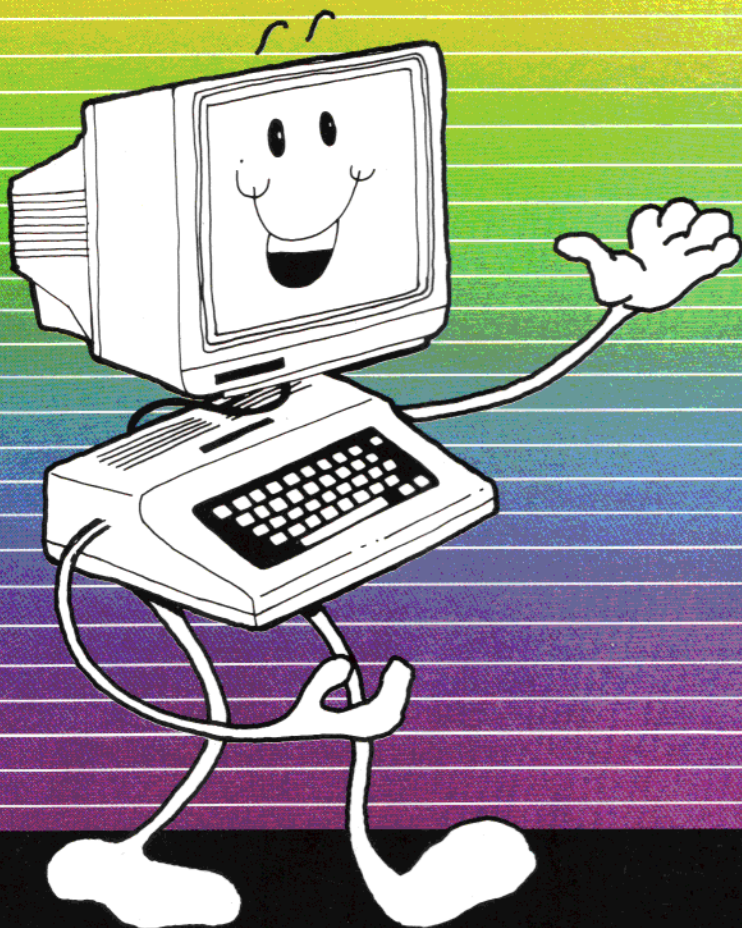# Introducing

YOUR COLOR COMPUTER 3

IMPORTANT NOTE

If you are using software that
requires the alternate color set,
select this color set by pressing
down the F1 key during
power up.

LIMITED WARRANTY

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Warning

Before inserting or removing a Program Pak™ ROM Cartridge, be sure the computer is off. If it is on, you can damage the Program Pak and the computer.

The FCC Wants You to Know . . .

This equipment has been certified to comply with the limits for a Class B computing device, pursuant to Subpart J of Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, and so on) certified to comply with the Class B limits may be attached to this computer. Operation with noncertified peripherals is likely to result in interference to radio and TV reception.

TO OUR CUSTOMERS

Your Color Computer 3 is more powerful and more versatile than most mammoth computers of twenty years ago. Although those metal giants filled huge, glass-walled rooms and cost millions of dollars, they couldn't sing or cipher half as well as your Color Computer can now in your own living room.

Despite its power and complexity, your computer is simple to operate. You alone determine how "technical" a machine you want it to be.

At the simplest level of operation, all you have to do is plug in a Tandy Program Pak to make the Color Computer 3 obey your every whim. Each ROM cartridge you install gives your machine the "memory" of a genius . . . in accounting, in alien-zapping games, in record-keeping, or in whatever you choose. You're the master. (If you want to start using your Color Computer right away, this booklet contains all the information you'll need for Program Pak operation.)

At a slightly more advanced level, you might want to write your own programs and make your computer the most responsive and important tool in your home. Even if you're a beginner, you'll find programming is easy and fun when you follow the instructions in the BASIC programming manual that comes with your Color Computer. As you gradually gain control of the computer (and all its power), you'll discover that computing is as rewarding as it is enjoyable.

If, however, you already know BASIC, and especially if you've used another Tandy model, simply read this operation manual; then use the Quick Reference Guide to get right down to programming. (The Color Computer 3 has many features not found on other Tandy computers, as well as some important differences. A few minutes spent with the Quick Reference Guide before you press (ENTER) could save you hours later on.)

Important Information

This equipment generates and uses radio frequency energy. If it is not installed and used properly, that is, in strict accordance with the manufacturer's instructions, it may cause interference with radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment *does* cause interference to radio or television reception, which can be determined by turning the equipment off and on, you should try to correct the interference by one or more of the following measures:

> Reorient the antenna of the receiver experiencing the interference

> Move the computer away from the receiver

> Plug the computer into a different outlet so that computer and receiver experiencing the interference are on different branch circuits

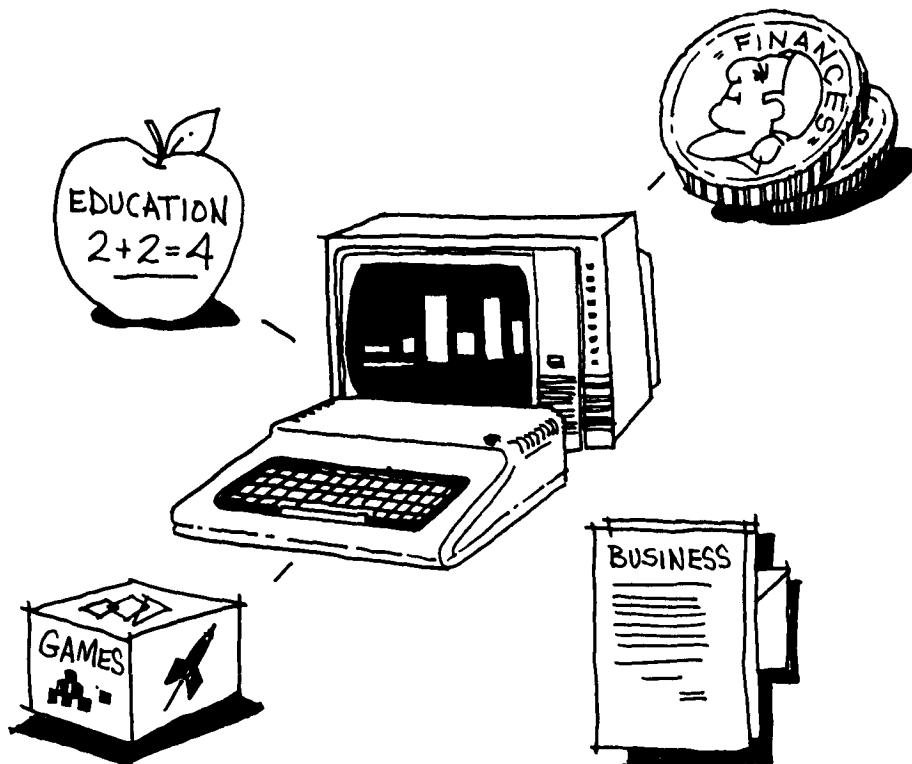If necessary, consult the dealer or an experienced radio/television technician.

CONTENTS

Congratulations! With your purchase of this Color Computer 3, you have taken the first step in one of today's most exciting adventures — personal computing. New horizons in entertainment, education, recreation, and home and financial management are now only an arm's length away. Amazement and amusement await.

Welcome to the future.

WELCOME TO COLOR!

The Color Computer 3 system consists of:

- A 57-key console keyboard for entering information into the computer
- Three different types of display interfaces that let you connect the computer to a standard color television set, a composite monitor, or a high-resolution RGB monitor, any of which will give you full-color displays plus a wide range of sounds
- A powerful 68B09E microprocessor
- Read Only Memory (ROM) containing the Extended Color BASIC Language
- Random Access Memory (RAM) for storing programs and data while the computer is on (amount is expandable from 128K to 512K, optional/extra)
- A ROM-cartridge slot for instant loading of Tandy Program Paks: games, home finance, education, and more (optional/extra)
- Two joystick interfaces for extra fun and versatility in games and special applications (requires joystick controllers, optional/extra)
- A high-speed cassette interface for permanently storing programs and data (requires a separate cassette recorder, optional/extra)
- A printer interface for printed copies of programs and data (requires a separate serial printer, optional/extra)
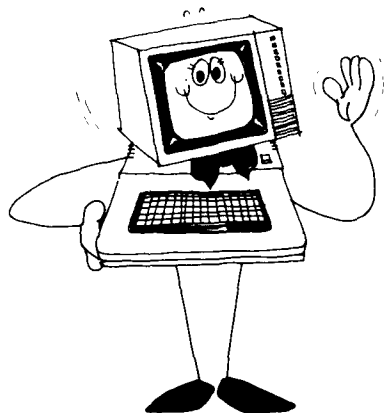
Display Output

The Color Computer 3 can be connected to one of three types of displays:
- A standard color television set
- A composite monitor, such as one of Radio Shack's televisions with monitor inputs (16-250 or 16-232)
- An RGB monitor with audio capabilities—Tandy's CM-8 Analog Monitor (26-3215) is strongly recommended for the best high-resolution graphics

There are 64 colors available for graphics use. The computer also generates musical tones and special effects through the speaker in your TV or monitor.

Keyboard

The keyboard consists of standard typewriter characters plus several control characters. The control character keys are marked with special names — (BREAK), (ENTER), (CLEAR), (–), and so on.
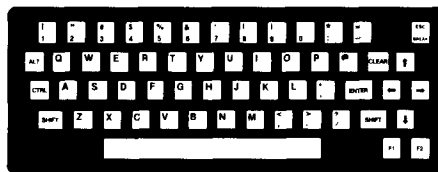
68B09E Microprocessor

This is the central processing unit where your computer does all its "thinking."

Read Only Memory (ROM)

ROM is where the computer stores built-in programs, including the Color Computer BASIC language. Each time you turn on the computer without a plug-in program cartridge, this built-in program takes charge of the microprocessor, enabling you to type in simple BASIC-language instructions.

The Color Computer 3 with Extended BASIC contains a 32K ROM, meaning it contains 32 x 1024 = 32768 characters (bytes) of permanently programmed memory.

Program Paks

The Color Computer 3 has a slot for plug-in ROM cartridges
(Program Paks), which can greatly expand its power and usefulness.
Normally, when a ROM cartridge is installed, the computer is
controlled by the plug-in program.
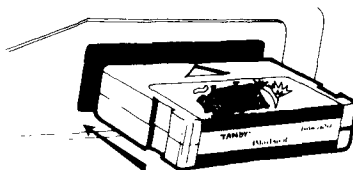
Note: Always turn the computer off before inserting or
removing a ROM cartridge.

Random Access Memory (RAM)

RAM is where your programs and results are stored while the
computer is on. It is erased when you turn off the computer.

Accessories

These are devices, such as a printer or cassette recorder, you can add to your computer to increase its usefulness in programming and data storage. The Color Computer 3 contains the necessary interfaces to simplify the addition of many accessories.

Joystick Controllers. Adding a pair of joystick controllers gives you yet another means of entering information and controlling the computer. The joysticks include fire-when-ready buttons and two-dimensional control sticks.

Multi-Pak Interface. With the Multi-Pak Interface (26-3124), you can connect as many as four Program Paks and/or interface controllers to your Color Computer at once. Therefore, frequently-used program paks do not have to be removed and reinserted over and over again.

Cassette. For long-term storage of programs and data, connect a cassette recorder to the computer and save the information on tape. The Color Computer 3 saves programs and data on tape at approximately 1500 baud, which is roughly 11,000 characters per minute. The CCR-81 (26-1208) comes with the necessary connecting cable and is highly recommended.

Disk System. For even greater storage capacity, you can add on a Color Computer Disk System (26-3131).

Printer. You can connect any Tandy serial interface printer to your Color Computer 3.

INSTALLATION

We've finally reached the part you've been waiting for — it's time to get your Color Computer "up and running."

Carefully unpack the computer. Be sure to remove all cables and papers in the shipping carton. Try to keep all the packing material intact so you can use it if you ever need to transport the computer.

Place the computer on a solid surface near the display unit. The display and computer should be near a power outlet so you will not need to use an extension cord to operate them.

But don't plug in the computer yet.
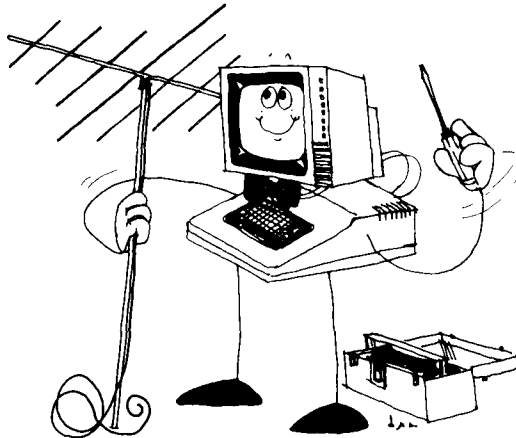
Note: If you are using a composite monitor or an RGB monitor, rather than a TV, proceed to the section, "Monitor Connections."

That's a Switch

Not only is your computer a computer, it's also a miniature television broadcasting station. A built-in television interface (called an RF Modulator) sends out a VHF signal that your set "sees" the same way it "sees" a network television show.

The Antenna Switchbox that comes with your computer lets you select either television-station reception or computer input without having to connect and disconnect the computer every time the television is used. This Antenna Switchbox consists of a short section of twin-lead cable, two screw terminals, a coaxial connector, and a slide switch.

We suggest you attach the Switchbox to the back of your TV set (see Figure 1).

Select a smooth, flat surface on the back of the television that is well within reach of the antenna cables. Wipe off any dust, dirt, or grease from the mounting surface; then remove the backing from the double-sided adhesive tape on the Switchbox. Press the Switchbox against the back of your TV cabinet in the desired location.
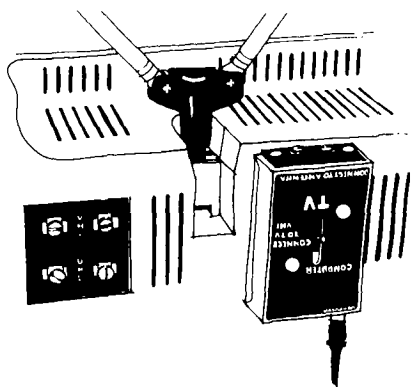
Figure 1. Mounting switchbox onto TV set (connections may vary. depending on your antenna installation).

Aerial Acrobatics

Disconnect the antenna wires currently attached to the VHF screw terminals on your set. In their place, attach the short twin-lead wires from the Switchbox labeled CONNECT TO TV VHF.

What you do next depends on the type of antenna installation you have.

If you have an **Internal Antenna** or **Rabbit Ears** or a **300-Ohm Lead-In External Antenna**, connect your VHF antenna leads to the Antenna Switchbox terminals labeled CONNECT TO ANTENNA (see Figures 2, 3, and 4).
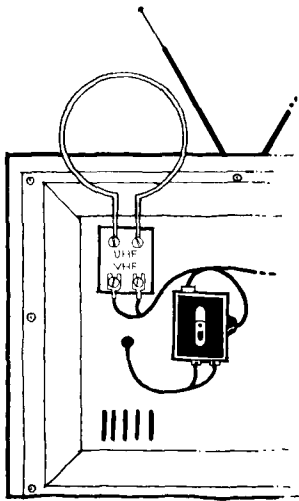

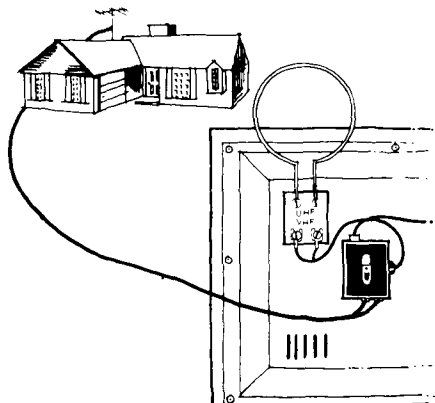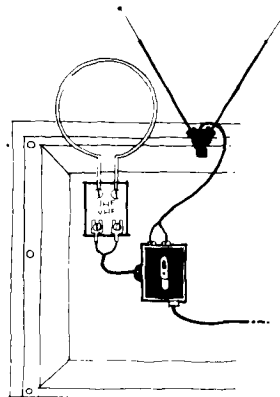*Figure 2. Rear view of TV with screw terminals and internal antenna.*

Figure 3. Rear view of TV with twin-lead and an external antenna.

Figure 4. Rear view of TV
with twin-lead and rabbit
ears antenna.

If you are making a connection to a TV with a **75-Ohm Coaxial Lead-In**, obtain a special 75-Ohm to 300-Ohm matching transformer such as Radio Shack Catalog Number 15-1140. Connect your antenna's coaxial cable lead-in to the transformer, then attach the transformer's twin-lead to the screw terminals on the Antenna Switchbox (see Figure 5).

Figure 5. Rear view of TV
with 75-Ohm coaxial
cable.
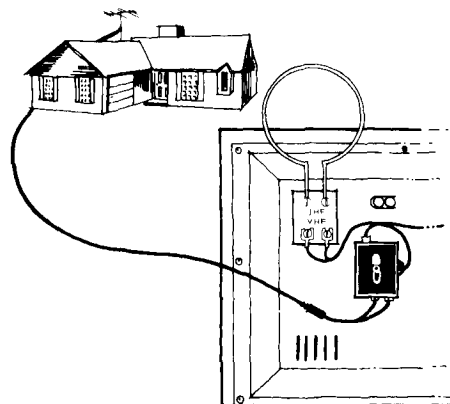
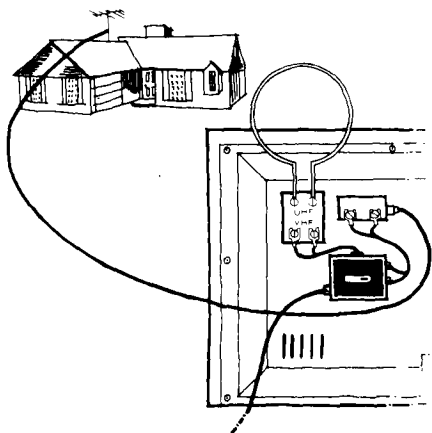If you have a **75-Ohm Coaxial Lead-In and a Matching Transformer**, connect the short twin-lead from the transformer to the screw terminals on the Antenna Switchbox (see Figure 6).

Figure 6. Rear view of TV with a 75-Ohm coaxial cable and a matching transformer.

The antenna installations described above are the most common types. However, you might need to know about a few other antenna types and features.

If your TV set has a 75/300-Ohm switch on the back, be sure to set the switch in the 300-Ohm position.

If your TV set has a round jumper cable protruding from the back, be sure the jumper cable is attached to the connector next to it.

If you have cable TV, you might want to contact a qualified service technician for installation assistance.

When your antenna system is properly hooked up to the Antenna Switchbox, connect the computer's coaxial cable from the TV jack on the back panel of the computer to the jack labeled COMPUTER on the Switchbox (see Figure 7).
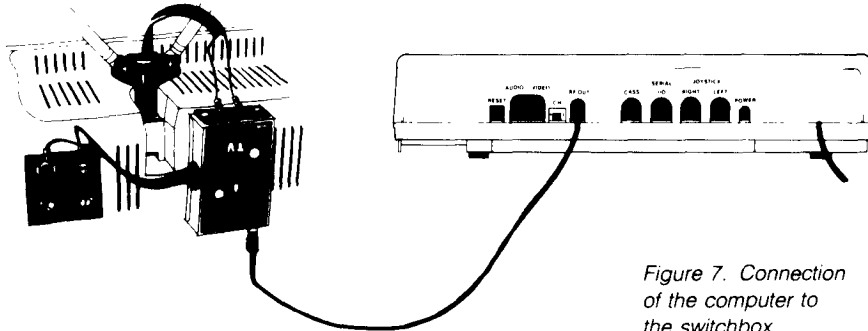
Figure 7. Connection of the computer to the switchbox.

Your Color Computer 3 is ready to use.

Monitor Connections

If you plan to use a composite monitor with your Color Computer 3, you will first need to purchase the appropriate connecting cables. The recommended cables to use with Radio Shack's televisions with monitor inputs (16-250 or 16-232) are the 6-foot VCR Video/Audio Cables (15-1535). You will need two of these. Once you have these cables, connection is simple:

1. Insert one end of the first cable into the VIDEO jack on the monitor. Insert the other end of the same cable into the VIDEO jack on the computer. (Refer to Figure 9 for the location of the Color Computer jacks.)

2. Insert one end of the second cable into the AUDIO jack on the monitor. Insert the other end of the same cable into the AUDIO jack on the computer.

    Note: The 16-250 TV/monitor has two AUDIO jacks. Either one can be used to connect with the AUDIO jack on the Color Computer 3.

If your video display unit is an RGB monitor, such as Tandy's CM-8 Analog Monitor (26-3215), follow these steps:

1. Turn your Color Computer 3 over so the bottom panel is exposed. Locate the RGB OUT connector.

2. The RGB monitor has a computer cable wired into the back of it. Plug this cable into the RGB OUT connector on the bottom of the computer.

3. Guide the cable through the channel so it is out of the way. (See Figure 8.)
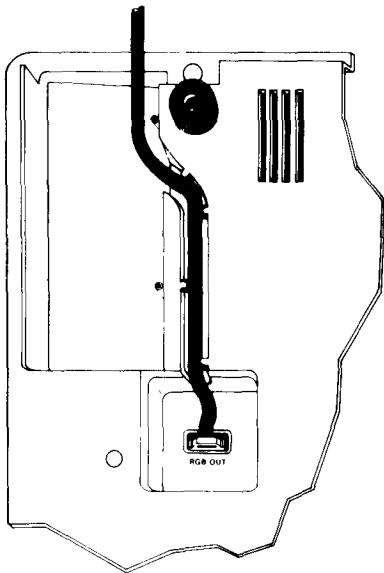
Figure 8. RGB monitor connection.

Connection of Other Accessories

Before connecting any accessory (a serial line printer, for example), be sure the computer and the accessory are both turned OFF.

Connect all accessories to the appropriate jacks on the rear panel of the computer. (See Figure 9 for location of connection points.) For interconnections between computer and accessories, refer to the owner's manual supplied with the accessory.
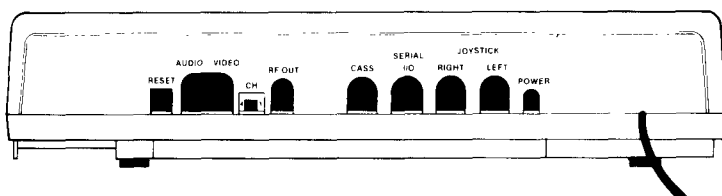
Figure 9. Computer controls and connections

Connection to an AC Power Source

Be sure the computer and all accessories are turned OFF. Connect the Color Computer and all accessories to an appropriate power source. Power requirements for Tandy products are specified on the units, as well as in the Specifications section of their respective owner's manuals.
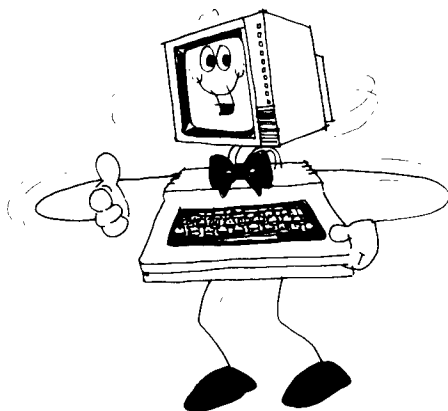
OPERATION

The following instructions for the start-up and use of the Color Computer 3 are for the ROM-based system **only**. If you have a disk-based system, see the *Color Computer Disk System* owner's manual.

Adjustments for All

Be sure your computer is turned OFF before making the following adjustments.

First, turn on your display, and set the volume at a normal listening level.

If you are using a television, select Channel 3 or 4 (whichever is weaker or not being used in your area). Select the same channel on the slide switch on the back panel of your computer. This is the channel on which your computer will "broadcast." Then, set the switch on the Antenna Switchbox to the COMPUTER position.

If your display is a composite monitor, be sure that VIDEO is selected.

Power Play

The power-on button is on the left-rear side of the computer case as you face the keyboard. Turn on the computer by pressing the button in and then releasing it.

When you power-up the computer without a cartridge installed, the screen displays a start-up message that describes your version and release of Color BASIC followed by

    OK

If this message doesn't appear, be sure the display unit is turned on and operational. If it is, check the brightness, contrast, and/or fine tuning controls and be sure they are adjusted properly. If the message still doesn't appear, turn off the system, recheck all the connections, and try again. (For further assistance, see the "Troubleshooting and Maintenance" section in this booklet.)

Get RESET . . . Go

The RESET button, located on the right-rear side of the computer as you face the keyboard, lets you stop a ROM program and then restart it at the beginning without turning the computer off and on. Pressing RESET doesn't erase the contents of memory like turning the computer off does. Therefore, when you are programming in Color BASIC, RESET stops execution but leaves your program intact.

A Turn-off

To turn off your computer, press the power button on the left-rear side of the computer case.

If you turn off the computer and then decide you want to use it again, **always leave it off for at least 15 seconds before turning it on.** The computer's power supply needs this much time to discharge its stored energy before you start it up again.

Keep in mind that turning off the computer erases all RAM-based programs and data from memory. If you want to save data or a program, do it before you turn off the computer. (See "Using the Cassette Recorder.")

THE KEYBOARD

Although your Color Computer's keyboard looks like a typewriter at first glance, it's actually much more versatile and sophisticated. Not only does it have all the letters, numbers, and characters of a typewriter, it also has many special keys that make typing and computing much easier. The function of any key depends on the software you are using. For example, in Color BASIC the ⊖ key moves the cursor left one space and deletes the last character typed. In another type of program, this key's function might be totally different. (The cursor, by the way, is the blinking light that lets you know exactly where you are typing on the screen.)
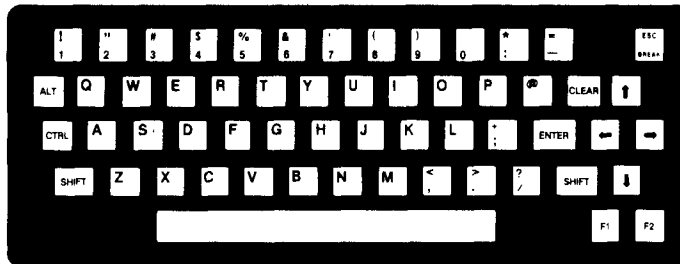
USING THE DISPLAY

Color is the Tandy Color Computer's middle name . . . and your computer's built-in flair for flights of light and sound lets you make computing the brightest and most exciting adventure this side of the Land of Oz.

The Color Computer can produce 64 distinct colors (as many as 16 at a time). The color tones you actually see depend on the quality and color adjustment of your display unit — not on the computer.

When you use a plug-in ROM Program Pak, the cartridge program determines the color on your television screen. However, when you use Color BASIC, **you** control the colors.
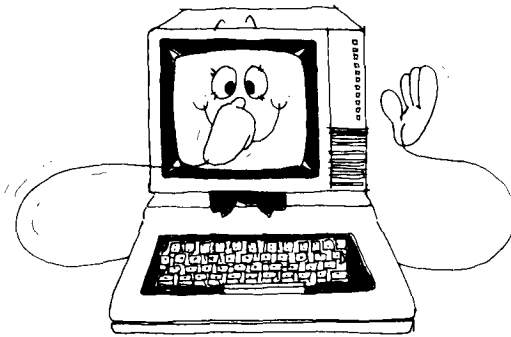
Getting Out of Prism

A program is a set of instructions that causes a computer to perform certain operations. That's it. That's all there is to it.

So far you've only seen two colors — green and black. Now let's take a look at all of the colors your computer can generate. (If you are using a TV or a composite monitor, the following program provides an opportunity for you to adjust your colors. But, remember, the range of adjustment varies depending on the condition and quality of your display unit.)

Start Color BASIC by pressing the RESET button, and then type the following program. Don't worry about spacing, but be sure you type everything else **exactly** as listed on the following page.

Note: All the characters in the program must appear in normal colors (black with a green background). If they appear in reversed colors (green with a black background), you need to start over. Turn the computer off, wait 15 seconds, turn it back on again, and (with the characters in normal colors) enter the program:

```
10  ON BRK GOTO 190 (ENTER)
20  HSCREEN 2 (ENTER)
30  GOSUB 150 (ENTER)
40  FOR R=0 TO 15 (ENTER)
50  HCOLOR R,15 (ENTER)
60  HLINE (R*20,0)-((R+1)*20,192), PSET, BF (ENTER)
70  HCOLOR 0,0 (ENTER)
80  NEXT R (ENTER)
90  FOR N=0 TO 3 (ENTER)
100 GOSUB 150 (ENTER)
110 A$=INKEY$: IF A$ = "" THEN 110 (ENTER)
120 NEXT N (ENTER)
130 PALETTE CMP (ENTER)
140 END (ENTER)
150 FOR R=0 TO 15 (ENTER)
160 PALETTE R, (N*16)+R (ENTER)
170 NEXT R (ENTER)
180 RETURN (ENTER)
190 PALETTE CMP: END (ENTER)
```

This program is too long to all fit on one screen. So, to check your program for typing errors, display (list) only a portion of the program at a time. First type:

```
LIST 10-100 (ENTER)
```

The first 10 lines of your program appear on the screen. They should look like this:

```
10  ON BRK GOTO 190
20  HSCREEN 2
30  GOSUB 150
40  FOR R=0 TO 15
50  HCOLOR R,15
60  HLINE (R*20,0)-((R+1)*20,192), PSET, BF
70  HCOLOR 0,0
80  NEXT R
90  FOR N=0 TO 3
100 GOSUB 150
```

Then, type:

```
LIST 110-190 (ENTER)
```

The last lines of your program appear on the screen for you to
check. They should look like this:

```
110 A$=INKEY$: IF A$ = "" THEN 110
120 NEXT N
130 PALETTE CMP
140 END
150 FOR R=0 TO 15
160 PALETTE R, (N*16)+R
170 NEXT R
180 RETURN
190 PALETTE CMP: END
```

If you find any mistakes, retype the line, beginning with the line
number. Now, type:

```
RUN (ENTER)
```

Your screen displays 16 color-bars on four different screens. To
move from one screen to the next, press any key. The fifth time you
press a key, the program ends. However, you can RUN the program
as many times as you wish. Use the color adjustment controls on
your television or composite monitor to set the colors to their proper
hue. The RGB monitor does not require color adjustments; simply
adjust the contrast and brightness if necessary.

Journey to the Center of Your Screen

This next program helps you center your computer display on the
screen. Type:

```
NEW (ENTER)
10  WIDTH 32 (ENTER)
20  CLS (ENTER)
30  FOR X = 0 TO 63 (ENTER)
40  Y = 15 (ENTER)
50  RESET (X,Y) (ENTER)
60  NEXT X (ENTER)
70  FOR Y = 0 TO 31 (ENTER)
80  X = 31 (ENTER)
90  RESET (X,Y) (ENTER)
100 NEXT Y (ENTER)
110 GOTO 110 (ENTER)
```

To check for errors, type:

```
LIST (ENTER)
```

Your program should look like this:

```
10  WIDTH 32
20  CLS
30  FOR X = 0 TO 63
40  Y = 15
50  RESET (X,Y)
60  NEXT X
70  FOR Y = 0 TO 31
80  X = 31
90  RESET (X,Y)
100 NEXT Y
110 GOTO 110
```

If you find an error, retype the line, beginning with the line number. Next, type:

```
RUN ⟨ENTER⟩
```

You should now have a green background, surrounded by black, with black horizontal and vertical lines intersecting at the exact center of the screen.

The Color Computer 3 generates a rectangular image designed to fill most of your display screen. Adjust your display's horizontal- and vertical-centering controls until this image is centered as well as possible.

Don't worry if you can't get a perfectly centered image or if you notice slight distortions in certain areas of your screen. These minor variations depend on the condition of your display unit. (If the distortions are severe, however, consult a qualified service technician.)

Sound and Safe

Not only is your Color Computer a clever creator of kaleidoscopic colors, it's also a singularly sophisticated singer of songs.

When you use a plug-in Program Pak cartridge, the cartridge program determines the sounds you hear. When you use the built-in Color BASIC language (by starting-up without a cartridge in the slot), you can actually program the sounds you want to hear.
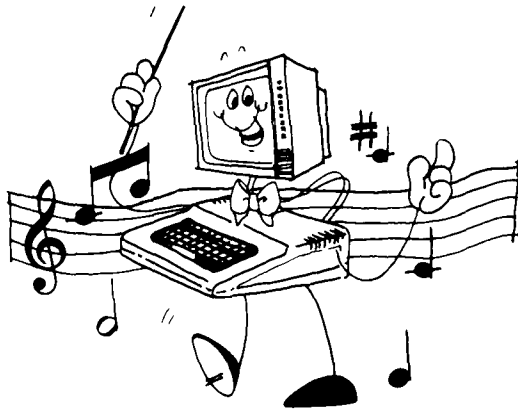
Your Color Computer is a superb singer, and you have nearly total control over the quality of the sound your TV or monitor produces. For example, type:

```
SOUND 39,20 (ENTER)
```

The computer obeys your *command* and produces a musical note that lasts 1.2 seconds. The program is SOUND *pitch-code,duration*. The *pitch-code* is any number in the range 1 to 255 (1 is the lowest pitch, 255 the highest), and *duration* is any number in the range 1 to 255. Duration sets the time the tone sounds in units of .06 second.

Your Color Computer has quite a range of sounds. The following program lets you hear the entire frequency range (codes 1-255) that Color BASIC can produce:

```
NEW (ENTER)
10 FOR X = 1 TO 255 (ENTER)
20 SOUND X,1 (ENTER)
30 NEXT X (ENTER)
```

To check for typing errors, type:

```
LIST (ENTER)
```

The program should look like this:

```
10 FOR X = 1 TO 255
20 SOUND X, 1
30 NEXT X
```

Check for typing errors as you did in the previous programs. When you're sure you've typed everything exactly as above, set your display unit's volume control to a normal level, and type:

RUN (ENTER)

If you want to hear more of what your Color Computer is capable, type in this short program:

```
NEW (ENTER)
10 X = RND (255) (ENTER)
20 Y = RND (30) (ENTER)
30 SOUND X,Y (ENTER)
40 GOTO 10 (ENTER)
```

To check for typing errors, type:

LIST (ENTER)

Your program should look like this:

```
10 X = RND (255)
20 Y = RND (30)
30 SOUND X,Y
40 GOTO 10
```

When you're sure the program is correct, type:

RUN (ENTER)

The music your computer plays will never be heard at Carnegie Hall, but it is nevertheless remarkable. You see, your computer plays random notes for random durations. And although it isn't Beethoven, your Color Computer is actually "composing" music.
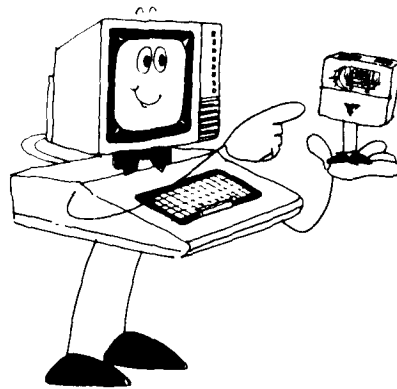
Press (BREAK) to stop the program.

PROGRAM PAK
INSTALLATION

Your Color Computer is amazingly versatile. It's a master of chess, a wizard at fantasy games, a tireless and efficient bookkeeper/secretary, a noted musician, and much more.

But its talents are only potential until it has two more things. First, it needs a memory. Then, it needs you.

Programs, such as those listed earlier in this booklet, give your computer the memory it needs to carry out specific tasks. Those programs are so simple that you can probably write some like them after a few days with your BASIC programming manual. The most sophisticated programs, however, can take hundreds or thousands of hours to develop and produce.

Tandy's preprogrammed ROM cartridges let you begin using your Color Computer immediately . . . for tasks as complex as playing a chess game, as detailed as maintaining financial records for a small business, and as educational as learning a foreign language.

Program Paks plug into the cartridge slot on the right side of your computer. Although they are the simplest and most effective means of programming your computer, ROM cartridges are sensitive electronic devices that you must handle carefully to protect them (and your computer) from damage.

BE SURE NOT TO PLUG IN A CARTRIDGE WHILE YOUR COMPUTER IS TURNED ON. The computer must always be turned OFF whenever a ROM cartridge is either plugged in or removed.
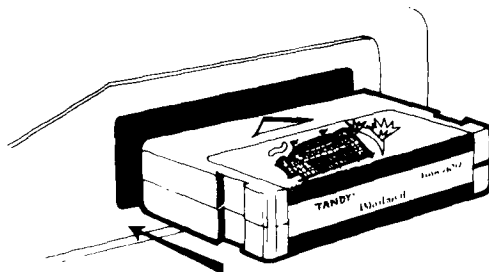
BE SURE NOT TO INSERT YOUR FINGERS OR OTHER OBJECTS INTO THE CARTRIDGE SLOT. Doing so could seriously damage your computer.

To install a Program Pak, locate the cartridge slot on the right side of the computer. Carefully insert the cartridge with the label side up and the open end facing into the slot. The cartridge should slide smoothly into the recessed receptacle in the computer case.

If you have difficulty inserting the cartridge, it might be upside down. Be sure the label is facing up, and then try again.

Some Program Paks will not auto start. Documentation for one of these cartridges may tell you to type in EXEC &HC000. Instead, type in:

    EXEC &HE010

This command will get the Program Pak started for you.

To remove a cartridge, FIRST TURN OFF THE COMPUTER; then gently pull out the cartridge. Store it in a safe place.

USING THE JOYSTICK CONTROLLERS

Joystick controllers (such as 26-3008 or 26-3012) are among the most popular accessories for the Color Computer. Most commonly used with computer games, joysticks are important in any application that involves translating two-dimensional hand movement into computer input.
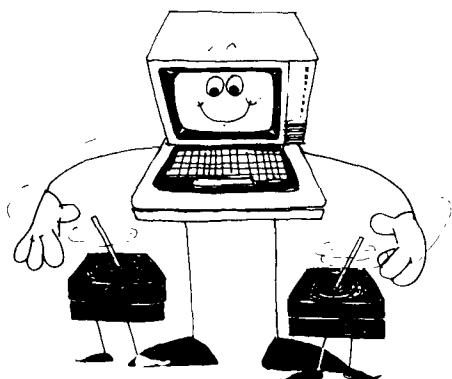
Depending on which ROM cartridge or BASIC program you use, joysticks let you alter the direction of a moving object on the display screen, reposition the cursor to different program options, draw diagrams on the video display screen, or make other adjustments where vertical and horizontal motions must be translated into signals that the computer understands.

Each joystick consists of a control stick that lets you input two-dimensional movements into the computer, and also a *fire button* that performs different functions in different programs. The fire button might launch a missile in an arcade game, execute a command in an educational package, and so on.

Your joystick controllers connect to the back of the computer in the two jacks marked JOYSTICK RIGHT/LEFT. It doesn't matter which joystick you use in either jack; the controllers are interchangeable.

Note: When using Color BASIC instead of a plug-in cartridge, you generate a stream of characters whenever you press the fire button. This is a normal "side effect" and can be ignored.
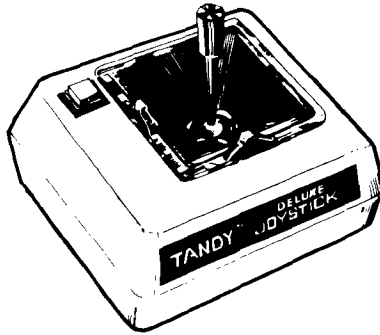
THE JOYSTICK CONTROLLERS FUNCTION CORRECTLY ONLY IN PROGRAMS WRITTEN SPECIFICALLY FOR THEIR USE.

USING THE
CASSETTE RECORDER

Your Computer has a type of amnesia every time you turn it off. When you turn it on again, it remembers only its Color BASIC language. The rest of its memory is gone.

This lets you reprogram your computer for different tasks. It is infinitely more versatile than the "computer" in a digital watch or a microwave oven, which has a permanent memory with a single function that you can never alter.
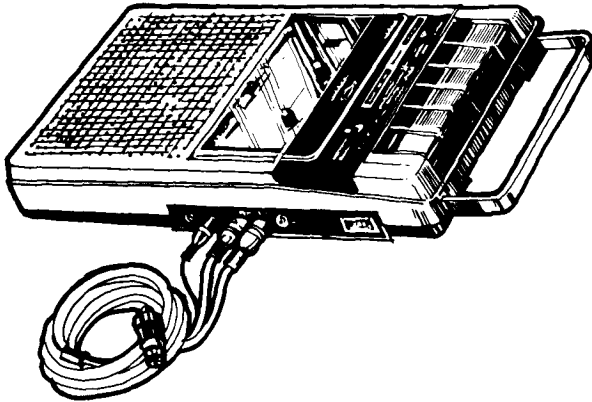
When you connect a cassette recorder to the Color Computer 3, you dramatically increase its power and versatility. Because thousands of cassette-based programs are written for the Color Computer, you can use the cassette recorder to expand your library of useful programs.

You can also use the recorder as an information storage bank for many Program Paks or other cassette programs. "Color SCRIPSIT" (26-3105), for example, lets you save letters, reports — even the Great American Novel — on cassette tape. Another Program Pak, "Color File" (26-3103), lets you store and manipulate addresses, personal records, and many other types of useful data. All this, and much more, is possible — even if you know absolutely nothing about computer programming.
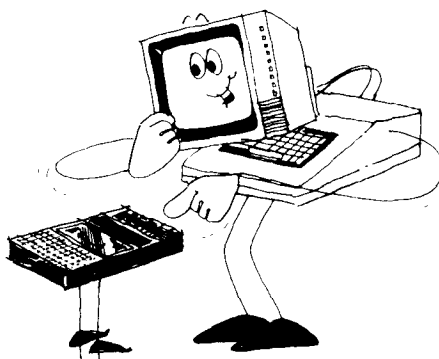
If you **do** know BASIC, you can store programs and data on cassette tape instead of having to retype them every time you start up the computer. With the CCR-81 cassette recorder, you can transfer programs and data from tape to computer at a rate of 1500 baud (about 190 characters per second, or 11,000 characters per minute). By using cassette data storage, in a matter of minutes you can reload programs into memory instead of typing them and then debugging them, a process that can take hours.

Note: Although you can use other recorders with the Color Computer, we strongly recommend that you use Tandy's CCR-81 (26-1208). The overall operation of the CCR-81 and the following connections, adjustments, and settings are thoroughly tested and documented with this cassette recorder but could vary with other recorders.

Making the Right Connections

Connect the cassette recorder to the computer if you wish to record and save your programs, use cassette-based prerecorded programs, or use a program (such as Color SCRIPSIT) that requires a cassette recorder to store information.

The following instructions assume you are using the CCR-81 Cassette Recorder.

A Color Computer/Cassette Recorder connection cable is included with your CCR-81, and we suggest you use this particular cable because it is specially designed for cassette recorder installation.

1. Connect the DIN plug on the short cable (DIN plug on one end and three plugs on the other) to the CASS jack on the back of the computer. **Be sure you get the plug connected securely.**

2. The three plugs on the other end of this cable connect to the recorder:

    A. Connect the black plug into the EAR jack on the side of the recorder. This connection provides the output signal from the recorder to the computer for loading tape programs into the Color Computer.

    B. Connect the larger gray plug into the AUX jack on the recorder. This connection provides the recording signal to record programs from the computer onto the tape.

        Leave the AUX plug in whether you are recording or playing back cassette data.

    C. Connect the smaller gray plug into the smaller MIC jack on the recorder. This lets the computer automatically control the recorder motor (turn tape motion on and off for recording and playing tapes).

        Note: Do not plug a remote microphone or a dummy plug into the larger MIC jack.

Adjust the volume control on your cassette recorder carefully. With the CCR-81 recorder, set the volume between 3 and 10. The recommended setting is 5.

Copy Right Protection

Here are some tips for making good recordings:

- When you're not using the computer to SAVE or LOAD programs, don't leave the recorder's RECORD or PLAY buttons down. Press STOP.

- You can avoid many problems with tapes by using new, high-quality computer tapes (26-301) whenever you save a program or data.

- If you want to reuse a prerecorded tape, erase the contents with a bulk tape eraser (44-232) to be sure you erase everything. Even though the recording process erases the old recording, enough information could be left to confuse the new recording.

- If you want to save a taped program permanently, break off the Erase Protect tab on the cassette (see your tape recorder manual). Without the tab, you can't press the RECORD button on your recorder. This keeps you from accidentally erasing that tape.

Error Conditioning

Several possible error messages can appear in the upper-left portion of the display screen when a mistake is made during a loading operation. For explanations of the error messages, refer to the appendix entitled "BASIC Error Messages" in the BASIC programming manual that you received with your Color Computer.

Note: If you try to load a blank tape, your Color Computer 3 searches for the program until the tape ends without giving any indication that the tape is blank. Press RESET to stop the loading process.
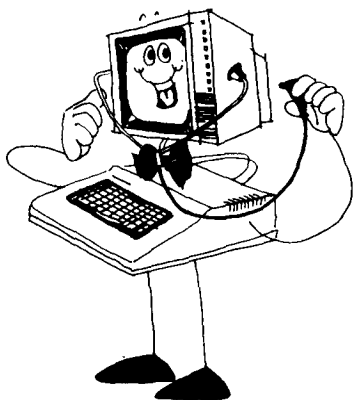
TROUBLESHOOTING AND MAINTENANCE

If you have problems operating your Color Computer 3, check the following table of symptoms.

If you don't find the cure, take the unit to your local Radio Shack store, where it will be repaired promptly and returned to you.

Medicine for the Melancholy

Symptom	Cure
OK (or appropriate prompt message if you are using a ROM cartridge) doesn't appear when you turn on the computer.	1. No AC power. Check the power cord connection. 2. Incorrect power-up sequence. All accessories should be ON before you turn on the computer. 3. Accessory device (for example, printer) is not connected properly. Recheck connection. 4. Your display screen needs adjustment. Check the contrast, brightness, and/or fine tuning controls. 5. If you are using a television, the Antenna Switch should be set to COMPUTER, not to TV. If you are using a composite monitor, check to be sure that VIDEO is selected.

Symptom	Cure
Poor reception or fuzzy display.	1. If you are using a TV, be sure it is set on the proper channel (3 or 4 — whichever gives the best display). 2. If you are using a TV, check the antenna connections to be sure they are connected both securely and properly. If you are using a composite monitor or an RGB monitor, check to be sure the cables are connected both securely and properly. 3. Your display screen needs adjustment. Check the contrast, brightness, and/or fine tuning controls.
Your cassette program won't load.	1. Improper recorder connection. Check connection instructions in the recorder owner's manual. 2. Cassette volume is too low or high. Check the recorder's volume control. 3. Information on tape might be garbled due to electricity discharge, magnetic field, or tape deterioration. Try to load the duplicate, if you have one. 4. Be sure that your cassette recorder is located as far away from your TV or monitor as possible.
The computer "hangs up" during normal operation, requiring RESET or power-off/on.	1. Fluctuations in the AC power supply. See AC Power Sources. 2. Defective or improperly installed connector. Check all connection cables to see that they are securely attached and that they are not frayed or broken. 3. Programming. Recheck the program.
"Ghosts" or mixed computer and TV reception (TV only).	Try using the other TV channel (3 or 4).

Current Events

Computers are sensitive to fluctuations in the power supply at the wall socket. This is rarely a problem unless you are operating in the vicinity of heavy electrical machinery. The power source can also be unstable if some appliance or office machine in the vicinity has a defective switch that arcs when turned on or off.

Your Color Computer 3 is equipped with a specially designed, built-in AC line filter. It should eliminate the effects of ordinary power-line fluctuations.

However, if the fluctuations are severe, you might need to take some or all of the following steps:

- Install bypass or isolation devices in the problem-causing devices

- Repair or replace any defective (arcing) switches on lights or appliances

- Install a separate power-line for the computer

- Install a special line filter designed for computers and other sensitive electronic equipment

Power-line problems are rare, and many times you can prevent them by choosing a proper installation location. The more complex the system and the more serious the application, the more consideration you should give to providing an ideal power source for your computer.

Remember the Maintenance

Your computer requires little maintenance. It's a good idea to keep it clean and free of dust build-up. This is especially important for the keyboard. Tandy sells a custom-designed Color Computer dust cover you might find helpful.

If you need to clean the computer case, use a damp, lint-free cloth.

The accessory devices (cassette recorder, line printer, and so on) might require more maintenance. Check the owner's manual for each accessory in your system.

SPECIFICATIONS

AC Power Supply

Power Requirements   105-130 VAC, 60 Hz
Current Drain   0.18 Amps RMS

Environmental Specifications

Temperature   55°F to 85°F (12.8°C to 29.4°C)
Altitude   − 100 to 6000 feet (− 30 to 1830
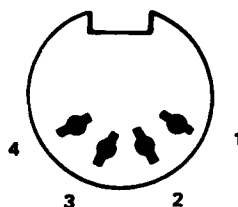   meters) above sea level

Microprocessor

Type   68B09E

Serial Interface

Standard RS-232-C Signal		Pin #
CD	Carrier Detect (Status Input Line)	1
RD	Receive Data	2
GROUND	Zero Voltage Reference	3
TD	Transmit Data Out	4

RS-232 Pin Location

Looking at the outside of the SERIAL I/O jack on the Color
Computer:

Printer Software Requirements

600 Baud
1 Start Bit (logical zero)
8 Data Bits (LSB first)
2 Stop Bits (logical one)
No Parity
132-Column Printer Width
Automatic Carriage Return at End of Line

Cassette Interface

Suggested Input Level for Playback from Recorder	1 to 5 Volts peak-to-peak at a minimum impedance of 220 Ohms
Typical Computer Output Level to Recorder	800 mV peak-to-peak at 1K Ohms
Remote On/Off Switching Capability	0.5 A maximum at 6 VDC

Cassette Jack Pin Location

Looking at the outside of the CASS jack on the computer:

1. Remote Control
2. Signal Ground
3. Remote Control
4. Input from Recorder's EARphone Jack
5. Output to Recorder's AUX or MIC Jack
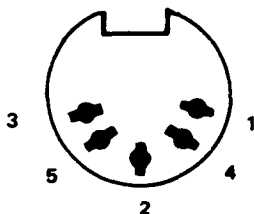
Joystick Controller Jack Pin Location

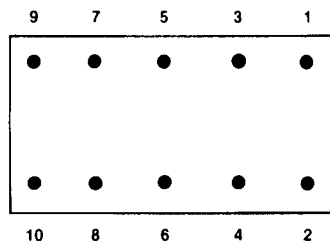Looking at the outside of the JOYSTICK jack on the computer:

1. Comparator Input (Right-Left)
2. Comparator Input (Up-Down)
3. Ground
4. Fire button 1, High when open, Low when closed
5. Vcc, current-limited +5VDC
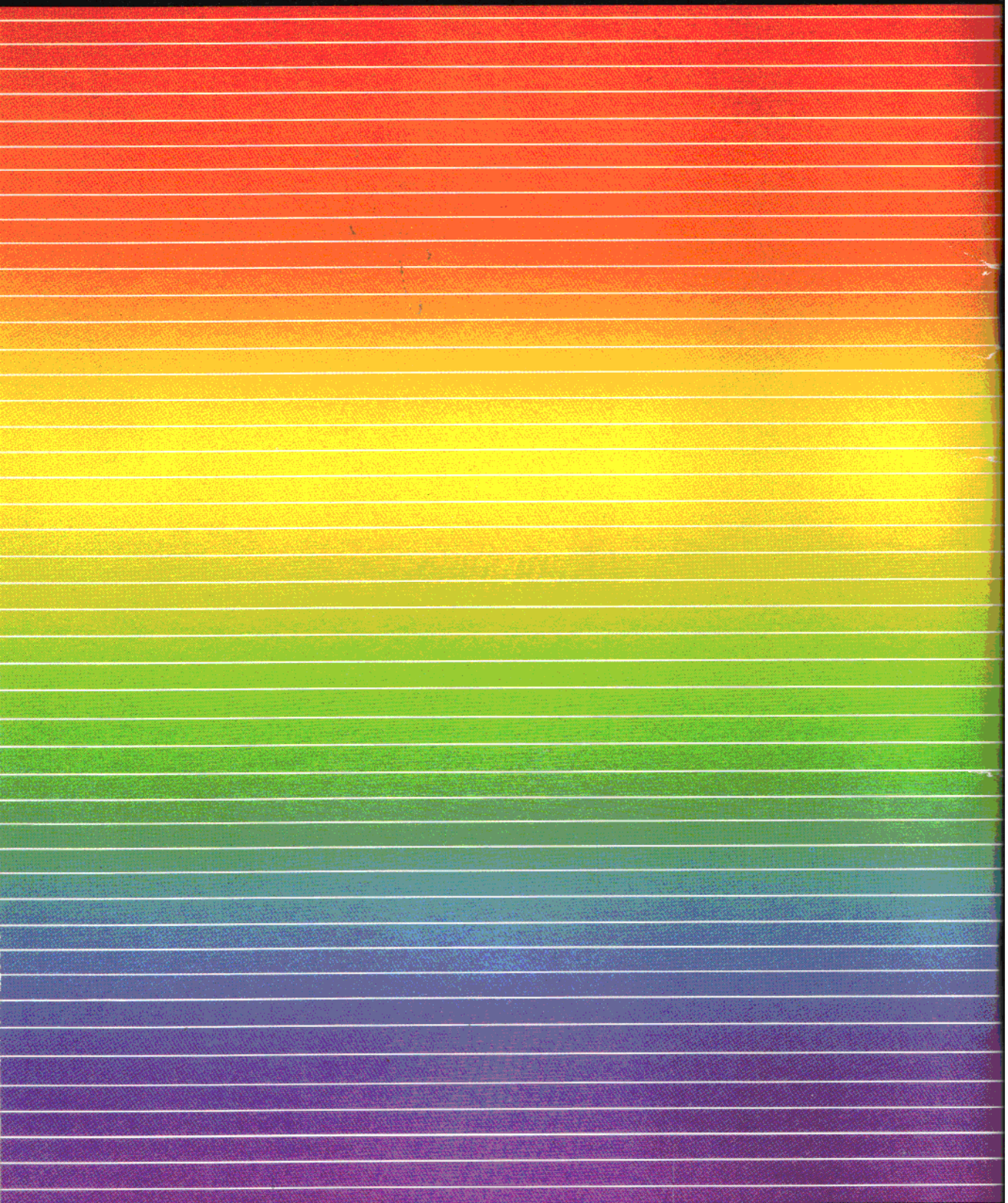6. Fire button 2, High when open, Low when closed
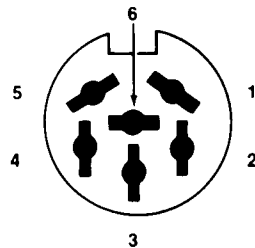
RGB Monitor Jack Pin Location

Looking at the outside of the RGB OUT jack on the bottom of the computer:

1. Ground
2. Ground
3. Red
4. Green
5. Blue

6. Polarity (No Pin)
7. Sound
8. Hsync
9. Vsync
10. No Connection