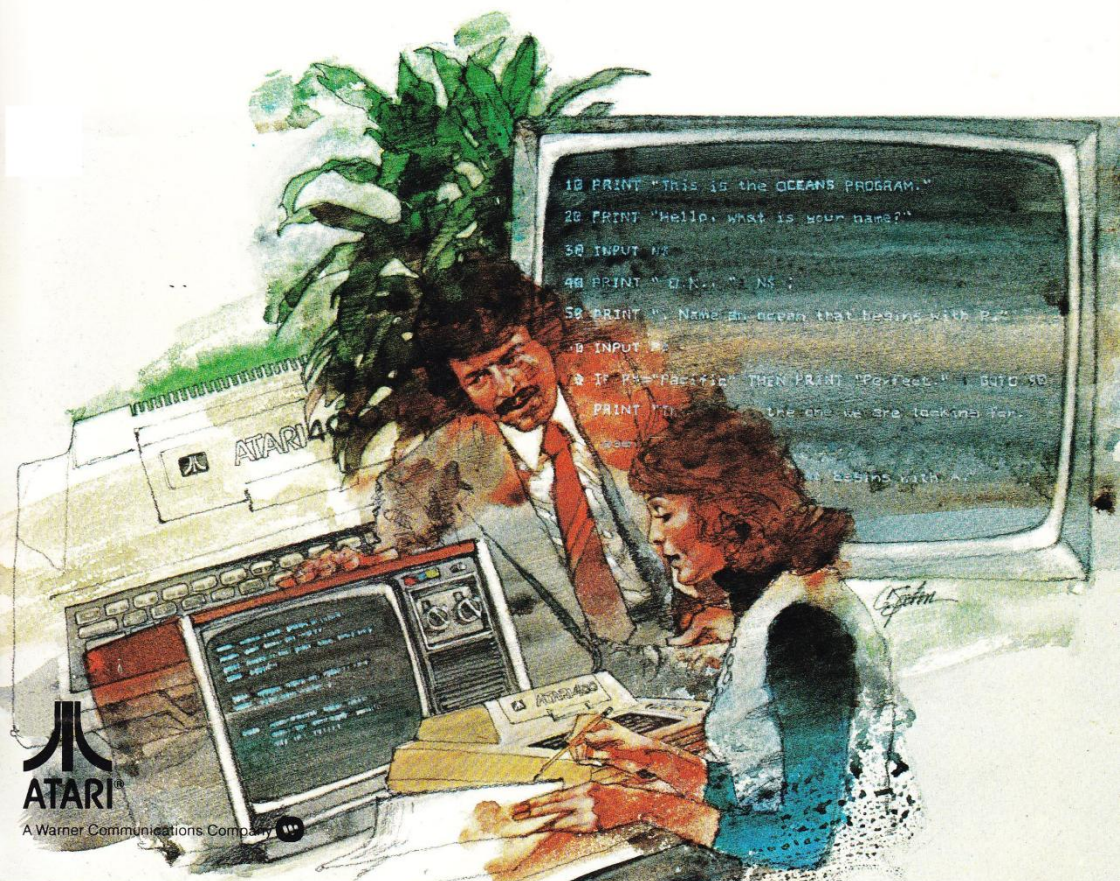


ATARITM 400

OPERATORS MANUAL



A Warner Communications Company

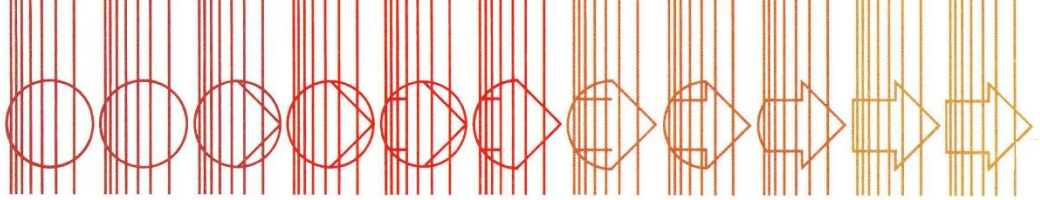
Retrocomputing

Every effort has been made to ensure that this manual accurately documents the operation of the ATARI 400 computer. However, due to the ongoing improvement and update of the computer software, Atari, Inc. cannot guarantee the accuracy of printed material after the date of publication, nor can Atari accept responsibility for errors or omissions. Revised manuals and update sheets will be published as needed and may be purchased by writing to:

Atari Software Support Group
P.O. Box 427
Sunnyvale, CA 94086

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1. INTRODUCTION

ATARI 400—THE PERSONAL COMPUTER WITH SOMETHING FOR EVERYONE.

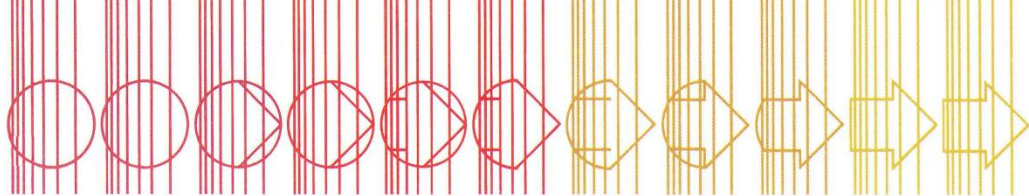
EDUCATION

Deliver Interactive, Audio-visual, Educational Materials. A variety of Interactive Educational Materials present more than twenty subjects through text, audio, diagrams and pictures. Each program carries on a dialogue with you through the **ATARI 400** screen, speaker and keyboard. These programs provide individualized instruction tailored to your pace and achievement level. You receive immediate feedback on your accuracy and understanding. Programs for kindergarten through college level will be available in a wide variety of subjects.

INFORMATION

Provide a serious tool for home and business Information Management. Information Management packages aid you in the orderly storage and quick retrieval of numeric, graphic, pictorial and text information. The Financial Management programs help you balance your checkbook and keep track of income and expenses. The Nutritional package helps you plan healthful meals and diets which include all essential nutrients. The Investment Analysis programs aid in capital assets management and tracking stock portfolios. A mailing list program sorts, edits, and prints lists of names and addresses for you (an optional printer is needed).



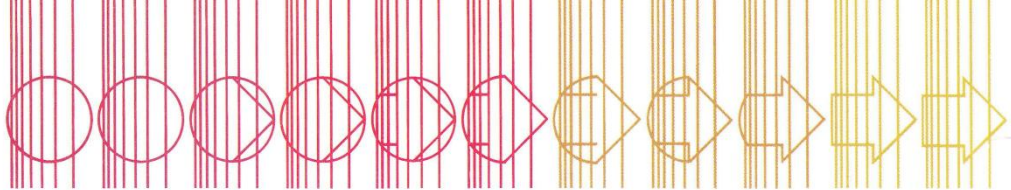


GAMES

Create a playfield for fast-paced games. Games provide hours of entertainment. You can purchase a wide variety of Game Cartridges and Controllers. Each game is designed for one to four players. Just insert the cartridge and connect the controllers. The **ATARI 400** will transport you to a fantasyland of skill and competition. Some games simulate competitive sports such as Basketball, well-known board games such as Chess, or puzzles. Other cartridges are new inventions created especially for the **ATARI 400**. Games are adaptable to your own mood and style. Play with your family, with your friends or by yourself.

PROGRAMMING

Perform all the functions of a fully-programmable General Purpose Computer. Your **ATARI 400** is actually a fully-programmable General Purpose Computer. As you explore the capabilities of the **ATARI 400** you will increase your knowledge of computer science considerably. The **Atari BASIC Language** Cartridge expands the Operating System software to include a versatile, easy-to-learn, high-level programming language for both student and professional use. The Operating System software provides access to the central processing unit, memory, Input/Output (I/O) ports and file manipulation utilities. Even if you have no experience at all, the **ATARI 400** and an inquiring mind are all you need to learn to develop custom applications for your personal computer.



Caution: Keep polybags away from small children.

2. UNPACKING

Your **ATARI 400** is a series of components which function together with your television set as a single system. You have just purchased the Basic System which includes:

- Computer Console
- TV Switch Box
- AC Power Adapter
- 1 Cartridge

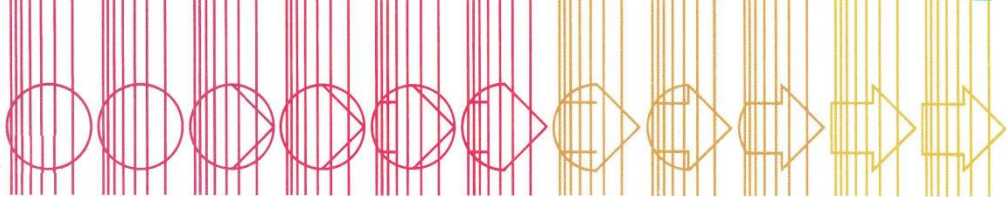
Atari BASIC Computing Language Cartridge

- 2 Instruction Books
Operators Manual
ATARI BASIC

The components, pictured on the next page, are the computer hardware. They are made of silicon, metal, plastic, paper and ink. They are the tangible components of the **ATARI 400** Computer System. Equally important, but impossible to photograph is

the **Atari 400** software. *Software* is the information and instructions encoded in the *hardware*. The software components of the **ATARI 400** Basic System are the Operating System software, the programs inside the Atari BASIC Language cartridge and, of course, the contents of the two books.

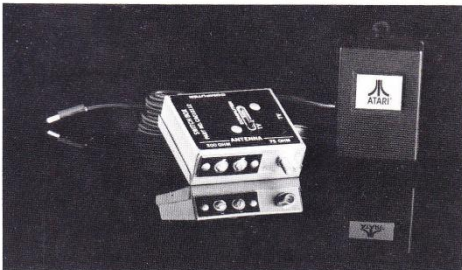
Your Atari retailer can supply you with game controllers and newly released cartridges as they become available. You may also wish to purchase the **Atari Program Recorder** which provides you with additional software storage on tape cassettes. The Program Recorder allows you to take advantage of an expanded library of preprogrammed educational materials and application programs. Or you may use it with any high-quality, blank audio cassette tape to save programs you write yourself.



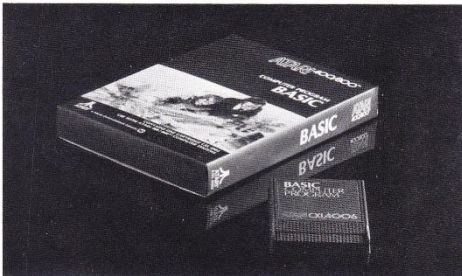
Inside the **ATARI 400 Console** are the *Central Processing Unit (CPU)* and the *Memory Bank* containing the *Operating System Read Only Memory (ROM) Module* and 8k (8 thousand characters or "bytes") of user programmable *Random Access Memory (RAM)*. The Console also holds the *Keyboard*, *Cartridge Slot*, *Controller Jacks* and a *Serial I/O Port* for connecting to peripheral components.



The **TV Switch Box** allows you to change from regular TV reception to **ATARI 400 Computer** display by moving the sliding switch on the box. The **AC Power Adapter** plugs into a normal wall socket and converts it to the low voltage used by your **ATARI 400**.

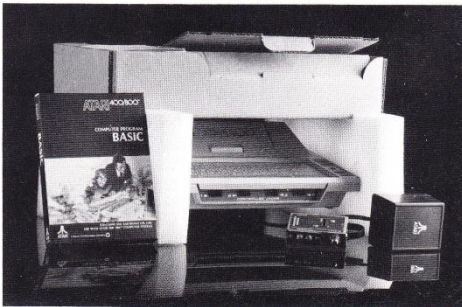


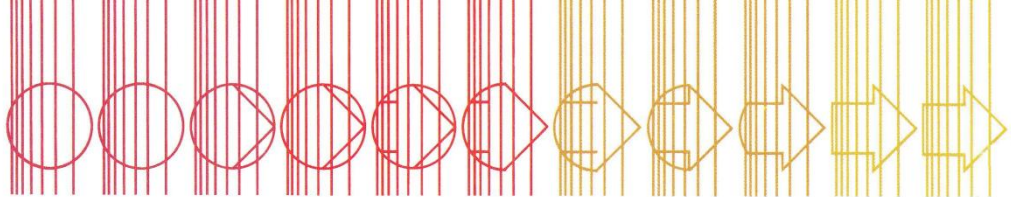
Atari BASIC Language is contained in the **cartridge** included with your Basic System. Additional cartridges may be purchased from your Atari retailer. Complete instructions accompany each cartridge.



Save all your **ATARI 400 packaging materials**. The accessory tray and polyethylene bag will keep your **ATARI 400** components organized and dust free when in daily use. The *outer carton* and *foam end caps* will protect your **ATARI 400** during moving or long term storage.

Warning: Do not allow small children to play with these or any other plastic packaging materials.





3. UNDERSTANDING SOFTWARE

The **ATARI 400** Basic System is very much like an empty sheet of paper. It has the potential for an unlimited number of applications. But that potential remains dormant until you add the software.

ATARI 400 software consists of an integrated series of coded instructions called programs. The foundation programs are supplied in the **Operating System ROM** Module. They activate the *keyboard* and the *screen display* so that you can create pictures and text one screenful at a time. They also control the flow of all information within the computer, making it possible to add additional software through the keyboard, cartridges, or cassette tapes.

Usually you add a second level of software to the **ATARI 400**. This can be done by inserting a cartridge into the cartridge slot. The software transforms the **ATARI 400** into a special purpose machine for playing a game, presenting educational material, manipulating information or entering programs through the keyboard. The optional program recorder provides an additional method for loading programs into the **ATARI 400**.

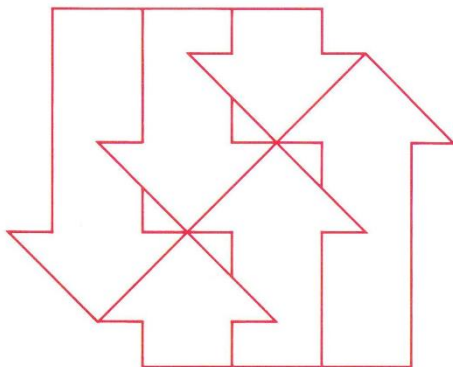
Atari Language Cartridges, such as the BASIC cartridge provided with your **ATARI 400**, allow you to write an unlimited library of original programs.

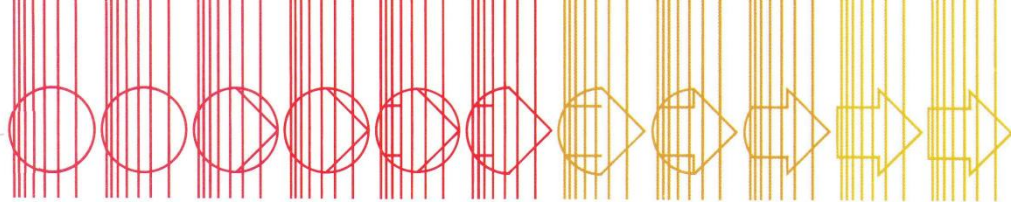
Atari Application Cartridges, designed by Atari's staff of professional programmers, contain pro-

grams that are permanently recorded in a ROM within the cartridge. They control the computer in machine language, the most intricate level on which to manipulate the computer. These cartridge programs produce full-color, animated displays and complex electronic decision-making.

Many entertaining **game cartridges** are available. Each **ATARI** game is designed to be easy for you to learn but difficult to master. You select the computer's roll... either as your opponent or your playfield... for many hours of innovative leisure.

Other **Atari Cartridges** have a more serious purpose. They are tools for increasing your speed and accuracy in handling words and numbers. Atari programmers identify and analyze problems of interest such as checkbook balancing or mailing list sorts and updates. They design a *generalized* solution to each problem, then program that solution in machine language and record it in the cartridge. When you insert the cartridge, the **ATARI 400** repeats this preprogrammed solution, substituting *your data* from the keyboard into its equations. Although all cartridges operate in the same general fashion, each cartridge causes the **ATARI 400** to use the screen display, keyboard, and/or controllers in a different way. You will need to read the instructions which accompany each cartridge for specific details. Keep these instruction sheets and your personal notes on the operation of the **ATARI 400** together with this manual in a 3-ring binder.





4. CONNECTING THE TV SWITCH BOX

The **TV Switch Box** is designed to be permanently attached to your television set and will not interfere with normal television reception. It has an adhesive backing to hold it in place on the back of the television and may be used with any of Atari's home video products.

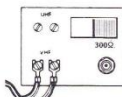
When the **COMPUTER-TV** switch on the Switch Box is in the **COMPUTER** position (as shown) your television receives signals from the **ATARI 400**. Tune your television to channel 2 or 3, whichever is weaker in your area. When the switch is in the **TV** position, signals come from your television antenna. You may need a screwdriver to install your **TV Switch Box**.

Disconnect your present antenna from the VHF terminals on the back of your television. Notice whether the antenna cable is the round, 75 OHM variety with a screw-on connector or the flat, twin-lead 300 OHM cable. Attach it to the matching 75 or 300 OHM connector labeled **ANTENNA** on the side of the **TV Switch Box**.

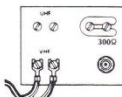
Now attach the short, flat, twin-lead 300 OHM cable labeled **TV** on the bottom of the **TV Switch Box** to the VHF screw terminals on the television.

If your television antenna is of the 300 OHM variety, your **TV Switch Box** is now installed.

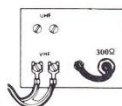
If your antenna is 75 OHMS, you must convert your television to accept the 300 OHM signal from the **TV Switch Box**. Check the antenna connection on the back of your television.



If it looks like this? Push the switch to the **300 OHM (300Ω)** position.

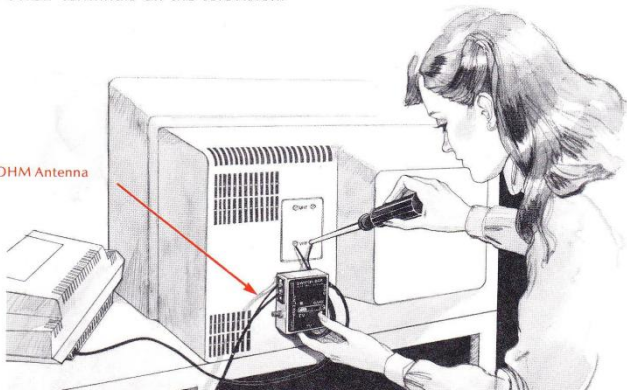


If it looks like this, loosen the screws holding the U-shaped slider and move it to the position marked **300 OHM** or **300Ω**.



If it looks like this? Screw the short round wire into the connector provided.

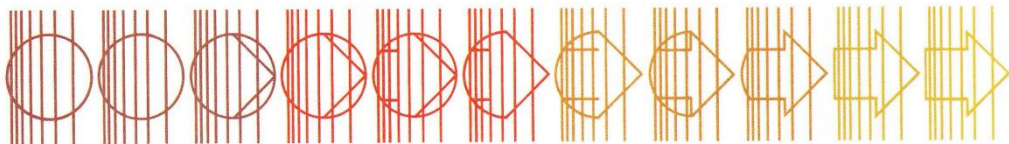
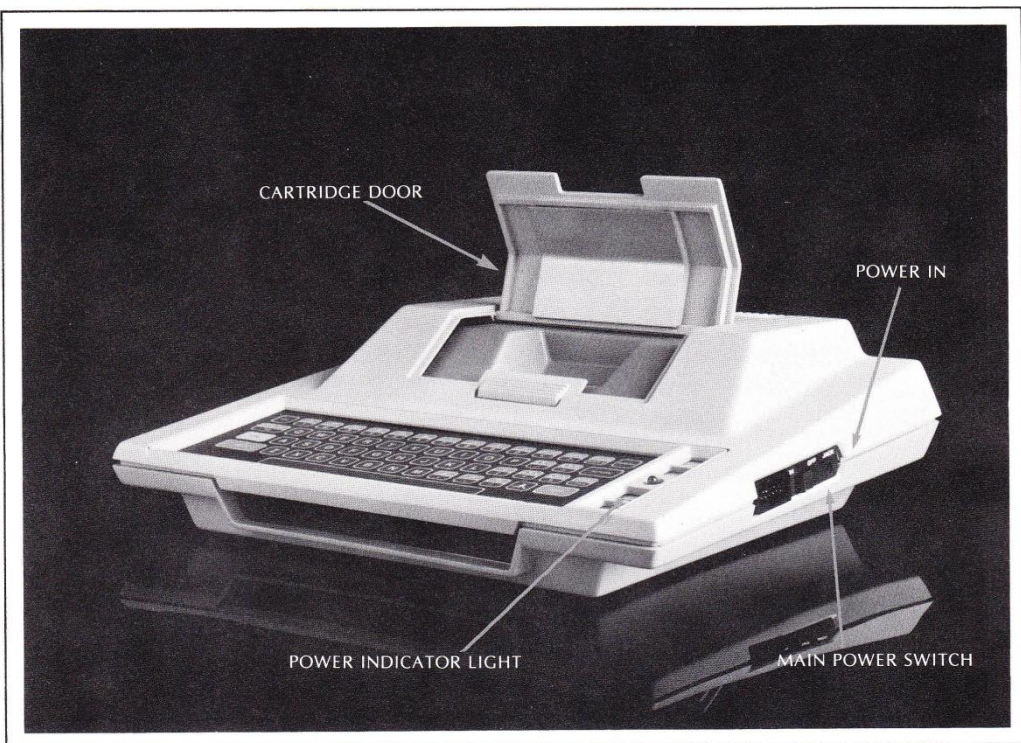
To External 300 OHM Antenna



Federal Communications Commission Regulations Require that you:

- Avoid using any longer twin-lead wire from the TV/Computer Switch Box to your television that is supplied with the TV/Computer Switch Box.
- Avoid connecting the twin-lead wire from the TV/Computer Switch Box to any television antenna or cable-TV outlet.
- Avoid attaching loose wires to your antenna terminals when using your **Atari 400 Personal Computer**.

Any of the above may cause interference to nearby television sets and is against Federal Communications Commission (FCC) regulations.



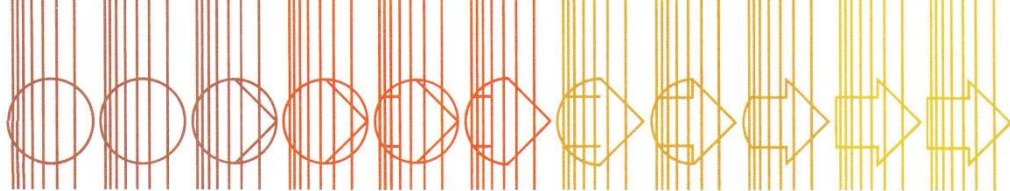
5. POWER UP

Once the **TV Switch Box** is connected, plug the **AC Power Adapter** into any 115 volt outlet (ordinary house current). Plug the end of the AC Power Adapter cable into the jack labeled **POWER IN** on the side panel of the Computer Console.

Push the *main power switch*, labeled **POWER ON/OFF** in the side panel, to **ON**. In order to prevent damage to the computer and cartridge, a secondary switch automatically turns **ATARI 400** off whenever the cartridge door is lifted. The *power indicator light* will only go on when the main power switch is **ON** and the cartridge door is closed. If the television is also on, tuned to channel 2

or 3 and properly connected, you will see a display from the **ATARI 400** on the screen. Whenever the cartridge door is opened the power light will go out and the screen display will go blank. The **ATARI 400** will automatically restart when the cartridge door is closed again.

Although the **ATARI 400** is engineered for durability, do not allow liquids or tiny objects to get inside the Computer Console. Also, keep the brightness and contrast controls on your television set at moderate or low levels. A long period of exposure to a static display at excessively high contrast or brightness may leave a permanent shadow on your television screen.

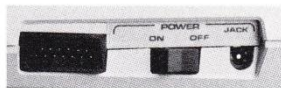


SIDE PANEL

The **Atari Program Recorder** and **Printer** (available from your Atari retailer) plug into the Serial Input/Output (I/O) jack labeled **PERIPHERAL**.

CHANNEL SWITCH

The recessed switch at the back of the console labeled **2-CHAN-3** should be set to channel 2 or 3 whichever has a *poorer television picture* in your viewing area. Be sure your television is tuned to the same channel.



PERIPHERAL JACK

POWER ON-OFF SWITCH

POWER JACK

CONTROLLER JACKS

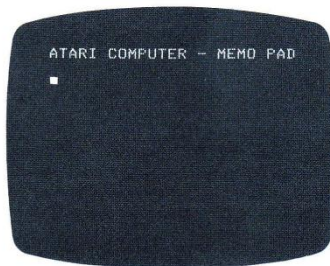
Controller Jacks accommodate one to four *controllers* for games and other applications. These jacks may also be used for future components such as a light pen.



CONTROLLER JACKS

SCREEN DISPLAY

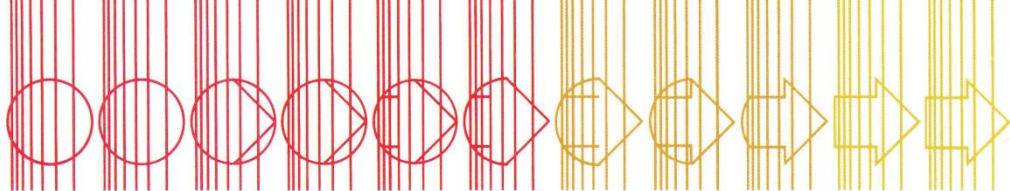
This *display* will appear on power up when cartridge slot is *empty*. The Atari 400 is now in **MEMO PAD MODE**. Whatever you type on the Keyboard will appear on the screen. You can change your screen display by using the **SCREEN EDITOR COMMANDS** described in the next section, Using the Keyboard and Screen Editing Functions. Each cartridge contains a different initial display which is explained in the cartridge instructions.



KEYBOARD

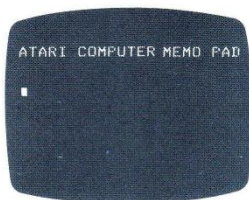
The **ATARI 400 Keyboard** is especially designed for flexibility. It has alphabetic, numeric, graphic and control functions which are detailed in Section 7. Each key has the capacity to be redefined by in-

structions from an individual cartridge. This provides you, the **ATARI 400** user, with the most efficient set of symbols for each **ATARI 400** computer application.



6. USING THE KEYBOARD AND SCREEN EDITING FUNCTIONS

The **ATARI 400** Keyboard puts a versatile set of *printing characters* and *screen editing* at your fingertips. Many special-purpose application cartridges and some games will require you to type your responses or commands to the **ATARI 400** Computer using these keys. Most keystrokes produce a visible change on the display screen. However, there are a few keys which are only used in combination with others. To investigate the effects of each key, power up your **ATARI 400** without a cartridge in the cartridge slot. You will see the display pictured below.



Notice the square below the **A** in **ATARI**. This square is called the **CURSOR**. A cursor is a mark which indicates where the next character you type will appear on the screen. The ability to move the cursor to any position on the screen and change the characters being displayed is one of **ATARI 400's** most useful features.

A glance at the keytops on your **ATARI 400** tells you that its keyboard closely resembles an ordinary typewriter. Play with the keyboard for a few minutes. There is no way you can damage your **ATARI 400** by typing and you will quickly become familiar with the various key functions. Each key will repeat its function rapidly if you depress it for longer than one second.

Find the **CAPS/LOWR** on the right hand side of the keyboard and press it once.

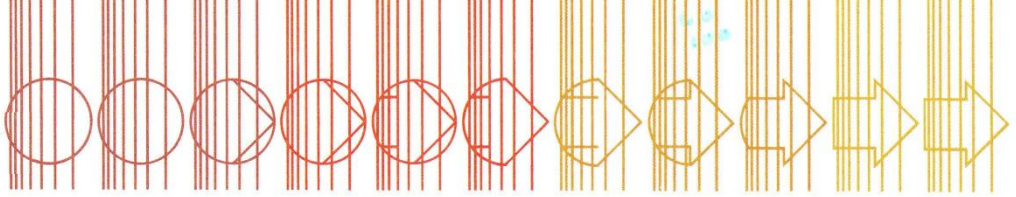
Lower Case

Type lower case letters, numbers, some punctuation marks, and math symbols by pushing single keys.

Upper Case

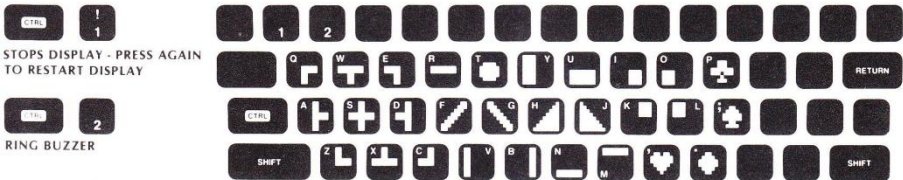
Pressing either of the **SHIFT** keys and holding it down while pressing another key will produce the upper case letters or the character shown on the upper half of the keytop on the actual keyboard. The diagram shows the characters that will be produced by the **SHIFT** and key combination.





Control Graphics

The control key **CTRL** functions as a second type of shift. When it is depressed in conjunction with another key a character from a completely new set of characters appears on the screen. These "graphic" characters can be used to produce interesting pictures, designs, and graphs either without a cartridge or with the ATARI BASIC cartridge. The diagram below shows the graphic characters produced by each **CTRL** plus key combination.



Shift and Control Lock

The **CAPS/LOWR** key will lock all the alphabet keys into their alternate character displays. The non-alphabet keys, those which show two or three characters on the keytops, remain unchanged. Note that this is not the way the shift lock works on an ordinary typewriter. Try out the **CAPS/LOWR** function following the chart below. You will find this feature useful when creating pictures with graphic characters and when programming in BASIC.

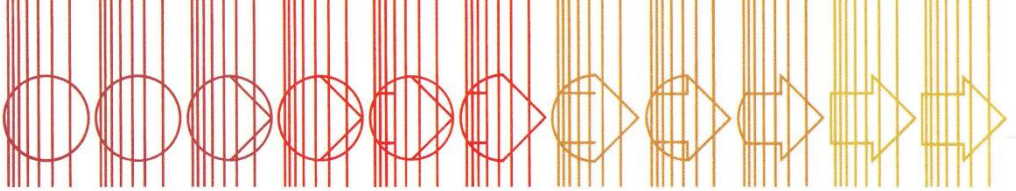
DO THIS	PRESS	TYPE	SEE THIS	COMMENTS
HOLD DOWN SHIFT	CAPS LOWR	ABCD...	ABCD...	UPPER CASE ALPHABET
PUSH CAPS LOWR		ABCD...	abcd...	LOWER CASE ALPHABET
HOLD DOWN CTRL	CAPS LOWR	ABCD...	HH	CONTROL GRAPHICS ON ALL LETTER KEYS

Return Key

The **RETURN** key has three functions. First, it moves the printing mechanism to the left margin and down one line of the screen. Notice that your **ATARI 400** will do this for you automatically after 38 characters even if you don't push **RETURN**. 38 is the greatest number of characters which will fit on a single *physical* line across the screen. However, your computer allows you to combine three lines of the display (116 characters) into a single entity called a *logical* line. Logical lines will be important when using the Screen Editor and when programming in BASIC language. Second, **RETURN** marks the end of a logical line for the computer. At times it will be convenient to push **RETURN** at the end of each physical line, making it coincide with each logical line. At other times the longer logical line will provide greater flexibility. Third, **RETURN** activates the computer. The specific action taken depends on what software is controlling the computer at the time **RETURN** is pushed.

Tab Key

CLR-SET-TAB operates much like the TAB key on a regular typewriter. **SHIFT** and **CLR-SET-TAB** set a TAB stop at the cursor position. **CTRL** and **CLR-SET-TAB** clear the TAB stop under the cursor. **CLR-SET-TAB** by itself spaces the cursor over to the next TAB stop. This key operates on logical lines so you can set tabs at any position up to the 116th character



Screen Editing Functions

The red keys shown on the diagram below control the screen editing functions. They move the cursor on the screen and modify the display. After reading the description of how each key works, stop and try it on your ATARI 400.



Cursor Movement Keys

Shift Clear

SHIFT **CLEAR** or **CTRL** **CLEAR** erases all characters on the screen and moves the cursor to the home position at the upper left corner of the screen.

Cursor Control Functions

The cursor control functions, **CTRL** **↑**, **CTRL** **↓**, **CTRL** **←** and, **CTRL** **→**, move the cursor on the screen in the direction shown by the arrows on the keytops. When you move the cursor over a letter, that letter is shown in "inverse video" on the screen. When you move the cursor away from it using the cursor controls the letter is unchanged. If you put the cursor over a character and then push another printing key, the new character will replace the one previously shown.

Line Insert Function

The line insert function **SHIFT** **INSERT** creates a space for a new line by moving the logical line containing the cursor and all lines below it down one line. Important: Any information on the bottom line of the screen will be lost.

Character Insert Function

The character insert function **CTRL** **INSERT** makes a space for a new character by moving the character under the cursor to the right. The rest of the line also shifts to the right. The cursor remains on the space which is now available for a new character.

Delete Back S

DELETE BACK S erases each character as the cursor moves back one space at a time. The whole line stays the same length.

Line Delete Function

The line delete function **SHIFT** **DELETE BACK S** removes one whole logical line. If there are lines below the deleted one they will all move up one line leaving a new blank line at the bottom of the screen.

Character Delete Function

The character delete function **CTRL** **DELETE BACK S** erases the character under the cursor by moving all the characters to the right of the cursor one space to the left. The line becomes shorter.



The keys shown in red in the diagram above have functions not found on an ordinary typewriter. The **ESC** key disables the cursor control movements and prints a graphic character instead. For example, press **ESC**, then hold down **CTRL** while typing **DELETE BACK S**. Instead of the text moving to the left you will see a special graphics character displayed. This function will prove very useful when you begin to program in BASIC. The characters produced in this manner are:

DO THIS

SEE THIS

PUSH



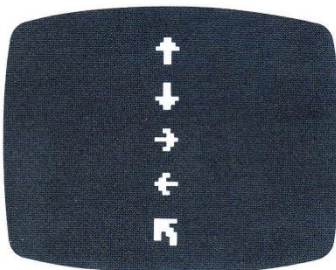
PUSH



PUSH



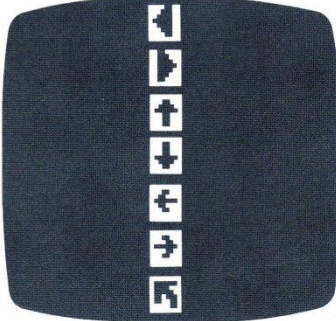
PUSH SIMULTANEOUSLY



PUSH



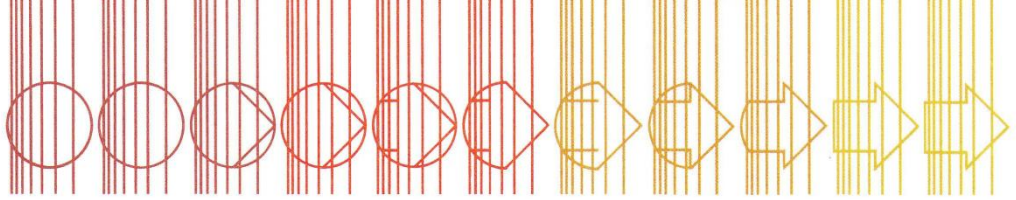
PUSH SIMULTANEOUSLY



Special Computer Keys

The **ALT** key switches characters into inverse video. Press it again to go back to normal display.

BREAK interrupts the computer while it is busy following instructions. Refer to the cartridge instruction sheet for its exact function.

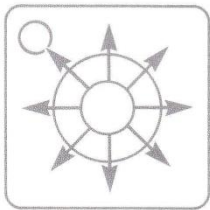


7. INSERTING CARTRIDGES

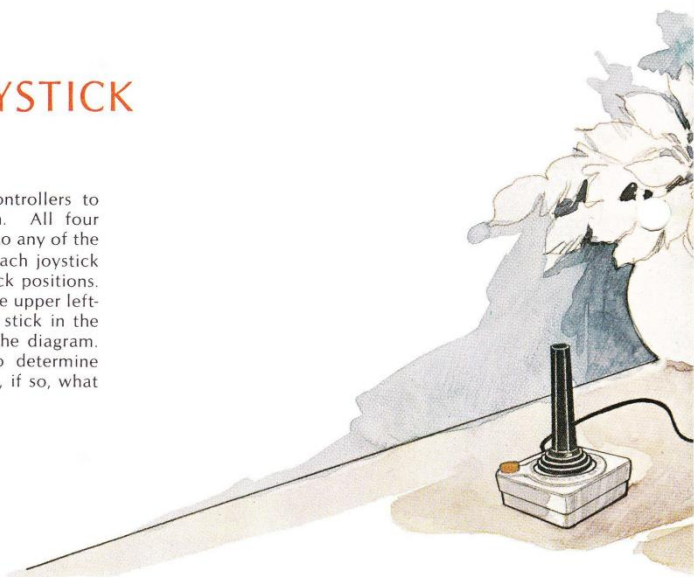
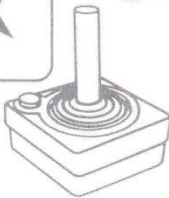
To insert a cartridge pull the *cartridge door release lever*. The cartridge door will spring open. Hold the cartridge with the label toward you and the opening down. Push it firmly, straight down, into the slot. It will snap gently into place. When it is all the way in the cartridge slot the door will just close over the cartridge without touching it. Push **START** to begin running a cartridge.

USING THE JOYSTICK CONTROLLERS

Many cartridges use the Joystick Controllers to move images on the display screen. All four joysticks are identical and can plug into any of the controller jacks shown to the right. Each joystick has one button and eight possible stick positions. Hold the joystick with the button in the upper left-hand corner and push the top of the stick in the direction of the arrow, as shown in the diagram. Consult the cartridge instructions to determine whether joysticks should be used and, if so, what each position means.



JOYSTICK
CONTROLLERS
ADDITIONAL
ACCESSORIES



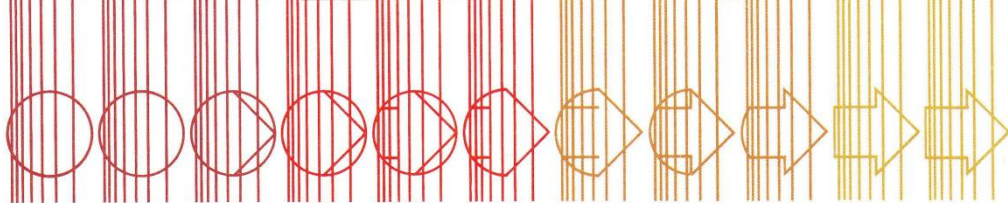
THE SYSTEM KEYS

The four keys to the right of the keyboard allow you to select different starting positions within a cartridge. Each starting position is the beginning of a game or application stored within a single cartridge.

Push **SYSTEM RESET** to stop the computer and restart from the beginning of the cartridge. Push



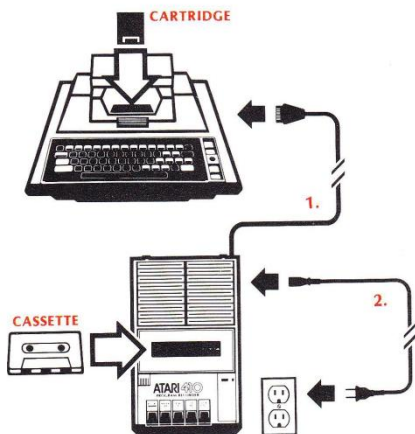
SELECT to see the initial screen at the beginning of the next game or application. Push **OPTION** to choose among the variations possible within a game or application. After you have made your choices with the **SELECT** and **OPTION** keys, push **START** to begin the action. More complete instructions are provided with each cartridge.



8. PROGRAM RECORDER (OPTIONAL)

The *optional Atari Program Recorder* is used with a cartridge to hold blocks of software too large to be maintained in cartridge form. Programs, recorded on magnetic tape, are copied by the computer from the tape into RAM memory. Once in memory, these programs can be run or modified by the user according to instructions given through the keyboard. Working in BASIC language, the user can also type his own programs into memory from the keyboard, then store them on tape for later use or modification.

The **Atari Program Recorder** resembles an ordinary audio cassette tape recorder. Its playback and recording levels have been permanently set at the correct volume for use with the Atari Computer.



To set up your ATARI 410 Program Recorder:

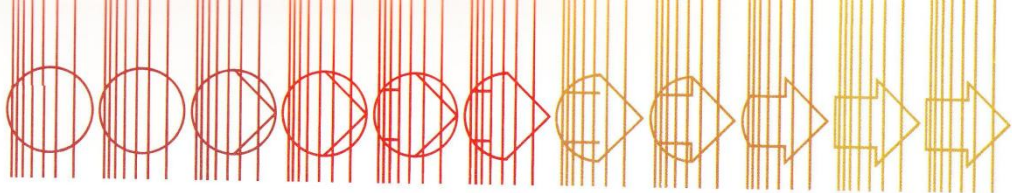
1. Plug the *data cord* (permanently attached to your recorder) into the jack labeled **PERIPHERAL** on the side panel of the **ATARI** Console.
2. Plug your *recorder power cord* into the jack labeled **AC** on the side of the recorder and into an ordinary wall socket.

To operate your ATARI 410 Program Recorder:

- Press **STOP EJECT** to open the cassette door and disengage the cassette.
- Insert a cassette and close door.
- Press **REWIND** to move to the beginning of the tape. (The tape will stop automatically.)
- Press the tape **COUNTER** reset button until the counter shows 000. As your tape advances, this counter will show your approximate current location on the tape. Use this number to find programs stored in the middle of the tape.
- Press **ADVANCE** to move tape forward to the location of your program if necessary, then press **STOP EJECT**.
- Press **PLAY** to ready the recorder for starting signal from the computer.
- **RECORD**, See Section 12. in your **ATARI 800 Operators Manual**, or Section 12 in your **ATARI 400 Operators Manual**.

To Run Your Program:

Your program instructions will tell you what to type on the keyboard to have the computer begin to read the tape. After the program is completely loaded into the computer, the tape will stop automatically. Press **STOP EJECT** to turn off the motor on your Program Recorder. Now type a command or press the computer system key labeled, **START**, whichever is specified on your instruction sheet, to begin using the program.



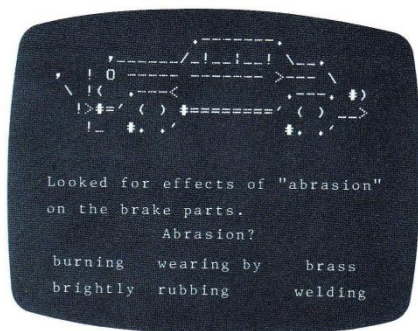
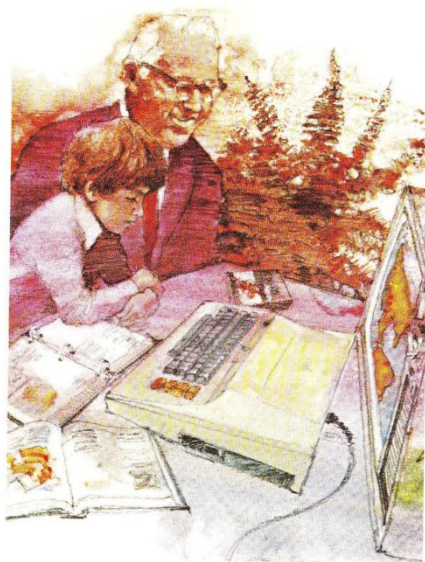
9. ATARI EDUCATIONAL SYSTEMS (OPTIONAL)

Each set of ATARI EDUCATIONAL SYSTEM Tapes consists of 16 lessons (4 tapes with 4 lessons per tape). Each lesson has approximately 30 frames which present text, pictures, and multiple-choice questions on the screen. A narrative accompanies each frame and provides additional information, asks the questions orally, and gives feedback on student responses. Students enter their responses by pushing the **1**, **2**, or **3** key on the computer keyboard.

Each lesson provides a self-paced learning experience which high school level students generally complete in 20 to 30 minutes, including responses. Lessons may be repeated as often as needed for thorough learning.

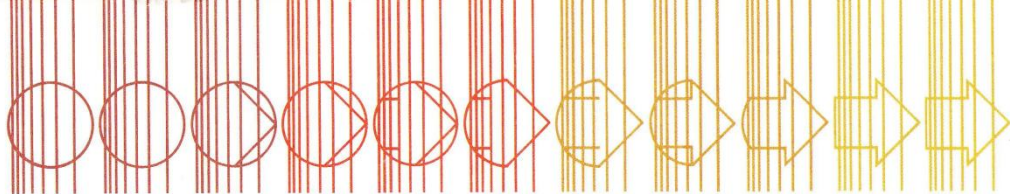
To use the ATARI EDUCATIONAL SYSTEM you will need:

- ATARI 400™ Basic System and Atari Program Recorder
 - ATARI EDUCATIONAL SYSTEM Master Cartridge
 - One or more sets of ATARI EDUCATIONAL SYSTEM Cassettes
1. Set up your ATARI Computer and Program Recorder.
 2. Insert ATARI EDUCATIONAL SYSTEM Cartridge in LEFT CARTRIDGE slot.
 3. Power up Computer.
 4. Put ATARI EDUCATIONAL SYSTEM Course Tape in Recorder and position tape at the beginning of the first or second lesson.
 5. Press PLAY on Recorder.
 6. Listen and read.
 7. To respond to questions press **1** key for left answer, **2** for middle answer, **3** for right answer. When only left and right choices are offered use **1** and **3**.



ACCOMPANYING NARRATION

The next morning Mike and Don started to check out the various adjustments in the car. They removed a wheel and looked for the effects of abrasion on the brake parts. This means the wearing away of material by rubbing action. Abrasion (burning brightly) (wearing by rubbing) (brass welding).



10. WHY LEARN TO PROGRAM?

All kinds of people teach themselves computer programming for all kinds of reasons. You may find that there are no preprogrammed cartridges or cassettes which make the computer do exactly what you want. Or, you may decide that learning to program is an important part of your career or educational plan.

Even if you have no practical use for computer programming you may find that learning to write programs in BASIC for your **ATARI 400** is an exciting and valuable experience. Programming sharpens your skill in thinking—in analyzing problems and devising step-by-step solutions. It deepens your understanding of computers in general, and no one can deny that computers are becoming a major force in modern society. A knowledge of programming makes you a more informed consumer and citizen who no longer accepts—"It was the computer's fault"—as an excuse for bad management.

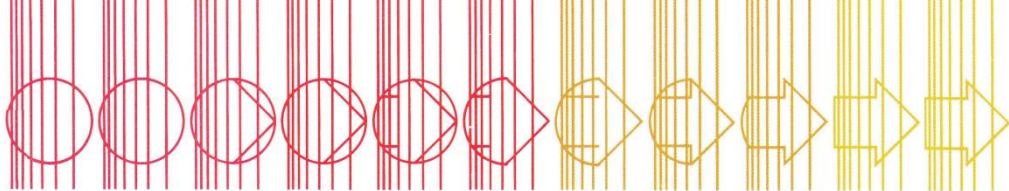
But perhaps the most important reason to learn to program is that it is fun. Start by instructing the computer to draw pictures and to print verbal messages on the display screen. Soon you will be choosing more and more complex tasks for your **ATARI 400** and will be enjoying the challenge of designing programs which allow the computer to do your bidding.

Good computer programs are usually created in three stages—*design*, *coding* and *debugging*. During design you choose a task for the computer and analyze it into component parts. During coding you translate these parts from their English or mathematical form into a computer language, in this case **ATARI BASIC**. Next you type your coded program into the **ATARI 400** Computer. As each line is typed, Atari BASIC will check it and report any mistakes in coding. After you have corrected these mistakes you can try to *RUN* your program. That is, you direct the computer to follow the set of instructions you have given it. Often you find you

have made other errors. The **ATARI 400** may succeed in running your program but the result is not exactly what you intended. You have made an error in design and need to go back and plan your program more carefully. At other times the computer will tell you that it can't follow your instructions as given because they contain logical or grammatical errors. You have made a second stage error in coding or typing. (At the third stage—debugging—you find and correct all of your remaining errors.) You continue to run and debug your program until the **ATARI 400**, under the control of your program, produces the results you desire.

Note that no computer actually "solves problems" or "answers questions" by itself. Using your design, the computer performs the instructions you have given it. It mechanically produces your "solution" to a problem or repeats your "answers" whenever you run the program.

BASIC (Beginners All-Purpose Symbolic Instruction Code) was invented so that people could learn to write programs quickly and easily. To you, the user, the BASIC language is a set of rules stated in English which tells you how to give the computer the instructions it needs to do your bidding. To the computer, BASIC is the same set of rules written in machine language. They allow it to translate your BASIC instructions into action. We call this machine language program the *BASIC Language Interpreter*. It is contained in the **Atari BASIC Language Cartridge**. The program which you write is called the *BASIC Source Program*. You enter your source program into the **ATARI 400** RAM memory by typing it on the keyboard with the **BASIC Cartridge** in the cartridge slot. The **ATARI 400** uses the Operating System programs (in the Operating System ROM), the BASIC Language Interpreter (in the cartridge) and your BASIC source program (typed on the keyboard or loaded from cassette and stored in RAM memory) to enable it to follow your instructions.

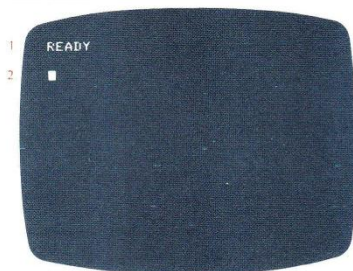


11. WRITING BASIC SOURCE PROGRAMS

This section will give you a quick introduction to writing programs in BASIC. If you have never programmed before use this section like a cookbook—follow the instructions but don't expect to understand them. You will find step-by-step explanations in *Atari BASIC—A Self-Teaching Guide*. For you seasoned programmers here is a glimpse of Atari BASIC. There is a great deal more to learn.

You will explore the use of nine BASIC codes, or commands: RUN, **BREAK**, **RETURN**, DIM, PRINT, INPUT, LIST, IF...THEN and GO TO. Start out by inserting the BASIC cartridge and Powering up. (See Sections 7 and 5.) Your initial screen display will be:

SEE THIS



COMMENTS

1. This is the **BASIC prompt**. It is a message from BASIC to you telling you that the computer is waiting for a command.
2. This mark is the **cursor**. It tells you where the next character will be printed.

Since ATARI Basic Language can only read upper case letters, press **SHIFT** and **CAPS/LOWR**. This locks all letters into upper case. Now type an English sentence.

DO THIS

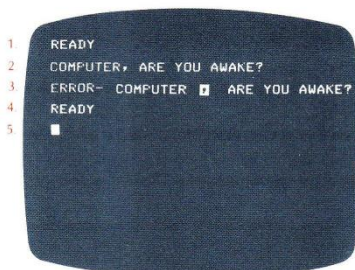
TYPE

COMPUTER, ARE YOU AWAKE?

PUSH



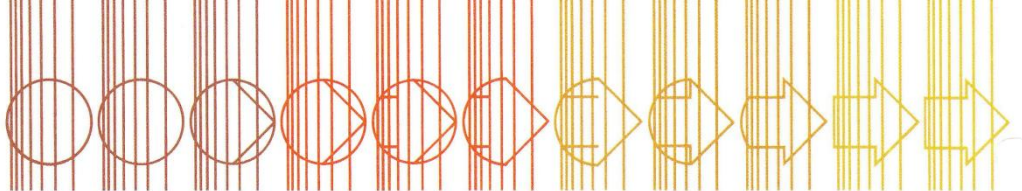
SEE THIS



COMMENTS

1. BASIC prompt - This will disappear off the top of the screen as new lines are added at the bottom.
2. You typed this line.
3. This is an **ERROR MESSAGE** from BASIC telling you that your source program cannot be interpreted.
The light and dark colors are reversed at the first illegal character.
4. BASIC prompt
5. The cursor again.

Yes, **ATARI 400** is awake. It is sending you a prerecorded message saying that you have typed in, or entered, a line of characters which is not in its list of *correct BASIC language codes*. You may find out more about your mistakes by looking up ERROR MESSAGES in **Atari BASIC**.



Before you do that, try entering the line again with these changes. Type the line exactly as shown, including the word **Print** and the quotation marks:

DO THIS

TYPE

```
PRINT 'ATARI 400, ARE YOU AWAKE?'
```

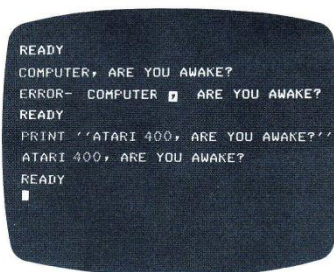
Be meticulous when you type. The computer cannot guess what you meant to include nor can it ignore extra characters. The computer will echo each character on the screen as you type. The line above is correct BASIC code.

DO THIS

PUSH

RETURN and the new screen will be:

SEE THIS

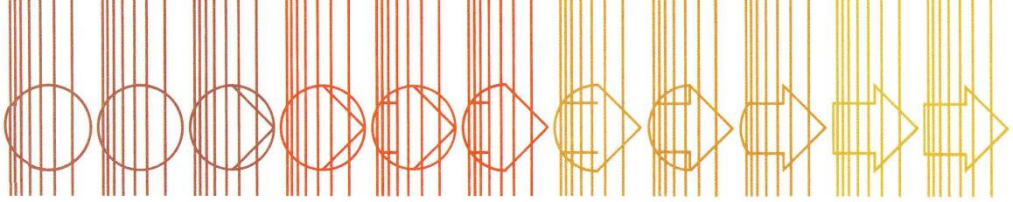


If your screen display doesn't look like the one above, check the echo of your typing to make sure you have copied every character exactly. Be sure to start your line with the cursor at the left margin. When you have found your mistake push **RETURN** and try again.

Play around with the Print command for a few minutes. You may put any characters you like inside the quotation marks including all the graphic and control characters described in Section 6. Experiment with the cursor controls and with logical lines of up to 116 characters. What happens if you forget to put in the quotation marks? Try it and see.

Note: Occasionally you may "lose control" of your computer by inadvertently commanding it to do something you didn't anticipate. If this happens, press **BREAK**. The computer should display:
STOPPED AT LINE 10 (or some other number)

If **BREAK** doesn't work, press **SYSTEM RESET**. The initial screen will be displayed.



You can also use your **ATARI 400** as a calculator. Use the Print command to make your **ATARI 400** evaluate arithmetic expressions.

DO THIS

TYPE

PRINT 45782 + 11111

PUSH

RETURN

SEE THIS



COMMENTS

Don't forget Print!

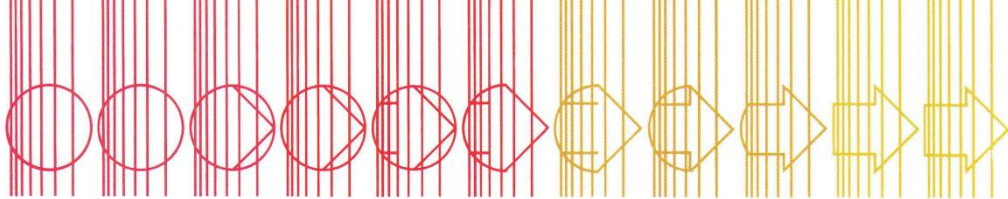
Here's your answer!

The **ATARI 400** evaluates expressions in the same way you were taught to do it in elementary school. Everything inside parentheses () will be done first, then exponentiation $\wedge$. Exponentiation means multiplying a number times itself several times. For example, $5 \wedge 3$ means 5 times 5 times 5 and is equal to 125. You will often see this expression written 5^3 . It is read "five raised to the third power". Type the exponentiation symbol on the computer by pressing **SHIFT** and **6**. All multiplication * and division / is done next. Addition + and subtraction - are performed last. If you have forgotten that the order in which calculations are done is important, try a few problems. You will find that $(4 + 6)/5 = 2$ while $4 + 6/5 = 5.2$ and $4/5 + 6 = 6.8$.

The **ATARI 400** will print any whole number value in the range -999999999 to 999999999 as a whole number. It will express fractions and numbers outside this range in scientific notation as a decimal number between one and ten times a power of ten. For example, if the value of your expression is 12345678909 the **ATARI 400** will write it as 1.23456789E+10, which means move the decimal point ten places to the right. You read this number as 1.23456789 times ten to the tenth power (10,000,000,000).

You can enter any expression and the **ATARI 400** will do the arithmetic. Remember that BASIC language does not tell you the correct expression to use to solve number problems. You must figure out how to calculate interest payments, sales commissions, expected time of arrival, or whatever you want to know. BASIC does have a large repertoire of arithmetic, algebraic, and trigonometric functions available, but you, the programmer, must still tell the computer how to combine them to produce meaningful results. You will find a complete discussion of BASIC language arithmetic in **Atari BASIC**. Spend some time familiarizing yourself with the way the **ATARI 400** handles numbers.

You have been using the Atari BASIC Language in the *direct mode*. This means that the **ATARI 400** follows your command as soon as you give it and then forgets about it. In *program mode*, you may give the computer about two hundred lines of instructions. Each line is stored until the RUN command is entered. Then the computer follows one instruction after another until the whole task is completed.



Although most BASIC commands can be given in direct mode, only a few of them are useful to the beginner. RUN is almost always used in direct mode to start at the beginning of a program. It is typed as a three letter sequence in upper case only. No action occurs until you press **RETURN**. **RETURN** signals the computer to read what you have typed and to execute the entire series of instructions. Pressing the **BREAK** key stops the program from running and displays the cursor. **BREAK** and **RETURN** are the only single key commands in BASIC. All others are typed as a series of letters followed by **RETURN**.

If you wish to enter a program into the **ATARI 400** in *program mode*, start each line at the left margin of the screen with a line number. You may number your lines with any whole numbers between one and 32767. You may enter program lines in any order. However, the computer will rearrange them and execute them starting with the smallest line number and proceeding to the next higher number until all lines have been followed. Most BASIC language programmers number their lines by tens so that they have nine line numbers available in case they wish to add new lines between the original ones.

To get started, power down and up once again. This will clear out your RAM memory.

DO THIS

TYPE

```
10 PRINT 'WIZARD, ARE YOU AWAKE?'
```

SEE THIS

COMMENTS

PUSH

RETURN

TYPE

RUN

PUSH

RETURN

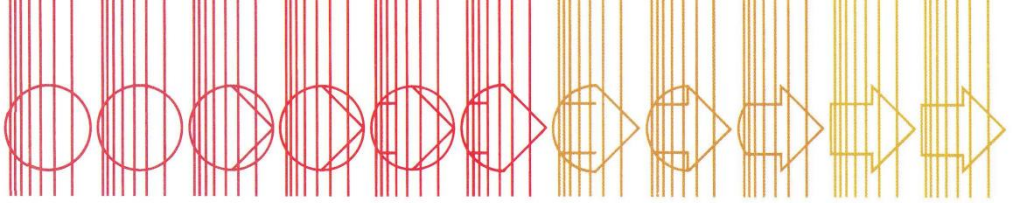
```
1 10 PRINT 'WIZARD, ARE YOU AWAKE?'  
2 RUN  
3 WIZARD, ARE YOU AWAKE?  
4 READY
```

1. Here is your one line program :
2. The computer found your stored instruction and followed it.
3. After completing its task, the computer signals you with the BASIC prompt.

Note that the number zero (0) is different from the letter "O" and one (1) is different from the letter l

If you make a mistake you may retype the line (including the line number) or use the screen editing keys to correct your line, then press **RETURN**.

Congratulations! You have just entered and run your first BASIC program.



To edit any line of BASIC code, use the display control keys described in Section 6. Position the cursor over the characters you wish to change and make the corrections within a logical line. When the line is correct, press **RETURN**. The **ATARI 400** will substitute the corrected line in place of the original one in RAM. To remove a whole line, type its line number and **RETURN**. For practice, replace the word "Wizard" in line 10 with your own name. Be sure to make your changes in the numbered line 10, not the line displayed after "RUN."

LIST is the command that makes the computer display your BASIC source program. Any time you wish to see the instructions your computer is following:

DO THIS

PUSH

BREAK

TYPE

LIST

PUSH

RETURN

SEE THIS

```
10 PRINT " WIZARD, ARE YOU AWAKE? "
```

Note that you may use **BREAK** to interrupt the computer even if it is busy running a program or calculating. All other commands must be given only after the cursor is displayed. Commands must be typed in upper case or you will get an error message.

Now add to your program by entering these lines:

DO THIS

TYPE

```
5 DIMA$(10) RETURN
```

```
20 INPUT A$ RETURN
```

```
30 IF A$ = "YES" THEN PRINT "YOUR PROG
```

```
RAMMING CAREER HAS BEGUN.": GOTO 60 RETURN
```

```
40 IF A$ = "NO" THEN PRINT "TECHNOLO
```

```
GY MAY PASS YOU BY...": GOTO 10 RETURN
```

```
60 PRINT "THIS PROGRAM HAS ENDED." RETURN
```

Press **RETURN** only where indicated and don't leave out the colon (:) near the end of each line. BASIC language ignores blank spaces unless they are inside quotation marks so you can leave them out when you need to save space. However, do put them in if you can so your listings will be easier for people to read.

Run this program and answer the question "Are you awake?" several times. Type your answer after the ? and then push **RETURN**. Run the program several more times. Try responding Yes; YES; yes; No; and maybe. What happens when your answer is neither "YES" nor "NO"? Right. The program prints the message in line 60 and then ends. Here is one possible "run" of this program:

DO THIS

TYPE

RUN

TYPE

YES

SEE THIS

```
WIZARD, ARE YOU AWAKE?
```

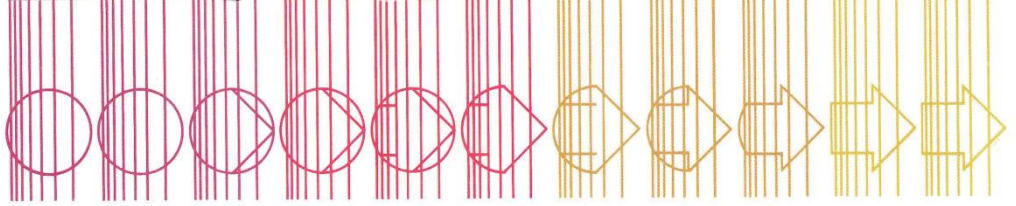
```
? YES
```

```
YOUR PROGRAMMING CAREER HAS BEGUN.
```

```
THIS PROGRAM HAS ENDED.
```

```
READY
```

■



To understand what the computer is doing, get a new listing and examine it line by line. Line 5 sets aside a place in the computer's memory for your answer to the question in line 10. Line 10 has the command PRINT "something." This something which you put between the quotation marks is called a string constant—string because it is a string of letters, numbers, and/or graphic characters—constant because it will remain the same every time you run this program.

Line 20 has the command INPUT something. This means: "Computer, wait until something is typed on the keyboard. Show whatever is typed on the screen and store it in a space in RAM memory labeled A\$. When **RETURN** is pressed go on to the instruction with the next higher line number." A\$ (read A string) is called a string variable—a string of letters, numbers, and/or graphic characters which will be different every time you run this program. Each string variable within a single program must have a different label. Many labels are available in BASIC but, for now, limit yourself to A\$ through Z\$. Line 5 gave us space to store ten characters in A\$. If we expected a long answer we could save more memory for A\$ by using a large number written within the parentheses.

Line 30 has IF...THEN PRINT "something": GOTO 60. When the condition following IF is met, i.e. when the computer finds the letters Y-E-S stored in the place in memory labeled A\$, then the rest of the line is followed. It prints "Your programming career has just begun." The computer encounters the colon (:) next. This tells it that the logical line isn't over yet, another command is coming. The GOTO command says "skip down to line 60 and ignore the lines in between."

When the condition is not met, i.e., when the computer finds Y-e-s or any other characters in A\$ then the rest of the line is ignored and the computer goes on to the next numbered line. In this case line 40.

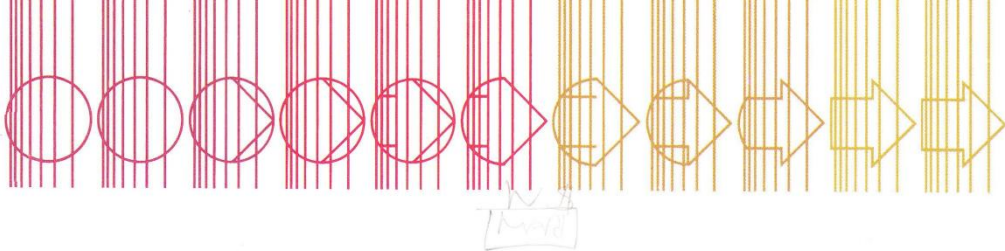
Line 40 works the same way as line 30. If Y-e-s has been entered at line 20, then its condition isn't met either and line 40 doesn't print anything. It just goes on to the next numbered line which is 60. (Notice that there is no line 50.) Line 60 prints its message and since there are no more lines, the program ends and READY is displayed. If N-O has been entered at line 20 then all of the line 40 is executed. The message in line 40 is printed and program control jumps back to line 10. This happens to begin the program over again.

Suppose you, the all-powerful programmer, wish to insist that the user, the person who runs or uses this program, must answer "YES" or "NO" before the program ends. You will want the computer to print a message whenever something other than "YES" or "NO" has been entered. After this message the question should be repeated on the display screen. Now try to figure out what line to add to make the computer do this. Experiment with line 50 before you go on.

There are many ways this line may be written. Here is a line 50 which will do the trick:

```
50 PRINT "YOU MUST ANSWER 'YES' OR 'NO'
   TO GO ON.": GOTO 10
```

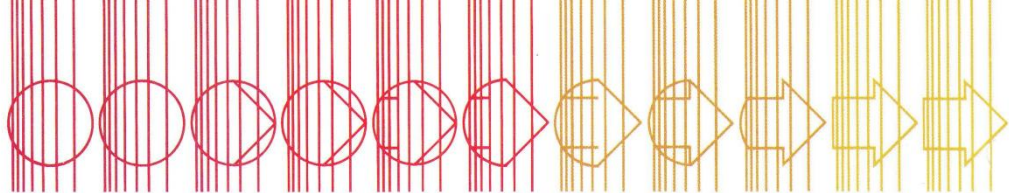
Enter this line, list and run this revised program several times. To anticipate what the display will look like, pretend you are the computer and follow the program. Remember that computers are machines which blindly stick to their programs no matter how nonsensical the results may be. This is why the design stage of programming is so important. It is up to you, the programmer, to plan each display the user will see, to anticipate what the user will type in response to that display, and to tell the computer what to do with every response.



You can use the format shown in this first sample program to code an unlimited number of dialogue type programs. You will need to change the string constants and occasionally rearrange the GOTO's. Here is another example:

```
10 DIMN$(100)
20 DIMA$(20)
30 DIMP$(20)
110 PRINT "THIS IS THE OCEANS PROGRAM."
120 PRINT "HELLO, WHAT IS YOUR NAME ";
130 INPUT N$
140 PRINT "O.K., "N$;
150 PRINT "NAME AN OCEAN THAT BEGINS WITH P."
160 INPUT P$
170 IF P$="PACIFIC" THEN PRINT "PERFECT."; GOTO 190
180 PRINT "THAT ISN'T THE ONE WE ARE LOOKING FOR.
TRY AGAIN."; GOTO 150
190 PRINT "NOW NAME ONE THAT BEGINS WITH A."
200 INPUT A$
210 IF A$ = "ATLANTIC" THEN PRINT "YOU'RE TOO
GOOD, "N$;" . NOW GIVE SOMEONE ELSE A TURN."; GOTO 120
220 PRINT "TRY AGAIN. REMEMBER, SPELLING COUNTS!"; GOTO 190
```

```
RUN
THIS IS THE OCEANS PROGRAM.
HELLO, WHAT IS YOUR NAME? SUE
O.K., SUE. NAME AN OCEAN THAT BEGINS
WITH P.
PHILLIPINE
THAT ISN'T THE ONE WE ARE LOOKING FOR.
TRY AGAIN.
NAME AN OCEAN THAT BEGINS WITH P.
PACIFIC
PERFECT.
NOW NAME ONE THAT BEGINS WITH A.
ATLANTIC
YOU'RE TOO GOOD, SUE. NOW GIVE SOMEONE
ELSE A TURN.
HELLO, WHAT IS YOUR NAME? PAUL
O.K., PAUL. NAME AN OCEAN THAT...
```



12. TRANSFERRING BASIC SOURCE PROGRAMS TO AND FROM CASSETTE TAPES

Now that you have a BASIC program entered into your computer and you know that it runs, you may want to save it on tape. Once you have a copy of your program on tape you will never have to retype that particular program again. When you want to add to or edit your program, you can load your first version into the computer from the tape, edit old lines and add new ones, then save the new version. The copy in your computer disappears each time you turn off your computer or load another program. But the copy on the tape will be available until you choose to erase it.

Set up your Program Recorder according to the instructions in Section 8 of this manual. If you already have a program in the computer, be sure not to power down at any time. If you have not yet written a BASIC Source Program, use Section 11 of this manual or Atari BASIC — A Self Teaching Guide to help you write one.

TO TRANSFER A PROGRAM TO TAPE:

1. Insert a blank cassette tape into the Program Recorder with the recording surface toward you and the label so that you can read it.
2. Push **REWIND** and wait until the tape stops.
3. Push the tape counter reset button until it reads 0000.
4. Push **STOP EJECT** once.
5. On the Computer Keyboard type: **CSAVE** **RETURN**. You will hear two beeps.
6. Push **RECORD** and **PLAY** simultaneously on the Program Recorder. Now push **RETURN** on the Keyboard again. You will hear a series of tones indicating that the Recorder is now under automatic control of the Computer. The Recorder will erase the beginning of the tape surface for eighteen seconds, write an introductory header needed by the computer, copy your program onto the tape, then stop.
7. It is ALWAYS good programming technique to create a backup copy of each program you wish to save. ATARI recommends that you store one program on each cassette and keep a backup on a separate cassette.
8. If you are planning to store more than one program on each tape, you may make your backup by repeating steps 5 and 6. Be sure to write down the starting tape counter number of your backups as well as your original programs.
9. Push **STOP** on the Program Recorder.

10. Finally, write the name and tape counter number of your new program on the cassette label and on a page which you should make and keep in the binder with your manuals.

TO TRANSFER A PROGRAM FROM TAPE TO THE COMPUTER

1. Insert BASIC Source tape into Program Recorder.
2. Rewind tape to the beginning and press **STOP EJECT**.
3. Press the tape counter reset button until it reads 000.
4. On the Computer Keyboard type: **CLOAD** **RETURN**. You will hear one beep.
5. If you have put more than one program on a single tape, advance the tape to the starting number of your program. Then type: **CLOAD** **RETURN**.
6. Push **PLAY** on the Program Recorder. Then push **RETURN** again. You will hear a series of tones as your program is copied.
7. When the tape stops, your program has been transferred from the cassette tape to the computer.
8. Push **STOP EJECT** on the Program Recorder.

Don't be discouraged if you are confused at this point. Many people are inexperienced in the kind of logical thinking required to write programs. You may need to allow yourself plenty of time to become comfortable with the step-by-step nature of the computer, and the sometimes infuriating attention you must pay to detail. But remember that *inexperience* does not mean *inability*. There are a tremendous number of new and sophisticated concepts presented in this book. You will want to read it many times and keep it handy so that you can look up details when you forget them.

You have just begun to discover what you can make your **ATARI 400** do with BASIC language. Your next step is to read and study **Atari BASIC**. If you are a "natural" at programming you will absorb its contents quickly and easily. If not, you should allow yourself several weeks or perhaps months to master the material presented. There is no hurry since at every stage of learning you will be creating your own programs to use and share on your **ATARI 400** Computer.

NOTES

NOTES



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