
| R | 114 | 72H | r | R | ^R | | R | R |
| S | 115 | 73H | s | S | ^S | | S | S |
| T | 116 | 74H | t | T | ^T | | T | T |
| U | 117 | 75H | u | U | ^U | | 4 | U |
| V | 118 | 76H | v | V | ^V | | V | V |
| W | 119 | 77H | w | W | ^W | | W | W |
| X | 120 | 78H | x | X | ^X | | X | X |
| Y | 121 | 79H | y | Y | ^Y | | Y | Y |
| Z | 122 | 7AH | z | Z | ^Z | | Z | Z |

ASCII Mode (continued)

| ATTACHE KEY | Base State ASCII dec | CODE hex | BASE CHAR | Shift States (ASCII Characters) SHIFT | CTRL | CTRL SHIFT | 10-KEY MODE | CAPS LOCK |
|---|---|---|---|---|---|---|---|---|
| - | 45 | 2DH | - | _ | | | - | - |
| = | 61 | 3DH | = | + | = | | = | = |
| [ | 91 | 5BH | [ | { | GS | GS | [ | [ |
| ] | 93 | 5DH | ] | } | ESC | ESC | ] | ] |
| ; | 59 | 3BH | ; | : | ; | : | * | ; |
| ' | 39 | 27H | ' | " | ' | " | ' | ' |
| , | 44 | 2CH | , | < | , | < | , | , |
| . | 46 | 2EH | . | > | | | | |
| / | 47 | 2FH | / | ? | / | ? | / | / |
| ` | 96 | 60H | ` | ~ | | | ` | ` |
| \ | 92 | 5CH | \ | \| | FS | FS | \ | \ |
| ESC | 27 | 1BH | ESC | ESC | VALET | ESC | ESC | ESC |
| BS | 08 | 08H | BS | BS | DEL | DEL | BS | BS |
| TAB | 09 | 09H | HT | HT | HT | HT | HT | HT |
| LF | 10 | 0AH | LF | LF | LF | LF | LF | LF |
| CR | 13 | 0DH | CR | CR | CR | CR | CR | CR |
| DEL | 127 | 7FH | DEL | DEL | DEL | DEL | DEL | DEL |
| LEFT | 08 | 08H | BS | BS | BS | BS | BS | BS |
| DOWN | 10 | 0AH | LF | LF | LF | LF | LF | LF |
| UP | 11 | 0BH | VT | VT | VT | VT | VT | VT |
| RIGHT | 12 | 0CH | FF | FF | FF | FF | FF | FF |
| SPACE | 32 | 20H | SP | SP | SP | SP | SP | SP |
| CAPS | | | | | | | | |
| RESET | | | | | | | | |
| SHIFT | | | | | | | | |

## ASCII Character Codes

| ASCII dec | CODE hex | ASCII CHAR. | ASCII dec | CODE hex | ASCII CHAR. | ASCII dec | CODE hex | ASCII CHAR. |
|---|---|---|---|---|---|---|---|---|
| 000 | 00 | NUL | 043 | 2B | + | 086 | 56 | V |
| 001 | 01 | SOH | 044 | 2C | ' | 087 | 57 | W |
| 002 | 02 | STX | 045 | 2D | - | 088 | 58 | X |
| 003 | 03 | ETX | 046 | 2E | . | 089 | 59 | Y |
| 004 | 04 | EOT | 047 | 2F | / | 090 | 5A | Z |
| 005 | 05 | ENQ | 048 | 30 | 0 | 091 | 5B | [ |
| 006 | 06 | ACK | 049 | 31 | 1 | 092 | 5C | \ |
| 007 | 07 | BEL | 050 | 32 | 2 | 093 | 5D | ] |
| 008 | 08 | BS | 051 | 33 | 3 | 094 | 5E | ^ |
| 009 | 09 | HT | 052 | 34 | 4 | 095 | 5F | _ |
| 010 | 0A | LF | 053 | 35 | 5 | 096 | 60 | ` |
| 011 | 0B | VT | 054 | 36 | 6 | 097 | 61 | a |
| 012 | 0C | FF | 055 | 37 | 7 | 098 | 62 | b |
| 013 | 0D | CR | 056 | 38 | 8 | 099 | 63 | c |
| 014 | 0E | SO | 057 | 39 | 9 | 100 | 64 | d |
| 015 | 0F | SI | 058 | 3A | : | 101 | 65 | e |
| 016 | 10 | DLE | 059 | 3B | ; | 102 | 66 | f |
| 017 | 11 | DC1 | 060 | 3C | < | 103 | 67 | g |
| 018 | 12 | DC2 | 061 | 3D | = | 104 | 68 | h |
| 019 | 13 | DC3 | 062 | 3E | > | 105 | 69 | i |
| 020 | 14 | DC4 | 063 | 3F | ? | 106 | 6A | j |
| 021 | 15 | NAK | 064 | 40 | @ | 107 | 6B | k |
| 022 | 16 | SYN | 065 | 41 | A | 108 | 6C | l |
| 023 | 17 | ETB | 066 | 42 | B | 109 | 6D | m |
| 024 | 18 | CAN | 067 | 43 | C | 110 | 6E | n |
| 025 | 19 | EM | 068 | 44 | D | 111 | 6F | o |
| 026 | 1A | SUB | 069 | 45 | E | 112 | 70 | p |
| 027 | 1B | ESCAPE | 070 | 46 | F | 113 | 71 | q |
| 028 | 1C | FS | 071 | 47 | G | 114 | 72 | r |
| 029 | 1D | GS | 072 | 48 | H | 115 | 73 | s |
| 030 | 1E | RS | 073 | 49 | I | 116 | 74 | t |
| 031 | 1F | US | 074 | 4A | J | 117 | 75 | u |
| 032 | 20 | SPACE | 075 | 4B | K | 118 | 76 | v |
| 033 | 21 | ! | 076 | 4C | L | 119 | 77 | w |
| 034 | 22 | " | 077 | 4D | M | 120 | 78 | x |
| 035 | 23 | # | 078 | 4E | N | 121 | 79 | y |
| 036 | 24 | $ | 079 | 4F | O | 122 | 7A | z |
| 037 | 25 | % | 080 | 50 | P | 123 | 7B | { |
| 038 | 26 | & | 081 | 51 | Q | 124 | 7C | \| |
| 039 | 27 | ' | 082 | 52 | R | 125 | 7D | } |
| 040 | 28 | ( | 083 | 53 | S | 126 | 7E | ~ |
| 041 | 29 | ) | 084 | 54 | T | 127 | 7F | DEL |
| 042 | 2A | * | 085 | 55 | U | | | |

## IBM-PC Mode

The Attache 8:16 keyboard is capable of producing the same codes as an IBM-PC keyboard. The tables below show which keys on an Attache 8:16 produce codes that correspond to IBM-PC keyboard codes.

When struck, a key returns either an ASCII character code or a two-byte sequence in registers AL, AH. The two-byte sequence returns NUL (000) in AL and a code indicating the function in AH. The following tables show the character that corresponds to the ASCII code generated or, if a keystroke generates a two-byte sequence, the actual code generated.

To produce the codes in the last four columns of the tables, two "keystrokes" are required. The **CTRL** or **SHIFT** combination must be struck first and then **released**, followed by the second key (or key combination) shown in the column. The code is **not** generated by striking the key in the column while simultaneously holding down the other keys.

## Special Key Combinations

Special key combinations are required on an Attache 8:16 to emulate the functions available on an IBM-PC keyboard. These special key combinations are summarized in the list below. In this list, + indicates a simultaneous strike and , indicates a pause.

| | |
|---|---|
| **CTRL** + **<number>** <**1** - **0**> | This sends the same code as the IBM function keys F1 - F10 (Attache number keys 1-0). |
| **CTRL** + **SHIFT** + **<number>** | This sends the same code as IBM-PC keys SHIFT + F1 - F10. |
| **CTRL** + **CAPS LOCK** , **CTRL** + **SHIFT** + **<number>** | This sends the same code as IBM-PC keys ALT 1-0, -, and =. Release **CTRL** + **CAPS LOCK** before pressing **CTRL** + **SHIFT** + **<number>**. |
| **CTRL** + **TAB** , **<number>** | This sends the same code as IBM-PC keys CTRL + F1 - F10. Release **CTRL** + **TAB** before pressing <number>. |
| **SHIFT** + **ESC** , **<number>** | This sends the same code as IBM-PC keys ALT + F1 - F10. Release **SHIFT** + **ESC** before pressing <number>. |

## IBM-PC Mode Key Codes

| ATTACHE KEY | BASE | SHIFT | CTRL | CTRL SHIFT (ALT) | (CTRL + CAPSLOCK) 10-KEY MODE | + CTRL SHIFT | 2 keystrokes CTRL TAB | SHIFT ESC |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | ! | 0,59 | 0,84 | | | 0,94 | 0,104 |
| 2 | 2 | @ | 0,60 | 0,85 | | | 0,95 | 0,105 |
| 3 | 3 | # | 0,61 | 0,86 | | | 0,96 | 0,106 |
| 4 | 4 | $ | 0,62 | 0,87 | | | 0,97 | 0,107 |
| 5 | 5 | % | 0,63 | 0,88 | | | 0,98 | 0,108 |
| 6 | 6 | & | 0,64 | 0,89 | | | 0,99 | 0,109 |
| 7 | 7 | * | 0,65 | 0,90 | 7 | 0,126 | 0,100 | 0,110 |
| 8 | 8 | ( | 0,66 | 0,91 | 8 | 0,127 | 0,101 | 0,111 |
| 9 | 9 | ) | 0,67 | 0,92 | 9 | 0,128 | 0,102 | 0,112 |
| 0 | 0 | ^ | 0,68 | 0,93 | | | 0,103 | 0,113 |
| A | a | A | SOH | 0,30 | | | | |
| B | b | B | STX | 0,48 | | | | |
| C | c | C | ETX | 0,46 | | | | |
| D | d | D | EOT | 0,32 | | | | |
| E | e | E | ENQ | 0,18 | | | | |
| F | f | F | ACK | 0,33 | | | | |
| G | g | G | BEL | 0,34 | | | | |
| H | h | H | BS | 0,35 | | | | |
| I | i | I | HT | 0,23 | 5 | 0,124 | | |
| J | j | J | LF | 0,36 | 1 | 0,120 | | |
| K | k | K | VT | 0,37 | 2 | 0,121 | | |
| L | l | L | FF | 0,38 | 3 | 0,122 | | |
| M | m | M | CR | 0,50 | 0 | 0,129 | | |
| N | n | N | SO | 0,49 | | | | |
| O | o | O | SI | 0,24 | 6 | 0,125 | | |
| P | p | P | DLE | 0,25 | + | | | |
| Q | q | Q | DC1 | 0,16 | | | | |
| R | r | R | DC2 | 0,19 | | | | |
| S | s | S | DC3 | 0,31 | | | | |
| T | t | T | DC4 | 0,20 | | | | |
| U | u | U | NAK | 0,22 | 4 | 0,123 | | |
| V | v | V | SYN | 0,47 | | | | |
| W | w | W | ETB | 0,17 | | | | |
| X | x | X | CAN | 0,45 | | | | |
| Y | y | Y | EM | 0,21 | | | | |
| Z | z | Z | SUB | 0,44 | | | | |

IBM-PC Mode (continued)

| ATTACHE KEY | BASE | SHIFT | CTRL | CTRL SHIFT (ALT) | (CTRL + CAPSLOCK) 10-KEY MODE | + CTRL SHIFT | 2 keystrokes CTRL TAB | SHIFT ESC |
|---|---|---|---|---|---|---|---|---|
| - | - | _ | US | US | - | 0,130 | | |
| = | = | + | 0,71 | 0,119 | = | 0,131 | | |
| [ | [ | { | GS | GS | | | | |
| ] | ] | } | ESC | ESC | | | | |
| ; | ; | : | ; | : | * | | | |
| ' | ' | " | 0,79 | 0,117 | | | | |
| , | , | < | , | < | | | | |
| . | . | > | | | . | | | |
| / | / | ? | / | ? | / | | | |
| ` | ` | ~ | | ~ | | | | |
| \ | \ | \| | FS | FS | | | | |
| ESC | ESC | | VALET | ESC | | | | |
| BS | BS | BS | DEL | DEL | | | | |
| TAB | HT | 0,15 | | HT | | | | |
| LF | LF | LF | BREAK | SCROLL | | | | |
| CAPS | | | | | | | | |
| CR | CR | CR | CR | CR | | | | |
| DEL | 0,83 | 0,82 | 0,82 | DEL | | | | |
| LEFT | 0,75 | 0,75 | 0,115 | 0,75 | | | | |
| DOWN | 0,80 | 0,81 | 0,81 | 0,118 | | | | |
| UP | 0,72 | 0,72 | 0,73 | 0,132 | | | | |
| RIGHT | 0,77 | 0,77 | 0,116 | 0,77 | | | | |
| SPACE | SP | SP | SP | SP | | | | |

## IBM-PC Keyboard Conversion Table

**Special Editing Keys**

| Function | IBM Key | 8:16 Key | Description |
|---|---|---|---|
| Copy one character | F1 | CTRL 1 | Copies one character from the template to the new line. |
| Copy up to a character | F2 | CTRL 2 | Copies all characters from the template to the new line up to the specified character. |
| Copy template | F3 | CTRL 3 | Copies all remaining characters in the template to the screen. |
| Skip one character | DEL | DEL | Does not copy (skips over) a character. |
| Skip up to a character | F4 | CTRL 4 | Does not copy (skips over) the characters in the template, up to the specified character. |
| Quit Input | ESC | CTRL x | Voids current input. Template is unchanged. |
| Insert | INS | CTRL DEL | Turns insert on or off. |
| Replace | INS | CTRL DEL | Turns insert mode off. |
| New template | F5 | CTRL 5 | Makes the new line the new template. |

IBM-PC Keyboard Conversion Table: Common Functions (continued)

| Function | IBM Key | 8:16 Key | Description |
|---|---|---|---|
| Cold boot | CTRL ALT DEL | **right SHIFT RESET** | Reloads the operating system. |
| Input | return arrow | **RETURN** | Inputs commands. |
| Stop command | CTRL SCROLL LOCK | **CTRL C** | Halts the execution of a command. |
| Stop | CTRL NUM LOCK | **CTRL S** | Freezes the display. **CTRL S** again restarts. |
| Print screen | SHIFT PrtSc | **CTRL SHIFT right arrow** | Prints the entire screen as currently displayed. |
| Print as displayed | CTRL PrtSc | **CTRL P** or **CTRL N** | Information prints as it displays. **CTRL N** stops print action. |
| Cancel command | ESC | **CTRL X** | Removes the current input line for corrections. |
| Insert mode | INS | **CTRL DEL** | Enters and exits insert mode. |
| Tab | arrows | **TAB** | Moves the cursor to the next tab stop. |

IBM-PC Keyboard Conversion Table: Common Function Keys

| Function | IBM Key | 8:16 Key | Description |
|---|---|---|---|
| Shift | shift arrow | **SHIFT** | Shifts keys to upper case. |
| Backspace | backspace arrow | **BACK SPACE** | Removes the character left of the cursor. |

Programming Keys

| Function | IBM Key | 8:16 Key | Description |
|---|---|---|---|
| KEY | F9 | **CTRL 9** | Changes the function of other function keys. |
| SCREEN | F10 | **CTRL 0** | Returns to character mode from graphics mode. |
| Numeric keypad | NUM LOCK | **CTRL CAPS LOCK** | Turns the numeric keypad on or off. |
| Home cursor | HOME | **CTRL =** | Moves the cursor to the first character on the top line. |
| Cursor to line end | END | **CTRL '** | Moves the cursor to the end of current line. |

IBM-PC Keyboard Conversion Table: Programming Keys (continued)

| Function | IBM Key | 8:16 Key | Description |
|---|---|---|---|
| Clear screen | CTRL HOME | CTRL SHIFT = | Clears the screen. |
| Alternate Functions | ALT A-Z | CTRL SHIFT A to Z | Can assign keys a function. |
| Alternate Functions | ALT 1-0 | CTRL CAPS LOCK; then CTRL SHIFT decimal value on keypad | User-assigned alternate key function. |
| Suspend system | CTRL NUM LOCK | CTRL LINE FEED | Stops all execution. Press any key to restart. |
| Page up | PG UP | CTRL up arrow | Scrolls back 25 lines and homes the cursor. |
| Top of file | CTRL PG UP | CTRL SHIFT up arrow | Moves cursor to the top of the current file. |
| Page down | PG DN | CTRL down arrow | Scrolls forward 25 lines and homes cursor. |
| Delete to page end | CTRL PG DN | CTRL SHIFT down arrow | Delete from cursor to the end of the screen. |
| Delete to line end | CTRL END | CTRL SHIFT ' | Deletes from the cursor to end of current line. |

IBM-PC Keyboard Conversion Table: Programming Keys (continued)

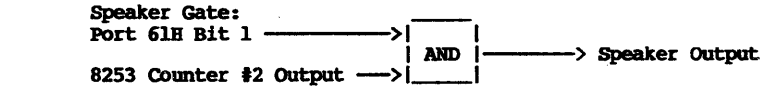
| Function | IBM Key | 8:16 Key | Description |
|---|---|---|---|
| Advance word | CTRL right arrow | CTRL right arrow | Moves cursor forward one word. |
| Return word | CTRL left arrow | CTRL left arrow | Moves cursor back one one word. |
| Delete | DEL | DEL | Backspaces and removes the character. |
| Secondary Function | SHIFT F1 to F10 | CTRL SHIFT 1 to 0 | Additional function keys. |
| Secondary Function | CTRL F1 to F10 | CTRL TAB 1 to 0 | Additional function keys. |
| Secondary Function | ALT F1 to F10 | SHIFT ESC 1 to 0 | Additional function keys. |
| Bell | CTRL G | CTRL ESC 0 | Turns bell on. |
| Line feed | CTRL enter | LINE FEED | Feeds one line to the printer. |

## Accessing the Sound Generator

The sound generator on an Attache 8:16 is set up to emulate the IBM-PC hardware. It is designed to allow IBM-PC programs which use sound to function on an Attache 8:16.

IBM-PC sound hardware consists of an Intel 8253 counter/timer chip. The 8253 includes a timer clock channel which is used for square wave generation (Counter #2 output); this produces tone for the speaker. The IBM-PC's Port B 61 hex (Port 61H) Bits 0 and 1 also control speaker output by gating the signal from Counter #2.

The following diagram illustrates sound generation using an 8253. As shown below, both Port 61H Bit 1 AND Counter #2 output must produce a high signal to activate the speaker. Port 61H Bit 1 OR Counter #2 output may go low to deactivate the speaker.




The frequency of Counter #2's square wave may be set and changed by programming the 8253 mode and count registers (refer to Intel documentation for details). Bit 0 of Port 61H causes Counter #2 output to be high (with a 0) or square wave (with a 1). Bit 1 of Port 61H turns the speaker gate on (with a 1) and off (with a 0).

The speaker gate must be set high before output from Counter #2 on the 8253 can be passed to the speaker. Similarly, Counter #2 output may be set high (Bit 0=0), allowing the speaker to be toggled by turning the speaker gate bit (Bit 1) on and off. This second method is commonly used in IBM-PC programs.

The Attache 8:16 software emulates the IBM hardware using the Attache's sound generator chip. The following port addresses simulate the IBM ports and can be used to affect speaker output:

| PORT: | FUNCTION: |
|---|---|
| 61 (HEX) | BIT 0=COUNTER #2 GATE, BIT 1=SPEAKER GATE |
| 42 (HEX) | COUNTER REGISTER #2 IN THE 8253 EMULATOR |
| 43 (HEX) | EMULATED 8253 MODE REGISTER |

Only mode 3 (square wave output) of the 8253 is emulated. The count register may be loaded with a low, high, or 2 byte load using the proper mode register commands. Only Counter #2 output is available. The counter register cannot be read back at any time.

**Note:** The constant high output on the 8253 Counter #2 output is simulated by outputting a 125KHz square wave to the speaker. When using the speaker gate as a toggle, higher frequencies may beat with the 125KHz signal and cause a warbling sound.

## MS-DOS Interrupts and Function Requests

The following charts provide a quick reference for locating MS-DOS interrupts and function requests. XENIX-compatible calls, MS-DOS interrupts, and MS-DOS function requests appear below.

**XENIX-Compatible Calls**

| Function Code | Description |
|---|---|
| Function 39H | Create Subdirectory |
| Function 3AH | Remove a Directory Entry |
| Function 3BH | Change the Current Directory |
| Function 3CH | Create a File |
| Function 3DH | Open a File |
| Function 3FH | Read From File/Device |
| Function 40H | Write to a File or Device |
| Function 41H | Delete a Directory Entry |
| Function 42H | Move a File Pointer |
| Function 43H | Change Attributes |
| Function 44H | I/O Control for Devices |
| Function 45H | Duplicate a File Handle |
| Function 46H | Force a Duplicate of a Handle |
| Function 4BH | Load and Execute a Program |
| Function 4CH | Terminate a Process |
| Function 4DH | Retrieve Return Code of "Child" |

## MS-DOS INTERRUPTS (Numeric Order)

| Interrupt Hex | Interrupt Dec | Description |
|---|---|---|
| 0H | 0 | Divide by Zero |
| 1H | 1 | Single Step |
| 2H | 2 | Non-Maskable Interrupt |
| 3H | 3 | Breakpoint |
| 4H | 4 | Overflow |
| 5H | 5 | Print Screen |
| 6H,7H | 6,7 | RESERVED |
| 8H | 8 | Time of Day |
| 9H | 9 | Keyboard (RESERVED) (9H not implemented) |
| AH | 10 | RESERVED |
| BH | 11 | Communications |
| CH | 12 | Communciations |
| DH | 13 | Disk |
| 10H | 16 | Video |
| 11H | 17 | Equipment Check |
| 12H | 18 | Memory |
| 13H | 19 | Diskette |
| 14H | 20 | Communications |
| 15H | 21 | Cassette (RESERVED) (15H not implemented) |
| 16H | 22 | Keyboard |
| 17H | 23 | Printer |
| 18H | 24 | ROM BASIC (RESERVED) (18H not implemented) |
| 19H | 25 | Bootstrap |
| 1AH | 26 | Time of Day |
| 1BH | 27 | Keyboard Break |
| 1CH | 28 | Timer Tick |
| 1DH | 29 | Video Initialize (RESERVED) (1DH not implemented) |
| 1EH | 30 | Diskette Parameters |
| 1FH | 31 | Pointer to Video Characters (1FH not implemented) |
| 20H | 32 | Program Terminate |
| 21H | 33 | Function Request |
| 22H | 34 | Terminate Address |
| 23H | 35 | CTRL C Exit Address |
| 24H | 36 | Fatal Error Abort Address |
| 25H | 37 | Absolute Disk Read |
| 26H | 38 | Absolute Disk Write |
| 27H | 39 | Terminate But Stay Resident |
| 28-3FH | 40-63 | RESERVED — DO NOT USE |

## MS-DOS FUNCTION REQUESTS (Numeric Order)

| Function Code | Function Name |
|---|---|
| 00H | Terminate Program |
| 01H | Read Keyboard and Echo |
| 02H | Display Character |
| 03H | Auxiliary Input |
| 04H | Auxiliary Output |
| 05H | Print Character |
| 06H | Direct Console I/O |
| 07H | Direct Console Input |
| 08H | Read Keyboard |
| 09H | Display String |
| 0AH | Buffered Keyboard Input |
| 0BH | Check Keyboard Status |
| 0CH | Flush Buffer, Read Keyboard |
| 0DH | Disk Reset |
| 0EH | Select Disk |
| 0FH | Open File |
| 10H | Close File |
| 11H | Search for First Entry |
| 12H | Search for Next Entry |
| 13H | Delete File |
| 14H | Sequential Read |
| 15H | Sequential Write |
| 16H | Create File |
| 17H | Rename File |
| 18H | RESERVED |
| 19H | Current Disk |
| 1AH | Set Disk Transfer Address |
| 1BH-20H | RESERVED |
| 21H | Random Read |
| 22H | Random Write |
| 23H | File Size |
| 24H | Set Relative Record |
| 25H | Set Vector |
| 26H | RESERVED |
| 27H | Random Block Read |
| 28H | Random Block Write |
| 29H | Parse File Name |
| 2AH | Get Date |
| 2BH | Set Date |
| 2CH | Get Time |
| 2DH | Set Time |
| 2EH | Set/Reset Verify Flag |
| 2FH | Get Disk Transfer Address |

MS-DOS FUNCTION REQUESTS (Continued)

| Function Code | Function Name |
|---|---|
| 30H | Get DOS Version Number |
| 31H | Keep Process |
| 32H | RESERVED |
| 33H | CTRL C Check |
| 34H | RESERVED |
| 35H | Get Interrupt Vector |
| 36H | Get Disk Free Space |
| 37H | RESERVED |
| 38H | Return Country-Dependent Information |
| 39H | Create Subdirectory |
| 3AH | Remove a Directory Entry |
| 3BH | Change Current Directory |
| 3CH | Create a File |
| 3DH | Open a File |
| 3EH | Close a File Handle |
| 3FH | Read From File/Device |
| 40H | Write to a File/Device |
| 41H | Delete a Directory Entry |
| 42H | Move a File Pointer |
| 43H | Change Attributes |
| 44H | I/O Control for Devices |
| 45H | Duplicate a File Handle |
| 46H | Force a Duplicate of a Handle |
| 47H | Return Text of Current Directory |
| 48H | Allocate Memory |
| 49H | Free Allocated Memory |
| 4AH | Modify Allocated Memory Blocks |
| 4BH | Load and Execute a Program |
| 4CH | Terminate a Process |
| 4DH | Retrieve the Return Code of a Child |
| 4EH | Find Match File |
| 4FH | Step Through a Directory Matching Files |
| 50H-53H | RESERVED |
| 54H | Return Current Setting of Verify |
| 55H | RESERVED |
| 56H | Move a Directory Entry |
| 57H | Get/Set Date/Time of File |

# Operator's Guide

## Appendixes

# Technical Specifications

## Overview

For reliability and ease of maintenance, Attache 8:16 consists of only six modules: the power supply, display screen, diskette drives, keyboard, 8086 processor board, and Z-80A processor board. Each module has interconnecting cables for easy insertion or removal, and diagnostic programs (contained in ROM) can instantly test the integrity of each component when service is required.

## Physical Dimensions

Height - 5.75 inches (14.6 cm), Width - 12 inches (30.5 cm), Depth - 13.6 inches (34.5 cm), Weight - 19 pounds.

## Power Supply

Attache's power supply contains its own self-checking circuitry to assure reliable operation. A thermostatically controlled DC brushless motor fan maintains constant internal temperatures.

The power supply operates from 95 to 135 volts or 190 to 270 volts with a frequency range of 48 to 440 Hz. With the proper power cord or international adapter and a turn of the voltage selector card on the back of the unit, Attache may be operated anywhere in the world.

Where conventional power is not available, the DC power option allows instant operation from 10 to 16 volt automobile or marine batteries, 20 to 32 volt aircraft systems, or from portable battery packs.

## Display Screen

The high-resolution 5.5-inch diagonal CRT provides optimum efficiency with minimum fatigue. Display typeface is a 6 x 7 character cell in an 8 x 10 block (with descenders). Software-selectable formats include 24 lines of 80 characters and 24 lines of 40 (double size) characters for CP/M and 25 lines of 80 characters for MS-DOS.

The standard character set contains 512 character types, including the full ASCII character set (upper and lower case), complete IBM-PC character set and symbols, special word processing and journalism symbols, Greek alphabet characters (upper and lower case), mathematical symbols, business form and graph drawing symbols, and symbols to complete German, Spanish, French, Italian, Swedish, and other alphabets.

Software selectable screen attributes (on a per character position basis or in combination) include reversed video, subscript, superscript, double size characters, boldface, underline, strikethrough, and highlighting.

The entire display screen content can be changed in 1/60 of a second. Alphanumeric memory provides 2K bytes of 16-bit words that are accessed through I/O commands. The display does not occupy any of the processor address space, and display refresh does not require processor time.

## Graphics

The Attache 8:16 provides both medium- and high-resolution bit-mapped graphics capabilities. When operated as an 8-bit computer under CP/M, the system defaults to the Attache standard of 320 X 240 pixels, organized as 24 lines of 80 characters.

When operated as a 16-bit computer under MS/DOS, the system selects either high-resolution mode of 640 X 200 pixels or medium-resolution of 320 X 200 pixels. Both display modes are completely compatible with the IBM-PC display.

A character ROM contains both the complete Attache character set and the complete IBM character set. The appropriate set is automatically selected when the operating system is loaded.

## Input/Output

The Attache 8:16 comes standard with two asynchronous communications ports and provision for an optional synchronous communication port and an optional GPIB (IEE-488) port. One asynchronous port is configured as an RS-232 printer interface and the other port is configured as an RS-232 data communications interface. Either of these ports may be easily reconfigured to support RS-422 and/or RS-423 line and protocol standards.

Asynchronous transmission rates of 19200, 9600, 4800, 2400, 1800, 1200, 600, 300, 150, 134.5, 110 or 75 baud may be selected independently for each port via keyboard or software control.

Attache interface cables (available from your dealer) allow direct connection to standard serial devices, local peripheral devices, and communications devices such as modems. In all local cable uses, Attache 8:16 appears as a Data Communications Equipment (DCE) device and the peripheral appears as a Data Terminal Equipment (DTE) device. For communications, Attache 8:16 appears as the DTE and the peripheral appears as the DCE.

## Auxiliary Video Display

In addition to the built-in 5.5 inch CRT, Attache 8:16 supports a variety of monitors and graphic terminals via its RS-170, RS-232, or GPIB (IEEE-488) ports.

Connecting a larger display screen for simultaneous display is easy with the standard RCA-type pin plug (RS-170) at the back of the unit.

## Keyboard

The keyboard contains a standard IBM Selectric™ style arrangement augmented with cursor direction, delete, and other keys required to implement the full set of ASCII communications codes. Keyboard connectors use a telephone-style modular cable connector and will accept a standard coil cord for keyboard operation up to 10 feet away from the main cabinet.

Tactile feedback and selectable audio feedback are provided by a three channel sound synthesis system which is used for keyclick sounds, system alarms, and bell sounds. The synthesizer is also software-accessible for a wide variety of other sounds.

Several keyboard modes are supported. With MS-DOS, the Attache 8:16 keyboard can be used to emulate IBM-PC keys and functions. With either CP/M or MS-DOS, Valet Set-Up Mode can be used for accessing Valet programs (screen dump, alarms, and calculator) and controlling the operating environment (screen brightness, keyboard sound and volume, printer and communications port baud rates, etc.). Other keyboard modes include 10-Key Mode for simulated 10-Key keyboard numerics and WordStar Mode for dedicated word processing functions.

## Memories

The Attache 8:16 contains three separate memories: a 256K byte RAM for the 8086 (16-bit) processor's programs and data, a 64K byte RAM for the Z-80A (8-bit) processor's programs, and a 28K byte RAM for graphics. The 64K under the Z-80 provides I/O buffering for the 8086.

ROM (Read-Only Memory) on the Z-80A processor board includes 4K bytes that are mapped in and out of the lower section of processor memory space via software, providing automatic startup diagnostics and machine initialization, subassembly tests for servicing and performance verification, CRT emulation (VT-52 and ADM-3A), and general purpose subroutines for reading from and writing to disks, displaying characters, and accessing the printer and communications ports.

The contents of two 4K byte ROM chips reside at the highest memory addresses of the 8086 processor board. The ROM contains device initialization routines, diagnostic routines, and a debugger.

## Processors

The dual Central Processing Units (CPU's) are an Intel 8086 processor operating at 8M Hz (interfacing with the 256K bytes RAM memory) and a Zilog Z-80A main processor operating at 4MHz (interfacing with the 64K bytes RAM memory).

The 8086 is a true 16-bit processor in that both its logic and data path are a full 16 bits.

A separate 9517A direct memory processor controls data transfers between memory and the Input/Output devices (the disk system, communications and printer ports, etc).

When the system is started by the user, the Z-80 tests to see which operating system has been selected. If MS/DOS is loaded, keyboard, graphics, disk format, and I/O are set to the appropriate configuration and control is passed to the 8086. If CP/M is loaded, that configuration is selected and the Z-80 retains control.

## Disk System

Two 5-1/4 inch disk drives are shock-mounted in the disk drive module assembly. A single-drive Attache 8:16 model is available.

When operated as an 8-bit computer, diskettes are written and read in the Attache standard format, which is 360K bytes per diskette (after CP/M) on diskettes that are soft sectored, (2D) double density and double sided, written 512 bytes per sector, 10 sectors per track, 38 tracks per side, and 48 tracks per inch (TPI). Disk transfers are handled by the direct memory processor, freeing the main processor for other tasks.

When operated as a 16-bit computer, diskettes may be read or written in all IBM PC-DOS formats, including 8-sector DOS 1.x and 9-sector DOS 2.0 formats with both single/double-sided and single/dual-density media. Maximum capacity with DOS 2.0 9-sector dual-sided, dual-density format is 360K bytes per diskette.

## Real-Time Clock

The battery-powered time and date clock operates even when the computer is powered down. The clock is software-accessible for screen display, printouts, and timed alarms.

# Glossary

| | |
|---|---|
| **A>** | Prompt which appears at the first column of a line on the screen to indicate that Drive A is logged and waiting for a command. |
| **Applications Software** | Software that performs a specific function (such as word processing or spread sheet analysis). |
| **Arrow Keys** | Move the cursor left, right, up, or down on the screen. |
| **Attache DOS Diskette** | Diskette containing the MS-DOS operating system, MS-DOS utility programs, and Valet programs. |
| **Attache Software Diskette** | Diskette containing the CP/M operating system and utility programs, Charton programs, Valet programs, and Attache utility programs. |
| **Attache Utility Programs** | Programs for copying CP/M, formatting diskettes, copying files, and changing the day/date clock. |
| **Attributes** | Features such as underline, boldface, subscript, superscript, reverse video, and highlighting that may be activated for characters that are displayed or printed. |
| **Auxiliary Video Jack** | Outlet at the back of Attache for attaching an additional video display. |
| **B>** | Prompt which appears at the first column of a line on the screen to indicate that Drive B is logged and waiting for a command. |
| **BACK SPACE Key** | Moves the cursor one column to the left. |
| **Backup** | The process of copying the entire contents of a diskette to another diskette. |
| **BASIC-80** | Microsoft's BASIC programming language. |
| **Baud Rate** | The number of bits per second transmitted between two electronic devices. |
| **Bell** | Alarm sound switched on or off in Set-up Mode. |
| **Block** | A section of text identified during word processing for copying or moving to other locations. |

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| **Block Copy** | WordStar-Plus command for copying a block of text elsewhere in the same file. |
| **Block End** | WordStar-Plus command signifying the end of a section of text being defined for a block operation. |
| **Block Hide** | WordStar-Plus command that "undisplays" marked blocks of text during word processing. |
| **Block Move** | WordStar-Plus command that takes a block of marked text from one location to another. |
| **Block Start** | WordStar-Plus command signifying the beginning of a section of text being defined for a block operation. |
| **Boot** | See Bootstrap Operation. |
| **Bootstrap Operation** | The loading of programs that occurs when the right **SHIFT** and **RESET** keys are pressed at the same time. Also known as "booting" or "rebooting." |
| **Brightness** | See Screen Brightness. |
| **Byte** | The basic unit of computer memory, which stores one character of data. |
| **Cable Sets** | The several cables used for connection of peripheral equipment to the Attache serial ports. |
| **CAPS LOCK Key** | Locks the keyboard in upper case. |
| **Carriage Return** | The function that ends a line and moves the cursor to the first column of the next line on the screen. |
| **Central Processing Unit** | The functional unit within a computer where all data processing occurs, also known as the CPU. |
| **Character** | A single letter, number, or other symbol. |
| **Character Pitch** | The number of characters printed per inch on a line. |
| **Character Set** | A series of like characters, such as ASCII, Greek, Math, Forms, etc. |
| **Character Size** | Either "standard" display size or double size. |
| **Charton** | Software program for creating pie charts, line charts, and bar charts on the Attache screen. |

**Clear Tab** WordStar-Plus command for clearing tab stops.

**Click** Keyboard sounds that are activated or modified in Set-up Mode.

**Clock** Attache's real-time clock.

**Cold Boot** The loading of programs and/or execution of diagnostics that occur when right **SHIFT** and **RESET** are pressed at the same time. Also known as "booting" or "rebooting."

**Column** The space on the screen for a single character on a line. Also one of two or more vertical sections of text and/or numbers that share the same lines but are separated by blank spaces and are functionally independent of each other.

**Command** An instruction to the computer.

**Comm Cable** Cable for attaching peripherals to the port labeled "Communications."

**Communications** The transmission of data from one electronic device to another.

**Communications Baud Rate** The rate of data transmission via the Comm port.

**Comm Port** The connector on the back of Attache for attaching a cable to communicate with another electronic device.

**Control Character Codes** Program codes used to address the display driver.

**Copy** See Block Copy.

**CP/M** An operating system used by Attache.

**CP/M Utility Programs** Programs used to copy files, display files and available file space, erase or rename files, and perform a variety of other maintenance functions under CP/M.

**CPU** The Central Processing Unit.

**CRT** Cathode Ray Tube, which is the display screen.

**CTRL Key** Used in conjunction with other keys for activating multi-function commands, operating modes, or control codes.

**Cursor** The movable highlighted rectangle on the display screen that indicatesyour current typing position on the screen.

**Cursor Movement Keys** See ARROW Keys.

**Cursor Column** The column where the cursor is located on the line.

**Cursor Line** The line where the cursor is located on the screen.

**Delete** A command that provides for removal of data from a document file or from a diskette. Also, Disk Manager option that deletes a file.

**DEL Key** Used alone or in conjunction with other modifier keys for deleting data from a document file.

**DIR** A utility program that lists on the screen a directory of files contained on a diskette.

**Directory** A listing of the names of all files contained on a diskette.

**Disk** Magnetic device where computerized information is stored. May be either "hard" or "floppy." Attache uses floppy disks, also known as diskettes.

**Disk Drive** The piece of hardware that holds the diskette and transfers information from the diskette to the processing unit and back.

**Disk Error** Error generated by the operating system to indicate a problem writing data from or reading data to a diskette.

**Disk Manager** Attache CP/M software program that provides disk and file maintenance options, including Backup, Format, Sysdup, File Copy, File Delete, File Rename, File Print, and File View.

**Diskette** Small magnetic disk where computerized information is stored, also known as "floppy" disk.

**Document** See Document File.

**Document File** A single body of text (such as a letter of correspondence or report) that is created during word processing and stored on a diskette. Also referred to as a document or file.

**Document Name** The name that is used to identify a document file. The file name is user-specified when the file is opened, but may be changed at any time as a part of routine directory maintenance.

**Drive** See Disk Drive.

**Edit** The process of revising keyed information.

**Embedded Command** An instruction that is integrated in the text.

**End** See Block End.

**ESC Key** Used alone in response to prompts and messages, with other keys to indicate embedded escape codes, or as a modifier key in conjunction with the CTRL key.

**Escape Codes** Program codes used to address the display driver.

**File** A collection of like records stored under a single file name, such as a document file containing a letter of correspondence or a report, or a command file containing program commands, executable programs, etc.

**File Directory** A listing of files contained on a diskette.

**File Display Area** The portion of the screen where text is keyed and displayed.

**File Line** A specific line in a file, or the line where the cursor resides.

**File Name** The name associated with a file, consisting of a primary name (up to eight characters) and an extension name (up to three characters) separated by a period.

**Find** WordStar-Plus command to search out a specific word or string of words in a document.

**Find/Replace Again** WordStar-Plus command to search for the next occurrence of a specific word or words from a previous Find command.

**Floppy Disk** See Diskette.

**Format** A program that prepares new diskettes for use with Attache.

**Format Dimensions** The physical dimensions of a page, including top and bottom margins, left and right margins, tab stops, and the number of lines per page.

**Format Error** An error that occurs during FORMAT.

**GO** Utility program that executes the program already in memory.

**Hardware** The physical equipment that is a computer system.

**Help, Dots** WordStar-Plus help menus.

**Help Level** WordStar-Plus help settings that determine the amount of informational detail included in prompts and help menus that are displayed on the screen.

**Hide** See Block Hide.

**Home Error** An error that is detected while the system is trying to recalibrate to track zero.

**I/O** Input/Output. Indicates capability for both inputing and outputing data.

**Insert Mode** WordStar-Plus command that allows typing of additional text between existing characters or words in a document.

**K** Kilobyte, which is 1,024 characters.

**Keyboard Click** See Click.

**Keyboard Volume** The Set-up Mode command for determining the sound level of keyboard click.

**LINE FEED Key** Used for indicating the end of a line during program editing, but not used for word processing.

**Load Programs** The process of copying programs from diskette storage to the processing unit so that work can be done on the computer.

**Local Cable** Cable for attaching peripherals to the port labeled "Printer."

**Logged Disk** The disk drive containing the diskette that is being used by the computer.

**Lower Case** Small letters of type, as opposed to upper case (capital) letters.

**Margin** The boundary to either side, above, and below text on a printed page.

**Margin Release** WordStar-Plus command that allows typing beyond the normal left-right margins during word processing.

**Margins, Format** WordStar-Plus menu that provides commands for changing margins and various format dimension default settings.

**Markers, Repeat** WordStar-Plus menu that provides commands for place markers, unusual cursor movements, and deletions.

**MBASIC** The CP/M version of Microsoft's BASIC-80 language.

**Menu** A table listing available command options.

**Mode** One of a computer system's operating states or modes which provide the means for keyboard multi-functions and other tasks where internal interpretations depend upon the active mode.

**Modifier Keys** The CTRL and SHIFT keys, which are used alone or with each other in conjunction with the multi-function keys, arrow keys, or DEL key to perform a variety of tasks.

**Move** See Block Move.

**MS-DOS** An operating system used by Attache 8:16.

**MS-DOS Utility Programs** Programs used to copy files, display files and available file space, erase or rename files, and perform a variety of other maintenance functions under MS-DOS.

**Multiplan** Microsoft's spreadsheet analysis program.

**Multi-Function Commands** Commands that are described on the template above the Attache keyboard and activated by pressing one or more modifier keys at the same time as one of the multi-function keys.

**Multi-Function Keys** Keys on the top row of the keyboard that have capabilities in addition to normal upper and lower case when used in conjunction with one or more keyboard modifier keys.

**No Disk Error** Error that occurs when there is no disk in the drive, the drive door is open, or the diskette has not been formatted for use with Attache.

**No-File Commands** WordStar-Plus commands that are initiated from the No-File Menu.

**No-File Menu** WordStar-Plus main menu.

**Operating System** The set of programs that run the computer hardware and interpret software commands.

**Port** The connectors on the back of Attache for attachment of printer or communications cables.

**PORTS** A utility program for temporarily changing the number of stop bits, data bits, or parity usage for the Attache serial ports.

**Print** WordStar-Plus command for printing a word processing document.

**Print Codes** WordStar-Plus menu that provides commands for activating Print Control Characters.

**Printer Port** The connector on the back of Attache for attaching a cable to transmit data to a printer.

**Printing, Control** WordStar-Plus menu that provides commands for general directory maintenance and for getting out of a document.

**Read Error** An error that is detected while the system is attempting to read a diskette.

**Reboot** The loading of programs and/or execution of diagnostics that occurs when the RESET key is pressed at the same time as the SHIFT key on the right side of the keyboard, also called a "cold boot."

**Reform** WordStar-Plus command that rejustifies text after editing.

**Rename** Program option that changes the name of a file.

**Replace** WordStar-Plus command for finding a text string and replacing it with another text string.

**RESET Key** Used in conjunction with the SHIFT key on the right side of the keyboard to reboot Attache.

**Return** See Carriage Return.

**RETURN Key** Enters carriage returns or "sends" keyboard commands to the processor.

**R/O** Read/Only. Data already stored on a diskette marked R/O can be accessed but no new information can be written.

**R/W** Read/Write. Data stored on a diskette marked R/W can be accessed and new information can be written.

**Save** WordStar-Plus command that transfers work from the processing unit to the diskette and then returns to the work in progress for additional editing.

**Scratch Diskettes** Diskettes which have been previously used that will be erased and used again.

**Screen Brightness** The Set-Up Mode function that allows the brightness of the display screen to be adjusted up or down.

**Screenful** The number of text lines on the screen display at one time.

**Scrolling** The function that "rolls" lines of text or entire "screenfuls" of text up or down on the screen.

**Sectors** Locations on a diskette where data is stored.

**Set** WordStar-Plus command for setting tab stops.

**Set-up Mode** Operating state used for setting or changing screen brightness, keyboard click sound, volume level, baud rates, etc.

**SHIFT Keys** Used for activating upper case as on a typewriter, and as modifier keys when used in conjunction with other multi-function keys.

**Software** The programs that instruct the computer at each step in the accomplishment of a task.

**Start** See Block Start.

| | |
|---|---|
| **System** | The necessary hardware and software for a "computer" that is functionally complete. Sometimes used in reference to the software package being used. |
| **System Error** | Error that occurs when a hardware problem is detected. |
| **Tab Clear** | WordStar-Plus command for clearing tab stops. |
| **TAB Key** | Used for moving the cursor from one tab stop to another. |
| **Tab Set** | WordStar-Plus command for setting tab stops. |
| **Terminal Mode** | Operating state where Attache emulates a computer terminal. |
| **Text String** | A group of adjacent characters or words. |
| **TIME** | A utility program that sets the time. |
| **Top of Screen** | WordStar-Plus command that moves the cursor to the first line that appears on the screen. |
| **Underline** | WordStar-Plus command for underlining text strings in a document. |
| **Upper Case** | Capital letters, as opposed to lower case letters. |
| **Utility Program** | A program used to assist in the operation and maintenance of the computer. |
| **Valet** | Software program for activating Screen Dump, Alarms, and Calculator functions. |
| **Volume** | The Set-up Mode function that allows modification of the key click sound volume. |
| **Write Error** | An error that is detected while the system is attempting to write to a diskette. |
| **10-Key Mode** | Operating state where certain keys emulate a 10-key pad for numeric entry, activated or deactivated by pressing CTRL and CAPS LOCK. |

# Index