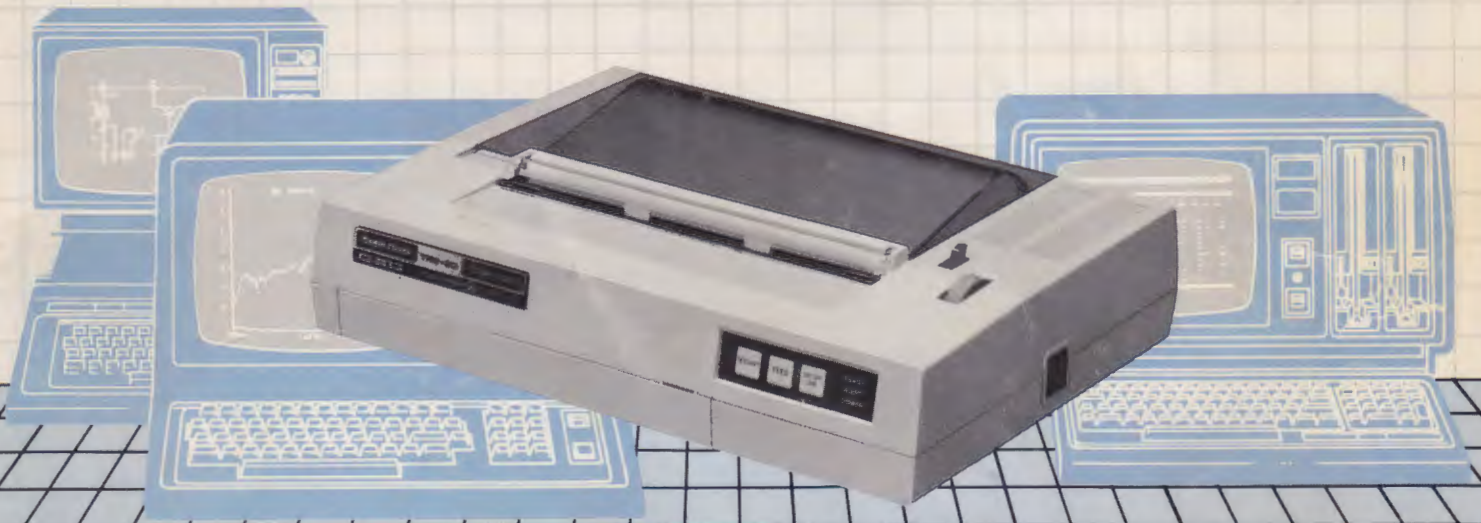


TRS-80[®]

CGP-220

OPERATION MANUAL

Catalog Number 26-1268



Radio Shack[®]

TRS-80

**COMPUTER
PRODUCTS**

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Introduction

Congratulations for selecting the TRS-80 CGP-220 Ink-Jet Printer!

The CGP-220 is a compact, “drop-on-demand” Ink-Jet Printer that can print characters and graphics in seven colors: Black, Red, Green, Yellow, Blue, Magenta, and Violet.

Some of its unique features include:

- Standard and Elongated characters.
- High speed printing—37 characters per second.
- Bit-addressable, minute graphics.
- 640 dots per line of high-resolution printing.
- Printing on plain single sheet paper or roll-paper.

The CGP-220 can also reproduce graphic displays from a TRS-80 Color Computer. All you need, besides a 16K Color Computer, is the Radio Shack Color Computer Screen Dump Program. The Screen Dump Program allows the CGP-220 to accept graphic input from the Color Computer for printing in four colors.

Additionally, the CGP-220 has both serial and parallel interfaces for use with any TRS-80 computer. Its large capacity Ink Packs let you print up to 4 million characters, and, finally, the CGP-220 operates at an unusually low noise-level. All these features set the CGP-220 apart, making it an all-purpose Printer that’s a real pleasure to use.

1/ Some Background Information

There are two principal ways in which all colors are produced.

The first involves mixing light rays. In this system—commonly known as the “RGB” method—Red, Green, and Blue light rays are projected on a surface (such as a theater screen or a color monitor) to generate all other colors.

The second method—and you’ll probably remember this from your junior high school art class—is based on the mixture of pigments such as ink or paint. In this method, the colors Yellow, Magenta, and Cyan are mixed in different combinations to produce all other colors. This is called the “subtractive” system, although it is most often known as the “YMC” method.

The CGP-220 uses the “YMC” method. Color monitors, on the other hand, use light rays to create color, and, therefore, use the “RGB” method.

It is possible, however, to print graphic displays from a color monitor because the CGP-220 is equipped with built-in software that allows conversion from the “RGB” method to the “YMC” method. This means, simply, that you can use a Color Computer to produce a graphic color display and then “dump” the picture to the CGP-220 for printing.

Of course, you can manipulate colors directly in the Bit Image or the Color-Scan Mode from a BASIC program. Color Screen Dumping is just an extra convenience that makes your CGP-220 more useful and a valuable addition to any computer system.

2/ Description of the CGP-220

Open the package and take out the CGP-220. Do not throw away the package material or the box. They may be useful if you ever need to transport the Printer or send it through the mail.

The CGP-220 package includes:

- A CGP-220 Ink-Jet Printer.
- A power cord.
- Three sheets of test paper.
- This owner's manual.

To get the most benefit from your Printer, take some time now to familiarize yourself with the various parts and controls.

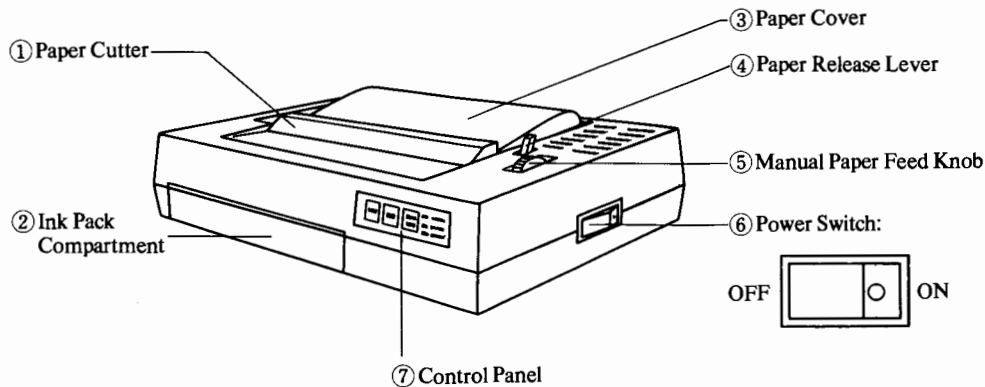


Figure 2-1. Front View

- ① **Paper Cutter.** When using Roll-Paper (26-1333), pull against edge of the Cutter to tear paper off.
- ② **Ink Pack Compartment.** The Ink Packs are housed inside this compartment. Pry open (compartment door swings down) with a coin or a flat object to change the Ink Packs when necessary.
- ③ **Paper Cover.** Keep Cover closed while Printer is in operation. Raise it to load Roll-Paper, lock or release the Green Lever, and pump the Ink Supply.
- ④ **Paper Release Lever.** Pull Lever forward to insert or release paper. Push Lever towards rear to secure paper in place.
- ⑤ **Manual Paper Feed Knob.** Rotate towards the rear to advance the paper manually.
- ⑥ **Power Switch.** Press the side with red circle to turn the Printer ON. Press the opposite side to turn the Printer OFF.

⑦ **Control Panel:**

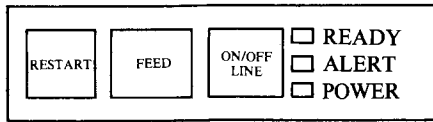


Figure 2-2. Control Panel

RESTART Switch. When you run out of paper, the Printer will stop printing. Load paper and press this Switch to return the Printer to its status before the out-of-paper condition occurred.

FEED Switch. Press this Switch once to advance paper one line. Keep pressing for continuous feed. This Switch is operative only when the ON/OFF LINE Switch is set to OFF LINE.

ON/OFF LINE Switch. This Switch sets the Printer ON or OFF LINE. When ON LINE, the Printer can operate with a computer. To operate other front panel switches or to stop printing, the Printer must be OFF LINE.

IMPORTANT NOTE FOR COLOR COMPUTER USERS.

Do not attempt to print when the ON-LINE/OFF-LINE switch is set to OFF-LINE. If you do, unpredictable printing may occur.

READY Indicator. If illuminated, this indicator signals the CGP-220 is ON LINE and ready to print.

ALERT Indicator. This Indicator will illuminate whenever the Printer is out of paper, a carriage fault has been committed, or to signal some electrical problem.

POWER Indicator. This Indicator will illuminate whenever the Printer is turned ON.

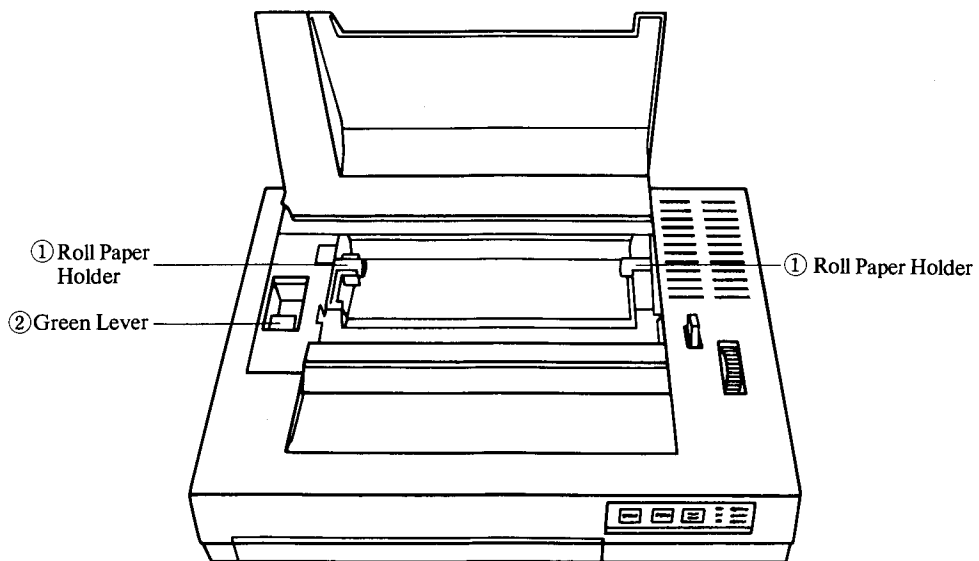


Figure 2-3. Top View

- ① **Roll Paper Holder.** Press toward left to load or remove Roll-Paper.
- ② **Green Lever.** The Green Lever can be used to lock the carriage and cap the ink nozzles (to protect against vibrations during transportation and prevent ink from drying or spilling), to unlock the carriage and uncap the nozzles, or to “pump” the ink supply.

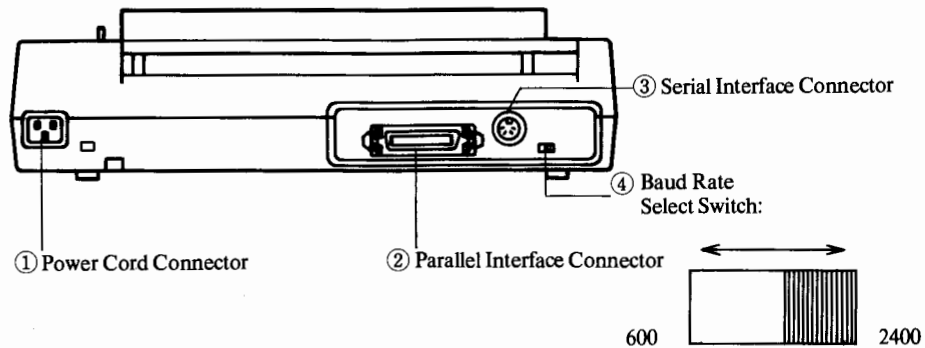


Figure 2-4. Rear View

- ① **Power Cord Connector.** Connect the supplied power cord here.
- ② **Parallel Interface Connector.** If your Computer has parallel interface capabilities, connect the appropriate Printer Cable here.
- ③ **Serial Interface Connector.** If you are using a Color Computer, connect the appropriate Printer Cable here.
 Note: Each printer interface connector becomes active when the Printer Cable is inserted. Use either connector (parallel or serial) but never both at the same time.
- ④ **Baud Rate Select Switch.** Set Switch to the left for 600 baud; set to the right for 2400 baud.

3/ Setting Up the CGP-220

This section shows you how to set up your Printer so that you can begin using it as quickly as possible.

Before getting started, however, you must choose an appropriate location to set up your Printer.

Observe the following precautions when selecting a location:

- Avoid connecting the Printer to the same outlet as noise-generating equipment (such as air-conditioners, copy machines, refrigerators, etc.).
- Avoid dusty places and direct sunlight, or extreme temperatures and humid conditions.
- Place the Printer on a sturdy, flat work surface.

Connecting the CGP-220 to an AC Power Source

Before plugging the power cord, be sure the CGP-220 Power Switch is in the OFF position.

1. Connect the female end of the power cord to the Power Jack on the rear of the CGP-220.
2. Connect the other end of the power cord to a 3-prong grounded outlet or to an approved power strip such as Radio Shack's Automatic Power Controller (26-1429). If you must use an extension cable, use the shortest one possible.

Paper Loading

The CGP-220 uses either Single-Sheets (26-1341) or Roll-Paper (26-1333).

Single-Sheet Paper Loading

1. Turn the power OFF.
2. Move the Paper Release Lever forward.
3. Insert a sheet of paper into the Paper insertion slot at the end of the Paper Cover.
4. Push the Paper Release Lever toward the rear and turn the Manual Feed Knob to pull the paper around until it feeds about 4" above the Paper Cutter.
5. Pull the Paper Release Lever forward again to align the paper, then push it toward the rear.
6. Turn the Paper Feed Knob to return the paper to the desired printing position.
7. Turn the power ON.

After the paper is loaded and the power is ON, check the ALERT Indicator. If it is illuminated, press the RESTART. If it turns off you may put the Printer ON LINE and begin printing. If the Indicator remains lit, the paper is probably loaded incorrectly.

Once the paper is properly loaded, printing will continue until the paper's bottom edge passes a "paper empty sensor." When this happens, the CGP-220 will go OFF

LINE and the ALERT Indicator will begin flashing. You should then insert another piece of paper and press the RESTART Switch. The CGP-220 will resume printing from where it left off.

Note: Be sure to set the Paper Release Lever toward the rear after the paper is loaded to avoid paper jam.

Roll-Paper

1. Be sure the power is turned OFF.
2. Open the Paper Cover. Press the Roll-Paper Holder toward the left. Insert the right end of the Roll-Paper into the circular projection on the right side, and then release the Roll-Paper Holder to secure the other end of the Roll-Paper.
3. Pull the Paper Release Lever forward.
4. Insert the Paper into the Paper Insertion Slot.
5. Push the Paper Release Lever toward the rear and use the Manual Feed knob to pull the paper around until it appears between the platen and the Paper Cutter.
6. Pull the Paper Release Lever forward again to align the paper, then push it toward the rear.
7. Turn the Manual Feed Knob to return the paper to the desired printing position.
8. Close the Paper Cover.
9. Turn the power ON.

After the paper is loaded and the power is ON, check the ALERT Indicator. If it is illuminated, press RESTART. If it turns off you may put the Printer ON LINE and begin printing. If the Indicator remains lit, the paper is probably loaded incorrectly.

Note: Be sure to set the Paper Release Lever toward the rear after the paper is loaded to avoid paper jam.

Setting the Green Lever

The Green Lever performs three primary functions:

- First, it lets you lock the carriage and cap the ink nozzles. This protects the Printer from vibrations during transportation and prevents the ink from drying or spilling.
- Second, it unlocks the carriage and uncaps the nozzles to permit printing.
- Third, the Green Lever can also be used to “pump” the ink supply to provide better printing quality.

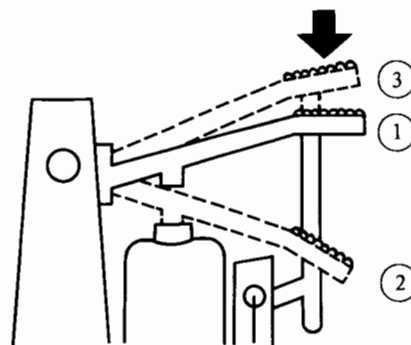


Figure 3-1. Green Lever Settings

Unlocking the Carriage

Having selected a suitable location for your Printer and connected it to a power source, the next thing you should do is unlock the carriage and uncap the nozzles. Printing will be impossible until this has been done.

1. Turn the power ON.
2. Open the Paper Cover.
3. Press the Green Lever down to position ② (see figure 3-1) and hold it there for one second.
4. Release the Green Lever.
5. The ALERT Indicator will blink for about ten seconds. When it stops blinking, lift the Green Lever to position ③.
6. Close the Paper Cover.

Locking the Carriage

If you are going to transport the Printer or leave it unused for a long period of time, it is advisable to lock the carriage and cap the ink nozzles. Follow this procedure:

1. Turn the power ON.
2. Open the Paper Cover.
3. Press the Green Lever all the way down and hold it there for 1 second.
4. Release the Lever and confirm that it stops at position 1 as shown in Figure 3-1.
5. The ALERT Indicator will blink for about ten seconds. This is normal. After it stops blinking you may turn the power OFF.
6. Close the Paper Cover.

Important Note: The power must be turned ON when locking the Lever. Otherwise the carriage cannot be locked properly. If you plan to transport or store the Printer for a period of time, see Appendix E/ Transportation and Storage for additional instructions.

Checking the Ink-Jet Mechanism

After loading the paper and unlocking the carriage, it is a good idea to confirm that the Ink-Jet mechanism is working properly. This is done by pressing the FEED switch (immediately after unlocking the carriage). The carriage will start moving and print the test pattern shown below.



Note: The Ink-Jet Mechanism may be checked by the above procedure every time the carriage is unlocked or after Ink-Supply Pumping (this will be discussed in the next section), or whenever ambient temperature is low.

If the printed pattern appears irregular or the color is weak, the ink supply may need to be “pumped.”

Ink Supply Pumping

When the CGP-220 does not print or printing quality is poor, the problem may be remedied by “pumping” the ink supply.

1. Turn the power ON and confirm that th Printer is OFF LINE.
2. Open the Paper Cover.
3. Press the Green Lever all the way down and hold it there for one second.
4. Release the Green Lever.
5. The ALERT Indicator will blink for about ten seconds. When it stops blinking, lift the Green Lever to the top position.
6. Close the Paper Cover.
7. Check the Ink-Jet Mechanism by printing the test pattern again.

If the quality of the printed pattern is still inadequate, repeat Ink Supply Pumping.

A maximum of two “pumping” should suffice. After Ink Pack replacement or long storage, however, five to six “pumpings” may be necessary.

Self-Test

In addition to checking the Ink-Jet Mechanism, you may check general printer operation and printing quality with the CGP-220's built-in self-test.

1. Turn the power OFF.
2. Turn the power ON while pressing the FEED Switch.
3. Release the FEED Switch.

The CGP-220 will begin the self-test, printing all the alphanumeric symbols that it is capable of producing. Each line will be printed in a different color.

To stop the self-test simply turn the power OFF.

Connecting the CGP-220 to a TRS-80

When connecting the CGP-220 to a TRS-80 Computer, be sure to use the correct printer cable. Table 1 indicates the appropriate printer cable for each Computer; Table 2 tells you where the printer connector is located on each TRS-80.

Also, before making any connections be sure to turn the power to all system components OFF.

TRS-80 to CGP-220 Cables

TRS-80	Cable Number
Model I (Exp. Interface)	26-1401
Models II/16/DT-1	26-4401
Model III	26-1401
Model 4	26-1401
Model 100	26-1409
Color Computer	26-3020

Table 1

TRS-80 Connection Points

TRS-80	Connector
Model I (Exp. Interface)	Left side of E.I.
Models II/16	Rear Panel of Computer
Models III/DT-1	Underneath Panel
Model 4	Underneath Panel
Model 100	Rear Panel of Computer
Color Computer	Rear Panel of Computer

Table 2

1. Attach the molded male end of the printer cable to the connector on the left rear of the CGP-220. Do not force the plug. If it doesn't fit, turn it over and try again.
2. Connect the other end of the cable to the Printer Jack of your Computer. See your TRS-80's owner's manual for specific instructions.
3. If you're using the Serial Interface connection, set the Baud Rate Switch to the appropriate position.

Important Note! You may use either the Serial or Parallel Interface connectors, but never both at the same time.

Power-Up Sequence

The precise power-up sequence will depend upon your Computer. We suggest that you consult your owner's manual for details on powering up your TRS-80 with peripheral devices (such as printers).

Replacing the Ink Packs

Your CGP-220 comes with two Ink Packs installed. The Black Ink Pack (26-1281) can print about four million characters; the Tri-Color Ink Pack (26-1282), about three million.

When printing quality does not improve after repeated Ink-Supply Pumping and you have already printed more than eight rolls of paper, it is likely that the Ink Packs are exhausted.

To replace the Ink Packs:

1. Turn the power OFF.
2. Insert a coin or a small flat object in the opening of the Ink Pack Compartment and, carefully, pry it open.
3. Grasp the empty Ink Pack by the sides and pull it out gently but firmly.
4. Be certain that the Ink Pack is empty by holding it sideways and then shaking it. If the ink sack inside does not jiggle freely, the Ink Pack is empty.
5. Insert the new Ink Pack in place, making sure it stays firmly attached.
6. Pump the Ink Supply.
7. Close the Ink Pack Compartment.

Note: Dispose of used Ink Pack immediately; remaining Ink may spill.

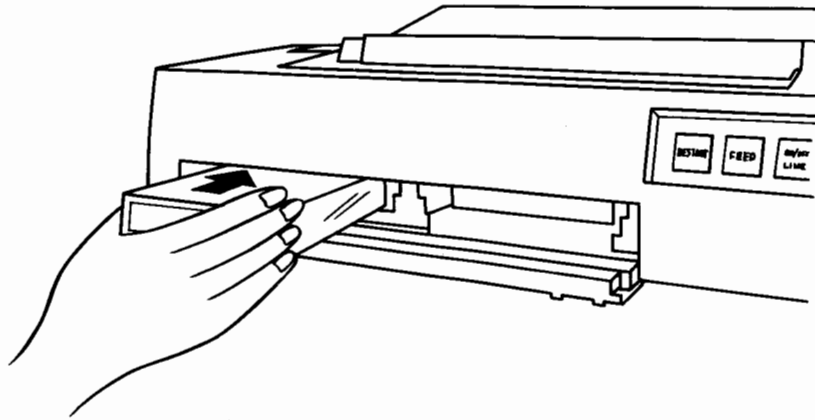


Figure 3-2. Replacing the Ink Packs

Remember...

- Use only Ink Pack replacements specially designed for the CGP-220 (Black Ink Pack, 26-1281; Tri-Color Ink Pack, 26-1282.)
- Never refill empty Ink Packs.
- Operate the Printer only when both Ink Packs are installed.
- Insert Ink Pack replacements in their appropriate slots (do not interchange them). The Black Ink Pack always goes in the left slot, the Tri-Color Ink Pack, in the right slot.

Failure to observe the above precautions may damage your Printer.

Special Note: If the CGP-220 is operated in locations 1000 or more meters above sea level (3,280'), low air pressure may cause Ink Supply malfunction. Should this occur, leave the Printer unused for 24 hours so that the pressure inside the Ink Packs and tubes equalizes to the air pressure outside. Then "pump" the Ink Supply. Also, if the Printer is carried around, bubbles may appear inside the ink tube, causing irregular printing. Leaving the unit unused for 6 hours and then "pumping" the Ink Supply takes care of this.

4/ Using the CGP-220 (General Printer Operation)

The CGP-220 is designed for three distinct modes of operation:

- Text Mode
- Bit Image Mode
- Color-Scan Mode

Text Mode is used for printing alphanumeric characters. The CGP-220 is in the Text Mode when you first power it up.

Bit Image Mode lets your Printer produce high-resolution monochrome graphic printouts of charts, logos, tables, etc.

Color-Scan Mode is very similar to the Bit Image Mode. However, the Color-Scan Mode permits greater manipulation of colors, allows for greater dot density per line, and has a different dot addressing scheme.

Control Codes

Before investigating the various print modes, consider how the TRS-80 communicates with the CGP-220 Ink-Jet Printer.

All information is sent to the Printer as numbers between 0 and 255 (00—FF in Hexadecimal). The CGP-220 interprets numbers according to the American Standard Code for Information Interchange, commonly referred to as the ASCII code.

Most numbers (or codes) are printed as letters, numbers, or symbols. However, some special sequences of code numbers are used to “control” various Printer functions.

These Control Codes allow you to instruct the Printer to perform certain special functions. For example, a Control Code may be used to change printing size, another, to repeat the printing of a character a certain number of times, etc.

Your CGP-220 recognizes 14 Control Codes. If a Code is not recognized by the Printer, it is ignored or printed as X.

Sending Control Codes from BASIC

As you probably already know, the BASIC command to instruct the Printer to print is LPRINT (if you are using a TRS-80 Color Computer, substitute this command with PRINT #-2,). However, before the Printer begins printing anything, it performs a small check to identify any control codes that might be present in the LPRINT statement.

Some Printer features are activated by a single code, but many functions require a sequence of two or more codes. Most multiple code sequences begin with decimal 27 (referred to as the “ESCape” Code).

The ESC code notifies the Printer that a special sequence is on its way. The next code(s) sent determine which Printer feature is selected. In BASIC, use CHR\$() to send these codes to the Printer.

For example, to send the code for a carriage return and a line feed, type:

```
LPRINT CHR$(13) ENTER
```

as part of program or in the “immediate mode” and you will see the paper advance one line.

5/ General Control Codes

You can make full use of all the printing features of your CGP-220 from within a BASIC program. In this section, we'll show you how to handle these various functions.

Line Feed/Carriage Return

The following control codes:

CHR\$(10) and CHR\$(13)

cause the Printer to print any buffer contents and perform a Line Feed. Additionally, CHR\$(13) performs a Carriage Return.

On initial power-up, the CGP-220 uses 1/6" (full) Line Feed when it advances the paper. You can change the Line Feed to 1/8", or three-quarter line feed, with the following command:

```
LPRINT CHR$(27);CHR$(56)
or LPRINT CHR$(27)"8"
```

After sending the control code for a three-quarter line feed, the CGP-220 "memorizes" the new line feed and advances paper this amount the next time it receives a Carriage Return/Line Feed code.

To demonstrate the difference in the line feeds, type the following BASIC program in your TRS-80:

```
10 LPRINT "LINE FEED PITCH TEST"
20 LPRINT "THIS IS NORMAL"
30 LPRINT CHR$(27);CHR$(56)
40 LPRINT "THIS IS 1/8 INCH"
```

Elongated Characters

The printing of characters can be elongated to twice the normal width with the control code:

```
LPRINT CHR$(27);CHR$(14)
```

This code may be used anywhere in a program to start character elongation. To terminate character elongation the control code:

```
LPRINT CHR$(27);CHR$(15)
```

has to be sent on another line of the program.

Type the following BASIC program to see how these two codes are used:

```
10 LPRINT "NORMAL CHARACTER";
20 LPRINT CHR$(27);CHR$(14);
30 LPRINT "ELONGATED";
40 LPRINT CHR$(27);CHR$(15);
50 LPRINT "BACK TO NORMAL"
```

Dot Pitch Selection

Dot Pitch refers to a character's vertical length versus its horizontal length. Normally dot pitch is set in a ratio of 4:3. That is, characters are slightly "taller" than they are wide. If you wish to print characters that are equally wide and tall, then you must send the control code:

```
LPRINT CHR$(27);CHR$(78)
or LPRINT CHR$(27) "N"
```

The entire line containing this code will then be printed in a 1:1 ratio. To return printing to the normal 4:3 ratio, you must send the code:

```
LPRINT CHR$(27);CHR$(80)
or LPRINT CHR$(27) "P"
```

To see the differences in dot pitch selection, type the following BASIC program and run it:

```
10 LPRINT "NORMAL DOT PITCH"
20 LPRINT CHR$(27) CHR$(78) "1:1 RATIO DOT PITCH"
30 LPRINT CHR$(27) CHR$(80) "BACK TO NORMAL DOT PITCH"
```

Print Head Positioning

You can send a control code to move the Print Head to a specific dot position along a line in each of the three modes of Printer operation (Text, Bit Image, and Color-Scan). You may move the Print Head to any of 640 dot positions within each line. The code to accomplish Print Head movement is:

```
LPRINT CHR$(27) CHR$(16) CHR$(n1) CHR$(n2)
```

where n1 specifies a range in the line (each line is divided into three ranges), and n2 specifies the desired position within that range. Since the maximum value you can send to the Printer is 255, it is necessary to break each line into three ranges. For this reason, n1 has to be included in the code.

Table 3 below indicates the values that n1 and n2 may assume.

CGP-220 Print Head Positioning

If you wish to specify dot column	n1 must be	n2 must be
0—255	0	0—255
256—511	1	0—255
512—640	2	0—129

Table 3

Type and run the following BASIC program to see how this code can be used:

```
10 LPRINT CHR$(27);CHR$(16) CHR$(1);CHR$(44);
20 LPRINT "THIS IS THE 300TH DOT POSITION"
```

In LINE 10, the Control Code CHR\$(27); CHR\$(16) tells the Printer to get ready to position the Print Head. Then CHR\$(1) specifies the second range in the line. From Table 3 above, you can see that if n1 is 1, dots 256—511 are addressable. Finally,

CHR\$(44) specifies the 44th dot position within the second range. Therefore when LINE 10 is executed, the Print Head will move the 300th dot position skipping 299 dots (or 44 dots inside the second range which begins with dot number 255, or $255 + 44 = 299$).

LINE 20 is simply an LPRINT statement with no Control Codes. After the Print Head is positioned, the phrase "THIS IS THE 300TH DOT POSITION" will be printed.

Character Repetition

It is possible to print a character repeatedly—up to 256 times—by using the control code:

```
LPRINT CHR$(28) CHR$(n1) CHR$(n2)
```

where n1 specifies the number of repetitions and n2 specifies the character to be printed repeatedly. n2 must be a printable character; otherwise, X will be printed (see Appendix B for a list of all printable characters). You may substitute the entire CHR\$(n2) with a printable character enclosed in quotes.

This can be very useful in underlining, printing graphic codes, or repeated graphics. Type the following single line program and run it to see how this code works.

```
10 LPRINT CHR$(28) CHR$(30) "T"
```

As you may have suspected it, the letter "T" is printed 30 times.

Color Selection

You may choose among the seven colors that the CGP-200 is capable of printing to create attractive graphics, logos, charts, or tables. To choose a color, you must send the code:

```
LPRINT CHR$(27) CHR$(84) CHR$(n1)  
or LPRINT CHR$(27) "T" CHR$(n1)
```

where n1 is a two-digit number from 48 to 55.

Table 4 below shows the color available with each number.

CGP-220 Color Selection

If you want to use color	n1 must be
Black	48
Red	49
Green	50
Yellow	51
Blue	52
Magenta	53
Violet	54
White (not printing)	55

Table 4

Type and run the following program for a display of the various colors available with the CGP-220:

```
10 LPRINT CHR$(27);"T";CHR$(48);"BLACK"  
20 LPRINT CHR$(27);"T";CHR$(49);"RED"  
30 LPRINT CHR$(27);"T";CHR$(50);"GREEN"  
40 LPRINT CHR$(27);"T";CHR$(51);"YELLOW"  
50 LPRINT CHR$(27);"T";CHR$(52);"BLUE"  
60 LPRINT CHR$(27);"T";CHR$(53);"MAGENTA"  
70 LPRINT CHR$(27);"T";CHR$(54);"VIOLET"
```

6/ Entering the Various Printing Modes

The Text Mode

When you first power-up the CGP-220, it immediately enters the Text Mode. You may then use the Printer for printing documents, letters, etc. You may also use any permissible control codes for underlining, positioning the Print Head, selecting colors, etc.

The Bit Image Mode

To enter the Bit Image Mode, simply send a CHR\$(18) to the Printer. (See section 7 of this manual for using the CGP-220 in the Bit Image Mode.)

To get out of the Bit Image Mode, send a CHR\$(30) to the Printer. The Printer will then return to whatever Mode it was in before you switched to the Bit Image Mode.

The Color-Scan Mode

To enter the Color-Scan Mode, you must send the code sequence:

CHR\$(27);CHR\$(67);CHR\$(n1);CHR\$(n2);CHR\$(n3);CHR\$(n4)
or CHR\$(27) "C" CHR\$(n1) CHR\$(n2);CHR\$(n3);CHR\$(n4)

n1 tells the Printer how many dot-rows are to be sent. n2, n3, and n4 determine how the colors are mixed. (See section 8 of this manual for details.)

After completing n1 number of dot rows in the Color-Scan Mode, the Printer will return to previous Mode.

7/ The Bit Image Mode

In the Bit Image Mode, you no longer have pre-defined characters at your disposal. You are responsible for the positioning and action of the Print Head.

In this Mode you may address 640 dots across each line and seven dots vertically for a total of 4480 dots per line ($640 \times 7 = 4480$). In other words, each line consists of 640 Dot-Columns and each Dot-Column contains seven dots.

How do you Print just one dot (or two or three) of those dots in the dot-column you want. For example, how can you print the 3rd dot from the top in the 400th column?

Simple. Just follow this general procedure:

1. Send a CHR\$(18) to put the CGP-220 into the Bit Image Mode.
2. Send a CHR\$(27) CHR\$(16) to tell the Printer you want to position the Print Head to print a specific dot.
3. Tell the Printer which dot-column you want to print. (This will take a little explanation. For now, just understand that you simply tell the Printer which dot-column you want to use.)
4. Tell the Printer what you want to print. You can do this in a number of different ways. For now just keep this overall process in mind.

For example, after entering the Bit Image Mode, you can tell the Printer to move the Print Head to a specific dot and then follow this with another two-code sequence for specifying the dot-column:

```
LPRINT CHR$(27);CHR$(16);CHR$(n1);CHR$(n2)
```

where n1 is a value between 0 — 2 and n2 is value between 0 — 255.

Even though dot-columns greater than 255 exist, you cannot send values greater than 255. That is, CHR\$(260) or CHR\$(400) are not allowed. You must break any number larger than 255 into a two-byte value.

For example, to draw a vertical column at dot-column 144, try this program:

```
10 LPRINT CHR$(18)
20 LPRINT CHR$(27);CHR$(16);CHR$(0);CHR$(144);CHR$(255)
```

(If you don't understand what the 255 is doing in line 20, don't worry. It will be explained in the next section.)

First, line 10 puts the CGP-220 into the Bit Image Mode. CHR\$(27); CHR\$(16) tells it to get ready to position the Print Head. Notice that, since you want to print a column in line 144 n1 has assumed the value of 0.

Table 5 shows what values are permissible for n1 and n2 for the corresponding dot-columns.

Graphic Dot Positioning

If you wish to specify dot-column	n1 must be	n2 must be
0—255	0	0—255
256—511	1	0—225
512—640	2	0—128

Table 5

Printing Graphic Patterns

By now, you've had some practice at positioning the Print Head. But you also need to be able to tell the CGP-220 what to print once the Head is positioned.

Remember we said that there are 7 vertical dots in a column. You can print any or all of these dots in any combination that you want.

Look back at the example we used when we talked about Head Print positioning in the previous section.

As you'll recall we left part of the program unexplained, particularly the role of CHR\$(255) in line 20. What CHR\$(255) does, in fact, is cause the CGP-220 to print an entire column of dots in dot-column 144. That's an example of all 7 dots printed at once.

There is a simple process for determining the appropriate number to cause the Printer to print any dot or any combinations of dots in any particular dot-column.

Type and run this program to print just the top dot of dot-column 144.

```
10 LPRINT CHR$(18)
20 LPRINT CHR$(27);CHR$(16);CHR$(0);CHR$(144);CHR$(129)
```

In this case, CHR\$(129) causes the top dot at dot-column 144 to be printed.

Even though the dots in each dot-column are arranged vertically, they are not numbered sequentially. Table 6 below shows the numbering scheme used to address particular dots.

CGP-220 Addressable Dot Numbering System

Dot#	Dot	Number You Must Use to Print the Dot:
1	*	129
2	*	130
4	*	132
8	*	136
16	*	144
32	*	160
64	*	192

Table 6

For example, if you wanted to print the bottom dot in dot-column 144, change line 20 of the previous program to:

```
20 LPRINT CHR$(27);CHR$(16);CHR$(0);CHR$(144);CHR$(192)
```

Similarly, if you wanted to print the third dot from the top, change line 20 to:

```
20 LPRINT CHR$(27);CHR$(16);CHR$(0);CHR$(144);CHR$(132)
```

This is fine if you only want to print individual dots. But how do you print a combination of dots?

It's actually quite simple too.

1. Specify the Dot #s (1–64) that represent each individual dot you wish to print.
2. Add those individual Dot #s together.
3. Add 128 to the sum of the Dot #s.

For example, if you want to print the first dot (Dot #1), the fourth dot (Dot #8), and the last dot (Dot #64), add the Dot #s together: $1 + 8 + 64 = 73$. Then add 128 to this number: $128 + 73 = 201$. You would then use 201 as the addressable dot pattern in the form CHR\$(201):

```
10 LPRINT CHR$(18)
20 LPRINT CHR$(27);CHR$(16);CHR$(0);CHR$(144);CHR$(201)
```

Remember how CHR\$(255) printed a solid vertical bar (all dots printed)? If you add all the individual Dot #s in a column and then add 128 to that number, 255 will be the result.

$$1 + 2 + 4 + 6 + 8 + 16 + 32 + 64 = 127$$
$$127 + 128 = 255$$

Line Feed

In the Bit Image Mode, it is assumed that you want to print rows of graphics one right after another (each 7 dots high). A single line feed advances the paper 7 dots or approximately 0.12 inch. This small paper advance allows for continuous printing without unwanted space between lines.

Repeat Function

You can use the repeat code, CHR\$(28), just as you do in the Text Mode.

CHR\$(28) will tell the CGP-220 to print a graphic pattern a specified number of times.

The format for the Repeat Function is:

repeat code + number of times to repeat + what to repeat

For example, LPRINT CHR\$(28); CHR\$(15); CHR\$(255) will print the solid vertical bar 15 times.

Color Function

The color designation for the Bit Image Mode is the same as in the Text Mode. For example, type and run the following program:

```
10 LPRINT CHR$(18)
20 FOR N=48 TO 54
30 LPRINT CHR$(27);CHR$(84);CHR$(N);
40 LPRINT CHR$(255)
50 NEXT N
```

The familiar solid vertical bar will be printed in 7 different colors.
(Elongation and Dot Pitch selection are also available in the Bit Image Mode.)

Mixing Modes

You can mix the Bit Mode and the Text Mode in the same line. However, if you do, “descending” text characters (like “p,” “q,” “y,” etc.) will be missing the last dot.

Leaving the Bit Image Mode

You must send code CHR\$(30) to exit the Bit Image Mode. The previous Printer conditions, such as Dot Pitch selection, color, and character size will be reestablished.

8/ Color-Scan Mode

The Color-Scan Mode is somewhat like the Bit Image Mode but it allows for greater manipulation of color, and permits greater detail in graphics creation. Also you may address a total of 640 dots per line.

You should be aware, however, that creating graphics in this Mode from a BASIC program is not particularly easy. The number of dots, the addressing scheme, and the manipulation of color, require a great deal of attention to detail and consumes a lot of memory space.

To print in the Color-Scan Mode, we suggest you create graphics on the screen and then “dump” that screen to the Printer using the Color Screen Dump Program (see chapter 9 of this manual for more details).

In the Color-Scan Mode, we will address dots in horizontal rows consisting of 8 dots each. Since there are 640 dots per line, you may address 80 dot-rows in each line ($640/8 = 80$).

To enter the Color-Scan Mode you must send the code:

```
LPRINT CHR$(27);CHR$(67)
```

Printing Graphic Patterns

The format for specifying color printing in this Mode is:
number of dot-rows to be printed + red data + green data + blue data

The first piece of information, number of dot-rows, tells the Printer how many dot-rows — out of possible 80 — are to be printed.

As it should be obvious, the color data tell the CGP-220 which dots are to be printed with the specified color.

For example, how do you tell the CGP-220 to print the third dot from the left with red?

A method much like the one in the Bit Image Mode is used to figure this out.

	Dot #'s	128	64	32	16	8	4	2	1
Dot to be printed in specified color		*	*	*	*	*	*	*	*

Just as it was done in the Bit Image Mode, use the corresponding Dot # to specify the dot to be printed. If you want to print more than one dot in the same color, use the sum of the Dot #s (in this mode, however, you do not have to add them to any number, just to each other).

If you don't specify a color, the dot(s) will be printed black. On the other hand, if you specify all three colors for any Dot # (s), the dot(s) will be printed white — or left unprinted, as you prefer.

To illustrate with a graphic example, type and run the following program:

```

10 LPRINT CHR$(27);CHR$(67);:REM ENTERING COLOR-SCAN MODE
20 LPRINT CHR$(3);:REM PRINTS THREE ROWS
30 LPRINT CHR$(128);CHR$(128);CHR$(128);:REM RED DATA-
LEFTMOST DOT ON EACH OF THE THREE ROWS
40 LPRINT CHR$(16);CHR$(16);CHR$(16);:REM GREEN DATA-4TH
DOT FROM LEFT ON EACH OF THE THREE ROWS
50 LPRINT CHR$(1);CHR$(1);CHR$(1);:REM BLUE DATA-RIGHTMOST
DOT ON EACH OF THE THREE ROWS

```

This program will print a red dot on the leftmost position on each dot-row, a green dot on the fourth position from the left, and a blue dot on the rightmost position, and all the other dots will be black.

Mixing Colors

The CGP-220 lets you mix any two colors to obtain a third color. Simply specify the color data so the same dot will be printed in the two desired colors.

The chart below shows you what color you can expect when you mix any two colors:

Red + Green = Yellow
 Red + Blue = Magenta
 Green + Blue = Violet

If you want to leave a dot "white," simply specify all three colors.

Type the following lines to modify the previous program:

```

30 LPRINT CHR$(195);CHR$(195);CHR$(195);
40 LPRINT CHR$(51);CHR$(51);CHR$(51);
50 LPRINT CHR$(60);CHR$(60);CHR$(60);

```

The program will print each of the three dot-rows as:

red — red — violet — violet — blue — blue — yellow — yellow

Line 30, the Red data, uses Dot #s 128, 64, 2 and 1 to add up to 195.

Line 40, the Green data, uses Dot #s 32, 16, 2, and 1 to add up to 51.

Line 50, the Blue data, uses Dot #s 32, 16, 8 and 4 to add up to 60.

Let's analyze what happens when the program is run and the pattern is printed:

Dot #s 128 and 64 have Red data only.
 Dot #s 32, and 16 have both Green and Blue data
 Dot #s 8, and 4 have Blue data only.
 Dot #s 2, and 1 have both Red and Green data.

Refer to the Color Chart. You will see that because Dot #s 32, and 16 have both Green and Blue, they should appear as Violet. Also, since Dot #s 2, and 1 have both Red and Green Data, they should appear as yellow.

Note: If you send more data to the CGP-220 than specified, the excess data will be processed in the Mode previous to entering the Color-Scan Mode, either Text or Bit Image. Also, note that in the Color-scan Mode the Dot Pitch is fixed to 1:1.

9/ Color Computer Screen Dump

The CGP-220 can reproduce graphics from a 16K Color Computer when the special Color Computer Screen Dump program is used. This machine language program loads in a few seconds and allows color screen dumps in four colors.

Whenever a screen dump routine is executed, you have the option of selecting a background color (Green, Black, or White). You should be aware that the color chosen will determine selection of all the other colors.

The table below summarizes color conversion according to background selected.

Background	Printable Colors			
GREEN	YELLOW	BLUE	RED	
↕	↕	↕	↕	
WHITE	BLUE	RED	ORANGE	
↕	↕	↕	↕	
BLACK	BLUE	RED	WHITE	

Table 7

Appendix A/ Control Code Summary

Dec.	Hex.	Symbol	Explanation
10	0A	LF	Performs Line Feed and prints data in print buffer.
13	0D	CR	Performs Carriage Return and Line Feed and prints data in buffer.
18	12	DC2	Puts the CGP-220 into the Bit Image Mode.
27+14	1B+E	ESC SO	Defines the beginning of character elongation.
27+15	1B+F	ESC SI	Defines the end of character elongation.
27+16 (+n1+n2)	1B+10	ESC POS	Moves the Print Head to a position specified by n1 and n2.
27+54	1B+36	ESC 6	Defines full line feed (1/6")
27+56	1B+38	ESC 8	Defines three-quarter line feed (1/8")
28+n1+n2	1C+n1+n2	FS	Defines character n2 repetition n1 number of times.
30	1E	RS	Defines the end of the Bit Image Mode and returns Printer to previous status.
27+84+n1	1B+54+n1	ESC T	Selects any of available colors where the color is specified by a two-digit number, n1.
27+67	1B+43	ESC C	Puts the CGP-220 into the Color-Scan Mode.
28+78	1B+4E	ESC N	Defines Dot-Pitch ratio as 1:1.
27+80	1B+50	ESC P	Defines Dot-Pitch ratio as 4:3.

Appendix B/ Characters Sets

The CGP-220 has 96 dot matrix patterns in the ROM (Read Only Memory). The following is a table of the character codes.

Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.	
32	20	40	SPACE	56	38	70	8
33	21	41	!	57	39	71	9
34	22	42	"	58	3A	72	:
35	23	43	#	59	3B	73	;
36	24	44	\$	60	3C	74	<
37	25	45	%	61	3D	75	=
38	26	46	&	62	3E	76	>
39	27	47	'	63	3F	77	?
40	28	50	(	64	40	100	@
41	29	51	)	65	41	101	A
42	2A	52	*	66	42	102	B
43	2B	53	+	67	43	103	C
44	2C	54	,	68	44	104	D
45	2D	55	-	69	45	105	E
46	2E	56	.	70	46	106	F
47	2F	57	/	71	47	107	G
48	30	60	0	72	48	110	H
49	31	61	1	73	49	111	I
50	32	62	2	74	50	112	J
51	33	63	3	75	51	113	K
52	34	64	4	76	52	114	L
53	35	65	5	77	53	115	M
54	36	66	6	78	54	116	N
55	37	67	7	79	55	117	O

Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.	
80	50	120	P	104	68	150	h
81	51	121	Q	105	69	151	i
82	52	121	R	106	6A	152	j
83	53	122	S	107	6B	153	k
84	54	123	T	108	6C	154	l
85	55	124	U	109	6D	155	m
86	56	125	V	110	6E	156	n
87	57	126	W	111	6F	157	o
88	58	127	X	112	70	160	p
89	59	130	Y	113	71	161	q
90	5A	131	Z	114	72	162	r
91	5B	132	[	115	73	163	s
92	5C	133	\	116	74	164	t
93	5D	134	]	117	75	165	u
94	5E	135	^	118	76	166	v
95	5F	136	—	119	77	167	w
96	60	137	,	120	78	170	x
97	61	140	a	121	79	171	y
98	62	141	b	122	7A	172	z
99	63	142	c	123	7B	173	|
100	64	143	d	124	7C	174	|
101	65	145	e	125	7D	175	|
102	66	146	f	126	7E	176	~
103	67	147	g	127	7F	177	Ignored

European Symbol Code

Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.	
160	A0	240	´	192	C0	300	â
161	A1	241	à	193	C1	301	ë
162	A2	242	ç	194	C2	302	î
163	A3	243	£	195	C3	303	ô
164	A4	244	`	196	C4	304	û
165	A5	245	μ	197	C5	305	ˆ
166	A6	246	◊	198	C6	306	ë
167	A7	247	▼	199	C7	307	ÿ
168	A8	250	†	200	C8	310	á
169	A9	251	§	201	C9	311	í
170	AA	252	SPACE	202	CA	312	ó
171	AB	253	SPACE	203	CB	313	ú
172	AC	254	SPACE	204	CC	314	!
173	AD	255	SPACE	205	CD	315	ñ
174	AE	256	SPACE	206	CE	316	ã
175	AF	257	¶	207	CF	317	õ
176	B0	260	¥	208	D0	320	Æ
177	B1	261	Ä	209	D1	321	æ
178	B2	262	Ö	210	D2	322	À
179	B3	263	Ü	211	D3	323	à
180	B4	264	¢	212	D4	324	Ø
181	B5	265	˘	213	D5	325	ø
182	B6	266	ä	214	D6	326	Ñ
183	B7	267	ö	215	D7	327	É
184	B8	270	u	216	D8	330	Á
185	B9	271	ß	217	D9	331	Í
186	BA	272	SPACE	218	DA	332	Ó
187	BB	273	é	219	DB	333	Ú
188	BC	274	ù	220	DC	334	ì
189	BD	275	è	221	DD	335	Û
190	BE	276	¨	222	DE	336	È
191	BF	277	f	223	DF	337	À

Appendix C/ Programming Information

The items below should be considered when you program the computer.

1. When Printer is turned on.
 - Text Mode is automatically selected.
 - 1/6" (Full) line feed is in effect.
 - Normal characters are selected (not Elongated).
 - Buffer memory is completely cleared.
2. Normal and Elongated characters can be intermixed in the same line. This may cause unexpected auto-wraparound. To prevent this, intermix Normal and Elongated characters only in short lines.
3. Elongated characters are not terminated at the end of the line but until a terminating code is received.
4. In the Character Repetition code, printable characters can be repeated as many times as provided for in the count number (with a maximum of 256). If any control code is received for repetition, it will be ignored or printed as X.
5. The Head Positioning code can be used at any carriage position. If designated dot column address is in the current text which is already printed out, overprint will occur.
6. Line feed in the Bit Image Mode advances the paper 7 dots (0.12 inch).
7. Bit Image and Text Mode can be used in the same line. However, "descending" text characters (p, q, j, g, etc. . .) will be missing the lowest dot.

Programming Examples

Note to Model II Programmers:

If the Printer goes OFF-LINE during a print operation, and remains off-line for a certain period of time, Model II TRSDOS will present an error message. Application programs should be written to trap such errors, inform the operator of the error condition, and give the operator a chance to correct the condition and continue printing. If it's a BASIC applications program, an I/O error will occur, and the operator may type CONT (ENTER).

The BASIC statements LPRINT and LLIST output to the Line Printer. See your Computer's Reference Manual for syntax details.

Examples:

```
LLIST
```

Lists the resident program to the Printer.

```
LPRINT "THIS IS ATEST"
```

Prints the message in quotes and tells the Printer that the next printable character begins a new line.

```
LPRINT "THIS IS PART OF ALINE";"THIS IS THE REST"
```

Prints both messages on the same line (because of the semicolon). The next printable character received starts a new line.

```
10 LPRINT "NORMAL"  
20 LPRINT CHR$(27);CHR$(14);  
30 LPRINT "ELONGATED";  
40 LPRINT CHR$(27);CHR$(15)  
50 LPRINT "BACK TO NORMAL"
```

Prints normal, elongated, and then normal characters again.

```
LPRINT CHR$(28);CHR$(9);"ABC"
```

Prints 9 characters of A's and one character "BC".

```
10 LPRINT CHR$(27);CHR$(16);CHR$(1);CHR$(44);  
20 LPRINT "THIS IS THE 300TH DOT POSITION"
```

Prints above message starting at 300th dot column position.

Appendix D/ Care and Maintenance

- Always plug the Printer into a 3-wire grounded outlet.
- Be sure that the Paper Cover is closed during operation.
- Never operate Printer without paper.
- Avoid leaning objects against Printer or placing anything on top. If any object is accidentally dropped into the machine, turn the power OFF and carefully remove object.
- Be sure to turn the power OFF when replacing the Ink Packs.
- Use only lint-free cloth to clean the Printer's surface. Do not use solvents or harsh cleaning agents. Mild detergent solution or desktop cleanser may be used sparingly.
- Keep hands away from carriage mechanism while Printer is in operation.
- Printer must be kept dry. If water is accidentally spilled on machine, turn the power OFF immediately and wipe the printer dry. Do not turn the power ON until the unit completely dry.

Appendix E/ Transportation and Storage

Transportation

Be sure to pack the CGP-220 as described below before transporting, to protect the precision ink-jet mechanism.

1. Turn the POWER switch on.
2. Lock the carriage (see page 11).
3. Turn the POWER switch off.
4. Remove all the paper from the Printer.
5. Detach the power cord and interface cable.
6. Secure the roll paper cover and ink pack compartment with tape.
7. Place the Printer in its original packing box. Make sure that it is well cushioned with styrofoam or other shock-absorbent packing material.

Notes:

1. Do not remove the Ink Packs when moving Printer. If removed, the ink may solidify.
2. Be careful not to jolt the Printer or expose it to vibration.

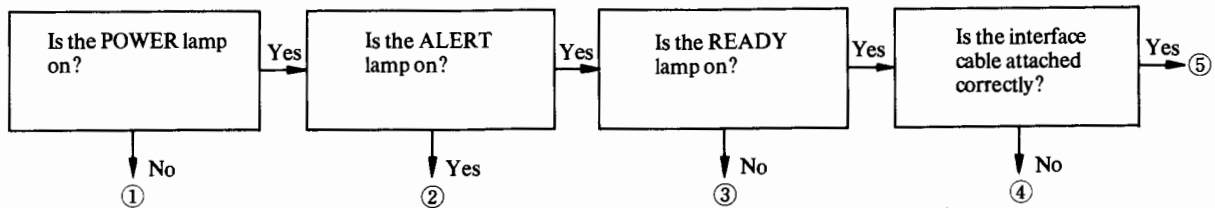
Storage

- * Do not remove Ink Packs for storage.
- * Be sure to maintain the Printer within the reasonable ranges of temperature and humidity.
- * Clean the Printer with a soft, dry cloth. Do not use harsh solvents such as thinner or benzene. This will damage the cover and/or internal electronic circuitry.
- * After the long storage (more than 6 months), perform the ink supply pumping 6 times and check the printing. If the Printer does not print, turn the POWER switch off and wait for 6 hours or more. Then perform the ink supply pumping procedure. If printing is still impossible, contact your Radio Shack service center.

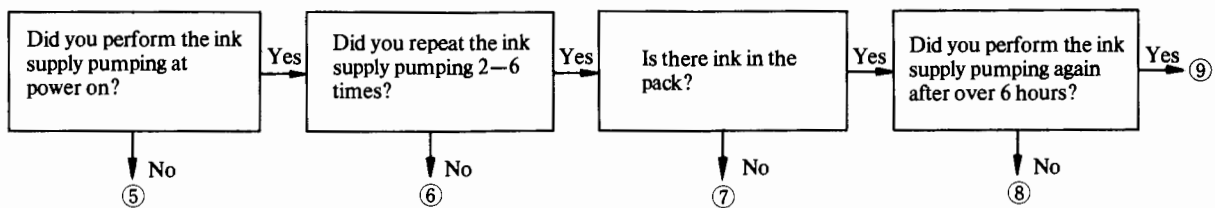
Appendix F/ Troubleshooting

If the printer does not operate properly, follow the troubleshooting procedure as shown below. If the problem persists, contact your Radio Shack's service representative.

Printer does not print.



Printing problems occur.



No.	Remedy
①	Check the power cord connection and power switch.
②	Clear the carriage lock and reset the paper correctly.
③	Press the ON-LINE/OFF-LINE switch
④	Check the interface cable.
⑤	Perform the ink supply pumping and print the test-pattern.
⑥	Repeat the ink supply pumping 2—6 times
⑦	Change the ink pack.
⑧	Turn the power off and do not use the printer for 6 hours or more. Then perform the ink supply pumping again.
⑨	Contact your Radio Shack's service representative.

Appendix G/ Specifications

Printing Type	Drop-on-demand Ink-Jet system
Print Head	Piezoelectric-type
Nozzle	7 colors: Yellow, Blue, Red, Green, Violet, Magenta, and Black
Character Set	
Standard and Elongated	Full ASCII Character Sets (96), and Special Character Sets (58)
Character Size	1.51mm (W) × 2.73mm (H) (standard) 3.02mm (W) × 2.73mm (H) (elongated)
Character Composition	5 × 7 dot matrix
Bit Image Printing	
Resolution	640/line (Bit Image Mode) 640/line (Color Scan Mode)
Printing Speed	37 characters/sec. (standard characters) 2630 dots/sec. (graphics)
Printing Direction	Bi-directional line scanning
Maximum Number of	91 for standard characters
Column	45 for elongated characters
Printing Pitch	Vertical — 4.23mm (1/6 inch) Horizontal — 2.12mm (1/12 inch)
Print Buffer	Character — 1 line (45 or 91 characters) Bit Image — 640 dots 4 colors Color Scan — 640 dots 4 colors
Interface	8-bit parallel interface and serial interface
Paper	Roll-Paper (26-1333) (Box of three rolls, 135' e/a) Single-sheet (26-1341)
Ink Packs	Black 26-1281 Tricolor 26-1282
Size	15 3/4" × 11 5/8" × 4 1/4" 400mm × 295mm × 114mm
Weight	12.3 lbs (5.6kg.)
Power Source	110V to 120V 60Hz 230V to 240V 60Hz

Subject to change without notice

Appendix H/ Interface Specifications

Parallel Interface

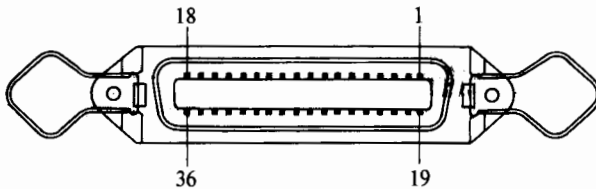


Figure H-1. Parallel Interface Connector

Signal pin assignments

Pin no.	Signal	Direction	Pin no.	Signal	Direction
1	$\overline{\text{DSTB}}$	In	19	$\overline{\text{DSTB-RET}}$	
2	DATA 1 (LSB)	In	20	DATA1-RET	
3	DATA 2	In	21	DATA2-RET	
4	DATA 3	In	22	DATA3-RET	
5	DATA 4	In	23	DATA4-RET	
6	DATA 5	In	24	DATA5-RET	
7	DATA 6	In	25	DATA6-RET	
8	DATA 7	In	26	DATA7-RET	
9	DATA 8 (MSB)	In	27	DATA8-RET	
10	$\overline{\text{ACK}}$	Out	28	$\overline{\text{ACK-RET}}$	
11	BUSY	Out	29	BUSY-RET	
12	PE	Out	30	GND (0 V)	
13	$\overline{\text{BUSY}}$	Out	31	NC	
14	GND (0 V)		32	$\overline{\text{FAULT}}$	Out
15	NC		33	NC	
16	GND (0 V)		34	NC	
17	FG		35	NC	
18	+5 V		36	GND (NC)	

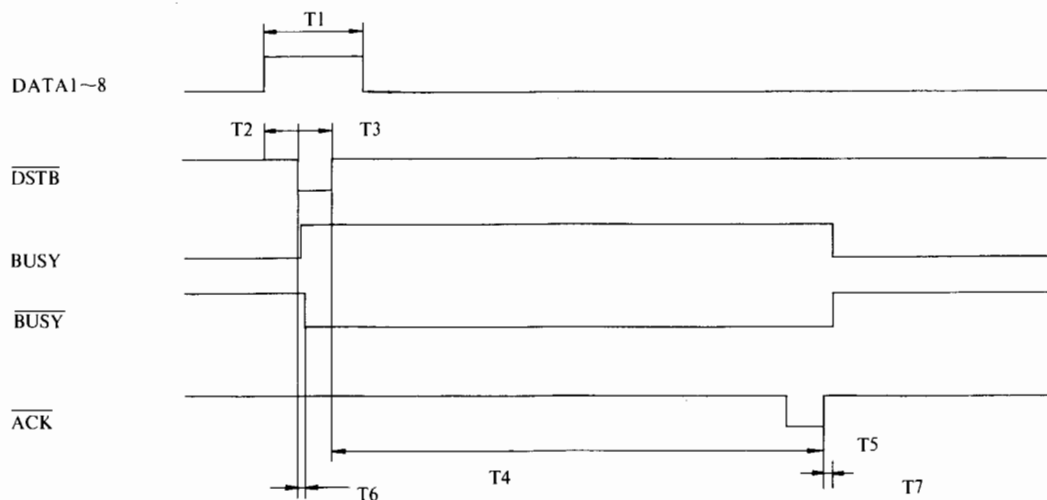
Note: The -RET signals are all connected to signal ground.

Parallel interface signals

Signal name	In/Out	Description
DSTB	In	DSTB is a negative going pulse which is used to transfer incoming data from the host into the printer. The pulse duration must be minimum of 1 microsecond. The relationship of the leading and trailing edge of the DSTB signal with the leading and trailing edge of the input data signals must be as shown in the interface timing diagram.
DATA 1~8	In	Data bits contain ASCII character data information. Data bit levels are positive true logic.
ACK	Out	The ACK signal is a negative-going signal which indicates, by the rising edge, that the printer is no longer busy. The falling edge of the ACK may occur any time during BUSY and the rising edge may occur coincident with the falling edge of BUSY or up to 5 microseconds later. The ACK pulse must be a minimum of 5 microseconds wide.
PAPER OUT (PE)	Out	The PAPER OUT signal is a positive-going pulse which indicates that the Printer is out of paper. If not active, this signal must be terminated low.
BUSY	Out	The BUSY signal is a positive going pulse which indicates that the printer is out of paper or printer is not ready to receive data. If not active, this signal must be terminated low.
BUSY	Out	The BUSY signal is the logical inverse of BUSY.
FAULT	Out	The FAULT line is a negative going signal that indicates there is a fault condition present; i.e., paper out, logic fault, offline condition, or other mechanical fault.

Timing Diagram

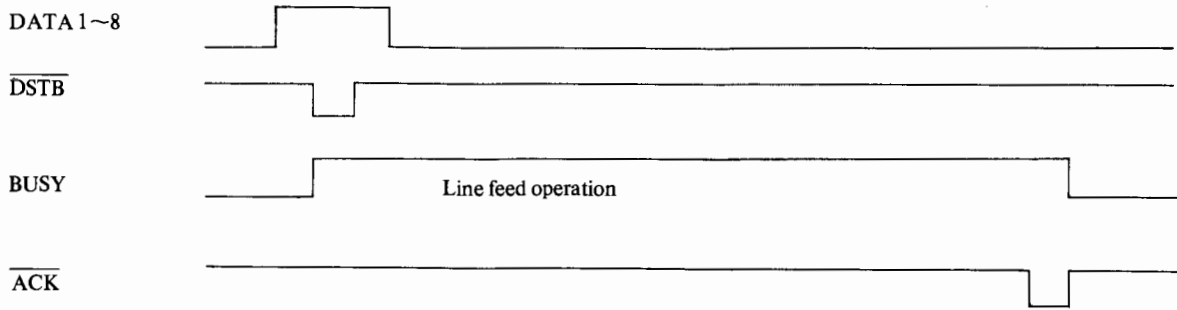
- DATA input timing diagram



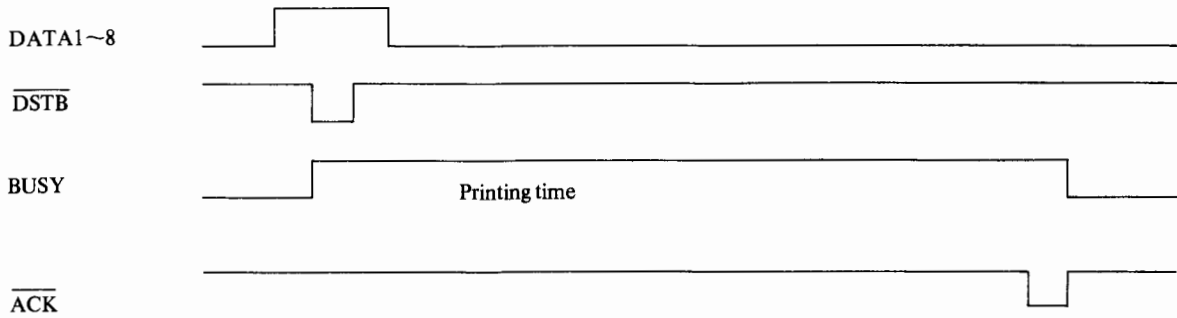
T5: 5 (μ s) min.
T6: 0.6 μ s max.

$2.75 \leq T1$ (μ s)
 $0 \leq T2$ (μ s)
 $1.stet \leq T3$ (μ s)
 $190 < T4$ (μ s)

- Line feed

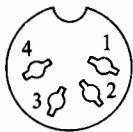


- Carriage return



Serial Interface

Signal pin assignment



Signal pin no.	Signal name
1	NC (No Connection)
2	STATUS
3	GND
4	DATA

Figure H-2. Serial Interface Connector

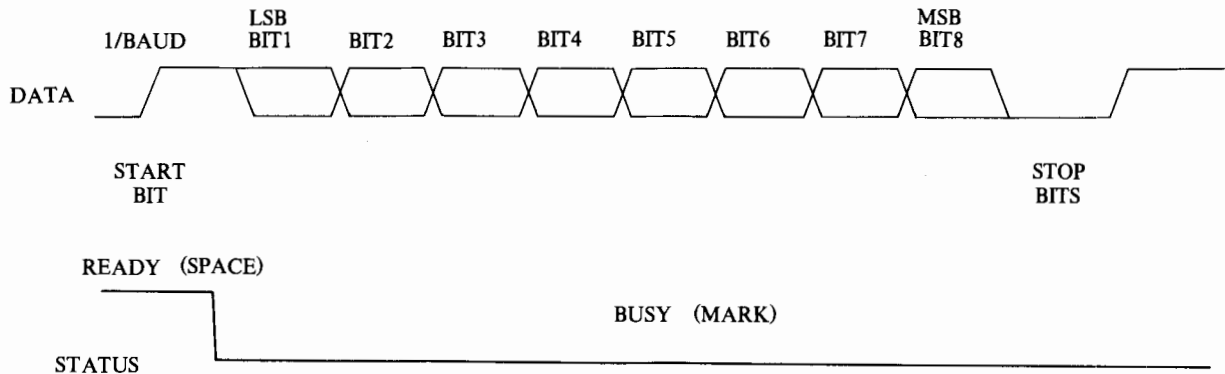
Serial interface signals

Signal name	Input/Output	Description
DATA	Input	Receiving eight bits of serial data from the host computer.
STATUS	Output	This signal indicates to the computer whether or not the printer can accept data. The "off" condition (Low) indicates that the printer is BUSY and cannot accept any more data. The "on" condition (High) indicates the printer is NOT BUSY, and can accept more data from the computer.
GND		This signal wire establishes a common ground between the printer and the computer.

Data format

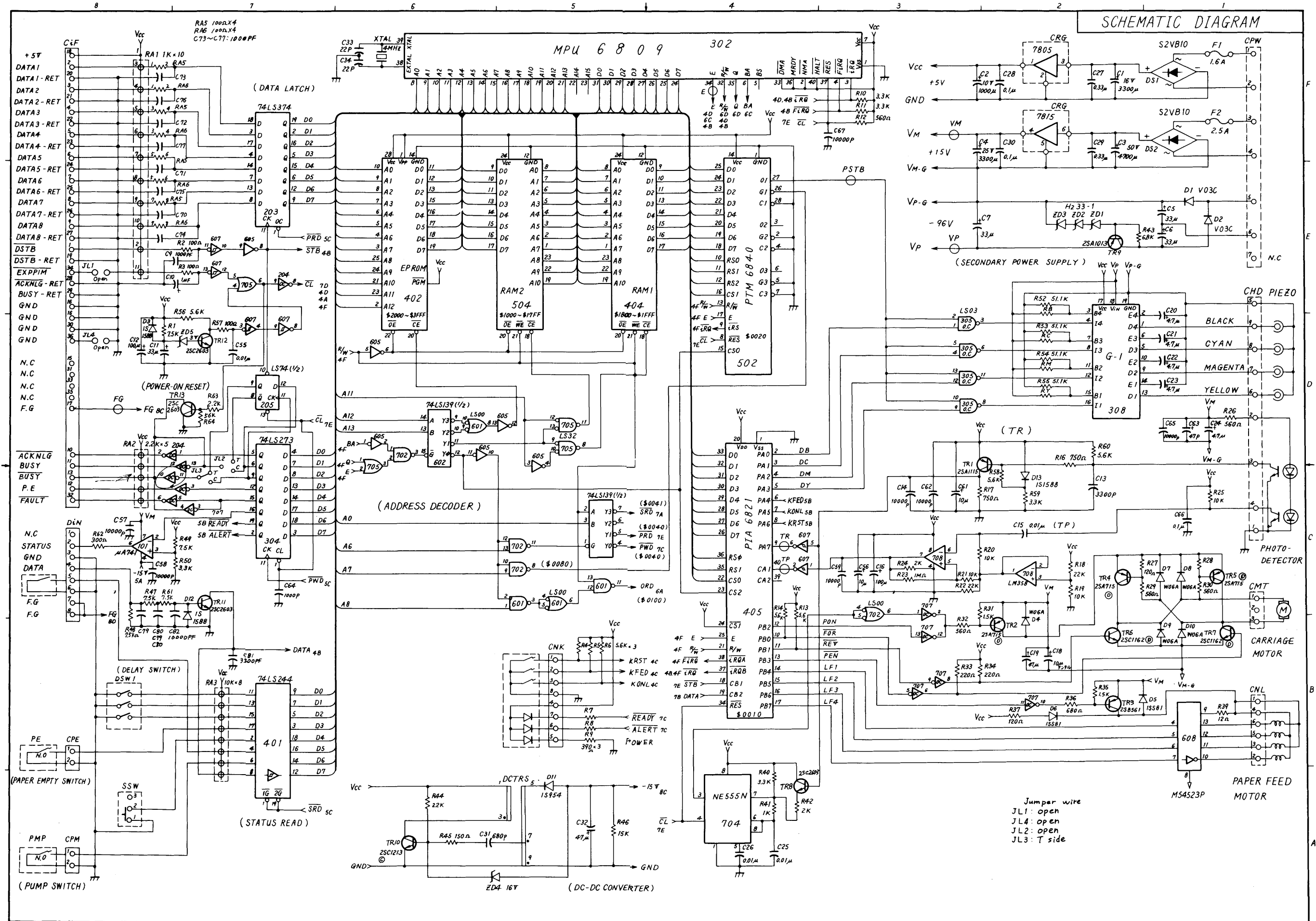
One (1) Start bit
 Eight (8) Data bits
 No parity
 Two (2) stop bits

Timing diagram



SPACE=Logical 0 +15V > SPACE level > +3V
 MARK=Logical 1 -3V > MARK level > -15V

Appendix I/ Schematic Diagram



IMPORTANT INFORMATION

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

- reorient the receiving antenna.
- relocate the computer with respect to the receiver.
- move the computer away from the receiver.
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: **How to Identify and Resolve Radio-TV Interference Problems**. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

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