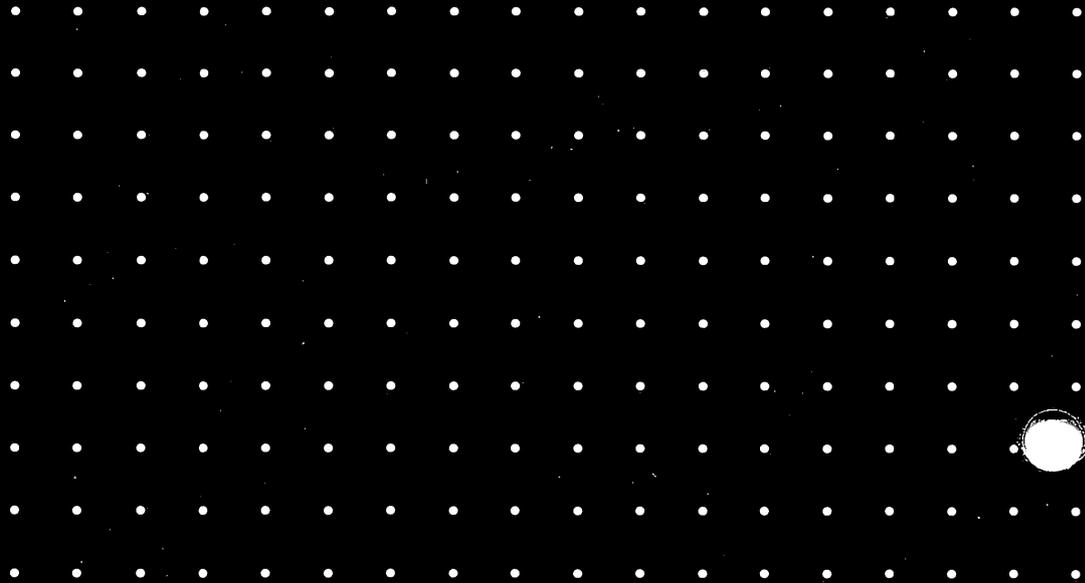


***Apple Daisy Wheel
Printer***

Apple Daisy Wheel
Printer



***Apple Daisy Wheel
Printer***



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Preface

This manual will tell you everything you need to know about operating and maintaining your Apple Daisy Wheel Printer.

Your printer will produce text that looks like it has been professionally typed, or better. Using LisaWrite, you can quickly prepare letters, documents, articles, and so on. Your printer can print characters used in languages other than English, and copyright, trademark, and other special symbols. Unlike a typewriter, it can easily print boldface as well as underlining. It can vary both the number of characters per inch (pitch) and the vertical spacing between lines. It can also draw graphs, diagrams, and pictures. Using a special command set, described in the technical appendixes, you can also program your printer to fill out forms, printing both backwards and forwards while moving the paper both up and down.

This manual contains two chapters and nine technical appendixes. You will only need Chapters 1 and 2, unless you are an experienced programmer wishing to modify the normal use of the printer. The first chapter describes how to unpack your printer and set it up with your Lisa for first use. The second chapter describes the printer in more detail, and explains routine care and handling of your printer.

Appendixes A and B summarize the command codes that can be sent to the printer, if you choose to program the printer yourself. Appendixes C through H give details on certain command parameters and on the printer hardware. A glossary of terms is included as Appendix I.

You can place this manual in the peripherals binder that is in the Lisa accessories box.

Chapter 1

Setting Up Your Printer

The following sections describe how to unpack and set up your printer.

After you set up your printer, you need to attach it to your Lisa. For how to do this, refer to the *Lisa Owner's Guide*, Section D, Desktop Manager Reference, Guide under Set Printer Configuration, or the *Workshop User's Guide for the Lisa* in the System Manager Section.

Unpacking

Your Apple Daisy Wheel Printer is packed in a single carton. Here's how to unpack it:

1. Inspect the exterior of the carton for obvious signs of damage or mishandling. Note any such evidence on the shipping papers, in case there is a later damage claim against the shipper.
2. Cut the tape seals on the top of the carton. Be careful not to cut too deeply into the box.
3. Open the top flaps of the carton and remove the instructions that are on top of the styrofoam cradle.

Follow these instructions carefully to complete the unpacking.

Removing the Shipping Restraints

At this point you should have the printer out of the carton and the styrofoam cradle, using the instructions packed on top of the cradle. Be sure to save all the packing materials. There are a few more things that must be done to get the printer ready to run. You'll need a large flat-blade screwdriver and a scissors or knife.

To prevent damage during shipment, the printer frame was clamped firmly to the bottom cover by a metal shipping strip. Follow the instructions below to remove it.

1. Tilt the printer back on its rear edge while holding it with one hand. The front panel, with the lights and switches, should be on top. Continue to hold the printer upright or it may topple and be damaged.
2. You will see a metal strip running along the bottom of the printer. Remove the two screws in the strip and take it away. Refer to Figure 1.

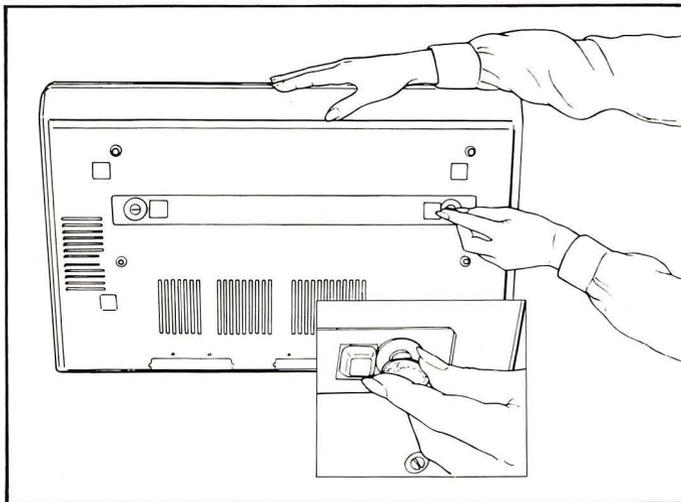


Figure 1. Removing the Metal Shipping Strip

3. Lower the printer so it is standing on its feet again. Put the metal strip and the set of screws in the styrofoam shipping cradle for possible future use.

The other set of shipping restraints is inside the printer, under the access cover (the one with the window in it). Continue with the following procedure:

4. Remove the access cover by grasping its lip and gently sliding the cover toward the front of the printer. Lift it upward and remove it. Remove the protective paper covering.

5. Remove the package of water-absorbing material from the inside of the printer and put it in a safe place, so that it can be used later if the printer is stored. Also remove the sheet of paper that shows a test printout; you will want to refer to it later.

6. Cut and remove the rubber bands that serve as tie-downs to hold the paper bale and carriage firmly in place. Figure 2 shows their locations. Be very careful not to damage any printer parts.

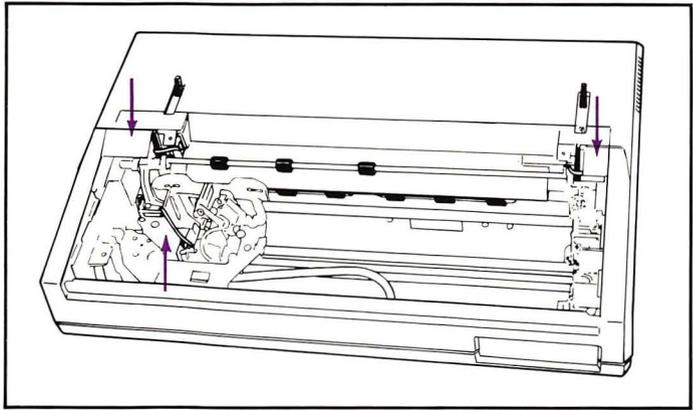


Figure 2. Tie-down Locations

7. Pull the ends of the ribbon together and up to remove the yellow nylon restraining bar from the metal track that the carriage rides on. The bar is open along the bottom. Save it for possible future use during printer shipment.

8. Replace the access cover by inserting the cover's plastic guides into the spaces in the tracks that run along each side of the case. Hold the cover level and gently slide it toward the back of the printer until it's completely closed. See Figure 3.

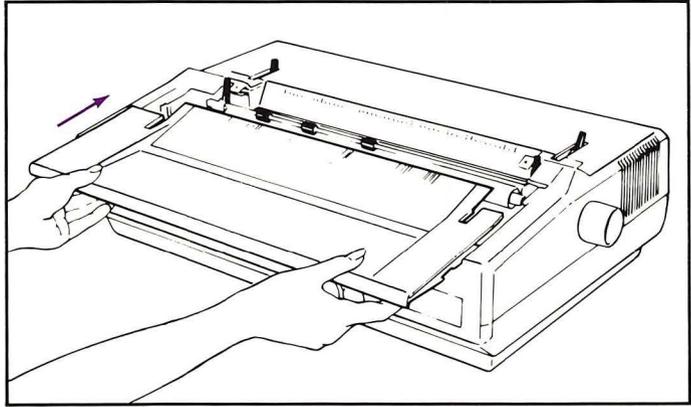


Figure 3. Replacing the Access Cover

The last thing to do is on the outside of the printer again.

9. Attach the platen knob to the printer. It goes in the hole on the right side of the case as you face the printer. Insert the two teeth on the knob's shaft in the corresponding slots inside the printer. Once this has been done, the knob should come to within about an eighth inch of the case and should turn the platen when it is rotated.

Installing the Print Wheel

Follow these steps to install the print wheel:

1. Remove the access cover.
2. Locate the release lever on the print mechanism and move it toward the print hammer. The easiest way to do this is to grasp the release lever and the print hammer between your thumb and forefinger, then squeeze them together. Refer to Figure 4.

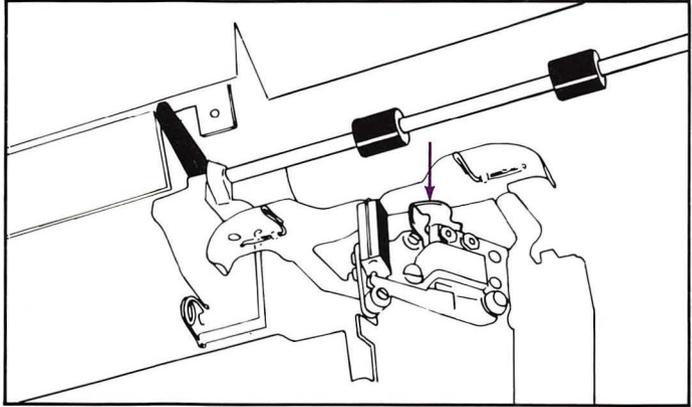


Figure 4. Print Mechanism Release Lever

3. As you squeeze the release lever toward the print hammer, pull back on the mechanism, tilting it toward you. See Figure 5.
4. You will now see the print wheel drive shaft with its triangular locating plate. Rotate the shaft until the long leg of the locating plate, with the upturned tab, points toward the print hammer.
5. Take the print wheel from its plastic case. Hold it by the knob at its hub and place the hub over the end of the drive shaft.
6. Carefully align the square cutout in the print wheel with the upturned tab on the locating plate, then press firmly on the center hub of the printwheel until it is seated on the shaft. Refer to Figure 6.

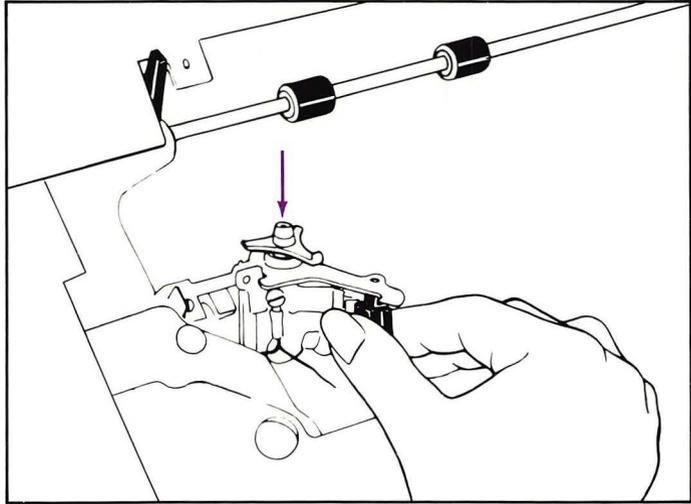


Figure 5. Releasing the Print Mechanism

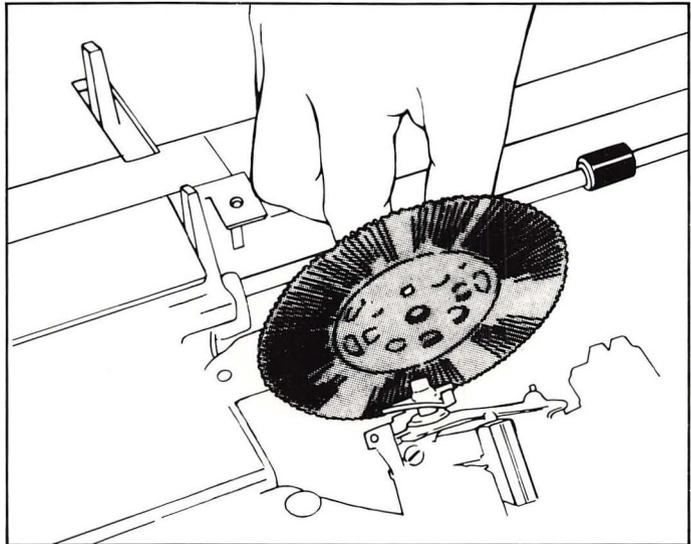


Figure 6. Aligning the Print Wheel

Press only on the center hub of the print wheel during installation. Applying force to the plastic spokes that carry the type font may break them.

Check for proper seating of the print wheel by turning it gently, using the center hub. The type spokes should rotate in a flat plane with no evidence of wobble. If the print wheel isn't fully seated on its shaft you may have ribbon feeding problems later.

7. While squeezing the release lever toward the print hammer, push the print mechanism away from you until it locks into place.

Don't move the print mechanism by pushing or pulling on the print wheel.

Installing the Ribbon

Follow these steps to install the ribbon:

1. Unwrap the ribbon cartridge. Remove and discard the cardboard packing stay.
2. If the exposed ribbon is not stretched tightly between the cartridge fingers, tighten it by turning the knob on top of the cartridge counterclockwise. See Figure 7.

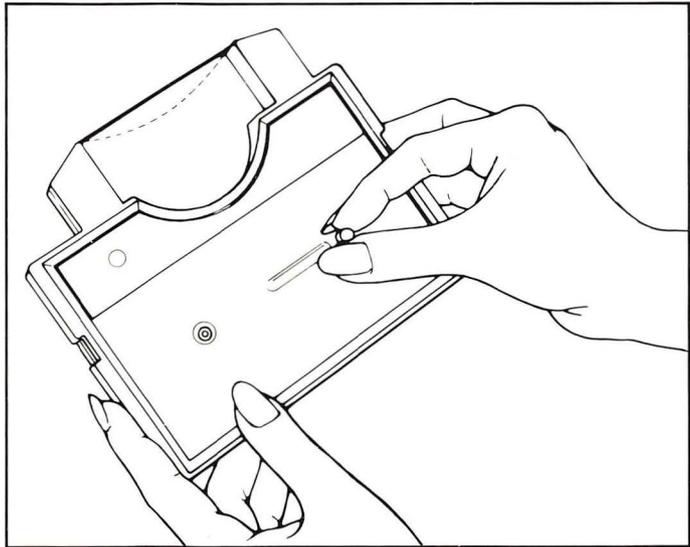


Figure 7. Tightening Ribbon

3. Hold the cartridge level, and slip the ribbon between the two wire-like guide pins and the plate holding them. The ribbon should pass between the print wheel spokes and the platen. Refer to Figure 8.

4. Align the notches in the ends of the ribbon cartridge with the hold-down clamps, and press down on the cartridge until it snaps into place.

5. Replace the access cover.

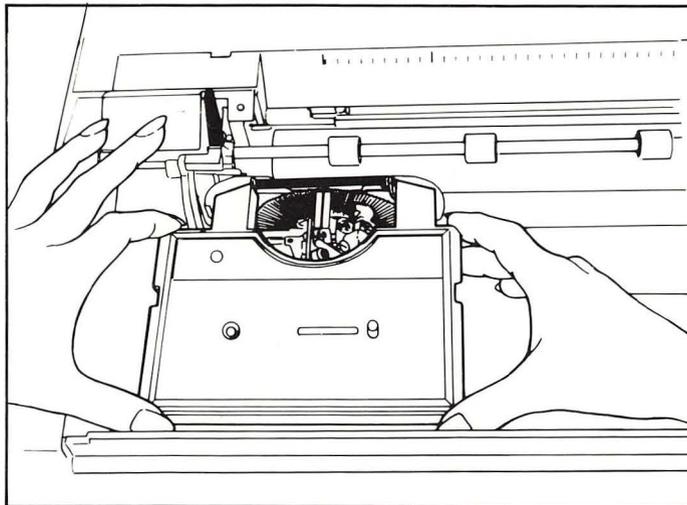


Figure 8. Ribbon Path

Paper

When you first set up your printer, you will find it easiest just to insert a single sheet of typing paper in it, just as you would in a typewriter. The full range of possibilities for things to print on is described in Chapter 2.

Here is a quick summary of this type of paper-loading:

1. Use the paper bale levers to lift the paper bale off the platen, toward you.
2. Insert the paper behind the platen, top-down.
3. Turn the platen knob so that the paper feeds down and around the platen. Bring it up to a point where the edges of the top and bottom parts of the sheet can be pressed against each other.
4. If the edges are not aligned, release the tension on the paper by pulling the paper release lever forward. Align the paper by pinching the edges together on each side and moving the paper to the proper position.

5. If necessary, move the paper and the paper edge guide right or left, holding on to the edges of the paper as you did in step 4 so that the alignment is not disturbed. The white line on the print mechanism shows where the print will begin at the left, if no left margin is specified in the instructions to the printer. Usually a margin will be specified, so you should line up this white line with the left edge of the paper. The print guide should be moved just to the left of this edge.

6. Return the paper release lever to the rear position, so that the paper is held firmly in place. Move the paper bale back to hold the paper against the platen.

7. Adjust the paper thickness lever for this type of paper: it should point toward the front of the printer.

Connecting the Printer

There are two types of connections that must be made before your printer can do anything: to a power source and to your Lisa. Before you make these hookups, you should be sure that the printer is located exactly where you want it.

Since everything that connects to your printer plugs into the lower edge of its back panel, you should try to place the printer so that you can either get behind it, or see over or around it.

You will need the following items, packed in the printer accessories box, to hook it up:

- Power Cord
- Communications Interface Cable
- Modem Eliminator Cable

If you don't have the Modem Eliminator cable, it is because its functionality is contained in the Communications Interface cable. If you have a Modem Eliminator cable, attach it now to the Communications Interface cable and while following the directions to connect your printer, assume that the two cables combined are the Communications Interface cable.

Power Cord

Locate the power switch on the left side of the printer as you face the back, or the right side as you face the front. Make sure the switch is **off**, i.e. the lower end is pressed in. Then plug in the power cord right next to the switch. The location of the power switch and the power cord connector are shown in Figure 9.

Plug the other end of the power cord into a standard three-prong electrical outlet.

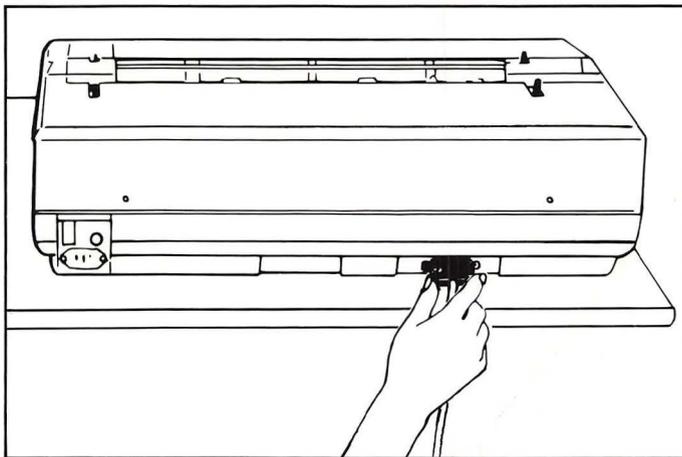


Figure 9. Power Switch and Power Cord Connector

For your own safety, and to protect your Lisa and printer, always make sure that your printer is grounded. If you don't have a three-prong grounded wall outlet, then use a three-prong to two-prong adapter, making sure to connect the ground wire on the adapter to the metal mounting screw on the wall outlet. If you must power your printer from an extension cord, make sure it's a three-wire cord.

Communications Interface Cable

Connect one end of the communications interface cable to the 25-pin connector on the back of the printer. It is toward the right as you face the back of the printer, toward the left as you face the front.

Plug the other end of the Printer Connecting Cable into the connector labeled Serial Device B in the back of your Lisa. If the Serial Device B connector is in use, you can plug the cable into the Serial Device A connector. Notice that these connectors can only be connected properly in one way.

Starting up the Printer

You are now ready to do some printing. When you first start up the printer, it is a good idea to confirm that it is working properly by performing at least one test that does not require the Lisa to do anything. The two basic tests that the printer can do itself, which can also be used later to aid in troubleshooting, are explained below.

First, turn on the printer:

- Turn the switch next to the power cord at the back of the printer to **on** by pressing the top half.
- You should hear the printer motor and fan start up, and two whirring noises as the carriage and print wheel are readied for printing.
- The green **ready** light on the upper left part of the front panel should glow steadily.

Printer Self-Tests

Both of these tests print out the alphabet (and other symbols on the print wheel) in a logical order, so it is easy to see whether they have worked properly.

Printer Test

This test confirms that all the printer mechanisms except those involved in communicating with the computer are working right.

1. In addition to a good ribbon and print wheel, you will need to install paper at least ten inches wide.
2. After the access cover is back in place, press and hold the **form feed** switch on the front panel and then turn on the printer.
3. After printing has begun, let go of the **form feed** switch.
4. When you want the printing to stop, either turn off the power or hold down the **form feed** switch as a line of characters is completed.

What Should Happen: The printer should produce the same line of 130 characters over and over, each time starting with the next character in the line, so it looks like the line is moving to the left. There will be ten characters per inch, no matter how the user access switches (the ones above and behind the front panel) have been set. The printer will produce each line left-to-right. Let it print out ten lines or so before stopping the test. If the test has not worked properly, consult your dealer.

Terminal Test

You may want to run this second test following the one above. Although it too does not require that your Lisa be on, it tests the circuitry in the printer that will allow it to receive information from the computer.

1. This time the printer will produce the number of characters per inch indicated by the operator access switches, which come set for 12 pitch. For this normal setting, you will need paper 11 inches wide. If the switches are set for 10 pitch, the paper must be at least 13 inches wide.

Be sure that you are using paper that is wide enough, so as not to print on the platen.

2. After making sure that the ribbon, print wheel, paper, and access cover are all in place, press and hold the **pause** switch on the front panel and then turn on the printer.

3. After printing has begun, let go of the **pause** switch.

4. You can stop the test either by turning off the power or by holding down the **pause** switch as a line of characters is completed.

What Should Happen: The printer should produce several lines of information and then a line of 130 characters—everything on the print wheel—over and over, each line exactly the same. This time the printing will be bidirectional: left-to-right, then right-to-left, and so on. Check your printout, as in Test 1. It should correspond to the one that came inside the printer.

Trouble-shooting

Your printer will do many complex things. Some of these depend upon other equipment working properly. The following list suggests some things inside and outside the printer that you can check before returning the printer to your dealer for service, when a problem arises.

The following is a list of things to check first:

- Does the printer have power? With the power switch on, you should hear the cooling fan running. If it is not, first check the power cord connection at both ends. Plug another electrical appliance, like a light or a radio, into the same outlet to verify power at the source. If the power source is all right but the printer's fuse is blown, replace it with a 5-amp 3AG fuse, available at most electrical supply or auto parts stores. If the fuse blows again after replacement, contact your dealer for assistance.
- What is the status of the front panel indicator lights? These lights will give you a clue as to where the problem lies.
- The **attend** light on means that the printer needs your attention — there is something you should do.
- The **ready** light on means that the printer is ready to print; if this light is blinking, the printer is almost ready.
- One or both of these lights will be on whenever the printer is switched on.

If the **ready** light is **blinking** and the **attend** light is **off**, just press the **pause** switch, and the printer should work normally.

If the **ready** light is blinking and the **attend** light is **on**, check for the following problems, and after fixing whatever is wrong, press the **pause** switch:

- Is the cover off, or put on wrong?
- Has the ribbon run out, or is it broken or tangled?
- Is there paper in the printer?

If the **ready** light is **on** and the **attend** light **off**, but the printer is not doing what you expect it to:

- Turn the power off, wait a few seconds, and then turn it on again. Does the printer initialize properly? The carriage should move all the way to the left, getting ready to start printing, and there should be two whirring sounds. If this initialization is not happening, contact your dealer.

- Do the printer self-tests give the correct results? Try both of the tests described in the previous section. If either test is unsuccessful, contact your dealer. If both tests work, you should look for problems with the cable that connects the printer to your Lisa: Is it properly attached? Has it been damaged? Or, if the problem is simply one of print quality, check the print wheel for dirt, wear, and correct installation, and make sure the ribbon is threaded and feeding properly.

If the **attend** light is **on** and the **ready** light is **off**, try turning the power off and then on again, as described above. If this doesn't help, contact your dealer, since the printer has found an internal electronic problem.

Chapter 2

Information About Your Printer

This section describes the parts of the printer and their functions. Refer to Figure 10.

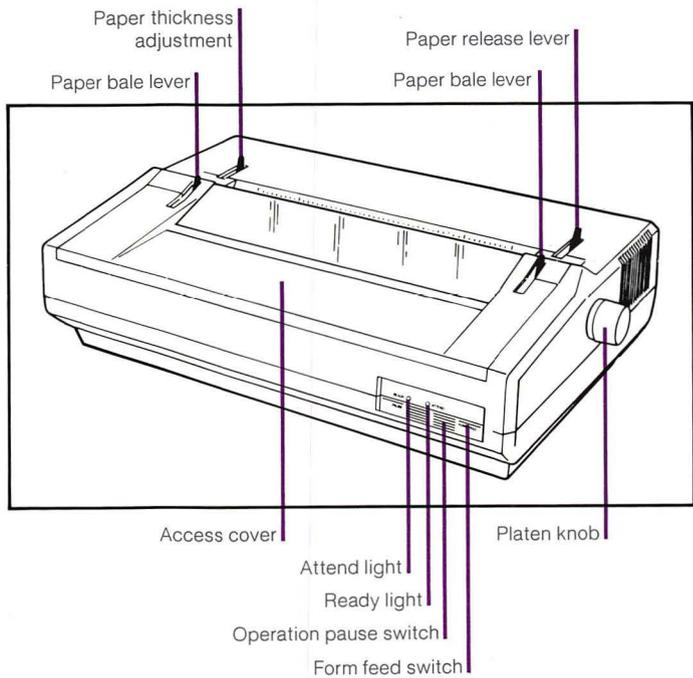


Figure 10. Important Parts - Front of Printer.

General Structure

The following sections describe the parts of the printer as they are labeled in Figure 10.

Platen Knob

You use the platen knob, as you would on a typewriter, to move the paper or form vertically during loading or unloading. When the knob is pressed inward the paper moves freely, allowing fine vertical adjustments.

Paper Bale Levers

Pulling the paper bale levers forward, toward you, moves the paper bale away from the platen surface, releasing the paper or form. Normal position of these levers for friction-feed operation is toward the rear of the printer. When you use the optional forms tractor, these levers should be in the forward, released, position.

Paper Release Lever

Pulling this lever forward, toward you, separates the feed rollers, located below the platen, from the platen. This allows you to adjust the paper or form freely in any direction. The normal operating position of this lever is toward the rear, away from you. When you use the optional forms tractor, the paper release lever must be in the released, forward, position.

Paper Thickness Adjustment

This lever adjusts the spacing between the printing mechanism and the platen. For single part forms or ordinary paper, place this lever in the forward, toward you, position. For multipart forms or extremely thick paper stock, you can move the lever one or more notches to the rear for better print quality.

Access Cover

The access cover keeps anything, such as hair, fingers, jewelry, paper clips, and the like, from interfering with the printing mechanism during its operation, while the window allows you to see what's going on. The printer will not work with the cover off, but it can be removed to change the ribbon or print wheel.

Ready Light

This light is **off** when power is not applied, and when the printer will not proceed after detecting an internal error. Under normal operating conditions this light is continuously **on**. It will **blink** when the printer has halted after the operation **pause** switch has been depressed or after the **attend** light has come on.

Attend Light

This light is **off** under normal conditions of operation. This light is continuously **on** when any of the following is true:

- The access cover is open or removed.
- The ribbon supply has run out or no ribbon cartridge is installed.
- The paper supply has run out.
- The printer is in **check**, having detected an internal error.

Operation Pause Switch

Pressing this switch will cause the printer to pause; or if it is pausing, to resume printing. When the **attend** light comes **on**, the printer will automatically pause. Only a single depression of the **pause** switch is necessary to start the printer printing. If an **attend** condition is not cleared, however, the printer will stay in pause mode even if the **pause** switch is depressed.

Form Feed Switch

This switch causes the paper to move to the top of the next form. The form length distance is determined by the setting of a group of switches in back of the front panel. The initial setting is for 8-1/2 × 11 inch paper.

Under the Access Cover

There are more important parts located under the access cover. When you slide the access cover open this time, you can let it drop down and hang on the front of the printer, rather than completely removing it.

Platen

The platen holds the paper or form in printing position. The cushion face on the platen presents the proper backing for best print quality and quiet operation.

Feed Rollers

The feed rollers (mounted in a cradle under the platen) press the paper tightly against the platen during friction-feed operation. This provides the driving force necessary for vertical paper movement.

Paper Bale

The paper bale holds the paper or form against the platen. This is necessary to prevent character smearing, and for quiet operation. The paper bale is spring-loaded against the platen during normal operation, and can be pulled forward while you are loading paper.

Print Mechanism

The print mechanism consists of a drive motor for the print wheel and the print hammer assembly. The print mechanism may be tilted forward to remove or install print wheels.

Carriage

The carriage carries the print mechanism, the ribbon cartridge, and ribbon drive system, allowing them to move from column to column across the paper. Flexible cables connect the carriage components to the printer electronics.

Behind the Front Panel

A couple of important items are located just behind the front panel. Lean over the printer and look near the back of the front panel for these parts.

User Access Switches

These eight little switches are used to set printer characteristics like the form length, pitch (horizontal character spacing), line spacing, and the like. Normally, you will never have to touch them.

Cover Screws

These are two of the four screws you have to take out to remove the printer's top cover. The other two are on the back panel.

On the Back Panel

The power cord and communications interface cable attach to connectors at the rear of the printer.

Power Cord Connector

One end of the power cord connects here. The other end goes to a three-wire grounded electrical outlet.

Power ON/OFF Switch

Power to the printer is controlled by this rocker-style switch. Pressing the top end of the switch (1 - ON) turns the power on. Pressing the bottom end (O - OFF) turns the power off.

Power Line Fuse

This fuse protects the printer's power supply against short circuits and overloads. The fuse can be examined by rotating the cap counterclockwise, using a small screwdriver or a dime.

Communications Interface Connector

One end of the communications interface cable connects here. The other end connects to your Lisa or to a modem. See Chapter 1 for how to connect your printer.

Cover Screws

These are two of the four screws you have to take out to remove the printer's top cover. The other two are in the corners behind the front panel.

Under the Top Cover

You seldom will need to remove the top cover of the printer, but there are parts under there that you should know about. Later, if you find you need to, remove the top cover.

Removing the Top Cover

To remove the printer's top cover, follow these steps:

1. Turn the printer **off** and disconnect the power cord from its connector on the rear panel.

The AC power cord must be disconnected before the top cover assembly is removed. **Lethal** voltages are present on the electronic printed circuit boards with the power cord connected.

2. Remove the access cover and the platen knob, and set them aside.

3. Loosen the four screws which hold the top cover on the printer. The two in the corners behind the front panel can be loosened with a Phillips head screwdriver, but not removed completely. They are "captive screws." The two on the back panel can be removed completely with a flat-blade screwdriver.

4. Carefully lift the top cover straight up and off the printer, and put it in a quiet corner.

To replace the top cover, simply follow the above steps in reverse.

Main Electronics Circuit Board

This circuit board contains the printer's three microprocessors and the supporting electronics necessary for printer operation.

Internal Configuration Switches

These switches determine the basic operating configuration of the printer. Normally, you should not disturb them. There are two banks of eight switches each; they are labelled SW1 on the left, as you face the printer normally, and SW2 on the right.

Maintenance Switches

These three switches are for use by maintenance people only. Do not disturb their settings.

More About Print Wheels, Ribbons, and Paper

What the Print Wheel Does

The print wheel acts just like the hammers on a standard typewriter, or like the round typing element found on some newer models: something pushes each letter-shaped outline against the ribbon, paper, and platen to make a mark. On your printer, each such letter-shaped outline, as well as those for many symbols, is at the tip of a spoke on a nylon wheel (“daisy wheel”). A print hammer strikes the other side of the tip of the spoke to make it print a character. Because the characters are different sizes, less force is needed to print the smaller ones. The printer automatically adjusts the force for each character.

How does the printer get each character in the right position to print at just the right instant? A microprocessor inside the printer rotates the print wheel to the proper position at the proper time. The location of each character is known relative to a particular “home” point on the print wheel, just as we locate places with a compass using North as a reference point.

As on typewriters with print elements, you can change what the print looks like by changing the print wheel. The wheel that comes with the printer is Prestige Elite 12 (the characters are sized to print 12 per inch). Different styles of print and character sizes (itches) are available from your Apple dealer. You may want to try using Courier 10, Gothic 15, or Boldface Executive PS (proportional spacing).

As mentioned later in this chapter, you can keep the need for print wheel-cleaning down by using different print wheels with fabric and carbon ribbons. This means that you may be taking print wheels on and off fairly frequently: to use different ones, to clean them, or, eventually, to replace them when they become worn. If you do this carefully each time, you should not harm the print wheel.

Removing the Print Wheel

Just as the ribbon is installed after the print wheel, it must be removed before the print wheel can be. After doing this, follow the steps below:

1. Release the print mechanism and tilt it toward you as you did when installing the print wheel.
2. Pull gently but firmly on the knob in the center of the print wheel to remove it. If you are going to store it, put it back in its plastic case.

Types of Ribbons and Their Use

Two types of ribbons are available for use with your printer: continuous-loop fabric ribbons, for general use, and multistrike carbon ribbons for higher print quality.

The fabric ribbons can be used indefinitely, and it is up to you to decide when to replace them, when the print becomes too light. Replace them only between print jobs.

Multistrike carbon ribbons pass through the print mechanism just once and must be replaced when they run out. The end-of-ribbon detector will stop the printer at this end-point. You will know what happened because the **ready** lamp will be **blinking** and the **attend** lamp on. You can replace the ribbon cartridge and put the access cover back on, and the printer will take up exactly where it left off. If the print wheel was also removed, there may be a slight hesitation before printing begins again.

Ribbon Replacement

To replace either kind of ribbon cartridge, follow these steps:

1. Open and remove the access cover.
2. Press down on the two hold-down clamps and lift the old cartridge off.
3. Follow the steps listed in Chapter 1 to install the new ribbon cartridge. The **attend** lamp should go **off** if it is on.
4. Press the **pause** switch, and the printer will resume printing right where it left off.

Loading Paper

You can load your printer with individual sheets of ordinary typing paper, business letterheads, single- or multiple-copy forms, or continuous fan-fold printer paper.

You can also use a cut sheet feeder with your printer. It accepts 8-1/2 × 11 inch paper of various thicknesses and can accommodate up to 250 sheets.

Single sheets and individual forms are easily handled with normal friction-feed (rollers press the paper against the platen, as a typewriter does) operation. For reliable feeding of continuous paper or forms, you will probably want to use the optional form-feeding tractor. The tractor requires paper with holes perforated in the edges to engage the tractor's sprocket pins.

Tractor-feed Operation

The procedures for mounting the optional form-feeding tractor, and loading tractor-fed paper and forms, are covered in the instructions that come with the tractor. The tractor accepts and drives continuous feed forms with perforated edges (standard one-half-inch vertical hole spacing). It adjusts to forms ranging from 3 to 15 inches wide.

When installing the tractor feeder on the printer, the friction feed pressure rollers and paper bale guide rollers must be disengaged. This means that the paper release lever must be pulled forward toward the front of the printer, as shown in Figure 11, otherwise paper feeding problems may occur.

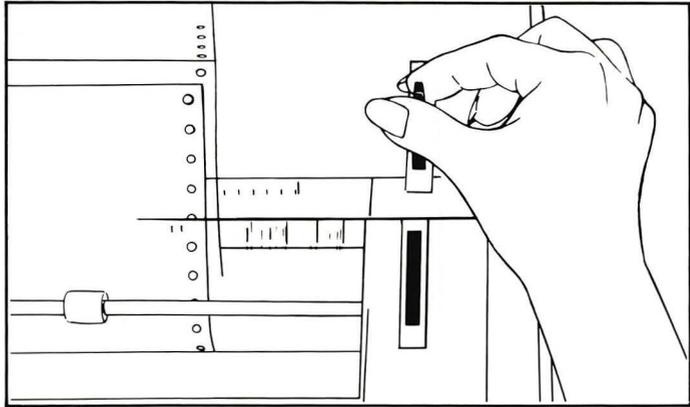


Figure 11. Paper Release Lever

After the paper is loaded, push the bale guide roller back to return it to its normal engaged position, and align the paper against itself, as shown in Figure 12.

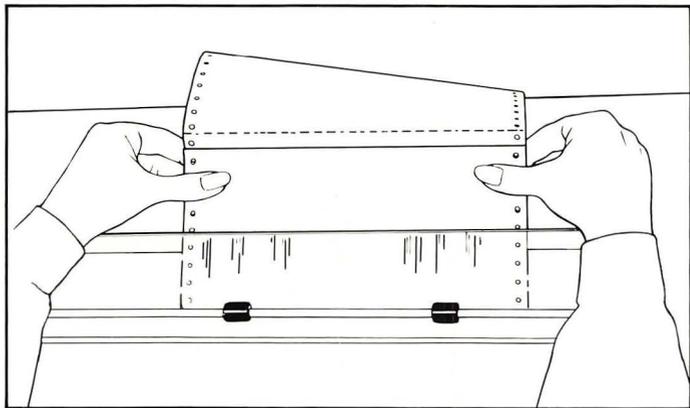


Figure 12. Aligning Paper in the Printer

Printer Placement When Using Continuous-feed Paper

If you will be using fan-fold continuous paper or forms, remember that you will need room for the paper supply behind the printer; the back of the printer should be at least 12 inches from the wall. An alternative is to place the printer at the back of a desk or table, with the paper supply in a box on the floor underneath it, feeding up behind. In either case, be sure that the paper is feeding up into the printer straight, not at an angle, and that the printed-on sheets coming out of the printer do not rest on the paper being fed in. You should also observe the Communication Interface Cable coming out of the back of the printer, which could interfere with paper feeding. If you have the paper on the table behind the printer, you can position it correctly by putting it on a thick book sitting several inches away from the printer.

Setting the Top-of-Form Position

Your printer, unlike a typewriter, automatically keeps track of the position of the top of form when using continuous fan-fold paper or forms. You will usually want to set the top-of-form position whenever you initially turn on the printer. Here's how to do it:

1. Make sure the printer is properly loaded with continuous paper or forms.
2. Turn the printer **on** and check its status lights. The **ready** lamp should be continuously **on** and the **attend** lamp **off**.
3. Press the **form feed** switch as shown in Figure 13. Paper will advance through the printer and stop.
4. When the paper stops moving, the printer “thinks” it is at the top-of-form position. If you're happy with the printer's idea of where the top-of-form is, fine. Stop right here and begin to use the printer.

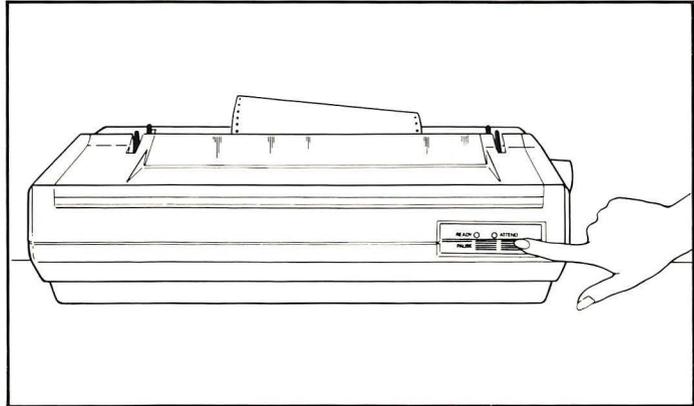


Figure 13. Setting the Top-of-Form Position

5. If you want the top-of-form to be at a different distance from the fan-fold perforation, adjust the paper position by using the platen knob. The platen knob can be pushed in for fine adjustments.
6. As long as the paper position is not changed by turning the platen knob, the printer will remember the top-of-form position. Pressing the **form feed** switch will cause the paper to move to this position at the top of a new sheet, as will sending the **form feed** character code to the printer.

These procedures for setting top-of-form are the same when using the cut sheet feeder. Pressing the **form feed** switch causes one sheet of paper to be fed.

Operating Environment

The printer's working environment should be:

- Indoors and reasonably clean.
- Between 50 and 104 degrees Fahrenheit (10-40 degrees Celsius), with humidity between 10 and 90 percent. While not operating, it can be stored at temperatures between -40 and $+104$ degrees Fahrenheit (-40 to $+60$ degrees Celsius) without damage, but no attempt should be made to run it at these extremes.
- Free from noticeable outside vibration during storage or when the printer is set up and working. Even though it might work, its service life can be greatly reduced by such vibration.



- Protected from liquids and vapors. Spilling any liquid inside or allowing the printer to be exposed to chemical or solvent fumes, including steam from a coffee maker, can quickly ruin it beyond repair. The printer's covers offer it no protection against such damage, though normally they will guard it against dust and other solid objects.

Cleaning

You should clean your printer periodically to maintain high print quality and dependability. Heavily used printers accumulate paper fibers and ink particles. All printers accumulate dust and atmospheric particles. General cleaning should be done weekly as a preventative measure. The platen should be checked weekly and cleaned whenever necessary.

If a cloth ribbon is used, especially the heavier inked varieties, clean the print wheel thoroughly each time the ribbon is replaced. In any case, cleaning the print wheel monthly will help preserve clear, sharp impressions. Between cleanings, brush away any loose paper with a moderately soft brush.

General Cleaning

For cleaning solution, use one of the light-bodied non-caustic cleaners such as Zoom, Formula 409, or Fantastik. Do not use petroleum-based solvents, chlorinated hydrocarbons (trichloroethylenes, etc.), or solutions that leave a powder residue.

Do not spray cleaners directly into the printer; use only the methods outlined below. Be very careful to avoid the print hammer when cleaning. The print hammer requires a special lubricant that must be applied in exactly the right quantity. Cleaning and lubricating the print hammer must be performed by qualified service personnel only.

To clean the external and internal surfaces of the printer, use a soft lint-free cloth, moistened with one of the cleaners listed above.

Ink spatters will accumulate on the metal ribbon shield. Remove this ink with a soft cloth or cotton swab moistened with isopropyl alcohol.

Cleaning the Print Wheel

The print wheel, removed from the printer, should be cleaned as follows:

The print wheel cleaning procedure can spatter ink on clothing and surrounding objects. Take any necessary precautions to avoid ruining clothing or other objects.

1. Place the print wheel in a shallow dish or container.
2. Pour cleaner (listed above) over the print wheel until it is barely covered.
3. Allow it to soak for a minute or two.
4. Using a type-cleaning brush or a medium-stiff toothbrush, remove any caked areas that have not dissolved.
5. When the print wheel is clean, carefully pat it dry with an absorbent cloth or paper towel.

Cleaning the Platen

Every few months (or more often, if necessary), remove and clean the platen. Use Fedron or an equivalent product (usually available from typewriter repair or supply outlets) for cleaning the platen. Minor cleaning can be done with one of the previously listed cleaners, but Fedron contains preservatives and lubricants for the platen surface that will greatly add to its life.

Fedron will attack paint and plastic parts. Do not use Fedron on any part of the printer except the platen, feed rolls, or bale rolls, and only when these parts have been removed. Fedron is extremely flammable; read and follow all precautions and warnings on the container.

Removing the Platen

1. Remove the printer's top cover, as described earlier in this chapter.
2. Pull the paper bail forward, out of the way.
3. Grasp both ends of the platen by the ends of the shaft.
4. Use your thumbs to depress the platen release levers at each end of the platen.
5. Lift the platen up and out.

While the platen is removed for cleaning, also clean the lower rollers and under-cradle below the platen area, using a soft cloth or swab moistened with Zoom, Formula 409, Fantastik, or an equivalent cleaner. Do not use Fedron in the cradle area or within the printer mechanism.

Replacing the Platen

1. Check to see that the lower rollers and the under-cradle are clean and properly seated.
2. As the platen is put in position, align the gear teeth on the right to center on the large gear below.
3. Simultaneously press down on both ends of the platen shaft. The platen will lock into place. If it does not, check the alignment.
4. Replace the top cover.

Storage and Shipping

Whenever you need to ship your printer, or put it into storage, repack it in the original shipping carton.

If you ever need to repack your printer for shipment to a new location, or perhaps to return it for service, use the packing material you saved when you unpacked it and follow these steps.

1. Remove the power cord and communications interface cable.
2. Remove the ribbon cartridge and print wheel as described in this chapter, locking the print mechanism back into its operating position.
3. Remove the access cover.
4. Push the print mechanism as far as it will go to the left. Using a plastic cable tie, a strong rubber band, or a strong twist-tie strip like the kind used to close plastic trash bags, loop the tie around the support rod for the ribbon feed motor (under the screw head visible at the left side of the ribbon drive plate, near the platen) then pass the tie around the horizontal support rod for the paper bale spring protruding from the left end of the carriage frame. Secure the print mechanism against the left side of the printer by tightening the tie snugly.

- 5.** Push the paper bale against the platen. Using two more cable ties or twist-tie strips, secure the paper bale in this position by passing a tie around the paper bale lever at each end of the bale and looping the tie around the platen release lever. Tighten the ties snugly.
- 6.** Replace the access cover.
- 7.** Tip the printer back on its rear edge and reinstall the metal shipping strip by inserting the screws through the strip into the two empty holes in the bottom of the printer. Tighten these screws firmly.
- 8.** Remove the platen knob and place it in its compartment in the bottom of the styrofoam shipping cradle.
- 9.** Put the print wheel and ribbon cartridge in a plastic bag and place the bag, cables, and power cord in the bottom of the shipping cradle.
- 10.** Carefully set the printer into the bottom of the styrofoam shipping cradle. Replace the top of the shipping cradle.
- 11.** Seal the cardboard shipping box using strong strapping tape; the kind with fiberglass strips is best.

Appendix A

Command Set

If you are a user of the Lisa Office System you will probably never read this section. It is intended only for experienced programmers who want to modify the normal operation of the printer.

Once your Apple Daisy Wheel Printer is configured with your Lisa, all printing operations can be executed through Lisa applications software. This appendix describes the actual controls which can be sent to the printer by the programmer in order to execute special features of the printer.

The printer has three sources of information on how to act:

- The built-in or “default” instructions, which it follows when it has received no alternative commands. These instructions become effective every time the printer performs the initialization sequence, either when you turn the power on or as a result of an initialization command sent by your Lisa. These instructions remain in effect until cancelled by subsequent printer commands. Thus, for example, the left margin is set to column 0 until you specify otherwise.
- The “basic operating configuration,” determined by the switch settings. When the printer is initialized, it reads the settings of these switches and remembers them until the power is turned off, or until specific printer commands are sent to change the character set, form length, pitch, etc.
- Special control codes, called “printer commands,” sent as a sequence of ASCII characters to the printer by the computer. There are 89 such commands.

Each of these methods of instructing the printer is described in this appendix.

Initialization Default Instructions

As mentioned above, turning the printer's power off and on (or issuing an initialization command) "clears" its memory of all previous commands, and at the same time gives it a set of predetermined default instructions. Any of these instructions can be altered by issuing commands to the printer.

The description of the initialization command, later in this chapter, gives a complete list of these default instructions. They were chosen so that the printer would be capable of producing useful printing when first turned on, before it had received any specific format commands. If these default instructions turn out to be different from those you normally use, you will want to create a "format file" of commands to send to your printer each time you start to use it.

Configuration Switch Instructions

The various configurations that can be set up by using the three sets of switches under the printer covers are described in Tables 1 through 3. Later in this appendix you will find ways of altering most of them temporarily by sending commands from the computer to the printer.

Table 1. Printer Control Switch Settings for Front of Printer

Switch	Setting	Result	Comments
8	*0	6 lines per inch	
	1	8 lines per inch	
7	*0	No line feed on carriage return	When a line feed occurs after a carriage return, the printer starts printing on the next line, rather than on top of the one that was just printed. Most text-entry programs insert these line feeds automatically; if you find you are using a program that causes lines to be printed on top of each other, change the open setting of this switch to closed.
	1	Automatic line feed on carriage return	
6,5,4,3	0000	3 in.	The printer reads this switch to find out the length of the form being printed on, so that formatting at the top and bottom of pages will be handled properly.
	0001	3-1/2 in.	
	0010	4 in.	
	1100	5 in.	
	0011	5-1/2 in.	
	0100	6 in.	
	0101	7 in.	
	0110	8 in.	

Table 1. Printer Control Switch Settings for Front of Printer, continued

Switch	Setting	Result	Comments
	0111	8-1/2 in.	
	1101	9 in.	
	1110	10 in.	
	*1000	11 in.	
	1001	11-2/3 in.	
	1010	12 in.	
	1011	14 in.	
	1111	16 in.	
2,1	00	10 char./in.	Pitch = characters per inch. Unless you want the printed characters to be unusually close together or far apart, the setting should correspond to the pitch number on the print wheel (or be set to PS).
	*01	12 char./in.	
	10	15 char./in.	
	11	Proportional spacing	

* Default factory setting

Table 2. Printer Control Switch 1 Setting for Back of Printer

Switch	Setting	Result	Comments
8,7	*11	Space parity	These switches control the printer's handling of the parity bit in each character. For space parity the parity bit is set to 0.
	10	Mark parity	
	01	Even parity	
	00	Odd parity	
6	0	Modem setting	The Modem/No Modem distinction has to do with the type of serial interface.
	*1	No Modem setting	
5,4	*00	ETX/ACK & DTR	A handshaking signalling system is used to control the signals sent back and forth between the printer and computer. The factory setting allows either ETX/ACK or DTR hardware handshaking. See Appendix H for details.
	01	XON/XOFF	
	10	DTR	
	11	(not used)	
3,2,1	000	110 baud	These switches control the rate at which the printer can receive data from the computer: for example 1200 baud, or bits per second.
	001	150 baud	
	010	300 baud	
	011	600 baud	
	*100	1200 baud	
	101	2400 baud	
	110	4800 baud	
	111	9600 baud	

* Default factory setting

Table 3. Printer Control Switch 2 Settings for Back of Printer

Switch	Setting	Result	Comments
8	0	No stop on paper out	When this switch is set to 1, the printer stops when it runs out of paper.
	* 1	Stop on paper out	
7	*0	Full Duplex	This setting controls an aspect of how signals travel back and forth.
	1	Half Duplex	
6	*0	No automatic carriage return/line feed	This switch controls the handling of overlong lines (extending beyond the right margin). When it is 0, excess characters are printed in the last column, on top of each other, rather than on the next line.
	1	Automatic carriage return/line feed	
5	0	Unidirectional printing	Normally bidirectional printing, in which the carriage moves in both directions, is selected for greater efficiency.
	* 1	Bidirectional printing	
4,3,2,1	*0000	ASCII Standard	These switches select a subset of the 130 characters on the print wheel, so that what you print is tailored to a particular language (or English dialect).
	0001	USA WP	
	0010	Italian	
	0011	Swedish	
	0100	English	
	0101	French	
	0110	German	
	0111	Spanish	

* Default factory setting

The Command Set

In addition to the 94 ASCII codes that cause a character to be printed, the printer also recognizes 89 commands that range from such familiar items as SPACE or LINE FEED to specialized text manipulation commands like BOLD OVERPRINT or AUTOMATIC UNDERSCORE.

To issue a command (or control sequence) to your printer, include it in a statement or operation that causes something to be printed by the printer. When you use a control sequence in a program, the characters won't be displayed on the screen and won't be printed as characters by your Apple Daisy Wheel Printer. Each time your printer sees a command in the stream of data sent to it by your Lisa, it stops printing and interprets the commands. After the printer has completed the action requested by the command, it resumes printing the text as before.

Most printer commands consist of an ESCAPE character followed by a sequence of other characters. Since the Lisa does not have an ESCAPE key on its keyboard, the only way to send commands to the printer is in a program in which the decimal or hexadecimal ASCII equivalent of these keys is used.

There is no problem sending those parts of the commands that consist of letters, numbers, and punctuation marks. However, non-printing control characters such as ESCAPE require special programming techniques.

The technique used to create such characters as ESCAPE involves the CHR or CHR\$ functions. The Pascal function CHR(nn) and the BASIC function CHR\$(nn) both return the ASCII character that corresponds to the decimal number nn. For example, if nn is 27, the function returns a ESCAPE character. Thus, the control code to begin underlining, ESCAPE I, can be sent to the printer by the following statements:

Pascal — Write (Printer,CHR(27), 'I')

BASIC — Print 1 CHR\$(27);"I";

assuming the printer is an output file opened as "Printer" and "#1" respectively. The full set of printer commands are discussed below under the following headings:

1. Command Types
2. Motion Minimization
3. Command Interaction with Configuration Switches
4. Command Syntax Definitions
5. Paper Feed Set Up and Define Commands
6. Paper Feed Motion Commands
7. Carriage Set Up and Define Commands
8. Carriage Motion Commands
9. Character Printing Set Up and Define Commands
10. Character Printing Commands
11. Test Commands
12. Miscellaneous Commands
13. Serial Communications Handshaking Commands

The paper feed, carriage movement, and character printing operations are broken into two groups of commands each: 1) Set Up and Define, and 2) Motion. The Set Up and Define commands determine “how” a command will be executed, or what “mode of operation” the printer is in. The Motion commands cause a specific action to take place.

Command Types

The 94 character-printing commands and other basic commands such as SPACE, CARRIAGE RETURN, BELL, etc., require transmission of a single character to the printer.

For the additional 70 commands, a more complex command format is used. These commands, with one exception, begin with the ASCII escape <ESC> character, followed by additional characters as required. These additional characters provide two types of information: 1) the first character after the <ESC> identifies the command, and 2) any additional characters provide the additional data needed for the command to be carried out.

Motion Minimization

Your printer uses a “motion minimization” technique to execute horizontal carriage and vertical paper motions in the least amount of time possible. Data coming from the computer to the printer are stored temporarily in a small memory in the printer, a “receive buffer,” while waiting to be used. As long as the host system keeps this buffer at least partly full, the printer will “look ahead” in the buffer before executing most motion commands. Thus it can make decisions about how to perform most efficiently.

What the printer wants to do is to execute one large motion instead of many smaller motions. A string of ten SPACE commands is executed as one motion, ten columns long; several sequential LINE FEED commands results in one vertical paper motion. A SPACE command followed by a BACKSPACE command results in no motion.

Motion minimization analysis is terminated by a variety of commands, or by emptying the receive buffer. Operation at 110 and 300 baud normally can't include motion minimization, since at these rates of data transmission from the computer (much slower than the default rate of 1200 baud), the printer normally executes commands as fast as they are being received, and does not take the time to analyze them first.

Command Interaction with Configuration Switches

Many commands can override the settings of operator access or internal configuration switches. These new settings hold until RESET is used to tell the printer to read the switches again, or until the printer is turned off. Some aspects of the configuration (for example the baud rate) can never be changed by software, however.

Command Syntax Definitions

Each command's heading includes the command name, plus the character sequence that must be sent to the printer to issue the command. The following symbols are used in the command character sequences:

- < > Angle brackets enclose the abbreviation for an ASCII control character, such as <ESC>.
The single control character is sent (without brackets).
- A , Characters not enclosed by brackets identify specific commands. The character must be sent as shown: lower case is not allowed for upper case, and vice versa.
- [] Square brackets enclose "data" characters required for the command, such as [d1]. A single character is sent (without brackets) for each position shown.
- d Represents a single hexadecimal digit (0-F). If more than one is required for a command, they will be numbered by position (d1, etc.).
- n Represents a single ASCII character chosen from the indicated table.

Characters in the command sequences are separated by spaces for clarity, but the spaces are not part of the command sequence and should not be sent.

Paper Feed Set Up and Define Commands

Set Top Margin: <ESC> +

With this command you can establish the top margin anywhere within the form length, except below the bottom margin. To implement this function, issue a series of LINE FEED commands until the desired top margin line is reached, then issue this command to set the top margin at that line. If any paper feed command advances the paper past the bottom margin the paper will automatically advance to the next top margin. The default top margin position is the top of form position.

Set Bottom Margin: <ESC> -

With this command you can establish the bottom margin anywhere within the form length, except above the top margin. To implement this function, use the same procedure used in setting the top margin. When a paper feed command advances the paper below the bottom margin, the paper will automatically advance to the next form's top margin. The default bottom margin position is the bottom of form position, as determined by the form length.

Define Vertical Spacing Increments: <ESC> L [d1] [d2]

Use this command to define the line feed distance in 1/48" increments. [d1] [d2] represent any line feed distance between 1/48" (0 1) and 159/48" (F 9). For line feed distances greater than 99/48", refer to Table 1 in Appendix C.

For example, to define the vertical spacing increment as 1/4":

1. First determine the number of 1/48" in 1/4" (12).
2. Because the number is less than 99, Table 1 is not needed, and the command is <ESC> L 1 2 .

If the desired line feed distance exceeds 99/48", for example 3", then:

1. Determine the number of 1/48" in 3" (144).
2. From Table 1 in Appendix C locate the digits E 4 for 144.
3. The command is <ESC> L E 4 .

Invalid parameters are ignored. If either [d1] or [d2] is zero, the digit 0 must be entered.

This command overrides the setting of the Lines Per Inch configuration switch.

Define Vertical Spacing Increments, Alternate:

<ESC> <RS> [n]

Use this command to define the line feed distance in 1/48" increments using a single ASCII character [n], which is determined from Table 2 in Appendix C.

For example, to define an increment of 1/4":

1. Determine the number of 1/48" in 1/4" (12).
2. Using Table 2, find the ASCII character for 12 to be <CR>. (The '1' comes from the row headers running down the left side of the table, the '2' from the column headers along the top.)
3. The command is <ESC> <RS> <CR> .

Note that the maximum number of 1/48" increments is limited by this method to 125.

This command overrides the setting of the Lines Per Inch configuration switch.

Set Form Length: <ESC> F [d1] [d2]

This command defines the form length in increments of 1/6" to a maximum of 127/6" or 21-1/6". [d1] [d2] represent any form length between 1/6" (0 1) and 127/6" (C 7). For distances greater than 99/6" use Table 1 in Appendix C to determine the correct digits.

For example, to define a form length of 17":

1. Determine the number of 1/6" increments in 17" (102).
2. From Table 1, locate 102 and find that the required digits are A 2.
3. The command is <ESC> F A 2 .

You must manually position the paper to the top of form line before issuing this command. Once the command is issued, the top of form will be established at that line. All subsequent FORM FEED commands will automatically advance the paper to the next top of form. This command overrides the setting of the Form Length configuration switches.

Graphics on "1/60": <ESC> 3

This command establishes a mode in which the following commands are altered as noted:

- SPACE commands move the carriage 1/60".
- BACKSPACE commands move the carriage 1/60".
- LINE FEED commands move the paper 1/48".
- NEGATIVE LINE FEED commands move the paper 1/48".
- Character-printing commands will not move the carriage after the character is printed.
- Auto Line Feed and Auto Carriage Return/Line Feed modes are ignored.

All other commands, including set up and define commands, are unaltered.

The Graphics mode is terminated by any of the following:

- GRAPHICS OFF: <ESC> 4
- CARRIAGE RETURN: <CR>
- INITIALIZE PRINTER: <ESC> <SUB> I
- POWER OFF/ON

Graphics On "1/120": <ESC> G

This command is identical to the GRAPHICS ON, 1/60" command except that SPACE and BACKSPACE commands produce 1/120" carriage motions.

Graphics Off: <ESC> 4

This command terminates either Graphics mode.

Auto Carriage Return/Line Feed on: <ESC> W

This command causes the printer to perform a CARRIAGE RETURN and a LINE FEED automatically when the carriage reaches the right margin.

When the carriage enters the five-column "hot zone" preceding the right margin, the audible alarm will sound.

If the printer is in either Graphics mode, the Auto Carriage Return/Line Feed mode is ignored. This command overrides the setting of the Auto Carriage Return/Line Feed internal configuration switch.

Auto Carriage Return/Line Feed off: <ESC> Z

This command turns off the Auto Carriage Return/Line Feed mode. It overrides the setting of the Auto Carriage Return/Line Feed internal configuration switch.

Auto Line Feed on: <ESC> ,

This command causes the printer to perform a LINE FEED automatically after each execution of a CARRIAGE RETURN. It overrides the setting of the Auto Line Feed configuration switch.

Auto Line Feed off: <ESC> .

This command turns off the Auto Line Feed mode. It overrides the setting of the Auto Line Feed configuration switch.

Paper Feed Motion Commands

Line Feed: <LF>

This command moves the paper one linespace. The line feed distance is determined by one of the following:

- Lines Per Inch switch setting
- DEFINE VERTICAL SPACE INCREMENT: <ESC> L [d1] [d2]
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE: <ESC> <RS> [n]

LINE FEED is affected by:

- GRAPHICS ON, 1/60": <ESC> 3
- GRAPHICS ON, 1/120": <ESC> G
- Motion minimization

LINE FEED terminates the Underscore mode.

Negative Line Feed: <ESC> <LF>

This command moves the paper backward to the previous line. The negative line feed distance is determined by the same factors that determine the line feed distance.

1/2 Line Feed: <ESC> U

This command moves the paper one-half linespace. If the line feed distance has been defined as an odd number of 1/48" increments, the paper moves one-half linespace rounded down to the next lower 1/48" increment.

Negative 1/2 Line Feed: <ESC> D

This command moves the paper backward one-half linespace. If the line feed distance has been defined as an odd number of 1/48" increments, the paper moves backward one-half linespace rounded down to the next lower 1/48" increment.

Absolute Vertical Tab to a Line Number: <ESC> P [d1] [d2]

This command moves paper either up or down to a line number specified by [d1] [d2], a two-digit number which can define a maximum of 127 line locations. For line numbers greater than 99, use Table 1 in Appendix C to determine the correct digits.

For example, to access Line 117:

1. Locate the value 117 in Table 1 and find the digits B 7.
2. The command is <ESC> P B 7 .

Line numbering begins at the top of form position, Line 00.

This command is directly or indirectly affected by the following:

- Lines Per Inch switch setting
- DEFINE VERTICAL SPACE INCREMENT: <ESC> L [d1] [d2]
- DEFINE VERTICAL SPACE INCREMENT, ALTERNATE: <ESC> <RS> [n]
- Form Length switch settings
- SET FORM LENGTH: <ESC> F [d1] [d2]
- SET BOTTOM MARGIN: <ESC> -
- SET TOP MARGIN: <ESC> +

Absolute Vertical Tab to a Line Number, Alternate:
<ESC> <VT> [n]

This alternate method for moving the paper to a specified line uses Table 2 in Appendix C to derive the [n] value for the desired line number. For example, to access line 117:

1. Locate the [n] value for 117 in Table 2. This value is a lower case v.
2. The command is <ESC> <VT> v .

This command is directly or indirectly affected by the same factors as the ABSOLUTE VERTICAL TAB TO A LINE NUMBER command, above.

Relative Vertical (Paper Feed) Motion: <ESC> V [n1] [n2] [n3]

This command moves paper up or down in increments of 1/48" to a maximum of 1791/48" (37.3"). [n1] [n2] [n3] are three ASCII characters that represent the direction and distance of the movement, and are derived from Table 3 in Appendix C.

For example, to move the paper up a distance of 10":

1. First determine the number of 1/48" in 10" (480).
2. Using Table 3, look in the first character column and determine the largest number which can be subtracted from 480, which is 256. Look to the right, select the "up" column and locate the [n1] character A.
3. Subtract: $480 - 256 = 224$. Go to the second character column and locate the largest number which can be subtracted from 224, which is 224. The ASCII character for [n2] is N.
4. Subtract: $224 - 224 = 0$. Go to the third character column and locate the remainder 0. The ASCII [n3] character is @.
5. The command is <ESC> V A N @ .

Form Feed: <FF>

This command moves the paper to the next top of form position. The form length distance is determined by one of the following:

- Form Length switch settings
- SET FORM LENGTH: <ESC> F [d1] [d2]

A FORM FEED will terminate the Underscore mode.

Carriage Set Up and Define Commands

Set Horizontal Tab Stop: <ESC> 1

Use this command to set horizontal tab stops electronically. Tabs are column-dependent and their physical position across the page will be a function of the pitch setting (character spacing).

For example:

- At 10 pitch, there are 132 possible tab positions.
- At 12 pitch, there are 154 possible tab positions.
- At 15 pitch, there are 198 possible tab positions.

Tabs will always track the pitch setting. A tab set at column 50 will always be at column 50. If a tab is set for column 150 at 12 pitch, and the pitch is changed to 10 characters per inch, the tab will be moved beyond the right end of the platen, since there are only 132 tab positions at 10 pitch. In this case, a tab to column 150 will cause the carriage to move to column 132, the last column on the page. You should anticipate this effect when changing pitch.

To set a tab stop, move the carriage to the desired column and then issue this command.

Clear All Horizontal Tab Stops: <ESC> 2

This command will clear all horizontal tab stops. Tab stops will also be cleared following a power OFF/ON sequence, or an INITIALIZE PRINTER: <ESC> <SUB> I command.

Clear Individual Tab Stops: <ESC> 8

This command will clear the tab stop at the current carriage position. Before issuing this command, make certain that the desired tab stop hasn't been shifted to another location on the page by a pitch change (see SET HORIZONTAL TAB STOP, above).

Tab Set List: <ESC> ([d1] [d2] , [d1] [d2] , [d1] [d2] .

Use this command to set up to 159 tabs at one time. The command character sequence is <ESC> (followed by a series of two digit hex numbers from 00 to F9, chosen by using Table 1 in Appendix C. Each pair of digits represents a column where a tab is to be set. Each pair of digits must be separated by a comma, and the last pair of digits must be followed by a period.

For example, set tabs at columns 05, 43, 79, 104, 109:

1. For columns greater than 99, use Table 1 in Appendix C. 104 = A 4, 109 = A 9.

2. The command is

```
<ESC>  
( 0 5  
, 4 3  
, 7 9  
, A 4  
, A  
9 .
```

Tab stops set in this manner are subject to the same factors that affect the Set Horizontal Tab Stop command. Refer to that command description for important details.

Tab stops set with this command may be listed in any order.

Tab Clear List: <ESC>) [d1][d2], [d1][d2], [d1][d2].

Use this command to clear up to 159 tabs at one time. The procedure for clearing tabs in this manner is identical to the method used for the Tab Set List command, above.

Set Left Margin: <ESC> 9

This command electronically sets the left margin. Send horizontal movement commands to position the carriage at the desired column, then issue this command. All subsequent CARRIAGE RETURN commands will move the carriage leftward to this column.

Note: the left margin is not column dependent; it is set at an absolute position. After a power OFF/ON sequence or an INITIALIZE PRINTER: <ESC> <SUB> I command, the left margin will be at column 0.

Although the carriage will return to the left margin following a CARRIAGE RETURN, you can still move beyond the left margin by issuing BACKSPACE or other leftward carriage movement commands.

Set Right Margin: <ESC> 0

This command electronically sets the right margin. Send horizontal movement commands to position the carriage at the desired column, then issue this command.

There is a “hot zone” five columns wide preceding the right margin. When the carriage enters this hot zone, the audible alarm will sound.

The default position of the right margin, after a power OFF/ON sequence or an INITIALIZE PRINTER: <ESC> <SUB> I command, is at the rightmost print column.

Define Horizontal Space Increments: <ESC> E [d1] [d2]

This command defines the space distance (column width) in increments of 1/120". [d1] [d2] represent any space distance between 1/120" (0 1) and 159/120" (F 9). For columns wider than 99/120" use Table 1 in Appendix C to determine the correct digits.

For example, to define the horizontal space increment as 1/4":

1. Determine the number of 1/120" in 1/4" (30).
2. Since the number is less than 99, Table 1 is not needed, and the command is <ESC> E 3 0 .

Since this command defines spacing, it will also affect the physical location of tab stops. Refer to the SET HORIZONTAL TAB STOP command description for important information.

Define Horizontal Space Increments, Alternate: <ESC> <US> [n]

This command defines the space distance (column width) in 1/120" increments using a single ASCII character [n], which is determined from Table 2 in Appendix C.

For example, to define the horizontal space increment as 1/4":

1. Determine the number of 1/120" in 1/4" (30).
2. From Table 2, the ASCII character for 30 is <US> .
3. The command is <ESC> <US> <US> .

No Escapement On Next Character Only: <ESC> N

Use this command to inhibit carriage motion after printing the next character. This command is useful for underscoring, slashing zeros, forming composite symbols, etc.

This command must be sent before the character that is to have its automatic spacing inhibited. This command is affected by the following:

- GRAPHICS ON, 1/60": <ESC> 3
- GRAPHICS ON, 1/120": <ESC> G
- GRAPHICS OFF: <ESC> 4

See the Paper Feed Set Up and Define Commands section above for complete information on Graphics modes.

Backward Print: <ESC> 6

This command reverses the normal carriage motion direction. The BACKSPACE will cause the carriage to move from left to right. The HORIZONTAL TAB command, however, is not affected.

This command is terminated by the FORWARD PRINT command or a CARRIAGE RETURN command. If the CARRIAGE RETURN is used to terminate backward printing, the carriage will return to the left margin.

Forward Print: <ESC> 5

This command is used to terminate the Backward Print mode.

Shift To Program Mode: <ESC> <SO>

This command places the printer in Program mode, and allows explicit control of the following functions for every character to be printed:

- HAMMER INTENSITY: Intensities can be programmed from a minimum value of 1 to a maximum value of 7. A value of 0 defaults the intensity to the printer's normal internal value.
- CARRIAGE MOTION: From 0/120" to 15/120".
- Ribbon Advance: Indirectly derived from the selected carriage motion increment.
- PRINT WHEEL POSITION: As determined by the ASCII code.

This mode permits the use of non-standard sequence print wheels. The information necessary for: 1) locating a specific character spoke on the print wheel, 2) setting the proper hammer intensity, and 3) providing the proper character spacing or "width", must be derived from data supplied with the special print wheel. (For example, see Appendix F.)

To implement this mode you must:

1. Enter the Program mode by transmitting the <ESC> <SO> command.
2. Send the ASCII code for the character to be printed.
3. Refer to Table 4 in Appendix C, and determine the desired hammer intensity and carriage spacing special programming ASCII character.
4. Send the special programming ASCII character.

As an example of the use of Table 4, assume that the character requires a hammer intensity of 4 and a spacing increment of 12/120". The special programming mode character will be L .

This mode is terminated by the RETURN TO NORMAL MODE command.

Other applications that use the Program mode are proportional spacing, right justification, etc.

Also see the descriptions of the ENTER SECONDARY PROGRAM MODE and PROGRAM MODE CARRIAGE MOTION commands.

Return To Normal Mode: <ESC> <SI>

This command terminates the Program, Secondary Program, and User Test modes of operation.

Enter Secondary Program Mode: <ESC> #

This command can be used only after entering the Program mode as an alternate method for controlling:

- **HAMMER INTENSITY:** Intensities can be programmed from a minimum value of 1 to a maximum value of 7. A value of 0 defaults the intensity to the printer's normal internal value.
- **RIBBON ADVANCE:** Increment can be selected from a minimum of 2 to a maximum of 5.
- **CARRIAGE MOTION:** Not programmable within this mode. Derived from the defined value for character spacing as determined by the setting of the Pitch switches, or by the DEFINE HORIZONTAL SPACING INCREMENTS commands.
- **PRINT WHEEL POSITION:** As determined by the ASCII code.

To implement this mode you must:

1. Enter the Program mode by transmitting the <ESC> <SO> command.
2. Enter the Secondary Program mode by transmitting the <ESC> # command.
3. Send the ASCII code for the character to be printed.
4. Refer to Table 4 in Appendix C, and determine the desired hammer intensity and ribbon advance special programming ASCII character. For a hammer intensity of 4 and a ribbon advance of 4, the special programming character is K, L, or M.
5. Send one of the special programming ASCII characters.

This mode is terminated by the RETURN TO NORMAL MODE command.

Auto Carriage Return/Line Feed On: <ESC> W
Auto Carriage Return/Line Feed Off: <ESC> Z

Refer to the Paper Feed Set Up and Define Commands section above for a complete description of these commands.

WPS On: <ESC> \$

This command allows the printer to use WPS (word processing sequence) print wheels correctly. The locations of characters on the print wheel differ from those on standard sequence print wheels, as do other factors that control printing. These factors include hammer intensity, ribbon advance, and (most important of all) the variable pitch requirements for proportional spacing.

All of the commands and controls may be used in the WPS mode except the Program mode commands.

This command overrides the Character Set and Pitch configuration switches. Columns are established as for 12-pitch operation, unless changed by a DEFINE HORIZONTAL SPACING INCREMENTS command.

WPS mode is terminated by the WPS OFF command.

WPS Off: <ESC> %

This command terminates the WPS mode.

Right Margin Control On: <ESC> O

This command directs the printer to perform a Carriage Return automatically after reaching the right margin "hot zone." The hot zone begins five columns (character spaces) before the right margin. The Carriage Return will be executed as soon as the first Space occurs within the hot zone. If a Space is not encountered in the hot zone, then the Carriage Return will execute as soon as a Space occurs after the right margin. If no Space occurs, then the Carriage Return will execute at the end of the platen.

Note: the right margin location is not affected by the horizontal space increment definition (pitch or column width).

This mode is terminated by the RIGHT MARGIN CONTROL OFF command.

Right Margin Control Off: <ESC> Y

This command terminates Right Margin Control mode.

Auto Bidirectional Printing On: <ESC> <

This command places the printer in the Automatic Bidirectional Printing mode. This command overrides the setting of the Bidirectional Printing configuration switch.

Received data is temporarily stored in an auxiliary character until a CARRIAGE RETURN is detected. The data is then sent to the printing mechanism in the direction that minimizes carriage motion. Motion minimization is maintained and most commands are accommodated in this mode.

The following conditions will force the printer into forward printing:

- Auxiliary buffer overflow
- Shift to Program Mode: <ESC> <SO>
- Enter Secondary Program Mode: <ESC> #
- AUTO BIDIRECTIONAL PRINTING OFF: <ESC> >

Auto Bidirectional Printing Off: <ESC> >

This command terminates Auto Bidirectional Printing mode. It overrides the setting of the Bidirectional Printing configuration switch.

Carriage Motion Commands

Space: <SP>

This command causes the carriage to move one space (normally to the right). Space distance (column width) is defined by one of the following:

- The Pitch switch settings
- DEFINE HORIZONTAL SPACING INCREMENTS:
<ESC> E [d1] [d2]
- DEFINE HORIZONTAL SPACING INCREMENTS,
ALTERNATE: <ESC> <US> [n]

Space direction or operation is affected by:

- Auto Carriage Return/Line Feed switch setting
- Auto Bidirectional Printing switch setting
- AUTO BIDIRECTIONAL PRINTING ON: <ESC> <
- BACKWARD PRINT: <ESC> 6
- AUTO CARRIAGE RETURN/LINE FEED ON:
<ESC> W
- GRAPHICS ON, 1/60": <ESC> 3
- GRAPHICS ON, 1/120": <ESC> G
- FORWARD PRINT: <ESC> 5
- RIGHT MARGIN CONTROL ON: <ESC> O
- Motion minimization

Refer to the appropriate configuration switch or command description for further detailed information.

Backspace: <BS>

This command causes the carriage to move one space (normally to the left). Backspace distance and direction are affected by the same configuration switches and commands as the SPACE command, above.

Backspace 1/120": <ESC> <BS>

This command causes the carriage to move 1/120" (normally to the left).

Carriage Return: <CR>

This command causes the carriage to move to the left margin. It terminates the following modes:

- Graphics On, 1/60": <ESC> 3
- Graphics On, 1/120": <ESC> G
- Backward Print: <ESC> 6

The Carriage Return affects, or is affected by, the following:

- Auto Carriage Return/Line Feed switch setting
- Auto Bidirectional Printing switch setting
- Auto Line Feed switch setting
- AUTO BIDIRECTIONAL PRINTING ON: <ESC> <
- AUTO CARRIAGE RETURN/LINE FEED ON: <ESC> W
- AUTO LINEFEED ON: <ESC> L
- RIGHT MARGIN CONTROL ON: <ESC> O
- UNDERSCORE ON: <ESC> I

Refer to the appropriate configuration switch or command description for more detailed information.

Horizontal Tab: <HT>

This command causes the carriage to move to the first tab stop to the right. If no tab stops have been set, the carriage will move to the end of the platen.

If some tab stops have been set, but no tab stops have been set to the right of the current carriage position, a HORIZONTAL TAB command will cause the carriage to move to the leftmost set tab stop and a LINE FEED operation will be performed (regardless of the setting of the Auto Line Feed mode).

HORIZONTAL TAB commands are affected by, or affect, the following:

- SET HORIZONTAL TAB STOP: <ESC> 1
- TAB SET LIST: <ESC> ([list]
- DEFINE HORIZONTAL SPACING INCREMENTS: <ESC> E [d1] [d2]
- DEFINE HORIZONTAL SPACING INCREMENTS, ALTERNATE: <ESC> <US> [n]
- Pitch switch settings
- Auto Underscore mode
- Motion minimization

Program Mode Carriage Motion: <US> [d]

This command is only used when the printer is in one of the Program modes. It causes the carriage to move either left or right between 1/120" and 63/120". [d] is an ASCII character, determined from Table 5 in Appendix C.

For example, for a carriage move command of 12/120" to the right:

1. In Table 5 locate 12/120".
2. Look to the right and select the "right" direction column.
3. The special ASCII character is found to be <VT>.
4. The command is <US> <VT> .

Absolute Horizontal Tab to a Column Number:
<ESC> C [d1] [d2]

This command moves the carriage to a specific column within the range of 0 to 159. [d1] [d2] represents the column number from 0 (0 0) to 159 (F 9). For column numbers greater than 99 refer to Table 1 in Appendix C.

For example, for an absolute movement to column 130:

1. Using Table 1, locate the digits D 0 for 130.
2. The command is <ESC> C D 0 .

Columns are space distance (column width) dependent. An ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER is therefore affected by the same configuration switches and commands that affect the SPACE command. Refer to the SPACE command description for detailed information.

Any attempt to tab to a column number beyond the right end of the platen will cause the carriage to move to the right end of the platen.

In the WPS mode, column widths are determined as for 12-pitch or by the DEFINE HORIZONTAL SPACING INCREMENTS commands.

Absolute Horizontal Tab to a Column Number, Alternate: <ESC> <HT> [n]

This command moves the carriage to a specific column within the range of 0 to 125, using a single ASCII character [n].

For example, for an absolute movement to column 55:

1. From Table 2, the ASCII character for 55 is 8.
2. The command is <ESC> <HT> 8 .

Refer to the ABSOLUTE HORIZONTAL TAB TO A COLUMN NUMBER command description above for further information.

Relative Horizontal Carriage Motion: <ESC> H [n1] [n2] [n3]

This command moves the carriage left or right any number of 1/120" increments between 0/120" and 1584/120". [n1] [n2] [n3] represent three ASCII characters determined using Table 3 in Appendix C.

For example, for a relative horizontal carriage motion to the left of 3-1/2":

1. Determine the number of 1/120" increments in 3-1/2" (420).
2. Turn to Table 3.
3. Find the largest number in the first column that can be subtracted from 420 (256). Looking to the right, select the ASCII character for the "left" direction. The character for [n1] is Q.
4. Subtract: $420 - 256 = 154$. Go to the second column and find the largest number that can be subtracted from 154 (144). Find the ASCII character for [n2] to be l.
5. Subtract: $154 - 144 = 10$. Go to the last column to determine the ASCII character for [n3] to be J.
6. The command is <ESC> H Q l J .

Commands which would cause the carriage to move beyond the platen limits are ignored.

Motion minimization is in effect for this command.

Character Printing Set Up and Define Commands

Underscore On: <ESC> I

This command places the printer in Underscore mode. In this mode, the printer will automatically underscore characters, words, phrases, sentences, paragraphs, etc. When the Underscore mode is turned ON, the printer remembers the current carriage position. Subsequent text sent to the printer will then be underscored when one of the following commands is issued:

- CARRIAGE RETURN: <CR>
- Any Paper Motion command
- UNDERSCORE OFF: <ESC> J

The following actions can also be expected:

- Horizontal space that is tabbed over will be underscored.
- Bold Overprint mode ON will cause multiple strike underscores.
- Moving the carriage to the left of the Underscore mode “start” point before causing underscore execution may have unexpected results.
- After the underscore is executed (unless the Underscore Off command has been used), the Underscore mode continues to be on, and a new underscore “start” point is remembered by the printer.

Underscore Off: <ESC> J

This command causes automatic underscore execution, then terminates Underscore mode.

Bold Overprint On: <ESC> K [d]

This command causes the print hammer to fire [d] times for each printed character before the carriage is moved to the next character position. [d] is a number between 1 and 4.

For example, to bold overprint the letter A three times:

1. Send <ESC> K 3 .
2. Send an ASCII letter A.
3. A will be printed three times.
4. The carriage will advance one column.

All subsequent characters will be printed three times each until:

- [d] is changed to some other value between 1 and 4 by reissuing the command.
- BOLD OVERPRINT OFF: <ESC> M is sent.

Refer to the SHADOW PRINT ON command description for additional information.

Bold Overprint Off: <ESC> M

This command terminates the Bold Overprint mode.

Shadow Print On: <ESC> Q

This command causes all characters to be printed twice, with the second printing offset by 1/120" from the first.

The following actions can also be expected:

- WPS mode: Spacing will be adjusted to accommodate the additional 1/120" displacement.
- Non-WPS mode: Character spaces will be reduced to maintain column integrity.
- Backward Printing mode: The shadow character is printed first.
- Bold Overprint mode: The first character will overprint; the second will single print.

Shadow Print Off: <ESC> R

This command terminates the Shadow Print mode.

No Print On: <ESC> S

This command inhibits the firing of the print hammer during printing of characters, without affecting any other function. No Print mode is used to mask passwords, etc.

No Print Off: <ESC> T

This command terminates the No Print mode.

WPS On: <ESC> \$

WPS Off: <ESC> %

Refer to the Carriage Set Up and Define Commands section for complete information on the WPS mode.

Select Language: <ESC> I [n]

This command selects the character set to be printed for the various ASCII codes. [n] represents a single ASCII character determined from Table 6 in Appendix C. Invalid parameters default to the Character Set configuration switch settings.

Note: the second character in the command sequence is lower case L (hex 6C).

For example, to set the character set for French:

1. Find in Table 6 that the ASCII character for French is F.
2. The command is <ESC> I F.

This command may override the settings of the Character Set internal configuration switches.

Shift Out to Extended Alphabet: <SO>

All alphabetic characters printed after this command is executed will be from the extended character set. Refer to Appendix E for character set information.

Shift in to Normal Alphabet: <SI>

All alphabetic characters printed after this command is executed will be from the normal character set. Refer to Appendix E for character set information.

Character Printing Commands

Normal Alphabet:

In Normal Alphabet mode, 94 of the 130 characters on the print wheel can be printed by transmitting the hexadecimal codes 21 through 7E. What character is printed for each code depends on the current character set. The current character set is determined by the setting of the Character Set internal configuration switches or the SELECT LANGUAGE command. Refer to Appendix E for a description of the normal character sets.

Print Character Located at Printwheel Position 002:
<ESC> /

Print Character Located at Printwheel Position 004:
<ESC> <SP>

There are 96 printable characters in the Normal Alphabet portion of a print wheel. Standard ASCII codes can print only 94 of these characters. The <ESC> / and <ESC> <SP> commands allow the two remaining characters to be printed. Refer to Appendix E to determine the character printed by these two commands.

Extended Alphabet:

The remaining characters on the 130-character print wheel can be printed when in Extended Alphabet mode by transmitting the hexadecimal codes 23, 40 through 68, and 7B through 7E. Refer to Appendix E for a description of the extended character set.

Test Commands

Status Request: <ESC> <SUB> <ENQ>

Status Reply: <ESC> : [n]

The STATUS REQUEST command causes the printer to transmit a status reply. Refer to Table 7 (Status Word Bit Definition chart) in Appendix C to decode [n].

For example:

1. The host system transmits <ESC> <SUB>
<ENQ> .

2. The printer responds with <ESC> : A .

3. The bit definition for "A", from Table 7:

b1=1=Successful execution of Self Test routine.

b2=0=Standard character sequence selected.

b3=0=No operator attention required.

b4=0=Printer not in CHECK.

b5=0=Auto Line Feed mode not selected.

b6=0=Printer idle.

b7=1=(Bit 7 will always be a 1).

The STATUS REQUEST command bypasses the receive buffer, and the printer's STATUS REPLY response is immediate.

The STATUS REPLY is also transmitted by the printer at the conclusion of a successful Self Test routine execution.

Self Test: <ESC> <SUB> <SO>

The Self Test routine is a comprehensive test of the printer's functions. Once the Self Test routine is initiated, all further commands will be ignored until the test is completed. Upon successful completion of the Self Test routine, the printer will transmit a STATUS REPLY. Refer to the STATUS REPLY command description for further information.

User Test Mode Commands

The User Test mode allows the host system to program the printer to perform a test program of any length up to a maximum of 223 characters.

To utilize the User Test mode:

1. Send ENTER USER TEST MODE: <ESC> @ T .

2. To "erase" the last entered character, send a <NUL> command.

3. Enter up to 223 characters.

4. Send END USER TEST MODE: <EOT> after program is entered.

5. To run the test one time, send PERFORM USER TEST ONCE: <STX> or
6. To run a repeated test, send PERFORM USER TEST CONTINUOUSLY: <SOH> .
7. To halt the continuous test, send HALT CONTINUOUS USER TEST: <ENQ> .
8. To leave the User Test mode and erase the program, send RETURN TO NORMAL MODE: <ESC> <SI> .

Miscellaneous Commands

Execute Pending Motions: <ESC> X

This command terminates motion minimization accumulation of horizontal and vertical motion commands and forces their execution.

Bell (Audible Alarm): <BEL>

This command causes the printer to sound its audible alarm.

Initialize Printer: <ESC> <SUB> I or <ESC> <CR> P

This command initializes the printer and has the same effect as turning the printer power OFF and back ON.

The printer is placed in a mode determined by the user access and internal configuration switches.

Additionally:

- The carriage is moved to column 0.
- The print wheel is synchronized with the printer's electronics.
- The right margin is set at the rightmost column.
- The left margin is set at column 0.
- All tab stops are cleared.
- The top margin is set at the top of form position.
- The bottom margin is set at the position defined by the Form Length switches.
- Both Graphics modes are set OFF.
- Forward Print mode is set ON.
- Both Program modes are set OFF.
- Right Margin Control mode is set OFF.

- Underscore mode is set OFF.
- Bold Overprint mode is set OFF.
- Shadow Print mode is set OFF.
- No Print mode is set OFF.
- User Test mode is set OFF.

When this command is used to initialize the printer, the printer will complete its restore and initialization sequence within one second. Commands received during this initialization period will be ignored.

Serial Communications Handshaking Commands

The following commands are different from those described in the rest of this chapter: they affect the way in which information is transmitted from the computer to the printer, rather than just telling the printer to do something special, and will not ordinarily be used in programs. They are included here for use in the very limited and special situations in which they may be needed.

Start Transmitting (XON): <DC1>
Stop Transmitting (XOFF): <DC3>

These two commands are used by the printer to indicate to the host system what the printer's receive buffer full/empty status is.

Refer to the Serial Communications section of Appendix H for a detailed description of XON/XOFF Handshaking mode.

End of Text: <ETX>
Acknowledge (Buffer Empey): <ACK>

These two commands are used by the host system and the printer to control data flow between them.

Refer to the Serial Communications section of Appendix H for a detailed description of ETX/ACK Handshaking mode.

Appendix B

Command Summary

This appendix contains a listing of the printer's command set.

Command Syntax Definitions

Each command's entry includes the command name, plus the character sequence which must be sent to the printer to issue the command. The following symbols are used in the command character sequences:

- < > Angle brackets enclose the abbreviation for an ASCII control character, such as <ESC>. The single control character is sent (without brackets).
- A , Characters not enclosed by brackets identify specific commands. The character must be sent as shown; lower case is not allowed for upper case, and vice versa.
- [] Square brackets enclose "data" characters required for the command, such as [d1]. A single character is sent (without brackets) for each position shown.
- d Represents a single hexadecimal digit (0-F). If more than one is required for a command, they will be numbered by position (d1, etc.).
- n Represents a single ASCII character chosen from the appropriate table.

Characters in the command sequences will be separated by spaces or clarity, but the spaces are not part of the command sequence and should not be sent.

Paper Feed Set Up and Define Commands

Set Top Margin: <ESC> +
Set Bottom Margin: <ESC> -
Define Vertical Spacing Increments: <ESC> L [d1] [d2]
Define Vertical Spacing Increments, Alternate: <ESC>
<RS> [n]
Set Form Length: <ESC> F [d1] [d2]
Graphics On, 1/60": <ESC> 3
Graphics On, 1/120": <ESC> G
Graphics Off: <ESC> 4
Auto Carriage Return/Line Feed On: <ESC> W
Auto Carriage Return/Line Feed Off: <ESC> Z
Auto Line Feed On: <ESC> ,
Auto Line Feed Off: <ESC> .

Paper Feed Motion Commands

Line Feed: <LF>
Negative Line Feed: <ESC> <LF>
1/2 Line Feed: <ESC> U
Negative 1/2 Line Feed: <ESC> D
Absolute Vertical Tab to a Line Number:
<ESC> P [d1] [d2]
Absolute Vertical Tab To a Line Number, Alternate:
<ESC> <VT> [n]
Relative Vertical (Paper Feed) Motion:
<ESC> V [n1] [n2] [n3]
Form Feed: <FF>

Carriage Set Up and Define Commands

Set Horizontal Tab Stop: <ESC> 1
Clear All Horizontal Tab Stops: <ESC> 2
Clear Individual Tab Stops: <ESC> 8
Tab Set List: <ESC> ([d1] [d2] , [d1] [d2] , [d1] [d2] .
Tab Clear List: <ESC>) [d1] [d2] , [d1] [d2] , [d1] .
Set Left Margin: <ESC> 9
Set Right Margin: <ESC> 0
Define Horizontal Space Increments:
<ESC> E [d1] [d2]
Define Horizontal Space Increments, Alternate:
<ESC> <US> [n]
No Escapement on Next Character Only: <ESC> N
Backward Print: <ESC> 6
Forward Print: <ESC> 5
Shift to Program Mode: <ESC> <SO>
Return to Normal Mode: <ESC> <SI>
Enter Secondary Program Mode: <ESC> #
Auto Carriage Return/Line Feed On: <ESC> W
Auto Carriage Return/Line Feed Off: <ESC> Z
WPS On: <ESC> \$
WPS Off: <ESC> %
Right Margin Control On: <ESC> O
Right Margin Control Off: <ESC> Y
Auto Bidirectional Printing On: <ESC> <
Auto Bidirectional Printing Off: <ESC> >

Carriage Motion Commands

Space: <SP>
Backspace: <BS>
Backspace 1/120": <ESC> <BS>
Carriage Return: <CR>
Horizontal Tab: <HT>
Program Mode Carriage Motion: <US> [d]
Absolute Horizontal Tab to a Column Number:
<ESC> C [d1] [d2]
Absolute Horizontal Tab to a Column Number, Alternate:
<ESC> <HT> [n]
Relative Horizontal Carriage Motion:
<ESC> H [n1] [n2] [n3]
Underscore On: <ESC> I
Underscore Off: <ESC> J
Bold Overprint On: <ESC> K [d]
Bold Overprint Off: <ESC> M
Shadow Print On: <ESC> Q
Shadow Print Off: <ESC> R
No Print On: <ESC> S
No Print Off: <ESC> T
WPS On: <ESC> \$
WPS Off: <ESC> %
Select Language: <ESC> L [n]
Shift Out to Extended Alphabet: <SO>
Shift in to Normal Alphabet: <SI>

Character Printing Commands

Normal Alphabet: [n]
Print Character Located at Printwheel Position 002:
<ESC> /
Print Character Located at Printwheel Position 004:
<ESC> <SP>
Extended Alphabet: [n]

Test Commands

Status Request: <ESC> <SUB> <ENQ>
Status Reply: <ESC> : [n]
Self Test: <ESC> <SUB> <SO>
Enter User Test Mode: <ESC> @ T
End User Test Mode: <EOT>
Perform User Test Once: <STX>
Perform User Test Continuously: <SOH>
Halt Continuous User Test: <ENQ>
Return to Normal Mode: <ESC> <SI>

Miscellaneous Commands

Execute Pending Motions: <ESC> X
Bell (Audible Alarm): <BEL>
Initialize Printer: <ESC> <SUB> I or
<ESC> <CR> P

Serial Communications Handshaking Commands

Start Transmitting (XON): <DC1>
Stop Transmitting (XOFF): <DC3>
End of Text: <ETX>
Acknowledge (Buffer Empty): <ACK>

Appendix C

Special Information Tables for Printer Commands

A number of commands require that spacing increments be represented in hexadecimal notation:

- Set Form Length
- Tab Set List
- Tab Clear List
- Define Vertical Spacing Increments
- Define Horizontal Spacing Increments

In defining spacing increments above the number 99, use the digits listed in Table 1 below, or the following information:

The units (second) digit in numbers greater than 99 is limited to 0 through 9, as it is for lower numbers. To represent decimal numbers above 99, the hexadecimal convention is used for the greater, or first, digit:

A = 10

D = 13

B = 11

E = 14

C = 12

F = 15

By combining the single hexadecimal first digit with the units digit, any decimal number between 100 and 159 can be represented by only two characters. For example, decimal 119 becomes B 9. Table 1 lists the possible combinations and the decimal number equivalents.

Table 1. Codes for Large Spacing Increments

Decimal Number	First Digit	Second Digit	Decimal Number	First Digit	Second Digit	Decimal Number	First Digit	Second Digit
100	A	0	120	C	0	140	E	0
101	A	1	121	C	1	141	E	1
102	A	2	122	C	2	142	E	2
103	A	3	123	C	3	143	E	3
104	A	4	124	C	4	144	E	4
105	A	5	125	C	5	145	E	5
106	A	6	126	C	6	146	E	6
107	A	7	127	C	7	147	E	7
108	A	8	128	C	8	148	E	8
109	A	9	129	C	9	149	E	9
110	B	0	130	D	0	150	F	0
111	B	1	131	D	1	151	F	1
112	B	2	132	D	2	152	F	2
113	B	3	133	D	3	153	F	3
114	B	4	134	D	4	154	F	4
115	B	5	135	D	5	155	F	5
116	B	6	136	D	6	156	F	6
117	B	7	137	D	7	157	F	7
118	B	8	138	D	8	158	F	8
119	B	9	139	D	9	159	F	9

Table 2 is to be used only in the single ASCII character parameter method of defining vertical and horizontal space increments and an absolute tab to a vertical line of a horizontal column. The values are related to normal ASCII character values by a fixed numerical difference.

Do not use the value for '2' (ETX) with the default handshaking configuration of your printer, since this code could be misinterpreted in this situation. Unless your handshaking configuration excludes ETX/ACK, use the other method of coding spacing increments to express the value 2/48".

Table 2. ASCII Character-Based Codes for Spacing Increments

Units		0	1	2	3	4	5	6	7	8	9
	0	SOH	STX	ETX*	EOT	ENQ	ACK	BEL	BS	HT	LF
	1	VT	FF	CR	SO	SI	DLE	DC1	DC2	DC3	DC4
	2	NAK	SYN	ETB	CAN	EM	SUB	ESC	FS	GS	RS
	3	US	SP	!	"	#	\$	%	&	'	(
T	4	)	*	+	,	-	.	/	0	1	2
E	5	3	4	5	6	7	8	9	:	;	<
N	6	=	>	?	@	A	B	C	D	E	F
S	7	G	H	I	J	K	L	M	N	O	P
	8	Q	R	S	T	U	V	W	X	Y	Z
	9	[	'	]	,	-	'	a	b	c	d
	10	e	f	g	h	i	j	k	l	m	n
	11	o	p	q	r	s	t	u	v	w	x
	12	y	z	{	|	}					

See the Relative Vertical Motion command in Appendix A for directions on how to use Table 3.

Table 3. Codes for Relative Motion Increments

First Character		Second Character		Third Character	
Distance	n1	Distance	n2	Distance	n3
	Right/ Up	Left/ Down			
0	@	P	0	@	@
256	A	Q	16	A	A
512	B	R	32	B	B
768	C	S	48	C	C
1024	D	T	64	D	D
1280	E	U	80	E	E
1536	F	V	96	F	F
			112	G	G
			128	H	H
			144	I	I
			160	J	J
			176	K	K
			192	L	L
			208	M	M
			224	N	N
			240	O	O

In Table 4, carriage motion is in increments of 1/120 inch. Zero hammer intensity causes default to normal intensities. Ribbon feed is a carriage motion function of the Program mode and is not independently selectable except during the Secondary Program mode. Shaded areas show illegal commands. See the Shift to Program Mode command description in Appendix A for an example of the use of the table.

Table 4. Codes Used with Special Print Wheels in Program Mode

Carriage Hammer								Ribbon Advance
	0	1	2	3	4	5	6	7
0		DLE	SP	0	@	P	'	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	"	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	\$	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
10	LF	SUB	*	:	J	Z	j	z
11	VT	ESC	+	;	K	[	k	{
12	FF	FS	,	<	L	_	l	|
13	CR	GS	-	=	M	]	m	}
14	SO	RS	.	>	N	^	n	~
15	SI	US	/	?	O	_	o	

Table 5 is used with the Program Mode Carriage Motion command to express distance and direction in terms of a single ASCII character. Note that the directions are reversed if the Backward Print command is in force.

Table 5. Program Mode Carriage Motion Codes

Distance in 1/120"	Direction R	L	Distance in 1/120"	Direction R	L	Distance in 1/120"	Direction R	L	Distance in 1/120"	Direction R	L
1	SOH	A	17	DC1	Q	33	!	a	49	1	q
2	STX	B	18	DC2	R	34	"	b	50	2	r
3	ETX	C	19	DC3	S	35	#	c	51	3	s
4	EOT	D	20	DC4	T	36	\$	d	52	4	t
5	ENQ	E	21	NAK	U	37	%	e	53	5	u
6	ACK	F	22	SYN	V	38	&	f	54	6	v
7	BEL	G	23	ETB	W	39	'	g	55	7	w
8	BS	H	24	CAN	X	40	(	h	56	8	x
9	HT	I	25	EM	Y	41	)	i	57	9	y
10	LF	J	26	SUB	Z	42	*	j	58	:	z
11	VT	K	27	ESC	[	43	+	k	59	:	{
12	FF	L	28	FS	\	44	,	l	60	<	|
13	CR	M	29	GS	]	45	-	m	61	=	}
14	SO	N	30	RS	^	46	.	n	62	>	∞
15	SI	O	31	US	/	47	/	o	63	?	
16	DLE	P	32	SP	~	48	0	p			

Table 6 is used to determine the “language” code (one of the ASCII characters in the right column) used in the Select Language command.

Table 6. Select Language Parameters.

Character Set	[n]
AppleASCII	A
AppleWP	B
Italian	C
Swedish	D
English (U.K.)	E
French	F
German	G
Spanish	H
Default to switch setting	Q

The ASCII characters in Table 7 are those occurring in a status reply (a response to a Status Request command). The binary (“one-zero”) representation of each character consists of seven bits, each of which has a meaning assigned to it. You can decode these meanings with the information at the bottom of the table.

Status Word Bit 8

	b7	1	1	1	1	1	1	1	1	
	b6	0	0	0	0	1	1	1	1	
	b5	0	0	1	1	0	0	1	1	
	b4	0	1	0	1	0	1	0	1	
b3	b2	b1								
0	0	0	@	H	P	X	'	h	p	x
0	0	1	A	I	Q	Y	a	i	q	y
0	1	0	B	J	R	Z	b	j	r	z
0	1	1	C	K	S	[	c	k	s	{
1	0	0	D	L	T	\	d	l	t	|
1	0	1	E	M	U	]	e	m	u	}
1	1	0	F	N	V	^	f	n	v	~
1	1	1	G	O	W	_	g	o	w	DEL

Data Bit Status Information

	0 = Unsuccessful execution of last self test. This status bit is 0 after a printer reset (initialization).
b2	Bit 2 is not used.
b3	1 = Operator attention required (top cover off, paper supply exhausted, or ribbon out). 0 = No operator attention required.
b4	1 = Printer in 'check'. 0 = Printer not in 'check'.
b5	1 = Auto Line Feed selected. 0 = Auto Line Feed not selected.
b6	1 = Printer busy. 0 = Printer idle.
b7	Bit 7 is always a 1.

Table 7. Status Word Data Bits

Appendix D

ASCII Codes

There are 256 possible 8-bit binary numbers, from 00000000 to 11111111. Of these the first 128 (from 00000000 to 01111111) have been assigned to characters and commands used in data processing and communication. The standard assignment is called ASCII Code (American Standard for Computer Information Interchange).

The codes in the range 128 to 255 are not assigned to specific characters, but are nevertheless usable as ASCII code values. For the equivalent ASCII code, subtract a hexadecimal 80 from the high code value.

The following chart lists the 128 standard ASCII character assignments. For each character it gives the decimal and hexadecimal numeric values.

ASCII	Dec	Hex	ASCII	Dec	Hex
NUL	0	00	@	64	40
SOH	1	01	A	65	41
STX	2	02	B	66	42
ETX	3	03	C	67	43
EOT	4	04	D	68	44
ENQ	5	05	E	69	45
ACK	6	06	F	70	46
BEL	7	07	G	71	47
BS	8	08	H	72	48
HT	9	09	I	73	49
LF	10	0A	J	74	4A
VT	11	0B	K	75	4B
FF	12	0C	L	76	4C
CR	13	0D	M	77	4D
SO	14	0E	N	78	4E
SI	15	0F	O	79	4F
DLE	16	10	P	80	50
DC1	17	11	Q	81	51
DC2	18	12	R	82	52
DC3	19	13	S	83	53
DC4	20	14	T	84	54
NAK	21	15	U	85	55
SYN	22	16	V	86	56
ETB	23	17	W	87	57
CAN	24	18	X	88	58
EM	25	19	Y	89	59
SUB	26	1A	Z	90	5A

ASCII	Dec	Hex	ASCII	Dec	Hex
ESC	27	1B	[	91	5B
FS	28	1C	\	92	5C
GS	29	1D	]	93	5D
RS	30	1E	^	94	5E
US	31	1F	_	95	5F
SP	32	20	'	96	60
!	33	21	a	97	61
"	34	22	b	98	62
#	35	23	c	99	63
\$	36	24	d	100	64
%	37	25	e	101	65
&	38	26	f	102	66
'	39	27	g	103	67
(	40	28	h	104	68
)	41	29	i	105	69
*	42	2A	j	106	6A
+	43	2B	k	107	6B
,	44	2C	l	108	6C
-	45	2D	m	109	6D
.	46	2E	n	110	6E
/	47	2F	o	111	6F
0	48	30	p	112	70
1	49	31	q	113	71
2	50	32	r	114	72
3	51	33	s	115	73
4	52	34	t	116	74
5	53	35	u	117	75
6	54	36	v	118	76
7	55	37	w	119	77
8	56	38	x	120	78
9	57	39	y	121	79
:	58	3A	z	122	7A
;	59	3B	{	123	7B
<	60	3C	|	124	7C
=	61	3D	}	125	7D
>	62	3E	~	126	7E
?	63	3F	DEL	127	7F

Hexadecimal Numbers

Straight binary numbers, while convenient for computers, tend to be unwieldy for human beings. In human communication they are usually replaced with hexadecimal ("hex") numbers.

Hex numbers use the ten ordinary (decimal) numerals to represent 0 through 9, plus the capital letters A through F to represent 10 through 15. Each hex digit represents four binary digits:

Hex	Binary	Hex	Binary	Hex	Binary	Hex	Binary
0	0000	4	0100	8	1000	C	1100
1	0001	5	0101	9	1001	D	1101
2	0010	6	0110	A	1010	E	1110
3	0011	7	0111	B	1011	F	1111

Thus to convert an 8-bit binary number into a 2-digit hex number, simply replace the first 4 bits with the first hex digit and the last 4 bits with the second hex digit.

Appendix E

Character Sets

Your printer will produce eight Normal and one Extended character sets from the Apple standard-sequence 130-character print wheel. Each character set provides the basic upper- and lowercase alphabet, numbers, and punctuation marks. The character sets differ in their inclusion of currency symbols, special symbols, characters with accents or umlauts, and special punctuation symbols, as required for routine use in various languages.

Differences between the Normal character sets are confined to hex codes 23, 40, 5B-5E, 60, and 7B-7E. Characters on the print wheel that are not printed by a particular Normal character set are always available in the Extended character set by using the SHIFT OUT TO EXTENDED ALPHABET command. The Extended Alphabet is the same for all character set selections.

The character set the printer uses is determined at initialization by the settings of the Character Set internal configuration switches. These switch settings may be overridden at any time by issuing the SELECT LANGUAGE command.

The table below lists the character sets and the hex code required to print each character.

Note that when you use an ASCII keyboard to compose text that will be printed in a character set other than ASCII, you must type the character in the Apple ASCII column that corresponds to the character you wish to print in another character set's column.

For example, suppose you are using an ASCII keyboard to compose text that will later be printed using the German character set. To print uppercase U with an umlaut, you must type the ASCII character J, which corresponds to hex code 5D. Likewise, you could type ASCII to print as lowercase o with an umlaut.

If you need to print a character that is not in the character set you are using, use the Extended Alphabet. For example, suppose you are using the ASCII character set and wish to print the dagger symbol: issue the SHIFT OUT TO EXTENDED ALPHABET command, then send the corresponding ASCII character }, followed by the SHIFT IN TO NORMAL ALPHABET command. The character sequence would be <SO> } <SI>.

Table 1. Non-printing ASCII Codes and Print Wheel Character Set (Elite 12)

Dec	Hex	Si Ascii	So Ascii	Dec	Hex	Si Ascii	So Ascii	Dec	Hex	Si Ascii	So Ascii	Dec	Hex	Si Ascii	So Ascii
00	00	NUL	NUL	32	20	SP	SP	64	40	Ⓐ	Ⓐ	96	60	Ⓕ	°
01	01	SOH	SOH	33	21	!	!	65	41	A	£	97	61	a	ì
02	02	STX	STX	34	22	"	"	66	42	B	¢	98	62	b	ò
03	03	ETX	ETX	35	23	Ⓢ	#	67	43	C	{	99	63	c	æ
04	04	EOT	EOT	36	24	\$	\$	68	44	D	\	100	64	d	ì
05	05	ENQ	ENQ	37	25	%	%	69	45	E	]	101	65	e	ç
06	06	ACK	ACK	38	26	&	&	70	46	F	~	102	66	f	β
07	07	BEL	BEL	39	27	'	'	71	47	G	~	103	67	g	—
08	08	BS	BS	40	28	(	(	72	48	H	~	104	68	h	•
09	09	HT	HT	41	29	)	)	73	49	I	~	105	69	i	ı
10	0A	LF	LF	42	2A	*	*	74	4A	J	ı	106	6A	j	ĵ
11	0B	VT	VT	43	2B	+	+	75	4B	K	ı	107	6B	k	k
12	0C	FF	FF	44	2C	,	,	76	4C	L	Ä	108	6C	l	l
13	0D	CR	CR	45	2D	-	-	77	4D	M	Ö	109	6D	m	m
14	0E	SO	SO	46	2E	.	.	78	4E	N	Ü	110	6E	n	n
15	0F	SI	SI	47	2F	/	/	79	4F	O	Å	111	6F	o	o
16	10	DLE	DLE	48	30	0	0	80	50	P	Ñ	112	70	p	p
17	11	DC1	DC1	49	31	1	1	81	51	Q	Æ	113	71	q	q
18	12	DC2	DC2	50	32	2	2	82	52	R	a	114	72	r	r
19	13	DC3	DC3	51	33	3	3	83	53	S	o	115	73	s	s
20	14	DC4	DC4	52	34	4	4	84	54	T	u	116	74	t	t
21	15	NAK	NAK	53	35	5	5	85	55	U	ä	117	75	u	u
22	16	SYN	SYN	54	36	6	6	86	56	V	ñ	118	76	v	v
23	17	ETB	ETB	55	37	7	7	87	57	W	é	119	77	w	w
24	18	CAN	CAN	56	38	8	8	88	58	X	ù	120	78	x	x
25	19	EM	EM	57	39	9	9	89	59	Y	è	121	79	y	y
26	1A	SUB	SUB	58	3A	:	:	90	5A	Z	à	122	7A	z	z
27	1B	ESC	ESC	59	3B	;	;	91	5B	Ⓢ	[	123	7B	Ⓢ	§
28	1C	FS	FS	60	3C	<	<	92	5C	Ⓢ	Ⓢ	124	7C	Ⓢ	§
29	1D	FS	FS	61	3D	=	=	93	5D	Ⓢ	]	125	7D	Ⓢ	†
30	1E	RS	RS	62	3E	>	>	94	5E	Ⓢ	Ⓢ	126	7E	Ⓢ	Ⓢ
31	1F	US	US	63	3F	?	?	95	5F	—	—	27	471B	2F	~
												27	321B	20	|

SI = Shift In Mode

SO = Shift Out Mode

= variable character, depending on language (see Table 2, in which columns correspond to circled reference numbers)

The columns in Table 2 correspond to the circled numbers in Table 1. Use this table to find the ASCII Standard character corresponding to a particular character in another "language."

Table 2. Foreign Language Variations in Character Set

Reference Number	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪
Hexadecimal	23	40	5B	5C	5D	5E	60	7B	7C	7D	7E
ASCII Standard	#	@	[	\	\]	-	{	|	}	~
USA WP	#	@	[°]	°	°	§	¶	†	®
Italian	£	\$	°	ç	é	è	ù	à	ò	è	ì
Swedish	#	@	Ä	Ö	Ä	~	~	ä	ö	ä	~
English (UK)	£	@	[	\	\]	~	~	{	|	}	..
French	£	à	°	ç	Š	~	~	é	ù	è	ü
German	#	\$	Ä	Ö	Ü	~	~	ä	ö	ü	ß
Spanish	£	\$	í	Ñ	¿	~	~	°	ñ	ç	~

Appendix F

Direct Addressing of Character Positions on Print Wheel

The information given below is used in reading Tables 4 and 5, Appendix C.

Table 1. Standard-Sequence Print Wheel Information

Hex Code	Character Representation (USA WP)	Print Wheel Address		Pitch Setting		Proportional Space Setting			
		Decimal	Hex	Ribbon Advance	Hammer Intensity	Ribbon Advance	Hammer Intensity	Width	Width (in.)
20	(space)	106	6A	3	4	3	4	3	
21	!	94	5E	2	3	3	3	5	
22	"	108	6C	3	2	3	2	5	
2A	*	86	56	3	3	4	3	5	.0594
2B	+	15	0F	3	3	4	2	5	.0680
2C	,	114	72	2	1	2	1	5	.0230
2D	-	104	68	3	2	4	1	5	.0576
2E	.	102	66	2	1	2	1	5	.0280
2F	/	112	70	3	4	5	4	5	.0382
30	0	23	17	3	4	4	4	5	.0576
31	1	19	13	3	3	2	3	5	.0530
32	2	20	14	3	4	4	4	5	.0552
33	3	21	15	3	4	4	4	5	.0569
34	4	24	18	3	4	4	4	5	.0622
35	5	22	16	3	4	4	4	5	.0551
36	6	25	19	3	4	4	4	5	.0584
37	7	26	1A	3	4	4	4	5	.0558
38	8	27	1B	3	4	4	4	5	.0578
39	9	28	1C	3	4	4	4	5	.0581
3A	:	82	52	2	1	2	1	5	.0182
3B	;	98	62	2	1	3	1	5	.0214
3C	<	31	1F	3	3	4	2	6	.0624
3D	=	30	1E	3	3	4	2	5	.0678
3E	>	29	1D	3	3	4	2	6	.0624
3F	?	88	58	3	3	3	2	5	.0526
40	@	34	22	4	6	4	6	5	.0690
41	A	89	59	4	5	5	5	7	.1024
42	B	79	4F	4	5	5	6	7	.0884
43	C	117	75	3	4	5	5	7	.0858
44	D	103	67	4	5	5	6	7	.0936
45	E	87	57	3	4	5	6	6	.0796
46	F	93	5D	3	4	5	4	6	.0793
47	G	115	73	4	5	5	6	7	.0935
48	H	107	6B	4	5	5	6	7	.0958
49	I	96	60	3	4	3	4	4	.0398
4A	J	92	5C	3	5	4	4	5	.0692
4B	K	111	6F	4	5	5	6	7	.0966
4C	L	91	5B	3	4	4	4	6	.0802

Table 1. Standard-Sequence Print Wheel Information, continued

Hex Code	Character Representation (USA WP)	Print Wheel Address		Pitch Setting		Proportional Space Setting			
		Decimal	Hex	Ribbon Advance	Hammer Intensity	Ribbon Advance	Hammer Intensity	Width	Width (in.)
4D	M	105	69	4	6	5	6	7	.1008
4E	N	95	5F	4	5	5	6	7	.0990
4F	O	101	65	4	5	5	6	7	.0945
50	P	81	51	3	5	5	6	6	.0790
51	Q	127	7F	4	6	5	6	7	.0918
52	R	99	63	4	5	5	6	7	.0963
53	S	85	55	3	5	5	6	6	.0688
54	T	83	53	4	4	5	4	7	.0918
55	U	97	61	4	5	5	5	7	.0949
56	V	90	5A	4	4	5	5	7	.1016
57	W	113	71	4	6	5	6	7	.1032
58	X	109	6D	3	5	5	5	7	.0994
59	Y	123	7B	4	4	5	4	7	.0963
5A	Z	77	4D	4	4	4	4	6	.0674
5B	[	35	23	2	4	3	4	5	.0298
5C		41	29	4	4	5	4	5	.0708
5D	]	33	21	2	4	3	4	5	.0292
5E		62	3E	3	4	5	6	8	.0920
5F	—	84	54	9	2	9	2	6	.1040
60		36	24	2	2	2	2	5	.0386
61	a	124	7C	4	4	5	4	5	.0708
62	b	9	09	3	4	5	5	6	.0840
63	c	5	05	3	4	4	4	5	.0660
64	d	1	01	3	4	5	5	6	.0792
65	e	130	82	3	3	4	3	5	.0650
66	f	116	74	3	3	4	3	4	.0580
67	g	6	06	3	5	5	6	6	.0752
68	h	2	02	3	4	5	5	6	.0826
69	i	3	03	3	3	3	3	3	.0426
6A	j	120	78	3	3	3	3	3	.0360
6B	k	10	0A	3	4	5	4	6	.0854
6C	l	122	7A	3	3	3	3	3	.0412
6D	m	119	77	4	6	5	6	7	.1004
6E	n	129	81	3	4	5	4	6	.0832
6F	o	125	7D	3	4	4	4	5	.0726
70	p	8	08	4	4	5	5	6	.0794
71	q	11	0B	4	5	5	5	6	.0806
72	r	126	7E	3	4	4	3	5	.0688
73	s	128	80	3	4	4	4	5	.0588
74	t	118	76	3	4	3	3	4	.0508
75	u	4	04	3	4	5	4	6	.0852
76	v	110	6E	4	3	4	3	6	.0870
77	w	121	79	4	5	5	5	7	.1008
78	x	12	0C	3	4	5	5	6	.0838
79	y	7	07	4	4	5	4	6	.0860
7A	z	13	0D	3	4	5	4	5	.0574
7B		80	50	3	4	4	4	5	.0494
7C		60	3C	3	4	4	6	5	.0666
7D		75	4B	3	4	2	4	4	.0492
7E		73	49	3	3	5	3	5	.0691

Table 1. Standard-Sequence Print Wheel Information, continued

Hex Code	Character Representation (USA WP)	Print Wheel Address		Pitch Setting		Proportional Space Setting			
		Decimal	Hex	Ribbon Advance	Hammer Intensity	Ribbon Advance	Hammer Intensity	Width	Width (in.)
7F		76	4C	3	2	3	2	5	.0484
81		32	20	4	5	4	5	6	.0736
82		40	28	3	4	4	4	5	.0608
83		57	39	2	4	3	4	5	.0288
84		63	3F	3	4	5	4	5	.0372
85		54	36	2	4	3	4	5	.0288
86		50	32	3	2	3	2	5	.0486
87		48	30	3	2	3	2	5	.0576
88		59	3B	3	2	3	2	5	.0504
89		65	41	3	2	3	2	5	.0532
8A		69	45	2	3	3	3	5	.0184
8B		71	47	3	3	3	2	5	.0530
8C	A	74	4A	4	5	5	5	7	.1033
8D	O	72	48	4	5	5	6	7	.0896
8E	U	70	46	4	5	5	5	7	.0950
8F	A	64	40	4	5	5	5	7	.1038
90	N	68	44	4	5	5	6	7	.0994
91		66	42	4	6	5	6	7	.0926
92	a	53	35	4	4	5	4	5	.0706
93	o	38	26	3	4	4	4	5	.0724
94	u	39	27	3	4	5	4	6	.0857
95	a	56	38	4	4	5	4	5	.0712
96	n	51	33	3	4	5	4	6	.0834
97	e	52	34	3	3	4	3	5	.0660
98	u	44	2C	3	4	5	4	6	.0856
99	e	55	37	3	3	4	3	5	.0656
9A	a	58	3A	4	4	5	4	5	.0712
A1	i	43	2B	3	3	3	3	3	.0484
A2	o	42	2A	3	4	4	4	5	.0728
A3		49	31	4	5	5	5	7	.0920
A4		46	2E	3	3	3	3	3	.0430
A5	c	45	2D	3	4	4	4	5	.0666
A6		47	2F	4	5	5	6	6	.0656
A7	-	61	3D	3	3	4	4	5	.0602
A8		67	43	3	3	3	3	5	.0402

Appendix G

Printer Specifications

Characteristics

Print

Full character set, office typewriter quality. A variable intensity ballistic hammer is programmed to strike with a force that is proportional to the character size.

Font

Uses 130 character print wheels. A variety of font styles in 10, 12, 15 pitch and multifont spacing are available.

Print Wheel

Plastic, operator interchangeable.

Forms

Continuous (sprocket or non-sprocket) or single sheet, 15 inches (38.1 cm) maximum width.

Paper Feed

Friction drive against a rubber pressure platen. Optional sprocket feed tractor available.

Ribbon

Plastic cartridge. Choice of multistrike carbon ribbon or endless fabric ribbon.

Ribbon Feed

Ribbon will feed proportionally to character width for maximum ribbon life.

Format**Horizontal:**

132 columns at 10 characters per inch
158 columns at 12 characters per inch
198 columns at 15 characters per inch
120 positions per inch resolution

Vertical:

6 or 8 lines per inch (line feed)
48 positions per inch resolution
Manual positioning using typewriter style knob

Power Requirements

90 to 132 VAC, 49-63 Hz Single Phase Internal Power Supply

Temperature

Operating: 10 to 40 degrees Celsius

Storage in Shipping Container: -40 to 60 degrees Celsius

Humidity

Operating: 10% to 90% relative; non-condensation

Storage in Shipping Container: 10% to 95% relative; non-condensation

Physical

Weight: 37 pounds (16.8 kg)
Width: 23.22 inches (59 cm)
Height: 6.87 inches (17.5 cm)
Depth: 14.84 inches (37.7 cm)

Operating Specifications

Text Print Speed

Average text print speed with the standard sequence Apple print wheel: 40 characters per second.

Paper Feed Speed

A slow rate of 3.5 inches per second.

Print Quality

Horizontal Positioning Accuracy: The following specifications apply to characters printed at 10 or 12 characters per inch. The horizontal spacing between the positions of any two adjacent identical characters shall be within .007 inches of nominal. The horizontal spacing between the positions of any two adjacent nonidentical characters shall be within .010 inches of nominal.

The absolute spacing over 132 columns of carriage motion at 10 columns per inch is 13.1 plus or minus .050 inches.

Vertical Positioning Accuracy: The following specifications apply only to vertical positioning caused by printer paper feed without manual or mechanical intervention. Except where specifically stated otherwise, the paper transport is by friction feed and in the forward (paper movement up) direction only.

The maximum absolute vertical character deviation over a full line of identical characters printed without intervening paper motion is .007 inches. The maximum absolute vertical character deviation of a full line of characters of any mix printed without intervening paper motion is .008 inches.

Vertical positioning of identical characters printed at a nominal spacing of 6 lines per inch is within .008 inches of nominal.

The absolute spacing over 11 inches of paper movement on a single sheet of paper is 11.00 plus or minus .050 inches. Two identical characters printed at the same location on a single sheet of paper are aligned vertically within .010 inches of each other after two intervening paper feed motions in opposite directions of up to 11 inches.

Paper Feed

The paper feed mechanism can accept multiple copies with a total thickness of no more than .025 inches when using a standard friction feed platen.

Paper Advance

Paper advance is accomplished by means of a separate stepping motor driving a gear train to rotate the platen and optional tractors. Bi-directional paper feeding is possible in increments of 1/48". Software drivers provide bi-directional line feed options of 6 and 8 lines per inch.

Paper Handling — Friction Feed

The printer uses a large diameter friction feed platen (1.432") and multiple pressure rollers. The platen is long enough to accommodate 15-inch wide paper.

The printer will accept 1-part to 6-part cut forms from 6 to 14-1/2 inches wide. Form length can be from 3 to 14 inches. Multicopy capability is directly related to the paper used. An original and five copies can be obtained with 11-pound opaque paper (extra smooth) and 8 pound medium black carbon.

Other paper combinations may perform acceptably, but it is recommended that proposed forms be tested in a trial run before use. Maximum thickness of set is not to exceed .025 inch. To optimize multicopy performance, the platen should be adjusted fore and aft to give the best possible copy. Insertion of the form will be from the rear of the platen. The following restrictions must be observed when selecting cut forms for use on this printer.

1. Stapled forms are not allowed.
2. Multiple-part cut forms must be glued at the top.
3. Partial forms separation is not recommended.
4. Crimped multiple-part forms are not recommended because they tend to separate when wrapped around the platen.

In the continuous forms application, card stock is not recommended and only single-part continuous forms are allowed. The operator will be required to straighten the paper since "walking" of the paper will occur because of the multiple-roller design. Unattended operation in this mode is not recommended.

Paper Handling — Tractor Feed Option

A removable tractor unit may be attached above the platen and will be driven by coupling to the platen drive gear of the unit. With the tractor feed option, forms ranging from 3 to 15 inches wide can be used. Multicopy capability is directly related to the paper used. An original and five copies can be obtained with 11-pound opaque paper (extra smooth) and 8 pound medium black carbon.

Other paper combinations may perform acceptably, but it is recommended that proposed forms be tested in a trial run before use. Maximum thickness of set is not to exceed .025 inch. To optimize multicopy performance, the platen should be adjusted fore and aft to give the best possible copy.

The tractor option will not permit tear-off of the last form printed. Stapled forms are not allowed. The paper supply may not be more than 36 inches below platen level. Five-part and six-part forms should be tried to determine if legibility, form feeding, and print registration are acceptable. The paper will be routed over the rear of the unit, into the rear of the tractor sprockets, down through the platen, and up into the front tractor sprockets above the platen.

The tractors can be adjusted to accommodate paper hole spacing from 3.125 inches to 14.5 inches.

Note: When operating the unit with tractors, the friction feed pressure rollers and platen guide rollers must be in the disengaged position (rollers away from the platen), otherwise paper feeding problems may occur. The friction feed pressure rollers should be engaged to assist paper loading only.

Code Compliance

The printer is designed to meet or equal the requirements of the following agency specifications:

U.L. 478

CSA C22.2 No. 154

VDE 0871 - 6/78, Level B

IEC 380 (comparable to ECMA 57 and VDE 0804/0805)

FCC Class B, Subpart J of Part 15 of Rules

Appendix H

Serial Interface Specifications

Serial Interface

EIA RS-232-C compatible. CCITT V.24 compatible.

Cable and Connector

Cable: Four 22 AWG conductors for “No Modem” operation (not included).

Cable: Eight 22 AWG conductors for modem connection (not included).

Connector: Twenty-five pin miniature connector, Cinch or Cannon DB-25P or equivalent (not included).

Modem Compatibility

Bell type 103A, 113A, 202C, 202S, or 212A, or equivalent.

Baud Rate

110, 150, 300, 600, 1200, 2400, 4800, 9600 baud selectable.

Parity

Odd, even, mark, or space; generation and checking.

Duplex

Half or full duplex.

Handshaking Protocol

ETX/ACK or DC1/DC3 (XON/XOFF) communication protocols, or Data Terminal Ready (DTR) hardware handshaking signal during “No Modem” operation.

Buffer

256 character minimum receive buffer.

Serial Interface Signals

Pin #	EIA Signal Name	Function
1	AA Protective Ground	Chassis or frame ground.
2	BA Transmit Data	This signal is used for the printer to transmit status or handshaking data.
3	BB Receive Data	This signal is used for the printer to receive data to be printed.
4	CA Request to Send	When TRUE, this signal means the printer wants to transmit data. Modem Mode: Full Duplex — Always TRUE. Half Duplex — Signal is FALSE when there is no data to send. Signal is TRUE when attempting to transmit data. No Modem Mode: Always TRUE.
5	CB Clear to Send	This signal must be TRUE for the printer to transmit data in the Modem mode.

Pin #	EIA Signal Name	Function
6	CC Data Set Ready	<p>Modem Mode: When TRUE indicates that the local modem is in data mode and is ready to receive or transmit data.</p> <p>No Modem Mode: Not used.</p>
7	AB Signal Ground	Ground reference for all data and control signals.
8	CF Carrier Detect	Not used.
20	CD Data Terminal Ready	<p>When TRUE, this signal means the printer is ready to accept data.</p> <p>Modem Mode: Always TRUE.</p> <p>Mo Modem Mode: Signal (switch selectable) may be used for hardware handshake. When handshaking, signal is FALSE if buffer is full and during initialization.</p>

Serial Communication

ETX/ACK Handshaking

When the printer is in the ETX/ACK Handshaking mode (and either the Modem or No Modem mode), the ASCII codes ETX and ACK can be used by the host system and printer to communicate.

When using the ETX/ACK Handshaking mode, the host system transmits blocks of data to the terminal. Each block must be smaller than the printer's receive buffer size and each block must have the ASCII code ETX as its last character. After sending a block of data, the host system stops transmitting and waits for the terminal to transmit an ASCII ACK code. The printer prints the block of data (or executes the commands) and, when it comes to the ETX code, it automatically transmits the ASCII ACK code to the host system, indicating that the host system may now transmit another block of data.

XON/XOFF Handshaking

When the printer is in the XON/XOFF Handshaking mode (and either the Modem or No Modem mode), the ASCII codes DC1 and DC3 are used by the printer to provide the host system with receive buffer full/empty status.

When the printer's receive buffer is within 64 characters of being full, the printer will transmit the ASCII code DC3 to the host system, indicating that it should stop transmitting (XOFF). When the printer's receive buffer is within 64 characters of being empty, the printer will transmit the ASCII code DC1 to the host system, indicating that it may again begin transmitting (XON).

DTR Handshaking

When the printer is in the DTR Handshaking mode and in the No Modem mode, the interface's Data Terminal Ready output signal is used as a handshaking signal.

The DTR signal is TRUE when indicating to the host system that it may transmit data to the printer. When the printer's receive buffer is within 64 characters of being full, the DTR signal is made FALSE, indicating to the host system that it should stop transmitting. When the printer's receive buffer is within 64 characters of being empty the DTR signal is made TRUE, indicating to the host system that it may again begin transmitting.

Error Conditions

Parity, overrun, and framing errors will result in the following:

- Sound alarm once.
- Print the ASCII character “^”.

Buffer overflow will result in a BREAK being transmitted to the host system, and all buffered data will be lost.

Appendix I

Glossary

ASCII: ASCII is an acronym for American Standard Code for Information Interchange. This code assigns a unique value from 0 to 127 to each of 128 numbers, letters, special characters, and control characters.

baud rate: A unit of data transmission rate: the number of signal elements per second.

bit: Contraction of Binary digIT, the smallest possible unit of information. A single bit is used to specify a two-way choice, such as that between “0” or “1”.

cable: A group of wires used to carry information between two devices. How many wires are used varies with the type of connection.

Central Processing Unit, or CPU: The “brain” of the computer. The CPU is responsible for executing instructions that control the use of memory and perform arithmetic and logical operations. A microprocessor is a CPU.

character: A letter, number, punctuation mark, or symbol for a special concept (such as a carriage return), that is used in printing or displaying information in a form readable by humans.

command: A communication from a user to a computer, or a computer to another device, to perform an immediate action.

control character: Control characters, a subclass of characters comprising the first 32 characters of ASCII, initiate, modify, or stop control functions.

daisy wheel: Sometimes called “print wheel”. An accessory used in many high-quality printing devices. So called because of the shape, many spokes branching outward from a circular center shaft.

default: A value, action, or setting that is automatically used by a computer system when no other explicit information has been given, or when no defined value has been specified.

DIP switch: Dual Inline Package switch. From the user's point of view, a tiny switch that can be moved one way or the other to represent one of two values.

forms tractor: A mechanism mounted on a printer to feed it paper evenly and continuously.

handshaking: A convention for controlling the rate of information transfer, required when one device cannot receive information at the rate it can be transmitted by the other device. Special characters or signals (in "software" or "hardware" handshaking respectively) are used as controls.

hexadecimal: A number system that uses the ten digits 0 through 9 and the six letters A through F to represent values in base 16.

initialize: To set to an initial state or value in preparation for some computation.

interface: The electronic components that allow two different devices to communicate.

microprocessor: A Central Processing Unit contained in a single integrated circuit.

modem: A device that enables a computer to transmit and receive information over a cable, typically a telephone line, by MODulating and DEModulating signals (converting bits into particular audio frequencies, and vice versa).

modem eliminator: A special cable needed for some types of interfacing.

pitch: A way of expressing the horizontal space allocated to each character: characters per inch.

serial interface: A method of transmitting information sequentially, one bit at a time, over a single wire or channel.

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