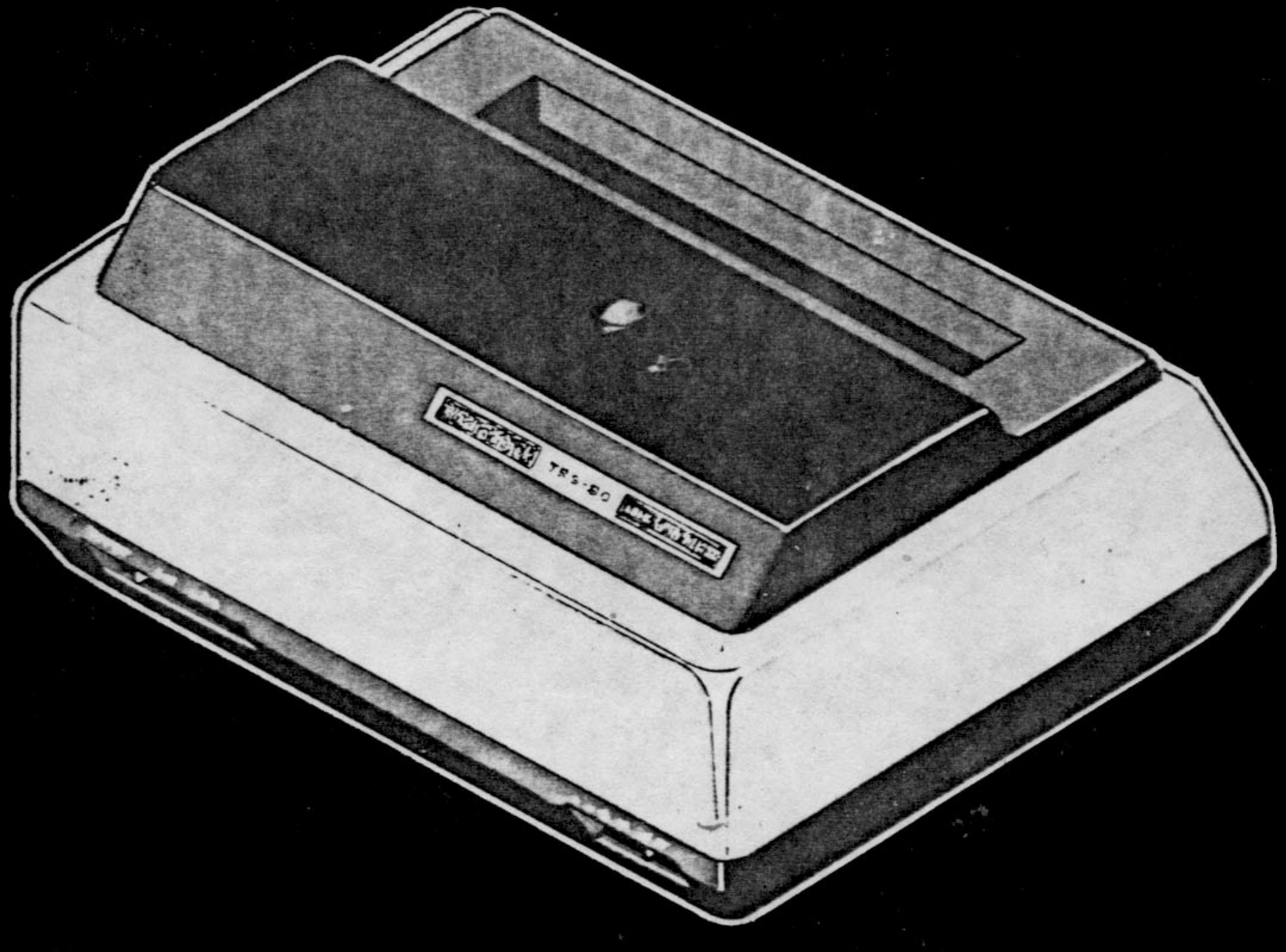
Line Printer II

Catalog Number 26-1154

Radio Shack®

TRS-80 MICRO COMPUTER SYSTEM

HARDWARE



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Congratulations for selecting this Radio Shack Computer Product!

The Line Printer II is an economical and versatile unit, ideal for use in small business and personal applications. The microprocessor-controlled printer features three-way paper-handling:

1. 9½" wide standard computer fanfold forms, with fixed-position pins to ensure perfect page registration; paper can be multi-part, up to three parts.
2. Rolled paper, 8½" wide, 1" core and up to 5" diameter; the Printer includes a paper roll holder assembly. With rolled paper, a built-in "rip and read" cutting edge lets you remove paper within 5 lines of the last line printed.
3. Single sheets of 8½" wide paper, hand-fed as with an ordinary typewriter.

Line Printer II uses a 7 by 7 dot matrix to produce the full 96-character upper and lower case character set. Two character sizes are available and selectable by software: 80 characters per line or 40 characters per line. Print speed for normal size characters is 50 characters per second.

Other exceptional features include:

- Buffered input to allow automatic wraparound to next line when print line exceeds 80 characters.
- Fast 10" per second carriage return.
- Special line-feed buffer for software-controlled forms control.
- Reset/On Switch resets Printer and selects on-line/off-line mode.
- Compact size - just 5 x 14½ x 11" (HWD).

Contents

Quick Set-Up Procedures (detailed instructions follow)

1. Install roll paper holder and roll paper, fanfold paper or forms and then install paper cutout guide.
2. Remove top cover and check ribbon.
3. Place POWER switch to the OFF position and place RESET switch ON.
4. Connect power cord to a 3-wire grounded AC outlet.
5. Connect interface cable to parallel input connector.
6. Place POWER switch ON and observe that the LED illuminates through paper exit slot.
7. To receive data, place RESET switch OFF.

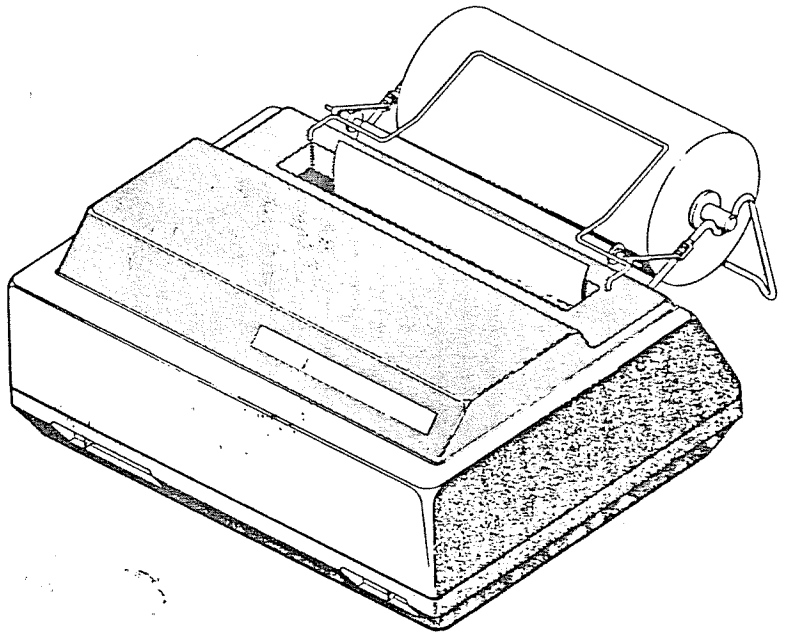
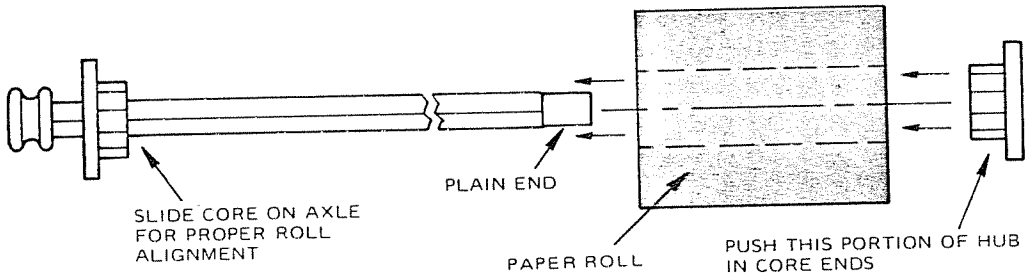


Figure 1. Line Printer II with roll paper

Roll Paper Holder Installation

1. Set the printer on a flat surface with enough room in back of the printer for the roll paper holder.
2. Refer to the accompanying illustration and squeeze the support arms together slightly.
3. Insert support arms into two holes provided at rear of printer and release arms.
4. Remove core hub from plain end and insert roller through standard 1-inch paper roll core and place roll on holder as shown with paper feeding from bottom of roll.



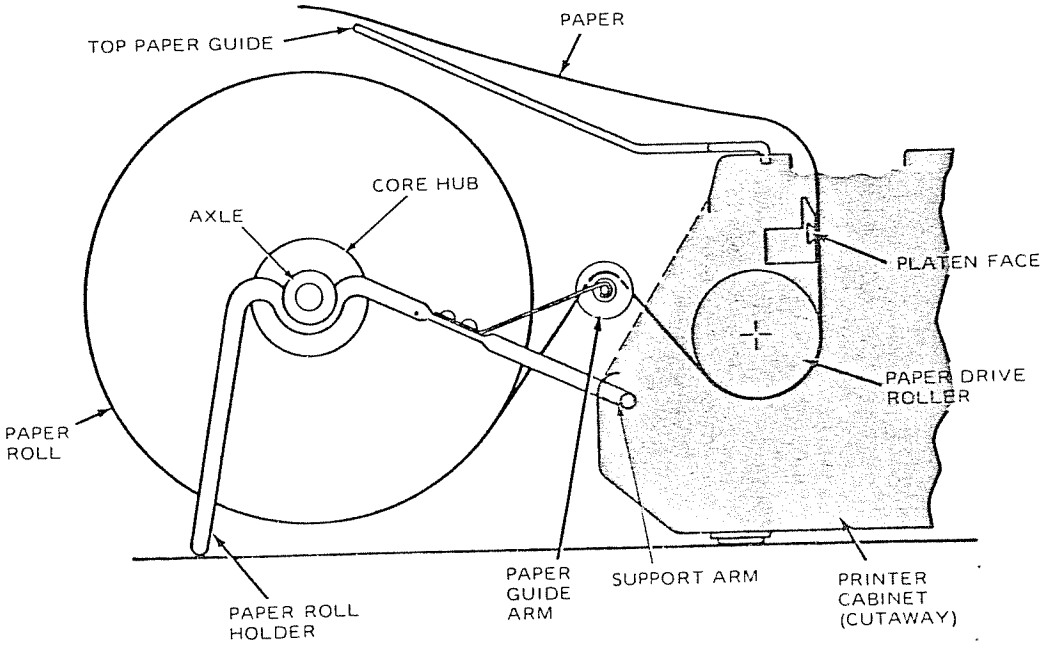


Figure 2. Roll paper installation

Paper Installation

Refer to the appropriate procedure below to install roll paper, fanfold paper or single sheets/forms.

Roll Paper

1. Install the roll on the paper holder as described previously.
2. Remove top cover by lifting rear edge until latches are clear of main cover and then slide cover back to disengage front clips.
3. Retract head to the paper/ribbon load position by rotating adjustment lever fully counterclockwise.
4. Push the pinch roller release lever down (away from Printer).
5. Feed the paper over the paper guide arm and through the bottom rear of the printer between the top paper guide and the pinch rollers.
6. Align the edges of the free end of paper with roll edges and straighten as required.
7. Slide roll on axle and align with paper drive roller as shown below.
8. Push the pinch roller release lever forward to secure paper.
9. Check ribbon position, remove slack if necessary by rotating ribbon drive roller as explained in Figure 4, move head lever to print position and install top cover.

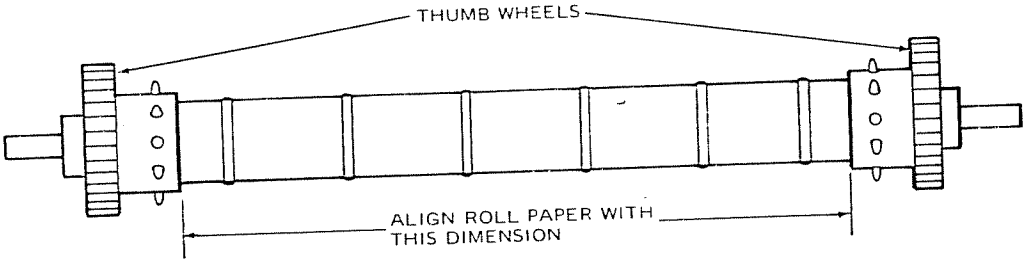


Figure 3. Paper drive roller

Fanfold Paper

1. Remove the top cover, retract head and make sure release lever is forward (closed).
2. Engage paper onto pins of paper drive roller at bottom rear of printer.
3. Hold paper in place while turning either thumbwheel until the paper exits through the top of the printer.
4. Be sure the paper supply is feeding properly.
5. Check ribbon, engage head and replace top cover.

General Note: When installing ribbon or paper always back head away from platen.

Ribbon Installation

Zip-pack ribbons are used with the printer. The procedure for installing the ribbon is as follows:

1. Remove printer top cover to gain access to ribbon tray.

Note: Use the throw away, plastic gloves provided with the new ribbon when performing the following steps.

2. Refer to the ribbon installation diagram and push the driven roller away from the drive roller.
2. Retract the head.
3. Unthread the old ribbon and discard it.
5. Remove the ZIP PACK from the plastic bag.
6. Place ZIP PACK in printer tray as shown.
7. Pull ribbon out from both ends of ZIP PACK and thread according to diagram being careful to position mobius loop twist on the left side.
8. Hold ribbon in place by pressing down on plastic strip through hole in shell piece and then remove wrapper by pulling end of wrapper.
9. Remove and discard shell and plastic strip.
10. Manually advance drive roller clockwise until slack is removed from ribbon.
11. Engage head and install top cover.

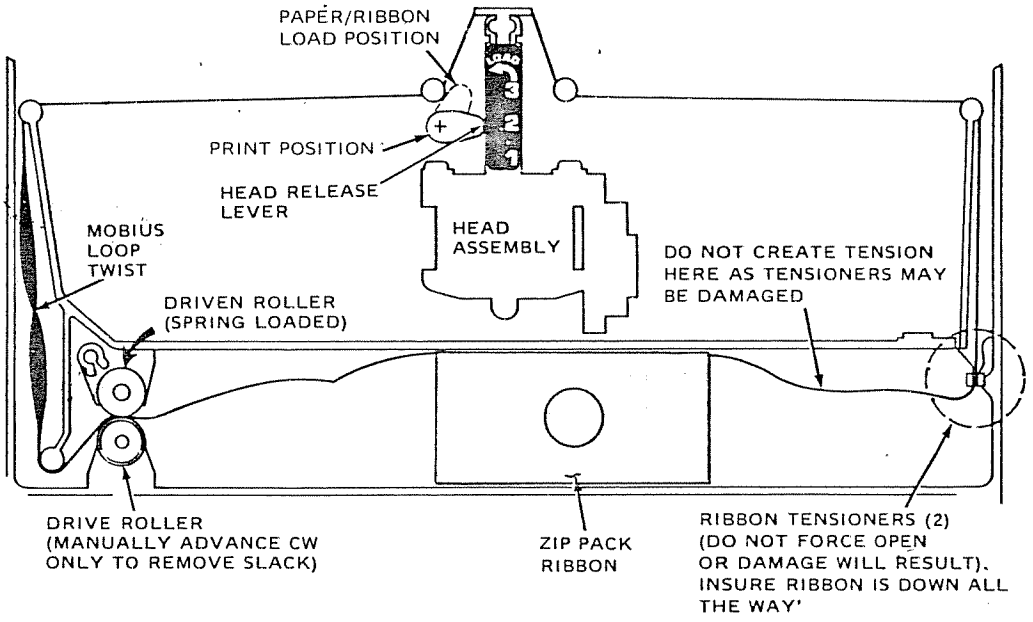


Figure 4. Ribbon threading diagram

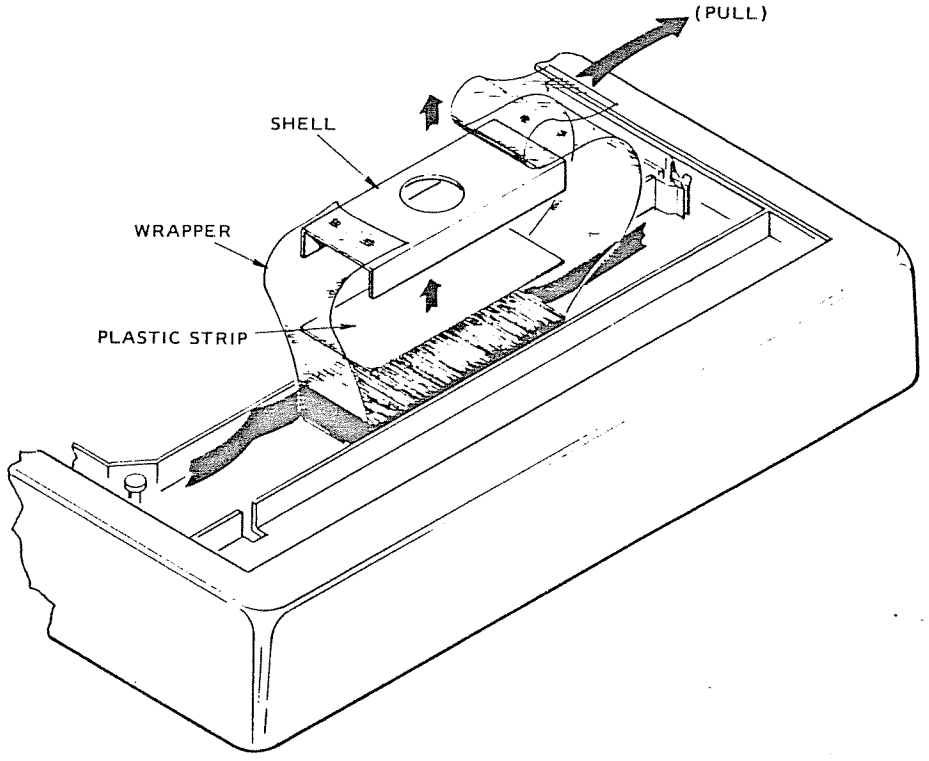


Figure 5. Zip Pack installation

Connection and Power-Up

1. Be sure a ribbon is installed in the printer and that an adequate supply of paper has been installed.
2. Connect 40 pin edge connector at the rear of the printer to TRS-80 Expansion Interface using 6 foot ribbon cable supplied.
3. Place RESET switch to ON position. This prevents the printer from printing and keeps it "off-line".
4. Connect power cord to 115 VAC outlet.
5. Place POWER switch to ON position. "Power On" LED should be visible through top cover paper opening.
6. Place RESET switch to OFF position. Printer is ready to accept data.

You can also use the Printer Interface cable, Catalog Number 26-1411, to connect direct to the TRS-80. See Figure 6 and 7.

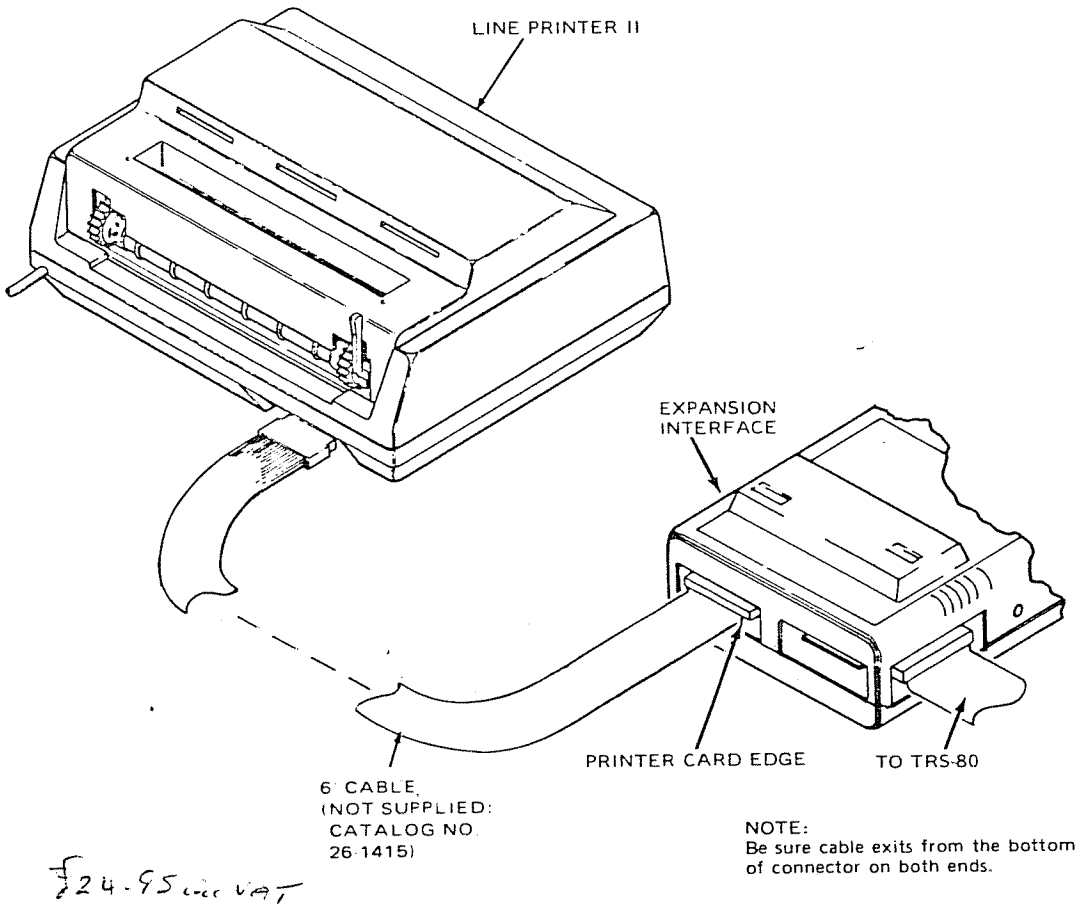


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Figure 6. Line Printer II cabling (to TRS-80 Expansion Interface)

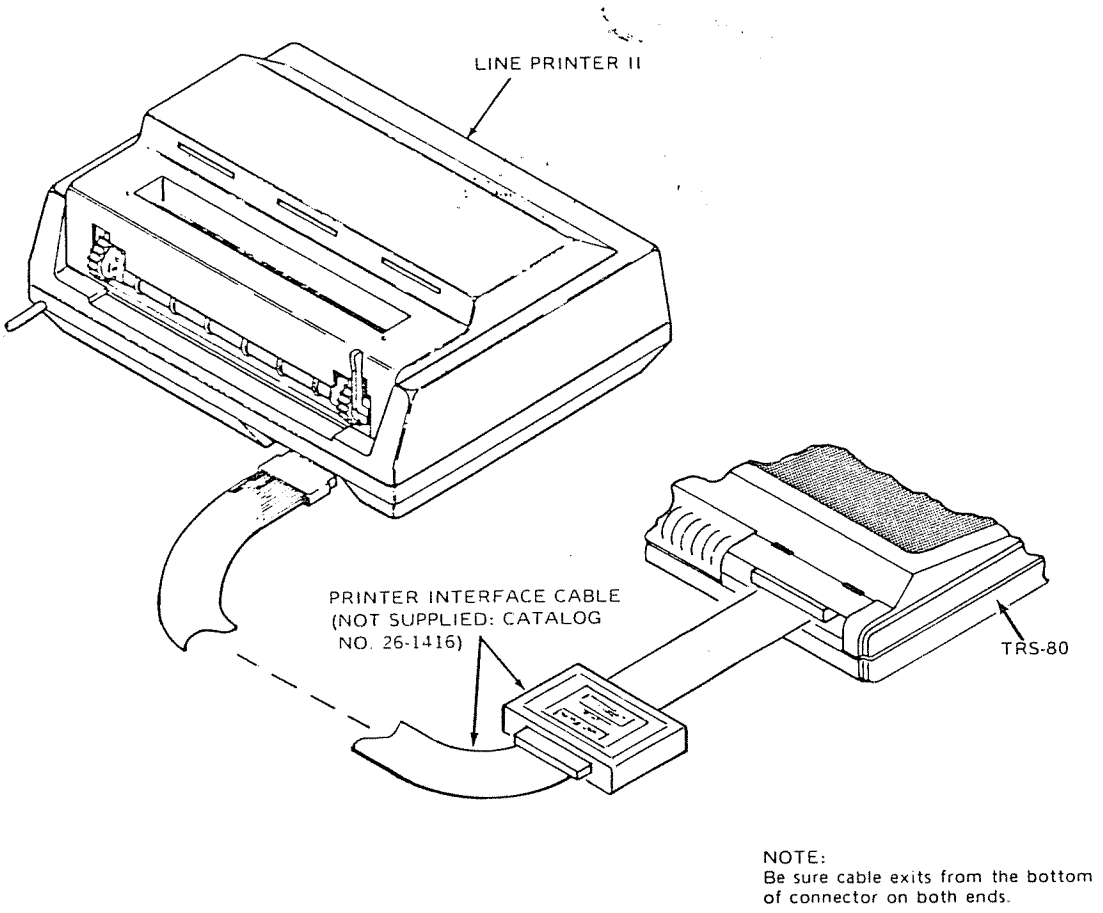


Figure 7. Line Printer II cabling (to TRS-80)

Important Notes for Using the Printer

1. Always plug printer into a 3-wire grounded outlet.
2. Do not leave or place objects on any part of printer.
3. Turn on RESET switch before loading paper or changing ribbons.
4. Do not subject printer to temperatures below +40° F or above +100° F during operation, to a sudden change in temperature, to dust or to extreme shock.
5. Use only a dry, soft cloth to clean printer surfaces. Do not use harsh detergents or chemicals.
6. Avoid touching print head print wires when handling paper or changing ribbons.
7. Periodically clean ink build-up from ribbon guide path and remove paper dust from interior.

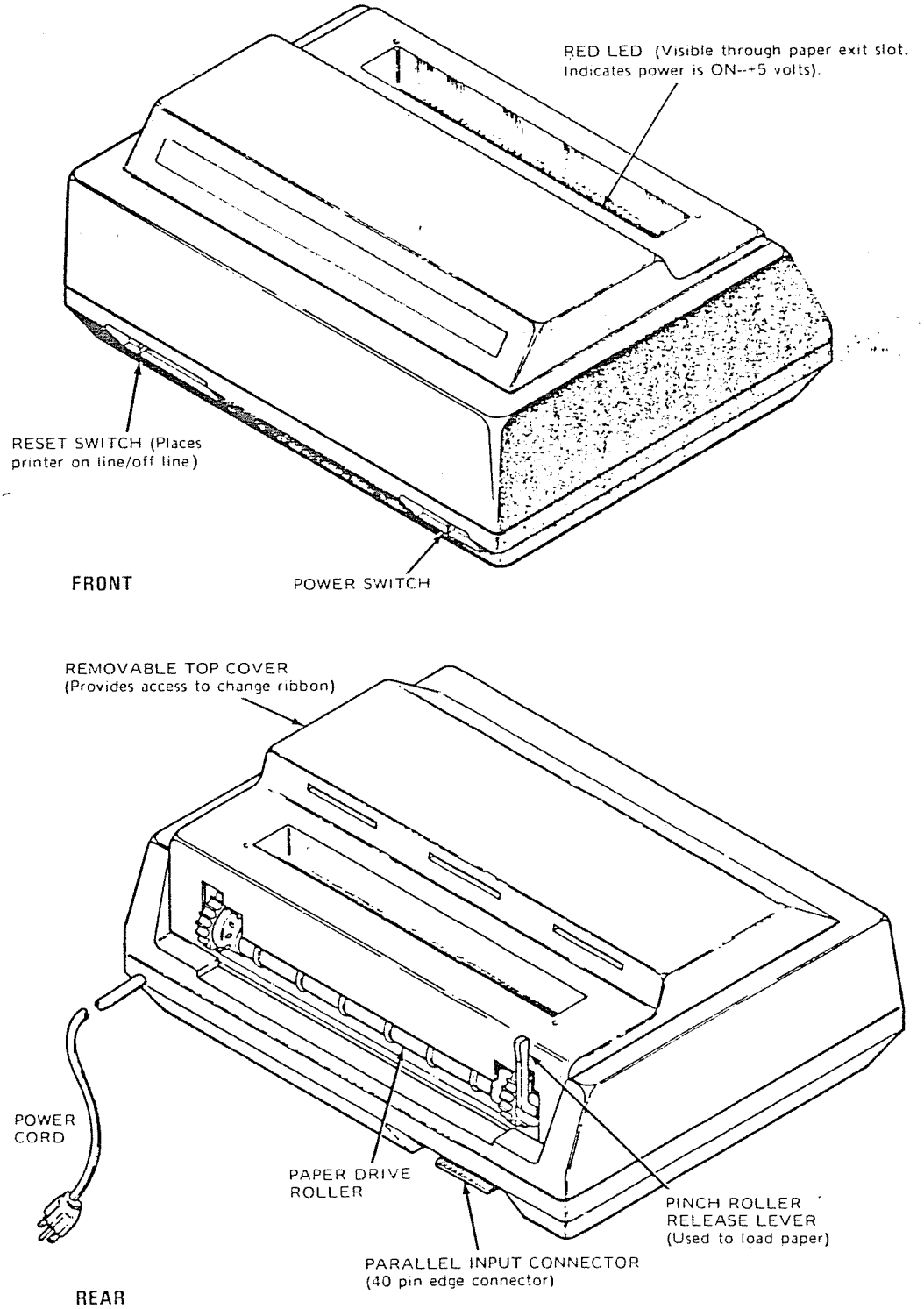


Figure 8. Operator Controls

Output to the Line Printer II

The simplest way to drive the Line Printer II is with LEVEL II BASIC LPRINT and LLIST statements. See the *LEVEL II BASIC Reference Manual* for details.

The Line Printer II doesn't print each character as it is received - it waits until it has received an entire line and then prints. Each line can contain up to 80 characters. (There's also a 40-character/line mode, described later under Special Features.)

If the line you are printing exceeds 80 characters, the Printer will automatically wrap-around to the next line, so no data will be lost.

Special Features

Double-Size Mode (40-characters/line)

For special effects like titling pages, printing headings, etc., you can switch the Printer to a double-size mode. In this mode, each line can contain up to 40 characters.

To switch to the double-size mode using LEVEL II BASIC, simply include CHR$ (27); CHR$ (14); as the first items in your LPRINT list. For example:

```
10 LPRINT CHR$(27);CHR$(14);" FAT LETTERS "
```

will produce the following printout:

```
F A T  L E T T E R S
```

When the Printer finishes printing the double-size line, it automatically switches back to the 80-character mode so it will be ready to print a regular 80-character line.

Only 40 characters at a time can be printed in the double-size mode. If you exceed 40 characters, the printer automatically wraps around to the next line and reverts to the 80-character/line mode.

Single characters may be printed double width by adding 128 to the ASCII value of the character expressed in decimal. This sets bit 8 for that character and causes each column to print twice. For example:

```
10 LPRINT "THE A IN F";CHR$(193);"T IS DOUBLE WIDTH"
```

will produce the following printout:

```
THE A IN FAT IS DOUBLE WIDTH
```

Remember that decimal 193 is 128 plus the ASCII code for A in decimal (128 + 65 = 193).

The double-size mode may be turned on and off within the same line. This lets you emphasize a word or words or even a single character in a word. To switch back and forth, just include CHR$ (27); CHR$ (14); to start the double-size mode and CHR$(27); CHR$(15); to stop. For example:

```
20 LPRINT"ABCDEFG";CHR$(27);CHR$(14);"HIJKLMNOP";
CHR$(27);CHR$(15);"QRSTUVWXYZ"
```

will produce the following printout:

ABCDEFGHIJKLMNOPQRSTUVWXYZ

Be careful when mixing normal and double sizes. If the line length exceeds 8 inches, the printer will automatically go back to the 80 character mode and will *ignore the excess characters.*

Lower Case Characters

Although the Line Printer II cannot produce the TRS-80 Video graphics characters, it *can* produce both upper and lower case letters, plus many other symbols. See **Printable Characters** for a complete listing.

Here are a couple of ways to use this capability from LEVEL II BASIC.

1. You can enter the lower-case characters from the keyboard when you are setting up messages and values to be LPRINTed. Even though the Display will show a capital letter, it will be stored in memory as lower-case.

   To enter a lower case character from the keyboard, hold down SHIFT key while hitting the key (just the opposite from a normal typewriter).

   For example, type in the following line, holding down the SHIFT key wherever you want a lower-case letter:

   ```
   10C LPRINT"Press SHIFT for l.c."
   ```

   You will see the lower case letters when you LLIST the line, or when you RUN it - even though the line appears on the Display as all capitals.

2. You can LPRINT the ASCII codes for all the lower case characters, using the CHR$ function. For example:

```
100 FOR I% = 97 TO 122
110 LPRINT CHR$(I%);" ";
120 NEXT
```

will produce the following printout:

```
a b c d e f g h i j k l m n o p q r s t u v w x y z
```

It's a good idea to always enclose lower case letters inside quotes in your BASIC programs. This distinguishes them from the all upper case characters on the TRS-80 screen and eliminates potential syntax problems when using the SHIFT key. For example, the statement:

```
100 PRINT@120,"HI"
```

will print as

```
100 PRINT↓120,"HI"
```

if you use SHIFT @ instead of just @. It is also an invalid statement, due to the SHIFT @.

Line Feed Operation

One line feed (LF) command moves the paper 1/6". The printer has a special LF buffer that holds up to 255 pending LF's so they may be sent quickly from the TRS-80. This allows TRS-80 operations to continue while the printer is doing limited paper handling.

For example, to perform 1" of paper movement using LEVEL II BASIC, enter the following:

```
10 FOR X=1 TO 6
20 LPRINT CHR$(138)
30 NEXT
```

This will cause the LF command (decimal 138) to be executed six times. All LF's sent within a line of data are executed before the line is printed.

Summary Of Control Codes

According to the American Standard Code for Information Interchange (ASCII), there are 32 control codes in addition to the codes for the printable characters. (Control codes are sent as data, but the receiving device interprets them as abbreviated "instructions", communications-status messages, etc.)

The Line Printer II will recognize five of these control codes as follows:

Function	Code		
	Decimal	Hex	Octal
(1) Line Feed	10	0A	12
Carriage Return	13	0D	15
Start Double Width	14	0E	16
Stop Double Width	15	0F	17
(2) Escape	27	1B	33

(1) TRS-80 operation also requires bit 8 (decimal 128) to be set for line feed operation. *Use decimal 138 not decimal 10!*

(2) Always precede start and stop double width instructions with escape (decimal 27).

Note: To output a control code from LEVEL II BASIC, use the CHR$ function, as follows:

```
100 LPRINT CHR$(13)
110 LPRINT CHR$(27);CHR$(14)
```

Whenever a carriage-return code is received, the Printer will print out the current contents of its holding buffer, then clear the buffer to get ready for the next line of data.

You can force several carriage returns within the same LPRINT statement. For example:

```
100 LPRINT"1 2 3";CHR$(13);"------";
CHR$(13);"4 5 6";CHR$(13);"------"
```

will produce

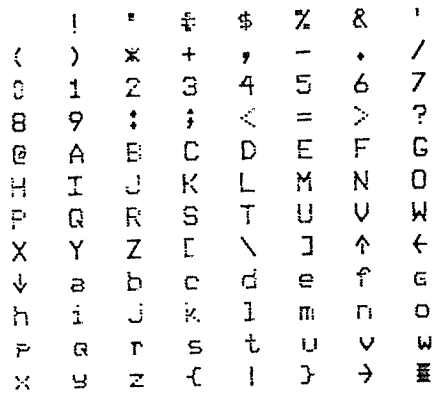
```
1 2 3
------
4 5 6
------
```

Four lines are printed using one statement.

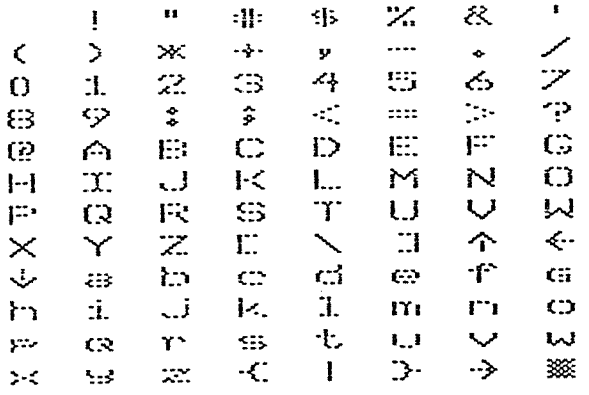
Printable Characters

The Line Printer II can produce all ASCII characters from hex 20 through hex 7F (decimal 32 through 127). Here's what they look like:

Normal Size



Double Size



Note that the following four codes are different from the usual ASCII character set.

Character		Code		
Usual ASCII	Line Printer II	Decimal	Hex	Octal
^	↑	94	5E	136
_	←	95	5F	137
`	↓	96	6O	140
~	→	126	7E	176

The arrows are more useful since they correspond to the TRS-80's Video Display character set.

Principles Of Operation

The Line Printer II stores characters for printing until one of two things happens:

1. Its 80 character holding buffer is filled.
2. It receives a carriage-return code (hex OD).

When (1) or (2) happens, the Printer prints out the contents of its 80 character buffer. If the buffer is empty when the carriage return is received, the printer simply advances the paper one line, leaving a blank line in the printout.

If more than 80 characters are received without receiving a carriage return, Printer goes BUSY, prints the line, then goes NOT BUSY and gets remainder of incoming data. The printer automatically starts to print when 80 characters are received and goes into a BUSY mode. During print, no additional characters may be stored in the holding buffer.

Printers feature an automatic line feed function. This feature automatically moves the paper up one line after printing without sending a line feed character. In addition, line feeds may be used for limited paper handling functions. The printer has a special line feed buffer separate from the data buffer that holds up to 255 line feeds. Each line feed moves the paper one-sixth of an inch. Thus, for example, to move the paper 12 inches would require 72 line feeds before the carriage return is sent. Line feeds within a line prior to a carriage return are all performed before printing the line. They do not cause the line of data to be printed.

Normal procedures for communicating with the Line Printer II simply require that each line of data be terminated with a carriage return and be preceded with a line feed code unless the automatic line feed feature is enabled. All lines must either be terminated with a carriage return or be exactly 80 characters long to initiate the forced print on buffer full.

Since elongated characters may be intermixed with normal characters on the same line as described below, any lines that exceed 8 inches without a carriage return will have the excess ignored and it will not be printed.

Reception of an escape code, SO code sequence (or bit 8 logically high) causes all the printable characters that follow to be printed at 5 characters per inch as opposed to 10 characters per inch for normal printing. Elongated characters are simply double width characters formed by printing each print column twice. The elongation sequence is as follows;

Sequence	Octal	Decimal	Hex	Function
ESC SO	033/016	27/14	1B/0E	Start elongation
ESC SI	033/017	27/15	1B/0F	Stop elongation

The ON/OFF switch controls the primary power. An LED, visible through the print head path, indicates that the +5 volts is active. Placing the RESET switch on stops all mechanical motion, resets the printer electronics, and clears the print buffer. Placing the switch off causes the printer to reset, the print head to return to the left and the electronics to go not busy.

Caution: Actuation of the RESET switch results in loss of data contained in the print buffer.

Specifications

Ribbon (6 per box)	20 yard x 9/16 inch wide zip pack
Paper	Cut Sheets (8½" wide) Rolls (8½" wide x 5" diameter with 1" Core), 2 ply Fanfold (9" pin-to-pin), 3 ply
Printing Speed	21 lines per minute (lpm) at 80 characters per line (cpl) or 65 lpm at 20 cpl left justified
Characters Per Line	80 maximum
Print Width	8 inches maximum (204 mm)
Character Structure	7 x 7 Dot Matrix
Line Feed Buffer	Capacity for 255 pending line feeds
Line Feed Repeat Rate	9 line feeds/second
Vertical Spacing	6 lines per inch
Horizontal Spacing	10 characters per inch
Parallel Data Input Connector	40-pin PC edge connector
Code	Standard USASCII-2
Character Set	Standard 96 alpha-numeric characters plus 5 control codes
Input Character Format	8 parallel data bits. (7 character data bits plus one control bit for elongated characters)
Input Data Rate	Up to 15,000 characters/second

Input Device Codes (Software Control)

Octal Code	Hex Code	Decimal Code	ASCII Mnemonic	Function
12	0A	10	LF	Initiates printing and moves paper up one line.
15	0D	13	CR	Same as LF.
16	0E	14	SO	Starts elongation (5 cpi).
17	0F	15	SI	Stops elongation.
33	1B	27	ESC	Escape code must precede SO and SI.

Input Voltage/ Frequency	115 VAC, 50/60 Hz, ±10%; 230 VAC, 50 Hz, ±10%
Power Requirements	100 watts
Size	14½" W x 11" D x 5" H; (368 mm) x (228 mm) x (127 mm)
Weight	10 lbs. (5.0 kg)

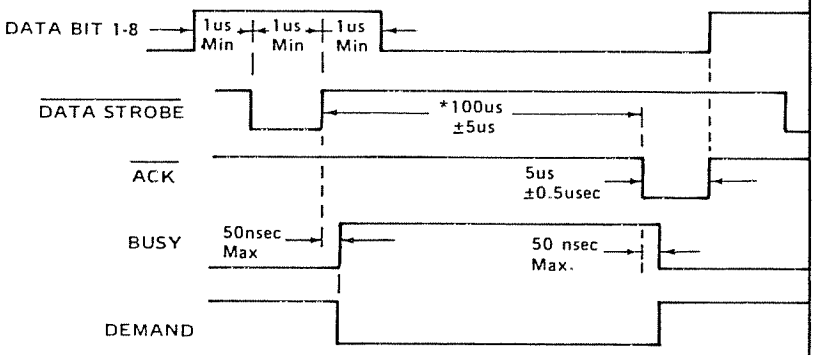
Standard Parallel Interface Connections

(P001)

INTERFACE PINOUT

PIN	SIGNAL
1	DATA STROBE
3	DATA BIT 1
5	DATA BIT 2
7	DATA BIT 3
9	DATA BIT 4
11	DATA BIT 5
13	DATA BIT 6
15	DATA BIT 7
17	DATA BIT 8
19	ACKNOWLEDGE
21	BUSY
23	GROUND
25	+5 VOLTS
27	SIGNAL GROUND
29	Not Used
31	SIGNAL GROUND
33	CHASSIS GROUND
35	+5 VOLTS
37	Not Used
39	Not Used
2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24	Twisted Pair Grounds For Pins 1/3/5/7/9/ 11/13/15/17/19/21/36
26	Not Used
28	+5 VOLTS
30	GROUND
32, 34	Internal Jumpers
36	DEMAND
38	Not Used
40	Not Used

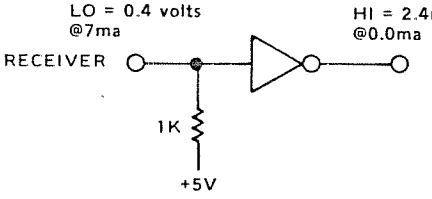
INTERFACE TIMING

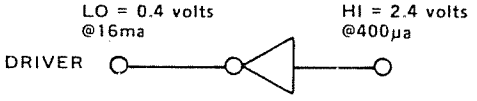


*100 usec is for data reception and line feeds that do not fill the line feed buffer. For line feeds that fill the buffer, the time is 110 msec +0 msec and -10 msec. For carriage return codes, the maximum time is 2.6 secs.

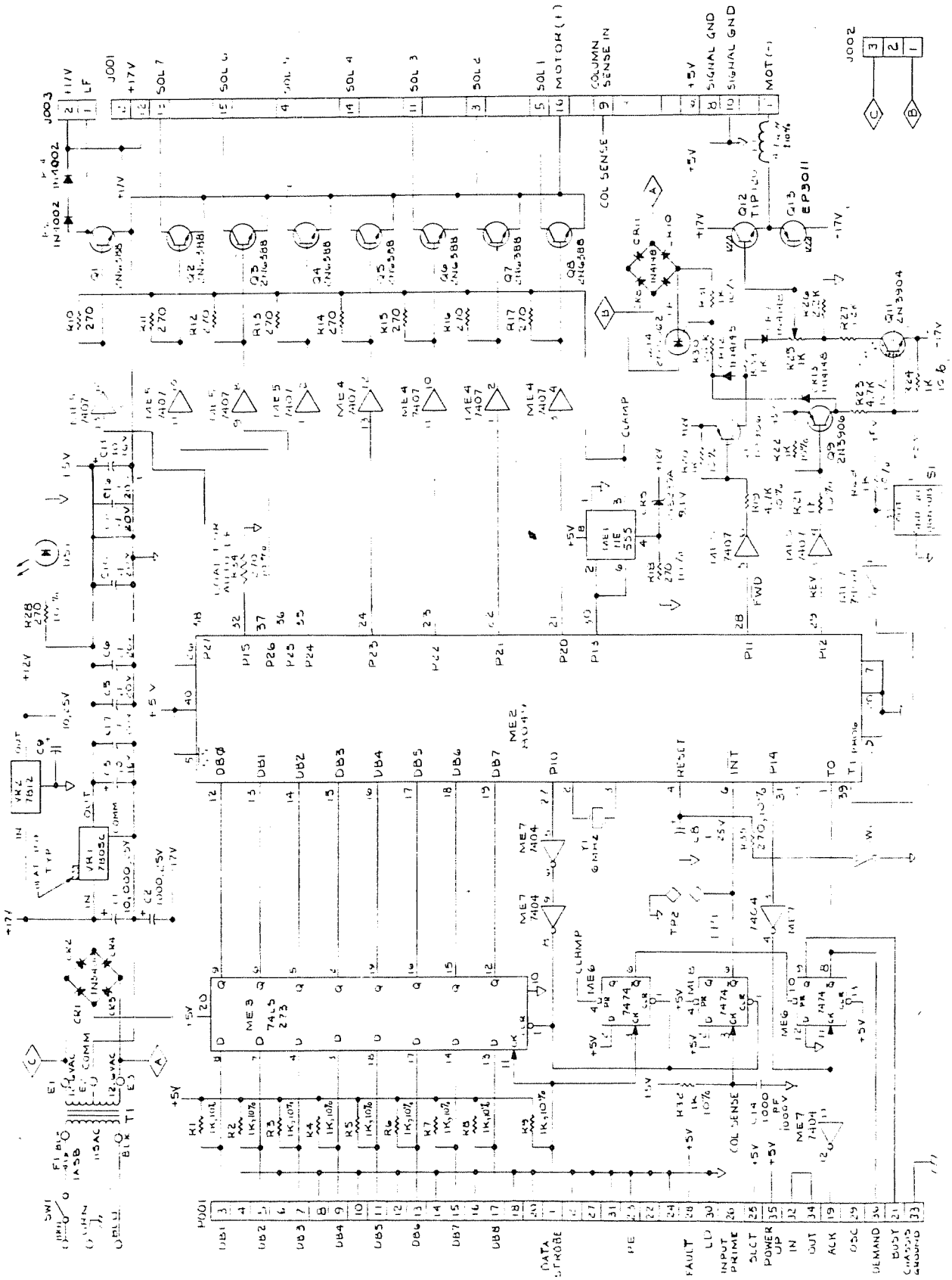
INTERFACE RECEIVERS & DRIVERS

All input/output signals are TTL compatible.





Schematic Diagram



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