

C-Itoh

CI-3500

Printer

**TRI PRINTER MODEL 40
PRELIMINARY USER MANUAL**

FCC STATEMENT

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

Reorient the receiving antenna

Relocate the computer with respect to the receiver

Move the computer away from the receiver

Plug the computer into a different outlet so that computer and receiver are on different branch circuits.

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

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

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

CONTENTS

CHAPTER 1 -- INTRODUCING THE TRI PRINTER MODEL 40

- HOW TO USE THIS MANUAL
- UNPACKING
- GETTING ACQUAINTED
- CHOOSING A LOCATION FOR YOUR MODEL 40

CHAPTER 2 -- SETTING UP YOUR TRI PRINTER MODEL 40

- INSTALLING THE INTERFACE AND FONT CARTRIDGES
- INSTALLING THE RIBBON CARTRIDGE
- SETTING THE TRACTOR WIDTH
- LOADING PAPER
- SETTING THE TOP OF FORM
- THE POWER FUSE
- YOUR PRINTER'S OPERATING CONTROLS AND STATUS INDICATORS
- CONTROL PANEL FIRST AID
- TESTING YOUR TRI PRINTER

CHAPTER 3 -- USING THE TRI PRINTER WITH YOUR APPLE COMPUTER

- THE MODEL 40 MEETS YOUR MACINTOSH
- HIGH-PERFORMANCE PRINTING FOR YOUR APPLE IIc

CHAPTER 4 -- FUNCTION SETTINGS: GETTING IT UNDER CONTROL

- HOW TO SET TRI PRINTER FUNCTIONS FROM THE CONTROL PANEL
- ONE MORE TIME
- FUNCTIONS GROUPED BY CATEGORY
- FUNCTIONS LISTED IN NUMERICAL ORDER
- DETAILED DESCRIPTION OF FUNCTION SETTINGS

CHAPTER 5 -- LIGHTS, CAMERA, ACTION!

- A QUICK LOOK AT ASCII CODES
- WHAT'S AN ESCAPE SEQUENCE?
- MODEL 40 CONTROL CODES

CHAPTER 6 -- EXTENDED CONTROL CODES: THE GREAT ESCAPE

- AN OVERVIEW OF THE MODEL 40'S ESCAPE SEQUENCES
- PRINT CONTROLS
- CHARACTER CONTROLS
- SYSTEM CONTROL SEQUENCES

CHAPTER 7 -- PROGRAMMING YOUR PRINTER

- BASIC PROGRAMMING TO CONTROL ESCAPE SEQUENCES
- ALL ABOUT VERTICAL FORMAT UNITS (VFUs)
- DOWNLOADING SPECIAL CHARACTERS
- TRI PRINTER MODEL 40 GRAPHICS

CHAPTER 8 -- HOW TO TAKE CARE OF YOUR TRI PRINTER

- ALARM CODES
- MAINTENANCE
- TROUBLESHOOTING
- REPACKING

APPENDIX A -- ASCII CODE TABLES

APPENDIX B -- PRINTER GRAPHICS

APPENDIX C -- SUMMARY OF ESCAPE SEQUENCES

APPENDIX D -- THE TRI PRINTER MODEL 40 INTERFACE

APPENDIX E -- TECHNICAL SPECIFICATIONS

GLOSSARY

INDEX

CHAPTER 1 INTRODUCING THE TRI PRINTER MODEL 40

The Tri Printer Model 40 is a rugged, compact, highly versatile printer that combines the best features of three specialized printers in one high-performance package. It produces excellent draft quality print at speeds up to 350 CPS (characters per second). The double density letter quality mode prints at 87.5 CPS, and in the graphics mode, the printer can turn out crisp graphics at densities up to 240 dots per inch. The Tri Printer is designed specifically to match the performance requirements of the Macintosh, along with extra features available on no other printer. The Tri Printer's extra speed and ruggedness assure high productivity and a long, trouble free life in demanding graphics service.

HOW TO USE THIS MANUAL

This manual will help you get started using your new printer, and parts of it will serve as a valuable reference for your future use. On the pages ahead, you will learn the basics of operating your Tri Printer Model 40, even if you are a novice computer user. You'll find detailed instructions for everything from unpacking the printer and connecting it to your computer to using the printer's advanced programmable features.

The first three chapters contain basic information that will be useful to the beginning or intermediate printer user. When you've finished them, your Tri Printer Model 40 will be up and running with your Macintosh or other Apple computer.

If you are an old hand with printers, you might want to scan the Specifications in Appendix A, zip through the sections on Font and Interface cartridge installation and ribbon and paper loading in chapter 2, then get right to work.

Chapter 4 tells you all about the advanced features hiding behind the printer's front panel controls. A careful reading may suggest ways to use your printer that have not occurred to you.

Chapters 5, 6 and 7 show you how to use the Tri Printer Model 40's sophisticated features. You can use the printer without this information, but if you are interested in writing your own programs, these chapters show you how your software can put the printer through its paces.

Chapter 8 is for everyone. You'll find hints for taking

care of the printer, and a summary of how your printer takes care of itself, using alarm displays and automatic shutdown. There's a troubleshooting chart to help you decide what to do if it stops working.

In the back of the manual, there are a number of Appendices that you will find helpful for later reference while using your printer. All but two are summaries of material presented in greater detail earlier in the manual. Of the two appendices that contain new material, one lists the complete technical specifications for the printer. The other provides a technical description of the printer's interface. This information will be of most use to the reader with a technical background.

How Are We Doing?

We want this manual to be as helpful to you as possible, whether you are a novice or an experienced computer professional. After you've looked the manual over, please take a few minutes to fill out and send in the reply card in the back to let us know how we are doing. Your comments and suggestions are welcome.

UNPACKING

The Tri Printer Model 40 comes in two cartons. The smaller carton contains the manual, so you've already opened it by the time you read this. Set the other items in the carton aside until later.

Place the large shipping carton on the floor or on a sturdy low table. Inspect the carton for signs of damage before you open it. Remove the staples on the top of the carton, carefully cut through the tape and open the box. The first thing you'll see is a cardboard tray supported at the ends by styrofoam blocks. In the tray you'll find the following items, shown in figure 1-1.

- o a long slender box containing a ribbon cartridge
- o a power cord
- o a wire assembly called a paper separator
- o an installation guide.

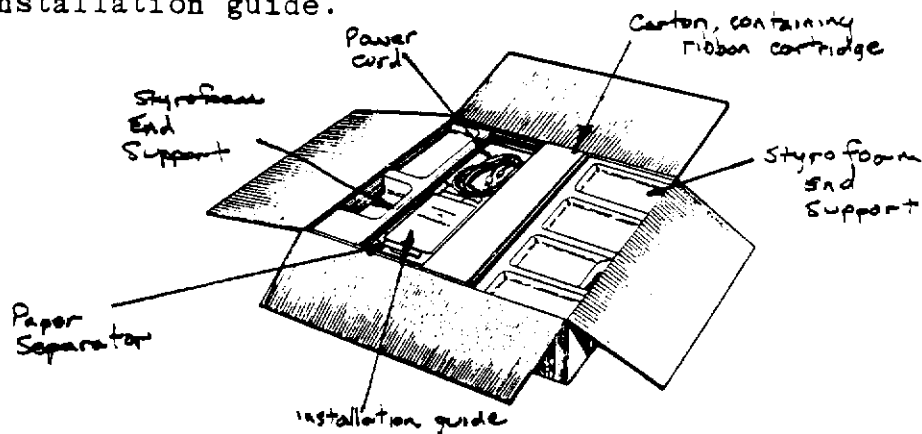


Figure 1-1. Printer Packing.

Remove the cardboard tray containing these items, and set it aside. The next task is to lift the printer out of the carton. It's light enough for one person to lift, but you might want someone to help by holding the carton. To pick up the printer, grasp the handholds in the styrofoam blocks on each side of the printer and lift. Place the printer on a flat, stable surface. Remove the styrofoam supports from the ends of the printer and slide the printer out of the plastic bag. This completes unpacking the printer; there are no internal restraints.

Inside the smaller carton, in addition to this manual, you should have found two plastic cartridges. The larger cartridge is the Interface cartridge and the smaller is the Font cartridge. These are shown in figure 1-2.

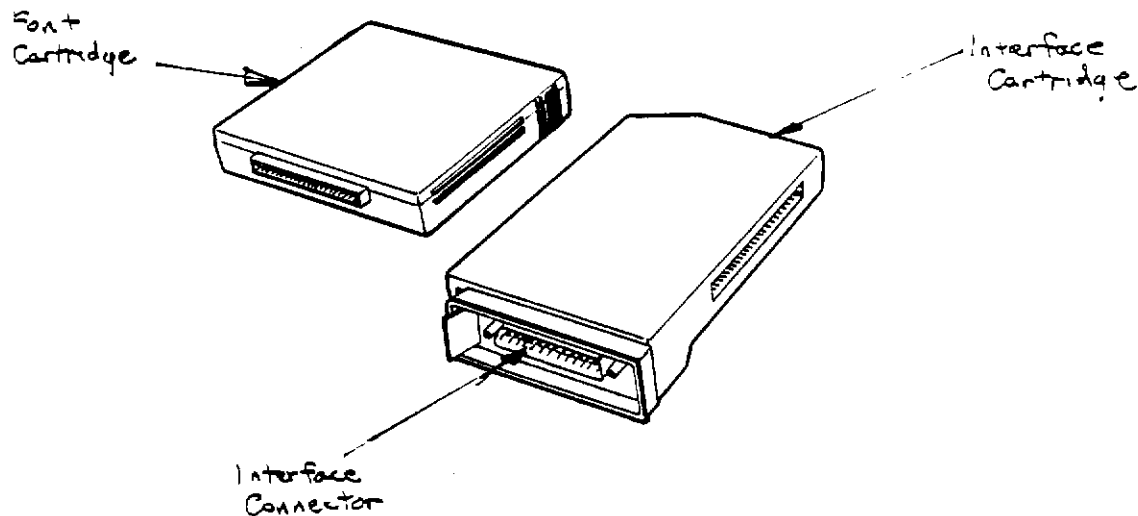


Figure 1-2. Interface Cartridge and Font Cartridge.

Save the packing materials for use if you need to ship the printer in the future. Take a moment to make sure that you have all of the small parts and accessories mentioned so far. Carefully examine the outside of the printer and each of the accessory items for shipping damage. If anything is missing or damaged, notify your dealer immediately. Now, let's take a closer look at the Tri Printer Model 40.

GETTING ACQUAINTED

Figure 1-3 shows the names of the major operating parts of the model 40. By spending a few minutes now getting to know these terms, you'll save time later learning how to use the printer.

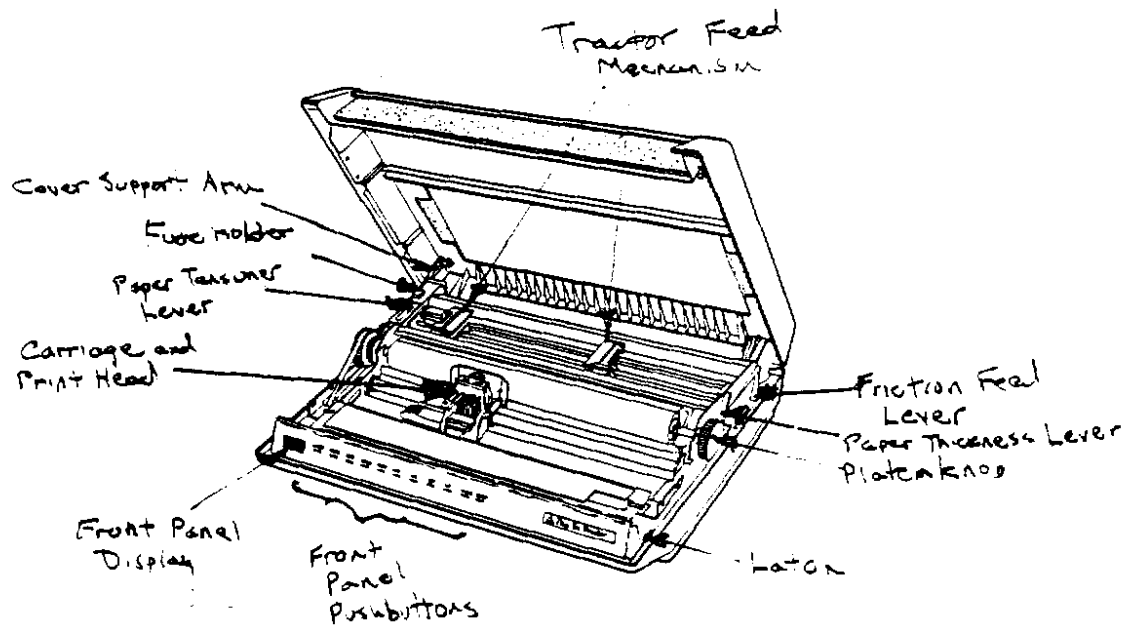


Figure 1-3. Inside View of Printer.

Top Cover Unit

The top cover unit serves two important purposes. First, it keeps dust and foreign objects out of the printer. This is important not only for the well being of your printer, fingers and belongings, but because the print head can become very hot when in use. Second, it helps to keep your printer quiet when it's working hard. Lift the lid; (grasp the groove on both sides near the front and lift) you will also see the top cover latches, in the front, and the support arm in the left rear.

CAUTION:

When you close the cover, the support arm does not automatically release. Lift the cover slightly; pull the arm toward the front of the printer, then close the cover.

Platen and Platen Knob

Now that the top cover is open, the platen and platen Knob are in view. The platen serves as a resilient striking surface. The platen knob lets you turn the platen when you load the paper.

Fuse

The fuse is a safety device that disconnects the power in case anything goes wrong with the machine. It is located inside a small box in the rear on the left. In most cases, it is best to refer fuse failures to qualified service personnel.

Tractor Feed Mechanism

The tractor feed mechanism is located behind the platen. It consists of two toothed belts, called tractors, sprockets, (these look like the treads of a tractor) a tractor gate and a tractor locking lever. The tractor mechanism guides the paper through the printer, and insures that the print will begin in the

same place at the top of each page. The spacing between the tractors can be adjusted to fit various paper sizes by releasing the locking levers, repositioning the tractors, and tightening the locking levers.

Paper Tensioner Lever

The paper tensioner lever is located to the left of the tractors. When the lever points to READY, it holds the paper snugly against the platen. This snug fit enables the printer to maintain the accuracy of the paper position when you use reverse line feeds. When the tensioner lever points to LOAD PAPER, the tension on the paper is released to allow the paper to pass around the platen without interference.

Friction Feed Lever

The friction feed lever is also used when loading paper. It should be in the FRICTION position when paper is being loaded, and in the PIN FEED position during normal operation.

Paper Thickness Lever

The paper thickness lever is located on the right side just next to the platen knob. This lever moves the print head to accommodate paper of various thicknesses. Next to the lever is a metal plate with numbers engraved in it. The numbers are a guide to the correct setting for various numbers of copies.

Cartridge Sockets

The cartridge sockets can be found on the right side of the machine in the open area toward the back of the printer. This is where you'll install the Font cartridge and the Interface cartridge.

Carriage and Print Head

The carriage is the movable part just in front of the platen. The entire carriage moves from side to side during printing, carrying the print head across the page. The print head is the portion of the machine that prints the words. It consists of a vertical column of 9 very stiff, fine steel wires. Toward the back of the print head are 9 electrically controlled magnets, one for each wire. When an electromagnet is energized, the wire is pushed strongly forward, striking the ribbon, which in turn prints a small dot, the size of the tip of the wire, on the paper.

Control Panel

The control panel is the most visible part of the printer. On it are 10 membrane-type push buttons and a 3-digit status display. The purpose of all of the switches is explained in chapters 2 and 3.

On/Off Switch

Now it is time to close the top cover and look at the back

of the printer. See figure 1-4. The on/off switch is located on the left side of the back of the machine.

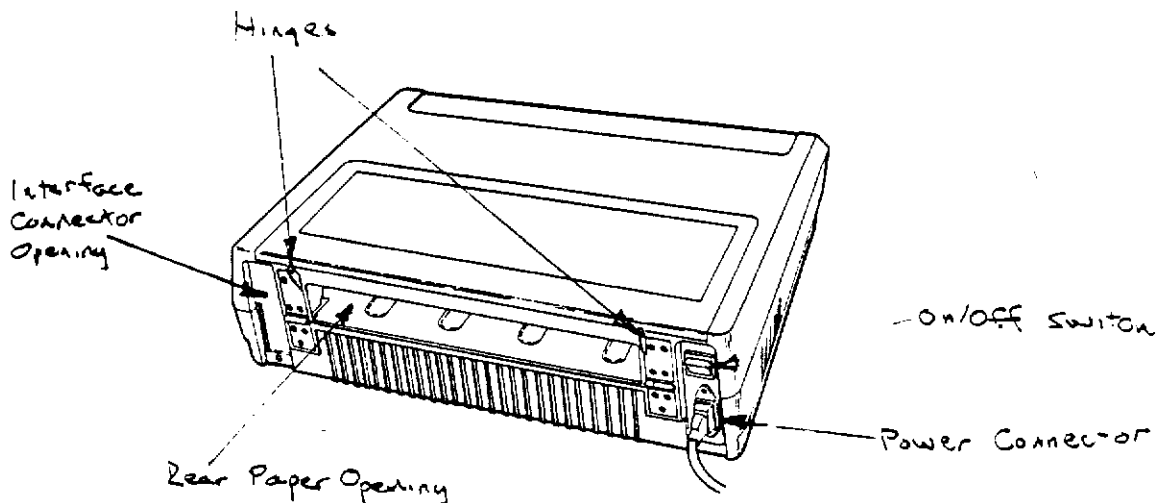


Figure 1-4. Rear View of Printer.

Power Connector

Directly underneath the on/off switch on the back of the printer, is the power connector. This is where the power cord will be plugged in.

Interface Connector Opening

After the Interface cartridge has been installed, the interface connector will protrude through this opening. This is where you will hook up the cable that connects the Model 40 with your computer.

CHOOSING A LOCATION FOR YOUR MODEL 40

Now that you know a little bit about your new printer, it's time to choose a permanent place where it can operate well. The printer should be placed on a flat, stable surface, but there are a number of other things to consider also.

- Locate the printer so that air can flow freely through the side vents, and remember to keep the area clear.
- Avoid direct sunlight or locations where the temperature will vary greatly.
- Be sure to include space in your planning for the paper supply and printed output.
- Connect the printer's power cord to a stable source of power. Use only 3-prong grounded receptacles, and be sure that any extension cord you use has a ground connection. Avoid using a receptacle where high-powered equipment, such as air conditioners, copiers and coffee makers are connected.
- Choose an area reasonably free from severe vibration.
- Avoid excessively dusty surroundings. Abrasive dust, such

as from manufacturing operations, can shorten the life of the mechanical parts of the printer.

- Keep in mind the distance from your Model 40 and the computer. Standard interface cables are usually about 6 feet long.

A good rule of thumb for choosing a location for computer equipment is to ask yourself if you would be comfortable working there, hour after hour. If the answer is yes, it's probably an acceptable location.



CHAPTER 2

SETTING UP YOUR TRI PRINTER MODEL 40

Now that you've become acquainted with your Tri Printer Model 40 and chosen a home for it, it's time to set it up and try it out. This chapter will give you all the facts you need to put it all together: you'll learn how to load paper, how to load and replace ribbon cartridges, and how to run the printer's self-test.

First, let's deal with those unattached parts that you set aside while you were unpacking the printer. Locate the tray that contains the ribbon cartridge, the cord, and the paper separator. You'll also need the font cartridge and the interface cartridge.

Plug the power cord into the power connector at the back of the machine. Install the paper separator by hooking the ends of the wire frame into the holes in the protruding part of the hinges on the back of the printer.

INSTALLING THE INTERFACE AND FONT CARTRIDGES

CAUTION:

Turn off the power before you install or remove either cartridge. Removing or installing the either cartridge with the power on can cause serious damage to both the printer and the cartridge!

Open the printer and look inside. The Font cartridge and the Interface cartridge will fit into the open area at the right behind the platen knob. See figure 2-1. The cartridges are shown in figure 2-2.

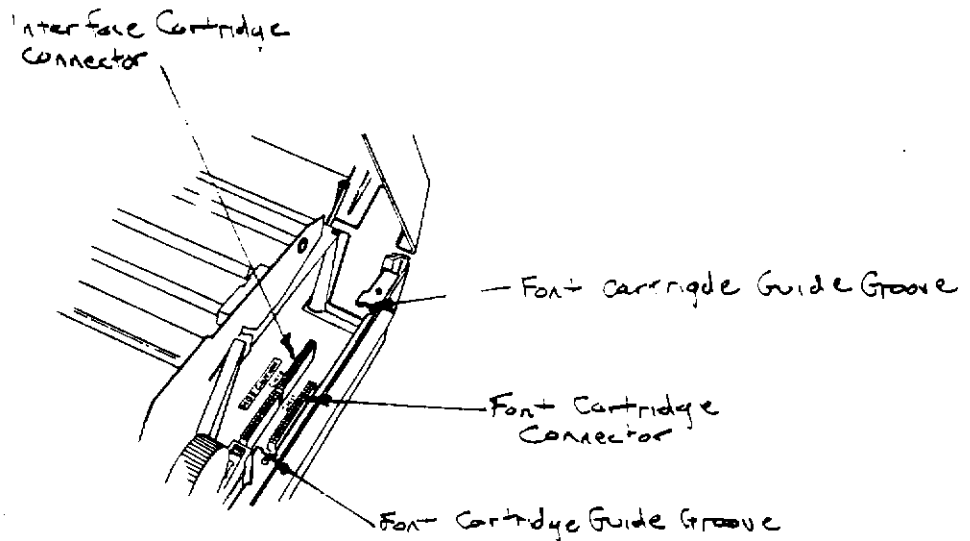


Figure 2-1. Font Cartridge and Interface Cartridge Locations.

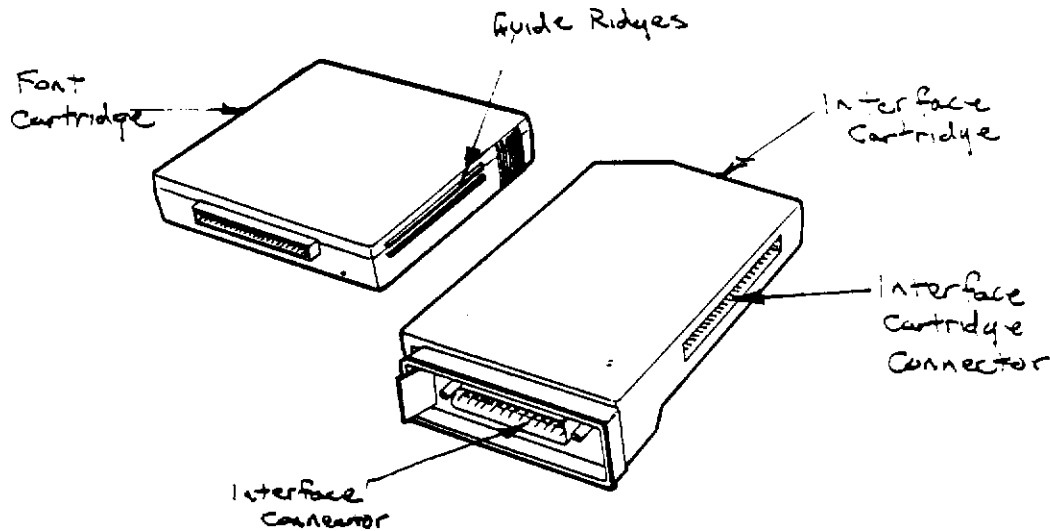


Figure 2-2. Font and Interface Cartridges.

Look closely at the Interface cartridge. It has a label on top that says "Interface." The second, larger label will face toward the right when the cartridge is installed. Notice that the Interface cartridge has two connectors. The 53-pin connector on the bottom connects the cartridge to the printer. The second connector, mounted on the back of the cartridge, is called the interface connector.

The interface connector is surrounded by a plastic barrier. The ridges along the sides of the barrier will engage the edges of the opening in the back panel when the cartridge is in place

as shown in figure 2-3. Position the Interface cartridge so that the barrier fits into the interface connector opening in the back panel. Press the cartridge firmly into place, without using excessive force.

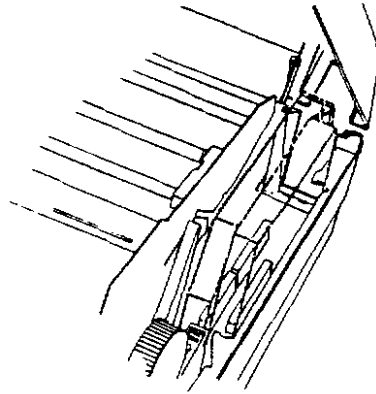


Figure 2-3. Interface Cartridge Installed.

Take a close look at the Font cartridge. The label that says "Font" is on the top. The larger second label will face toward the right when the cartridge is installed. On the bottom of the Font cartridge you'll see the 34-pin connector that connects the cartridge to the printer.

Notice the long grooved ridges that run along the edges, below the finger grips. Those ridges are intended to guide the cartridge into position while you are inserting it. The metal strip that runs along the right side of the printer has grooves in it that fit those ridges, as shown in figure 2-1. Figure 2-4 shows the Font cartridge installed in its proper place.

Be sure that the large label is facing toward the right side of the printer. Position the cartridge so the ridges engage the grooves, and press it firmly into place, without using excessive force.

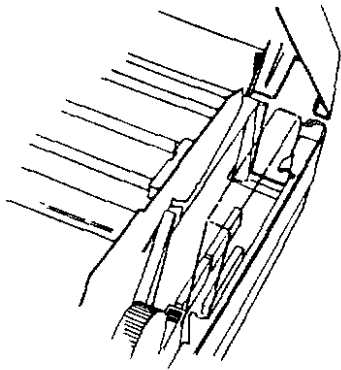


Figure 2-4. Font Cartridge Installed.

INSTALLING THE RIBBON CARTRIDGE

Unwrap the ribbon cartridge and examine its ends. Notice the two plastic projections on each end. Locate the place where the cartridge is to be installed (See figure 2-5). Position the cartridge over the printer with the exposed ribbon toward the platen. Align the plastic projections with the notches in the metal on each side of the printer.

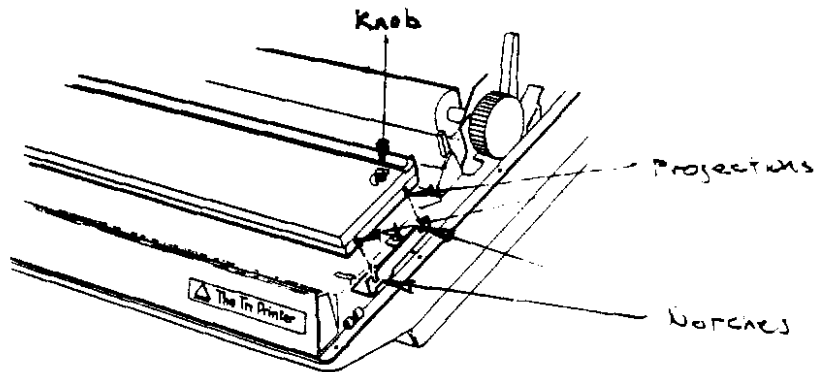


Figure 2-5. Installing the Ribbon Cartridge.

If the cartridge does not fall into place right away, turn the knob at the right of the cartridge until it clicks into place. Once the cartridge is properly seated, pull some slack in the ribbon. NOTE: Before you touch up the exposed ribbon, you may wish to put on the gloves that are provided for your

convenience.

Follow these steps, illustrated in figures 2-6 and 2-7.

1. Begin by threading the ribbon between the print head and the ribbon mask.
2. Thread the ribbon around the guide rollers on the left and right of the print head.
3. Thread the ribbon around the guide rollers nearest the front panel.
4. Turn the knob at the right to take up the slack.
5. Remove the red retainer near the the center of the cartridge.

When you have finished, the ribbon should follow the path shown in figure 2-7.

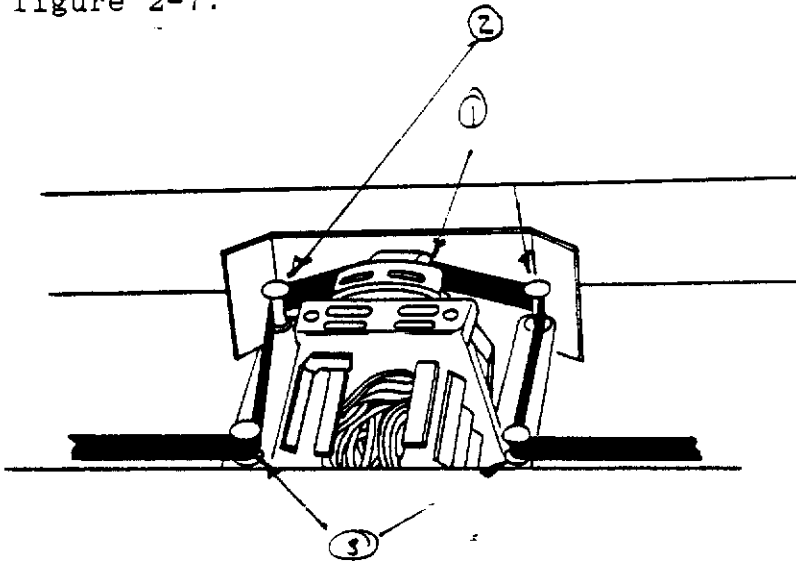


Figure 2-6. Threading the Ribbon.

Figure 2-7. The Ribbon Path.

SETTING THE TRACTOR WIDTH

Unlike many printers, the Tri Printer Model 40 has its forms tractor assembly already built in. The important features of the tractor feed mechanism are shown in figure 2-8.

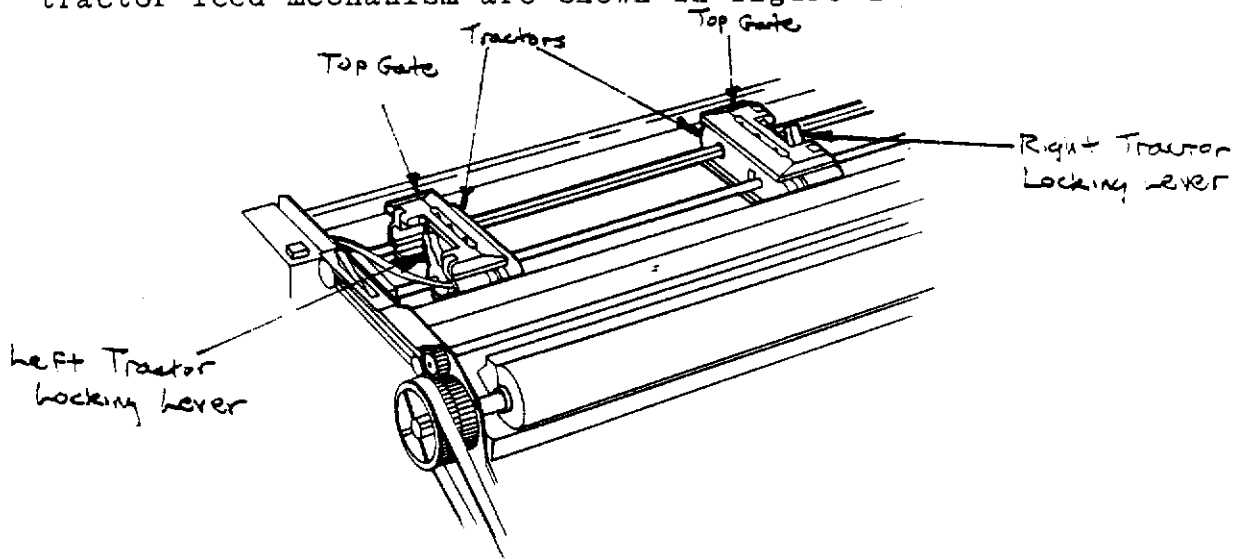


Figure 2-8. The Tractor Feed Mechanism.

Before loading the paper for the first time, you must set the tractor to fit the paper width. (See Figure 2-9) This need only be done once, unless you change paper size.

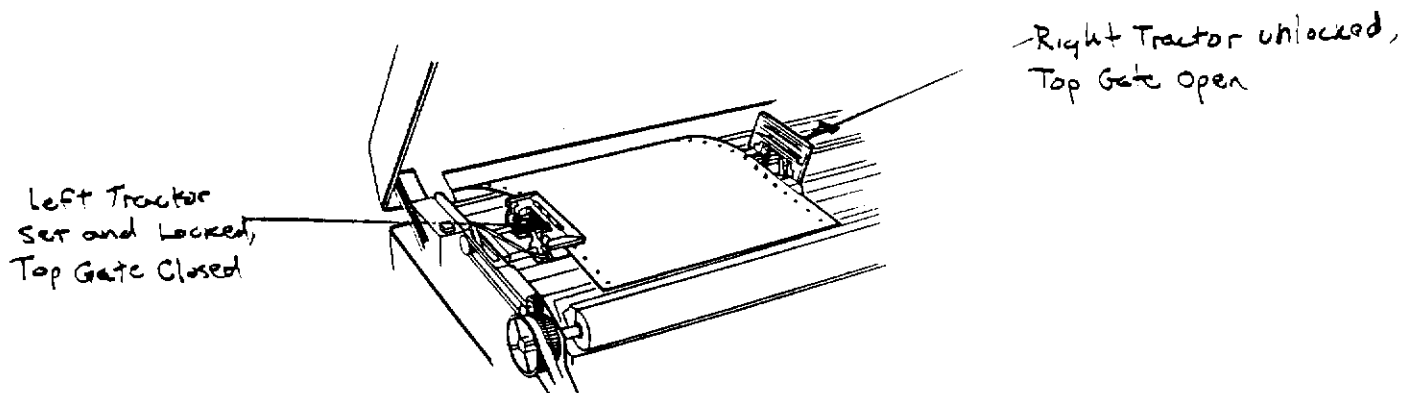


Figure 2-9. Adjusting the Tractor Width.

1. Release the tractor locking levers and push the left tractor to the right until it touches the stop. This sets the location of column 1.
2. Relock the left tractor.
3. Open the top tractor gates.
4. Insert a piece of paper through the back opening and place it upon the tractor sprockets.
5. Position the paper so the holes on the left side fit over the pins on the left tractor belt. Close the left tractor gate.
6. Slide the right tractor as needed until the holes on the right side of the paper fit over the pins on the right tractor belt.
7. Change the position of the right tractor, if necessary, to remove any puckering or wrinkling.
3. Lock the right tractor locking lever. The width is set.

LOADING PAPER

There are two entry slots for paper on the Tri Printer. One is in the rear, and is also used as the paper exit. The other paper entry is through a slot in the bottom of the printer. There are two ways to load paper: rear entry and bottom entry. Rear entry loading is the preferred method, because bottom entry loading does not permit reverse line feeds, which may be required for certain printing operations. Bottom feed should be used for heavy, multi-part forms.

Rear Entry Loading

If you've ever loaded paper into a printer with a tractor feed before, you will appreciate the The Tri Printer Model 40's easy paper loading procedure. These step by step instructions for rear entry make paper loading worry free.

1. Make sure the power is turned off.
2. Open the top cover and set the paper tensioner lever to point to LOAD PAPER. Set the friction lever to point to FRICTION.
3. Lift the tractor mechanism so that the bottom tractor gates are visible. See Figures 2-8 and 2-10. (NOTE: There are two sets of tractor gates - top and bottom.)

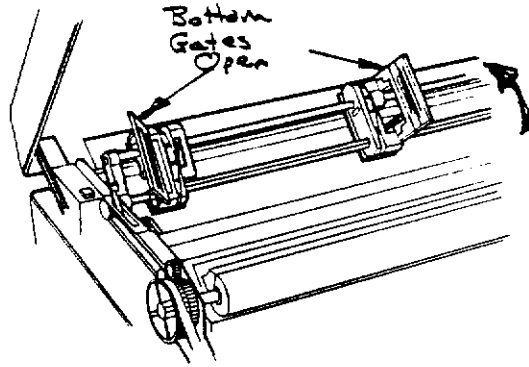


Figure 2-10. Tractor Mechanism Lifted With Bottom Gates Open.

4. Feed the paper in through the rear paper opening, shown in figure 2-11, until the end is just in front of the tractor feed.

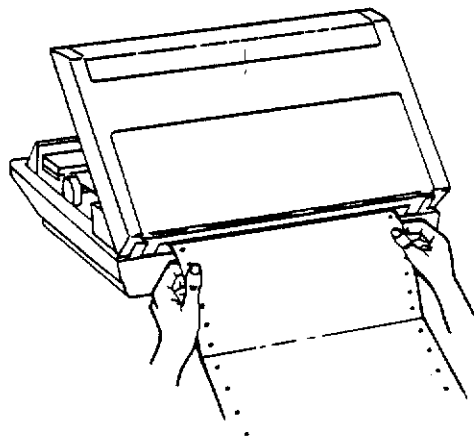


Figure 2-11. Rear Paper Opening.

5. Bend the paper upward and engage three holes (not 2, not 4) over the three corresponding pins on each tractor. (See

Figure 2-12)

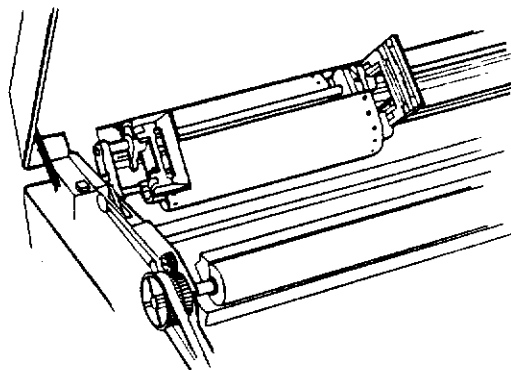


Figure 2-12. Paper Entry Form Rear, With Three Holes Engaged in Tractors.

6. Close the bottom tractors over the paper.
7. Lower the tractor feed mechanism back to its original position.

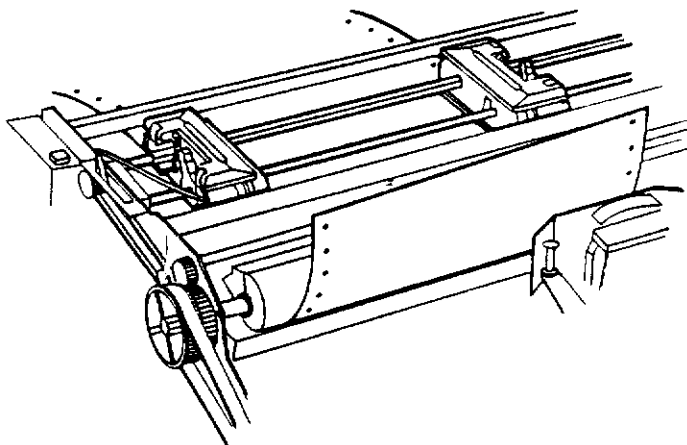


Figure 2-13. Rolling the Paper Under the Platen.

8. The paper should now be pointing toward the bottom of the platen. Turn the platen knob until the paper comes up far enough to reach back to the top of the tractor. See Figure 2-13.

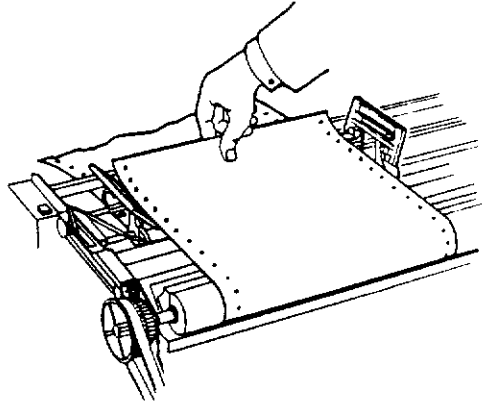


Figure 2-14. Pulling the Paper Over the Tractor Pins.

9. Open the top tractor gates (now facing you), pull the end of the paper toward the back of the printer to take up the slack in the paper, and engage the holes in the paper with the pins on the tractors. See Figure 2-14.
10. Close the tractor gates and turn the platen knob while guiding the paper out through the rear opening.
11. Push the paper tension lever so that it points to READY, and the friction lever so that it points to PIN FEED.
12. Close the lid; the paper is loaded. If you had any difficulty following the procedure, figure 2-15 will help. It shows a side view of the overall paper path for rear paper feed.

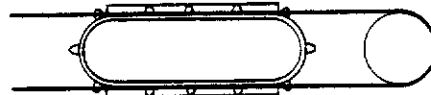


Figure 2-15. Side View of Paper Path, Rear Paper Feed.

Bottom Entry Loading

To load paper from the bottom, the printer must be installed on a pedestal with an opening below the printer's bottom entry. Proceed as follows:

1. Make sure the power is turned off.
2. Open the top cover and push the friction roller release lever toward the back of the machine so it points to FRICTION, and push the paper tension lever to the front of the machine so it points to READY.
3. Feed the paper in through the bottom entry, shown in figure 2-16. It should come up right in front of the platen as shown in figure 2-13, without rolling it through the platen.

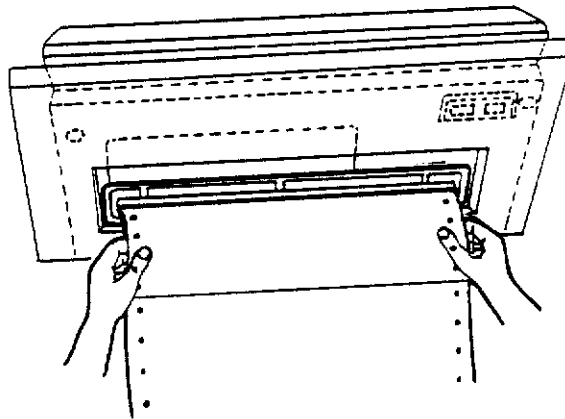


Figure 2-16. Bottom Paper Opening.

4. Open the top tractor gates.
5. Pull the paper up until it reaches past the tractors. Engage the holes in the paper with the pins on the tractor belts. See figure 2-18.
6. Close the tractor gates.
7. Pull the friction lever toward the front of the machine so that it is on PIN FEED.
8. Close the lid. The paper is now loaded. If you had any difficulty following the procedure, figure 2-17 will help. It shows a side view of the overall paper path for rear paper feed.

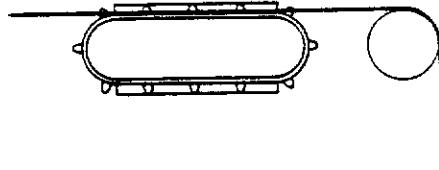


Figure 2-17. Side View of Paper Path, Bottom Paper Feed.

SETTING THE TOP OF FORM

If you've had experience with other printers, you will be pleasantly surprised at the stability of the Tri Printer's top of form feature, and you'll be delighted with the consistent positioning of the top line on your printed pages.

To set the top of form, roll the platen forward until the perforations in the paper are about even with the top of the ribbon. When you turn on the power later, the printer will remember the position of the paper, and each time it advances to a new page, it will automatically stop at the same position.

As long as the power remains on, the printing on each page will begin at exactly the same distance from the perforations. Make sure that the printer has advanced to the next top of form each time you turn the power off, and you won't have to think about setting the top of form again until the paper runs out! If the power is ever turned off while the printer is in mid-page, the top of form setting will be lost. All you have to do to reset it is to position the platen as described above, with the power off.

THE POWER FUSE

There is a fuse holder at the left rear of the printer, inside the cover. Figure 2-18 shows how to remove the fuse, using a non-metallic object such as a toothpick. Fuses occasionally fail just from aging. If the fuse blows, you may replace it once; if it immediately blows again, it is best to refer the problem to a competent service technician.

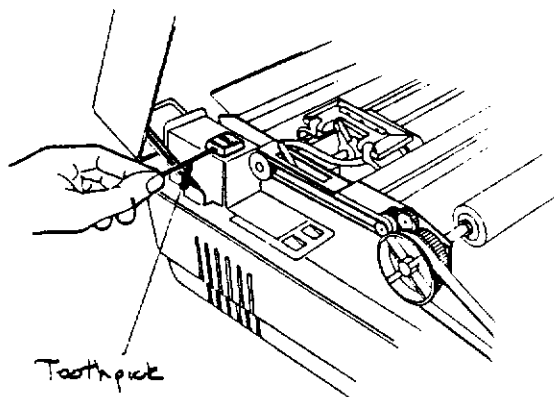


Figure 2-18. Removing the Fuse.

YOUR TRI PRINTER'S OPERATING CONTROLS AND STATUS INDICATORS

Let's take a closer look at the control panel of the printer, shown in figure 2-19. There are 11 buttons and a 3-character display. The 11 buttons can control virtually all of the functions that the machine performs, including those that are controlled on most printers by internal DIP switches. Your Tri Printer has no DIP switches at all. If you've had experience setting up printers, you will recognize that freedom from DIP switches is a major advantage.



Figure 2-19. The Printer Control Panel.

The functions of the control panel can be broken down into three categories.

1. Operating Controls

2. Status Indicators
3. Function Settings

The operating controls and status indicators are both used for day-to-day operation, and are described below.

Function settings let you control such things as horizontal pitch control, number of data bits used, and a special diagnostic tool called hex dump. Most programs that are designed to work with a Macintosh control these functions automatically.

Since you will use the function settings less frequently than the operating controls and status indicators, we'll postpone discussing function settings until chapter 4. Operating controls and function settings are described in the following sections.

Operating Controls

The operating controls are the most important because you'll use them daily. The four operating controls are:

ONLINE

Pressing the ONLINE button lets you switch the connection to the computer alternately on and off. When the printer is hooked up to the computer, the display will read

OFFL

and the printer will accept input from the computer.

The next push of the ONLINE button switches the printer OFFLINE, and the display reads

ONL

When you first turn on the power to the printer, it enters the ONLINE state. If you prefer, the printer can begin in the OFFLINE state. See the description of Function 30 in chapter 4.

TEST

When you press the Test button, the printer prints an example of its currently selected typeface. See Testing Your Printer, later in this chapter. TEST only works when the printer is OFFLINE.

TOF

Stands for Top of Form. When you press TOF, the paper advances to the top of the next page. TOF only works when the printer is OFFLINE.

LF

Stands for Line Feed. When you press LF, the paper advances to the next line. LF only works when the printer is OFFLINE.

Status Indicators

Status indicators inform you of certain choices that have been previously made, such as the form length, the type font, and the number of characters per inch.

FORMS

When you press this button, the status display shows the length of the paper the printer is set for. The display is in units of 1/4". An 11" size is displayed as 44; a 14" length is displayed as 56.

FONT

When you press the FONT button, the status display shows either U-1 or U-2. 1 means draft quality, while 2 means letter quality.

CPI

Pressing the CPI button displays the number of characters per inch.

LPI

If you press the LPI button, the status display shows the current line feed size, in units of 1/144". For example, 6 lines per inch, the most common value, is displayed as 24.

CONTROL PANEL FIRST AID

If someone presses the wrong button on the control panel, you may see some unexpected things on the display. Here are some examples, with a quick way out of each. The object in each case is to get the display to look like this.

OFFL

Case 1:

The display looks like

FA00 (blinking)

The Fix:

Press ENTER.

Case 2:

The display looks like

F.03 (or F followed by any number, not blinking)

The Fix:

Press ENTER twice.

Case 3:

The display looks like

U-1 (or U followed by any number, blinking)

The Fix:

Press ENTER.

Case 4:

The display looks like

A.01 (or A followed by any number)

The Fix:

Read the section on alarms codes in chapter 6.

Case 5:

The display looks like

U-1 (or U followed by any number, not blinking)

The Fix:

Press RESET twice, then press ENTER twice.

Case 6:

The display looks like

HE.1 (or HE followed by any number, blinking)

The Fix:

Press ONLINE. The display will change to

OFFL

Then press MODE. The display will change to

F.00 (blinking)

Next, press 1 and 3, then ENTER. The display will change to

U-2 or U-3

Press 1, then ENTER.

NOTE: If you can afford to discard the contents of the buffer, that is, characters sent to the printer but not yet printed, another fix for case 6 is to turn the printer off, then on.

Case 7:

The display looks like:

CHA

The Fix:

Press 3, then 3, then ENTER. The display will change to

d-2

Press RESET.

TESTING YOUR TRI PRINTER

Now, to operate the machine! Before you turn on the printer, make sure the power cord is connected, and the top cover is securely closed. These things done, turn on the printer, and follow these simple steps to run the printer's self-test.

1. Look at the front panel display. If it looks like this

OFFL

continue with step 2. If it looks like this

OnL

press the ONLINE button to put it offline and proceed to step 2.

2. Press the TEST button. The display will change to

d-1

3. This display is telling you the number of the test function the printer is set to perform. You'll learn how to change its setting in chapter 4, to perform other tests. Press

ONLINE, and the test function will begin. The display remains the same, except that it blinks while the printing is in progress.

4. To stop the printing, press ONLINE at any time. After a short delay, the printer will stop and the display will remain the same, but it will stop blinking.
5. To resume the test, just press ONLINE. For settings 1, 2 and 3, you may stop and resume the printout as often as you wish by pressing ONLINE. Settings 4 and 5 will not resume; you have to start them over from step 1.
6. To end the test procedure, press RESET, and the display will change to

OFFL

You are now ready to begin printing.

CHAPTER 3 USING THE TRI PRINTER MODEL 40 WITH YOUR APPLE COMPUTER

The Tri Printer Model 40 is a serial printer that is designed to work with the Macintosh. It can be used with any computer that has a serial interface, but it is most readily suited for use with the Macintosh and Macintosh XL, as well as the Apple IIc.

THE MODEL 40 MEETS YOUR MACINTOSH

To work with the Apple Macintosh and Macintosh XL computers, a printer must operate in a special high-quality graphics mode, because in normal operation, the Macintosh transmits characters to a printer in an unusual way.

Most computers transmit a character by sending the ASCII code for the character (a binary number) to the printer. The printer interprets the ASCII code as a command to print the corresponding character. How that character looks depends on the design of the printer. A different printer, on receiving the same ASCII code, will print the same character, but the style of the character may differ.

The Macintosh works quite differently. Instead of sending ASCII codes to the printer to tell the printer to print a character, the Macintosh sends the dot-by-dot graphic image of the character, a column at a time. The computer, rather than the printer, determines the appearance of the characters.

To clarify this distinction, table 3-1 compares what it takes to send a single character to the printer, using the two methods. Both the ASCII codes and the graphics data are given in the hexadecimal number system, which is discussed in chapter 5. Notice how much more information the computer has to send in the graphics mode. A single number specifies the letter in ASCII; it takes 8 numbers, one for each column, to describe the same letter graphically.

Character	ASCII Code	Graphics Codes
A	\$41	\$70, \$14, \$12, \$11, \$12, \$14, \$70, \$00
P	\$50	\$00, \$7F, \$09, \$09, \$09, \$09, \$06, \$00

Table 3-1. Comparison of Graphics and ASCII Character Data.

In this way, by using the printer in the graphics mode, the

Macintosh controls exactly the appearance of each letter printed. This clever approach makes it possible for Macwrite, the Macintosh word processor, to print many different styles, or fonts, of type, in a variety of sizes.

To be usable with the Macintosh, a printer must be able to print high quality graphic images as well as letters and numbers. That's where the Tri Printer Model 40 really excels. Its extra ruggedness enables it to maintain top performance hour after hour in graphics service.

The Macintosh Connection

To set up your Model 40 to work with the Macintosh, you'll need an Imagewriter cable, Apple part number 590-0169. Ask your dealer. If you wish, you can have a cable custom-made at many computer stores at a reasonable cost. If you order a custom cable, it should be wired as shown in figure 3-1.

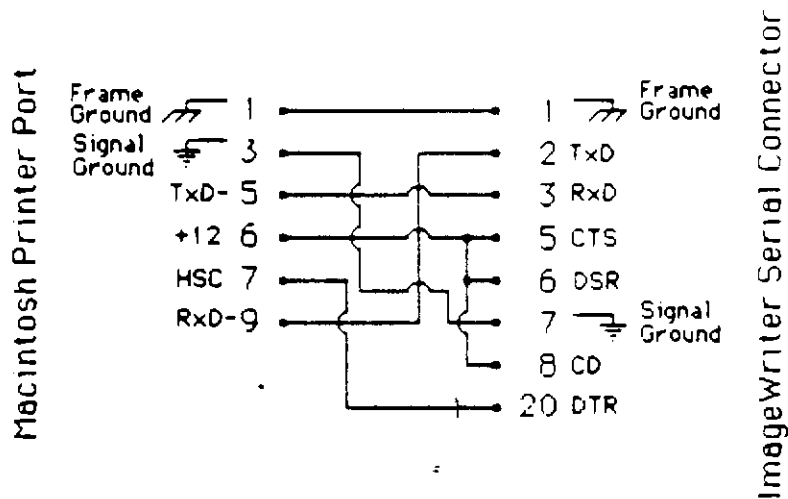


Figure 3-1. Macintosh Cable Connections.

The smaller connector at the Macintosh end is called a 9-pin connector, even though it may have as few as five pins installed. The connector for the printer end is called a 25-pin connector, even though it may have as few as four pins installed.

Once you have the proper cable, the rest is easy. First, plug the 9-pin connector into the printer connector on the back of the Macintosh. If you face the back of the computer, the printer connector is the third connector from the left. The symbol shown in figure 3-2 is molded in the case above the connector. Secure the cable to the computer by turning the cable lock screws clockwise until they are tight.



Figure 3-2. Printer Symbol Molded on the Macintosh Case.

Next, plug the 25-pin connector into the interface connector on the back of the printer. Secure the cable at the printer end by turning the cable lock screws clockwise until they are tight.

That's all there is to it! All you have to do now is follow the instructions in your Macintosh manual. You'll get clean, crisp printing with Macwrite, and your Macpaint pictures will be beautifully detailed.

If your Macintosh manual tells you to set something called DIP switches, remember that the Model 40 has no DIP switches. The advanced control features on the front panel take the place of DIP switches. Read the manual carefully to be sure that you understand what the DIP switch is supposed to do, then look up the same function in Chapter 4.

HIGH-PERFORMANCE PRINTING FOR YOUR APPLE IIc

The Apple IIc computer comes equipped with a serial printer interface that's just right for your Tri Printer Model 40. Unlike the Macintosh, the Apple IIc sends conventional ASCII codes to the printer. The Tri Printer use this type of input in both its DP (draft print) and LQ (letter quality) modes.

Hooking Up to Your Apple IIc

To use your Model 40 with an Apple IIc, you'll need an Apple IIc printer cable, Apple part number 590-0191-A, or its equivalent, available from your dealer. If you wish, you can have a cable custom-made at many computer stores at a reasonable cost. If you order a custom cable, it should be wired as shown in figure 3-3.

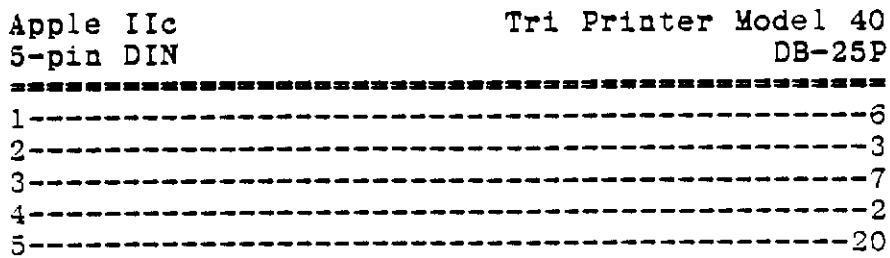


Figure 3-3. Apple IIc Cable Connections.

Now, connect the DIN connector (the round connector) to the printer connector on the back of the Apple IIc, and the DB-25 connector to the interface connector on the back of the Model 40. Now, just follow the instructions in your Apple IIc manual that tell how to use the Imagewriter printer.

CHAPTER 4

FUNCTION SETTINGS: GETTING IT UNDER CONTROL

The Tri Printer Model 40's unique control panel does much more than control the printer's operation. In this chapter, you'll learn how to use the panel's powerful function setting mode to gain complete mastery over your printer. With the Model 40, you can control many useful features that are difficult to control or omitted altogether on other printers.

Later in the chapter, there are three listings of the function settings. First, a list grouped by category, with a brief description. Second, you'll find another brief list arranged in numerical order, and finally, a complete description of each function, in numerical order.

HOW TO SET TRI PRINTER FUNCTIONS FROM THE CONTROL PANEL

The following procedure can be used to set most of the printer functions from the front panel. Be sure the printer is turned on, but not printing.

1. Look at the front panel display. If it looks like this

OFFL

continue with step 2. If it looks like this

OnL

press the ONLINE button.

NOTE

Whenever you want to set a function, you must begin by putting the printer into the offline state.

2. Press the MODE pushbutton. The display will change to

F.00 (blinking)

NOTE:

When the display blinks, it means that the printer is asking you for information. In this case, the blinking F.00 means that it is asking you for the number of the function you want to set.

3. At this point, you enter the number of the function you want to set. Let's set the horizontal pitch, function 5, to 17.1 characters per inch. Press 5. The display will change to

F.05

4. Press ENTER. The display will change to

U.02 (blinking)

NOTE:

This display is telling you two things. As before, the blinking display means the printer is asking for information. In this case, the U means it wants a menu selection. In addition, it is telling you the current setting: 2.

HELPFUL HINT:

If you do not want to change the setting, the quickest way to exit from the function and get back to normal operation is to simply press ENTER

5. Press 1, then 7, then ENTER. The display will change to

OFFL

6. You have changed function 5's setting to 17, which changes the printer's horizontal pitch from 12 to 17.1 characters per inch. All that remains to resume printing is to press ONLINE. The display will change to

OnL

That's all there is to it. You're ready to print at the new pitch.

ONE MORE TIME

Let's review those steps once more without the pictures.

1. Be sure the printer is OFFLINE.
2. Press MODE.
3. Enter the number of the function you want to change.
4. Press ENTER.
5. Enter the number of the setting you want to make. Press ENTER.
6. Put the printer online, and you're all set.

Remember, if you find that the setting is already what you want, just press ENTER at step 5.

FUNCTIONS GROUPED BY CATEGORY

1. Interface Characteristics.

Characteristic	Function No.	Page
Protocol selection: XON/XOFF or DTR		50
Data transmission rate (baud rate) selection		51
Character code length selection - 7 or 8 bits.		52
Parity bit: none, even, odd, ignore		53
Stop bit: 1, 2		54

2. Printing Characteristics

Characteristic	Function No.	Page
Character set selection - countries.		41
Font selection: DP or LQ		4
Page length selection.		3
Horizontal pitch selection.		5
Line spacing.		6
Form width.		10
Left margin setting.		11
Right margin setting.		12
Automatic line feed after carriage return.		26
Print direction: uni- or bidirectional.		34
Zero character style: slashed or open		48
Print command code select: CR or CR, LF, VT, FF, US		46
Print start after: code, code+buffer, code+buffer+1.		31
Do when buffer full: print, print+CR, print+CR+LF .		47
Paper feed speed: high or low		36

3. Control Code Interpretation

Characteristic	Function No.	Page
Invalid function: ignore or space.		21
BEL: ignore or buzz.		23
BS: ignore or backspace.		24
LF and VT: add carriage return?.		25
CR: add line feed?.		26
DC1/DC3: ignore or printer select/deselect		27
CAN: ignore or clear buffer.		28

4. Miscellaneous Functions

Characteristic	Function No.	Page
Test: 3 tests, initialize, print function status . . .	2	
Hex dump: print all chars in hex and ASCII	13	
Initial state: on line or off line	30	
Switch buzzer ON/OFF	32	
Alarm buzzer ON/OFF	33	
Optional memory area: data buffer, download or both.	14	

FUNCTIONS LISTED IN NUMERICAL ORDER

Function Number	Characteristic	Page
2	Test: 3 tests, initialize, print function status	
3	Page length selection	
4	Font selection: DP or LQ	
5	Horizontal pitch selection	
6	Line spacing	
10	Form width	
11	Left margin setting	
12	Right margin setting	
13	Hex dump: print all chars in hex and ASCII	
14	Optional memory area: data buffer, download or both	
20	Character code length: 7 or 8 bits - see 52	
21	Invalid function: ignore or space	
23	BEL: ignore or buzz	
24	BS: ignore or backspace	
25	LF and VT: add carriage return?	
26	CR: add line feed?	
27	DC1/DC3: ignore or printer select/deselect	
28	CAN: ignore or clear buffer	
30	Initial state: on line or off line	
31	Print start after: code, code+buffer, code+buffer+1	
32	Switch buzzer ON/OFF	
33	Alarm buzzer ON/OFF	
34	Print direction: uni- or bidirectional	
36	Paper feed speed: high or low	
41	Character set selection - languages	
46	Print command code select: CR or CR, LF, VT, FF, US	
47	Do when buffer full: print, print+CR, print+CR+LF	
48	Zero character style: slashed or open	
50	Protocol selection: XON/XOFF or DTR	
51	Data transmission rate (baud rate) selection	
52	Character code length: 7 or 8 bits - see 20	
53	Parity bit: none, even, odd, ignore	
54	Stop bit: 1, 2	

DETAILED DESCRIPTION OF FUNCTION SETTINGS

On the following pages, you'll find a list of all of the functions that are adjustable from the front panel. Following the description of each function is a list of the menu choices you may make for that function.

F.02

FUNCTION 2 - Test

This function selects which of five events will occur when you use the TEST button on the control panel. This function can be used for three different purposes. First, you can use it to run your choice of three tests that demonstrate your printer's operation. Second, you can use it to reset all of the printer's functions to their factory-set values. Third, and probably most important, you can use it to print out all of the current function settings.

The three available tests and their menu settings are:

1-Character Set Test

When you select menu setting 1, running the test will cause the printer to print all of the characters in the currently selected character set (as set by function 41) in either the DP or LQ mode, as currently set by function 4. The length of the printed line will be controlled by the form width (function 10) and the margins (functions 11 and 12). The characters are printed in a sliding pattern; that is, each line will begin with the next character in the sequence.

2-Character

When you select menu setting 2, running the test will cause the printer to repeatedly print any single character that you specify at the time you run the test. As in test 1, the character set, margins and font are controlled by other functions.

3-Mixed Characters

In this test a sliding pattern similar to test 1 is performed except that the characters are printed in assorted sizes and styles, such as extended, bold, vertically expanded, italic, underline, superscript and subscript.

4-Initialization

When you select and run this setting, all of the function settings previously stored are restored to the factory settings. This may be used to quickly and easily restore the standard settings after you have made several changes.

5-Menu Settings

When you make this choice, running the test causes the

current settings for each function to be printed.

NOTE:

After you have set up the printer for a special purpose, it's a good idea to use Test 5 to make a printed copy of the settings, write down the purpose and the date on the page and save it for future use. If you ever need to call CIE or your dealer for help with a printer malfunction, run Test 5 before you call, and keep the printout on hand during the call.

F.03

FUNCTION 3 - FORM LENGTH

You'll use this function to enter the form length; that is, the paper height. You'll have to do a little arithmetic, because the length is expressed in units of 1/4 inch. You can set it to any value from 1/4 to 255/4 (63 3/4) inches. The factory setting is 44 (11inches). For 14 inch legal size paper, the correct setting is 56.

F.04

FUNCTION 4 - FONT

This function lets you select either the data processing (DP) font, adequate for most purposes, or, where appearance is of paramount importance, the letter quality (LQ) font. The DP font is menu setting 1 and the LQ font is 2. The factory setting is 1, DP font.

F.05

FUNCTION 5 - CPI

With this function, you can set the number of characters per inch. There are eight menu choices:

- 1 Proportional - 1
- 2 Proportional - 2
- 9 9.2 CPI
- 10 10 CPI
- 12 12 CPI
- 13 13.2 CPI
- 15 15 CPI
- 17 17.1 CPI

The factory setting is 12, elite pitch.

F.06

FUNCTION 6 - LINE FEED WIDTH

If you want to change the number of printed lines per inch on the paper, this is the function to use. You'll have to do some arithmetic, because the units are increments of 1/144 inch. The allowed settings range from 1/144 to 99/144 inches. The factory setting is 24 (1/6 inch).

F.10

JUNCTION 10 - FORM WIDTH

This function lets you set the form width. The form width is the distance from the leftmost to the rightmost carriage position. The units are in increments of 1/10 inch. The factory setting is 136 (13.6 inches). Note that when the pitch is 10CPI the setting of this function equals the number of characters per line.

F.11

FUNCTION 11 - LEFT MARGIN

You will use this function to set the left margin. The units are in increments of 1/10 inch, measured from the leftmost carriage position. The factory setting is 0 inches. You may use any setting up to the setting of the right margin. If you try to select a number larger than the right margin setting, the printer will beep twice.

F.12

FUNCTION 12 - RIGHT MARGIN

You can set the right margin using this function. The units are in increments of 1/10 inch, measured from the leftmost carriage position. The factory setting is 136/10 inch. You may use any setting greater than the left margin setting, provided that it is less than the form width. If you try to select a number smaller than the left margin or larger than the form width, the printer will beep twice.

F.13

FUNCTION 13 - HEX DUMP

When the printer is in the hex dump mode, it prints any codes it receives from the computer in two groups: on the left, the hexadecimal value for each code, and on the right, the ASCII

printable character that corresponds to the code. If a code is not printable, its hexadecimal value is printed, but its position in the ASCII group at the right is filled by a period.

There are two selectable modes of operation for this function. In mode 1 all codes the printer receives, including control, codes are printed in hexadecimal. In mode 2 all received codes are printed as in mode 1, but the printer starts a new line each time it receives a LF, VT, FF, or CR code.

The HEX dump mode can only be entered from the front panel. This function/menu setting cannot be saved permanently in memory. When it is first turned on, the printer will always be in the normal print mode.

There are three menu selections:

- 1-Normal print mode
- 2-HEX dump mode 1
- 3-HEX dump mode 2

When the printer is placed online in the hex dump mode, the status display will show which hex dump mode is in use. HE1 indicates HEX mode 1 and HE2 indicates mode 2.

Regardless of the current printer setup the HEX codes and received data is printed in the DP mode at 10CPI and 6 LPI. The printout is 70 columns wide. Printing starts at the left margin and begins with a four digit hexadecimal count of the printed codes. Sixteen hexadecimal codes will then follow, then the corresponding sixteen ASCII graphic character. If hex dump mode 2 is in use and the printer receives a LF, VT, FF, or CR code, the line will end with fewer than 16 characters.

Figure 4-1 illustrates hex dump mode 1, and figure 4-2 shows hex dump mode 2.

0000	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
0010	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
0020	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F	!"#\$%&'()*+,-./
0030	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	0123456789:;<=>?
0040	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	@ABCDEFGHIJKLMNO
0050	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	PQRSTUVWXYZ[^_
0060	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	`abcdefgijklmno
0070	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F	pqrstuvwxyz{ }~.
0080	80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
0090	90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F
00A0	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF	!"#\$%&'()*+,-./
00B0	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF	0123456789:;<=>?
00C0	C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF	@ABCDEFGHIJKLMNO
00D0	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	DA	DB	DC	DD	DE	DF	PQRSTUVWXYZ[^_
00E0	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	EA	EB	EC	ED	EE	EF	`abcdefgijklmno
00F0	F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	FA	FB	FC	FD	FE	FF	pqrstuvwxyz{ }~.

Figure 4-1. Hex Dump 1.

```

0000 00 01 02 03 04 05 06 07 08 09 0A .....
000B 0B
000C 0C
000D 0D
000E 0E 0F 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D .....
001E 1E 1F 20 21 22 23 24 25 26 27 28 29 2A 2B 2C 2D .. !"#$%&'()*+,-
002E 2E 2F 30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D ./0123456789:;<=
003E 3E 3F 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D >?@ABCDEFGHIJKLM
004E 4E 4F 50 51 52 53 54 55 56 57 58 59 5A 5B 5C 5D NOPQRSTUVWXYZ[\]
005E 5E 5F 60 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D ^_`abcdefghijklm
006E 6E 6F 70 71 72 73 74 75 76 77 78 79 7A 7B 7C 7D nopqrstuvwxyz(!)
007E 7E 7F 80 81 82 83 84 85 86 87 88 89 8A
008B 8B
008C 8C
008D 8D
008E 8E 8F 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D .....
009E 9E 9F A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD .. !"#$%&'()*+,-
00AE AE AF B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD ./0123456789:;<=
00BE BE BF C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD >?@ABCDEFGHIJKLM
00CE CE CF D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD NOPQRSTUVWXYZ[\]
00DE DE DF E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED ^_`abcdefghijklm
00EE EE EF F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD nopqrstuvwxyz(!)
00FE FE FF

```

Figure 4-2. Hex Dump 2.

F.14

FUNCTION 14 - OPTIONAL MEMORY AREA

There is an optional 16K RAM memory inside the font cartridge. You can use this function to determine how the optional memory area will be used. Any change you make will not take effect until the power is next turned on. The following four menu settings are available. The factory setting is 1.

- 1-Not used
- 2-Extended input buffer (adds to the internal 2K buffer)
- 3-Down loading buffer (see downloading later this chapter)
- 4-Combine expanded input buffer and downloading buffer

F.20

FUNCTION 20 - DATA BITS

This function may be used to set the length of a character, for the printer's internal processing purposes, to 7 or 8 bits. Function 52 sets the length of the incoming data to match the character length transmitted by the host computer. When Function 52 is set to allow 8 bits, this function instructs the printer to ignore the 8th bit. If function 52 is set to 7, this function MUST be set to 2, 7 bits. The 8-bit setting should be used for both functions unless there is a strong reason to do otherwise. The factory setting for this function is 1, 8 bits. The 8-bit setting is necessary if you want the printer to produce graphics. The menu settings are:

- 1-8 bits
- 2-7 bits

F.21

FUNCTION 21 - INVALID CODE RESPONSE

This function lets you select how the printer will respond to invalid control codes (that is, codes that are not recognized by the printer). See chapter 5 for a list of valid control codes. There are two menu choices. The factory setting is 1, ignore invalid control codes. If this function is set to 1, the printer's audible alarm will beep at each invalid code, if Function 33 is set to 1, beeper on.

- 1-Ignore
- 2-Change to a space

F.23

FUNCTION 23 - BEL CODE

When this function is set to 1, the printer beeps whenever it receives a BEL code. When it is set to 2, the BEL code has no effect. The factory setting is 1, BEL code enabled.

- 1-Enabled
- 2-Ignored

F.24

FUNCTION 24 - BS CODE

You can use this function to select how the printer will interpret a backspace (BS). When it is set to 2, the BS code has no effect. The factory setting is 1, BS code enabled.

- 1-Enabled
- 2-Ignored

F.25

FUNCTION 25 - LF AND VT CODE

This function lets you select how the line feed (LF) code and the vertical tab (VT) code are interpreted. Both are set at once, to execute either a line feed and carriage return or a line feed only. The factory setting is 1, line feed with carriage return.

- 1-LF and CR
- 2-LF only

F.26

FUNCTION 26 - CR CODE

This function determines how a carriage return (CR) code is

interpreted. It can either be a carriage return and line feed or a carriage return only. The factory setting is 1, carriage return only.

- 1-CR only
- 2-CR and LF

F.27

FUNCTION 27 - DC1/DC3 CODE

This function lets you select how the printer interprets a device control 1 (DC1) code and a device control 3 (DC3) code. If DC1 and DC3 are enabled, they act as a remote online/offline switch for the printer. DC1 puts the printer online, DC3 puts it offline. The factory setting is 2, DC1/DC3 code ignored. Note that this function pertains to DC1 and DC3 codes received by the printer. It does not affect the manner in which the printer sends DC1 and DC3 to the computer. See function 50.

- 1-Enabled
- 2-Ignored

F.28

FUNCTION 28 - CAN CODE

This function allows you to select whether the printer will respond to a CAN (Cancel) control code. If the CAN code is enabled, sending a CAN code to the printer clears all of the printable data (not control codes) in the buffer since the last print start code (print start codes are set by function 46). The factory setting is 1, CAN code enabled.

- 1-Enabled
- 2-Ignored

F.30

FUNCTION 30 - ON/OFF LINE

You may use this function to select whether the printer starts out online or offline when it is first turned on. The factory setting is 2. This makes the printer go into the online state when turned ON.

- 1-Offline
- 2-Online

F.31

FUNCTION 31 - PRINT START

The printer stores characters in its line buffer until some event occurs to start it printing. This function lets you select what events cause printing to start. By selecting the first

setting, printing can be started by a control code (the code specified by function 46) or when the buffer is full and a character code is received. The second setting starts printing when the control code is received or when the buffer is full. The third setting allows printing to be started by the control code only. The factory menu setting is 1, control code or buffer full+1.

- 1-Start by control code or buffer full+1
- 2-Start by control code or buffer full
- 3-Start by control code

F.32

FUNCTION 32 - SWITCH TONE

This function lets you select whether the printer beeps each time a front panel pushbutton is depressed. The factory setting is 1, ON.

- 1-ON
- 2-OFF

F.33

FUNCTION 33 - ALARM

You can turn the beeper on or off using this function. The factory setting is 1, the beeper on.

- 1-ON
- 2-OFF

F.34

FUNCTION 34 - PRINT DIRECTION

This function lets you select the direction of printing, either unidirectional or bidirectional. The factory setting is 1, bidirectional.

- 1-Bidirectional
- 2-Unidirectional

F.35

FUNCTION 36 - PAPER SLEW SPEED

This function lets you select either a high or low speed paper feed rate. The factory setting is 1, high speed, 12 inches per second.

- 1-High speed 12IPS
- 2-Low speed 8IPS

F41

FUNCTION 41 - CHARACTER SET

Using this function, you can choose any of eleven character sets. The USA character set is 96 character ASCII. The nine remaining international character sets are ASCII with modifications to include the different characters of each alphabet. A sample of the international character sets is shown in Appendix A. The factory setting is USA (ASCII).

- 1-USA (ASCII)
- 2-Italian
- 3-USA (ASCII)
- 4-British
- 5-German
- 6-Swedish
- 7-French
- 8-Spanish
- 9-Japanese
- 10-Danish
- 11-French Canadian

F46

FUNCTION 46 - PRINT COMMAND MODE

The printer stores characters in its buffer until some event occurs to start it printing. One of the events is receiving one or more control codes. See function 31. This function lets you select the control code(s) that start printing. The factory menu setting is 2.

- 1-CR
- 2-CR, LF, VT, FF and US

F47

FUNCTION 47 - FULL LINE BUFFER

This function lets you select what the printer will do after it prints the contents of the buffer. It can either execute both CR and LF or only CR. Default is CR only.

- 1-Carriage Return
- 2-Carriage Return and Line Feed

F.48

FUNCTION 48 - ZERO CHARACTER FONT

With this function, you can choose whether the zero has a slash through it or not. The factory setting is 2, without a slash.

- 1-With slash
- 2-Without slash

F.50

FUNCTION 50 - PROTOCOL

This function lets you choose between two communications protocols: XON/XOFF or DTR Ready/Busy. The factory setting is 3, DTR Ready/Busy protocol.

- 3-DTR Ready Busy
- 4-XON/XOFF

F.51

FUNCTION 51 - BAUD RATE

You can set the data transmission rate using this function. The factory menu setting is 9600BPS.

- 1-9600 BPS
- 2-4800 BPS
- 3-2400 BPS
- 4-1200 BPS
- 5-600 BPS
- 6-300 BPS
- 7-150 BPS

F.52

FUNCTION 52 - DATA LENGTH (External)

This function may be used to set the length of an incoming character to 7 or 8 bits. The length should be set to match the length of the data being transmitted to the printer by the computer. The data length must be 8 bits if you want to use graphics. The Macintosh requires 8-bit transmission. The factory setting for this function is 8, 8 bits. Function 20 sets the printer's internal data length, and may be set to 7 bits whether this function is set to 7 or 8. If this function is set to 7, function 20 MUST be set to 2, 7 bits. The 8-bit setting should be used for both functions unless there is a strong reason to do otherwise. The menu settings are:

- 8-8bits
- 7-7bits

F.53

FUNCTION 53 - PARITY BIT

You can use this function to enable and select parity. The factory setting is None (no parity). If the parity is selected as ignored, the data transmitted by the printer is set with even parity.

- 1-None
- 2-Odd
- 3-Even
- 4-Ignored

F.54

FUNCTION 54 - STOP BITS

This function lets you set the number of stop bits per data word. Regardless of the setting of this function, receive data is checked for only one stop bit. The factory setting is 1 stop bit.

- 1-1bit
- 2-2bits



CHAPTER 5 LIGHTS, CAMERA, ACTION!

In this chapter, you'll learn how your computer can control the Tri Printer Model 40's many outstanding features, using the magic of ASCII control codes and escape sequences.

A QUICK LOOK AT ASCII CODES

ASCII stands for the American Standard Code for Information Interchange. There is a complete ASCII code chart in Appendix A. ASCII is used for most communication between microcomputers and their peripherals, such as modems, printers and terminals.

ASCII standard codes are binary numbers that range from 0000000 to 1111111. In the decimal system, these are the numbers between 0 and 127. The ASCII standard specifies what each number in that range means when computers communicate.

In the ASCII standard, nearly all of the numbers above 32 (0100000 binary) represent letters, numbers and punctuation marks. For example, 65 (1000001 binary) is capital "A", 66 is capital "B", and so on. Lower case letters begin with 97, which stands for "a", and ends with 122, for "z". The numbers start with 48, for "0", and end with 57, for "9".

All of the remaining numbers above 32 are punctuation marks or mathematical symbols, except 127. 127 doesn't print anything anymore, but it was once used to "erase" ASCII characters punched as holes in paper tape. With punched paper tape, the only way to "erase" a character was to cross it out by punching all possible holes in that character's space: 1111111, which is decimal 127.

The numbers below 32 do not represent printed symbols. These special codes are called control codes. They are used to control the equipment that receives them. For example, three control codes used by most printers are tab, backspace and carriage return. Not all of the 32 available control codes are used by any one peripheral. The codes used by the Tri Printer Model 40 are described later in this chapter.

What About The Eighth Bit?

Microcomputers usually communicate in 8-bit groups called bytes. While the ASCII standard only uses seven bits, it does not require the eighth bit to be a zero. Note that if we allow bit 8 to be a one, the other seven bits can assume all of the same combinations as described above. Thus there are 128 more

codes possible with bit 8 high, for a total of 256. Though these additional codes are not part of the ASCII standard, they are often called extended ASCII, or high ASCII.

The Model 40 is intended use 8-bit codes. It uses some of the high ASCII codes to select optional custom character sets that you can program. Downloading special character sets is discussed later in this chapter. Eight bits are also needed when your printer draws pictures in the graphics mode.

WHAT'S AN ESCAPE SEQUENCE?

There is an additional series of control codes used for more complex functions. These are called Escape sequences, because they always begin with ASCII control code 27, which is called Escape, abbreviated ESC.

An escape sequence is a succession of two or more ASCII codes that begins with the ASCII ESC (escape) control code. The escape code tells the printer that what immediately follows should not be interpreted normally.

Many escape sequences include a variable, a value that can be chosen to fit a particular purpose. For example, the escape sequence to set a horizontal tab includes a variable (a number) that can set a tab to any of up to 235 positions.

Using variables means that each escape sequence can produce many different results. In fact, you can choose among thousands of different operating conditions with just twenty or thirty escape sequences. You'll find a complete description of the Tri Printer Model 40's escape sequences in chapter 6.

MODEL 40 CONTROL CODES

The Tri Printer Model 40 recognizes the following control codes. The first number is the decimal value of the code; the number in parentheses is the hexadecimal value. The dollar sign means that the number that follows is hexadecimal.

NUL

0 (\$00) Null

No operation. The printer recognizes NUL as a valid code, but performs no action when it is received.

EOT

4 (\$04) End of Transmission

If the printer is engaged in downloading a custom character set (see section on downloading later in this chapter) it stops downloading when it receives this code.

BEL

7 (\$07) Bell

When the printer receives this code, it generates an

audible tone. NOTE: The audible tone may be disabled from the control panel by selecting setting 2 for Function 23. See chapter 4.

BS

8 (\$08) Backspace

Moves the print head one position to the left. If the next code is a printable character, the printer prints it over the last character previously printed, using the same horizontal pitch.

NOTE 1: The printer will ignore any control code (including another BS) that immediately follows.

NOTE 2: The backspace may be disabled from the control panel by selecting setting 2 for Function 24. See chapter 4.

HT

9 (\$09) Horizontal Tab

Advances the print head to the next horizontal tab position. If no horizontal tabs are set, the printer ignores this code.

LF

10 (\$0A) Line Feed

Advances the paper one line.

VT

11 (\$0B) Vertical Tab

Advances the paper to the next vertical tab position. If no vertical tabs are set, the printer ignores this code.

FF

12 (\$0C) Form Feed

Advances the paper to the top of the next page.

CR

13 (\$0D) Carriage Return

Returns the carriage to the first column position.

NOTE: The action of this code may be changed from the front panel to add an automatic line feed, by selecting setting 2 for Function 26. See chapter 4.

SO

14 (\$0E) Shift Out

Turns on the expanded character width mode.

SI

15 (\$0F) Shift In

Turns off the expanded character width mode.

DC1

17 (\$11) Device Control 1

If the printer is off line, this code puts it on line.

If the printer is already on line, DC1 is ignored. NOTE: DC1 and DC3 may be disabled from the front panel by selecting setting 2 for Function 27. See chapter 4.

DC3

19 (\$13) Device Control 3

If the printer is on line, this code puts it off line. If the printer is already off line, DC3 is ignored. NOTE: DC1 and DC3 may be disabled from the front panel by selecting setting 2 for Function 27. See chapter 4.

CAN

24 (\$18) Cancel

This code causes the printer to discard without printing all of the printable characters received since the last carriage return or line feed. Any control codes received during that interval are processed normally.

ESC

27 (\$1B) Escape

Multiple-character control codes are called escape sequences. Escape is always the first character in an escape sequence.

GS

29 (\$1D) Group Separator

Used to start a VFU (Vertical Format Unit) loading sequence. A VFU lists the vertical tabs and the form length for a particular form. For repetitive printing of forms, the VFU saves you the inconvenience of entering the format information each time you enter the data to be printed on the form. VFUs are discussed in detail in Chapter 7. See also RS and US.

RS

30 (\$1E) Record Separator

Used to end a VFU (Vertical Format Unit) loading sequence. See GS.

US

31 (\$1F) Unit Separator

This code is used for 2 purposes.

1. When printing within a VFU (Vertical Format Unit), to end a line and advance the paper to the next vertical tab position set in the VFU. If there are no vertical tabs set or there are none before the next top of form, US advances the paper to the next top of form.
2. To advance the paper a specified number of lines.

US must always be followed by a second character. The second character determines which of the functions above is performed.

1. If the second character is a letter between A and F, US

advances to the next tab in a VFU, and the letter specifies what page of the form you are requesting, as follows.

Letter	Page
A	Skip to next TOF or BOF
B	1
C	2
D	3
E	4
F	5

2. If the second character is a number between 1 and 15, US advances the paper that number of lines.

Vertical Format Units are discussed in detail in Chapter 7. See also GS.

Control codes not listed here are not defined for use with the Model 40. When the printer receives an undefined code, the printer will normally ignore the code and sound an audible alarm. NOTE: The printer's action in response to an undefined code may be changed from the front panel by selecting setting 2 for Function 21. See chapter 4. When setting 2 is selected, all undefined codes cause the printer to print a space.



CHAPTER 6

EXTENDED CONTROL CODES: THE GREAT ESCAPE

The control codes introduced in chapter 5 let your computer control all of your printer's basic operations: that is, operations that always work the same way. Whenever the computer sends the code for a line feed, the printer rolls the platen one line, moving the paper upward. A tab code makes the printer's carriage move to the next tab stop, every time.

This chapter is about a different kind of control codes: control codes that change the way your printer operates. They're called escape sequences. Escape sequences can be used to change the spacing between lines, to set or clear tab stops, to change character pitch, to set or clear margins, and much, much more.

AN OVERVIEW OF THE MODEL 40'S ESCAPE SEQUENCES

The Tri Printer Model 40 recognizes 24 escape sequences. In this chapter, they are organized into three categories: Print Controls, Character Controls and System Controls.

PRINT CONTROLS

The print control sequence functions are described in detail in the following items.

1. Printing Direction Controls

When the power is first turned on, and after printer reset, the printing direction is set in accordance with the setting of Function 34.

ESC<

(\$1B \$3C)

Places the printer in the bidirectional print mode, in which printing occurs in both directions. The bidirectional print mode continues until either the unidirectional print mode sequence (ESC>) is received or Function 34 is set to menu setting 1, unidirectional printing.

ESC>

(\$1B \$3E)

Places the printer in the unidirectional print mode, in which printing occurs only when the print head is moving left to right. The unidirectional print mode continues until either the bidirectional print mode sequence (ESC<) is received or Function 34 is set for menu setting 2, bidirectional printing.

2. Selection of character quality

When the power is first turned on and after a printer reset, the character quality is set according to the setting of Function 4.

ESC M

(\$1B \$4D)

Places the printer in the DP (Draft Print) mode. In the DP mode, the printer prints at a high speed, using low-density characters. The printer remains in this mode until the LQ mode sequence (ESC m) is received or Function 4 is set to 2.

ESC m

(\$1B \$6D)

Places the printer in the LQ (letter quality) mode. In the LQ mode, the printer prints at 1/4 the speed of the DP mode, using a character dot density double that of the DP mode both horizontally and vertically. The LQ mode continues until the DP mode sequence (ESC M) is received or Function 4 is set to 1.

3. Horizontal pitch controls

When the power is first turned on, or after printer reset, the horizontal pitch is determined by the setting of Function 5. When any of the following sequences is used to set the pitch, the pitch remains at the new setting until another horizontal pitch control sequence is received or Function 5 is set to another horizontal pitch.

ESC n

(\$1B \$6E)

Sets the horizontal pitch to 9.2 cpi.

ESC N

(\$1B \$4E)

Sets the horizontal pitch to 10 cpi.

ESC E

(\$1B \$45)

Sets the horizontal pitch to 12 cpi.

ESC e

(\$1B \$65)

Sets the horizontal pitch to 13.2 cpi.

ESC q

(\$1B \$71)

Sets the horizontal pitch to 15 cpi.

ESC Q

(\$1B \$51)

Sets the horizontal pitch to 17.1 cpi.

ESC P

(\$1B \$50)

Sets the horizontal pitch to Proportional 1.

ESC p

(\$1B \$70)

Sets the horizontal pitch to Proportional 2.

NOTE: Proportional 1 and Proportional 2 print the same in the character mode.

The table below shows the relationship between pitch and dot density in the graphics mode.

Horizontal Pitch	Density, dots per inch
9.2 cpi	72 dpi
10 cpi	80 dpi
12 cpi	96 dpi
13.2 cpi	110.8 dpi
15 cpi	120 dpi
17.1 cpi	130.9 dpi
Proportional - 1	160 dpi
Proportional - 2	144 dpi

4. Selection of character generator (CG)

The following sequences are used to switch between the internal character generator and the download character generator. When the power is first turned on, or after a printer reset, the internal character generator is selected.

ESC \$

(\$1B \$24)

Sets the internal CG mode. The internal CG mode continues until one of the download CG mode sequences (ESC ' or ESC *) is received.

ESC '

(\$1B \$27)

Selects download CG mode 1. In this mode, the printer responds to printable character codes in the range from \$20 - \$7E and \$A0 - \$FE when the data length is designated as 8 bits, and \$20 - \$7E when the data length is designated as 7 bits.

Download CG mode 1 continues until either internal CG mode sequence (ESC\$) or download CG mode 2 sequence (ESC*) is received.

ESC *

(\$1B \$2A)

Selects download CG mode 2. In this mode, the printer responds to printable character codes in the range from \$A0 - \$FE (\$20 - \$7E for the data) when the data length is designated as 7 bits. It is ignored when the data length is designated as 8 bits.

Download CG mode 2 continues until either the internal CG mode sequence (ESC\$) or the download CG mode 1 sequence (ESC ') is received.

5. Margin Settings

ESC L nnn

(S1B S4C ***)

Sets the left margin. In this sequence, nnn is a decimal number between 000 and Max. Column - 1 that represents the number of columns from the carriage's home position (H. P.).

The distance per column is determined by the horizontal pitch when the margin is set, and does not change if the horizontal pitch is changed thereafter.

The distance per column is equivalent to 10 cpi in the Proportional 1 mode, and 9 cpi in the Proportional 2 mode.

The left margin position becomes zero if you attempt to set it equal to or beyond the right margin.

The left margin is reset to the setting of Function 11 when the power is turned on and after a printer reset.

The left margin remains unchanged unless:

- o A new left margin is set using this sequence (ESC L).
- o The setting of Function 11 is changed.
- o The power is turned on again or the printer is reset.

ESC / nnn

(41B \$2F ***)

Sets the right margin. In this sequence, nnn is a decimal number between 001 and Max. Column that represents the number of columns from the carriage's home position (H. P.).

The distance per column is determined by the horizontal pitch when the margin is set, and does not change if the horizontal pitch is changed thereafter.

The distance per column is equivalent to 10 cpi in the Proportional 1 mode, and 9 cpi in the Proportional 2 mode.

The right margin is cleared if you attempt to set it equal to or beyond the left margin, or greater than the total line width.

The right margin is reset to the setting of Function 12 when the power is turned on and after a printer reset.

The right margin remains unchanged unless:

- o A new right margin is set using this sequence (ESC L).
- o The setting of Function 12 is changed.
- o The power is turned on again or the printer is reset.

6. Graphics Modes

The sequences described below are used to select the graphic mode.

Column-Oriented Graphics

ESC S nnnn
(\$1B \$53 ****)

ESC G nnnn
(\$1B \$47 ****)

ESC g nnn
(\$1B \$67 ***)

The first two sequences, ESC S and ESC G, act identically. Either is used to start a sequence of bytes that specify a pattern of dots. The decimal number of bytes to follow is nnnn. For example, if nnnn is 0024, the number of bytes to follow is 24. Each byte specifies the pattern in a single column of dots. The maximum number of bytes in the string is the largest 4-digit number, 9999, plus the 6 prefix characters, for a total of 10005 characters.

The third sequence, ESC g nnn, works in much the same way, except that nnn is 1/8 the number of bytes that follow. That is, if nnn is 024, the number of bytes that follow is 8 X 24, or 192, not 24. The maximum number of bytes is 8 X 999, or 7992, plus the five-byte prefix, for a total of 7997.

When the specified number of data bytes have been received, the printer automatically returns to the previous operating mode.

The following example illustrates the difference between the use of ESC S (or ESC G) and ESC g. The same 8 byte data string (\$41, \$42, \$43, \$44, \$45, \$46, \$47, \$48) is printed by both of the following sequences.

```
ESC S 0008 A B C D E F G H  
$1B $53 $30 $30 $30 $38 $41 $42 $43 $44 $45 $46 $47 $48
```

or

```
ESC g 001 A B C D E F G H  
$1B$ $67 $30 $30 $31 $41 $42 $43 $44 $45 $46 $47 $48
```

7. Line Feed Pitch Control

When the power is turned on and after a printer reset, the line feed pitch is determined by the setting of Function 6. If the line feed pitch is changed using one of the sequences below, the pitch remains at the new setting until either another line feed pitch control sequence is received or the setting of Function 6 is changed.

ESC A
(\$1B \$41)
Sets the line feed pitch to 1/6 in.

ESC B

(\$1B \$42)

Sets the line feed pitch is set to 1/8 in.

ESC T nn

(\$1B \$54 **)

Sets the line feed pitch to any value up to about 11/16 in., in steps of 1/144 in. The value of nn must be between 01 and 99. The size is nn/144 in.

For example, assume you want a line feed pitch of 1/4 in. Calculate the number of 144ths in 1/4: 36/144. Then find the ASCII codes for each digit of nn.

ESC T 3 6

\$1B \$54 \$33 \$36

8. Line feed direction control

When the power is first turned on, and after a printer reset, the line feed is set to the forward direction.

ESC f

(\$1B \$66)

Sets the line feed to forward.

The line feed direction remains the same until the reverse line feed sequence (ESC r) is received.

ESC r

(\$1B \$72)

Sets the line feed to reverse.

The line feed direction remains the same until the forward line feed sequence (ESC f) is received.

NOTE: The FF and LF pushbuttons on the control panel operate in the forward direction regardless of the line feed direction.

9. Dot Spacing

These sequences add spaces in multiples of 1 dot width between characters in the proportional spacing modes.

1 thru 6 dot space**ESC n**

(\$1B *)

Adds a space n dots wide before the next character. The value of n must be between 1 and 6. The sequence is valid for one character. A double dot space is added in the horizontally expanded mode.

Spacings greater than 6 dot widths may be produced by sending multiple sequences.

0 thru 9 dot space**ESC s n**

(\$1B \$73 *)

Adds a space n dots wide after each of the following

characters. The value of n must be between 0 and 9.
The spacing continues until:
o You send the sequence with 0 for n (ESC s 0).
o You change the horizontal pitch from proportional to another pitch.
The sequence is ignored if the horizontal pitch is not set to proportional.

10. VFU (Vertical Format Unit) Controls

The following sequences let you load a Vertical Format Unit (VFU) very easily. To use it after it is loaded, the printed information must contain a VT character to advance the paper to the next vertical tab position, and a US to advance to the next form. A VFU system for more complex forms appears in chapter 7, along with a discussion of VFU's in general.

A GS code clears VFU's loaded in this manner.

ESC v
(\$1B \$76)

ESC v .
(\$1B \$77 \$2E)
Both sequences set the TOF to the present position.

ESC v nn .
(\$1B \$77 ** \$2E)
Sets the form length to the number of lines specified by "nn." The value of "nn" must be between 01 and 96.
This sequence also clears the bottom margin and vertical tab settings.
For example, to set the form length to 20 lines the sequence is:
ESC w 2 0 .
\$1B \$77 \$32 \$30 \$2E

ESC v n1, n2 .
(\$1B \$77 ** \$2C ** \$2E)
When two numbers are specified separated by a comma, the first sets the form length, the second sets the bottom margin. The bottom margin must be at least one less than the form length.
For example, to set the form length to 50 lines, and the bottom margin to 5 lines, the sequence is:
ESC w 5 0 , 0 5 .
\$1B \$77 \$35 \$30 \$2C \$30 \$35 #2E

ESC v n1, n2, n3 .
(\$1B \$77 ** \$2C ** \$2C ** \$2E)
When three or more numbers are specified separated by commas, the first sets the form length, the second sets the bottom margin, and the third and subsequent set vertical tabs.
For example, to set the form length to 30 lines, the

bottom margin to 10 lines, and vertical tabs in the 6th and 12th lines, the sequence is:

```
ESC w 3 0 , 1 0 , 0 6 , 1 2 .  
$1B $77 $33 $30 $2C $31 $30 $2C $30 $36 $2C $31 $32 $2E
```

Horizontal Tabs

Horizontal tabs are located with respect to the left margin as the first column. The position of the print head after a horizontal tab of a specified number of columns depends on the horizontal pitch. The relationship between the pitch and the maximum number of columns appears in the following table.

Horizontal Pitch	Maximum Column Number for Tabs
9.2 cpi	125
10 cpi	136
12 cpi	163
13.2 cpi	179
15 cpi	204
17.1 cpi	233
Proportional 1	136
Proportional 2	125

When power is turned on, there are no horizontal tabs set. If there are no tabs set, the printer does not act on the horizontal tab code (HT).

Horizontal Tab Setting

ESC (n1, n2, ..., nn .
(\$1B \$28 * \$2C ... \$2C * \$2E)

When the printer receives this sequence, it clears all of the previously set tab positions, and sets new ones.

The terms "n1" thru "nn" are the ASCII codes for 3-digit decimal numbers that represent the column positions at which horizontal tabs are to be set. They must be sent in ascending order. The value of n1, etc. must be between 1 and the maximum number of columns at the current horizontal pitch.

For example, to set tabs in the 10th and 20th columns, use the following sequence.

```
ESC 010,020.  
$1B $2B $30 $31 $30 $2C $30 $32 $30 $2E
```

You can set a maximum of 32 horizontal tabs.

The horizontal pitch for tabbing purposes is 10 cpi in the Proportional 1 mode, and 9.2 cpi in the Proportional 2 mode.

All the horizontal tabs are cleared when the power is turned on, after a printer reset, and when you attempt you set a tab in an impossible place, such as beyond the maximum

column.

Horizontal Tab Partial Clear

ESC) n1, n2, ..., nn .

(\$1B \$29 * \$2C * \$2C ... \$2C * \$2E)

Clears the tabs that occupy the column positions designated by n1, n2, etc. All other tabs remain unchanged.

The terms "n1" thru "nn" are the ASCII codes for 3-digit decimal numbers that represent the column positions at which horizontal tabs are to be cleared. They must be sent in ascending order. The value of n1, etc. must be between 1 and the maximum number of columns at the current horizontal pitch.

For example, to clear the horizontal tabs set in the 10th and 20th columns, use the following sequence.

ESC) 010 , 020 .

\$1B \$29 \$30 \$31 \$30 \$2C \$30 \$32 \$30 \$2E

You can clear a maximum of 32 horizontal tabs with this command.

All the horizontal tabs will be cleared if you make an error using this sequence.

Horizontal Tab Clear

ESC 0

(\$1B \$30)

Clears all the horizontal tabs.

Additional Horizontal Tab Set

ESC u nn

(\$1B \$75 *)

Sets a designated tab without clearing those previously set. "nn" is the ASCII code for the three-digit number that represents the column position of the tab to be set. The value of "nn" must be between 1 and the maximum number of columns at the current horizontal pitch.

For example, to set an additional tab in the 30th column, use the following sequence.

ESC u 030

\$1B \$75 \$30 \$33 \$30

The printer ignores this sequence when there is an error in its use.

12. Set Top of Form

ESC v

(\$1B \$76)

Sets the top of form to the present position.

13. Repeat Control Designation

The repeat control sequences are used to automatically repeat a character, a graphics pattern or a dot space.

Character repeat

ESC R nnn

(\$1B \$52 ***)

Commands the printer to print the next character it receives the number of times designated by "nnn." The term "nnn" is the ASCII code for the three-digit decimal number that represents the number of times to print the next character.

For example, to print the letter "A" ten times, use the following sequence:

ESC R 0 1 0 A

\$1B \$52 \$30 \$31 \$30 \$41

Dot String Repeat

ESC V nnnn

(\$1B \$56 ****)

Commands the printer to interpret the next code it receives as a graphics image, and to print it the number of times designated by "nnnn." The term "nnnn" is the ASCII code for the four-digit decimal number that represents the number of times to print the next code.

For example, to print the dot image that corresponds to the number \$10 (a single dot struck by the fifth wire from the top - see appendix B) 10 times, use the following sequence:

\$1B \$56 \$30 \$30 \$31 \$30 \$10

Dot Space Tab (Dot addressing)

ESC F nnnn

(\$1B \$46 ****)

Moves the print head to the right nnnn columns from the left margin. The term "nnnn" is the ASCII code for the four-digit decimal number that represents the number of columns to move the print head to the right of the left margin.

The actual distance the head moves depends on the size of a column, which depends on the horizontal pitch setting. In Proportional 1 mode, the column size is equivalent to 10 pitch; in Proportional 2 mode, it is equivalent to 9.2 pitch.

If this sequence specifies a position to the left of the present print head position, to the left of the left margin, or to the right of the right margin, the printer ignores it.

14. Download Custom Characters

Maximum Width Select

ESC -

(\$1B \$2D)

These are the first two characters in a custom character downloading sequence for 12-dot-wide characters. This sequence cancels a previously issued sequence for 24-dot-wide characters.

ESC +

(\$1B \$2D)

These are the first two characters in a custom character downloading sequence for 24-dot-wide characters. This sequence cancels a previously issued sequence for 12-dot-wide characters.

Download Start

ESC I

(\$1B \$49)

Starts downloading custom characters. The downloading procedure is described in detail in chapter 5.

If the sequence includes an invalid character code or an incorrect width code, the download mode is terminated, and the subsequent data is treated as data to be printed.

Internal CG copy into download CG

ESC t

(\$1B \$74)

When this sequence is received, the printer's internal character generator is copied into the download memory.

CHARACTER CONTROLS

The Character Controls change the appearance of the printed characters.

1. Boldface print

Boldface Start

ESC !

(\$1B \$21)

Starts boldface printing. Boldface printing continues until the boldface clear sequence (ESC ") is received.

Boldface Clear

ESC "

(\$1B \$22)

Stops boldface printing, resumes normal printing.

2. Vertically Expanded Print

Vertically Expanded Print On

ESC U 1

(\$1B \$55 \$31)

Starts vertically expanded (double height) printing.

CAUTION: selecting double height print DOES NOT increase the line feed size.

If vertically expanded print extends into the bottom margin, printing in the bottom margin is not prevented.

Vertically expanded printing continues until printer receives the vertically expanded type clear sequence.

Vertically Expanded Print Off

ESC U 0

(\$1B \$55 \$30)

Clears vertically expanded printing.

3. Italic Printing

Italic Print On

ESC i 1

(\$1B #69 \$31)

Starts italic printing.

Italic printing continues until the printer receives the italic print clear sequence.

When you select the column-oriented graphics mode, italic printing is suspended; it resumes when the character mode is resumed.

. When you select subscript or superscript print, italic printing is suspended; it resumes when normal printing resumes.

Italic Print Off

ESC i 0

(\$1B \$69 \$30)

Clears italic printing.

4. Underline Printing

Underline Print On

ESC X

(\$1B \$58)

Starts underline print

Underline printing continues until the printer receives the underline print clear sequence.

When you select the column-oriented graphics mode, underline printing is suspended; it resumes when the character mode is resumed.

Space created by shifting the horizontal tab is not underlined.

Underline Print Off

ESC Y

(\$1B \$59)

Clears underline print.

5. Superscript/Subscript Printing

Superscript On

ESC x

(1BH 78H)

Starts superscript print.

Superscript prints a half-height character in the top half of the normal printing area of the line.

Superscript printing continues until the printer receives the subscript on sequence or the superscript/subscript off sequence.

When you select the column-oriented graphics mode, superscript printing is suspended; it resumes when the character mode is resumed.

Superscript printing suspends italic printing; italic printing resumes when superscript printing is terminated.

Subscript On

ESC y

(\$1B \$79)

Starts subscript printing.

Subscript prints a half-height character in the bottom half of the normal printing area of the line.

Subscript printing continues until the printer receives the superscript on sequence or the superscript/subscript off sequence.

When you select the column-oriented graphics mode, subscript printing is suspended; it resumes when the character mode is resumed.

Subscript printing suspends italic printing; italic printing resumes when subscript printing is terminated.

Superscript/Subscript Off

ESC z

(\$1B \$7A)

Clears both superscript and subscript printing.

6. Character Control All Off

ESC K

(\$1B \$4B)

Clears bold, vertically expanded, horizontally expanded, italic, underline, superscript and subscript printing.

SYSTEM CONTROL SEQUENCES

1. Automatic Carriage Return

When the power is first turned on, or after printer reset, the Automatic Carriage Return is set in accordance with the settings of Functions 25 and 46.

Line Feed Only

ESC 1 1

(\$1B \$6C \$31)

Causes the printer to perform only a line feed when it receives a LF code.

In order for this command to operate, Function 46 must be set to 2, or the print command code of Virtual DIP Switch A must be set to CR, LF, VT, FF, US.

The following example illustrates the effect of a LF code when the Line Feed Only code is in effect:

Data: ESC 1 1 A A A A LF A A A A LF

Printing results: AAAA
 AAAA

2. Line Feed + Carriage Return

ESC 1 0

(\$1B \$6C \$30)

Causes the printer to perform a carriage return in addition to a line feed when it receives a LF code.

The following example illustrates the effect of a LF code when this code is in effect:

Data: ESC 1 0 B B B B LF B B B B LF

Printing results: BBBB
 BBBB

Virtual DIP Switch Set

Some of the printer system controls are arranged as if they were controlled by imaginary switches. You can use the sequences in this section to operate these controls.

When the power is first turned on and after printer reset, these switches are set in accordance with the settings of control panel functions.

ESC D nn mm

(\$1B \$44 ** **)

Turns on selected virtual switches. The byte marked nn controls Switch B; the byte marked mm controls Switch A.

The terms "nn" and "mm" refer to the binary or decimal equivalents of a binary number. In the binary number, a "1" turns a switch on, and a "0" has no effect. The least significant bit (the bit on the right) controls switch 8; the most significant bit controls switch 1.

ESC Z nn mm
 (\$1B \$5A ** **)

Turns off selected virtual switches. The byte marked nn controls Switch B; the byte marked mm controls Switch A.

The terms "nn" and "mm" refer to the binary or decimal equivalents of a binary number. In the binary number, a "1" turns a switch off, and a "0" has no effect. The least significant bit (the bit on the right) controls switch 8; the most significant bit controls switch 1.

SWITCH A			OFF	ON
NUMBER	FUNCTION	PURPOSE		
1	41	International Character Sets	See Table	
2	"	"	6-3	
3	"	"	"	
4	N o t	U s e d		
5	27	DC1/DC3 code	Valid	Invalid
6	47	Do when buffer full	CR	CR+LF
7	46	Print command codes	CR	CR,LF,VT, FF,US
8	26	CR: add LF?	CR	CR+LF

Table 6-1. Virtual DIP Switch A.

SWITCH B			OFF	ON
NUMBER	FUNCTION	PURPOSE		
1	48	Zero character style	Open	Slashed
2	N o t	U s e d		
3	N o t	U s e d		
4	N o t	U s e d		
5	N o t	U s e d		
6	20	Char code length	8 bits	7 bits
7	N o t	U s e d		
8	N o t	U s e d		

Table 6-2. Virtual DIP Switch B.

FUNCTION 41 SETTING	CHARACTER SET	1	2	3
1	USA (ASCII)	OFF	OFF	OFF
2	Italian	OFF	OFF	ON
3	USA (ASCII)	OFF	ON	OFF
4	British	OFF	ON	ON
5	German	ON	OFF	OFF
6	Swedish	ON	OFF	ON
7	French	ON	ON	OFF
8	Spanish	ON	ON	ON

Table 6-3. Switch A 1-3 - International Character Sets.

3. Paper Empty Alarm On/Off

When the power is first turned on, or after printer reset, the paper empty alarm is on.

Paper Empty Alarm Off

ESC O

(\$1B \$4F)

Disables the paper empty alarm, allowing printing to continue, even if a paper empty condition is detected.

Paper Empty Alarm On

ESC o

(\$1B \$6F)

Paper empty alarm operates normally; printing is suspended the moment a paper empty condition is detected.

4. Printer reset

ESC c

(\$1B \$63)

Resets the printer to its initial state (the state when the power is first turned on). If the state of the function has been changed from the front panel, the printer is set to the changed state. VFU settings are preserved.

CHAPTER 7

PROGRAMMING YOUR PRINTER

This chapter shows you how to write programs to control your printer's features. The first part shows examples BASIC commands to send escape sequences to the printer so your computer can select the many print features covered in chapter 6. Later in the chapter, you will learn to program three of your printer's advanced features: the Vertical Format Unit, Downloading Character Sets, and Graphics.

BASIC PROGRAMMING TO CONTROL ESCAPE SEQUENCES

The following program gives examples of the use of all of the printer's major printing features. It is written in Microsoft BASIC. If you are using the BASICs available for the Apple IIc, you will have to modify it slightly, because some of these other versions do not have the LPRINT command. Instead, you first issue a command that changes the destination of the PRINT command, and use the PRINT command. See your BASIC manual for details.

If you prefer to use Pascal, the body of the program will be very similar; you will use WRITELN statements instead of LPRINT, and the CHR(n) function instead of CHR\$(n).

Program Run 1 shows a wide range of the Tri Printer's printing features. Program Listing 1, which follows, shows what the program has to do to use the features. Each line is intended to stand alone; each feature is turned on, then off. The comments, along with the printed text, explain the purpose of each line.

TRI PRINTER MODEL 40 DEMONSTRATION PROGRAM

This is an example of underlining a word.
Here's how to use boldface on a word.
This is italic print. It doesn't work with proportional print.
It's easy to use ^{SUPERSCRIPT} and _{SUBSCRIPT} in the same line.
Here is horizontally expanded print.
Vertically expanded print is showy!

You can combine any of the features above, except superscript and subscript.
Now for some pitch changes.

This is extended (9.2 cpi) pitch.
This is standard pica (10 pitch.)
This is elite (12 pitch.)
This is semi-condensed (13.2 pitch.)
This is condensed (15 pitch.)
This is ultra-condensed (17.1 pitch.)
This is proportional 1. Proportional 2 looks the same.
This is draft quality print.

Try these codes in your own programs.

Program Run 1. General Print Features Demonstration.

```
10 REM This program demonstrates the use of BASIC to operate the Tri Printer's features.
20 LPRINT CHR$(27)CHR$(99): LPRINT CHR$(27) CHR$(76) "008":REM Resets the printer to clear any p
reviously used features and sets a left margin.
25 LPRINT "TRI PRINTER MODEL 40 DEMONSTRATION PROGRAM": LPRINT
30 LPRINT "This is an example of " CHR$(27) CHR$(88) "underlining" CHR$(27) CHR$(89) " a word."
40 LPRINT "Here's how to use "CHR$(27) CHR$(33) "boldface" CHR$(27) CHR$(34) " on a word."
50 LPRINT CHR$(27) CHR$(105) CHR$(49) "This is italic print. It doesn't work with proportional
print." CHR$(27) CHR$(105) CHR$(48)
60 LPRINT "It's easy to use "CHR$(27) CHR$(120) "superscript " CHR$(27) CHR$(122) "and " CHR$(27
) CHR$(121) "subscript " CHR$(27) CHR$(122) "in the same line."
70 LPRINT CHR$(14) "Here is horizontally expanded print." CHR$(15)
80 LPRINT CHR$(27) CHR$(85) CHR$(49) "Vertically expanded print is showy!" CHR$(27) CHR$(85) CHR
$(48)
90 LPRINT :REM leave some space below
100 LPRINT "You can combine any of the features above, except superscript and subscript."
110 LPRINT "Now for some pitch changes."
120 LPRINT CHR$(27) CHR$(110) "This is extended (9.2 cpi) pitch."
130 LPRINT CHR$(27) CHR$(78) "This is standard pica (10 pitch.)"
140 LPRINT CHR$(27) CHR$(69) "This is elite (12 pitch.)"
150 LPRINT CHR$(27) CHR$(101) "This is semi-condensed (13.2 pitch.)"
160 LPRINT CHR$(27) CHR$(113) "This is condensed (15 pitch.)"
170 LPRINT CHR$(27) CHR$(81) "This is ultra-condensed (17.1 pitch.)"
180 LPRINT CHR$(27) CHR$(80) "This is proportional 1. Proportional 2 looks the same."
190 LPRINT CHR$(27) CHR$(78) CHR$(27) CHR$(77) "This is draft quality print." CHR$(27) CHR$(109)
200 LPRINT: LPRINT "Try these codes in your own programs.
210 LPRINT CHR$(12)CHR$(12) :REM eject a page
```

Program Listing 1.

ALL ABOUT VERTICAL FORMAT UNITS (VFUs)

If you use your printer to fill out pre-printed forms, such as invoices or statements, the Vertical Format Unit (VFU) will be a real time saver. A VFU is a pre-programmed list of vertical tabs that your printer can store and re-use whenever it is needed. Using the VFU, the printer automatically positions the paper on the correct line to receive the next piece of data from the computer.

The code to move the paper to the next blank is always the same. That means that you don't have to remember that the next blank is 2 lines down, the blank after that 5 lines down, and so on. And the paper moves at the printer's maximum speed, without waiting for the computer to give line-by-line instructions.

Building a VFU

A VFU always begins with a TOF (Top of Form) sequence. The form always ends with a BOF (Bottom of Form) sequence, and the physical page ends with a Next TOF sequence. Each sequence is just three ASCII codes in a row, as shown below.

NAME	ASCII	Decimal	Hexadecimal	Effect
TOF	GS A @	29 65 64	\$1D \$41 \$40	Sets Top of Form
BOF	C @	67 64	\$43 \$40	Ends tabbed part of page
Next TOF	A @ RS	65 64 30	\$41 \$40 \$1E	Signals advance to next page

Between the TOF and the BOF, you will put a code sequence for each line to tell the printer whether to stop at that line or skip it. Note that the printer ALWAYS stops at the first line, because that is always the TOF. If the tabbed part of the page is shorter than the physical page, you will put a "no tab" sequence for each line between BOF and Next TOF as well. You have to provide a code sequence for every line on the page, even if there will be no printing on it, because the printer keeps track of where it is on the page by counting lines.

Let's try a simple example. Suppose you have a pre-printed form on a page 11 inches (66 lines) long. The blanks in the form are all on the top half of the page. The form is spaced so that the printer's normal 6 lines per inch spacing will fit the blanks. The blanks to be filled in alternate with the form's printed lines, so you'll need to skip the first line, tab to the second line, skip the third line, tab to the fourth line, skip

the fifth line, and so on. There are 16 lines to be filled in.

Here is a line-by-line summary of this description:

- Line 1: Blank
- Line 2: Blank
- Line 3: Pre-printed
- Line 4: Blank
- Line 5: Pre-printed
- Line 6: Blank
- Line 7: Pre-printed
- Line 8: Blank
- Line 9: Pre-printed
- Line 10: Blank
- Line 11: Pre-printed
- Line 12: Blank
- Line 13: Pre-printed
- Line 14: Blank
- Line 15: Pre-printed
- Line 16: Blank

The remaining lines are pre-printed.

The VFU to fill in this form starts with a TOF (remember, the paper ALWAYS stops at the TOF), then, beginning with line 2, alternates No Tab and Tab sequences for 16 lines, followed by a BOF sequence, 50 No Tab sequences, then a Next TOF sequence. The Tab and No Tab sequences are as follows.

Effect	ASCII	Decimal	Hexadecimal
No Tab	@ @	64 64	\$40 \$40
Tab	B @	66 64	\$42 \$40

The VFU for this example (in decimal) is shown in figure 7-1. There are spaces shown between the characters so you can see them. The actual sequence of characters that makes up the VFU may not include spaces. It must contain nothing but valid TOF, BOF, Next TOF, Tab and No Tab sequences.

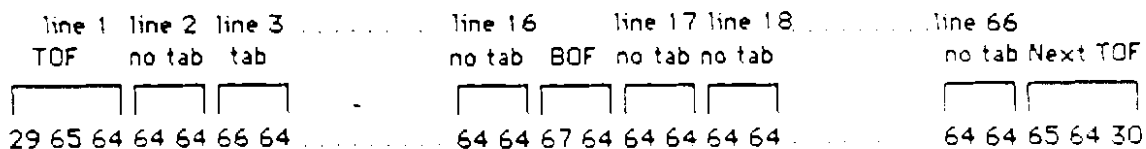


Figure 7-1. A Simple VFU.

Loading a VFU

To load your VFU, all you have to do is send it to the printer. You have to send it in one continuous stream, with no

spaces, carriage returns of line feeds. The easiest way to send a string of characters to the printer is to write a simple BASIC or Pascal program. A BASIC program fragment for the VFU in figure 7-1 is shown in program listing 2. Refer to your BASIC or Pascal language manual for more information.

```

10 REM This program loads a simple VFU into the printer.
20 LPRINT CHR$(29) CHR$(65) CHR$(64) CHR$(64) CHR$(64) CHR$(66) CHR$(64) CHR$(64) CHR$(64) CHR$(
66)CHR$(64);
30 REM the semicolon prevents the computer from sending a carriage return and line feed.
40 LPRINT CHR$(64) CHR$(64) CHR$(66) CHR$(64): REM . . . . and so on to complete the 66 lines
on the paper.

```

Program Listing 2. A Program to Load the Simple VFU.

VFU's for Multipage Forms

In the example above, the form had only a single page. The VFU included 58 No Tab sequences. To avoid repeating lengthy strings of No Tabs, the printer lets you format up to 5 pages (or 5 separate forms) with a single sequence. Here's how it works.

When you plan a multipage (or multiform) VFU, imagine the pages of the form stacked in a single pile. In your mind's eye, hold the stack up to the light, so you can see the blanks through the paper. Make a list of the tabs on line 1 for all of the pages, then line 2 for all of the pages, then line 3 for all of the pages, and so on. The example below shows a worksheet listing the tabs in a hypothetical multipage form. The pages are arranged in columns, and the each line represents the same line on all pages. An X in a column means a tab for that page.

	p. 1	p. 2	p. 3	p. 4	p. 5
1			X		
2	X	X		X	X
3			X		X
4	X	X		X	X
5		X	X	X	
.					
.					
.					
.					
66		X			

The additional code sequences for multipage forms fit this kind of worksheet very well. There is a code for any combination of tabs for up to 5 pages. You use a No Tab code only when there are no tabs on any of the pages for that line. Otherwise, you use the proper tab code for the page or pages where the tabs occur. A look at the tab codes will make this clearer.

Tab on Pages:	ASCII	Decimal	Hexadecimal
No Tab	@ @	64 64	\$40 \$40
p1	B @	66 64	\$42 \$40
p2	D @	68 64	\$44 \$40
p3	H @	72 64	\$48 \$40
p4	P @	80 64	\$50 \$40
p5	' @	96 64	\$60 \$40
p1, p2	F @	70 64	\$46 \$40
p1, p3	J @	74 64	\$4A \$40
p1, p4	R @	82 64	\$52 \$40
p1, p5	b @	98 64	\$62 \$40
p2, p3	L @	76 64	\$4C \$40
p2, p4	T @	84 64	\$54 \$40
p2, p5	d @	100 64	\$64 \$40
p3, p4	X @	88 64	\$58 \$40
p3, p5	h @	104 64	\$68 \$40
p4, p5	p @	112 64	\$70 \$40
p1, p2, p3	N @	78 64	\$4E \$40
p1, p2, p4	V @	86 64	\$56 \$40
p1, p2, p5	f @	102 64	\$66 \$40
p1, p3, p4	Z @	90 64	\$5A \$40
p1, p3, p5	j @	106 64	\$6A \$40
p1, p4, p5	r @	114 64	\$72 \$40
p2, p3, p4	@	92 64	\$5C \$40
p2, p3, p5	l @	108 64	\$6C \$40
p2, p4, p5	t @	116 64	\$74 \$40
p3, p4, p5	x @	120 64	\$78 \$40
p1, p2, p3, p4	@	94 64	\$5E \$40
p1, p2, p3, p5	n @	110 64	\$6E \$40
p1, p2, p4, p5	v @	118 64	\$76 \$40
p1, p3, p4, p5	z @	122 64	\$7A \$40
p2, p3, p4, p5	@	124 64	\$7C \$40
p1, p2, p3, p4, p5	@	126 64	\$7E \$40

In the example above, line 1 has a tab only on page 3, so the code sequence for line 1 is H@. Line 2 has tabs on pages 1, 2, 4 and 5, so the sequence for line 2 is v@. Using the worksheet and the list of codes, you can write out the whole VFU sequence.

How to Use a VFU

To use a VFU, you must first load it as described above. Then, when you compose a page for printing, include the following codes as required. Word processing programs have a method of including control codes in text. Read your word processor manual to learn how to do it.

Effect	ASCII	Decimal	Hexadecimal
Next Tab p1	US B	31 66	\$1F \$42
Next Tab p2	US C	31 67	\$1F \$43
Next Tab p3	US D	31 68	\$1F \$44
Next Tab p4	US E	31 69	\$1F \$45
Next Tab p5	US F	31 70	\$1F \$46
Next BOF or TOF	US A	31 65	\$1F \$41
Next TOF	FF	12	\$0C

Notice that once the VFU is set up, you can treat each page of the form completely separately, by using the Next Tab code for that page alone, or you can treat the VFU as a multipage form, by inserting page 1 Next Tab codes into page 1 text, page 2 Next Tabs into page 2, and so on.

DOWNLOADING SPECIAL CHARACTERS

The Tri Printer Model 40 lets you create your own special characters and use them mixed with or in place of the printer's normal characters. Perhaps you need special scientific or mathematical symbols. Or you might want to match some previously printed material. Or maybe you're just tired of ordinary typefaces, and want to try something new. Whatever the purpose, it's easy to create your own custom characters.

Any character you create will have all the attributes of the existing characters: you can have a draft quality and letter quality version that can be printed in boldface or italics, underlined or expanded horizontally or vertically. There are some restrictions on italicizing special characters.

Adding custom characters to your printer's repertoire is a 4-step process. First, you will design the characters. Next, you create a list of the codes to produce the individual columns of dots that make up a character. Third, you incorporate the list of codes into a BASIC program that sends them to the printer, where they are stored, ready for use. Finally, you retrieve them from storage and print them. These steps are described in the following sections.

How a Custom Character is Printed

Before we begin, let's take a look at how a custom character is printed, to find out what we're trying to accomplish. The Tri Printer's printing head consists of 9 wires in a vertical line. Each wire may be separately driven against the ribbon to make a small dot on the paper. A custom character is printed by giving the printer a set of instructions for 8 of those 9 wires that spells out what dots to print in each tiny column of the character.

In the DP mode, an 8-bit byte of code can describe a single column of the letter. For LQ characters, print head prints a series of 8-dot columns for all of the columns in the letter,

then the paper advances one-half the diameter of a dot, and the printer prints an additional 8 dots per column. You'll need 2 bytes per column for LQ characters.

Designing a Custom Character

The first step is to draw the character on paper and look carefully at its features. A dot matrix printer such as the Tri Printer Model 40 prints columns of dots, so you'll have to visualize the character as an array of dots. To help you think about it, use one of the grids in figure 7-2.

A custom character may be either 12 or 24 columns wide. 12-column characters are used for the draft print (DP) font, and 24-column characters for the letter quality (LQ) font. The DP font is 9 rows high, while the LQ font is 18 rows high. Some of the columns and rows are reserved for special uses.

In the DP font, The last column is reserved. It is left blank to allow a space between characters. The character may be up to 8 rows high. The grid is shown 9 rows high, because you have the option of using rows 2 through 9 instead of 1 through 8 if your character needs to descend below the baseline. Characters that you want to italicize may be no wider than 10 columns.

The LQ font has similar restrictions. The last column is reserved for a space between characters. A character may be up to 16 rows high. Row 17 is reserved for descending characters; row 18 is reserved for underlining. Characters to be italicized may be no wider than 20 columns.

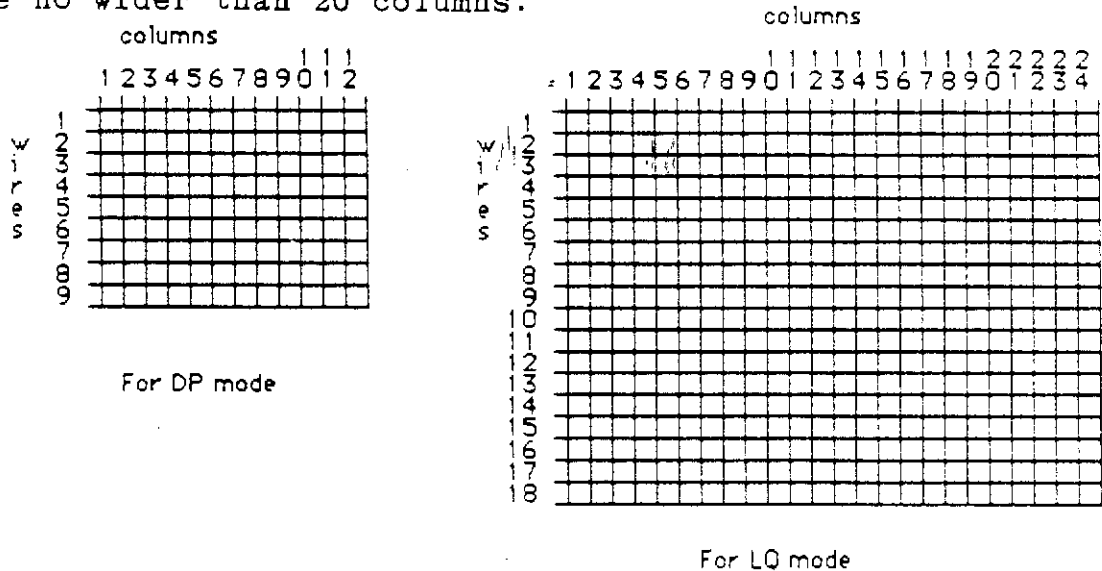


Figure 7-2. Custom Character Grids.

Let's look at an example of a DP character. Suppose you need a number 9. You'll start by laying it out on a DP grid as shown in figure 7-3.

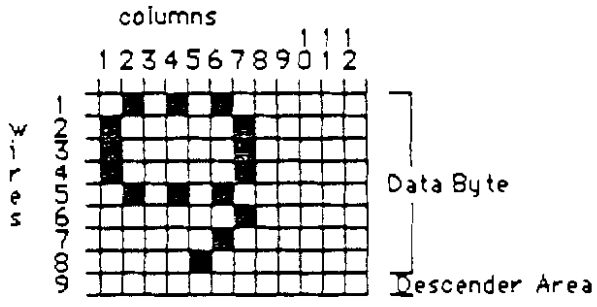


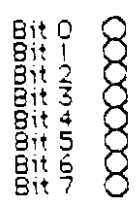
Figure 7-3. A Custom Character For the DP Mode.

Making a List of Codes

The next step is to list the codes you'll need to specify each column. Examine the first column. The top cell in the first column corresponds to the least significant bit (the bit farthest right) in the byte that draws it, the second to the second least significant bit, and so on, as you can see in figure 7-4. Appendix B shows all of the possible 8-bit codes and the graphic pattern that corresponds to each.

Examine a column at a time. Find the pattern in Appendix B that matches the column and make a list of the hexadecimal numbers that appear above the patterns. Next, look up the decimal equivalents of the hexadecimal numbers in the table at the end of Appendix B.

The wires in the print head are arranged in a column:



The binary ASCII code for "U" is:

0 1 0 1 0 1 0 1 which produces this pattern:

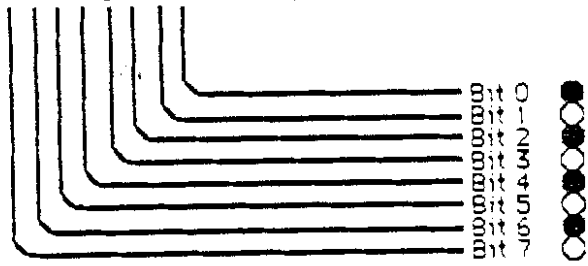


Figure 7-4. The Graphic Image From a Data Byte.

In the chart below, you'll find a list of the codes for each of the graphic column images to make the number "9" in figure 7-3. Next to each is its decimal equivalent. Now you have a list of codes, in decimal form, that specify the appearance of the custom character.

Column	Hexadecimal	Decimal
1	\$0E	14
2	\$11	17
3	\$00	00
4	\$11	17
5	\$80	128
6	\$51	81
7	\$2E	46
8	\$00	00
9	\$00	00
10	\$00	00
11	\$00	00

Loading a Custom Character

To load one or more custom characters, you must send the printer the sequences of codes that follow, in the order shown. You can send them using BASIC or Pascal, or any other language you may have available.

1. ESC - 27 45 \$1B \$2D (DP 12-dot width)
or
ESC + 27 43 \$1B \$2B (LQ 24-dot width)(choose one)
2. ESC I 27 73 \$1B \$49
3. ASCII or high ASCII code that will cause the first character to be printed*
4. A width code for the first character (see table 7-1)
5. The list of bytes that describes the first character
NOTE: Repeat steps 3, 4 and 5 for each custom character you want to define.
6. EOT 4 \$04 (after the last character)

The first sequence sets the stage for an 8-column or a 16-column character. This refers to the maximum width; choose the 8-column sequence for any width up to 8, and the 16-column sequence for anything wider.

The Character Code

The character code for Step 3 requires some explanation. This refers to the code that will later be used to tell the computer to print the custom character. There are two choices.

1. You can use any of the printable standard ASCII codes for both LQ and DP characters. You may not use any non-printing character code. The advantage of using a regular character code is that standard ASCII codes are easy for your computer to produce.
2. For DP characters, you have an additional option. You can use some of the high ASCII codes as well: that is, the same codes as the ASCII printing characters, but with bit 7 changed to a one. This gives you 80 possible codes. The disadvantage is that it is a little less convenient to make your computer produce high ASCII codes.

To sum up the rules for character codes, the allowed codes are \$20 through \$7E (32 through 126 decimal) and \$A0 through \$FE (160 through 254 decimal) for DP characters, and \$20 through \$7E for LQ characters.

The Width Code

The width code serves two purposes. It tells the printer how many binary numbers (1 per column) to expect for the character being described. Also, it specifies printing by wires 1 through 8 or 2 through 9. The table below summarizes the values for the width code.

Columns	Wires 1-8			Wires 2-9		
	ASCII	Decimal	Hex	ASCII	Decimal	Hex
1	A	65	\$41	a	97	\$61
2	B	66	\$42	b	98	\$62
3	C	67	\$43	c	99	\$63
4	D	68	\$44	d	100	\$64
5	E	69	\$45	e	101	\$65
6	F	70	\$46	f	102	\$66
7	G	71	\$47	g	103	\$67
8	H	72	\$48	h	104	\$68
9	I	73	\$49	i	105	\$69
10	J	74	\$4A	j	106	\$6A
11	K	75	\$4B	k	107	\$6B
12	L	76	\$4C	l	108	\$6C
13	M	77	\$4D	m	109	\$6D
14	N	78	\$4E	n	110	\$6E
15	O	79	\$4F	o	111	\$6F
16	P	80	\$50	p	112	\$70

Printing a Custom Character

Now that you've sent the custom character to the printer, the process known as "downloading," is stored in the printer's memory, ready to be used. Each time you want to print the custom character, you must send an escape sequence that tells the printer to interpret the very next code as a custom character. The escape codes are as follows.

Function	ASCII	Decimal	Hex
Switch to Custom	ESC ' (hex 27)	39	\$1B \$27
Switch to Custom (high ASCII)	ESC * (hex 27)	42	\$1B \$2A
Switch back to Regular	ESC \$ (hex 27)	36	\$1B \$24

To print a single custom character with a regular ASCII code in the midst of regular characters, send ESC ' , then the character code, then ESC \$. Or, if the characters were loaded with high ASCII codes, the sequence is ESC * , then the code, then ESC \$. The spaces between ESC and the next character in the previous sentence are to make it easier to read; you should not use spaces in the sequence.

An LQ Example

Figure 7-5 illustrates the design of a number "9" in the LQ font. The table that follows lists the codes for the columns that make up the character. Note that there are 2 codes for each column. The first code for each column is the top 8 dots; the second is the lower 8 dots.

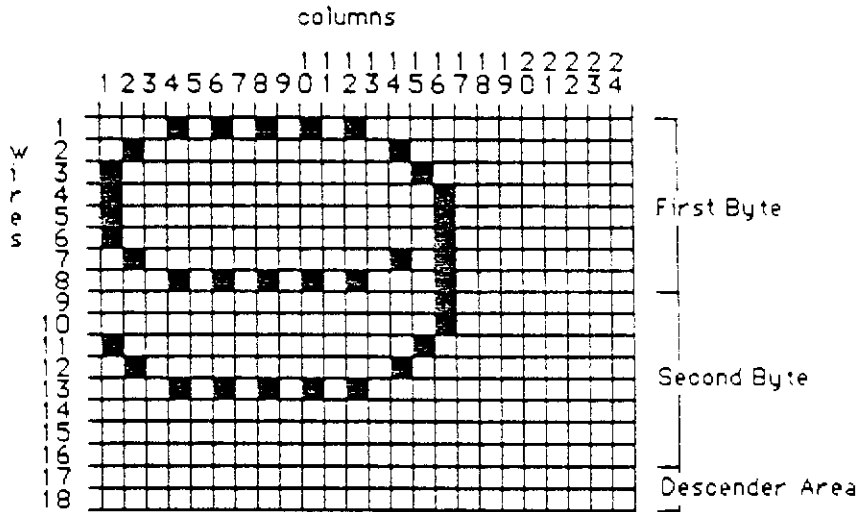


Figure 7-5. An LQ Custom Character.

Column	Hexadecimal	Decimal
1	\$3C	60
1	\$04	04
2	\$40	64
2	\$08	08
3	\$00	00
3	\$00	00
4	\$81	129
4	\$10	16
5	\$00	00
5	\$00	00
6	\$81	129
6	\$10	16
7	\$00	00
7	\$00	00
8	\$81	129
8	\$10	16
9	\$00	00
9	\$00	00
10	\$81	129
10	\$10	16
11	\$00	00
11	\$00	00
12	\$81	129
12	\$10	16
13	\$00	00

13	\$00	00
13	\$00	00
14	\$42	66
14	\$08	08
15	\$04	04
15	\$04	04
16	\$F8	248
16	\$03	03
17	\$00	00
17	\$00	00
18	\$00	00
18	\$00	00
19	\$00	00
19	\$00	00
20	\$00	00
20	\$00	00
21	\$00	00
21	\$00	00
22	\$00	00
22	\$00	00
23	\$00	00
23	\$00	00

TRI PRINTER MODEL 40 GRAPHICS

As described in the section on custom characters, the printing head consists of 9 wires in a vertical line. Each wire may be separately driven against the ribbon to make a small dot on the paper. The printer's graphics printing scheme is to use 8 of the 9 wires in the printing head for graphics, one for each binary bit in the data byte.

Suppose, for example, that you want to print some horizontal lines. Figure 7-4, back in the section about custom characters, shows how the binary byte and the printed column are related. A complete list of all the 8-bit codes and their corresponding graphic images is given in Appendix B.

Look at the graphics images in Appendix B. Start with the number \$33 (51 decimal). This code will print four dots in two groups of two. If you send a whole line of this code, the printer will print two horizontal lines, as shown below. In the section on printing graphics, you'll learn how to do this.

Just as you can design custom characters, you can design graphics of any arbitrary form. Generally, you have to specify a number for every eight dots in the graphic, so designing graphics

can be time consuming. Programs like Macpaint make complex graphics easy, but if you need to design graphics without the aid of Macpaint, the following strategy will help you.

1. Make a large grid, with heavy rulings every 8 lines. The 8-line grouping helps you see how the graphic fits into the printer's printing line structure.
2. Draw the graphic you want to print on the grid. It simplifies printing if you either start or end on one of the 8-dot boundary lines.
3. Examine one 8-dot column at a time between the heavy rulings. Moving from left to right, make a list of the numbers required to produce the graphic images in each column. You'll find a complete repertoire of graphics bytes in Appendix B. Be on the lookout for two special conditions in portions of the graphic.
 - a. A printer line contains only horizontal lines, or contains horizontal lines more than 7 columns long
 - b. A printer line contains only a few isolated dots (that is, a line that contains mostly empty space)When you see either of these conditions, note them. There are special printing shortcuts that fit these situations.
4. Prepare a list of codes for each line, then proceed to the printing process.

How to Print Graphics

The method you use to print graphics depends on whether you find either of the special conditions in 3 above. Let's look at the two graphics printing shortcuts that fit those conditions. The general graphics printing method is described in chapter 6 under Column Oriented Graphics; the three codes used are ESC G, ESC g (note the lower case) and ESC S. The programming examples in this chapter will help you understand how to send the graphics codes to the printer.

Horizontal Lines

To print horizontal lines, send the following sequence.

ASCII	Decimal	Hexadecimal
ESC V nnnn **	27 86 nnnn **	\$1B \$56 nnnn **

NOTE: It takes 8 bytes to specify any configuration of horizontal lines. Whenever you see horizontal lines that are longer than 8 columns, you'll save work by using this method.

In the table above, nnnn is the number of identical columns you want printed. In BASIC, you can put the number in quotes:

```
LPRINT CHR$(27) CHR$(86) "nnnn" CHR$(**)
```

The number designated by "nnnn" can be any value up to 9999 decimal (270F hexadecimal). See the chart later in this chapter

for the number of dots per inch at various printer pitch settings. The number nnnn must take up four characters. If the number is shorter, fill it to four characters with leading zeroes or leading spaces.

The ** in the table above represents the decimal or hexadecimal code for the graphic image you want to print. In BASIC, use the decimal number.

Isolated Dots

To print a few isolated dots, it may be quicker to use the following sequence.

ASCII	Decimal	Hexadecimal
ESC F nnnn **	27 87 nnnn **	\$1B \$46 nnnn **

NOTE: It takes 8 bytes to move the print head to any point on a line. Whenever you see an empty space longer than 8 columns, you'll save work by using this method.

Two Programming Examples For Horizontal Lines

Earlier in this section, you saw two horizontal lines produced by using decimal 51 as the code, repeated over and over across the page. The program in Program Listing 2 produced that pattern.

Program Run 2.

```
10 LPRINT CHR$(27) CHR$(99) :REM Resets the printer
20 LPRINT CHR$(27) CHR$(86) "0480" CHR$(51)
```

Program Listing 2.

It is difficult to see on this printed reproduction, but on the original each line looks like two lines side by side. This is because there is a small gap where the two circular dots come together. Program Run 3 shows a denser line, and Program Listing 3 tells you how it's done. The difference is bold printing, selected in line 10. As you'll see in the next section, the 17 pitch plus the bold printing improve both horizontal and vertical density by filling in the gaps.

Program Run 3.

```
10 LPRINT CHR$(27) CHR$(99): LPRINT CHR$(27) CHR$(81): LPRINT CHR$(27) CHR$(33)
20 REM LINE 10 resets the printer, sets 17.1 pitch and selects BOLD PRINT
30 REM forcing vertical hi-res printing.
40 LPRINT CHR$(27) CHR$(86) "0480" CHR$(51)
```

Program Listing 3.

Bold Printing For Graphics

If you use the bold print control sequence (ESC !) in the graphics mode, the printer prints twice, shifting each column horizontally by 1/2 dot space. For dot densities higher than 120 dots per inch (greater than 15 cpi) such a horizontal shift is not possible, because the maximum horizontal dot density is 120 X 2, or 240 dpi. At these higher densities, such as occurs at 17.1 cpi, the printer prints twice, shifting the paper vertically by 1/144 in.

The table below shows the relationship between pitch and dot density for bold printing in the graphics mode.

Horizontal Pitch	Dots per inch	Dots per inch (Bold)
9.2 cpi	72 dpi	144 dpi
10 cpi	80 dpi	160 dpi
12 cpi	96 dpi	180 dpi
13.2 cpi	110.8 dpi	205.7 dpi
15 cpi	120 dpi	240 dpi
17.1 cpi	130.9 dpi	Vertical
Proportional - 1	160 dpi	Vertical
Proportional - 2	144 dpi	Vertical

**CHAPTER 8
HOW TO TAKE CARE OF YOUR TRI PRINTER**

ALARM CODES

When something goes wrong, the status display on your printer's front panel will display the letter A, followed by a period and a 2-digit number. A display that begins with A is called an Alarm Code. The following list explains the meanings of the most common alarm codes and tells you what to do about them.

Code	Meaning	Remedy
-------------	----------------	---------------

A.01

Alarm 1 The top cover is open. Close the top cover.

A.02

Alarm 2 The paper has run out or is jammed. Load paper and press the RESET button. If the paper has not run out, it may be jammed or loaded incorrectly. Reload the paper and press the RESET button.

A.03

Alarm 3 * The printhead is overheated. Allow the printer to cool. When the printhead has cooled, the printer will resume printing automatically.

A.04

Alarm 4 * The carriage motor is overheated. Allow the printer to cool. When the carriage motor has cooled, the printer will resume printing automatically.

A11 - Paper jammed between roller and head.

A.05

<p>Alarm 5 A failure has occurred in the memory in the Font Cartridge.</p>	<p>Change the Font Cartridge** or press the RESET button on the control panel. Call your service representative for a more permanent solution.</p>
---	--

NOTE 1:

If your printer ever displays an alarm code that is not on this list, take these steps:

1. Turn the printer power switch OFF, then ON again. If the alarm reappears, go on to step 2.
2. Consult your local service representative, or call CIE's Technical Hot Line _____, and we will tell you what to do.

*** NOTE 2:**

If overheating occurs, (A.03 or A.04) the printer protects itself by slowing down, and finally by stopping. There is no need to shut the power off. Remember that if you shut the printer power off, all of the data in the printer's buffer will be lost. If this will seriously inconvenience you, keep the power on while you wait for the printer to resume printing.

CAUTION:

REMOVING OR INSTALLING THE FONT CARTRIDGE OR THE INTERFACE CARTRIDGE WITH THE PRINTER POWER ON MAY CAUSE SERIOUS DAMAGE TO THE PRINTER.

Multiple Alarms

When more than one alarm condition occurs at the same time, the printer displays the more urgent alarm code. As soon as the more urgent alarm condition has been corrected, the printer displays the next less urgent alarm code. The order of urgency is:

1. Overheating
2. Paper out
3. Cover open

MAINTENANCE

The Tri Printer is an exceptionally rugged unit. No periodic maintenance is needed except for occasional dusting or cleaning.

Use a dry, lint-free cloth to dust the printer. To clean the case, disconnect the AC power and wipe the case with a cloth dampened with a solution of mild detergent. To avoid damaging the plastic, DO NOT USE strong detergents or solvents.

TROUBLESHOOTING

Use the following chart to help determine the cause if the printer fails to operate properly.

TROUBLESHOOTING CHART:

to follow

REPACKING

To repack the printer for shipment or storage, follow these steps.

1. Turn off the machine and disconnect the power cord from the wall receptacle and the connector on the back of the printer; set the cord aside.
2. Remove the paper tray and set it aside.
3. If you wish to remove the font and interface cartridges, open the top of the printer and remove each cartridge by pulling straight up firmly.
4. Close the top cover and make sure it is locked into position.
5. Lay the large plastic bag out on a flat surface. Slide the printer carefully into the plastic bag.
6. Lifting one end of the printer at a time, slip the styrofoam supports back onto both ends.
7. Gripping the handholds on the styrofoam supports, lift the printer, with the styrofoam supports attached, into the box.
8. Place the cord, the paper tray into the cardboard tray, and put the tray between the styrofoam supports as shown in figure 8-1. Close the box and store, or for shipping retape the box securely and ship.

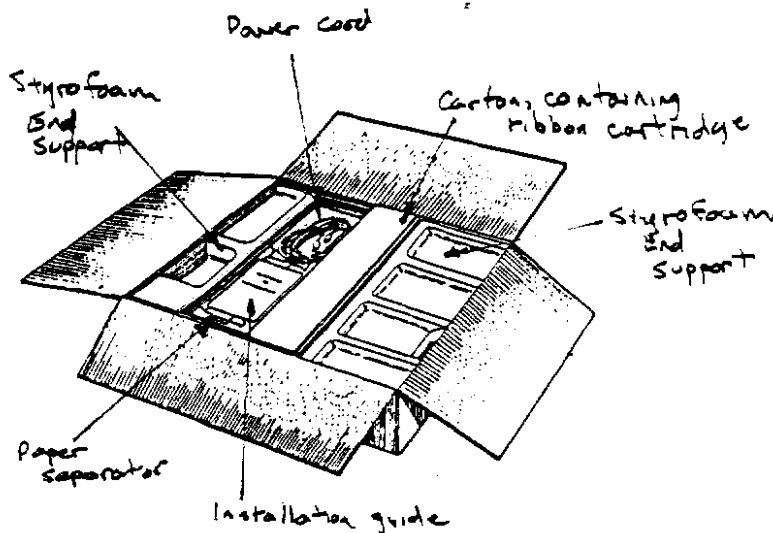


Figure 8-1. Repacking.

APPENDIX A
ASCII CODE TABLES

To Follow

APPENDIX B
PRINTER GRAPHICS

The following chart shows the graphic representation of every hexadecimal number between \$00 and \$FF. The dots are arranged in the same relative position as on the print head. Use these dot configurations to build custom characters and graphics. You'll find a conversion table from hexadecimal to decimal at the end of the appendix.

00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000

APPENDIX B
 P1
 REDUCE &
 PASTE UP AS
 2 COLS UP
 8 BOXES

**APPENDIX C
SUMMARY OF ESCAPE SEQUENCES**

FUNCTION	ASCII	HEX	DECIMAL
PRINT CONTROLS			
1. Printing direction			
Unidirectional printing	ESC >	1B 3E	27 62
Bidirectional printing	ESC <	1B 3C	27 60
2. Character quality			
DP (Draft Printing mode)	ESC M	1B 4D	27 77
LQ (Letter Quality mode)	ESC m	1B 6D	27 109
3. Horizontal pitch			
9.2 cpi (Extended)	ESC n	1B 6E	27 110
10 cpi (Pica)	ESC N	1B 4E	27 78
12 cpi (Elite)	ESC E	1B 45	27 69
13.2 cpi (Semi-condensed)	ESC e	1B 65	27 101
15 cpi (Condensed)	ESC q	1B 71	27 113
17.1 cpi (Ultra-condensed)	ESC Q	1B 51	27 81
Proportional -1	ESC P	1B 50	27 80
Proportional -2	ESC p	1B 70	27 112
4. Downloading character sets			
Internal CG mode	ESC \$	1B 24	27 36
Download CG mode 1	ESC '	1B 27	27 39
Download CG mode 2	ESC *	1B 2A	27 42
5. Left/Right margin set			
Left margin set	ESC L	1B 4C	27 76
Right margin set	ESC /	1B 2F	27 47
6. Column Oriented graphic mode			
Graphic mode	ESC G	1B 47	27 71
Graphic mode	ESC S	1B 53	27 83
Graphic mode	ESC g	1B 67	27 103
7. Line feed width			
1/6" line feed mode	ESC A	1B 41	27 65
1/8" line feed mode	ESC B	1B 42	27 66
n/144" line feed mode	ESC T	1B 54	27 84
n = 1 - 99			
8. Line feed direction			
Forward line feed	ESC f	1B 66	27 102
Reverse line feed	ESC r	1B 72	27 114
9. Dot space			
1 dot space	ESC 1	1B 31	27 49

2 dot space	ESC 2	1B 32	27 50
3 dot space	ESC 3	1B 33	27 51
4 dot space	ESC 4	1B 34	27 52
5 dot space	ESC 5	1B 35	27 53
6 dot space	ESC 6	1B 36	27 54
0 - 9 dot space	ESC s	1B 73	27 115

10. VFU

Simple VFU set	ESC w	1B 77	27 119
----------------	-------	-------	--------

11. Horizontal tab

Horizontal tab set	ESC (1B 28	27 40
Horizontal tab partial clear	ESC)	1B 29	27 41
Horizontal tab clear	ESC 0	1B 30	27 48
Horizontal tab additional set	ESC u	1B 75	27 117

12. TOF set

TOF set	ESC v	1B 76	27 118
---------	-------	-------	--------

13. Repeat control

Character repeat	ESC R	1B 52	82
8-bit dot string repeat	ESC V	1B 56	86
Dot space tab (dot addressing)	ESC F	1B 46	70

14. Download custom characters

Download CG (8-dot) select	ESC -	1B 2D	27 45
Download CG (16-dot) select	ESC +	1B 2B	27 43
Download request	ESC I	1B 49	27 73
Download CG copy	ESC t	1B 74	27 116

CHARACTER CONTROLS

1. Bold print

Bold print on	ESC !	1B 21	27 33
Bold print off	ESC "	1B 22	27 34

2. Vertically expanded type

Vertically expanded print on	ESC U 1	1B 55 31	27 85 49
Vertically expanded print off	ESC U 0	1B 55 30	27 85 48

3. Italic print

Italic print on	ESC i 1	1B 69 31	27 105 49
Italic print off	ESC i 0	1B 69 30	27 105 48

4. Underline

Underline on	ESC X	1B 58	27 88
Underline off	ESC Y	1B 59	27 89

5. Superscript, Subscript

Superscript on	ESC X	1B 78	27 120
Subscript on	ESC Y	1B 79	27 121
Superscript/Subscript off	ESC Z	1B 7A	27 122

6. Character control codes all off

All character controls off ESC K 1B 4B 27 75

SYSTEM CONTROLS

1. Automatic carriage return

Line feed ESC 1 1 1B 6C 31 27 108 49
Line feed + Carriage return ESC 1 0 1B 6C 30 27 108 48

2. Virtual DIP switch set

DIP SW open ESC Z 1B 5A 27 90
DIP SW close ESC D 1B 44 27 68

3. Paper Empty alarm on/off

Alarm off ESC O 1B 4F 27 79
Alarm on ESC o 1B 6F 27 111

4. Printer reset

Resets printer to its initial state. ESC c 1B 63 27 99

APPENDIX D
THE TRI PRINTER MODEL 40 INTERFACE

The Tri Printer Model 40 is equipped with a standard RS-232C Data Terminal Equipment (DTE) serial interface, with a DB-25 25-pin female connector. The pin assignments for the interface connector are shown in table D-1.

PIN	INIT	NAME	SOURCE
1	FG	Frame Ground	
2	TXD	Transmitted Data	Printer
3	RXD	Received Date	Computer
4	RTS	Request To Send	Printer
7	SG	Signal Ground	
14	FAULT		Printer
20	DTR	Data Terminal Ready	Printer

Table D-1. Interface connector pin assignments.

1. Frame Ground (FG) is a safety ground line that connects the chassis of the printer to that of the computer.
2. Transmit Data (TXD) is serial data from the printer to the computer. Normally, data from the printer to the computer consists only of XON and XOFF characters that tell the computer to stop sending data when the computer's buffer is full. This is used only for the XON/XOFF protocol. See Protocols, below.
3. Received Data (RXD) is the serial data from the computer to the printer.
4. Request To Send (RTS) is a DC signal from the printer to the computer. It is true whenever the printer power is on.
7. Signal Ground is the ground that accompanies the data. It must be provided for the interface to work properly.
14. FAULT is a special DC signal from the printer to the computer. It is not part of the RS-232C standard. FAULT is high when the printer is online, low when it is offline.
20. Data Terminal Ready (DTR) is a DC signal from the printer to the computer. It is true when the printer is on and is ready to receive data. It is false when the printer is unable to receive data. This pin is used for the Busy/Ready protocol.

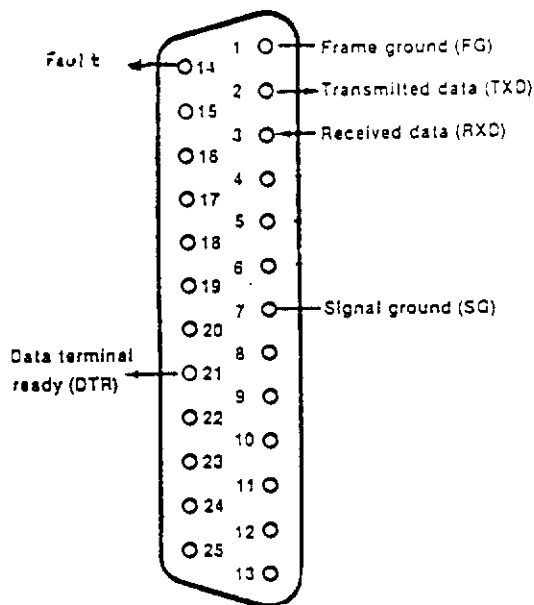


Figure D-1. Interface Connector Pin Layout.

PROTOCOLS

The Model 20 can use either of two protocols to control data flow from the computer. They are Busy/Ready and XON/XOFF. Function 50 in chapter 4 describes how to select either protocol from the front panel. The function of both protocols is to request that the computer stop sending data when the printer's buffer becomes filled to within 256 bytes of capacity; and request that transmission resume when the available space in the buffer reaches 512 bytes.

Busy/Ready Protocol

The Busy/Ready protocol is a DC signal transmitted using pin 20, the DTR pin. When DTR is high, the printer is requesting data; when it is low, the printer is requesting that no data be sent.

XON/XOFF Protocol

The XON/XOFF protocol consists of a pair of ASCII characters (DC1 and DC3) transmitted serially by the printer to the computer via Pin 2 of the interface connector. To request data, the printer transmits XON (DC1); to request the computer to stop sending data, it sends XOFF (DC3).

DATA TRANSMISSION CHARACTERISTICS

Data Rates

The data transmission rate may be set to any of the following values:

- 9600 BPS
- 4800 BPS
- 2400 BPS
- 1200 BPS
- 600 BPS
- 300 BPS
- 150 BPS

The rate may be set from the front panel using function 51, described in chapter 4.

Data Format

The data format is as follows:

- 1 start bit
- 7 or 8 bit data length
- parity may be even, odd, ignored, or none.
- 1 stop bit on receive; 1 or 2 stops selectable on transmit.

The data length should always be set to 8 bits.

If parity is set to "ignore", data sent to the computer will have even parity.

**APPENDIX E
TECHNICAL SPECIFICATIONS**

Dimensions

Width: 570mm (22 inches)
Height: 120mm (4.7 inches)
Depth: 420mm (16.5 inches)
Weight: 17.6Kg (38.8 pounds)

Environmental Considerations

Operating Temperature: 4 thru 40 degrees C
Operating Humidity: 5 thru 90% (Non-condensing)
Storage Temperature: -40 thru 70 degrees C
Storage Humidity: 5 thru 95% (Non-condensing)
Noise level less than 58 dB

Print Functions

Print Method: Logic seeking bidirectional printing
Print Head: Nine-wire head
Wire diameter: 0.3 mm (0.012 inches.)
Service life: 1000 million dots/wire

Print Modes

DP mode: Draft quality (normal dot density)
LQ mode: Letter Quality (double dot density)

Print Speed

Print Mode	Maximum Instantaneous Speed
DP mode	350 (CPS)
LQ mode	87.5 (CPS)

Print Attributes

Enlargement (double wide and/or double high letters)
Bold face
Underline
Superscript/Subscript
Italics
Any combination of these attributes may be used.

Character Pitch and Maximum Columns

Pitch(CPI)	Columns	
	8"	13.6"
9.2 (4.6)	72 (36)	125 (62)
10 (5)	80 (40)	136 (68)
12 (6)	96 (48)	163 (81)
13.2 (6.6)	105 (52)	179 (89)
15 (7.5)	120 (60)	204 (102)
17.1 (8.55)	136 (68)	233 (116)
Proportional 1		
Proportional 2		

Values enclosed by parentheses are for double wide characters.

Character Sets

94-character ASCII

9 International character sets:

French
German
British
Danish
Swedish
Italian
Spanish
Canadian
Japanese

Character Font Dot Matrix

Print Mode	Matrix (Hor. x Vert.)	
	w/o descender	with descender
DP mode	9 x 7	9 x 8
LQ mode	17 x 13	17 x 16

Graphics Dot Density

Horizontal: 72, 80, 96, 110.8, 120, 130.9, 144, 160
(144, 160, 180, 205.7, 240)
Vertical: 72 (144)

Values in parentheses are for boldface.

Paper Feed Direction

Bidirectional (Rear paper feed only)

Paper Feed Speed

Through speed: 10 inches/second (minimum)
Linefeed speed: 30 millisc/linefeed (1/6-in. feed)

Paper Specifications

Width: 2.95 to 16 inches with sprocket holes
Thickness: 0.003 to 0.022 inches.
Copies: 1 to 6 part forms
Paper Weight: Single part 15 lb. paper minimum,
40 lb. paper maximum.
Multipart forms up to 6-part
(15 lb. original plus 5-12 lb. copies and 5-8
lb. carbons interleaved)
Lighter weight forms may be used as long
as no less than 15 lb. single and 10 lb.
multipart
Minimum and maximum weights also apply
to carbonless forms.
Fastening such as crimping, stitching,
or gluing should be used to fasten forms
together in the margins only. Hard fasteners
such as staples may not be used.
The quality of multipart printout

depends on the quality and weight of the forms.

Perforation For adequate strength at the folds in continuous paper, the ratio of cut to uncut sections in the perforation should not exceed 2:1.

Lines Per Inch

Spacing between lines is $N/144$ lines/inch, where $N=1$ to 99
Lines per inch can be varied from 144 to less than 2 (1.46)

Paper Feed Mechanism

Bidirectional 4-pin tractor

Ribbon Type

Stationary cartridge type
Color-black
Length-65 meters (213 feet) (mobius strip)

Power Requirements

Voltage: 88 thru 132 VAC or 176 thru 264 VAC
Frequency: 47 thru 400 Hz
Power consumption: not more than 200 Watts

Interface

RS-232C Serial Interface
Data Format: Start Bit 1 bit
Data Bits 7 or 8, selectable
Parity Bit Even
Odd
None
Ignore
Stop Bit (s) 1 or 2 selectable on transmission;
1 checked on reception
Protocols XON/XOFF
DTR Ready/Busy (Pin 20)
Print Buffer 1.5K Bytes x 2

GLOSSARY

A

- Alphanumeric** Word used to designate letters and numbers: the characters that make up ordinary words and numbers.
- ASCII** A standard code used to convey information from one computing machine to another: American Standard Code for Information Interchange. Each symbol is represented by a single 7-bit binary number. Its value can be expressed in decimal, hexadecimal, or binary numbers, but the number used by the computer or peripheral is binary.

B

- Bank** A set of items physically next to each other, such as a bank of switches in a row, or a section of memory without gaps.
- Baud** A measurement of how fast information is transferred between computing machines, such as a computer and a printer. The faster the Baud rate, the faster the information moves. 300 Baud (300 bits per second) is approximately equal to 30 characters per second, while 1200 baud is approximately equal to 120 characters per second.
- Binary number system** A system of numbers consisting only of 0's and 1's. The decimal number 7, for example, is expressed in binary numbers as 111. these numbers are unwieldy for people, but very convenient for computers.
- Bit** A single digit in the binary numbering system; the smallest element of information in a computer's memory.
- Buffer** A storage area in the computer's memory, in an external device or in a printer, designed to hold data temporarily until it can be processed by a computer or typed by a printer.

Boot The process of resetting and restarting a computer. In some computers, booting consists only of inserting a disk and turning the computer on. In others, it requires pressing a reset button or multiple keyboard keys.

Byte A group of eight binary digits that taken together, express a single character or other piece of information.

C

Character A symbol that represents a letter, number, punctuation mark or, in the broadest definition, a control code.

Code A system or set of rules used for communication of information.

Column A vertical line or set of spaces on a printed page or display screen. A printer that can print 80 letters across a single line is said to print "80 columns" across the page.

Compatible The condition of being able to operate correctly when connected to another computing machine or printer. When machine number one is compatible with machine number two, it can either be used with machine number two, or can be used with other machines that can be used with machine number two.

Control key A key on the computer's keyboard that modifies the actions of most other keys. It is similar in action to a shift key, in that you hold it down while pressing a second key. On an ASCII keyboard, a control key is used to produce ASCII control characters.

CPI Characters per inch, or pitch, of a printer; the number of characters printed per inch in a printed line.

CPS Characters per second; a measure of the speed of a printer's operation.

CPU Central processing unit; the "brain" of a

computer. In a microcomputer, the CPU is usually a single integrated circuit.

D

- Daisy wheel The flat, round printing element used in many letter quality printers. By replacing the daisy wheel, you can change the typeface of the printer quickly and easily.
- Data All information sent between computing machines can be called data. In certain cases, data refers specifically to the information to be typed, while non-printed information is referred to as "control codes" or "printing parameters."
- Decimal numbers The common numbering system we use in everyday transactions.
- Default The choice for a particular function or option, such as the number of lines per page or the number of characters on a line, that a computing machine will select if you fail to specify one.
- DIP Switch A bank of switches, named after its packaging (dual-inline package). These devices are commonly used to set various choices on computer equipment.
- Download The process of transferring information from a computer to a peripheral, or between two computers, in which the transferred information remains available for use in the second device. In printers, custom character sets, graphics or vertical format units (VFUs) are commonly downloaded.
- DP mode Draft Print. In a dot matrix printer, a high-speed printing mode in which the print head makes a single printing pass over each character. See LQ mode.

E

- Escape key A special key on the computer's keyboard that signals that the character or sequence that follows should be interpreted in a special way. When pressed,

the Escape key generates a special ASCII code that most printers recognize as the first character of a special command code sequence, often called an "escape sequence."

F

Form Feed

The ASCII control code that commands a printer to advance continuous-form paper to the next page.

G

Graphics mode

A capability of a printer to print lines and images other than alphanumeric characters.

H

Handshake

The exchange of control information between a computer and a peripheral device. In an interface between a computer and a printer, the handshake is used by the computer to notify the printer that data is available to be printed, and by the printer to notify the computer that its buffer is full, so it cannot accept any more data, or that its buffer has been emptied, so it can accept more data. Sometimes known as a protocol.

Hard copy

The printed version of information from a computer's memory; the printed output from a printer.

Hexadecimal

A number system of base 16. Base 16 is easy to convert to and from binary, a computer's natural number system, and is relatively easy for people to manipulate.

I

Initialize

To establish beginning operating values for a particular piece of software or hardware, akin to setting the volume and tuning in the desired channel when first turning on a TV set. Most types of computer equipment initialize themselves automatically.

Interface

The point or process at which two

separate systems touch, for example: the printer interface is where and how the computer contacts the printer.

J

Justify

The process of printing information with straight right margins, in addition to the normally straight left margins. Word processing programs justify text by adding space between the words and -- with more sophisticated printers -- between the letters along a line of print to make the right margins come out exactly even.

K

K

An abbreviation of the Greek word for 1000. In computer work, 1K means 1024, and is used to specify the number of characters involved in some computer function or capacity, such as 64K of random access memory.

L

Loading

The process of transferring information into a computing device.

LPI

Lines per inch. On a printer, the number of lines of type per vertical inch of paper.

LQ mode

Letter Quality mode. In a dot matrix printer, a high-quality printing mode in which each dot in a character is struck twice, the second time after the print head or the paper is moved by half the dot diameter.

Mail merging

The process of automatically typing a single document many times, each time inserting slightly different information gleaned from a separate list or computer file. The result is usually some form of "personalized" letters.

O

On line

Physically connected to a computer and in current contact with it, for example, when a printer is on line, it is printing

or ready to print.

Output device A piece of equipment which takes information from a computer and transfers it to some other form, such as printed "hard copy." A printer is an important output device.

P

Parallel A method for transferring information from a computer to a peripheral device, wherein all of the bits that make up a character are transmitted simultaneously over separate wires. Parallel printer interfaces are generally more standardized and easier to operate than serial printer interfaces.

Parameter A piece of information which controls some aspect of a computer's or a printer's operation, such as baud rate, number of lines per page, or number of characters per line. By changing the parameters, you control the operation of the device.

Peripheral Any device that works with a computer and is controlled by it, such as a printer.

Pitch The number of columns per inch, (horizontal pitch), or the number of lines per inch (vertical pitch).

Port The location where the computer can be fitted with an input or an output device. A printer port is a location mainly intended for sending information to a printer.

Print A command that tells a computer to send information to an attached printer.

Printer A machine that takes information from a computer and converts it to letters and numbers or pictures on a piece of paper.

Proportional Spacing A system of spacing letters on a printed page that allows less space for narrow letters, such as "i," than for wide letters, such as "M". The more common spacing method for computer printers is

columnar: that is, all characters occupy the same space.

Program A set of instructions to a computer that, taken together, cause it to perform a specific job, task, or activity. Word processing programs cause computers to function as tools for writing and printing a wide variety of documents.

Prompt A query from your computer, seeking information. A prompt may or may not tell you what information it needs from you right now. The simplest kind of prompt is a single symbol (letter, or punctuation) that tells you that the program in use is awaiting information from you. For example, PC-DOS's prompt is "A>" displayed at the left of the screen.

R

Ribbon Cartridge A plastic box that contains the typing ribbon for a printer.

S

Serial interface A procedure for transferring information from a computer to a printer or other device along a single wire (although other wires are used to signal when the information is coming and when it is not). Serial printer interfaces allow the use of very long cables (even telephone lines) between the printer and the computer.

Slot A physical connection inside a computer in which you can install an accessory, such as a printer adapter.

Software Another word for "programs" or the instructions that control a computer.

V

VFU Vertical Format Unit. A method of pre-programming a printer's vertical motion to permit forms to be filled out quickly.

W

Word processor

A program that enables you to type letters, words, and numbers into a computer's memory, manipulate and change them as desired, and cause them to be printed automatically under computer control.