HOW TO USE ATARI COMPUTERS

An Introduction to
the 400, 800, and 1200

An Alfred Handy Guide

by Michael Boom

The Atari 400 computer.

The Atari 800 computer.

The Atari 1200 computer.

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AN ALFRED HANDY GUIDE

Computer Series Editor:
George Ledin Jr.

ALFRED PUBLISHING CO., INC.
SHERMAN OAKS, CA 91403

ACKNOWLEDGEMENTS

I'd like to express my thanks to all of the people who helped me in my research for this book, especially Gary Furr, A. J. Sekel, and Judy Wilson of Atari, Mindy Storch of Datasoft, and Donna McNeilley of Percom Data. I would also like to thank the staff of HW Computers in Northridge for their cheerful answers to inquiries about the latest Atari compatible products, and Roland Kato for being a computer novice guinea pig (who also lent us his pristine Atari 800 for photos.) Thanks also go to Steven Manus and Joe Cellini for their editorial help, and to Lynn Morton for general inspiration.

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20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2

Alfred Publishing Co., Inc.
15335 Morrison Street
P.O. Box 5964
Sherman Oaks, CA 91413

Library of Congress Cataloging in Publication Data

Boom, Michael.
How to use the Atari computers.

(An Alfred handy guide)
Includes bibliographies.
1. Atari computer—Programming. 2. Basic (Computer program language) I. Title.
QA76.8.A82B658 1983 001.64 83-8792
ISBN 0-88284-235-8

INTRODUCTION

Welcome to the world of the home computer. They are machines that did not exist a few short years ago, but are now common in many households. People use them to figure household finances, keep records, write letters and books, educate their children (or their parents!), and to play elaborate games.

This Handy Guide introduces you to three of the most popular home computers: the low-priced 400, the full-featured 800, and the top of the line 1200 (see inside front cover). In addition, we will examine many of the numerous products manufactured by Atari and other companies to augment these machines by increasing their power and uses.

The material is presented logically through seven chapters. The first offers an overall look at a typical Atari system: what the parts are, what they do. Chapter 2 shows how to get your computer running. In Chapter 3 you learn the keyboard and the screen editor (the part of the computer that displays what you type), and in Chapter 4 you take a brief look at BASIC programming. Chapter 5 shows you how to store programs, and Chapters 6 and 7 will help you build up your Atari by showing you how to expand your program library and to buy optional equipment. The Appendix is a handy, self-contained guide for the complete novice on how to load and run programs.

If you can't wait to unpack your computer and start playing games immediately, read Chapter 2 to get your computer running, and jump to the Appendix to learn how to load and run your game cartridge. But if you have more self-control, let's take a look at the Atari computer system.

1. THE ATARI HOME COMPUTERS

So there it sits in front of you, boxed up or on a desk. Just what is a home computer anyway? Let's look at the obvious facts first. A home computer is a machine which can perform small tasks, such as adding two numbers or displaying a small dot on a TV screen. Many machines around us are capable of doing this. A pocket calculator can add numbers. We can make dots with a pencil. What makes a computer something different?

To begin with, it can perform a wide variety of small tasks extremely quickly. This gives it the power to combine them into much larger and more impressive tasks. For instance, if the computer displays a number of small dots in the correct place on a TV screen, it can draw a complex picture (see Plate I on inside back cover). Perhaps the most important feature of the computer is that it has a memory to store lists of these small tasks. In this way, the computer has a guide to tell it

which tasks to perform, and in what order. A list of these tasks is known as a *program*.

You can create your own programs for your Atari or buy programs which were written by other people to run on your machine. In computer jargon, programs are referred to as *software*, to distinguish them from the rest of the computer system, the *hardware*. You might like to think of the hardware as anything that exists physically, that you can get your hands on, and software as a set of directions which causes your hardware to run the way you'd like it to. When you buy a record for your stereo system, the music on the disk represents software; it tells the stereo how to make the sounds that you paid for. The needle, the turntable, the amplifier, and the other parts of your stereo are all hardware, waiting for the directions encoded in the grooves of the record to tell them what to do.

HARDWARE

Now that we know the difference between hardware and software, let's find out just what hardware is included in the typical Atari computer system. Like a stereo system, a home computer system can take many different forms depending on what peripherals you add to the Atari computer (see Figure 1.1).

FIGURE 1.1. A typical Atari computer system: the 800, 810 disk drive, and Amdek Color 1 monitor.

THE CPU

The heart of the system is the Atari computer itself. Atari makes three models: the 400, the 800, and the 1200, which are essentially similar except for a few important differences which we will note later.

The Atari computer is similar to a stereo receiver because it combines many components in one package. The heart of the Atari is the *microprocessor* (or *central processing unit*, CPU), a small chip located deep inside the machine. The microprocessor is the brain and command center, responsible for all the calculations and figure manipulations performed by the Atari. It is in

charge of executing the commands you give, and it controls all of the other parts of the computer, including other chips which display things on the TV screen, make sounds, and perform many other functions necessary to run the computer. The Atari uses a 6502 microprocessor, the same kind used in several other popular home computers.

MEMORY

The second major part of the computer is the *memory* required to store programs and information necessary to run the computer. These programs and information, known as *data*, are stored as tiny electric charges inside memory chips. The chips are connected to the microprocessor by tiny strips of conducting metal. We can see the plug-in memory modules where these chips are stored by lifting up the top of the Atari 800 computer as in Figure 1.2.

FIGURE 1.2. The 800 computer with its cover removed revealing plug-in 16K memory cartridges and a 10K ROM cartridge.

As you notice on the labels of the memory modules, there are two kinds of memory, RAM and ROM. These acronyms stand for *Random Access Memory* and *Read Only Memory*. To understand the difference between the two, let's think of memory as a large blackboard at school. As a teacher presents instructions and explanations to his students, he writes them on the blackboard. If he wants to present some new information, he can erase the board and write again. In a similar manner, Random Access Memory (RAM) can be filled with data and then erased later to put in new material. The data in RAM can be easily moved around into different memory locations, and erased and rewritten at will.

Now let's imagine a student sneaking into the classroom after hours and writing something very sinister in indelible spray paint on the blackboard. The teacher will find it impossible to remove with his eraser. That message is there for good! Since it has filled up

the blackboard, the blackboard is now useless for writing on, and serves only to display the student's message. This is similar to Read Only Memory (ROM), a type of memory which stores data permanently. The computer can only read the data in ROM, it cannot erase it or write anything new on it.

There are different uses for each type of memory. ROM is used to store unchanging data that is important for making the computer work. RAM is usually used to store computer instructions and information which change from time to time.

Before we leave the topic of memory, let's discuss one other aspect. Computer memory is limited. It can only remember a finite number of things, and there are ways of measuring its capacity in units. The smallest unit of memory is a *bit*, which can only remember if something is on or off. Eight bits combine to make a *byte*, which is just enough memory to store one character of the alphabet or number system. A thousand bytes are referred to as a *kilobyte*, or *K*, and a million bytes are known as a *megabyte*, or *meg*. (Note: One kilobyte is actually 1024 bytes and one megabyte is 1,048,576 bytes, reckoned using binary arithmetic, the type of counting a computer does. However, for our purposes, it's easier to think of them as one thousand and one million, respectively.) Since different computers come with different amounts of memory, you'll usually see them advertised with these units of memory measurement prominently displayed.

The amount of memory you have in your computer determines what programs you can run. Larger portions of RAM let you run longer and more complex programs. Atari computers come with memory measuring from 16 kilobytes to 64 kilobytes of RAM. An important difference between the 400, 800, and 1200 Ataris is the amount of RAM each contains. Atari 400's are sold with 16K of memory. If you want to expand the memory, the 400 must be taken apart and a special memory board put in, which can expand its memory capacity up to 48K. The 800 is now sold with its full capacity of 48K RAM, although in the past it was sold with just 16 or even 8K. If you have an Atari 800 with less than 48K, its RAM is easily expanded using plug-in memory modules. The Atari 1200 comes with 64K of RAM already installed in the computer, but unlike the 800, the memory is not user-accessible for removal or change.

THE KEYBOARD

The third and final major part of the Atari computer is the keyboard. The keyboard is our main channel of communication with the microprocessor inside. If you are familiar with typewriter keyboards, you'll see the similarities. This makes it very easy for the experienced typist to adapt to a computer keyboard. There are also a number of extra keys with little arrows and strange words on them that are used for computer functions not found on typewriters. We'll talk about how to use them later in Chapter 3.

There is a great difference between the keyboards of the three different Atari computers. The 800 and 1200 both have a full-size *full stroke* keyboard. This

means that each individual key can be depressed fully, which gives it the feel of a typewriter. The 400 has a *membrane* keyboard which responds to pressure on the keys, but does not let the keys sink into the board.

The membrane keyboard is smaller than the full stroke. The chief advantage of a membrane keyboard is that it is fairly kidproof, and can take a lot of abuse. Spilled drinks will not bother it, while a can of soda spilled in the keys of a full stroke keyboard can ruin it. The chief drawback of the membrane keyboard is that it is hard to type on for long periods of time, something to take into consideration if you are planning to use your Atari for word processing or entering large amounts of data. Try them out before you buy.

Now that we've seen what the computer is made up of, let's look at the other hardware used to complete the system. These other pieces of hardware are known as *peripherals*.

THE MONITOR

The *monitor* is probably the most crucial peripheral to a system. It allows the computer to communicate with us by displaying letters or pictures on the screen. The monitor's speaker is used to create music and sounds controlled by the Atari. It also lets us see what we have typed into the computer. The Atari is designed to use your TV set as the monitor. The 800 and the 1200 can also use specially designed computer monitors which will give the Atari a clearer picture, but which will not tune in your favorite television programs (see Figure 1.1).

THE PROGRAM RECORDER AND THE DISK DRIVE

Another important peripheral is the *data storage device*. This may seem unnecessary, since we have all that memory in the computer designed to hold data. However, the RAM used to hold data has one serious problem: when the computer is turned off, everything in it is erased! This can be highly discouraging if you just spent five hours creating a program and then turned off the computer. RAM takes a steady current of electricity to keep data stored in its memory. The way around this problem is to read out the contents of memory to another device that can store data without constant power. Then the computer can be turned off, or the memory erased for another program, without the first program being lost.

Why bother with RAM in the first place if it loses data so easily? Well, in its weakness lies its strength. Its ability to be erased and written to so easily, a quality called *volatility*, makes it very easy for the microprocessor to use. It is many times faster than the best data storage device, and this is important to the operating speed of your computer. By using both RAM and a data storage device, we can utilize the strengths of both—fast memory with RAM and permanent memory with the data storage device.

A typical Atari system uses one or both of two storage devices: the *program recorder* and the *disk drive*. The program recorder (see Figure 1.3) is much less expensive than the disk drive and works quite well for data storage. It's a specially designed cassette recorder which hooks up to the Atari. Data is converted from RAM into electrical signals, which are recorded onto a cassette tape in the same way that music or any sound would be recorded. Later, when you wish to load the data back into RAM, the program recorder plays back into the Atari the electric signals which are interpreted and stored back into RAM as the original data.

FIGURE 1.3. The 410 Program Recorder.

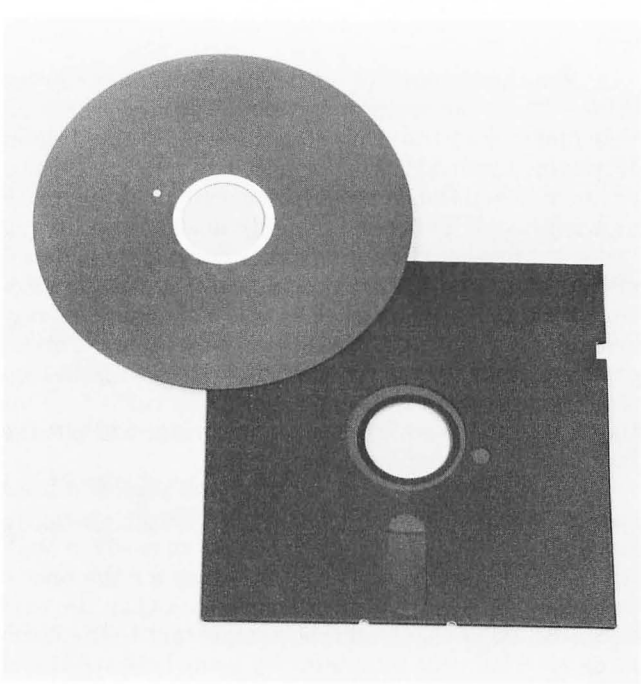

FIGURE 1.4. Floppy disks, opened and unopened.

The disk drive stores data on a small piece of flexible coated plastic known as a *floppy disk* (see Figure 1.4). This disk is made from the same material as recording tape—mylar with an iron oxide coating—but it is a bit thicker. It gets its name from the fact that it's very flexible and not as rigid as some other disks are. (*Hard disks* are discussed in Chapter 6.) The floppy disk is enclosed in a tough, square outer envelope which protects it from creases and fingerprints, deadly enemies of the data stored on the disk. You can see the floppy disk through an oblong hole in the envelope, where it should never be touched. You might fingerprint it!

The disk drive (see Figure 1.1) has a recording head which moves back and forth across the disk through this hole while the disk is rotating. This recording head can record electrical signals onto the disk in much the same way that the recording head of the program recorder records onto a cassette. The contents of the Atari RAM are converted into signals which are then stored on the disk. The signals can be read back later and reconverted to data to be stored in RAM.

What is the advantage of a disk drive over the program recorder? It seems to record data very much like the program recorder does. Why pay all that extra money for one?

The disk drive's main advantages are speed and data accessibility. It can load and store data 10 to 20 times faster than a cassette recorder. It can also store and retrieve data from the disk in any order. How does that help us? Let's use an analogy. Consider trying to find your favorite song on a record album. If you have the album on cassette, you must fast forward and rewind until you find the song. This can take some time and effort, especially if the song is somewhere in the middle of the album. If you have the album on a 33 rpm record, you can look at the album jacket for its location and set the needle down directly at the beginning of the song with little searching or effort. In a similar manner, data on a disk drive can be found almost instantaneously by the record head moving across the disk. Each disk has a *directory* on it that lists (in magnetic signals) all of the programs and information contained on the disk. The computer can look at that directory and go directly to the data required.

Once it finds the data, it can load it much faster than the cassette recorder can. A long program on cassette might take 8 minutes to load (once found). The same program would load from disk in a matter of seconds. The disk drive is also more reliable, and not so likely to garble signals sent back to the computer.

PLUG-IN ROM CARTRIDGES

There's a third way to store data, although unless you have special equipment you can't do it. This method is to store the data on a ROM chip as a series of circuits. Once the chip is created, the software embedded on it is generally there for good. You can buy programs stored in ROM. They usually come in a cartridge, which is plugged into an appropriate socket in the computer. The major advantage of the cartridge is that it loads

instantly by plugging it in and turning the computer on, a very simple procedure. Cartridges are also very durable, and can withstand a lot of rough handling that disks and cassettes can't. The number of cartridge slots differ between the three Atari computers. The 400 and 1200 have only one such cartridge slot, while the 800 has two, allowing for longer programs to be loaded using two cartridges simultaneously.

We've now seen the hardware included in a typical Atari home computer system: the Atari computer itself, a monitor to display information, and a program storage device (program recorder or disk drive) to store programs and information on. Although any functional Atari computer system needs at least this much hardware to get good use from it, many more peripherals can be added to increase its power and versatility.

SOFTWARE

A computer without software can't do anything. It might as well be used as a very large paperweight or converted into a very curious planter. To make it run, we need to supply it with software.

Software comes on a variety of storage media. We can buy it on floppy disks, on cassette, or on a plug-in ROM cartridge. And just as books and printed material are written in many different languages, such as Dutch or Japanese, so is software. Let's look at two languages commonly used with the Atari computer system.

MACHINE LANGUAGE

Machine language is the internal language of the computer: all commands received by the microprocessor must be in machine language. It's a very fast and efficient language used by advanced programmers, but it's not easy to use. It's written as a series of numbers. These numbers are converted into electrical pulses which tell the microprocessor what to do. Since the numbers put into the computer speak directly to the microprocessor, the microprocessor can act very quickly on them. For this reason, most arcade style video games are written in machine language, since machine language is quick enough to provide exciting video displays. Writing a program in machine language can take a good deal of time and effort, but it can pay off.

BASIC

Since most people do not like to talk in numbers, it's fortunate that we have other computer languages that are much easier to use. In computer parlance, something easy to use is known as "friendly." One of the friendliest computer languages in use today is BASIC (which is an acronym for Beginner's All-purpose Symbolic Instruction Code). When we write a program in BASIC, we use English words to command the computer. In order to use BASIC on the Atari, we must first have a machine language program which will

interpret for the microprocessor. This program takes our BASIC English commands and translates them into machine language. We will take a much closer look at BASIC programming in Chapter 4 and cover the many other languages available for use on the Atari in Chapter 7.

Atari computers are marketed with a variety of optional software. We'll look at the software most commonly included in a simple computer system.

THE OPERATING SYSTEM

One piece of software included with every Atari sold is a very important program called the *operating system* (OS for short), a machine language program which runs all of the fundamental functions of the computer. With no OS, the computer would just sit in front of you when turned on, doing nothing. The OS tells it how to respond to the keyboard and switches, how to display on the monitor, how to receive programs from the disk drive or program recorder, and thousands of other things. You must have the OS in the computer to run anything. The OS is contained in a large plug-in ROM cartridge, which is inserted with the RAM cartridges under the cover of the computer (see Figure 1.2). The OS begins working the instant the computer is turned on.

THE BASIC CARTRIDGE

BASIC may be included as a language with Atari computers. I highly recommend purchasing it if you don't have it. It comes in a small plug-in ROM cartridge which plugs into a cartridge slot in the top front of the computer (see Chapter 4 for specifics.) You must have the BASIC cartridge to run any programs you purchase which are written in BASIC. As discussed earlier, the BASIC cartridge contains a machine language program which interprets the BASIC commands for the microprocessor. BASIC is the most commonly used language among Atari owners who write their own programs.

THE DISK OPERATING SYSTEM

If you buy an Atari 810 disk drive, a machine language program is included called the *disk operating system*, or *DOS* for short. DOS comes on a floppy disk and loads into the computer as soon as the computer is turned on. DOS gives the Atari the capability to exchange data with the disk drive, to look at the disk directory, and to control the drive motor. Without DOS, you cannot use the Atari 810 disk drive. Cassette owners without disk drive need not worry about DOS, as it has nothing to do with the program recorder.

This is the software common to most Atari computer systems. There is an incredible amount and variety of additional software available to make your Atari perform all sorts of interesting and useful jobs. We will look at some of it in Chapter 7.

2. RUNNING YOUR ATARI COMPUTER

Setting up and running an Atari computer system is not a difficult job. The computer system that most people own includes the computer, a monitor, a program storage device, and some game controllers. The computer and the peripherals have all been designed to connect to each other very easily. The only tool you'll need is a screwdriver. Just follow the instructions in the owners manual of whichever model you own.

Before you start hooking things up, take a look around you for a good place to set up. You'll want a table or desk where you can sit down at the computer as if it were a typewriter. There should be room for the disk drive or program recorder nearby, and the monitor should be close for easy viewing. If your monitor is small enough (perhaps a 13-inch screen), you might set it up directly behind the computer. If it's a large console TV, set your computer table in front of it at a close enough distance for easy viewing. You'll find that the cables connecting all of the peripherals will set some limits on their distance.

TAKING STOCK

You should have:

- A TV switch box
- A power supply
- An owner's guide
- The computer itself

The 1200 has a cord for the TV switch box.

SETTING UP

If everything is there, first hook the computer up to your monitor or TV set, then plug in the power cords, carefully following the instructions in your owner's guide.

Once everything is connected, trip the rocker switch labelled POWER on the side of the computer to test whether the computer and monitor work. If there are no cartridges in the cartridge slots, the Atari 400 and 800 will display the message ATARI COMPUTER—MEMO PAD in white on a blue background. The 1200 will display a rainbow-hued Atari symbol on a black background. If nothing shows on your screen, check to make sure the channel is set correctly on your Atari and the TV set. (The TV might also need some fine tuning.) If things still don't work, consult your dealer for help.

Now that we know the computer and monitor work, we can turn them off and hook up our program storage device. Again, follow the appropriate instruc-

tions in your owner's guide to connect either your Atari 410 Program Recorder or Atari 810 Disk Drive.

At this point you are ready to power up, but if you're going to play games, you'll probably require a joystick or a paddle controller. You can buy them at your Atari dealer. Located under the front of the keyboard of the 400 and 800 computers is a row of jacks labelled CONTROLLER JACKS. They're numbered 1 through 4. Just plug in the cord from the end of the joystick or paddles into jack #1, and you're ready to go. If you need to use more joysticks or paddles, plug them in jacks 2-4 in numerical order.

POWERING UP

Now that the system is all hooked up, it's time to turn it on. Although it seems that all you have to do is turn on a few switches, it's not quite that simple in some cases. When you use the disk drive with a system, a certain power up procedure has to be followed to make the system work.

Powering up is easy if you are not going to use the disk drive. Just turn on the monitor and the computer, and you're ready to go. Be sure the cartridge door is closed on the 400 and 800 computer, since an open cartridge door automatically turns the computer off. The program recorder doesn't need to be turned on since it works only when you press the PLAY, ADVANCE, and REWIND keys, and is turned off when none of these keys are depressed.

When you're using the disk drive however, a certain order has to be followed in powering up. This is because of DOS, the Disk Operating System we discussed in Chapter 1. It's a machine language program which must be loaded into the computer so that your Atari can run the disk drive. If you'll look at the two diskettes included with your 810 disk drive, you'll notice one is labelled Master Diskette II. This is the disk that contains DOS. If we need DOS so that the Atari can use the disk drive, how can we load DOS from the diskette which must be loaded from the disk drive?

Fortunately, there is a solution which lets the computer take care of this, pulling itself up by its own bootstraps. When the computer is turned on, it has a small program in its own memory which sends out a signal through the data cable to see if there's a disk drive attached to the computer, and if that disk drive is turned on. If there is a powered-up disk drive on the line, this small program automatically looks for DOS on the disk inserted in the drive and loads it into the computer. This is called *booting up* or *booting DOS*. You can see that if there is no powered-up disk drive with DOS in it when you turn on the computer, DOS will not be booted.

Now make sure the computer and all the peripherals are turned off. This is how to power up the Atari computer system with a disk drive attached:

1. Turn on the disk drive. You'll hear some whirring mechanical sounds, and see two red lights come on. After a few seconds, the whirring will stop, and the red light labelled "BUSY" will go off.

2. After the BUSY light is off, open the front door of the disk drive.
3. Remove the diskette marked "Master Diskette II" from its envelope, and insert it with the label up and the arrow on the label pointed into the disk drive. Be very careful not to touch the diskette inside the black outer sleeve. Push the diskette into the drive until you feel a slight click (see Figure 2.1). You shouldn't have to force it.
4. Close the disk drive door. If it won't close easily, make sure the diskette is pushed all the way back into the drive.
5. Turn on the monitor.
6. Turn on the computer. You should see the BUSY light go on and hear the whirring of the disk drive. If the sound is turned up on the monitor, you'll hear a fast beeping sound, which is DOS being loaded into the computer. After DOS is loaded, you'll see some printing come up on the screen headed: Disk Operating System. This is called the DOS MENU. Congratulations! Your computer system is now up and running.

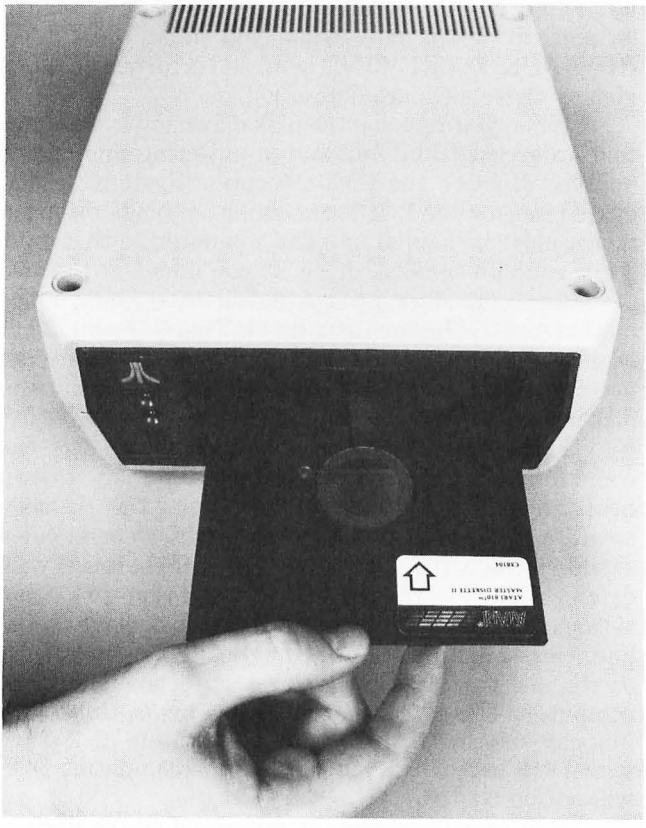

FIGURE 2.1. Inserting the Master Diskette.

If, for some reason, you see BOOT ERROR repeating itself endlessly on the monitor, something is going wrong, and the computer cannot find DOS. Turn the computer off, and wait for the BUSY light to go off on

the disk drive. Check to make sure the diskette is inserted properly. If it is, make sure the door is closed, the data cable is securely connected at both ends, and the disk drive is turned on. Try powering up once more.

If you have a cartridge in the computer, you won't see the DOS menu. Instead, the cartridge program will start running. If you want to see the DOS menu without having the cartridge run first, you must take the cartridge out and power up once again.

3. USING THE KEYBOARD

We know from our look at Atari hardware in Chapter 1 that the heart of the Atari computer is the microprocessor, a small chip located inside the computer. The keyboard lets us communicate with the microprocessor. Each time we press a key on the keyboard, a character appears on the screen and is also sent to the microprocessor (in machine language). When the microprocessor communicates with us, it does so by printing messages on the monitor. Let's imagine the monitor screen as a bulletin board where we post messages for the microprocessor to read, and it in turn posts messages for us. In Chapter 1, we also talked about the Operating System, a machine language program that's always in the computer, running everything. There's a special part of the Operating System that keeps track of our bulletin board and lets us exchange messages with the microprocessor. This part of the OS is called the *screen editor*. In order to talk to our computer, we need to know the rules by which the screen editor works.

In this chapter, we'll learn those rules. We'll see how each of the keys on the keyboard works, and how the screen editor takes care of displaying our messages on the screen. The Atari 400, 800, and 1200 computers all use the same screen editor. However, the keyboard of the 1200 is laid out just a bit differently than those of the 400 and 800 and it has a few extra keys. First we'll go through the keys common to all of the computers, and then we'll go through a special section learning to use the extra Atari 1200 keys.

ENTERING MEMO PAD MODE

We're going to test out the keyboard, play with it, and get familiar with the operation of the screen editor. This means we'll be putting a lot of gibberish on the screen. If the BASIC cartridge is in the machine, or DOS is booted up, the Atari will be expecting some logical commands. It will be very confused by what we are typing. There's a way around this on the 400 and 800 computers: We can enter the *Memo Pad Mode*.

The Memo Pad Mode is a kind of electronic scratch pad where we can type whatever we want, and the computer will not react to it. It's most useful for learning how to use the keyboard.

To enter the Memo Pad Mode, first turn off your computer system if it is on. Turning it off is easy. Making sure there's no disk in the disk drive, just turn off the power switches to the disk drive, the computer, and the monitor. By turning the computer off, we have erased everything in its memory. Now make sure there are no cartridges in the cartridge slots. Turn on the monitor, then turn on the computer. Do *not* turn on the disk drive. We don't want DOS to be booted. The title ATARI COMPUTER—MEMO PAD should be displayed on the top of the screen. We are ready to play around with the keyboard.

If you are using a 1200 computer, the Atari will display a rainbow-colored ATARI instead of the Memo Pad heading. The 1200 does not have a Memo Pad Mode. What you'll have to do is turn off your system as described above. Now take the BASIC cartridge included with your computer and plug it into the cartridge slot on the left side of the 1200, with the BASIC title on the cartridge facing up (see Figure 3.1). Turn on the monitor and then the computer. Your screen should respond with READY. The 1200 is now expecting some specific BASIC commands which it won't get. It will just have to deal with gibberish, and it will probably complain occasionally, sending back ERROR messages which you'll have to ignore. Hitting the RETURN key is what usually prompts these ERROR complaints. If you avoid RETURN, you should be able to simulate Memo Pad Mode without too much trouble.

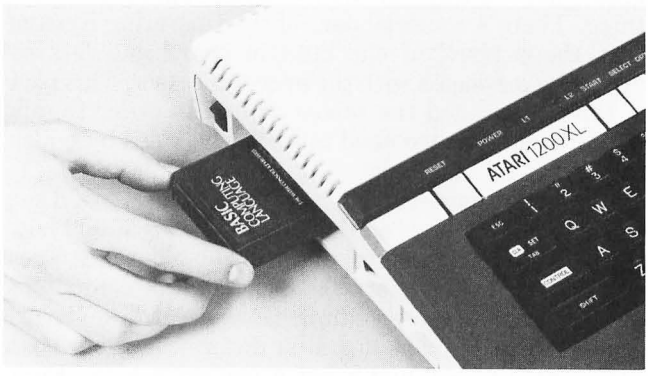

FIGURE 3.1. Inserting the BASIC cartridge into the Atari 1200.

TRYING THE KEYBOARD

The best way to find out about the keyboard is to try it out. Go ahead! Type anything at random. If you would like, try all the different keys to see what they will do. You won't hurt anything on the computer. If, for any reason, the computer *locks up*, meaning it won't respond to the keyboard, just hit the SYSTEM RESET button located in the upper right-hand corner of the 400 and 800 computers, and in the upper left-hand corner of the 1200 computer. If all else fails, you can simply turn the computer off and then on again.

You may notice several interesting things. For instance, if you hold most keys down for longer than a

second or two, they will begin repeating the character or function they represent on the screen. If you happen to leave the keyboard for more than about eight minutes, you'll notice that the colors on the screen will start changing automatically. The Atari does this to protect your monitor from color burnout. You can make it stop the color cycling by pressing any key on the keyboard. You may also notice strangely shaped characters, or characters that seem to be the inverse of the other characters. These will have to remain mysteries until our keyboard exploration later in this chapter.

One very important thing to notice is the small white square that moves around the screen as you type. It seems to act as the type head, leaving characters wherever it is positioned. This small square is called the *cursor*, and it appears on the screen to let you know where you are typing. You'll notice that if you type to the end of a line, the cursor automatically jumps back to the left and down one line. You don't need the RETURN key to do this, as you would on a typewriter. This is called *wraparound*.

MOVING THE CURSOR

Because you can move the cursor without printing characters on the screen, you can use it to move easily to another screen area where you wish to type. This is how to do it. On the left edge of the keyboard, you'll notice a key marked CTRL (see Figure 3.2) or CONTROL on the 1200. Hold this key down, then simultaneously press one of the keys on the right marked with small arrows in white squares. You'll notice the cursor jumps one space in whatever direction the arrow was pointing. If you hold the arrow key down, it will repeat, moving the cursor across the screen. When the cursor hits one side of the screen, it will automatically jump to the opposite side, and continue moving in the arrow's direction.

You will notice that if the cursor passes over characters already on the screen, it doesn't erase them. Instead, it just passes over them, turning them momentarily into a blue character on white background instead of white on blue. This is called an *inverse* character. If you locate the cursor on top of a character and then begin typing new characters, the old character will be erased and replaced with a new character. Try it out.

CLEARING THE SCREEN

If you begin to type at the bottom of the screen and run out of room, you'll notice the Screen Editor automatically shifts all the characters up on the screen to give you more room to type. The lines at the top of the screen are pushed upwards out of sight. This is called *scrolling*. If you want to start fresh and clear out the screen, hold down the SHIFT key, located both in the bottom left and bottom right corners of the keyboard, and then press the CLEAR key on the top row toward the right (see Figure 3.2). Everything on the screen will be erased, and the cursor will be placed at the top left corner of the screen.

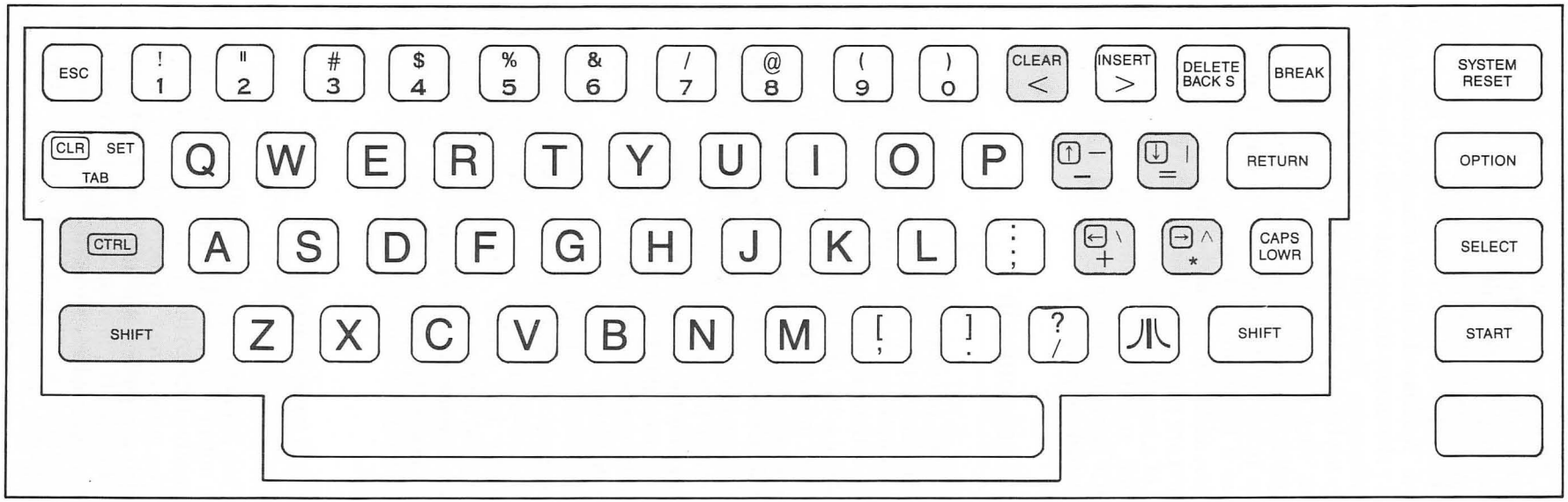

FIGURE 3.2. An 800 keyboard with the CTRL, cursor movement, SHIFT, and CLEAR keys highlighted.

TYPES OF KEYS

Now it's time to take a close look at the keyboard and the individual keys to find out what they do. We'll divide the keys into four different types in order to understand them better. They are:

1. **Character keys**. These keys produce characters on the screen when pressed.
2. **Editing keys**. These keys don't actually produce characters when pressed, but move the cursor around, clear the screen, shift characters around on the screen, and perform other editing functions.
3. **Programming keys**. This is a small group of keys that are used mainly to perform special tasks when programming.
4. **Program control keys**. These keys are sometimes used when running a program to control the program.

Let's first look at character keys.

CHARACTER KEYS

Character keys (see Figure 3.4) are the simplest keys to understand. They are the letters, numbers, punctuation, and special mathematical symbols which appear on the keys in the middle of the board. You press a character key and a character appears on the screen. The long space bar at the bottom of the keyboard is also a character key which produces only a space as its character. Some character keys have more than one symbol on them, such as the number keys in the top row of the keyboard and the cursor movement keys to the right. These multiple-character keys are used with the SHIFT and CTRL keys.

EDITING KEYS

The editing keys are generally located to the right and left of the keyboard (see Figure 3.3). Let's look at them one at a time.

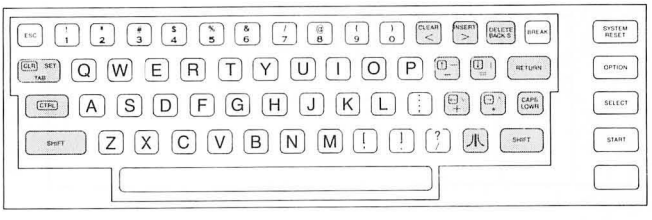

FIGURE 3.3. An 800 keyboard with highlighted editing keys.

SHIFT KEYS

The SHIFT key lets us get a second character from most of the keys. There are two SHIFT keys, one

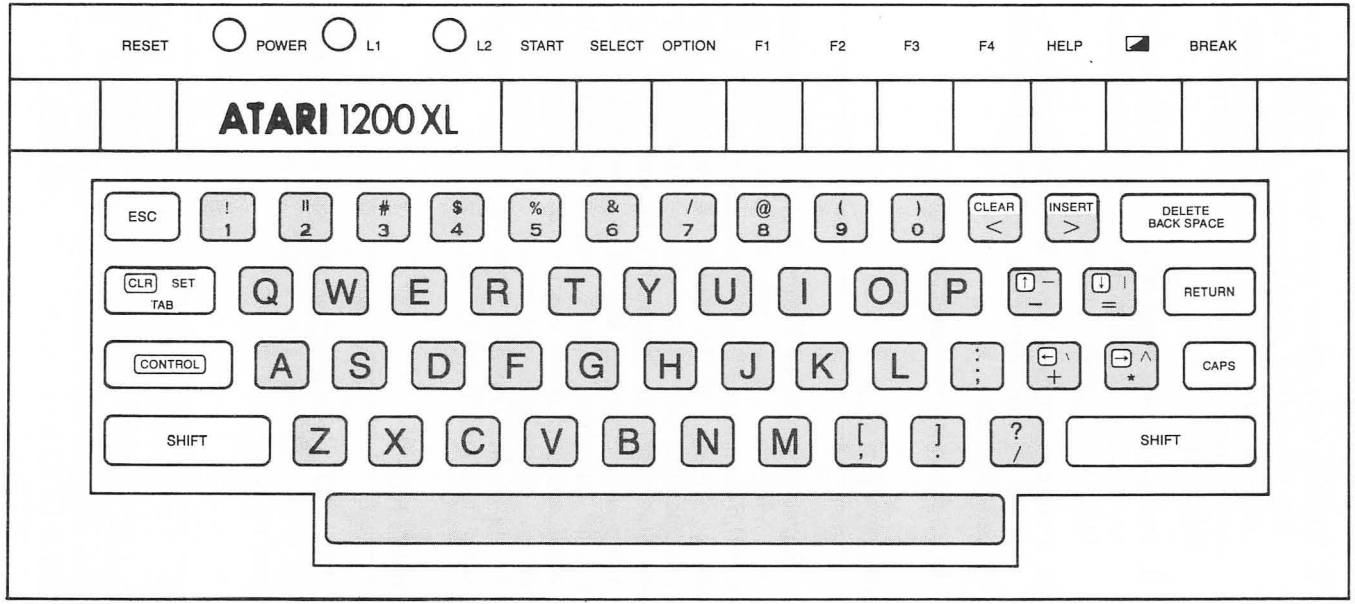

FIGURE 3.4. A 1200 keyboard with highlighted character keys.

in each lower corner of the keyboard which do the same thing. By pressing SHIFT and a two-symbol character key simultaneously, you get the upper character to display on the screen. For instance, pressing the SHIFT and the 3 key together produces a # on the screen. Using SHIFT with a three-symbol key gives you the upper right symbol. For example, pressing the SHIFT with the * key yields a ^. If you are used to using the typewriter, you know that a typewriter's shift key gives you capital letters. Why doesn't it do the same thing on the Atari keyboard? It's time to look at our next key.

CAPS/LOWR KEY (CAPS on the 1200)

By now, you've probably noticed that the letters produced on the screen are all upper-case (capital) letters. The CAPS/LOWR key gives us lower-case letters as well. Press it once. Now try typing letters onto the screen. They're all in lower case! As long as the keyboard is in lower-case mode, the SHIFT key will give us capital letters if pressed simultaneously with any of the letter keys. One important thing to notice is that the CAPS/LOWR key only affects the letter keys (see Figure 3.4). The two- and three-symbol keys work just as they had before. To put a # on the screen, we still have to press SHIFT and 3 together whether we are in upper- or lower-case mode. To return to the upper-case mode on the 400 and 800 computers, press SHIFT and CAPS/LOWR together, and the keyboard once again produces only capital letters regardless of the use of the SHIFT key. To do the same thing on the 1200, just press the CAPS key a second time to return to upper-case mode. You do not need to use the SHIFT key with it.

CTRL KEY (CONTROL on the 1200)

The CTRL key is like a second SHIFT key. It gets a third set of characters out of many keys. Try it out. Hold the C key down while typing the letter keys. You should get some strange results! The figures you see on the screen are called *graphics characters.* You can use graphics characters as building blocks to draw pictures of things if you wish. You'll notice all sorts of shapes, including hearts, clubs, diamonds, and spades for card playing. Since the graphics symbols are not shown on the keys, you should look in your owner's manual to see their location on the keyboard.

In addition to the graphics characters, the CTRL key gives us the upper left-hand symbol of a three-symbol key. We have already seen how this works by moving our cursor around. For example, pressing CTRL and + moves our cursor one space to the left, the direction of the arrow in the upper left of the key.

Another useful bit of information about the CTRL key is that it can be locked into use as the SHIFT key was, using the CAPS/LOWR key. Hold the CTRL key down and press the CAPS/LOWR key once. Now try typing on the letter keys. The graphics characters appear without holding down the CTRL key! Locking the CTRL key with the CAPS/LOWR key works only on the keys controlled by the lower-case

mode: that is, the letter keys (shown in Figure 3.4). To get graphics characters from the comma, period, and semicolon keys, you must still press down the CTRL key. To return to the normal upper-case mode, press SHIFT and CAPS/LOWR simultaneously. (Or just CAPS on the 1200.)

Using the CTRL key with the number keys can yield some interesting results. Hit the CTRL key and the 1 key together. Now try to type on the keyboard. The screen is frozen! Nothing new can be added. Hitting CTRL 1 again will unfreeze the screen. This is a handy feature to use when the computer is printing things on the screen so fast that they disappear before you get a good look. By freezing and unfreezing the screen, you can read at your leisure. If you hit CTRL and 2 together, you will hear a buzzer. That's CTRL 2's sole purpose. CTRL 3 creates an EOL (End Of Line) signal, which the computer will merely interpret as a RETURN right now. EOL is used for advanced programming purposes. The other number keys do not do anything when used with CTRL.

THE ATARI KEY (人)

On the 1200 computer, this key is labelled with a ◢, and is located to the right of the shiny chrome keys at the top of the computer. Hitting the Atari key once causes all the characters to be printed in inverse video, which is a kind of negative image. Try it out. It even works with the graphics characters. To get back to regular characters, press the Atari key once again.

THE RETURN KEY

On a typewriter, the RETURN key usually serves as a carriage return, ending the line you are typing on and returning to the left side of the page, one line lower. The RETURN key on the Atari will do this on the screen,ending the line and returning to the left, but it is not really like the typewriter return key. Think of the RETURN key as a message to the computer saying "I'm done typing, I'm returning control to you so you can read my message." In Memo Pad Mode, the computer does not read the message, but later, when using BASIC, you will see how RETURN works in this way.

TAB/SET/CLEAR KEY

This key is really three keys in one. Pressing the key alone will work the TAB function. Pressing it with SHIFT will work the SET function, and pressing it with CTRL will work the CLR function. TAB works as the tab on a typewriter does. When you press it once, the cursor jumps to the right a set number of spaces, then stops. Press it again and it will jump to the right once more. These stopping places are called, logically enough, *tab stops*. You continue this until the cursor returns to the left side of the screen, where you can start all over. TAB gives you the ability to get to the center of the screen easily.

Although tab stops are preset when you turn on the computer, you can move them wherever you like. To do this, move the cursor to the spot on the line

where you would like a tab stop. When it is there, use the SET function by pressing the SHIFT and TAB.

To clear out a tab stop, use the TAB key to move the cursor to the tab stop you want to get rid of, then use the CLR function by pressing the CTRL and TAB keys together. The next time you use the TAB function, the cursor will no longer stop there.

CURSOR MOVEMENT KEYS (→, ↑, ←, and ↓)

These keys are normally character keys, yielding characters when used alone or with the SHIFT key. Using them with the CTRL key moves the cursor in the direction of the arrow without disturbing the characters on the screen which the cursor crosses over. When the cursor hits the edge of the screen using these keys, it will wraparound (jump) to the opposite side, then continue its movement. You will use these keys a lot.

DELETE/BACK S KEY (DELETE/BACK SPACE on the 1200)

This is a triple-function key, which lets us remove characters from the screen. Hitting the DELETE/BACK S key alone will move the cursor one space to the left (backwards), erasing whatever character is under it. This is the BACK S (backspace) function. You can use BACK S to erase something you just typed.

The DELETE function on the top of the key can be used with either the SHIFT or CTRL keys with different results. SHIFT DELETE will cause the whole line that the cursor is resting on to disappear. All the lines underneath the cursor will then jump up one line. CTRL DELETE will cause one character, the one under the cursor, to disappear. All the other characters to the right of the cursor will then move over one position to the left. If you hold the DELETE key down for a while, the key repeat will start, and you can delete a lot of characters. The best way to understand how this key works is to type a lot of characters on the screen and then move the cursor back into the midst of them. Try this key by itself, then with the CTRL and SHIFT keys.

INSERT KEY

This key is part of a character key. The INSERT function only works when you press it with CTRL or SHIFT. Think of the INSERT function as the opposite of DELETE. If you press SHIFT INSERT, all the lines below the cursor will be pushed down one line, and a blank line will appear where the cursor is. You can then use the blank line to type in whatever characters you want. CTRL INSERT will insert one space by shifting the characters under the cursor and to the right of it one position to the right. Try this key out in the same way you tried DELETE/BACK S.

CLEAR KEY

This key is also part of a character key. The CLEAR function works the same with either the SHIFT

key or the CTRL key. Pressing SHIFT CLEAR or CTRL CLEAR will erase everything from the screen and return the cursor to the upper left-hand corner.

PROGRAMMING KEYS

The programming keys (see Figure 3.5) are usually used when writing or running a program, but let's take a look at them now.

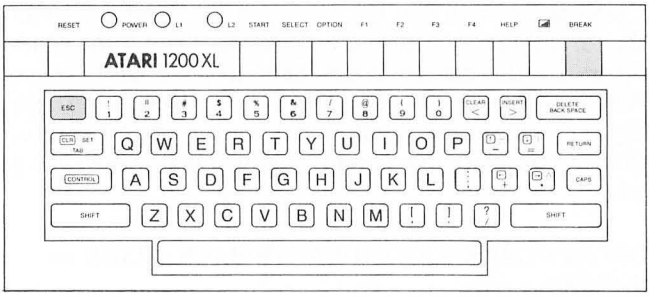

FIGURE 3.5. 1200 keyboard with highlighted programming keys.

ESC KEY

This key (short for "escape key") tells the Atari to ignore the next editing key pushed, and to print a special symbol representing that editing function instead. Press ESC once, then press DELETE/BACK S. You will see an arrow representing BACK S appear on the screen, but no actual back space will happen. This works with the editing functions as well, such as CLEAR and INSERT. It even works with the ESC key itself! Try pressing ESC twice. Note that this key doesn't work with RETURN, SHIFT, CTRL, CAPS/LOWER, the Atari key, and BREAK.

BREAK KEY

The BREAK key is used to tell the computer to stop what it is doing. (No, it does not break the computer.) You can use it when the computer is busy running some program that you want stopped, either to change something in the program or to load a new program entirely.

PROGRAM CONTROL KEYS

On the Atari 400 and 800 computers, there is a row of four orange and brown keys to the right of the keyboard (see Figure 3.6). These are the program control keys. On the 1200 computer, these four keys are part of the strip of chrome keys at the top of the keyboard. These keys are:

- START key
- SELECT key
- OPTION key
- SYSTEM RESET key (RESET on the 1200)

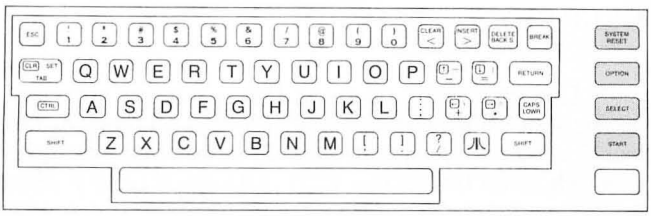

FIGURE 3.6. 800 keyboard with highlighted program control keys.

The START, SELECT, and OPTION keys are not useful to us yet, because their different functions are dependent on a program running. START might be used to start a game for instance, or perhaps to make the program calculate something. SELECT might choose between different versions of the program. The point to remember now is that these keys have no set function, and quite often do not apply to running a specific program. Check the instructions of any program you buy to see if they use the START, SELECT, or OPTION keys. SYSTEM RESET is a type of emergency button. Pressing it stops all activity in the computer, sets everything back to normal, and starts the computer running as if it had just been turned on. The big difference between hitting SYSTEM RESET and turning the computer off and then back on again is that SYSTEM RESET does not erase a program in the computer's memory. Turning the computer off and on again would wipe the memory clean. Try SYSTEM RESET now. The screen will be wiped clean, and ATARI COMPUTER—MEMO PAD will appear (or READY on the 1200). If you were typing in inverse or lower-case letters, the keyboard will now be reset to normal upper-case letters. Use SYSTEM RESET for emergencies when the BREAK key will not work.

ATARI 1200 KEYS

The Atari 1200 computer has five extra keys not found on the 400 and 800 computers. These are all located in the strip of chrome keys at the top of the keyboard (see Figure 3.7). They give the 1200 some additional capabilities. Let's take a look.

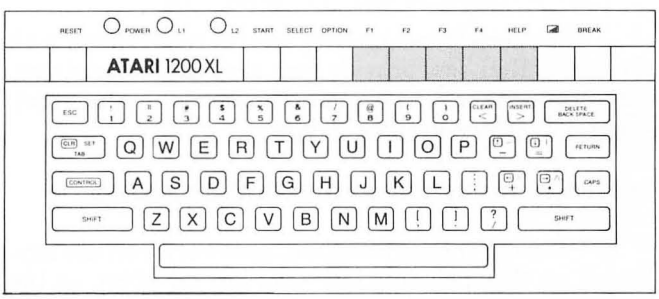

FIGURE 3.7. Highlighted extra Atari 1200 keys.

HELP KEY

Unfortunately, pressing this key when you can't figure something out will not give you an answer. (At least, not now!) What it does do is run the computer through some tests. The 1200 tests itself briefly when it is turned on to see if its memory is okay. If you wish to run it through more extensive testing, this is what to do:

- Type BYE and then hit RETURN. You should get a rainbow ATARI on the screen.
- Push HELP. A list of tests will come up on the screen.
- Use the SELECT key to choose the test you want.
- Use START to begin the test.
- If you choose ALL TESTS, the computer will continue repeating all tests until you hit HELP to stop it. The other tests will stop themselves.

For information on what these tests do, consult your owner's manual. One thing to note about the Memory Test is that it takes time. If you run it, you'll have time to go get a cup of coffee.

F1, F2, F3, AND F4 KEYS

These are called *special function keys*. They can be used by themselves, with the SHIFT key, or with the CONTROL key. By themselves, they are cursor movement keys, doing the same thing as CONTROL and the cursor movement keys on the lower keyboard. Using the special function keys saves the effort of Moving the cursor this way saves the effort of pushing down two keys simultaneously. This is what they do:

- F1: Cursor up
- F2: Cursor down
- F3: Cursor left
- F4: Cursor right

Using the special function keys with the SHIFT key moves the cursor also, but in large leaps. SHIFT and:

- F1: Cursor to top left of screen
- F2: Cursor to bottom left of screen
- F3: Cursor to left of current line
- F4: Cursor to right of current line

The special function keys used in combination with the CONTROL key provide four very useful functions. Since these functions are a little more complex, each is covered below in more detail.

CONTROL F1: KEYBOARD DISABLE/ENABLE

Pressing this combination once turns off the keyboard, so that pressing the keys has no effect on the computer. This is a handy function if you have to leave the computer in the middle of some work and don't want others to meddle with what you have in the com-

puter. This is especially handy if you have small children around. To turn the keyboard back on again, press CONTROL F1 a second time. The light labelled L1 above the chrome strip will come on when the keyboard is disabled so you will know why nothing is happening at the keyboard.

CONTROL F2: DMA DISABLE

DMA stands for Direct Memory Access, but you don't really need to know that. What this combination does is to blank the monitor screen. This could come in handy if you've been typing something embarrassing on the computer and somebody walks into the room who shouldn't see it, but its real purpose is to speed up the computer. If the microprocessor has a lot of calculations to do, it can do them much faster if it does not have to keep telling the monitor what to display on the screen. Hitting CONTROL F2 allows these calculations to run much faster. Hitting any other key on the keyboard except for BREAK, SHIFT, or CONTROL will return the screen display. Using the HELP key seems to work the best, since it does not add any character to the screen.

CONTROL F3: KEY CLICK DISABLE/ENABLE

Every time you press a key on the keyboard, a click comes out of the monitor speaker if you have the volume turned up. This lets you know the key has been pressed all the way. If you want to turn the click off, press this combination. Press it again to turn it on.

CONTROL F4: INTERNATIONAL/DOMESTIC CHARACTER SET SELECTION

In the previous description of the CONTROL key, we learned how to produce graphics characters. Using this combination of keys changes all the graphics characters to international characters. This gives us the opportunity to use special characters so that we can type in German, Spanish, or other languages. When we have selected the L2 comes on. We can now create international characters by using CONTROL with the letter keys. The owner's manual shows you where the characters can be found on the keyboard. To get back to the graphics characters (the domestic character set), press CONTROL F4 a second time. Light L2 will go off. All the international characters on the screen will change back to graphics characters. You cannot mix graphics and international characters.

This concludes our examination of the keyboard. Before we move on to the next chapter, there are a few things we need to know about the screen editor.

THE SCREEN EDITOR

You may have noticed earlier that the screen editor does some unexpected things. For instance, it occasionally buzzes at you while you type. If you use SHIFT DELETE to delete a line, it may delete several lines instead. What's going on?

When we look at the screen, we see characters in distinct lines and columns. The screen editor sees things differently. What we see as one line, it may see as merely part of a longer line. To differentiate between our line and the screen editor's line, we need to name two different kinds of lines. They are the *physical line* and the *logical line*. The physical line is what we see, the logical line is what the screen editor sees.

Let's go back to our conception of the screen as a bulletin board used to pass messages back and forth between us and the microprocessor. When we want to send a message to the microprocessor, we type it on the screen, then hit RETURN to tell it to read what we just typed. If we've been typing other things before the message, we don't want them included in the message. The screen editor works this out by requiring a RETURN after each message. This RETURN marks the end of one message and the beginning of the next.

When we send messages to the microprocessor, we have to keep in mind that we are dealing with a simple silicon chip, not a human mind. It can't handle a message that is too long. The screen editor works this out by limiting messages to three physical lines in length. This message is called a logical line.

Now some things become clear. When the computer buzzes at you, it's because you are eight characters before the end of a logical line, which can be only three physical lines in length. Pressing SHIFT DELETE deletes a logical line, not a physical line. When the logical line is longer than one physical line, then all of the physical lines included are deleted.

Keep in mind that a logical line can be as short as one character or as long as three physical lines. Hitting RETURN determines its length. If when you are typing a message, you realize that you've made a mistake and don't want it sent to the microprocessor, hit BREAK instead of RETURN. This ends the logical line without sending it to the microprocessor.

ARE WE DONE WITH THE KEYBOARD?

Not quite. One fact should be noted. What we have learned about the keyboard is the way it usually works. Occasionally you may buy a program that causes the keyboard to work differently. This is usually done to make the program easier for you to use. Be sure to read the program directions carefully. Now—let's move on to programming!

4. A LOOK AT BASIC PROGRAMMING

BASIC programming is a subject that has filled many books. We're not going to be able to gain any kind of comprehensive knowledge of BASIC in one

chapter of a Handy Guide. Instead, our object will be to understand the fundamental structure of BASIC programming. We'll learn a few of the commands available and how to enter them, concentrating on the commands that let us load and save programs using an external storage device such as a cassette recorder or a disk drive.

BASIC is a computer language that was originally developed by John Kemeny and Thomas Kurtz at Dartmouth College in the mid-sixties. Designed specifically for beginning computer programmers, it is particularly clear and easy to use, and found on almost every microcomputer sold today. Although BASIC has developed many dialects—new commands have been added and old commands revised—its fundamental structure remains the same. The new versions adapt it to the strengths and peculiarities of many different computers.

There are two versions of BASIC available for use on the Atari. One is Microsoft BASIC, a version used on many microcomputers, including the Apple II. The other, written especially for the Atari, is known appropriately enough as Atari BASIC. We will talk about Atari BASIC in this chapter.

LOADING BASIC

Atari BASIC comes on a plug-in ROM cartridge. Loading it is very simple. Open the cartridge door on the Atari 400 and 800 computers and plug it in the appropriate slot. There is only one cartridge slot on the Atari 400, but there are two on the 800. Make sure you insert it in the left-hand slot (see Figure 4.1). The 1200 has a cartridge slot on the left side where you don't have to open a cartridge door. Just plug the cartridge in (see Figure 3.1). Now power up the system as discussed in Chapter 2.

FIGURE 4.1. Load the Atari BASIC cartridge in the left-hand slot.

ENTERING COMMANDS

We've been talking quite a bit about commands. Now it's time to find out exactly what they are. BASIC commands are usually English words which cause the computer to perform specific functions. Some of the BASIC commands we'll learn about in this chapter are:

- PRINT
- SAVE
- RUN
- LIST

There are a few very important things you should know about Atari BASIC commands. As you can see, they are typed in capital letters. They can't be typed in small letters, nor can they be typed in inverse letters. Spelling counts! The computer is not a person who might guess what you mean if you type PRENT instead of PRINT. The slightest misspelling will confound the computer, and it will respond with an error message.

As mentioned in the last chapter, we give commands to the computer by using the screen as a kind of message board. The computer tells you when it is ready for a command by printing READY on the monitor. We give it a command by first typing the command on the monitor and then entering it by hitting the RETURN key. There should be a READY on the screen now. Let's give the computer a command. Type the command BYE. If it's misspelled, you can go back and correct it. Once you're ready to enter the command, hit RETURN. You should now be back in the Memo Pad mode, or, on the 1200, the Atari rainbow display. The computer has acted on your command, BYE, which lets you leave BASIC. To get back to BASIC, hit the SYSTEM RESET key.

If you did something wrong, misspelled a word perhaps, then you probably got an error message from the computer. This is the computer's way of saying that it did not understand what was entered. The Atari scans your command character by character. When it reaches a character that does not make sense to it, it marks it with an inverse character, then reprints your faulty command on the monitor. This means you'll have to find out what you did wrong and re-enter your command.

If the computer knows of some specific error that was made, it will also give you an error number with your error message. You can look up the number in the inside cover page of your *Atari BASIC Reference Manual*, which is included with your BASIC cartridge. Error messages can be annoying, but without them, we would never know what we did wrong when the computer won't respond to our commands.

THE PRINT COMMAND

A very important BASIC command is PRINT, which tells the computer to print characters of your choosing on the screen. Let's try it out. First type in

the command PRINT. Follow it with a space, then a double quote ("). Now type in anything you want, perhaps something like:

```
PRINT "COMPUTERS CAN'T THINK,
AND I'M GLAD."
```

When everything looks right, hit the RETURN key to enter the command. Your Atari should print out the message enclosed in quotes.

PRINT can also be used to calculate arithmetic expressions. Try entering this (notice there are no quotes):

```
PRINT 56+34
```

The Atari will respond with 90, the correct answer to 56 + 34. In computerese, it has just *evaluated* the arithmetic expression 56 + 34. Now try:

```
PRINT "56+34"
```

The Atari will print 56 + 34, which are the characters in the quotes. It won't evaluate the expression.

This is an important rule regarding PRINT: Anything following PRINT in quotes will be printed out exactly as you entered it. Any expression not in quotes will be evaluated and the result printed out. PRINT can make your Atari into a very powerful calculator. You can evaluate complex expressions like (2 + 67)*45/42. Experiment and see what you can do.

WRITING A PROGRAM

Thus far we have been using BASIC in the *immediate mode*. We type in a command and enter it using RETURN, and the computer executes the command immediately. If we want the Atari to do anything more than one simple command at a time, we have to use the *deferred mode*. In the deferred mode, we can enter a long list of commands in the order we want the computer to execute them. These commands will be stored in the computer's memory, and will be executed in order at a later time.

This is how a command is entered in the deferred mode. First type in a number. It has to be a positive integer from 0 to 32767; no negative numbers or fractions are allowed. Now follow it with a space, and then your command. Enter this line with the RETURN key. The computer will not execute the command, but will instead store it away to execute later. For example, try entering:

```
1 PRINT "NOT NOW, LATER!"
```

The computer does not print anything! It just sits there. Let's enter another deferred command.

```
2 PRINT "BUT NOW IS LATER"
```

This command also is not executed, but simply stored in memory.

We've just created a very simple program made up of two different PRINT commands. The program is stored in the computer's memory. If we want to run our program, we enter the immediate command RUN. Try it out. The computer will now execute the commands in the program and print out two lines of characters. You can ask the Atari to RUN this program as often as you wish—the program still remains in the memory.

If you wish to see the program, enter the command LIST. This causes the computer to list any program in its memory. Try it out. The Atari will print out the two lines you entered earlier.

HOW THE ATARI RUNS A PROGRAM

When the computer runs a program, it checks the numbers at the beginning of each line in the program. It then performs the commands in numerical order, going from the lowest line number to the highest line number. The numbers don't have to be consecutive, as they were in our example. For instance, you could have entered the two PRINT commands as lines 10 and 20 instead of 1 and 2. The program would still run in the same way. If you had entered the two lines above in reverse order by first entering line 2 and then line 1, the computer would reorder the lines by their numbers and execute line 1 before line 2.

There are some commands which alter the order in which the computer executes the program lines. GOTO, for example, is a command which is followed by a line number. When the computer executes this command, it will jump to the line number mentioned, start executing commands there, and then move on to the following lines. Let's try it out. Enter a third line in our program:

```
3 GOTO 1
```

Now RUN the program. Your screen will quickly fill up with text! We have programmed an endless loop. The Atari executes lines 1, 2, and 3. The command at line 3 tells it to go back to line 1, and so it does, starting all over again. Since the computer is very obedient (or incredibly simple, depending on how you look at it), it repeats the commands endlessly. Now is a good time to use the BREAK key, which makes the computer stop its loop. Programmers use GOTO and other similar commands so that small programs can accomplish a great deal of work.

Since we've gone to the work of writing this incredibly valuable program, we don't want it to be erased and lost forever when we turn off the computer. Let's save it.

SAVING A PROGRAM ON CASSETTE

If you have a Program Recorder and want to save the program on a cassette, here's what to do:

1. Put a cassette in the recorder. (Make sure it's rewound all the way to the beginning of the side.)
2. Enter the command CSAVE, which stands for cassette save. You will hear two buzzes from the computer. This is a signal to press two keys on the recorder.
3. Press the PLAY and RECORD keys on the recorder simultaneously. They should lock into place.
4. Hit RETURN on the computer. You should hear a high-pitched whine from your monitor speaker, and the cassette in the machine will start moving. After a few seconds, you'll hear some ugly sounding rasberries from your monitor. Never fear! This is the sound of your program being transferred to the cassette. When the computer is finished, the noise will stop, and it will come back to you with READY on the screen
5. Press the STOP button on the recorder, and rewind the cassette to the beginning.

Your program is now stored on cassette.

SAVING A PROGRAM ON DISK

If we're going to store the program on a disk drive, we'll need to think of a name for our program. DOS (the Disk Operating System) needs the name to store the program under, so we can ask for it by name later.

NAMING THE PROGRAM

DOS is very particular about the name we use. It has to follow these rules:

1. It can't be any longer than 8 characters.
2. We can only use the letters A-Z and the numerals 0 through 9 in the name.
3. The name must start with a letter. (Numerals can only be used after the first character of a name.)
4. We cannot use lower-case letters, inverse characters, or spaces in the name.

If you need more than eight characters in the name, you can add a three character *extender*. Type a period after the name and add one to three characters. The extender must follow rules 2 and 4 above. Some examples of correct names are:

- `TESTPROG`
- `DIZZY`
- `GAME1`
- `NAMELONG.EST`

The computer will not accept names like:

- ELIZABETH (more than 8 characters without an extender)
- TEST 1 (has a space in the name)
- 1TEST (starts with a number and not a letter)
- Gamepack (uses lower-case letters)
- HELP!! (uses exclamation points)

Let's name our program TEXT, since that's what it produces on the screen. Find the diskette labelled Formatted Diskette II that came with your disk drive. Take the Master Diskette out of the drive, and insert the formatted diskette. We are now ready to store our program on disk.

SAVING THE PROGRAM

We use the command SAVE to save our program. We follow it with D: to indicate that we will save it on disk, and follow that with our program name. This information following SAVE must be in quotation marks. This is how it should look:

```
SAVE "D:TEXT"
```

When you enter this command, you'll hear the disk drive start up and chatter for a short while. The beeping noises you hear coming from the monitor speaker are the sounds of your program being sent to the disk drive. After a second or two, the noise will stop and the computer will respond with READY. This means that your program is now saved on the disk.

ERASING THE MEMORY

Now that we have stored our program on either cassette or disk, let's enter LIST to see what's in the Atari's memory. Our program should still be there. When we save a program, it's duplicated on the program storage device and not erased from memory. Here is a command to wipe the Atari's memory clean: NEW. Enter NEW, and now enter LIST. The computer lists nothing! The Atari's program memory is now clean, and our program is gone. Fortunately, we saved it elsewhere.

LOADING A PROGRAM FROM CASSETTE

Now we need to get our program back into the Atari's memory. Here's how to load it from cassette:

1. Insert the cassette in the recorder (make sure it's rewound all the way).
2. Enter CLOAD (for cassette load), and you will

hear one buzz from the computer. This signals you to press one key on the recorder.

3. Press the PLAY key.
4. Press RETURN on the computer. After a few seconds, you will hear raspberries from your monitor speaker. This is your program being loaded. When it is entirely loaded, the computer will respond with READY.
5. Hit STOP on the recorder.
6. Rewind the tape for the next time you need it.

Your program should now be loaded. Enter LIST to see if the program is there. It should be. If not, try again, and make sure the cassette is rewound.

LOADING A PROGRAM FROM DISK

To load a program from disk:

1. Insert the program disk in the disk drive.
2. Enter LOAD "D: followed by your program name and a close quote.

To reload our TEXT program, we enter:

```
LOAD "D:TEXT"
```

The disk drive will whir, the monitor will beep, and you should have your program in the Atari's memory in a few short seconds. When it is finished loading, the Atari will respond with READY.

Your program should now be loaded. Type RUN to see if the program is there and working. It should fill up the screen with text if it is. Remember to hit BREAK to stop the program.

If you're using the disk drive to load a program, you can shorten the above process by entering:

```
RUN "D:TEXT"
```

When you use the RUN command followed by the program name, the computer combines the LOAD and RUN commands by first loading the program, then immediately running it after it is loaded.

5. FILE STORAGE: CASSETTE AND DISK

While you work with your computer, you will begin to accumulate programs and data. These saved programs and data are known as *files*, and might be thought of in the same way you would think of files kept in a file drawer. Each file on disk or cassette might contain a program or a list of information, such as your address book or a recipe file.

As your collection of disks and cassettes grows, you'll probably have the experience of losing some of your files through faulty hardware or careless handling. Learning more about file storage can prevent this. In this chapter, we'll discuss the hows and whys of file storage: how to buy the proper cassettes and diskettes for your system, how to store your files safely, how to keep your hardware in top condition, and other useful facts. This chapter is divided into two parts, one for cassette storage on the Atari 410 Program Recorder, and the other for disk storage on the Atari 810 Disk Drive.

CASSETTES AND THE ATARI 410

What type of cassettes will the 410 use? It will use any kind of cassette that a simple audio cassette recorder will use. Naturally, some cassettes work better than others, and some offer much more value for their cost. Let's look at cassettes which work well with the 410.

BUYING CASSETTES

Our first order of business is buying cassettes. First of all, the 410 is not set up to take advantage of the higher grade tapes used in audio recording, such as chromium dioxide or metal particle tape. Ferric oxide tape works just fine; it's also cheaper. The second item to consider is that the 410 packs a lot of information on a small amount of tape. Short-length cassettes work best for storing files. The third major consideration is the length of the leader on the cassette. The leader is a short length of tape at the beginning and end of each cassette. It does not have any ferric oxide on it, and can't be recorded on. It's used to make the cassette tape stronger where it joins the hubs inside. If the leader is longer than 13 inches (7 seconds worth), it will not work with the 410.

So what is the ideal cassette for use with the 410? Try a C15 or C30 ferric oxide tape with a leader shorter than 7 seconds. A C15 cassette gives you 7 1/2 minutes of recording time per side, and can store over 25,000 characters of data. Longer tapes work well, but you'll have to do a lot more rewinding and fast forwarding to get to files stored on your cassette. There are leaderless cassettes manufactured specifically for computer use, but these are usually more expensive than audio cassettes, and not necessarily better.

MULTIPLE PROGRAM STORAGE ON CASSETTE

When you save information on a cassette, it's usually convenient to store just one file on each side. This way, there's no problem finding the beginning of your file. You just rewind the cassette to the beginning of the side, then load the file. If you'd like to save some money by putting several files on each side, you must use the tape counter on the 410. The tape counter is a

small meter that tells you how much of the cassette you've played.

When you first put the cassette in to save a file, make sure it is rewound all the way to the beginning of the side. Press the small button next to the counter. This will reset the counter to 000. Now save the file. When the Atari is finished, and the 410 has stopped, advance the tape at least 10 counts past the current counter reading. Write the new counter reading down, and you're ready to save another file. This way you can save many files on one side of a cassette. Just be sure to leave at least 10 counts between the end of one file and the beginning of the next, and to write down the counter reading at the beginning of each file.

When you want to load a file from a cassette that has several files per side, first rewind the cassette all the way to the beginning of the side. Set the counter to 000, then fast forward the cassette to the counter reading where the desired file is stored. Follow normal loading procedures. Sometimes the counter will get off by a count or two, and the file will not load. Don't despair. Try starting the file load at counter readings one or two counts on each side of the original reading. If it still doesn't load, then it's time to despair! You may have lost your file for good.

Another hazard to keep in mind is that tape stretches. This throws the readings off, and can even make a file stored at the beginning of a cassette refuse to load. In this case, just advance the tape another counter reading or two and try again. Files stored at the beginning of the tape are more immune to loss than those stored in the middle of the tape.

One other important fact to note is that tape counters vary from recorder to recorder. Therefore, you'll probably have trouble finding a file stored in the middle of a cassette made on another machine.

DUPLICATING FILES

As you can see, cassettes are not always the most reliable of storage media. It's important to make duplicate copies of important files by saving them twice. This way, if one of your files is lost because of a faulty cassette or an error in saving it, you always have a backup. Get into the habit of backing up every important file on two different cassettes.

Once you have two cassette copies, keep one rewound to the beginning of side 1, and the other rewound to the beginning of side 2. This way, you will not have to go through a lot of rewinding to get to a program on the opposite side of a cassette. Just use the cassette that's rewound to the side you want.

WRITE PROTECTING A CASSETTE

When you have important files that you absolutely do not want erased or recorded over, there is a way to *write protect* the cassette. Lay the cassette with the side you want protected facing up. Turn the cassette around so you can see the back. You'll see two small tabs. Break out the one on the right. The top side of the cassette is now write protected.

To write protect the other side, break out the other tab. You'll find that it's now physically impossible to record on the write protected sides. You won't be able to press the RECORD key down on the recorder when you put the cassette in. If you change your mind and want to erase or record over a write-protected cassette, just put a piece of tape over the write protect tab socket. Now you can record on the cassette.

CARE OF YOUR CASSETTES

When you store your cassettes, be sure to keep them away from magnetic fields. Magnetism erases cassettes. Common sources of magnetic fields are your computer monitor and high heat. Leaving a cassette in a closed car on a hot sunny day may not only erase parts of your cassette, but may also melt the plastic casing.

In addition to physically protecting your cassettes, be sure to label them clearly so you know what files are on which cassette, and where. This is especially important for files stored in the middle of a cassette. They will be lost completely if you don't know where to set the tape to start loading! Good cataloging will save you a lot of time and trouble.

RECORDER MAINTENANCE

Like any audio cassette recorder, your Atari 410 recorder needs some routine maintenance to keep it in peak condition. This maintenance is fairly simple, and can be done in a few minutes.

CLEANING THE HEADS

As you use your recorder, some of the ferric oxide on the cassette tape will rub off on the record and playback heads. Eventually this buildup will prevent recording and playback. You should clean the heads periodically. You'll need a cotton swab and some 95% denatured alcohol. Here's what to do:

FIGURE 5.1. Cleaning the recorder heads.

1. Unplug the recorder.
2. Press the STOP EJECT key to open the cassette compartment.
3. Press the PLAY key to make the recording and playback heads come out
4. Dip the swab in alcohol, then wipe the tape heads (see Figure 5.1).
5. Wipe the pinch roller and rubber capstan wheel, rotating the capstan wheel with your fingers to make sure you get the whole wheel.
6. Clean out any cotton left over in the recorder.
7. Press STOP to retract the heads.

DEMAGNETIZING THE HEADS

Tape passing by the heads also imparts a small magnetic charge which can build up over time. This magnetism will also impair the record and playback quality of the recorder. To demagnetize the heads, you'll need a head demagnetizer, which you can buy at an audio or electronic store. Now:

1. Open the recorder and extend the heads as decribed above.
2. Plug in the demagnetizer and turn it on if it has a switch.
3. Pass the tip of the demagnetizer over each head a few times.
4. Slowly pull the demagnetizer away from the heads until you're a yard or two away.
5. Turn off the demagnetizer.

It is important to follow steps 4 and 5. If you turn off the demagnetizer close to the recorder heads, it will leave a magnetic charge.

Cleaning and demagnetizing the heads occasionally will keep your recorder in good shape and minimize file losses. There are a number of maintenance products on the market to make this even easier, but beware of cleaning cassettes; they are abrasive and will eventually wear out the heads.

DISKETTES AND THE ATARI 810

As a rule, file storage on disks is much more convenient and efficient than cassette storage. There are still several things to watch and take care of when using the disk drive.

BUYING DISKS

Once you have filled the Formatted Diskette II that came with your disk drive, you'll need to buy more disks for use with your Atari 810 disk drive. There are all sorts of disks out there. Which ones work? In a

nutshell, the standard disk used on the 810 is a 5 1/4 inch, *single-sided, single-density, soft-sectored* floppy diskette. This is quite a chunk of information! What does it all mean?

First of all, the 810 uses floppy disks and not the hard disks that are used in hard disk drives. There are three sizes of floppy disks: the 8 inch floppy, the 5 1/4 inch floppy, and the 3 1/2 inch floppy (also called a micro-floppy). The only size that fits the 810 is the 5 1/4 inch floppy.

"Soft-sectored" is a term that describes the way the 810 locates information stored on disk. Some drives use a hard-sectored disk. There are holes punched in the disk that the disk drive can read to tell how far the disk has rotated. The 810 doesn't need these holes. It sets down magnetic signals on the disk that it can read later to determine disk position. This is soft-sectoring.

"Single-density" refers to the storage quality of the disk. Some disk drives store twice the amount of information on a disk as the Atari 810 does. Since the information must be packed twice as tightly to fit in the same area, a disk of high enough quality to store this information is called double-density. A single-density disk is of lower recording quality and is consequently cheaper. The 810 will work fine with either single- or double-density disks. Since most disk manufacturers now only manufacture double-density quality disks, you probably won't have to worry about density.

The last specification for buying disks is choosing single-sided or double-sided disks. The Atari will use either one. The difference between the two is that single-sided diskettes (like the disks included with your 810 drive) only record on one side while double-sided disks can be recorded on both sides. This gives you double the amount of storage with one disk. Needless to say, double-sided diskettes are more expensive than single-sided disks. Later in this section, we'll talk about how to make single-sided diskettes into double-sided diskettes with very little difficulty.

When you finally sally forth to the market to buy your disks, what should you look for in quality? Many disks have guarantees that range from a few years to a lifetime. Many also have reinforced hubs, which make the disk sturdier and give it a longer lifetime. Some disks are packaged in plastic library cases which you can use for storage later on, some come in cardboard boxes. Some include labels, others don't. In general, you should try to buy the sturdiest disks possible for your money, since a worn out disk means lost files. Unless you have a special disk storage holder, you might want to pay a little extra money for plastic cases, which are sturdy, convenient to use, and will protect your disks from minor catastrophes.

FORMATTING DISKS

Now that you have your disks, we must *format* them. As explained above, the 810 drive uses a soft sector system to find locations on the disk. A brand new blank disk will only confuse the drive hopelessly. Before the disk can be used, the 810 must put down magnetic signposts so it can find its way around later

on. This process is called formatting. To format the disk, we must learn to use the DOS menu.

USING THE DOS MENU

You might remember seeing the DOS menu when we learned how to power up in Chapter 2. You will get the DOS menu on the screen anytime you power up without a cartridge. (But be sure you have a disk with DOS on it so it will boot up!) If you power up and boot DOS while the BASIC cartridge is in place, you will just get a READY prompt. To get to the DOS menu anytime you are in BASIC, enter the command DOS, and after a few seconds of loading, the menu will appear. Be sure to have DOS on a disk in the drive or the command will not work. You should also be aware that going to DOS will usually erase whatever program you have in memory! Be sure to save anything you want to keep before you go to the DOS menu. You'll notice that there are several options listed after the letters A through O. Each one of these options performs some kind of task that lets us copy files, move them from disk to disk, rename them, erase them, and so on. Learning to use all of the disk options takes some time, so we won't learn all of them here. I suggest you read the literature about DOS that you received with your disk drive.

FORMAT OPTION

Let's format those new disks we bought. Remove the DOS disk and put a new disk in the drive. Now enter I to select the formatting option. When the computer asks you which drive to format, enter 1, unless you have more than one disk drive and you have your new disk in a drive other than drive number one. Now the Atari will ask you to type Y to format. Do it! (You can type any other key if you have a change of heart about formatting.) You can now hear the disk drive clicking and whirring as it formats the disk. When it's done, the drive will stop, and the DOS menu will read: SELECT ITEM OR RETURN FOR MENU.

Take out your disk and do this again for the rest of your new disks. It's best to format all of your disks when you first get them so you won't be frustrated when you grab a disk to store a program, only to find that it hasn't been formatted and won't work. One very important thing to know about formatting: *It erases everything already on the disk!* If you format a disk with files on it, the disk will emerge clean of any files. The format option can be a handy disk-erasing function, but use it with care.

DISK DIRECTORY OPTION

Someday you'll come across a disk in your collection, and you'll have no idea what's on it. Then it's time to use option A, the disk directory. Put a disk with some files stored on it into the disk drive. Now type in A and follow it with two RETURNs. A list of

all the files stored on the disk will be printed on the screen.

Notice that each file is followed with a number. This number tells us how many *sectors* it takes to store the file. A sector is an area of the disk that stores 128 bytes of information. The 810 has 707 sectors it can use for file storage. At the bottom of the listed files, you should see a line which tells you how many free sectors remain. If you pay attention to the sector information, you can tell how much room is left on your disk for more files. You can also see which files are longer than others by noting the number of sectors it takes to store them.

WRITING DOS FILES OPTION

So far, you've probably had to insert the Master Diskette every time you wanted to load DOS. This can be tedious if you want to use other disks afterwards, since you have to swap disks after loading. It's easier to have DOS on the disk you'll be using so you won't have to swap disks. The H option lets us put DOS on any disk we would like. Once your chosen disk is in the drive, enter H. The computer will ask you which drive you want DOS written to. Enter 1 unless you are using multiple drives as mentioned earlier. At the next prompt, enter Y, and DOS will be put on your diskette. It's handy to have DOS on every one of your diskettes, since you don't have to shuffle disks around to load DOS.

RUN CARTRIDGE OPTION

The last DOS menu option we'll learn to use is B, Run Cartridge. If you have the BASIC cartridge in the computer, or any other languages on a plugged-in cartridge, enter B. The DOS menu will disappear, and you'll be back in BASIC or whatever program is on the cartridge.

WRITE PROTECTING DISKS

We found out that when you format a disk, everything on it is erased. It's also possible to lose files by using the same file name twice to save two different programs. If we have something very important on a disk and want to be absolutely safe, we can *write protect* the disk so that it will be impossible to format or write anything new on it. When you insert a disk into the drive, you'll notice a notch in the left-hand side of the sleeve of the diskette. This is the write protect notch for the side of the diskette you are loading.

When the disk is in the drive, a beam of light shines where the notch is, and if it passes through, then the drive is allowed to write on the disk. If the beam of light does not pass through the disk, no writing or formatting is allowed. To write protect the disk, take a write protect tab, which should be furnished with your disk, and wrap it around the notch. If you don't have tabs, you can use a piece of black tape or

anything that will block the light passing through the notch. Your disk is now safe. If you want to write to your disk again, simply remove the tab from the disk.

CONVERTING SINGLE-SIDED DISKS TO DOUBLE

When disks are manufactured, each side is checked for recording accuracy. If one side does not measure up, then only the good side is used, and it becomes a single-sided disk. In most cases, the bad side is still quite usable by the Atari 810. The only reason that the back side can't be used is that there is no write protect notch for it.

If you take a paper hole punch and punch a notch on the opposite side of the sleeve from the original notch, you can then use the back side of the disk. Be sure the second notch is located at exactly the same position on its side of the sleeve as the original notch is on its side. Otherwise, the notch light won't find it, and won't allow you to use the back side.

A couple of important things to note: Any warranty on your disk will certainly be voided. Also, the back side is not as not as dependable as the certified front side. You will know if the back side works if you can format it. If you can't format it, then it's a bad side and can't be used.

STORING AND PROTECTING DISKETTES

Like cassettes, disks are prone to damage from outside forces. Keep them away from magnetic sources such as your monitor, or you risk file erasure. Extreme heat can also erase files, so avoid leaving disks in a hot car. Moisture can ruin a disk, and touching the exposed area of the disk through the head reading holes can ruin files with fingerprints. Never bend the disk; it will keep it from spinning freely. Always keep the disk stored in its jacket, and try to keep it in a case or file, away from dust and dirt.

MAINTAINING THE DISK DRIVE

The disk drive has a recording head like a tape recorder, which needs to be maintained in a similar manner. Dirt, dust, and ferric oxide from the disk can build up on the head and diminish its recording capabilities. It can also build up a magnetic charge over time. The head needs to be periodically cleaned and demagnetized.

Unlike a tape recorder, the head is located deep inside the machine, where it can be hard to get at. Some people prefer to take their disk drive in to a service center to have it cleaned and demagnetized. Others do it themselves, either by taking the drive apart and cleaning the head by hand, or by using a cleaning disk.

6. PERIPHERALS

As you get to know the capabilities of your Atari and become more proficient in using it, you'll also become more aware of the things you wish it could do that it can't. Never fear! It's easy to add peripherals to your computer system that will build it into a truly powerful tool. There is an amazing variety of add-ons built by Atari and other companies, and we'll take a look at many of them in this chapter.

Before you go out to spend money indiscriminately on hardware for your Atari, take some time to consider your purchases. Answering the four questions below satisfactorily will help you avoid buying a peripheral that just collects dust later.

Does the peripheral do what you want it to do? The CollosoWriter 8000 printer may print 8000 characters per second, but if it's all in Japanese, it may not fit your needs. Be very specific about what you want a peripheral to do before you start shopping.

Is the peripheral compatible with your computer system? Make sure first of all that it will run with an Atari computer. Then make sure you have the necessary memory needed to support the peripheral. Some peripherals also need extra connecting cables and equipment before you can attach them. Be sure they are available.

Can you buy or write software to run the peripheral? Unless your Atari has a program telling it how to give orders to this strange piece of hardware, it won't be able to do a thing. Some hardware manufacturers sell software with their peripheral, others let you write your own (if you have enough information) or let you find it on the market. Just make sure you can supply it somehow, or your peripheral will just sit there and make you feel foolish.

Is there a clear owner's manual or a knowledgeable person around to make sure you know how to operate the peripheral? Never forget that most computer equipment is more than a little complex; it needs good clear instructions to be properly operated. If you have a knowledgeable friend or salesperson around, fine. If not, make sure you take a look at the manual before you buy.

Once you've settled on a good peripheral, you have two major options for buying it—mail order discount stores and retail computer stores. The advantage of the mail order discount business is obvious: very low prices. Unfortunately, at these low prices they can't really afford to give you much service or advice. Mail order works best when you know you won't have problems operating what you buy.

If you aren't good at wading through manuals, or need some good advice, you should consider buying at a retail store. Just make sure that the employees there really know the equipment they sell, or you'll be paying more for nothing.

Now let's take a look at some of the products out there. What will they do? We'll look at the most popular peripherals, and also examine some of the more unusual hardware available. Occasionally we'll discuss a specific peripheral model when it provides a good

example of a certain type of peripheral. Keep in mind that it's just an example, and the brand we mention may not be the best for your purposes. As always, you must shop around.

Since the microcomputer industry is changing constantly, be on the lookout for new products coming on the market and old ones being phased out. Prices are always changing.

PRINTERS

Adding a printer to your computer gives it the ability to create "hard copy"—print which will not disappear the moment you switch off your computer. A good printer can print out listings of your programs, letters to friends or business associates, mailing labels, manuscripts, and many other documents. It's one of the most useful peripherals available. Since there is a huge selection of printers compatible with the Atari computer, at increasingly competitive prices, it's very important to know what you want your printer to be able to do before you buy it.

One of the first things to consider is character quality. How does the printer form the characters that it prints on paper? Most computer printers are *dot matrix* printers. Dot matrix characters are formed by a small comb of pins which sweeps across the paper for each line of print. The pins hammer against an inked ribbon in the correct combination to create whatever kind of character is desired. The more pins there are, the more complex and well-formed the characters can be. Although dot matrix print does not look as nice as typewritten text, it's much faster, and usually offers a choice of different character styles called *fonts*, such as pica, elite, boldface, and elongated. Quality of print changes quite a bit from printer to printer, and usually varies according to price.

A cheaper form of dot matrix printer is called the *thermal* printer. The thermal printer uses specially coated paper, and prints by using hot pins that burn the characters into the chemical coating instead of hammering them on with a ribbon. The disadvantage of the thermal printer is that it must use special paper, and the print quality is not usually good. However, it is much quieter than any other kind of printer.

For very high quality print, most people use a *letter quality printer*. The letter quality printer creates letters the same way that a typewriter does—it hammers the characters on the paper using a ribbon and a set of fully formed metal characters. While it's possible to actually hook up an electric typewriter to the Atari (with considerable difficulty unless the typewriter is especially designed for a computer interface), it's usually preferable to use a *daisy wheel printer*. The daisy wheel printer has a small rotating wheel (the daisy wheel) with many flexible hubs. Each of the hubs ends with a metal character which strikes ribbon and paper to print a character. A daisy wheel printer prints much faster than a typewriter, but with equivalent print quality. You can change fonts by physically changing the daisy wheel. A letter quality printer's high print

quality is offset by its slow speed and high noise output. Many of them are also quite expensive, but some have recently been priced under $700.

Other things to consider when buying a printer:

Is it *bidirectional* (able to print both coming and going, which gives it more speed)?

Is it a 40-column printer or an 80-column printer? It usually takes 80 columns to fill an average 8 1/2 x 11 inch piece of paper. 40-column printers are usually used to print on a small roll of adding machine paper.

Does it have friction feed, tractor feed, or both? Tractor feed uses toothed gears or belts to feed fanfold paper (special computer printer paper) through the printer without you worrying about putting each page in separately. Friction feed lets you put in individual sheets of paper, such as letterhead stationery.

How big is its *buffer?* Your Atari feeds text to the printer very quickly. The printer uses it very slowly, which forces your computer to wait. A buffer is memory in the printer which stores the text from the computer and feeds it to the print head. The larger the buffer is, the sooner your computer can finish feeding text to the printer so you can use it again.

Is it capable of graphics? In other words, if it's a dot matrix printer, can you control each individual dot printed to create detailed pictures instead of characters?

The most common printers in use with the Atari computer are 80- column dot matrix printers. The most popular models seem to be the Atari 825 printer (which is really a Centronics 737 printer) and the Epson MX-80 printer, which has a few less features and is cheaper than the Atari 825. The NEC PC8023A printer is gaining in popularity.

MODEMS

A modem is a peripheral which allows you to send data from your computer over the phone lines and to receive data from other computers. It's a very useful peripheral, because with it you can use your computer to read information stored in many other computers, large and small, around the world.

As with printers, there is a variety of modems available to use with the Atari. One of the first considerations a modem buyer must make is that of speed. How quickly can the modem send and receive data over the phone lines? Data transfer speed is measured in bits per second (bps). Most modems used with microcomputers are capable of 300 bps, which would let you send one screenful of text over the phone lines in about a minute and a half. 1200 bps modems are becoming more common now, and will quadruple your data transfer speed. Many modem makers refer to "baud rate" in describing their equipment. The baud rate measures the frequency of the signal that carries the data. Sometimes the baud rate is equal to the bps capability of a modem, but sometimes it is not. For instance, most 1200 bps modems use a 600 baud signal for transmitting data. Always look at the bps measurement to determine data transmission speed.

Modems can transmit data in *full duplex* or *half duplex*. Full duplex transmission allows the modem to

send and receive data at the same time, similar to a telephone conversation where you can listen and speak simultaneously. Half duplex transmission forces two computers to take turns sending and receiving data, much like a conversation over a two way radio. Full duplex is most common in microcomputer modems.

Another important consideration is whether the modem is *direct connect* or *acoustic*. An acoustic modem requires you to place the handset of a telephone into a cradle lined with foam rubber, where the direct connect modem does away with the need for a telephone, plugging directly into a telephone jack and sending electric signals over the phone wires. Direct connect modems are much more reliable than acoustic modems.

Many modems are "intelligent." This means they contain their own microprocessor and software which allow the modem to perform many tasks by itself with only a prompt from your Atari. Let's take a look at the intelligent features of the Hayes Smartmodem 1200.

The Smartmodem 1200 can transmit data at both 300 and 1200 bps, and other rates below 300 bps. This direct-connect modem can send data at either full or half duplex. The microprocessor inside allows it to automatically set itself for the data transmission rate you choose to use with your computer. It will also dial any number you wish, using either touch tone or rotary dial signals. It can answer the phone, and will also hang up when the computer on the other end of the line hangs up. These intelligent features make life much easier for modem users, and allow you to set yourself up as a "bulletin board." This particular modem sells for under $600.

Keep in mind that a modem requires a modem cable and the 850 Interface Module to connect it with the Atari. You'll also need some software to run it. Prices for modems range from the $600 already mentioned to below $100 for much simpler models.

ATARI 850 INTERFACE MODULE

Most printers and modems can't be connected directly to the Atari computer. Many printers, for instance, use a parallel interface port, but there are no parallel ports on the Atari! You need an Atari 850 Interface Module. This interface module plugs into the peripheral port of the Atari, and has a parallel interface port as well as four serial interface ports. The parallel port is usually used to connect printers, and the serial ports can be used to connect many different peripherals, including modems. The 850 has its own microprocessor and machine language software which keeps track of all the peripherals attached to it. The Atari 850 is available for under $200, and allows you to add all sorts of exotic hardware to your computer.

IMPROVING YOUR CURRENT SYSTEM

Printers and modems are additions to your Atari system. Many products are made to improve and expand the capabilities of equipment you may already own,

such as memory expansion or keyboard replacement. Let's take a look.

EXPANDING YOUR MEMORY

If you bought an Atari 800 before 1983 without the full 48K of RAM included, Atari makes memory cartridges which plug into the three memory slots of the 800. These RAM cartridges come in memory amounts of 8K and 16K. Atari 1200s come with a full 64K of memory and are not usually expanded. Atari 400's are sold with 16K of memory, and are theoretically not meant to be expanded since they have only one memory slot which is hidden in the depths of the computer. There are ways around this!

Independent hardware producers have come out with memory boards which are fully compatible with Atari computers. They come in amounts of 16K, 32K, 48K, and 64K. 16K and 32K memory boards are used to expand the 800 computer to its full memory capacity of 48K. Using a 32K board with a 16K board brings your computer up to 48K without using the third memory slot. This extra slot can come in handy later, as we'll see.

48K boards are used mainly for expanding the 400 computer to 48K. The 400 is not designed for easy memory expansion, so you must take the computer apart to get into the memory slot. Since there's only one slot, the 16K RAM board which occupies it must be taken out and the 48K board inserted in its place. Most owners have a computer service shop change their memory if they feel uneasy about taking their computer apart. Remember that the board which comes out of your 400 is still perfectly good, and can be used in the memory slots of the Atari 800.

Mosaic Electronics manufactures a 64K RAM board for the 400 and 800. The design of the 400 and 800 computers will not allow the use of more than 52K of RAM, so the extra 12K is available only by switching back and forth between four different 4K blocks of memory. The benefits of a 64K RAM board may not be useful for the beginning computer user, but intermediate and advanced users can make very good use of it.

Several different companies make memory boards. Non-Atari boards are usually lower in price than the equivalent Atari boards. Qualities which distinguish one board from another are the length of their guarantee and the quality of their components. Some boards are built with gold-plated connectors which discourage corrosion. Corroded memory connectors will lock up your computer.

THE COMPUTER MONITOR

Most people who buy a home computer use their television set as a monitor, since it saves them the cost of buying a new peripheral. A TV set is not often the ideal monitor, however. The picture quality is not as clear as it might be, and text can be difficult to read. If someone is using a hair blower or a vacuum cleaner, or if your printer is turned on, the TV set will usually

pick up static and interference. A computer monitor can solve these problems.

Computer monitors are specially designed for use with computers, and present a much clearer picture than a TV set. They connect directly to the computer without the use of a junction box, and use a much wider bandwidth to send the picture over which results in a much clearer picture. They come in two basic types: the color monitor and the monochromatic monitor.

A color monitor looks and works like a color television set without a channel selector. One very popular model for use with the Atari is the Amdek Color-I monitor (see Figure 1.1). It has knobs to control the speaker volume, the color, tint, brightness, and contrast of the picture, and the vertical hold. Most color monitors have a 13-inch screen. The Amdek has a speaker, but not all monitors do. If you use a monitor with no speaker, you can easily hook up a separate speaker or feed the audio signal to your stereo system.

Monochromatic monitors usually display just green or amber against a black background. The chief advantage of a monochromatic monitor is that it can display text and fine lines with much more clarity than a color monitor. A monochromatic monitor is much less apt to create eyestrain than a color monitor. For these reasons, they are usually used for word processing purposes.

When you buy a monitor, be sure that it will accept a composite video signal, which is the type that the Atari computer sends out. RGB type monitors will not work with the Atari. Be sure that you get the special connecting cable necessary to hook your monitor up to your computer. Remember also that you can't use a monitor with an Atari 400, since it has no monitor jack.

DISK DRIVES

Disk drives are fast and efficient. Floppy disks are the most common medium for commercial software, and many tasks, such as word processing and data base management, are virtually impossible without a disk drive. If you have only cassette program storage, a disk drive should be your first upgrade. If you have one disk drive, a second drive can make your system much more flexible. If you're a glutton for mass program storage, you can connect up to four disk drives to an Atari, although two seems to be the optimum number.

The Atari 810 disk drive is the standard drive in use with Atari computers, but other companies now make disk drives for the Atari computer. Some of these disk drives offer substantial improvements over the Atari 810.

One of the major drive producing companies is Percom Data. Percom produces several types of disk drives. The AT-88 is designed to be directly competitive with the Atari 810. It is a single-density drive, stores 88 kilobytes of data, hooks up directly to your Atari, and is considerably cheaper than the 810. The real added value comes when you purchase additional Percom drives. All of the controlling electronics are contained in the first drive, so additional drives (called slaves) are simpler and cheaper than the first one.

Percom also sells a double-density disk drive for the Atari called the RFD. The double-density RFD gives you twice the storage capability of a single-density disk drive, with a capacity of 176 kilobytes. The RFD comes with a special DOS which allows it to use all this extra storage space. The RFD will read and write as a single-density as well as a double-density drive, so all disks made for the Atari 810 drive will be compatible with the RFD as well. Double head models of the RFD allow it to record on both sides of a disk without flipping it over, which again doubles available storage memory. As with the AT-88, the first RFD drive contains all of the controlling electronics, so add-on drives cost much less than the original. The RFD sells for under $700.

For truly large memory storage, you can buy a hard disk drive. The most common hard disk drive used with microcomputers is a type called the Winchester drive, manufactured by several different companies. The Winchester disk drive uses a stainless steel disk to store data on. This disk is factory installed, and is not removable, which is not really a handicap considering how much storage is available. The average Winchester disk stores 6 to 20 megabytes (million bytes, remember)! This is 65 to 225 times the storage capacity of a single-density floppy disk. Winchester drives are for the serious user: they cost anywhere from $2000 to $7000.

THE 80-COLUMN BOARD

When you use the Atari computer to arrange text for printout on a printer, you'll run across a problem. You can only display 40 characters across the width of the monitor, while a good printer will usually print 80 columns across an 8 1/2 by 11 inch paper. Plugging an 80-column board into your Atari will let it display 80 characters across the monitor.

Full-View 80 is an 80-column board manufactured by Bit 3 Computer Corporation. It plugs into the third memory slot of the Atari 800, where it is connected to the monitor by a very thin flat cable coming out from under the computer's cover. It works with the Atari BASIC cartridge, and will work with some word processing software on the market. Since the characters are reduced in size to fit into 80 columns, the only kind of monitor which will display the text from this board clearly enough is a monochromatic monitor.

FULL STROKE KEYBOARD FOR THE ATARI 400

If you do quite a bit of work with the keyboard of the Atari 400, you surely realize its limitations by now. It is cramped and difficult to feel correctly for a touch typist. If you're desperate enough, you can get a new keyboard without throwing away your 400 and buying an 800 or 1200.

Several companies make a full stroke keyboard kit which will replace the membrane keyboard of the 400. You must disconnect and unplug the membrane keyboard, then plug in and connect the full stroke keyboard. This fairly simple installation and can be done

at home. These replacement keyboards generally sell for under $130.

GAME CONTROLLERS

For all their serious applications, Atari computers are great game machines. The graphics and sounds are superb, and the joystick ports make connecting and disconnecting game controllers very simple. The Atari computer uses the same controllers as the Atari 2600 and 5200 video game machines, so Atari joysticks and paddle controllers are inexpensive and easy to use. However, video game connoisseurs might wish to buy special controllers to make their games play more like the arcade games. There are dozens of high-quality joysticks, paddles, and trackballs made by independent manufacturers.

ADDITIONAL PERIPHERALS

There is, in addition to the peripherals we have mentioned, a wide variety of miscellaneous peripherals which are useful or entertaining to use. Since the Atari computer is such an excellent video graphics machine, many of them augment those graphics abilities. Some of them make computer use a little more convenient.

DIGITIZERS

Versa Computing makes a digitizer for the Atari computer called VersaWriter. A digitizer is a drawing board with a flexible arm attached. It connects via a cable to a joystick port. When you trace a picture on the board with the end of the arm, the picture is drawn on your monitor, and can be stored for later use.

If you intend to write programs with a lot of pictures, a digitizer makes picture creation much easier. VersaWriter comes with software which lets you select "paint brush" size, use an "air brush" for shading, scale the picture being traced, fill the figures drawn with colors, and use other very handy functions. It also lets you mix text with your pictures, and allows you to save each picture for use in your own programs.

LIGHT PEN

A light pen looks much like its name: it is a slender metal tube attached to a joystick port. When you press a light pen to the screen, the computer can tell its location. When used with the appropriate software, it can draw pictures directly on the screen, select options from a screen-printed menu, erase, and perform many other functions. The Atari computer was originally designed to use a light pen designed by Atari, but Atari marketed the light pen only briefly, then withdrew it from the market. Independent hardware manufacturers have stepped in, and there are several light pens now available, with prices ranging from around $150 to below $40.

PLOTTERS

A plotter is somewhat like a digitizer in reverse: a picture on your monitor screen can be drawn by the plotter onto a sheet of paper. Plotters usually hold a sheet of paper on a paper bed and draw figures with fine felt tip pens. A plotter can usually use two or three different color pens, and the more expensive models can use up to six or seven pens. Aside from the colors available, the chief advantage of a plotter over a dot matrix printer capable of graphics is that the plotter draws very smooth lines and circles without that "computer look" that dot matrix leaves. Most plotters are also capable of printing out text for labelling pictures plotted.

CHRONOGRAPHS

The primary use of a chronograph is to control automatic computer functions which must take place at a certain time of day. If you have ingeniously wired your home burglar system to be controlled by your computer, incorporating a chronograph into your control program lets you turn it on and off on specific days, hours, and minutes of your choosing. Perhaps the most common application is to use it in conjunction with a modem to send and receive data from other computers or computer networks at night, when you're sleeping and the phone rates are much lower. The Hayes Chronograph sells for under $250.

OTHER PERIPHERALS

There are many other peripherals which we don't have space to discuss. Some companies sell computer controllable robot arms and robots which will work with the Atari. Another peripheral provides an interface between the Atari and a videodisk so that you can access any individual frame on the disk under computer control. There are also EPROM writers which will let you write your own programs on ROM chips to plug into the cartridge slots of the Atari. Keep your eyes open. New peripherals are being introduced all the time.

7. SOFTWARE: RUNNING YOUR COMPUTER

Without software you can do nothing to your computer system but turn it on and off. You need programs to run your computer, to tell it what to do. If you can program, you can write your own software. However, many computer owners are not programmers, or don't have the time to spend writing programs. Even expert programmers don't have the time to create software for everything they'd like their computer to do.

Fortunately, the Atari computer system is very popular, and the large number of Atari owners creates a good market for Atari compatible software. The amount of software available is overwhelming. A glance through a computer magazine will reveal more software than most people would care to consider. There is software to keep your finances up to date, to teach the kids math, to play chess with you, to run your printer, to draw pictures on your monitor, and on and on. New software is being written all the time.

To make some sort of sense out of this rampant software, let's split it into four categories:

- Applications software
- Utility software
- Computer languages
- Games

Briefly, applications software is software written to perform a specific task for you, such as word processing, data base management, bookkeeping, education. Utility software is designed to make operating your computer easier. There are utilities to fix damaged disk files, to re-number BASIC programs, and to design graphic monitor displays. Computer languages offer you different methods of programming, and games are just that: entertainment.

When you shop for software, as with hardware, it's very important to make sure it will work for you. Consider the following questions when buying.

Is the program compatible with your system? Make sure it's written for an Atari computer, and that you have enough memory to run it. Make sure it comes on a medium you can load in your system (i.e. cartridge, cassette, or disk). Make sure you have the necessary peripherals to make it work. For instance, a telecommunications program requires a modem.

Is the program easy to use? Difficult or "unfriendly" programs are sometimes self-defeating. For instance, a bookkeeping program which is very confusing will not save you any time over using pencil and paper.

Is the program versatile? A good program should give you many options and should be flexible enough to be used for your particular needs. In a game program, this might mean varying difficulty levels to keep the challenge up. In a data base program, it might mean being able to tailor your record format so you can enter the information most important to you. It's important to realize that versatility and ease of use often conflict with each other. You need to decide which is most important to you.

Will you get repeated good use of the program? This is especially important in game software, where boredom can set in long before you've gotten the value of your purchase price from it.

Does the software company offer a good backup and replacement policy? Unfortunately, disks and cassettes do wear out, and if they do, the software you paid for is gone. Some companies give you "unprotected" software, which means you can copy it yourself to create a backup for use in case of disaster. Most companies "protect" their software, making it impossible for you to duplicate. They do this to foil "pirating"

(duplicating copyrighted software to give away or sell). Most companies who protect their software will replace failed disks or cassettes for a low price ($5.00 or less), and some will give you a second copy for use as a backup.

APPLICATIONS

Application software for the Atari falls into several general categories which are covered briefly below.

WORD PROCESSING

Word processing seems to be one of the most praised applications of a home computer. It lets you write all of your text on the monitor screen and store it in RAM before printing it out on a printer. Since the text is stored on a very volatile medium, it's very easy to correct and edit. Paragraphs can be moved around, words replaced, and sections deleted with minimum difficulty. Standard business letters can be saved on disk to be used again later, replacing only the name, address, and pertinent information of the addressee.

Once the text is set in the desired way, the word processing software lets you print it in the way you want. You can use different print fonts, change margins, center text, make the right edge of the text as even as the left edge (known as "right justification"), and use many other printer options to make your final document look good. You can store your text on disk after printing for later re-use.

Obviously, a word processor can save you a lot of time, especially if you must deal with first drafts, second drafts, and revisions. Many people who initially disdain computers are eventually won over by this convenience. There are three major word processing programs currently available for the Atari.

Text Wizard is an easy to use word processor offered by Datasoft. You need at least 32K of RAM and a disk drive to run it. You also need either an Atari 825 (Centronics 737) printer, or an Epson MX80 printer. Once you have loaded and run the program, you merely type the text you want on the monitor screen. *Text Wizard* automatically takes care of returning the cursor at the end of the line, so the only time you need to hit RETURN is at the end of a paragraph. As you type past the bottom of the screen, the text automatically scrolls up a line at a time.

Once the text is entered, you can manipulate it easily with the editing commands. The cursor moves around much as it does in BASIC, and you can use it to insert or delete text. You can insert whole lines or paragraphs, or just one character at a time. Likewise, you can delete blocks of text easily, or delete just one line or character. You can also move entire blocks of text from one location in a document to another, or duplicate the block as many times as memory will permit. Special commands let you page through long stretches of text, and jump immediately to the top or bottom of the document. Other commands will search for a specific phrase anywhere that it is contained in the document, and replace it with another if you wish.

After the text is in the form you wish it to be, you can place special printing commands in the text which will allow you to set all the margins (top, bottom, left, and right), choose a specific font, underline or emphasize text, print text in two columns, and right justify the text. *Text Wizard* will also automatically number pages if you want it to, and add headers and footers (a label that appears at the top or bottom of each page.) It saves documents on disk, and will let you *chain* documents filed on disk so that very long documents can be formed from much shorter ones. The manual included is very easy to understand, and a command reference card is included to make the operation simple. It costs under $100.

LJK Enterprises sells *Letter Perfect*, a word processor not as easy to use as *Text Wizard*, but with a few extra features. *Letter Perfect* can be altered easily to work with almost any printer on the market. It will also work with the 80-column board, and comes in cartridge form as well as disk. It will merge with *Data Perfect*, a data base program by LJK, so you can create form letters. *Letter Perfect* is a little complex to use, and the manual is not very clear, so beginners should beware. It sells for under $150.

Atari has a new word processing program called *AtariWriter*. It was written to Atari's specifications by Datasoft, the folks who wrote *Text Wizard*. It works very much like *Text Wizard*, but has some added features. It is a little easier to edit text and put in printing commands using *AtariWriter*. *AtariWriter* also lets you preview each page on the screen (by scrolling from side to side and looking at sections of the page) before you print it out. It comes on cartridge, will store documents on cassette as well as disk, and costs less than $100.

DATA BASE PROGRAMS

Having a data base program lets you use your computer like a card catalog. The program will set up a file to store your records in. For instance, you might wish to keep a list of all your books in the computer memory. First, the data base program creates a *file*, perhaps called BOOKS, to store your information in. Then you would decide what information was important to know about books. The information about each book would be called a *record*, and each record would contain information in specific parts called *fields*. Each record in your Books file might have three fields: one for the title, one for the author, and one for the subject of the book. Once you have entered all of your books in the Books file, you will have one record for each book. You have just created a data base for your books. The data base program will store the records on disk and keep track of their location.

The real power of a data base program comes in handling the data base once it is entered. It will automatically put the records in alphabetical or numeric order using any field you wish. For instance, you might have it arrange all of your book records in alphabetical order by author. It will search through the data base to find any record using any field. You might have it show you each book record for book titles between B

and F. The program is very powerful when you can search records using several fields at once. This lets you look for all books about octopi written by Ed Cephalopod.

The data base program should be able to generate lists and reports using a connected printer. This will let you print out your entire data base in any order you want, or just selected portions of it. It will also let you choose just which fields of the records you want printed, and in what order. Some data base programs will total up numerical fields at the end of a printout, which comes in very handy when storing income tax or other financial records. Other data base programs, such as LJK's *Data Perfect*, will merge with word processing programs as discussed earlier.

A popular data base program for the Atari is *Filemanager 800+*, sold by Synapse Software, which requires 40K of RAM and one disk drive. Two disk drives make it easier to use. With *Filemanager 800+*, you can design your own records of up to 20 fields. Each record can be up to 9 screen pages long. You can search your data base using up to four fields at a time and can print out selected records on your printer using the fields you choose. You can also use it to print out labels for mailing list chores. It will total up numerical fields if desired, and sells for less than $100.

FINANCIAL PROGRAMS

There are several programs on the market to help you keep financial records. They range from specific home finances, such as keeping track of a paper route, to business applications such as general ledger records. Let's take a look at one of them, *The Bookkeeper*, which is very popular with small business owners.

The Bookkeeper is designed by Atari for computer users who may not be familiar with computers. It's easy to use if you understand the principles of double-entry bookkeeping. It needs 32K of RAM, a disk drive, and a printer. *The Bookkeeper* keeps track of general ledger records using double-entry bookkeeping. It will also handle accounts receivable and accounts payable information. You can store up to 350 total accounts, and handle up to 1000 distributions each month. It will keep track of checks written, cash received, and invoices written, and print out reports for all of these categories. It's very useful for small businesses, and sells for under $150.

SPREADSHEETS

VisiCalc is the only spreadsheet program available for the Atari. For businessmen and women, *Visicalc* is often the single most useful program they own. Consider *Visicalc* as a large electronic worksheet on which you can make calculations and present notes and results. The monitor screen is a window on a small section of the worksheet which can be moved around to view any section desired.

Visicalc can give you up to 63 columns and 254 rows to enter data. Any of these positions can be a

label, a value, or a formula. Any position can be defined using other positions. When you change the value of any one position on the spreadsheet, all other positions dependent on that position will change their value automatically. This extremely powerful feature allows you to use *Visicalc* for projections and "what if. . . " calculations. For instance, you might enter a series of products for sale, with the individual prices, projected sales for the upcoming year, and total projected sales. When you raise or lower the price of a single product, the projected sales figures will all be changed automatically. *Visicalc* comes with a very well-written manual, and can be easily used by the nonprogrammer after a few hours of practice. It sells for under $250.

EDUCATION

The head of a major home computer firm once remarked that it is the "guilt factor" that sells home computers. Parents want their children to learn about computers, so they feel guilty if they don't supply them with a computer to learn on at home. If this is the case, surprisingly little educational software is sold in relationship to games and applications. To assuage any lingering feelings of guilt for playing too many games, there are some excellent education programs available. For convenience, we will categorize them as drill, simulations, or study courses.

Drill programs are usually used to teach children a fundamental concept using repetitive exercises for them to practice with. This need not be as dreary as it sounds. Many educational programs are written to make the learning fun, and are often some type of game, with rewards for correct answers and very nice graphic displays. Some of the topics covered are multiplication and division, spelling, geography, shape recognition, typing, and speed reading for advanced readers. There are drill programs for all ages, from toddler to adult, and they are a good way to teach fundamentals as well as to make the user more comfortable with computers.

Simulations can teach complex subjects by presenting a situation on a screen that the user must react to in a knowledgeable way. One of the most popular simulations is *Scram*, a nuclear reactor simulator sold by Atari. In *Scram*, a picture of the inner workings of a nuclear reactor is placed on the screen. The graphics are excellent. You can see the cooling fluid flowing through the pipes, and you can hear the turbines turning. You can also open and close valves to regulate the operation of the reactor. If you turn them in the wrong combination, you can cause a meltdown in the reactor. Periodic earthquakes which damage the reactor keep things interesting. It's obvious that the big advantage of a simulation is the chance to learn by doing without having to live (or die!) with your mistakes.

Study courses essentially use the computer to make an audio-visual presentation of a subject. Atari markets courses in French, German, Italian, and Spanish, and other courses in programming your Atari. Most of these courses use the program recorder to present the course with a sound track on the cassette. One interesting study course is a series of tutorials sold

by Educational Software, entitled appropriately enough *Tricky Tutorials*. Each of these tutorials teaches you about a different aspect of advanced Atari graphics, using BASIC programs which you can inspect and change to get your own results. They teach you how to design your own characters, animate figures on the screen, and create advanced sounds and music among other things. They sell for under $20 each.

TELECOMMUNICATIONS

If you own a modem, you'll need telecommunication software to run it. This software must be able to control the 850 Interface Module, which sets the baud rate and other important factors that the modem will need to operate correctly.

One excellent telecommunication program is *Tele-Talk*, sold by Datasoft. It gives you full control of the 850 Interface Module, and is very easy to use. The novice user can turn on the computer system with *Tele-Talk* and begin using the modem immediately without setting any controls. It displays all the text that comes in over the modem on the monitor and saves it in memory as well. You can "spool" the text in memory to disk, which allows you to look at it later, after your time on the modem is over. Another handy feature is a time display that gives you the time of day (after you enter it initially), the amount of time you've spent on the phone lines, and the amount of money it's costing you (figured automatically after you set the hourly rate). *Tele-Talk* sells for under $50.

UTILITIES

Utilities are not written to accomplish any particular task, but are meant to help you get better use out of your computer. There are all sorts of utility programs available, and we'll look at several of them.

BASIC UTILITIES

There are many utilities that help you use Atari BASIC. One of them is *Monkey Wrench*, sold by Eastern House Software, which deserves mention in part because it's the only program on a cartridge for the right-hand slot of the Atari 800. *Monkey Wrench* provides many convenient features for the BASIC programmer, which include automatic line numbering, line renumbering, line deletion over a specific range, and hexidecimal/decimal conversion. It will also reset screen margins easily, and will make the cursor keys work without using the CONTROL key. It has a memory test package, and a machine language monitor for machine language programmers. If all the above terms read like gibberish to you, then you probably don't need *Monkey Wrench*. Experienced programmers, however, will find it a very useful time-saving tool for under $50.

GRAPHICS SOFTWARE

The Atari computer probably has the best home computer graphics on the market, capable of astonishingly fine pictures for a microcomputer. Unfortunately, most of the advanced graphics which make these fine pictures possible are not possible to create easily using BASIC. It's not surprising, then, that there are many Atari utilities to help you create graphics on the Atari.

There are several programs available which let you design your characters (fonts) on the screen. This gives you the capability of using Greek or Cyrillic characters, or perhaps creating special scientific symbols. One very good character designer is Fontedit, included in a tutorial from the Code Works called *Iridis 2*. Fontedit displays characters on a large square filled with a grid. By using a joystick to fill in or erase various parts of the grid, you can design your own characters one at a time, and then store the whole character set on disk or cassette. Fontedit is part of a tutorial, so the whole program is listed out with a detailed explanation of how it works. *Iridis 2* includes a second program, *Knotwork*, and is a bargain at under $20.

Other graphics utilities concentrate on creating complex and colorful pictures easily on screen. *Graphic Master*, offered by Datasoft, is one of these. It functions as a sort of "cut and paste" board for creating designs. You can draw your own designs with a joystick, or use a table of chemical or electronic symbols supplied with the program. Once the designs are in place, *Graphic Master* lets you "grab" selected areas of the screen to copy them on another part of the screen, or move them to a second blank screen. In the process, you can rotate the grabbed image in 90 degree increments, invert it, or slant it. Once the screen is filled the way you want it, you can save it to disk or have it printed out on a printer with dot graphics capabilities. *Graphic Master* sells for under $40.

After you have created a picture on the monitor, you can print it out in color on a black and white dot matrix printer using a utility called *Color Print*, also from Datasoft. *Color Print* uses color carbons to print out colors. After the picture is loaded into the computer, *Color Print* analyzes the colors, and then makes four different passes over one sheet of paper in the printer, using a different color carbon each time. The end result is a color reproduction on paper of the picture on your monitor. *Color Print* sells for under $40.

MUSIC SOFTWARE

The Atari computer is capable of producing four voices of sound over a three octave range. *Music Composer* is a program by Atari designed to help you use these voices to create music. You need to understand music notation to use it, but if you do, you can enter notes and rests easily on a staff to create the melodies you want. The *Music Composer* will play your compositions back to you in up to four part harmony, displaying the music on the screen as it is played. *Music Composer* sells for under $40.

DISK UTILITIES

There are several utilities that help you deal with disk storage. Some of them will keep a record of all the files you've stored on your disk collection for easy location, others help you deal with faulty disks and lost files. *Diskey* is a utility from Adventure International which helps you retrieve files lost on disk. It lets you look closely at the code in each sector of information on the disk. If you have accidently deleted a file, *Diskey* will sometimes allow you to restore the file by piling up its remains. It will also let you repair damaged files that will not load, and copy oddly formatted disks. It's not for the beginning user, but is very useful for the disk user who knows what he or she is doing. *Diskey* sells for under $50.

COMPUTER LANGUAGES

The Atari is a multi-lingual computer—that is, it can use many different computer languages for you to do your programming. The standard language, of course, is Atari BASIC, but there's a variety of other languages available for your specific programming needs.

BASIC A+

BASIC A+ is a version of BASIC written by Optimized Systems Software, the same people who wrote Atari BASIC, which had to fit in an 8K ROM cartridge. Its commands allow you to control the advanced graphics capabilities of the Atari, make working the disk drive simpler, and also simplify working the joysticks. BASIC A+ allows program renumbering and the ability to delete ranges of numbers. Any programs written to run with Atari BASIC will also run with BASIC A+. BASIC A+ comes on disk, uses 14K of memory, and sells for under $80.

MICROSOFT BASIC

Microsoft BASIC is the dialect of BASIC used on Apple, Commodore, and Radio Shack computers. It has several useful features not included in Atari BASIC. One of these is advanced string-handling capabilities (the ability to handle text easily). Line renumbering and ranges of line deletion are available, as well as advanced input/output capabilities, which make using the disk drive and other peripherals easier. Additional printer commands are included, and one extremely powerful feature is the ability to define your own commands. Many people use Microsoft BASIC to easily translate programs from other computers which also use Microsoft BASIC. It uses 19.5K of memory, and is sold on disk by Atari for under $90.

PILOT

Pilot is a simple language designed for children and computer novices. It's essentially pared-down

BASIC which uses one- and two-letter commands that don't demand extensive typing skills. It's most powerful feature is *Turtle Graphics*, which allow you to create sophisticated drawings by commanding an imaginary turtle to crawl across the screen. Pilot is easily learned, and its pleasing graphics capabilities make it an excellent language with which to introduce a novice to programming. Atari sells Pilot on cartridge for under $80.

OTHER LANGUAGES

For the sophisticated programmer, there are a number of superior programming languages available for the Atari. These include Assembly, C, FORTH, LISP, and Pascal.

GAMES

Games on home computers are often mentioned as an embarassed afterthought, as if they represented a trivial waste of a computer. But software sales records and a look at almost anyone's software library will quickly dispel that notion. More game programs are sold than any other type of software. So many games are available for the Atari, that we can only examine the major types of games.

ARCADE GAMES

Arcade games are the most popular type of game on the Atari, because of the excellent graphics available. They require a quick eye and fast reflexes. They are usually shoot 'em up games, where you control the firing motion with a joystick, or maze games, where you maneuver a character through, avoiding dangers and seeking out rewards. The granddaddy of all Atari computer arcade games is Atari's *Star Raiders*; its incredible graphic realism has sold probably more Atari computers than any application program ever will.

STRATEGY GAMES

Strategy games are usually adapted from popular board or card games. A home computer is very good at dice shaking, minding a bank, checking for rule infractions, and other tedious tasks. If you can't find other players, the computer will play against you, sometimes too capably. There are versions of popular board games such as chess, checkers, and backgammon, and of card games like cribbage, bridge, blackjack, and poker.

War games work very well on a home computer, since the computer will calculate and keep track of all the odds necessary for play. A classic of war game programming is *Eastern Front*, sold by Atari, where you control the German army invading Russia in 1941 (see Plate II on inside back cover). The computer controls the Russian forces and puts up a very good fight.

ADVENTURE GAMES

Adventure gaming is an exclusive game genre of the computer. You control the central character, telling him, her, or it, where to move, what to look at, what to pick up, and what to say. Many adventure games are presented entirely in text, which, as you move from location to location, describes your surroundings to you. Usually, you have a goal to accomplish, a rescue, treasure to find, or merely staying alive. The first and classic adventure game known, appropriately enough, as *Adventure*, is sold by Creative Computing Software. Other classics are the series of adventures created by Scott Adams for Adventure International, and the Infocom *Zork* series. Some adventure games are now written with pictures displaying the surroundings. One of the best is Datasoft's *Sands of Egypt* (see Plate III on inside back cover).

APPENDIX

This appendix is a quick and easy reference to loading programs on Atari computers. Keep in mind that the Atari 400, 800, and 1200 computers vary somewhat in location of cartridge slots and power switch. The cartridge slot and power switch are on the left side of the Atari 1200. The 400 and 800 have a cartridge door just above the keyboard, and the power switch is located on the right side (it's a rocker switch, and shouldn't be confused with the channel selector switch, a sliding switch.)

LOADING A CARTRIDGE PROGRAM

1. Start with all equipment turned off.
2. Turn on monitor or TV set.
3. Open cartridge door (for 400 and 800 computers only).
4. Insert cartridge in cartridge slot (label side up in 1200 computer, label side forward in 400 and 800 computers.) Use the left hand slot of the 800 computer.
5. Close cartridge door.
6. Turn on computer.

LOADING A CASSETTE PROGRAM

We'll discuss two different kinds of cassette programs: autoboot programs and BASIC programs. BASIC programs must have the BASIC cartridge inserted before loading, autoboot programs usually require that the cartridge slot is empty.

AUTOBOOT PROGRAMS

1. Start with all equipment turned off.

2. Make sure cartridge slot is empty.
3. Turn on monitor or TV set.
4. Insert cassette, label side up, in recorder.
5. Rewind tape to beginning.
6. Hold the yellow START button down on the right side of the keyboard.
7. While holding down the START button, turn on the computer.
8. When the computer buzzés once, release the START key and depress the PLAY button on the cassette recorder.
9. Press the RETURN key on the right side of the computer keyboard.
10. After the program is loaded (when something finally appears on the screen), depress the STOP key on the cassette recorder.

If the program doesn't load, it may need the BASIC cartridge. Replace step 2 with:

2. Insert BASIC cartridge, make sure cartridge door is closed on 400 and 800 computers.

BASIC PROGRAMS

1. Use the instructions above on loading a cartridge program to insert the BASIC cartridge.
2. Insert cassette, label side up, in recorder.
3. Type CLOAD and then press the RETURN key on the right side of the keyboard.
4. When the computer buzzes once, depress the PLAY button on the cassette recorder.
5. When the program has finished loading (READY will appear on the screen under CLOAD), depress the STOP key on the cassette recorder.
6. Type RUN and press the RETURN key, and the program should run.

There are three types of BASIC cassette programs. The instructions above are for the most common type. If the program will not load, and you get an error message on the screen, try replacing step 3 above with:

3. Type ENTER "C:" and then press the RETURN key.

If this doesn't load the program successfully either, then try:

3. Type LOAD "C:" and then press the RETURN key.

LOADING A DISK PROGRAM

We'll discuss both autoboot programs and BASIC programs. BASIC programs must have the BASIC cartridge inserted before loading, while autoboot programs usually require that the cartridge slot is empty.

Before starting, one very important message: Handle the disk with care, and only by its outer cover. Don't touch the exposed surface through the slots or bend the cover.

LOADING AN AUTOBOOT PROGRAM

1. Start with all equipment turned off.
2. Make sure cartridge slot is empty.
3. Turn on disk drive and monitor or TV set.
4. After BUSY light has gone out on disk drive, open the door and insert the disk label side up, exposed slot toward rear of drive.
5. Close the drive door.
6. Turn on the computer.
7. The program will load, and the disk drive will turn itself off. Remember never to open the drive door unless the BUSY light is off.

Some autoboot programs require the BASIC cartridge to run. If the program won't load, or you get a display that says Disk Operating System, then try once again substituting this for instruction 2.

2. Insert BASIC cartridge, make sure cartridge door is closed on 400 and 800 computers.

LOADING A BASIC PROGRAM

1. Start with all equipment turned off.
2. Insert BASIC cartridge. make sure door is closed on 400 and 800 computers.
3. Turn on disk drive and monitor or TV set.
4. Find Atari Master Diskette II, or any other disk that has DOS contained on it.
5. After BUSY light has gone out on disk drive, open the door and insert the disk label-side up, exposed slot toward rear of drive.
6. Close disk drive door.
7. Turn on the computer.
8. After BUSY light has gone out on disk drive, open disk drive and remove Master Diskette.
9. Insert disk containing BASIC program.
10. Close drive door.
11. Type RUN "D: followed by the name of the program you want loaded, then hit the RETURN key.

If you get BOOT ERROR on the screen after step 8, you probably don't have a disk with DOS in the drive, or the drive door isn't closed. If so, insert the correct disk, close the door, and try again. If step 12 won't load the program, try:

12. Type ENTER "D: followed by the name of the program you want loaded, then hit the RETURN key.
13. When READY appears on the screen, type RUN and hit RETURN.

If a program won't load after following these instructions, then refer to your owner's manual.

TURNING OFF THE COMPUTER SYSTEM

1. If BUSY light is off, remove disk from disk drive and close door.
2. Turn off disk drive, monitor and computer.
3. Make sure the STOP key has been depressed.

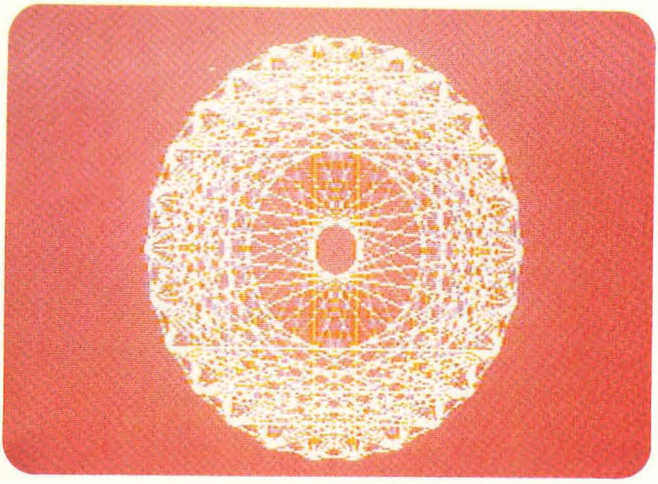

PLATE I An example of high-resolution Atari graphics.

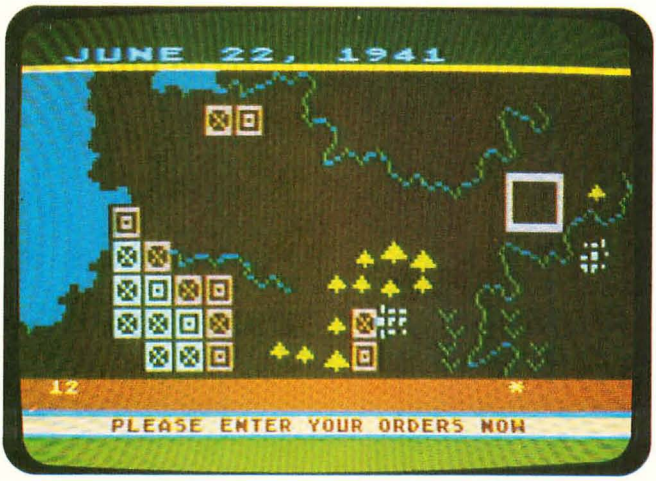

PLATE II Atari's classic war strategy game, *Eastern Front*.

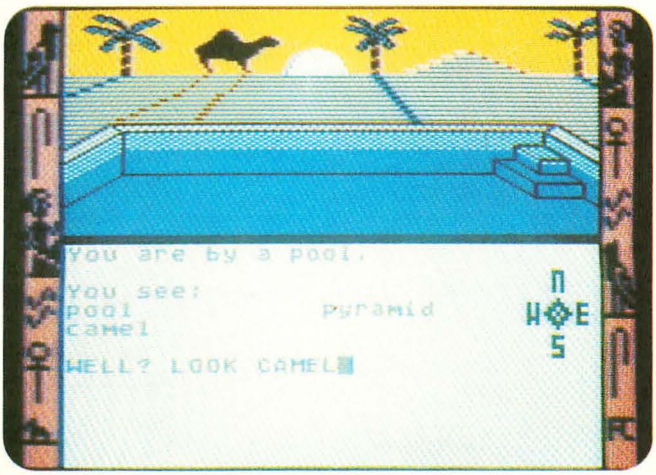

PLATE III A pictoral adventure game, Datasoft's *Sands of Egypt*.

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ISBN 0-88284-235-8