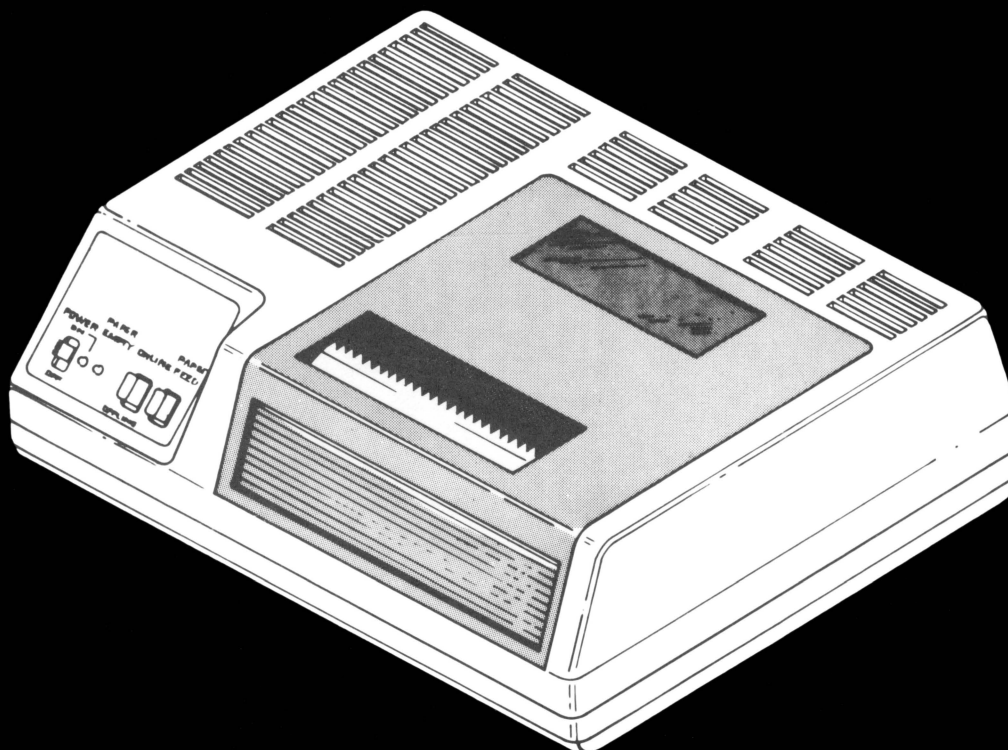


QUICK PRINTER

Catalog Number 26-1153

Radio Shack®
TRS-80
MICRO
COMPUTER
SYSTEM

HARDWARE



Standard features of your Radio Shack QUICK PRINTER non-impact printer include software-selectable printing of 5, 10 or 20 characters per inch, software-controlled underlining, standard 96 USASCII character set for upper **and** lower case printing, and an out-of-paper buzzer. The quiet, lightweight desk-top unit operates from standard AC line voltage. It prints 80-character lines at 2.5 lines-per-second on a standard 4-3/4" aluminized roll of paper.

Some additional features include:

Compact Size. The printer and two rolls of print paper will fit inside a briefcase.

Uncomplicated Design. All logic elements are standard off-the-shelf devices (readily available).

Economical Operation. The only consumable item is the paper.

Efficient Operation. Power consumption is less than 40 watts during printing.

The print head contains nine stiff tungsten wire electrodes arranged in a slanted vertical column. The electrodes ride on aluminum-coated paper during forward motion and are lifted from it when the head returns to the left. As the head travels left (back to the start position), the paper advances one-fifth of an inch. A single motor, rotating in one direction, initiates all mechanical motion, including head motion and paper feed.

When the motor starts, an address counter is loaded to the address of the first character on the line. The ASCII code is presented to a ROM that generates the dot information for that character. Characters measuring five dots wide by eight dots high are printed by causing current to pass from the electrodes in the print head to the aluminum-coated paper, thus exposing the permanent black background. The printed characters, created by this discharge printing principle, are not affected by light, temperature or humidity. This means you can reproduce the print-out on any office copying machine.

To use the Quick Printer with Radio Shack's TRS-80 Microcomputer you must have the Expansion Interface (26-1140, 26-1141 or 26-1142). Connection is simple; you'll need an Interface Cable (available from your local Radio Shack store).

Specifications

Printing Speed	150 lines-per-minute (200 characters-per-second)
Characters-Per-Line	80, 40 or 20 maximum (selectable by input device)
Print Width	4 inches maximum (102mm)
Character Structure	5x8 Dot Matrix (Ninth dot used only for underlining; selectable by input device)
Vertical Spacing	5 lines per inch
Horizontal Spacing	5/10/20 characters per inch
Print Head Life	1 million characters
Parallel Input Connector	36 Pin Amphenol 57-40360
Code	Standard USASCII-2
Character Set	Standard 96 alpha-numeric characters plus 8 control codes (May be strapped to recognize lower-case alphas as upper-case with 64 printable characters).
Character Format	7 parallel data bits

Input Device Codes (Software Control)

Octal Code	ASCII Mnemonic	Function
07	BEL	Sounds buzzer for 2-3 seconds
12 or 15	LF/CR	Initiates printing and moves paper up one line
13 or 14	FF	Form feed
16	SO	Stops underlining
17	SI	Starts underlining
35	GS	Initiates 20 char/inch printing
36	RS	Initiates 10 char/inch printing
37	US	Initiates 5 char/inch printing

Temperature	Operating: 32° to 104°F (0° to 40°C) Storage: -40 to 140°F (-40 to 60°C)
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Humidity Operating: 10 to 90%
 (no condensation)
 Storage: 5 to 95%
 (no condensation)

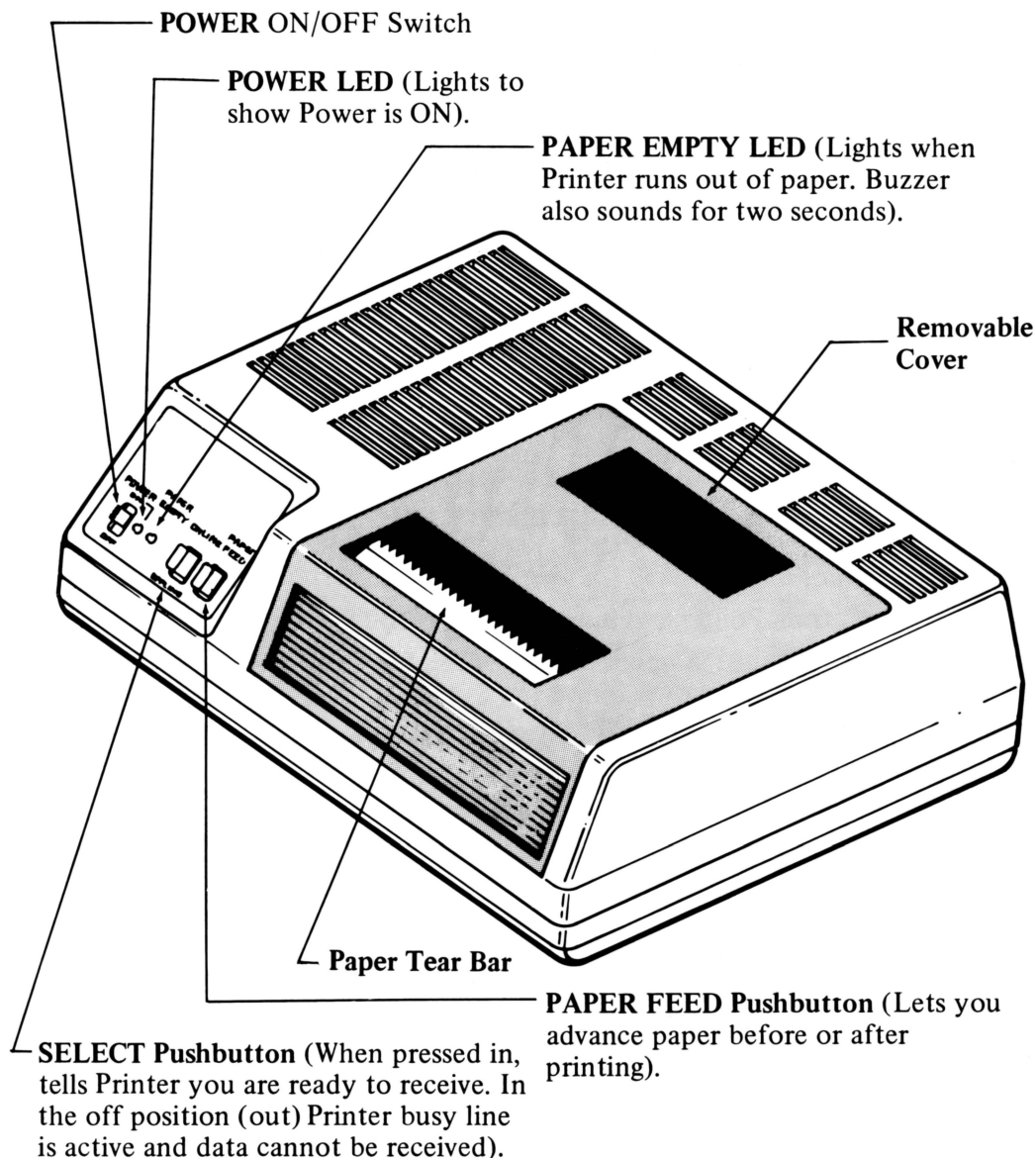
Paper Aluminum coated, 4-3/4"
 (120mm) wide

Power Requirements 120 VAC, 50/60 Hz
 30 Watts non-printing;
 40 Watts printing

Size 4-1/2"H x 13"W x 10-1/2"D
 (108mm) x (330mm) x (270mm)

Weight 10 lbs. (4.5 kg)

Controls



Do's & Don'ts

- Always plug Printer into a 3-wire grounded outlet.
- Avoid leaving or placing objects on any part of Printer.
- Turn power off before loading paper.
- Automatic motor control turns motor off when no data is being received.
- Do not expose Printer to high or low temperatures, to sudden change in temperature, to dust or to extreme shock.
- Use only dry, soft cloth to clean Printer surfaces. **Do not use harsh detergents or chemicals.**
- Do not touch print head styli.
- If paper jams, pull head slider away from platen, then remove paper and reinsert. Make sure paper does not touch head or roller.
- Clean discharge residue from front of mechanism every 3 to 5 paper rolls.
- Do not turn power off while the print head is in motion. This may cause the head to stay on the paper when the power is reapplied. If this condition should occur, press the PAPER FEED push-button to return the head to the normal position.

Loading Paper

Refer to Figure 1:

1. Set POWER switch OFF.
2. Remove Printer cover.
3. Remove paper shaft from Printer and insert into paper roll.
4. Place shaft into slots provided in upper cabinet of Printer with paper exiting from bottom as shown below.
5. Feed paper between platen and friction feed roller. **Take care not to bend paper sensor.**
6. Rotate platen by hand until paper exits between platen and print head.
7. If necessary, grasp the edges of the paper and adjust its position to insure a straight feed path.
8. Replace Printer cover.

NOTE: check that aluminized surface touches metal paper guides on each end of platen. Guides provide ground circuit for paper sensor.

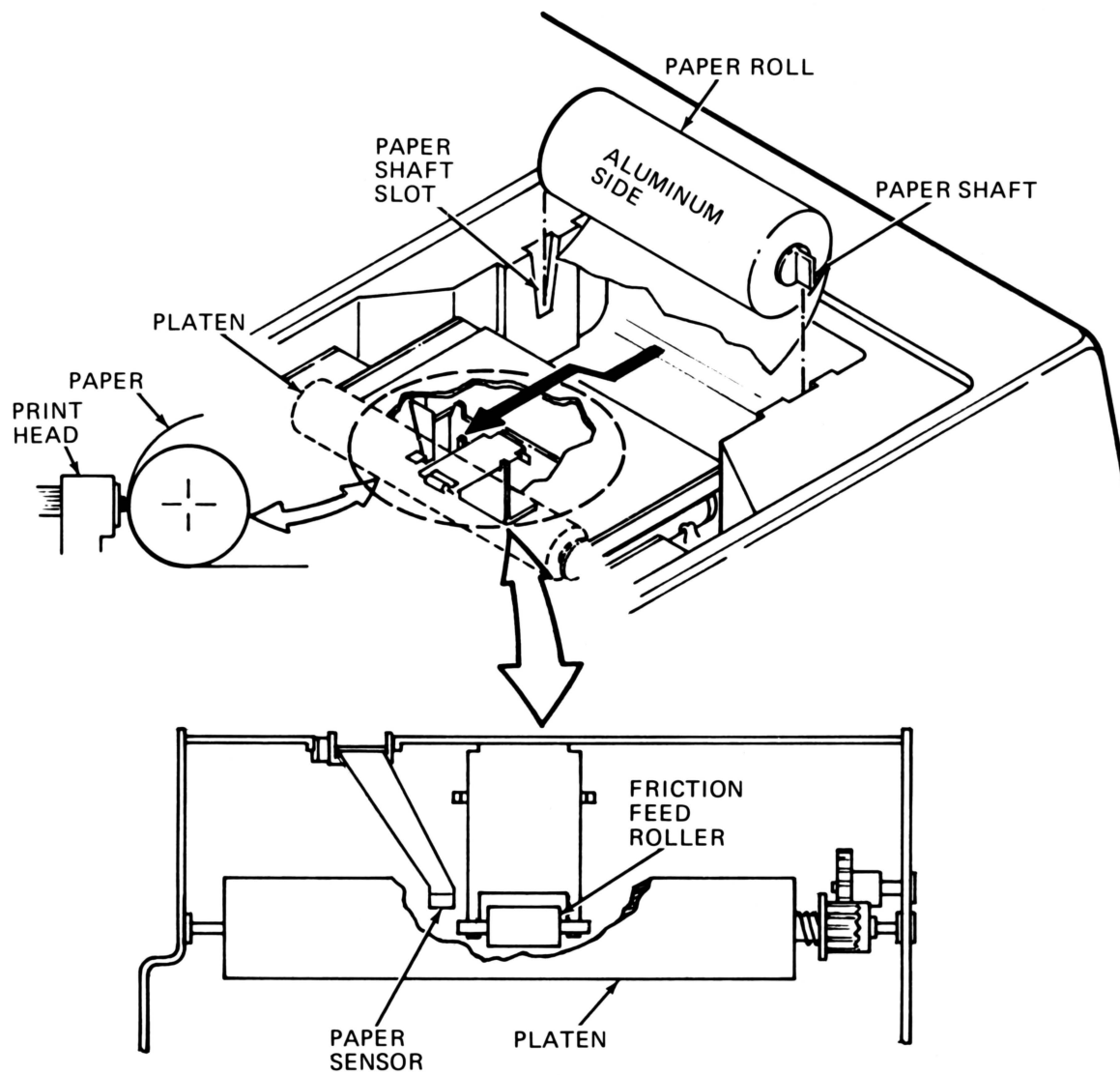


Figure 1.

Installation Checkout

1. Plug power cord into 120V AC outlet (or 230/240 VAC for units so marked on the rear).
2. Slide POWER switch up (ON). The red ON pilot lamp should light.
3. Press SELECT push-button ON.
4. Press and hold PAPER FEED push-button; paper should advance and the head assembly should move back and forth.
5. Remove Printer cover and wind paper back onto roll. Check that the buzzer sounds for 2-3 seconds and that the red PAPER EMPTY lamp lights as the paper passes away from the paper sensor.
6. Re-load paper and check that PAPER EMPTY lamp goes out.
7. Release SELECT push-button to OFF and repeat steps 4 through 6. All indications should be the same.

Using the Printer

1. Load paper into Printer as described earlier.
2. Plug Printer into appropriate AC outlet. ALWAYS USE A 3-WIRE GROUNDED OUTLET.
3. Use an Interface Cable to connect between the rear of the QUICK PRINTER and the TRS-80 Expansion Interface. Or, you can connect the QUICK PRINTER directly to the Expansion Port edge connector on the back of a LEVEL II machine. (The Interface Cable is available through your local Radio Shack store.)
4. Set Printer's POWER switch to ON position.
5. Press SELECT push-button to ON position.
6. The Quick Printer is now ready to accept data.
7. To de-activate the Printer (go off-line), press SELECT push-button once more to release it to the OFF position.

Software Control of the Quick Printer

You can control many of the Quick Printer functions and print characteristics via program statements. For the sake of example, BASIC program statements are used below. However, the same results can be obtained using any other programming language to issue the required control codes.

Function	Std. Abbrev.	Control Code		
		Decimal	Hexa-decimal	Octal
Pitch=80 char/line	GS	29	1D	35
Pitch=40 char/line	RS	30	1E	36
Pitch=20 char/line	US	31	1F	37
Underline=On	S1	15	0F	17
Underline=Off	S0	14	0E	16
Audio Alarm	BEL	7	07	07
Line feed and carriage return	LF/CR	10or13	0Aor0D	12or15
Form feed (new page)	FF	11or12	0Bor0C	13or14

To issue a line printer control code in BASIC, use the CHR\$(*n*) function, where *n* is the desired ASCII control code.

Examples:

```
1) LPRINTCHR$(31)"LARGE"CHR$(30)" MEDIUM"
    CHR$(29)" SMALL"
```

produces the following:

```
  LARGE MEDIUM SMALL
```

```
2) LPRINT CHR$(15)"DON'T FORGET"CHR$(14)
    " TO TURN OFF THE UNDERLINE!"
```

produces:

```
  DON'T FORGET TO TURN OFF THE UNDERLINE!
```

```
3) LPRINT"LINE ONE"CHR$(10)"LINE TWO"
    CHR$(10)"LINE THREE"
```

produces:

```
  LINE ONE
  LINE TWO
  LINE THREE
```

4) Using the top-of-form function requires a little more care:

```

10 POKE 16424,15: POKE 16425,1:
   REM...14 LINES/PAGE
20 K=1: REM...INITIALIZE PAGE COUNT
30 LPRINT TAB(12)"*** PAGE"K"***":
   LPRINTCHR$(15)" N", "  N*N", "  SQR(N)"
   CHR$(14): REM...TURN OFF UNDERLINE
40 FOR I=K*10 TO K*10+9:
   LPRINT I,I*I,SQR(I): NEXT
50 K=K+1: IF K=5 THEN END
60 LPRINT CHR$(11):
   REM...TOP OF PAGE
70 GOTO 30

```

CHR\$(11) in line 60 produces a form feed. Run this program to produce:

*** PAGE 1 ***		
N	N*N	SQR(N)
10	100	3.16228
11	121	3.31663
12	144	3.4641
13	169	3.60555
14	196	3.74166
15	225	3.87298
16	256	4
17	289	4.12311
18	324	4.24264
19	361	4.3589
*** PAGE 2 ***		
N	N*N	SQR(N)
20	400	4.47214
21	441	4.58258
22	484	4.69042
23	529	4.79583
24	576	4.89898
25	625	5

More on Pitch (Print Density)

The Computer powers up in a GS condition. This tells the Quick Printer to use the 80 character/line pitch setting. Once you change the pitch, for example, with an LPRINT CHR\$(30) or CHR\$(31), all LPRINTs will use the most recently selected pitch. To return to the normal 80 character/line setting, execute an LPRINT CHR\$(29).

Caution: The 40 character/line and 20 character/line settings are to be used with carefully controlled output. If you attempt to print more characters per line than the pitch setting will allow, you will lose data and may cause abnormal printer operation.

Most line listings of programs, and typical LPRINT statement execution, will require the 80 character/line density. *Use the 40 and 20 character/line settings only when you're sure the output won't exceed the capacity of that setting.*

For example, to print a large heading, you might want to use the low-density setting.

```
LPRINT CHR$(31)"HEADING"CHR$(29)
HEADING
```

Suppose you want to line-list a program with the medium print density. Simply insert line-feeds (down arrows) in the lines which exceed 40 characters. That's the way the printout in Example 4 above was generated. (Place the linefeeds at the beginning of a statement, not inside quotes and not inside keywords.)

More on the Underline Function

The Computer powers up in an S1 (Underline Off) condition. Once you change to an S0 condition, for example, using LPRINT CHR\$(15), all subsequent Quick Printer output will be underlined. Execute another LPRINT CHR\$(14) to disable the underline function.

More on the Audio Alarm

When a BEL code is executed the tone will sound for about 2 seconds. During that time, any BEL control codes received will be ignored. Therefore, to produce a tone lasting longer than 2 seconds, insert a delay loop between the several LPRINT CHR\$(7) statements.

Example

```
10 LPRINT CHR$(7)
20 FOR I=1 TO 745: NEXT I
30 LPRINT CHR$(7)
```

More on the Line Feed/Carriage Return Code

Line feed and carriage return are always executed together [in BASIC via CHR\$(*n*), where *n*=10 or 13 (decimal)].

The LF/CR control code will be ignored if it is the first or last item in an LPRINT statement.

More on the Form Feed Code

When the Computer powers up, page size is initialized to 66 lines/page. Therefore you probably won't want to do a top of form feed without **first** altering the page size — or you'll use a lot of paper very quickly.

If you want *n* lines per page, then insert the following statements early in your program. They need be executed only once unless you want to change the page size or re-initialize the line count. POKE 16424,*n*+1: POKE 16425,1

Lower Case with the Quick Printer

While the Quick Printer cannot reproduce the TRS-80 video graphics characters, it can produce both upper and lower case letters. To enter a lower case character from the keyboard, hold down the SHIFT key while hitting the character. Even though the Display shows a capital letter, the ASCII code for the lower case will be stored internally.

There are at least three ways to take advantage of this capability:

- 1) LPRINT the lower case/upper case information inside quotes.

Example:

```
100 LPRINT "Only The First Letters  
Are Capitalized"  
Only The First Letters  
Are Capitalized
```

Hold down the SHIFT key to enter lower-case letters (just the opposite from a normal typewriter).

- 2) LPRINT the information by reference to the ASCII codes for upper and lower case letters.

```
10 FOR I=65 TO 89 STEP 3  
15 I1=I+1:I2=I+2:I3=I+3  
20 LPRINT CHR$(I)CHR$(I+32),  
    CHR$(I1)CHR$(I1+32),  
    CHR$(I2)CHR$(I2+32),  
    CHR$(I3)CHR$(I3+32)
```

```
30 NEXT
```

Aa	Bb	Cc
Dd	Ee	Ff
Gg	Hh	Ii
Jj	Kk	Ll
Mm	Nn	Oo
Pp	Qq	Rr
Ss	Tt	Uu
Vv	Ww	Xx
Yy	Zz	[[

- 3) Perform a line list of program lines containing upper and lower case letters.

Note: Be careful about using lower case letters outside of quotes. There are some cases where this will produce a hard-to-find syntax error (for example, PRINT@ with a SHIFT @ symbol).

Machine Language LP Output Routine

Here's a subroutine that outputs a single byte to the Quick Printer. Load the data byte (hex code for an ASCII character) into the A-register, then call the subroutine. To force a line feed/carriage return, for example, load A with OAH.

Hex Oper. Add. Code	Source Line #	Source Code Listing	
	00100		;
	00110		; SUBROUTINE FOR SENDING A BYTE TO LP
	00120		;
	00130		; PUT ASCII BYTE IN A-REGISTER & CALL
	00140		;
	00150		; 'BUSY' CONDITION TESTED FOR
	00160		;
7000	00170	ORG	7000H
7000 D9	00180	PRTOUT EXX	; SAVE REGISTERS
7001 21E837	00190	LD	HL, 37E8H ; LOAD LP ADDRESS
7004 56	00200	PRTLPS LD	D, (HL) ; LOAD LP STATUS BYTE
7005 CB7A	00210	BIT	7, D ; IS LP BUSY?
7007 C20470	00220	JP	NZ, PRTLPS ; YES - CHECK AGAIN
700A 77	00230	LD	(HL), A ; NO - OUTPUT BYTE TO LP
700B D9	00240	EXX	; RESTORE REGISTERS
700C C9	00250	RET	; RETURN

Principles of Operation

Overall Operation

Operation is controlled by a mechanical printer assembly and a main electronics PC Board with an integral "on board" DC power supply. As data is received, it is accumulated in a line buffer. This buffer stores one 80-character line. Data is accumulated in this buffer until a PRINT command is issued. This occurs when an LF character or CR character is received or when the buffer contains 80 characters, whichever occurs first. The PRINT command initiates operation of the printer assembly.

The "moving" print head carries the nine vertical styli electrodes across the paper to form the required characters. As the head moves from left to right, the electronics "fires" the corresponding styli which vaporizes the one-micron coating of aluminum from the black background of the paper. The styli are fired in a 5x9 dot matrix sequence to form the appropriate character. For character densities of 20 characters per inch, the styli fire 100 times as the head moves one inch (5 dots wide x 20 characters).

Note: a pause in the firing equivalent to one dot time occurs between each character for spacing. Thus, 120 time slots are used for each line of head motion.

For 10 characters-per-inch, the styli fire 100 times also, however, each column fires twice. This exposes a double size, horizontal line of the black background as the head moves. For 5 characters-per-inch, the styli fire four times for each column. This technique creates short, horizontal lines instead of dots which provide elongated characters for 10 and 5 characters-per-inch. During 10 or 5 characters-per-inch operation, a pause equivalent to 2 or 4 dot times, respectively, occurs for character spacing.

When the print head reaches the right margin, a gear mechanism moves the paper up one line and the head moves left to the “rest” position. When the PRINT command is activated again, the printer operation described above continues for the next line of characters.

Mechanical Operation

The printer assembly consists of a 12-volt motor which drives a continuous loop timing belt. The belt is positioned below the paper platen and moves one continuous revolution horizontally whenever a line is to be printed or the paper is advanced. As the belt moves, it carries the attached print head across the platen from left to right and then right to left at a constant speed. Variations in input data rates are accommodated by the line buffer in the electronics. Changes in character density are accomplished by multiple styli firings as described previously. This constant speed, in conjunction with performing one complete revolution of the timing belt (regardless of the line length to be printed or the number of paper feeds to be made), results in a very simple, reliable print mechanism.

Head Motion

The print head is mounted in a holder and connected to the electronics with a flexible pc cable. Two horizontal rods support the head holder assembly. The 12-volt drive motor moves a rubber-toothed timing belt via nylon gears in a clockwise direction as viewed from the front. The head holder assembly is permanently attached to the timing belt via an L-shaped slider pin which rides in two vertical guides.

Figure 2B shows the motion as the head moves from the “at rest” position to the “print” position. As the holder moves to the leftmost position, it carries the head along with it. At the left side, the timing belt moves the slider pin up and around the left gear. Head motion stops during this transition. When the slider pin reaches the top of the left gear, head motion to the right begins. This is the start print position. Printing may continue until the slider pin begins to pass around the right gear. As the slider pin moves down, the head motion stops momentarily and then moves left back to the rest position. This process repeats each time the printer assembly is activated for printing one line of characters or for paper feeding.

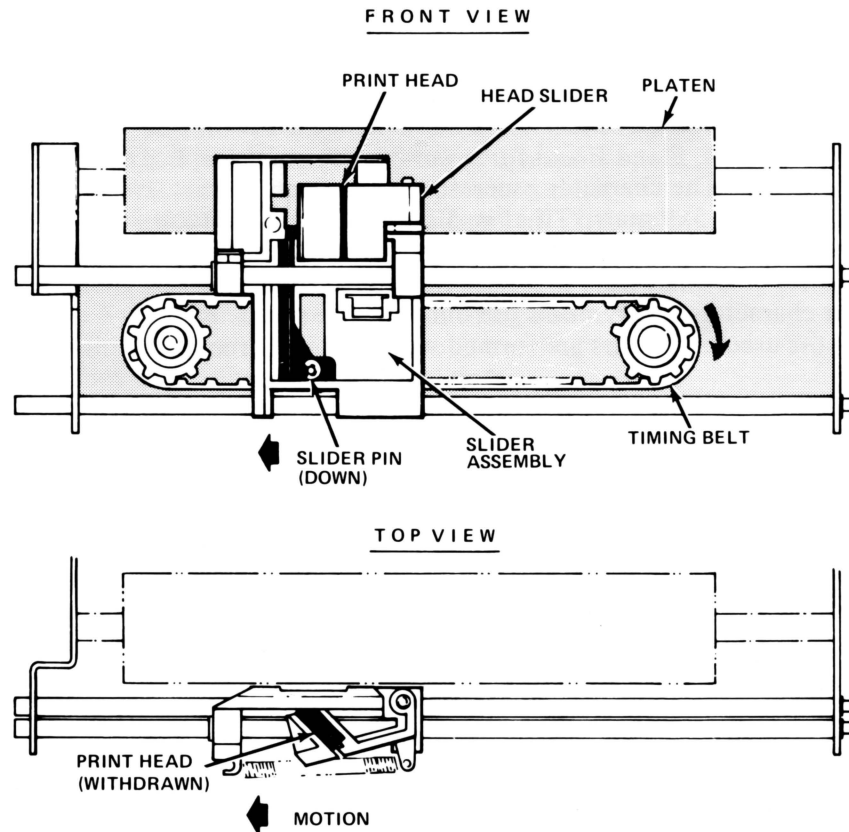


Figure 2A. "AT REST"

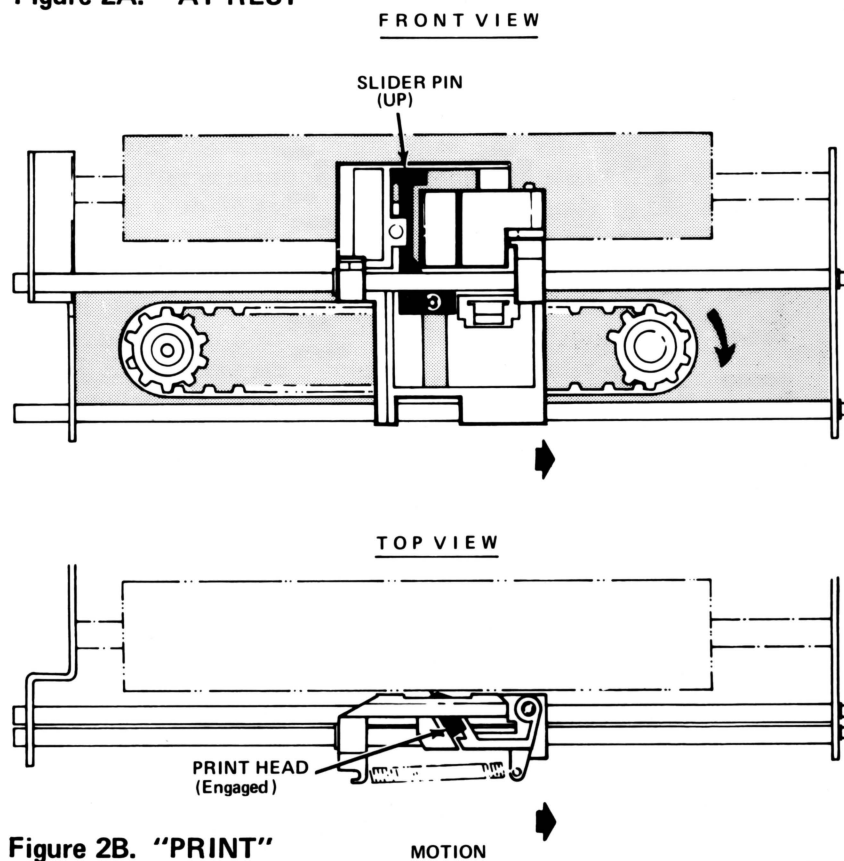


Figure 2B. "PRINT"

Styli Operation

As the print head moves from left to right, the nine vertical styli are energized as required to form the characters. The sequence for forming upper case characters D, E and F and for lower-case characters e, f and g is illustrated below. The character generator in the electronics provides drive signals for a 5x9 matrix, that is, 5 dots wide by 9 dots high. The ninth stylus is used for underlining only. The eighth stylus is used only for lower case characters that have descenders such as g, p and q. All other characters and symbols use only the top seven styli. Thus, the most used characters are formed with a 5x7 matrix.

As shown below, the head moves to the right at a constant speed, while the electronics fires the appropriate styli 5 successive times to form one character. For example, to form the upper-case D, the top seven styli fire in the first column position. For columns 2 and 3, styli 1 and 7 fire. Styli 2 and 6 fire for column 4 and styli 3, 4 and 5 fire for column 5. This sequence of firing the styli 5 successive times forms the character "D".

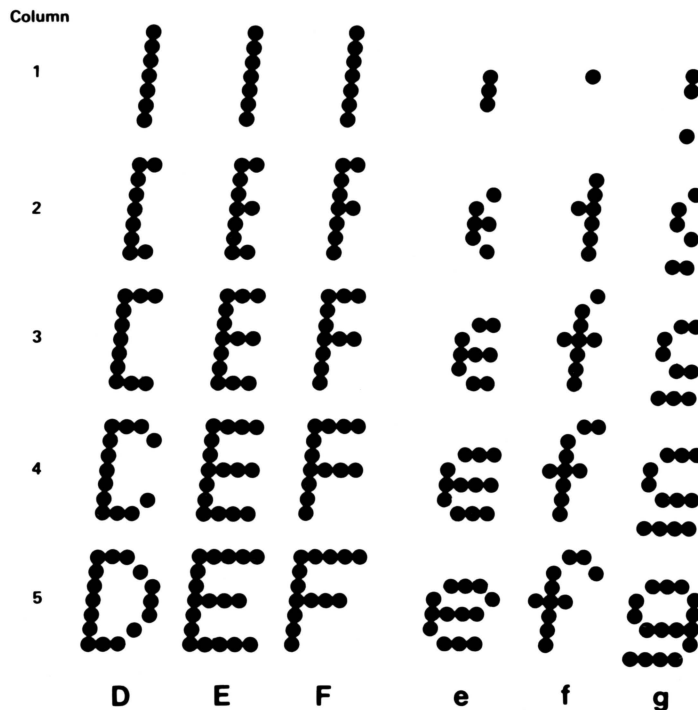


Figure 3. CHARACTER FORMATION

Elongated Characters

Character density refers to the number of characters per inch on the printed line. This may be 5, 10 or 20 characters per inch (CPI). The basic 20 CPI structure is simply “stretched” to occupy more space and provide wider characters for emphasis or increased clarity.

Figure 4 shows the relationship between 20, 10 and 5 CPI, from top to bottom. This is a representative drawing since 10 CPI characters are actually formed by firing the same styli for each column twice. The 5 CPI characters result from firing each column four times. The printed characters appear to be “stretched” as shown, although they are formed by individual dots.



Figure 4. ELONGATED CHARACTERS

Timing Pickups

An inductive pickup and associated timing wheel provide “alpha” timing pulses for character generation. The circumference of the timing wheel is serrated with 36 teeth. It is attached directly to the DC drive motor. As the wheel spins, the inductive pickup senses the gap between adjacent teeth and generates an “alpha” pulse. For every inch of head motion, 120 alpha pulses occur. Each pulse sets the timing for one column of dots in a character for the most dense printing of 20 CPI. Since there are 5 columns per character in the matrix, 100 alpha pulses are used for the character formation while the remaining 20 pulses provide one column of spacing between the 20 characters. For the less dense printing of 10 CPI and 5 CPI, every second or fourth alpha pulse is used, respectively.

Another timing pickup generates “beta” pulses that initiate the once-per-line timing for printing and for stopping the DC drive motor. This is an optical pickup consisting of a light source and a photo-transistor. The light beam is interrupted by a 90° cam that is positioned to allow light to pass as the head moves from the start print position across the page and back to the rest position. The drive motor is started by the electronics upon receipt of a CR or LF code, (a buffer full condition or a paper feed command). It stops when the “beta” signal ends.

Paper Feed

Line spacing of 5 lines-per-inch is provided by a drive mechanism that controls a cam gear. When the head nears the right edge of the paper, the cam gear engages a platen drive gear. This gear moves “one tooth” as the head moves from right to left and back to the rest position. The platen moves the paper up 1/5” in preparation for printing the next line. As the head moves from right to left, the slider in the holder assembly drops down. This action lifts the styli electrodes away from the paper. When the holder moves around the left gear of the timing belt, the slider moves up which allows the electrodes to ride on the paper prior to printing. Note that all paper feed operations require one full revolution to the timing belt regardless of whether any printing is accomplished.

Service & Maintenance

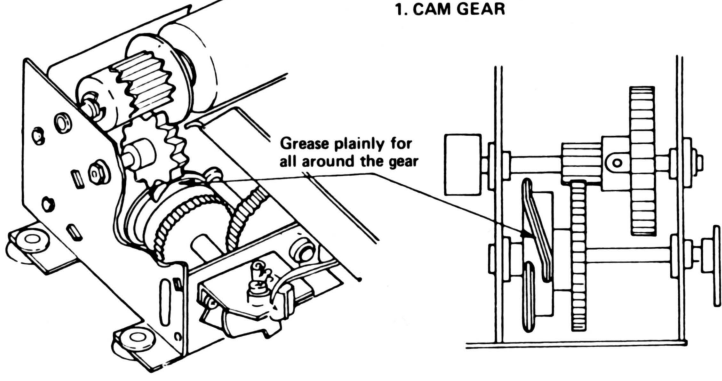
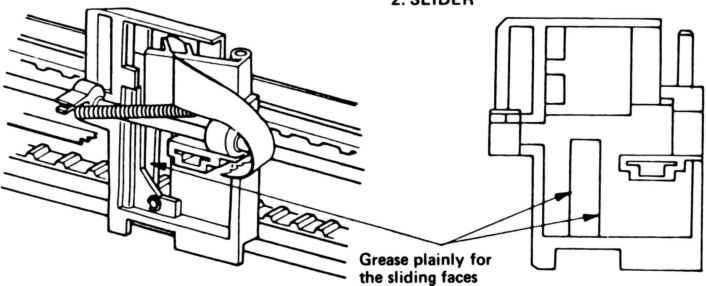
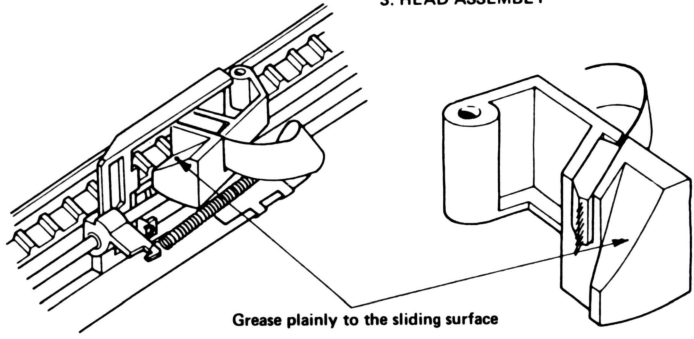
NOTE: The following information is provided as reference for those users who wish to perform their own maintenance. This information assumes considerable mechanical aptitude. **Do not attempt to perform any of these suggested procedures if you do not have adequate experience with electro-mechanical devices.**

Preventive Maintenance

Routine preventive maintenance should be performed at scheduled intervals to insure satisfactory performance. Maintenance consists of lubrication, head sanding and printer cleaning.

Lubrication

To insure normal printer operation, silicon grease should be applied to the items shown on the Lubrication Chart at the recommended intervals.

<p>1. CAM GEAR</p>  <p>Grease plainly for all around the gear</p>	<p>Apply 0.5 gram of grease on all contact surfaces after every 100 hours of operation.</p>
<p>2. SLIDER</p>  <p>Grease plainly for the sliding faces</p>	<p>Apply 0.2 gram of grease to slider guide edges after every 20 hours of operation.</p>
<p>3. HEAD ASSEMBLY</p>  <p>Grease plainly to the sliding surface</p>	<p>Apply 0.1 gram of grease to beveled surface of head assembly where slider rides, after every 20 hours of operation.</p>

Head Sanding

This procedure should be performed at regular intervals to correct the effects of normal head wear. The styli which expose the aluminum coated paper are not used equally since the bottom two are used only for lower case characters with descenders (8th styli) and for underlining (9th styli). As a result, styli 1-7 erode slightly more than 8 & 9. After repeated use, they rest further away from the paper than normal, causing less aluminum to be exposed with correspondingly fainter characters. This procedure removes a tiny amount of tungsten carbide from the 8th and 9th electrodes which allows all styli to rest evenly on the aluminum coating with the correct force for forming high quality characters.

Material Required: Sheet of fine abrasive paper

Procedure:

1. Remove paper roll from Printer.
2. Set POWER switch on.
3. Make sure SELECT push-button is in the out position (off).
4. Insert abrasive paper sheet into Printer with the abrasive side facing down (same way paper is loaded).
5. Hold PAPER FEED push-button down until abrasive sheet finishes feeding through the Printer.
6. Repeat steps 4 and 5.
7. Remove abrasive sheet and reload paper roll.

Maintenance Interval: This procedure should be performed after 20 rolls of paper are used (or as required).

Cleaning

Visually inspect the printer assembly for accumulation of aluminum dust. Clean periodically with soft bristled brush to prevent dust build-up on greased parts.

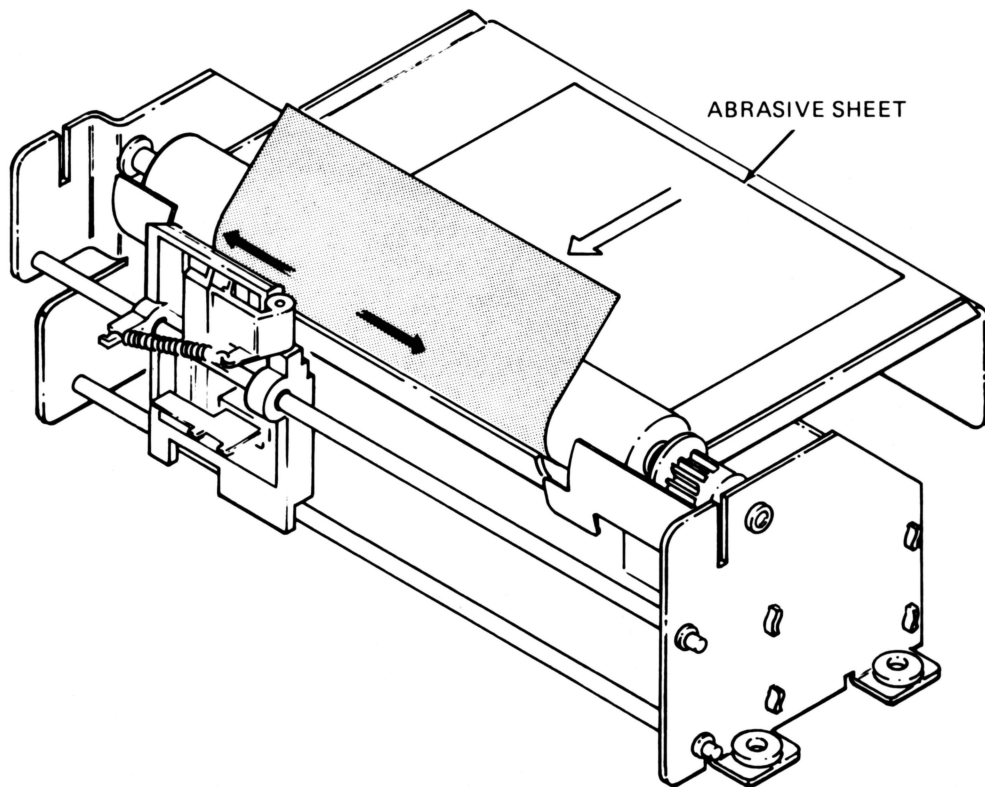


Figure 5. HEAD SANDING

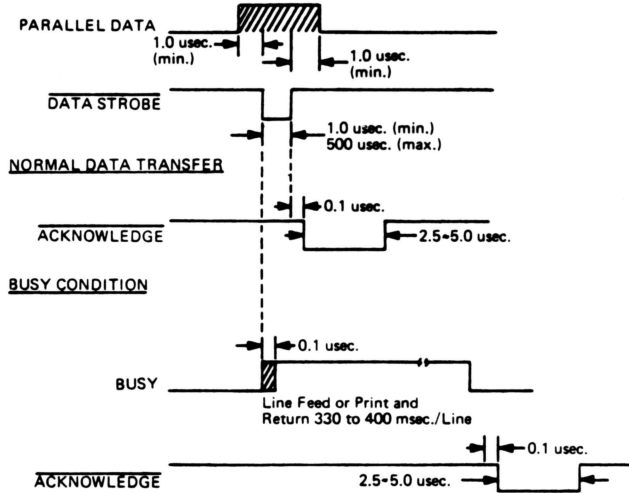
J004 INTERFACE PINOUT

PIN	SIGNAL
1	DATA STROBE
2	DATA BIT 1
3	DATA BIT 2
4	DATA BIT 3
5	DATA BIT 4
6	DATA BIT 5
7	DATA BIT 6
8	DATA BIT 7
9	—
10	ACKNOWLEDGE
11	BUSY
12	PAPER OUT /POWER OFF
13	—
14	GROUND
15	—
16	GROUND
17	CHASSIS GROUND
18	+5V
19	—
20	—
21	—
22	—
23	—
24	—
25	—
26	—
27	—
28	—
29	—
30	—
31	—
32	—
33	GROUND
34	—
35	—
36	—

TWISTED PAIR GROUND

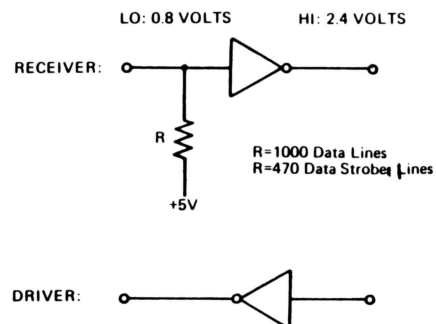
* BUSY = DESELECTED, PAPER EMPTY
OR PRINT IN PROCESS

INTERFACE TIMING



INTERFACE DRIVERS AND RECEIVERS

ALL input/output signals are TTL compatible.



LIMITED WARRANTY

Radio Shack warrants for a period of 90 days from the date of delivery to customer that the computer hardware described herein shall be free from defects in material and workmanship under normal use and service. This warranty shall be void if this unit's case or cabinet is opened or if the unit is altered or modified. During this period, if a defect should occur, the product must be returned to a Radio Shack store or dealer for repair. Customer's sole and exclusive remedy in the event of defect is expressly limited to the correction of the defect by adjustment, repair or replacement at Radio Shack's election and sole expense, except there shall be no obligation to replace or repair items which by their nature are expendable. No representation or other affirmation of fact, including but not limited to statements regarding capacity, suitability for use, or performance of the equipment, shall be or be deemed to be a warranty or representation by Radio Shack, for any purpose, nor give rise to any liability or obligation of Radio Shack whatsoever.

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