SERVICE MANUAL

2673A INTELLIGENT GRAPHICS PRINTER

HEWLETT PACKARD

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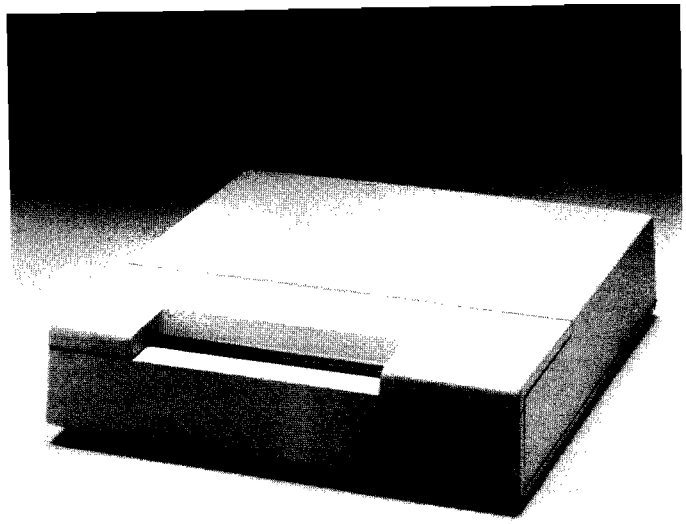


INTRODUCTION 1

INTRODUCTION ..... This section provides an overview of the service manual, lists printer equipment provided, and briefly describes the options and accessories available.

MANUAL OVERVIEW ..... The service manual consists of the following sections:

Section 1 — Introduction. Provides a general overview of the service manual, lists printer equipment provided, and briefly describes the options and accessories available.

Section 2 — Installation/Interfacing. Provides information on installation, connection of peripheral equipment, interfacing and cabling.

Section 3 — Configuration/Control Codes. Outlines and briefly explains the various configuration settings, control codes, and escape sequences pertinent to the 2673A.

Section 4 — Troubleshooting. Describes the printer's self tests and offers troubleshooting hints for repairing the unit.

Section 5 — Parts Lists. Includes identification and part numbers of assemblies and components that are considered field replaceable.

Section 6 — Removal and Replacement. Provides procedures and illustrations to aid in removing and replacing assemblies and components.

Section 7 — Functional Operation. Contains a brief functional description of the various assemblies within the printer.

EQUIPMENT PROVIDED

The following equipment and documentation are provided with the printer:

1. One pack of fan-fold paper, HP Accessory No. 92160M (4 packs).
2. Power cord
3. Paper stacker, HP Part No. 02670-20012.
4. 2673A Owner's Manual, HP Part No. 02670-90016.

OPTIONS AVAILABLE

Options are factory modifications of a standard printer that are requested by the customer at the time of purchase. These options are listed in **Table 1-1.**

Table 1-1. 2673A Options

Options	Descriptions
-040	Delete HP-IB, add RS-232C Serial interface (no cable).
-042	Delete HP-IB, add Centronics-compatible parallel interface (no cable).
-044	Delete HP-IB, add HP parallel interface (no cable).
-240	HP 264X Character Terminal Interface Kit: Delete HP-IB, add HP parallel interface, 13238A Duplex Register Card and 13232J interface cable.

OPERATING SUPPLIES

Operating supplies may be ordered with the printer or separately from your local Hewlett-Packard Sales Office listed at the back of this manual. Operating accessories are listed in Table 1-2.

Table 1-2. Operating Accessories

Paper Number	Description
92160M (blue) 92160N (black)	Thermal paper, page-perforated and fan folded. 4 packs, 330 sheets 8.5" x 11" each pack.
92160A (blue) 92160B (black)	Thermal paper. 24 rolls. 8.5" x 100' each roll.
92160C (black)	Thermal paper. Page-perforated. 24 rolls. 100 sheets 8.5" x 11" each roll.

INSTALLATION/INTERFACING 2

INTRODUCTION ..... This section covers initial installation information, such as checking for proper line voltage, switch settings, and how to install both roll and fan fold paper. In addition, information is given on the different interface options and the cabling required for connecting them to a specific terminal.

POWER ..... The printer's power requirements are listed on a rear panel sticker. Units configured for 100V/120V operation use a 2.0 Amp fuse. Those configured for 220V/240V operation use a 1.25 Amp fuse.

CAUTION

Ensure the voltage selected on the printer matches the line voltage being used. An incorrect voltage setting can damage the unit.

CHANGING THE VOLTAGE

Before turning on the printer for the first time, check the rear panel voltage matrix to ensure the settings are correct. **IF THE SETTINGS OF THE VOLTAGE MATRIX DO NOT MATCH THE LOCAL LINE VOLTAGE, DO NOT TURN ON THE PRINTER.**

To correct an incorrect voltage setting:

1. Observe the matrix on the printer's rear panel. The numbers on the four curved lines are the voltages that will result from setting the switches to the positions indicated (see **Figure 2-1** for additional information).

2. Position the two switches for the proper voltage.

3. Ensure the correct fuse is installed. Operation at 100V/120V requires a 2.0 Amp fuse, while 220V/240V requires a 1.25 Amp fuse.

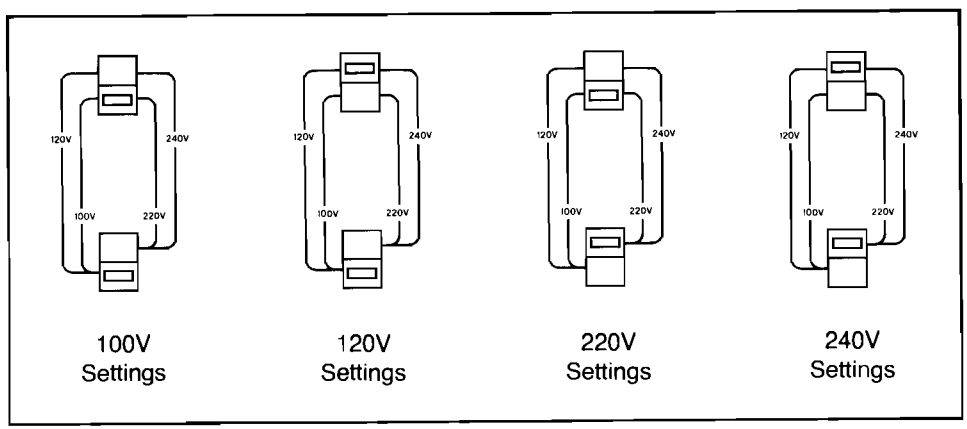


Figure 2-1. Line Voltage Switch Settings

THERMAL PAPER .....

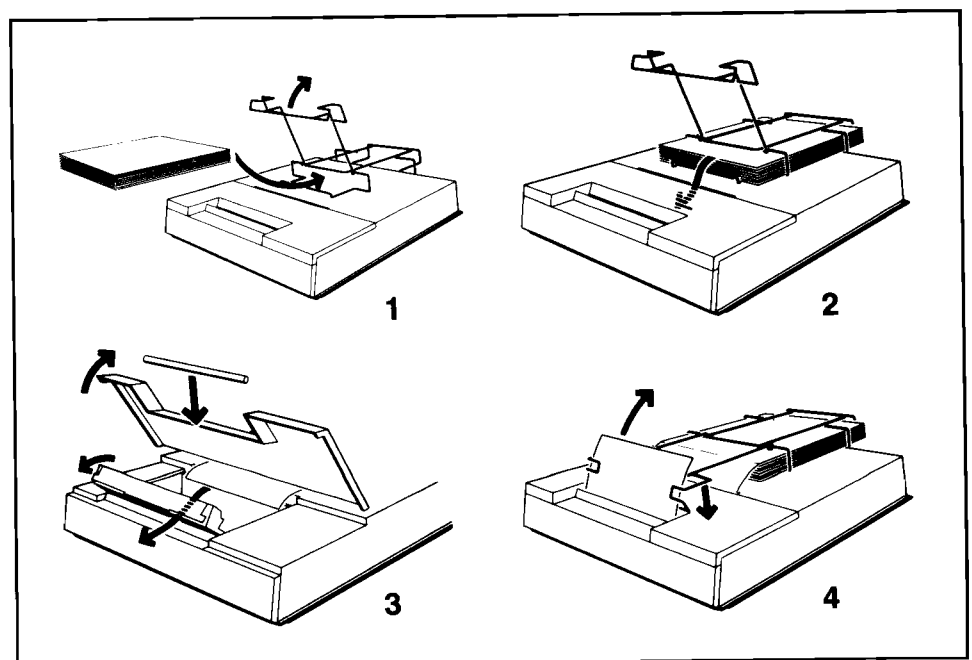
The 2673A uses thermal print paper for its thermal print mechanism (TPM). Hewlett-Packard recommends using only HP paper to ensure quality printing and to maintain validation of equipment warranty and service contract. Paper other than HP's may severely reduce the print head life. Equipment warranty and service contract information is available from your local HP Sales and Service Office. HP thermal paper can be ordered in several forms:

92160M (Blue) **92160N (Black)**	Thermal paper. Page-perforated and fan-folded. 4 packs, 330 sheets 8.5″ × 11″ each pack.
92160A (Blue) **92160B (Black)**	Thermal paper. 24 rolls. 8.5″ × 100′ each roll.
92160C (Black)	Thermal paper. Page-perforated. 24 rolls, 100 sheets 8.5″ × 11′ each roll.

REPLACING FAN-FOLD PAPER

..... Replace fan-fold paper by using the following procedure.

- Set the stack of new paper on top of the printer below the paper stacker. Open the paper bin, raise the paper latch, and remove the paper roll rod.
- Feed the leading edge of the paper into the paper bin and toward the front of the printer between the paper latch and the clear plastic tear window. Make sure the glossy side of the paper is facing the print head or the printer won't be able to print on the paper. Be careful not to touch the print head.

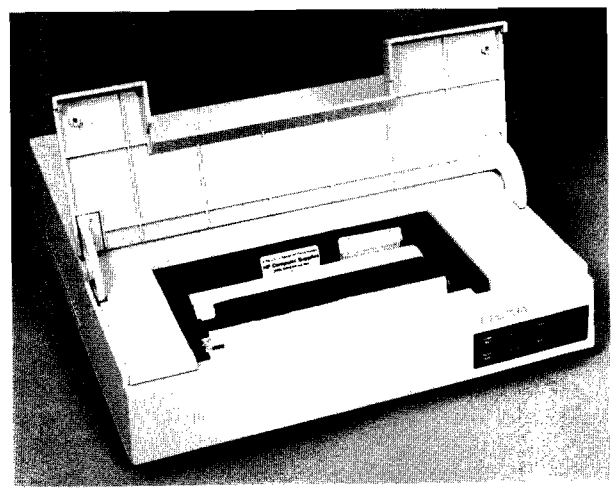


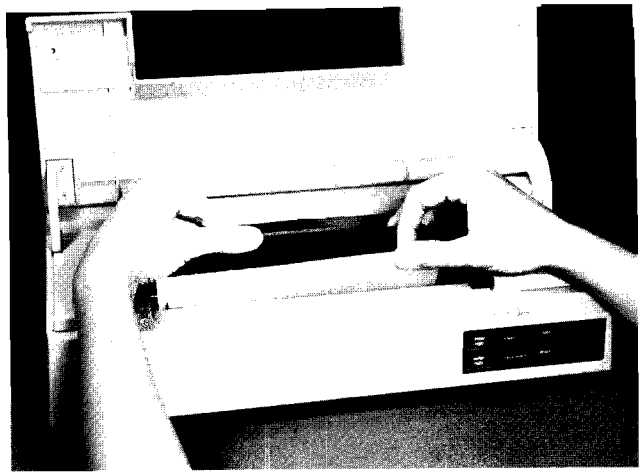
- Replace the paper roll rod over the paper.
- Lower the paper latch and press down on it until it locks into place with a distinct "click". Close the paper bin.
- Press the Form Feed button on the front of the printer a few times to help the paper in stacking itself on the paper rack.

REPLACING ROLLED PAPER

Replace rolled paper by using the following procedure:

- Open the paper bin and raise the paper latch. Remove any remaining paper and the metal rod that holds the paper roll.
- Remove the old paper core from the rod and slide the rod into the core of a new paper roll.
- Place the rod and roll of paper into the guide slots and press downward and back until the rod clicks into place. The paper should unwind from the back of the roll toward the base of the front, then upward past the print head. The glossy side of the paper must face the print head or no print image will appear.
- Feed the leading edge of the paper toward the front between the paper latch and the clear plastic tear window. Be careful not to touch the print head.





- Lower the paper latch, but don't lock it into place. Line the edges of the paper up with the lines embossed on the edges of the tear window.
- Pull about 12 inches of paper upward past the plastic tear window and tear it off. The glue spot, which anchors the end of the paper on the roll, must not touch the print head during operation.
- Press down on the paper latch until it locks into place with a distinct "click". Close the paper bin.

HP-IB INTERFACE

INTRODUCTION

The Hewlett-Packard Interface Bus (HP-IB) is among the most common interfaces between two HP devices. The HP-IB is a 16-line bus consisting of:

- three handshake lines
- five control lines
- eight data I/O lines

A device on the HP-IB may function as a Listener, a Talker, or a Controller. The controller regulates device interaction on the bus. An HP-IB device can function as either a Talker or a Listener. Listeners receive data sent over the bus, while Talkers transmit data to other devices on the bus. The 2673A printer is usually a Listener, but will sometimes function as a Talker, as explained later in this section.

The Configuration mode allows the printer to be set up to accommodate particular HP-IB needs. Through the Configuration mode, the user can define the HP-IB mode of operation, the address assignment, and how it reacts to a need for service, such as a Paper Out condition.

ADDRESSING

The HP-IB address is a number which serves as the identification for each device on the bus. With these addresses, the Controller commands particular devices on the bus to be Talkers or Listeners. Because it is a printer and not a terminal or desktop computer, the HP 2673A usually will be a Listener. It can "listen" in either of two ways: "listen always" or "addressed to listen."

LISTEN ALWAYS MODE ..... In this mode, the printer receives all data sent over the bus, even if it is intended for another device. Listen Always is enabled through Configuration (see Section 3). If Listen Always is enabled, the printer will automatically disable Service Request and skip the printer address selection. Listen Always will not be selectable if secondary command mode is enabled.

ADDRESSABLE MODE ..... When Listen Always is disabled, the printer must be "addressed to listen" before it will print data from the bus. The address code sent by the controller must match the address of the printer, as set through configuration. Any number from 0 to 29 (decimal) can be chosen, assuming it is not used by another device on the bus.

NOTE

If parallel polling or secondary commands are to be used, the address range must be confined to 0 through 7.

SERVICE REQUEST (SRQ) .....

The service request is an active low signal that the printer sends to notify the controller when it is out of paper or when the paper latch is open. When the controller senses an SRQ, it may poll the devices to determine which device asserted SRQ and why. The printer will release SRQ when the controller performs a serial poll or when the Paper Out/Door Open condition is corrected.

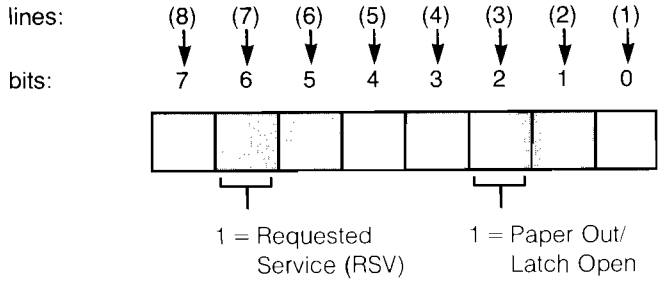
NOTE

If Listen Always mode or secondary commands are enabled, the printer will not assert a service request.

POLLING .....

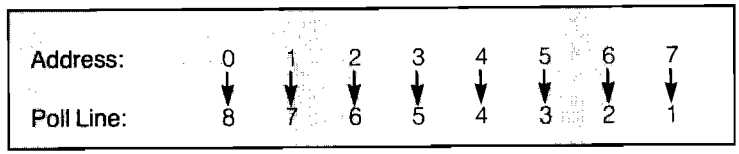
The controller may run periodic checks of the bus devices to determine which, if any, requires service; or a device may request service, causing the controller to check the devices on the bus. Two kinds of polling may be performed over HP-IB: serial and parallel.

SERIAL POLL ..... In a serial poll, the controller requests status of one specific device on the bus by addressing only that device to respond. The printer returns an eight-bit status byte, which is shown below. Data In/Out lines are given in parentheses.



If the printer requested service, bit 6 and bit 2 will be set to 1 (low). Commands used in serial polling: SPE (Serial Poll Enable, decimal 25), SPD (Serial Poll Disable, decimal 24). Lines used in serial polling: ATN (Attention), SRQ (Service Request), DIO (Data In/Out) 1-8.

PARALLEL POLL ..... Parallel polling provides a fast way for a controller to determine if any of a possible eight devices require service. The controller can perform a parallel poll only on devices which have addresses 0 to 7. Each of the eight devices is assigned a DIO line for polling, and the lines correspond to the addresses in the following manner:



The controller performs a parallel poll by asserting the EOI and ATN lines. Each device responds over its assigned DIO line if it requires service. When secondary commands are enabled, the printer responds to a parallel poll by requesting service for the following conditions: Ready for Data, Ready To Send Data, Power Failure Recovery, or Paper Out/Latch Open. When secondary commands are disabled, the printer will request service only for a Paper Out/Latch Open condition. Lines used in parallel polling: EOI (End or Identify), ATN (Attention), DIO lines 1-8.

BUS COMMANDS

The devices on HP-IB receive special instructions in the form of commands. To send a command over the bus, the controller sets the bus into command mode by asserting the ATN line. All data then encountered while the ATN line is asserted will be treated as commands.

The 2673A can be set to expect commands in one of two modes: primary commands only, or primary and accompanying secondary commands. The two command types differ in their scope; the primary commands address each device as either a Talker or a Listener, while the secondary commands tell it what kind of talking or listening it is going to do.

PRIMARY COMMANDS

As stated above, the primary commands put each device on the interface bus into either Listen or Talk mode by addressing the device as a Listener or a Talker.

When secondary commands are disabled through the Configuration mode, the primary commands are used alone. When secondary commands are enabled, the primary commands function as the first stage of a two-part command and must be accompanied by a secondary command.

The primary commands are shown in the following box.

Primary Commands								
Talk	X	1	0	A	A	A	A	A
Listen	X	0	1	A	A	A	A	A

The " X " in the commands shown above stands for the parity bit. The 2673 printer ignores parity and does not care about the value of this bit. The " AAAAA " in the commands represents the HP-IB address of the device for which the command is intended. The 2673 interprets the eighth bit of each byte as data, and if the controlling device uses the eighth bit for parity, data communications may be limited. The 2673 printer ignores parity over HP-IB. In its "Talk" responses, the printer sends the eighth bit as zero.

SECONDARY COMMANDS

The secondary commands complete a two-byte detailed instruction. The first byte is one of the primary commands previously defined, which will address the printer to be in either talk or listen mode. The second byte designates what type of talk or listen operation is to be performed.

Secondary commands are enabled through the Configuration mode and may be easily turned on or off, as needed. Secondary commands must be disabled whenever the printer is being used on a system that does not support secondary commands. Enabling Secondary Command mode automatically disables Listen Always and the Service Request. If secondary commands are enabled, the printer will require a secondary command for any Talk or Listen function.

Secondary commands are either Secondary Listen or Secondary Talk commands. These are defined in the following paragraphs.

SECONDARY TALK COMMANDS

The 2673 printer will recognize three Secondary Talk commands: DSJ, I/O Status, and Data. The printer will respond to any other nonsupported secondary talk command with a Null (all zeros) data byte with EOI asserted. Supported commands are briefly described below.

Talk DSJ	X	1	1	1	0	0	0	0

DSJ is an abbreviation for Device Specified Jump. When the 2673 receives the primary Talk command followed by the secondary Talk DSJ command, it will respond by sending one data byte. This returned byte will have a value of 0, 1, or 2, (as shown below) and will be accompanied by an asserted EOI.

00000000 = Ready for data.

A printer response of Zero signals that the printer is ready to receive a data burst of up to 32 bytes. Data bursts other than 32 bytes are acceptable; however, bursts exceeding the 32 byte limit will be processed at a slightly slower rate. Bursts less than 32 bytes should be terminated with an EOI assertion or an Unlisten command.

00000001 = Ready to send data.

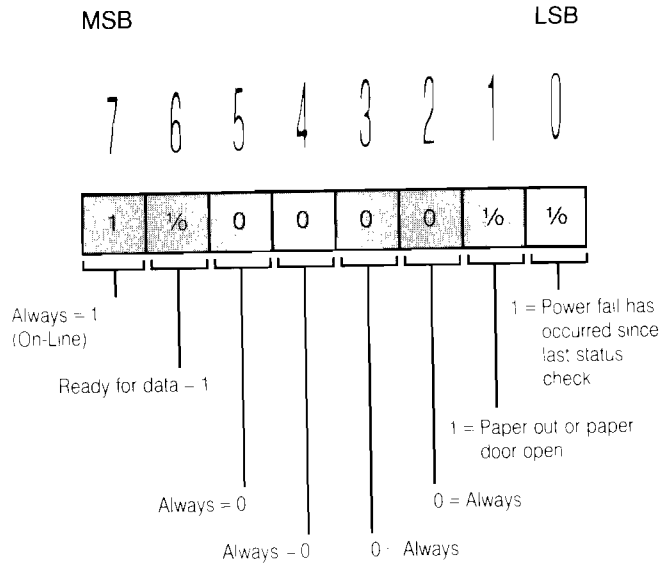
A response of One signals that the printer has data to send (status bytes, etc.) and wants to be Addressed to Talk Data. The appropriate system follow-up to this response is to send the primary Talk command, followed by the secondary Talk Data command.

00000010 = Read Status.

A response of Two indicates the printer has some kind of problem, such as Paper Out or a recent power-on (i.e., possible power failure), and the system should check printer status.

Talk I/O Status	X	1	1	0	1	1	1	0

The I/O Status check is a means for the Controller to look at the current printer status. When the printer receives the primary Talk command followed by the secondary Talk I/O Status command, the printer responds by sending the status byte shown below, with EOI asserted.



Talk Data	X	1	1	0	0	0	0	0

The Talk Data secondary command instructs the printer to send data bytes over the bus. The data transmitted by the printer is usually status information and will be terminated with a CR and a LF with EOI asserted.

If the printer receives the Talk Data secondary command, but has no data to send, it will transmit one Null (all zeros) data byte with EOI asserted.

SECONDARY LISTEN COMMANDS

The 2673A printer supports three Secondary Listen commands: Device Clear, Print and Slew, and Listen to Data. Any other secondary listen command will cause the printer to accept all incoming data and then ignore it. Supported commands are briefly described below.

Device Clear	X	1	1	1	0	0	0	0

The secondary Device Clear command instructs the printer to reset the interface to a known condition and clear any output pending to the HP-IB controller. This secondary command is followed by one additional byte, used by other devices for parity enabling, which the printer ignores.

Print and Slew	X	1	1	0	1	0	0	0

The Print and Slew secondary command is an instruction controlling the printer's paper feed. The printer receives the primary Listen command followed by the secondary Print and Slew command and one additional byte. If the value of this byte is decimal 64 (40 hex), the printer will perform a Carriage Return and Form Feed. Any value other than 64 will cause the printer to execute a Carriage Return and Linefeed.

Listen to Data	X	1	1	0	0	0	0	0

The secondary Listen to Data command tells the printer that the bytes following the command represent data to be printed. See burst size explanation described under Secondary Talk Commands.

UNIVERSAL IDENTIFY

COMMAND ..... The Universal Identify command is a means for the controller to identify devices on the bus. The command consists of two bytes: the first byte is the primary Untalk command, and the second is a secondary command addressing a specific device.

When addressed, the 2673 printer will respond to the Universal Identify Command with two data bytes. The first byte of the response is a general device classification, which tells the controller that the printer is a printer/terminal device. The second byte of the response tells the controller that the printer is an HP 2673. These response bytes are shown below.

Byte 1:	0 0 1 0 0 0 0 0	(20 hex)
Byte 2:	0 0 0 0 1 0 1 1	(0B hex)

DEVICE CLEAR (DCL) ..... When the controller sends the printer a DCL (decimal 20), the printer will reset the interface to a known condition and clear any output pending to the HP-IB controller. To reset the printer, the user can press the RESET key or send the ESC E sequence.

HP-IB CONNECTOR ..... Figure 2-2 shows a pinout of the signals associated with the HP-IB connector.

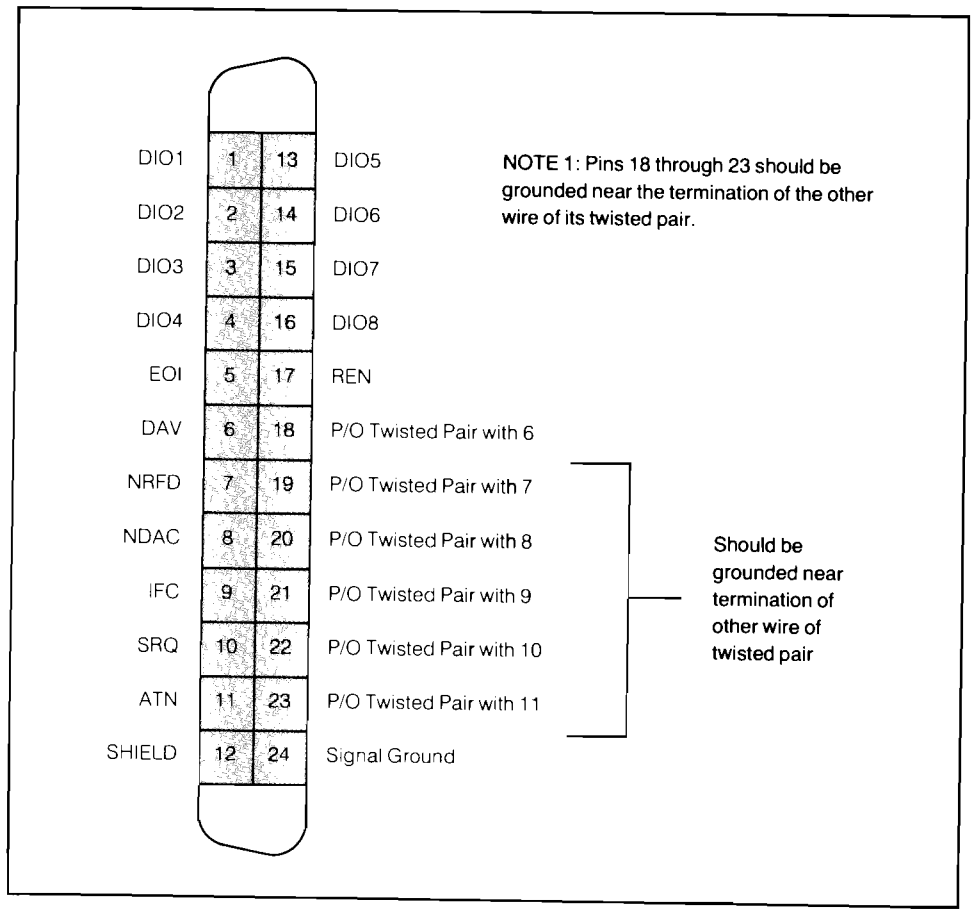


Figure 2-2. HP-IB Connector

8-BIT PARALLEL INTERFACE

INTRODUCTION .....

The HP 8-bit parallel I/O is one of the parallel interfaces available for the 2673A printer. This interface provides simple communications between the printer and a number of HP devices. The 37-pin connector on the rear panel provides a sliding-lock secondary fastener to ensure a proper connection between the printer and cable. (See **Figure 2-3** for a pinout of the connector.)

If the printer was ordered with the Centronics-compatible parallel interface, an adapter cable was also supplied (P/N 02670-60094) that converts the 37-pin connector to a 36-pin connector. The adapter is installed between the printer's connector and the system cable.

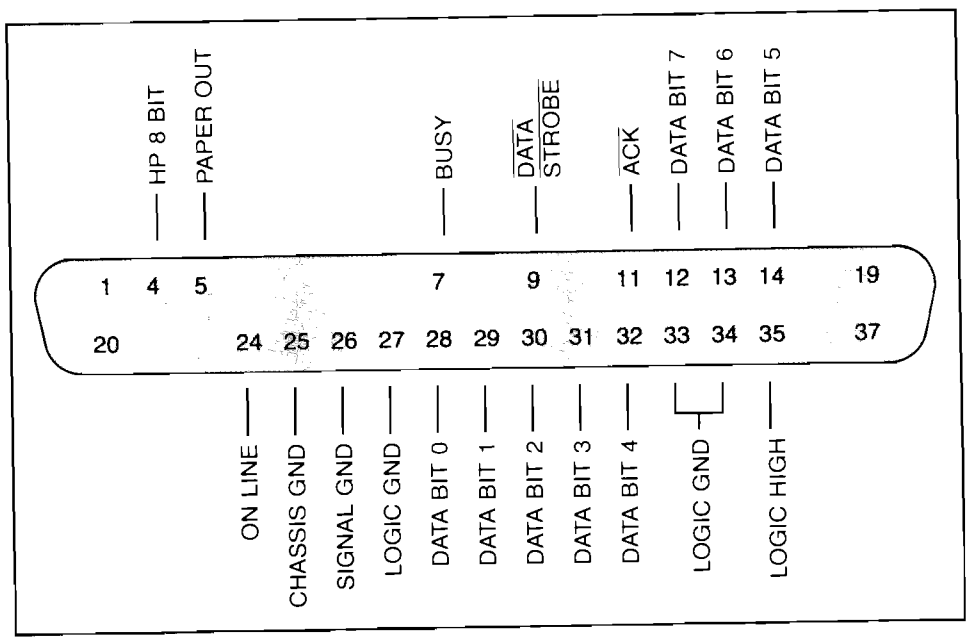
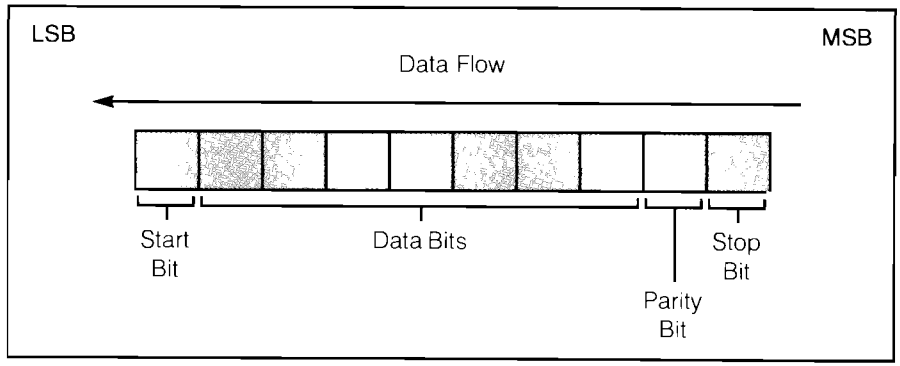


Figure 2-3. HP 8-Bit Parallel Connector

RS-232C INTERFACE

INTRODUCTION

This section provides a general description of the Serial Interface and includes information on data flow, parity, handshakes, and datacomm errors. The optional RS-232C interface provides a means of serial data communications between the printer and the controlling device. Serial data communications differs from other forms of datacomm in that serial data is transmitted one bit at a time, rather than one byte at a time. In serial data transmissions recognized by the HP 2673A printer, data is transferred in the following general format:



The start bit and stop bits frame each byte of data. The 2673A printer can accept data with one or more stop bits, but data transmitted by the printer will have the number of stop bits specified in the printer's configuration.

PARITY ..... Parity is a means of checking incoming data for accuracy. The 2673 printer provides five parity options for selection through the Configuration mode: Even, Odd, Zero, One, and None. These are defined below.

Even parity: the eighth bit will change as needed to produce an even number of set bits in each byte.

Odd parity: the eighth bit will change as needed to produce an odd number of set bits in each byte.

Zeros: the printer will ignore incoming parity and will send a zero as the eighth bit on all outgoing data.*

Ones: the printer will ignore incoming parity and wil send a one as the eighth bit on all outgoing data.*

None: the printer will not expect or send any parity bit.

*Parity setting of 0 or 1 forces 7 data bits.

PARITY CHECK ..... The Parity Check portion of the printer's Configuration will allow parity checking for even and odd parity only. When using even or odd parity and parity checking is disabled, the printer will ignore any incoming errors. When parity checking is enabled, the printer responds to errors it encounters by printing a Delete (■) character.

HANDSHAKES

Handshakes are signals exchanged by the printer and its host to prevent data buffer overrun (i.e., data being transmitted when the printer's input buffer is full and cannot accept it). The handshake to be used depends on the requirements of the host system.

The handshakes available through the Configuration mode are: ENQ/ACK, XON/XOFF, Hardware, and Binary. The printer may have any, several, or none of these handshakes enabled, depending on the host system. The handshakes are described below.

ENQ/ACK ENQ/ACK stands for Enquire/Acknowledge. With this protocol, the host computer or terminal sends an ASCII ENQ control code to enquire if the printer is ready to receive a block of data. When the printer has room in its buffer for at least 96 bytes, it will acknowledge the host with an ASCII ACK control code.

XON/XOFF With the XON/XOFF handshake, the printer keeps track of how many characters are in its buffer and signals the host device when it can and cannot accept more data. When the input buffer fills to within 48 bytes of its capacity, the printer sends a Transmit Off signal (ASCII control character DC3) to signal the host computer to stop transmitting data. When the buffer has 96 or more free bytes available, the printer sends a Transmit On signal (ASCII control character DC1) which signals the host computer to resume data transmission. This process continues until the current data transfer operation is complete.

HARDWARE The Receive Hardware handshake, when enabled, allows the printer to send a "busy" signal on pin 20, which is the Data Terminal Ready (DTR) line (CD for RS-232C; 108.2 for CCITT V.24). When the buffer fills to within 48 bytes of capacity, the printer pulls this line low, which signals the host to stop data transmission. When the buffer capacity has 96 or more free bytes available, the printer will assert this line high to signal the host to resume data transmission. This is the only type of handshake available when the printer is connected to an HP 264X terminal with a 13232G cable (P/N 02640-60098).

NOTE

Dropping the DTR line may cause some modems to disconnect. If this situation occurs, try a different handshake.

BINARY HANDSHAKE ..... This handshake is applicable when receiving raster graphics data from an HP host using a similar Binary ENQ/ACK protocol. Prior to sending a line of raster data, the host will transfer, e.g., ESC*b90W ENQ. Selecting Binary ENQ on the printer causes the printer to interpret the ENQ code properly, instead of accepting it as the first byte of binary data. When the printer can accept 96 bytes of data, it responds with an ACK, and the host then transmits the bytes of graphics data.

DATACOMM ERRORS .....

The printer recognizes and is affected by three kinds of datacomm errors: parity errors, framing errors, and buffer overruns.

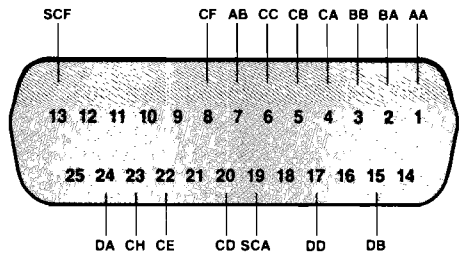
Parity errors occur when some kind of parity check is enabled through Configuration, and the parity bit of the incoming data does not match the parity expected by the printer.

Framing errors occur when the printer fails to encounter a stop bit where it expects to find one. Framing errors often result from a printer baud rate setting that does not match the baud rate used by the host device.

Buffer overrun occurs when the data come in faster than the printer can print it. This usually occurs when the printer is operating without benefit of handshakes at higher baud rates (e.g., 1200 or above).

When the printer comes across a parity or framing error, it prints a Delete character (■). When experiencing datacomm errors, check the parity and baud rate settings in the Datacomm Configuration. If the settings are correct, check the cable. **Figure 2-4** shows the RS-232C pin configuration.

RS-232C Interface
(female)



Pin Number	Signal Name	Function
1	AA	Protective ground
2	BA	Transmit Data
3	BB	Receive Data
4	CA	Request to Send
5	CB	Clear to Send
6	CC	Data Set Ready
7	AB	Signal ground
8	CF	Data Carrier Detect
12	SCF	Secondary Data Carrier Detect
15	DB	Transmit Clock
17	DD	Receive Clock
19	SCA	Secondary Request to Send
20	CD	Data Terminal Ready
22	CE	Ring Indicator
23	CH	Speed Select
24	DA	External Transmit Clock Out

Figure 2-4. 25-Pin RS-232C Connector

Table 2-1. Printer Interfacing

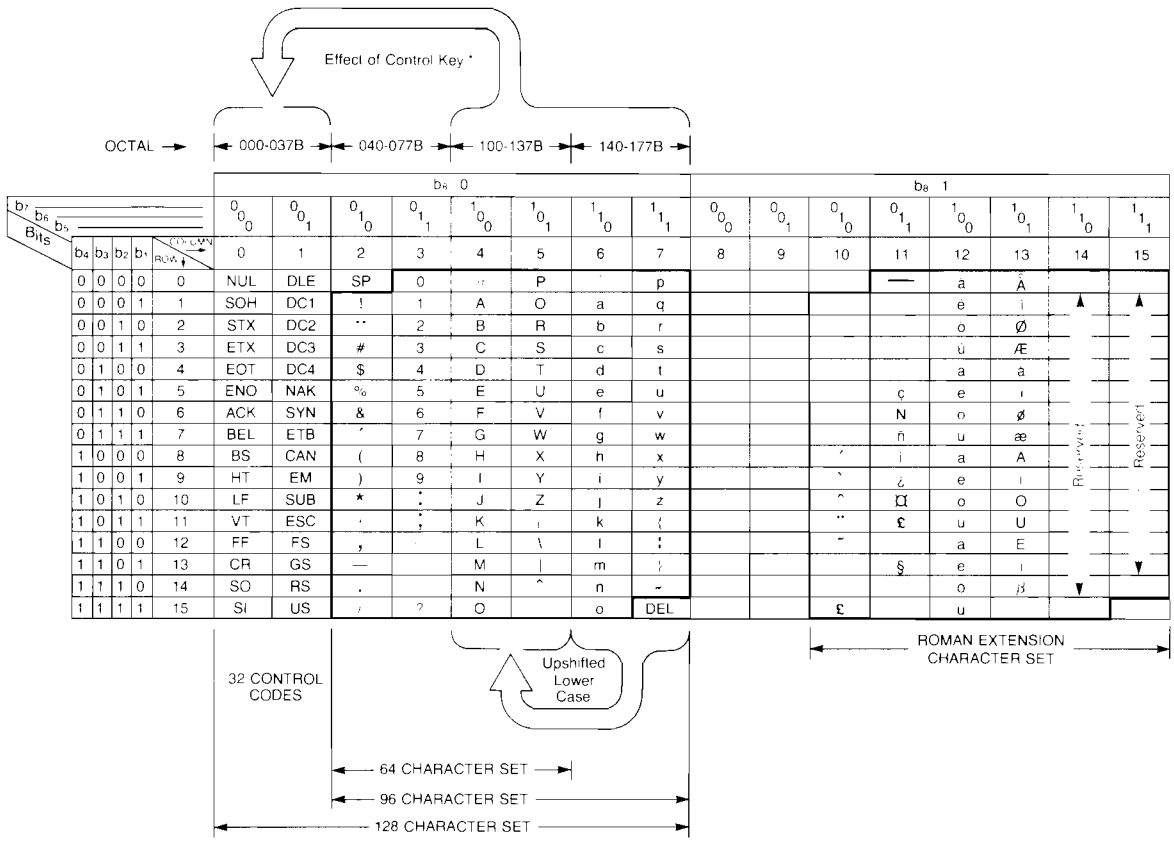
<table>
<tr><th>SOURCE</th><th>SYSTEM IF</th><th>IF TYPE</th><th>CABLE</th><th>COMMENTS/SWITCH SETTINGS</th></tr>
<tr><td>HP 83A/85A</td><td>82937A</td><td>HP-IB</td><td>N/A</td><td>Requires 82936A ROM drawer and 00085-15002 plotter/printer ROM.
S1 Switch Settings:
<table><tr><td></td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr><tr><td></td><td>x</td><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table></td></tr>
<tr><td>HP2623A/ 24A/B/26A</td><td>—</td><td>RS-232C</td><td>13242G (13242-60008)</td><td></td></tr>
<tr><td>HP 2642/ 47/48</td><td>13296A (02640-60128)</td><td>HP-IB</td><td>10631A/B</td><td>Switches:
<table><tr><td>A4</td><td>A11</td><td>A10</td><td>A9</td></tr><tr><td>closed</td><td>open</td><td>closed</td><td>closed</td></tr></table><table><tr><td>PL6</td><td>PL5 thru PL0</td></tr><tr><td>closed</td><td>open</td></tr></table>ATN, ATN2: open
FC, TA: closed
LA: open in 2642, 47; closed in 2648
B0-B4: terminal address
SC: open - system controller</td></tr>
<tr><td>HP264X</td><td>13238A (02640-60031)</td><td>8-Bit</td><td>13232J (02640-60116)</td><td>Requires device support ROM (13261A). The 2640 can dump only a maximum of 80 columns and cannot send escape sequences to the printer. Open switch N on keyboard interface PCA, P/N 02640-60123.</td></tr>
</table>

Table 2-1. Printer Interfacing (Continued)

<table>
<tr><th>SOURCE</th><th>SYSTEM IF</th><th>IF TYPE</th><th>CABLE</th><th>COMMENTS/SWITCH SETTINGS</th></tr>
<tr><td>HP 264X</td><td>13250B</td><td>RS-232C</td><td>13232G</td><td>Switch: A11 A10 A9 A4
Settings: closed open closed open
FC0, FC1, FC2: Baud Rate
FC3,FC4: Parity
FC5, FC6, FC7: Number of null characters
2SB: open = one stop bit, closed = two stop bits.
All other switches = open.
Comments: Requires device support ROM 13261A. Cable supports only hardware handshake.</td></tr>
<tr><td>HP 9815S</td><td>98135A</td><td>HP-IB</td><td>N/A</td><td></td></tr>
<tr><td>HP 9825A</td><td>98034A</td><td>HP-IB</td><td>N/A</td><td>Requires general I/O ROM.</td></tr>
<tr><td>HP 9826A</td><td>98624A</td><td>HP-IB</td><td>N/A</td><td></td></tr>
<tr><td>HP 9835A</td><td>98034A</td><td>HP-IB</td><td>N/A</td><td>For graphics, requires plotter ROM and I/O ROM.</td></tr>
<tr><td>HP 9845B/ T/C</td><td>98034A</td><td>HP-IB</td><td>N/A</td><td></td></tr>
</table>

USASCII AND ROMAN EXTENSION CHARACTER SETS

The relationship between the USASCII and Roman Extension character sets involves not only the primary and secondary character set conventions of shift-in and shift-out, but also 8-bit codes and their function as character set selectors. The chart below shows the relationship between these two character sets. Paragraphs providing details on chart structure and eighth-bit mode appear following the chart.



USING THE CHART

The USASCII character set, shown on the left side of the chart, comes in three widely-recognized levels, as indicated by the arrows below the ASCII portion of the chart. (The 2673A printer supports the full 128-character ASCII set.)

The large arrows above and below the chart show how a character code is changed by using the SHIFT and CNTL keys of the host device. The CNTL (Control) key is used in combination with alpha keys to produce control codes. For example, pressing CNTL and L will generate a Form Feed control code (shown on the chart as FF).

The binary codes for the various characters are shown both above and to the left of the characters in the chart. The first four bits of the character byte appear on the left side of the chart. The next three bits appear above each column of characters. The eighth bit appears at the very top of the chart. For example, the representation of the character "K" is:

	b_8	b_7	b_6	b_5	b_4	b_3	b_2	b_1
BINARY	0	1	0	0	1	0	1	1
OCTAL		1		1			3	

For quick reference, ranges of octal values are shown over each pair of columns in the ASCII portion of the chart.

EIGHTH-BIT MODE ..... As shown by the character set chart, when the 8th bit of a character byte is set to zero (0), the character will come from the primary character set, and when the 8th bit is set to one, the character will come from the secondary character set. This is true when the printer's configuration is set to recognize the 8-bit data.

Display Functions mode allows you to check data containing 8-bit codes. When Display Functions is enabled, it resets the 8th bit and turns on the underline for every 8-bit character received by the printer. It also confines printed characters to the primary character set.

So, for example, if the printer is in Display Functions and receives the German word, "hässlich" (in which the "ä" must come from the Roman Extension set), the printer will print, " hL̲sslich ".

(In order to accompish this, Display Functions will disable any underlining the printer might be configured to do. If underlining were enabled when Display Functions was turned on, and underlining is set as a latching function, it will be turned back on after exiting Display Functions. If, however, underlining is enabled on a line-by-line basis, it will not be operating when Display Functions is disabled.)

CONFIGURATION/CONTROL CODES

3

INTRODUCTION

Various Printer features can be examined and/or altered through the 2673A Configuration Subsystem. These features can be classified as "POWER-ON" Configuration (stored in EAROM), or "CURRENT" Configuration (currently enabled but not permanently stored in EAROM).

DISPLAYING CONFIGURATION SETTINGS

Configuration settings for "CURRENT" and "POWER-ON" can be displayed through use of the CONFIG. /EXIT key. **Pressing** this key displays the following menu:

SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFIGURATION

To display the CURRENT Configuration settings, depress the SELECT key immediately after the menu has been printed. To display the POWER-ON Configuration settings, use the ▶▶ key to position the printhead immediately before the SHOW POWER-ON parameter and depress the SELECT key. Currently enabled settings will be underlined.

CONFIGURATION CHANGES

To alter the POWER-ON Configuration, press the CONFIG. EXIT key. The following menu is printed:

SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFIGURATION

Using the ▶▶ key, position the printhead immediately before the CONFIGURE POWER-ON parameter. Press the SELECT key to select that parameter (it will be underlined immediately after selection). The first feature for configuration will be printed. To change that feature, depress the ▶▶ key to position the printhead immediately before the desired setting of that feature, and the SELECT key to select that setting. To change other features, depress the ▼ key repeatedly until the desired feature is printed. Features not changed through use of the SELECT key will retain their current settings.

Some features can be "ENABLED" or "DISABLED" only, and using the SELECT key will toggle the state of those features.

For example, to alter the **AUTO PAGE MODE:**

- **Press** the CONFIG. EXIT key to display the configuration menu.
- **Press** the ▶▶ key to position the printhead immediately before CONFIGURE POWER-ON.
- **Press** the SELECT key.
- **Press** the ▼ key 6 times.
- Select the desired ON or OFF mode by use of the ▶▶ key and the SELECT key. The option selected will be underlined, and the deselected option will be slashed out.
- **Press** the CONFIG. EXIT key to exit Configuration.

The preceding steps will result in the following printout:

```
     SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFIGURATION

PRINT SIZE:       NORMAL   COMPRESSED   EXPANDED

LEFT MARGIN--SELECT 2 DIGITS (##)--RANGE: PRINT POSITIONS 01 THRU 80
       FIRST DIGIT  ##          SECOND DIGIT  ##
     0 1 2 3 4 5 6 7 8 9      0 1 2 3 4 5 6 7 8 9

RIGHT MARGIN--MUST BE TO THE RIGHT OF THE LEFT MARGIN
       FIRST DIGIT  ##          SECOND DIGIT  ##
     0 1 2 3 4 5 6 7 8 9      0 1 2 3 4 5 6 7 8 9

PERFORATED PAPER:      ON   OFF  |  AUTO PAGE MODE:      ON   OFF

************************* CONFIGURATION COMPLETED **************************
```

To alter the CURRENT Configuration without altering the POWER-ON Configuration, use the ESCAPE sequences as described in Table 3-1 (also refer to the APPENDIX). Table 3-1 explains all features that are alterable by means of the front panel CONFIG. EXIT key, and their equivalent ESCAPE sequences.

SETTING CONFIGURATION DEFAULTS

DEFAULT settings can be implemented for each configuration feature by positioning the printhead immediately before the RESET CONFIGURATION parameter and depressing the SELECT key. Note that this will set default parameters for both the POWER-ON configuration (stored in EAROM) and the CURRENT configuration. The printer will print a warning message and ask the user if they wish to continue with the default settings. Table 3-1 states what default setting will be set for each feature. Defaults will also be set for DATACOMM parameters (see Table 3-2).

Table 3-1
Configuration Features

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
PRINT SIZE Normal Compressed Expanded	10 characters/inch, maximum of 80 characters per line 16.2 characters/inch, maximum of 132 characters/line 5 characters/inch, maximum of 40 characters/line (SINCE EACH PRINT SIZE IS MUTUALLY EXCLUSIVE, THE ENABLING OF A NEW PRINT MODE AUTOMATICALLY DISABLES THE PREVIOUS MODE) [Default = Normal]	ESC&k0S ESC&k2S ESC&k1S
LEFT MARGIN	Defines the first character position of the print line, remembered as a physical position of the print head. Maximum ranges are 1-40 for EXPANDED Mode, 1-80 for NORMAL Mode, or 1-132 for COMPRESSED Mode. Setting the LEFT margin to the right of the current RIGHT margin will cause the command to be ignored. [Default = 01]	ESC&a‹integer›L where ‹integer› is the character position of the LEFT margin.

(continued on next page)

Table 3-1. Configuration Features (continued)

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
RIGHT MARGIN	Defines the end of the print line, remembered as a physical position of the print head. Maximum ranges are 1-40 for EXPANDED Mode, 1-80 for NORMAL Mode, or 1-132 for COMPRESSED Mode. Setting the RIGHT margin to the left of the current LEFT margin will cause the command to be ignored. [Default = 80]	**ESC&a‹integer›M** where ‹integer› is the character position of the RIGHT margin.
PERFORATED PAPER	When this mode is selected, the 2673A assumes that it is using perforated thermal paper, which has a top-of-form hole in the paper for optical sensing. When a form feed code is received, the printer advances to top of form. If no top-of-form is detected within 12 inches, the printer will stop advancing paper. [Default = On]	Not applicable
AUTO PAGE MODE	When this mode is selected, printed data is automatically formatted into page segments with top and bottom margins. When disabled, text data prints continuously without page separations, unless PERFORATED PAPER mode is selected or a FORM FEED is received. If AUTO PAGE MODE is enabled and PERFORATED PAPER mode is disabled, a small tic mark is printed at the top of each new page. [Default = Off]	**ESC&l1L** (enable) **ESC&l0L** (disable)

(continued on next page)

Table 3-1. Configuration Features (continued)

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
PHYSICAL PAGE LENGTH	Defines the number of text lines available for printing on a physical page when continuous roll paper is used. Range of this parameter is between 1 and 255. When AUTO PAGE MODE is disabled and continuous roll paper is being used, the page length is fixed at 72 lines (12 inches). If AUTO PAGE MODE is enabled, the default is 65 lines. [Default = 65]	ESC&l‹integer›P where ‹integer› is the number of text lines > 0 and < 256.
TOP MARGIN	Defines the number of lines to skip relative to the physical top-of-form. Skip occurs whenever a FORM FEED is received or when the printer receives characters to be printed that would exceed the currently set text length. Range of this parameter is between 0 and 255 inclusive. When AUTO PAGE MODE is disabled and continuous roll paper is being used, the top margin length is fixed at 0. If AUTO PAGE MODE is enabled, the default is 2 lines. Also, a fixed minimum top margin of 2 lines is used whenever PERFORATED PAPER mode is enabled. [Default = 2]	Not applicable
TEXT LENGTH	Defines the allowable number of text lines to be printed on a page, following the top margin. Range of this parameter is between 1 and 155. If AUTO PAGE MODE is enabled, the default text length is 60 lines (10 inches). The TEXT LENGTH is not defined if AUTO PAGE MODE is disabled. [Default = 60]	ESC&l‹integer›F where ‹integer› is the number of text lines > 0 and < 256.

(continued on next page)

Table 3-1. Configuration Features (continued)

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
MISCELLANEOUS SELECTIONS		
Save Paper Mode	Results in each CR, FF, and LF being printed as an ASCII period, with all lines being wrapped around in a continuous mode. [Default = Disabled]	ESC&k1U (enable) ESC&k0U (disable)
Line Wrap Around	When disabled, lines which contain more than 80 printable characters (for NORMAL print size) will be truncated. Enabling LINE WRAP-AROUND allows these characters to continue printing on the next line. [Default = Disabled]	ESC&s0C (enable) ESC&s1C (disable)
Permanent Enhancement Latching	When enabled, allows all selected Enhancements (CHARACTER FRAMING, BOLD PRINTING, and UNDERLINING) to remain in effect until explicitly disabled. [Default = Enabled]	ESC&k1E (enable) ESC&k0E (disable)
Tab With Enhancements	If disabled, spaces that are traversed when executing a TAB will not be Enhanced, if Enhanced printing is being performed. If the TAB WITH ENHANCEMENTS option has been enabled, then these spaces will be Enhanced. [Default = Enabled]	Not applicable
CR = CR,LF	When a CR command is received, the printhead will move to the beginning of the next line. [Default: CR = CR]	ESC&k1G

(continued on next page)

Table 3-1. Configuration Features (continued)

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
(continued) LF = CR,LF and FF = CR,FF	When a LF command or a FF command is received, the printhead will move to the beginning of the next line (for LF) or form (for FF). In the DEFAULT mode, vertical paper movement will occur but printhead will retain current position. [Default: LF = LF and FF = FF]	ESC&k2G
DISPLAY FUNCTIONS	When set to "ON", the 2673A will print but not locally execute control codes or ESC sequences, with the following exceptions: If a CR command is received, the CR character will be printed and a CR/LF will be executed. If an ESC Z command is received (disable DISPLAY FUNCTIONS), the command will be both printed and executed. This is a temporary setting which cannot be made part of a POWER-ON configuration. DISPLAY FUNCTIONS mode can be disabled by pressing the RESET key. [Default = Off]	ESC Y (enable) ESC Z (disable)
GRAPHICS X OFFSET (Dot Columns)	The number of dot columns to move the start of the graphics data relative to the left physical margin of the printer. Range of this parameter is between 0 and 720. [Default = 0]	ESC*r‹integer›X where ‹integer› is the number of dot columns ≥ −9999 and ≤ 9999.

(continued on next page)

Table 3-1. Configuration Features (continued)

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
GRAPHICS Y OFFSET (Raster Lnies)	The number of raster lines to move the start of the graphics data relative to the top line of print. Range of this parameter is between 0 and 999. [Default = 0]	ESC*r‹integer›Y where ‹integer› is the number of raster lines ≥ –9999 and ≤ 9999.
PRIMARY CHARACTER SET	Selects the primary character set to be used in the printer. [Default = USASCII]	ESC(‹int›‹char› where ‹int› and ‹char› define a particular character set as defined in the Appendix.
SECONDARY CHARACTER SET	Selects the secondary character set to be used in the printer. [Default = Roman Extension]	ESC)‹int›‹char› where ‹int› and ‹char› define a particular character set as defined in the Appendix.
CHARACTER SET SELECTION Shift In / Shift Out	When enabled, characters are printed from the currently assigned primary character set until an SO control code is received, at which time all subsequent characters will be printed from the currently assigned secondary character set. This continues until an SI control code is received, at which time the primary character is reactivated. [Default = Enabled]	ESC&k0I (enable) ESC&k1I (disables SI/SO; enables 8th bit mode)

(continued on next page)

Table 3-1. Configuration Features (continued)

FEATURE	EXPLANATION	EQUIVALENT ESCAPE SEQUENCE (WILL ALTER CURRENT CONFIGURATION BUT NOT POWER-ON CONFIGURATION)
(continued) Eighth Bit Mode	When enabled, characters are selected from the currently assigned primary character set whenever the MSB of the character byte is Zero. When the MSB is set to One, the currently assigned secondary character set is activated, plus characters which correspond to Control Codes are not defined, and are therefore ignored by the printer. If the printer is configured for 8th BIT MODE, and DISPLAY FUNCTIONS is also enabled, characters received which have the 8th bit set will be displayed as the 7 bit character equivalent, but will be underlined to signify that the MSB was set. [Default = Disabled]	**ESC&k1I** (enable) **ESC&k0I** (disables 8th BIT MODE; enables SI/SO MODE)
PERMANENT CHARACTER SET LATCHING	When enabled, SI/SO MODE is set such that an SI command activates the Primary character set and an SO command the Secondary character set. When disabled, an SI command is automatically assumed at the beginning of each new line unless an SO command is explicitly used. [Default = Enabled]	**ESC&k1F** (enable) **ESC&k0F** (disable permanent latch and enable line-by-line mode)

DISPLAYING DATACOMM SETTINGS

Datacomm Configuration settings can be displayed through use of the CONFIG. EXIT key. Pressing this key displays the following menu:

SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFIGURATION

To display the DATACOMM Configuration settings, depress the ▶▶ key to position the printhead immediately before the SHOW DATACOMM parameter. Press the SELECT key to select that parameter (it will be underlined immediately after selection).

DATACOMM CONFIGURATION CHANGES

To alter the DATACOMM configuration settings, press the CONFIG. EXIT key. the following menu is displayed:

SHOW CURRENT | SHOW POWER-ON | SHOW DATACOMM | CONFIGURE POWER-ON | CONFIGURE DATACOMM | RESET CONFIGURATION

Position the printhead immediately before the CONFIGURE DATACOMM parameter using the ▶▶ key. Press the SELECT key to select that parameter (it will be underlined immediately after selection). The first feature for configuration will be printed. To change that feature, depress the ▶▶ key to position the printhead immediately before the desired setting of that feature, and the SELECT key to select that setting. To change other features, depress the ▼ key repeatedly until the desired feature is printed. Features not changed through use of the SELECT key will retain their current settings, unless disabled by the setting of a previous feature (see the example of SECONDARY COMMANDS in the next paragraph). All features altered will be permanently stored in EAROM until changed by the user through use of the SELECT key.

Table 3-2 explains all features that are alterable by means of the front panel CONFIG EXIT key. Not all features listed will always be printed, because enabling some features automatically sets other features to a required setting. For example, when configuring HP-IB, setting SECONDARY COMMANDS "ON" automatically disables SERVICE REQUEST and LISTEN ALWAYS, and hence the LISTEN ALWAYS and SERVICE REQUEST features will not be printed out as options for the user to set.

SETTING DATACOMM DEFAULTS

DEFAULT settings can be implemented for each configuration feature by positioning the printhead immediately before the RESET CONFIGURATION parameter and **depressing** the SELECT key. Table 3-2 states what default setting will be set for each feature. Defaults will also be set for the POWER-ON and CURRENT Configuration parameters (see Table 3-1).

Table 3-2
Datacomm Configuration Features

TYPE OF INTERFACE	FEATURE	EXPLANATION
HP-IB	SECONDARY COMMANDS	This feature is enabled when attached to systems utilizing Secondary HP-IB Commands. Setting this feature ON automatically sets LISTEN ALWAYS and SERVICE REQUEST off, limits addressing to the range 0-7, and enables Parallel Polling support. In addition, the printer will support the commands listed below: PARALLEL POLLING PRIMARY COMMANDS – My Talk Address (MTA) – My Listen Address (MLA) SECONDARY COMMANDS Secondary Talk: – Device Specified Jump (DSJ) – I/O Status – Data (talk) Secondary Listen: – Device Clear – Print & Siew – Data (listen) UNIVERSAL IDENTIFY COMMAND (returns 2 identify data bytes) INTERFACE RESET – Interface Clear – Universal Device Clear – Untalk – Unlisten [Default = Off]

(continued on next page)

Table 3-2. Datacomm Configuration Features (continued)

TYPE OF INTERFACE	FEATURE	EXPLANATION
HP-IB (continued)	LISTEN ALWAYS	When enabled, allows the device always to be in a listening mode. When disabled, the device is expecting to be specifically addressed. [Default = Off]
	SERVICE REQUEST	When enabled, the device has the ability to request service for "paper out" or "door open" by pulling the SRQ line low. When disabled, no requests are issued. [Default = On]
	HP-IB ADDRESS	Defines the HP-IB address of the printer. When Secondary Commands are enabled, this address range is limited to 0-7. When SECONDARY COMMANDS are disabled, the range is 0-29. Setting the address in the range of 0-7 allows parallel polling. [Default = 1]
RS-232C	BAUD RATE	Sets the Datacomm transfer rate. This rate should match that of the connecting computer or terminal. Allowable BAUD rates are 110, 300, 600, 1200, 2400, 4800, 9600, 19200, or EXTERNAL CLOCK. [Default = 2400]
	PARITY	Allows use of a Parity bit for error checking. The selected Parity type should match that of the connecting computer or terminal. Allowable PARITY types are EVEN, ODD, ZERO, ONE, or NONE. [Default = None]
	PARITY CHECKING	When ON, allows the printer to check parity and report an error code if incorrect parity is received. If set to OFF, incorrect parity will be ignored. This feature is only allowed to be set if EVEN or ODD parity is selected. It can also be selected through using the following ESCAPE sequence: ESC&s1Z (disable parity checking) ESC&s0Z (enable parity checking) [Default = Off]

(continued on next page)

Table 3-2. Datacomm Configuration Features (continued)

TYPE OF INTERFACE	FEATURE	EXPLANATION
RS-232C (continued)	DATA BITS	Specifies the number of bits for serial data. Character data can be set to either 7 or 8 data bits. (8 bits are required for sending graphics data). Parity is allowed for either character length. [Default = 8]
	HANDSHAKES	Specifies the type of Handshaking desired. Types allowed are ENQ/ACK, XON/XOFF, HARDWARE, BINARY, or none. More than one can be selected at a time. Explanations are given below:
	Enq/Ack	Enquire/Acknowledge handshake. Allows the computer or terminal to send an ASCII ENQ control code to enquire if the printer is ready to receive data; the printer will then acknowledge with an ASCII ACK control code when its input buffer has room for 96 or more characters.
	Xon/Xoff	Allows the printer to signal the connecting computer or terminal with an XOFF (ASCII DC3 control code) whenever its input buffer capacity reaches 48 characters or less, and an XON (ASCII DC1 control code) when room for 96 or more characters exists.
	Hardware	When enabled, HARDWARE Handshaking allows the printer to drop DATA TERMINAL READY (CD) whenever its input buffer capacity reaches 48 characters or less. DTR is raised when room for 96 or more characters exists.
	Binary	A special ENQ/ACK handshake used during a raster graphics transfer. In this mode, the computer or terminal sends an ASCII ENQ control code immediately after the "W" in the raster transfer ESCAPE sequence. The printer responds with an ASCII ACK control code when its input buffer has room for 96 or more bytes of information. [Default = ENQ/ACK on, all others off]

(continued on next page)

Table 3-2. Datacomm Configuration Features (continued)

TYPE OF INTERFACE	FEATURE	EXPLANATION
RS-232C (continued)	STOP BITS	Specifies the number of stop bits for serial data. Allowed settings are 1, 1.5, or 2 (generally used for 110 BAUD only). [Default = 1]
	STRIP NULL/DELETE	Allows the printer to ignore or recognize NULL characters (0000000) or DELETE characters (1111111) in the data stream. When ON, NULLs and DELETEs will be stripped from the data stream by the printer interface. When OFF, the interface will pass them to the printer as valid characters. [Default = Off]
PARALLEL	DATA BITS	Specifies the number of data bits per character, set to either 7 or 8. (8 bits are required for graphics data). [Default = 8]
	INVERT DATA	When set to "ON", data is inverted. Useful for special or non-standard parallel interfaces. [Default = Off]

CONTROL CODES

Control Codes are used to perform certain printer or terminal functions (e.g. backspace, form feed, etc.) and also handshaking functions for serial data transfer (e.g. Enquiry, Acknowledge, etc.). Hex values 0 through 1F and 7F are control codes. The chart below contains the control codes recognized by the 2673A.

MNEMONIC	SYMBOL	KEYS	DECIMAL EQUIVALENT	DESCRIPTION
NUL	$^{N}_{U}$	CNTL @	0	Null; usually used as a fill character for timing purposes. Null has no other function except as an 8-bit character in graphics mode.
ENQ	$^{E}_{Q}$	CNTL E	5	Enquiry; received by printer from the host computer or controller. Printer will respond with an ACK when ready to accept data. (This code used for RS-232C interfacing only).
ACK	$^{A}_{K}$	CNTL F	6	Acknowledge; transmitted by printer in response to an ENQ from the host computer or controller. Indicates that the printer is ready to accept data. (This code used for RS-232C interfacing only).
BEL	🔔	CNTL G	7	Bell; causes the printer to beep.
BS	$^{B}_{S}$	CNTL H	8	Backspace; moves the character position one space toward the left margin.
HT	$^{H}_{T}$	CNTL I	9	Horizontal Tabulation; moves the printhead to the next preset tab stop to the right of the present position. If no tabs are set, printer will perform a CR/LF.
LF	$^{L}_{F}$	CNTL J	10	Line Feed. Advances the paper one line.
FF	$^{F}_{F}$	CNTL L	12	Form Feed; Advances the paper to the first printable line on the next page.

(continued on next page)

CONTROL CODES (continued)

MNEMONIC	SYMBOL	KEYS	DECIMAL EQUIVALENT	DESCRIPTION
CR	$^{C}_{R}$	CNTL M	13	Carriage Return; moves the printhead to the left margin. Does not advance paper.
SO	$^{S}_{O}$	CNTL N	14	Shift Out; selects the currently-designated secondary character set to be active for printing operations.
SI	$^{S}_{I}$	CNTL O	15	Shift In; selects the currently-designated primary character set to be active for printing operations.
DC1	$^{D}_{1}$	CNTL Q	17	Device Control 1; trigger for output status request. Used as an XON handshake character for RS-232C interfacing.
DC3	$^{D}_{3}$	CNTL S	19	Device Control 3; used as an XOFF handshake character for RS-232C interfacing.
ESC	$^{E}_{C}$	CNTL [	27	Escape; indicates that the characters immediately following are part of a command sequence.

SELF-TEST / TROUBLESHOOTING

4

INTRODUCTION

This section explains the various self tests available in the 2673A, and how these tests may be used for troubleshooting. Through use of these tests, the failing board or socketed component can be isolated, and troubleshooting can be easily accomplished within a minimal amount of time. For specific help in diagnosing problems associated with the Power Supply or TPM, refer to the appropriate section headings.

PRELIMINARY CHECKS

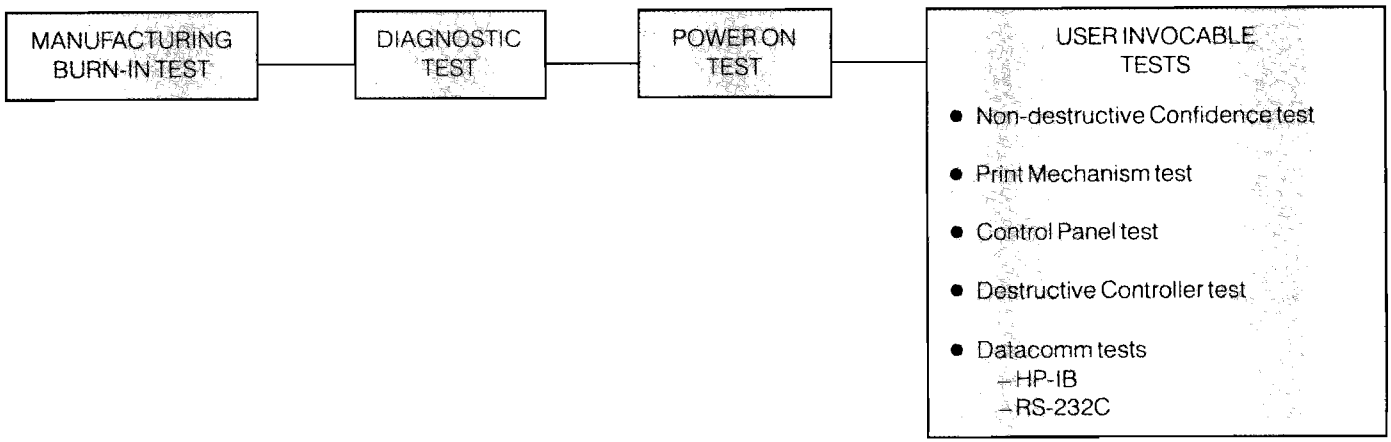
If the 2673A should fail to come up after power-on, a few preliminary checks should be performed before self-test diagnosis is attempted:

- Check the external line fuse and the fuse located on the power supply (F1). If F1 is blown, turn the printer power off, pull connectors J11, J12, and J13, replace F1, and turn the printer back on. If F1 blows again, the power supply is probably defective and should be replaced.

- Check that the TPM latch is fully closed and paper is installed.
- Check all internal and external cable connections.
- Check all socketed components for proper alignment (i.e. no bent pins) and firm seating.
- If the self test character display LED (located on the processor board) displays a ".8", refer to Table 4-1 for probable causes. If the LED is blank and the printer still fails to perform, check for power supply problems or incorrect voltage configuration (refer to Section 2 for proper line voltage switch settings).

SELF TEST FEATURES

..... Four modes of testing are available in the 2673A, using a total of 8 tests. These tests are illustrated below:



Use of these tests can verify the integrity of the following areas:

– Z80 Processor	(Functional)
– Firmware ROMs	(Present, correct ID, correct checksum)
– Static RAMs	(Functional)
– Character ROM	(Present, correct ID, correct checksum)
– Optional character ROM or Demo ROM	(Correct ID, correct checksum)
– EAROM	(Correct Initialization, correct checksum)
– 16 ms Timer	(Functional)
– HP-IB Interface	(Present, functional registers)
– RS-232C Interface	(Present, functional data loopback, baud rate timing, byte configuration, control lines, interrupts)
– Parallel Interface	(Present)
– Thermal Print Mechanism (TPM)	(Present, functional processor, correct ROM checksum, functional RAM, paper present and door closed)
– Control Panel	(Functional)

All of the above tests turn on the front panel LEDs when initiated. Successful completion of a test causes the 2673A to beep and turn off all LEDs except for the POWER ON indicator. When an error is encountered, the self-test character display LED located on the Processor board will indicate the error condition or an error message will be printed. **Table 4-1** contains error codes and corrective actions. **Table 4-2** explains messages.

POWER-ON TEST ..... This test is invoked automatically at POWER-ON. Time to complete is approximately 2 seconds. If the test is successful, the printer will beep and all front panel LEDs will turn off except the POWER-ON LED. No information will be printed for successful completion. Fatal errors will be displayed in the self test character display LED, and non-fatal errors will be printed. Refer to **Table 4-1** for error codes and corrective action. **Table 4-2** explains printed error messages. The following modules are tested during POWER-ON Test:

- Z80 Processor
- Firmware ROMs
- Static RAMs
- TPM
- Character ROM
- Optional Character ROM or Demo ROM
- EAROM
- 16 ms Timer
- Datacomm

Setting switches 1 & 2 on the Processor board both OPEN (i.e. 00) will allow the POWER-ON test to be invoked at each power-on cycle. As the test starts, the TPM will make one sweep back and forth with the print head. When the test concludes successfully, the printer will beep and initialize itself to the configuration stored in the EAROM.

USER INVOCABLE TESTS

Non-Destructive Confidence Test ..... This test is similar to the Power On test in all respects except the test on RAM, where it performs a non-destructive test in the form of a READ, COMPLEMENT, STORE, and COMPARE operation twice on each location of RAM to verify it and leave it in its original state. If the test is successful, the printer will beep and all front panel LEDs will turn off except the POWER ON LED, plus the message **"Self Test OK"** will be printed. Time to complete is approximately 2 seconds. Errors that are non-fatal will be printed, and errors that are fatal will be displayed in the self test character display LED (refer to **Table 4-2** for error message interpretation, and **Table 4-1** for error codes and corrective action).

To invoke this test, perform the following functions:

1. Ensure switches 1 & 2 on the Processor board are both set OPEN prior to Power On.
2. Depress the **TEST** key on the control panel; the following menu is printed:

```
SELF TEST:    CONFIDENCE I PRINT MECH I CONTROL PANEL I CONTROLLER I DATACOMM
```

3. Press the **SELECT** key (the CONFIDENCE parameter will be underlined immediately after selection).
4. Successful completion results in the message **"Self Test OK"** being printed and the printer being set back to its original state.
5. Errors are displayed either in the self test character display LED, or else are printed in an error message (if the error is non-fatal). The LED indication is in the format "– A . B . C" where A, B, and C each remain on for one half second and pertain to error isolation codes as defined in **Table 4-1.** Printed error messages will state the module that failed (e.g. DATACOMM FAILURE), followed by the 3 letter error code. Refer to **Table 4-2** for error message interpretation. Printed error messages will be displayed once, and the test will attempt to continue. Fatal error codes displayed in the LED will continue to loop unless the **RESET** key is held in for several seconds, at which time the printer will attempt to print the message "**IGNORING FAILURE ABC**", where ABC represents the error code. The printer will then attempt to reinitialize itself.

Print Mechanism Test ..... This test verifies the function of the Thermal Print Mechanism (TPM) controller, checks the character set ROMS for presence, correct ID and checksum, and also prints a character set test pattern. Displayed are the Line Drawing set, Roman Extension set, USASCII set, Expanded print sample, Normal print sample, Compressed print sample, Enhancements (Bold, Framed, Underlined, and Combinations), and a TPM alignment pattern (see **Figure 4-1**). If the test is successful, the printer will beep and all front panel LEDs will turn off except the POWER-ON LED, plus the message "**Self Test OK**" will be printed. Time to complete is approximately 11 seconds. Errors that are non-fatal will be printed, and errors that are fatal will be displayed in the self test character display LED (refer to **Table 4-2** for error message interpretation, and **Table 4-1** for error codes and corrective action).

To invoke this test, perform the following functions:

1. Ensure switches 1 & 2 on the Processor board are both set OPEN prior to Power On.
2. Depress the **TEST** key on the control panel; the following menu is printed:

```
SELF TEST:      CONFIDENCE | PRINT MECH | CONTROL PANEL | CONTROLLER | DATACOMM
```

3. Using the **▶▶** key, position the printhead immediately before the PRINT MECH parameter and press the **SELECT** key (it will be underlined immediately after selection).
4. Successful completion will result in the aforementioned print pattern being displayed, followed by the message "**Self Test OK**". The printer will then be set back to its original state.

5. Errors are displayed either in the self test character display LED, or else are printed in an error message (if the error is non-fatal). The LED indication is in the format "– A . B . C" where A, B, and C each remain on for one half second and pertain to error isolation codes as defined in **Table 4-1**. Printed error messages will state the module that failed (e.g. CHARACTER ROM FAILURE), followed by the 3 letter error code. Refer to **Table 4-2** for error message interpretation. Printed error messages will be displayed once, and the test will attempt to continue. Fatal error codes displayed in the LED will continue to loop unless the user holds the **RESET** button in, at which time the printer will attempt to print the message "**IGNORING FAILURE ABC**", where ABC represents the error code. The printer will then attempt to reinitialize itself.

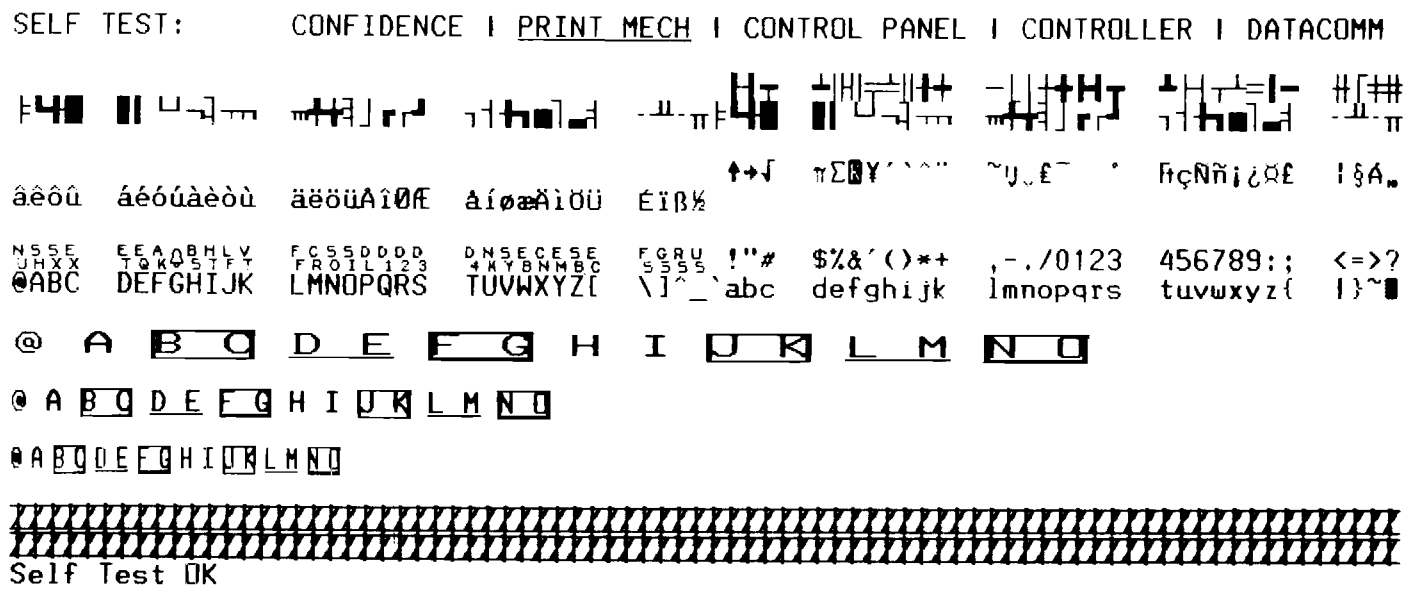


Figure 4-1. Print Mech Test Pattern

Control Panel Test ..... This test allows functional verification of all front panel keys. It may be invoked either by selecting the CONTROL PANEL test through means of the front panel TEST switch, or else by setting an internal switch on the Processor board prior to Power On (this is necessary in case the front panel TEST switch is non-operative). If the test is successful, the printer will beep each time the correct key is depressed. Failure to beep indicates non-contact of that switch, and stuck keys are displayed in a printer error message.

To invoke this test, perform the following functions:

1. Ensure switches 1 & 2 on the Processor board are both set OPEN, unless the test is to be invoked immediately after Power On; in this case set switch 1 OPEN and switch 2 CLOSED prior to Power on. If using these switches, skip to step 4 below.

2. **Depress** the TEST key on the control panel; the following menu is printed:

```
SELF TEST:      CONFIDENCE | PRINT MECH | CONTROL PANEL | CONTROLLER | DATACOMM
```

3. Using the ▶▶ key, position the printhead immediately before the CONTROL PANEL parameter and **press** the SELECT key (it will be underlined immediately after selection).

4. A message will be printed out, instructing the user to depress each key, left to right, top to bottom.

5. As each key is pressed in its proper order, an audible beep will be heard. After successful completion of testing each key, the message "**Self Test OK**" will be printed, and the printer will return to its original state.

6. Errors are detected by a lack of an audible beep (for keys which don't make contact) or, for stuck keys, the message "**CONTROL PANEL FAILURE C1x**" will be displayed, where "**x**" represents the number of the key that is stuck. Keys are numbered left to right, top to bottom, with FORM FEED number 1 and ▶▶ number 8. The only way to exit the control panel test if an error is encountered is to cycle the printer power after resetting switches 1 & 2.

Destructive Controller Test ..... This test is similar to the Power On test in all respects. If the test is successful, the printer will beep and all front panel LED's will turn off except the POWER ON LED. The message **"Self Test OK"** will be printed, followed by ROM identification data, which identifies the part numbers and date codes of each installed ROM. Time to complete is approximately 2 seconds. Errors that are non-fatal will be printed, and errors that are fatal will be displayed in the self test character display LED (refer to **Table 4-2** for error message interpretation, and **Table 4-1** for error codes and corrective action).

To invoke this test, perform the following functions:

1. Ensure switches 1 & 2 on the Processor board are both set OPEN prior to Power On.

2. Depress the **TEST** key on the control panel; the following menu is printed:

```
SELF TEST:      CONFIDENCE | PRINT MECH | CONTROL PANEL | CONTROLLER | DATACOMM
```

3. Using the **▶▶** key, position the printhead immediately before the CONTROLLER parameter and **press** the **SELECT** key (it will be underlined immediately after selection).

4. Successful completion will result in the message **"Self Test OK"** being printed. The printer will then display identification data for all installed ROM's, displaying part number, date code, and a description of the ROM contents. After this the printer will reinitialize itself back to its Power-On state.

5. Errors are displayed either in the self test character display LED, or else are printed in an error message (if the error is non-fatal). The LED indication is in the format "– A . B . C" where A, B, and C each remain on for one half second and pertain to error isolation codes as defined in **Table 4-1.** Printed error messages will state the module that failed (e.g. DATACOM FAILURE), followed by the 3 letter error code. Refer to **Table 4-2** for error message interpretation. Printed error messages will be displayed once, and the test will attempt to continue. Fatal error codes displayed in the LED will continue to loop unless the **RESET** key is held in for several seconds, at which time the printer will attempt to print the message "**IGNORING FAILURE ABC**", where ABC represents the error code. The printer will then attempt to reinitialize itself.

Data Communication Tests

The HP-IB and RS-232C interfaces can be tested by means of user-invocable self-tests; there is no self test available for checking the parallel interface. Both self tests are described below.

HP-IB Test

This test verifies the presence of the HP-IB hardware and performs a read/write check of the interface registers on the Intel 8291A. No exhaustive testing is done, because to do so would require an external HP-IB controller. If the test is successful, the printer will beep and all front panel LED's will turn off except the POWER ON LED, plus the message "**Self Test OK**" will be printed. Time to complete is approximately 2 seconds. Errors will be displayed in a printed error message (refer to **Table 4-2** for error message interpretation, and **Table 4-1** for error codes and corrective action).

To invoke this test, perform the following functions:

1. Ensure switches 1 & 2 on the Processor board are both set OPEN prior to Power On.

2. Depress the **TEST** key on the control panel; the following menu is printed:

```
SELF TEST:      CONFIDENCE | PRINT MECH | CONTROL PANEL | CONTROLLER | DATACOMM
```

3. Using the **▶▶** key, position the printhead immediately before the DATACOMM parameter and **press** the **SELECT** key (it will be immediately underlined after selection).

4. Successful completion will result in message "**Self Test OK**" being printed, and the printer being set back to its Power-On state.

5. If an error is detected, the message "**DATACOMM FAILURE ABC**" will be printed, where A, B, and C represent an error code as defined in **Table 4-1**. The self test character display LED will dispay an "**E**", indicating the occurance of a non-fatal error.

RS-232C Test ..... This test performs internal data loopback tests, baud rate checking, various byte configuration checks, and interrupt checking of the printer interface. A special test hood (part no. 02620-60062) is required to perform this test completely, although certain checks can be performed without a test hood. The levels of testing are defined as: Level 0, no test hood or external loopback device present; Level 1, loopback device present (detected by presence of CLEAR TO SEND (CB) signal); and Level 2, test hood present. If Level 1 is to be used with an external interface that does not support data loopback, an error message will be printed; in this case, disconnect the interface cable and perform the Level 0 or Level 2 (using test hood) test. Tests performed for each level are described below:

LEVEL	TESTS PERFORMED
0	Transmit, Receive, and Interrupt capabilities of the interface chip; internal hardware data loopback; configured baud rate*, parity and data byte configurations.
1	Transmit, Receive, and Interrupt capabilities of the interface chip; internal hardware data loopback; configured baud rate†, parity and data byte configurations; external data loopback (if CLEAR TO SEND (CB) is present) at the user defined configuration parameters.
2	Transmit, Receive, and Interrupt capabilities of the interface chip; internal hardware data loopback; configured baud rate*, parity and data byte configurations; external data loopback; modem control signals (CH, CB, CF, SCF,and CE).

NOTE

*If configured for EXTERNAL baud rate, no data loopback tests can be performed; reconfigure to some internal baud rate and re-run test.

NOTE

†If configured for EXTERNAL baud rate, the printer will assume that the external looping device is supplying the clock. Data loopback checks will be performed at that baud rate.

If the test is successful, the printer will beep and all front panel LED's will turn off except the POWER ON LED, plus the message "**Self Test OK**" will be printed. Time to complete is dependent upon the configured baud rate, with the slowest baud rate (110 baud) taking the greatest amount of time to complete the test. Errors will be displayed in a printed error message (refer to **Table 4-2** for error message interpretation, and **Table 4-1** for error codes and corrective action). At the time each test is entered, a message will be printed indicating which test Level (0, 1, or 2) is being run.

To invoke this test, perform the following functions:

1. Ensure switches 1 & 2 on the Processor board are both set OPEN prior to Power On.

2. If the test is to be run without a test hood or external interface attached, go to step 4. If an external interface is to be used, leave the cable to the printer connected and go to step 4.

3. Connect test hood 02620-60062 to the rear connector of the printer.

4. **Depress** the **TEST** key on the control panel; the following menu is printed:

```
SELF TEST:      CONFIDENCE | PRINT MECH | CONTROL PANEL | CONTROLLER | DATACOMM
```

5. Using the **▶▶** key, position the printhead immediately before the DATACOMM parameter and **press** the **SELECT** key (it will be immediately underlined after selection).

6. A message will be printed indicating what level of test is being performed.

7. Successful completion will result in the message "**Self Test OK**" being printed and the printer being reinitialized to its Power-On state.

8. If an error is detected, the message "**DATACOMM FAILURE ABC**" will be printed, where A, B, and C represent an error code as defined in **Table 4-1**. The self test character display LED will display an "**E**", indicating the occurance of an error.

MANUFACTURING BURN-IN TEST

This test is a continuous loop test that checks all printer modules except the continuity portion of the control panel test. It is a useful test for troubleshooting intermittently failing units. As the tests execute successfully, once each hour the printer will display the TPM self test pattern. Errors that are non-fatal will be printed, and errors that are fatal will be displayed in the self test character display LED (refer to **Table 4-2** for error message interpretation, and **Table 4-1** for error codes and corrective action).

To invoke this test, perform the following functions:

1. With the printer powered off, close switches 1 & 2 on the Processor board.

2. Power the printer on; the TPM should display the character sets and the TPM alignment pattern.

3. If the test executes successfully, the pattern displayed on the printer will be repeated approximately once each hour. As the test is executing, the printer will beep at the end of each test loop, and the self test character display LED will display the test number of each test as it is being run.

4. To exit the test, power off the unit and reset switches 1 & 2.

5. Errors are displayed either in the self test character display LED or in a printed error message (if the error is non-fatal). The LED indication is in the format "– A . B . C" where A, B, and C each remain on for one half second and pertain to error isolation codes as defined in **Table 4-1.** Printed error messages will state the module that failed (e.g. DATACOM FAILURE), followed by the 3 letter error code. Refer to **Table 4-2** for error message interpretation. Error messages or codes will continue to loop unless the **RESET** key is held in for several seconds, at which time the printer will attempt to abort the test. The message "**RESET abort of Manufacturing Test**" or "**IGNORING FAILURE ABC**" may be printed, plus the printer will attempt to reinitialize itself.

NOTE

An alternate method of selecting this test without using internal switches 1 & 2 is as follows:

1. Ensure switches 1 & 2 on the Processor board are set to their normal position prior to Power On (i.e., both OPEN).

2. Press and hold the TEST key.

3. Simultaneously press the FORM FEED , PAPER FEED , and RESET keys, then release the TEST key.

4. The test will begin executing by printing the character sets and the TPM alignment pattern.Thereafter, this pattern will be repeated approximately once each hour.

This method sets a Flag in the EAROM that causes the test to execute each time the unit is powered on. The only method for clearing this flag is to abort the test by holding in the RESET key for several seconds. The message "RESET abort of Manufacturing Test" will be displayed.

DIAGNOSTIC TEST ..... This test is a continuous loop test that checks all printer modules except the continuity portion of the control panel test. Nothing is ever printed during this test, and all errors (fatal and non-fatal) will be displayed in the self test character display LED (refer to **Table 4-1** for error codes and corrective action).

To invoke this test, perform the following functions:

1. With the printer powered off, close switch 1 and open switch 2 on the Processor board.

2. Power the printer on; the test will immediately begin to execute.

3. As the test executes successfully, the printer will beep at the end of each test loop, and the self test character display LED will display the test number of each test as it is being run.

4. The only way to abort the test is to power the printer off and reset (OPEN) switch 1 on the Processor board.

5. Errors are displayed in the self test character display LED in the format "– A . B . C" where A, B, and C each remain on for one half second and pertain to error isolation codes as defined in **Table 4-1**. When an error is encountered, the self test character display LED will display the error, and then the series of diagnostic tests will start over at the beginning.

POWER SUPPLY CHECKS

Voltage levels can be measured for correct tolerance at certain labeled test points on the Processor PCA. The table below gives the voltages and acceptable levels, plus power supply connectors carrying those voltages:

VOLTAGE	ACCEPTABLE LEVELS	POWER SUPPLY CONNECTORS CARRYING THIS VOLTAGE
+5V	4.85V to 5.15V	J11 pins 2 & 3 J13 pins 12, 13, 14
+16.1V	15.6V to 16.6V	J12 pins 3 & 4 J13 pin 4
−12V*	−13.2V to −10.8V	J13 pin 8
−28V	−30.8V to −25.2V	J13 pin 2
+12V	11.4V to 12.6V	J13 pin 6
GND		J11 pins 1 & 4 J12 pins 1 & 2 J13 pins 1, 3, 5, 7, 9, 10

If any of the voltages should measure out of tolerance, the power supply should be replaced.*

* −12V is used only by the RS-232C interface. If this interface is not present, this voltage may measure out of tolerance even though the supply is not defective.

If fuse F1 on the power supply is blown, it usually indicates a defective crowbar circuit. To check, turn the printer power off, disconnect J11, J12 and J13, replace F1, and turn the printer back on. If F1 blows again, the power supply is defective and should be replaced. If F1 does not blow, the processor board is probably defective.

Figure 4-2 shows a back panel wiring diagram.

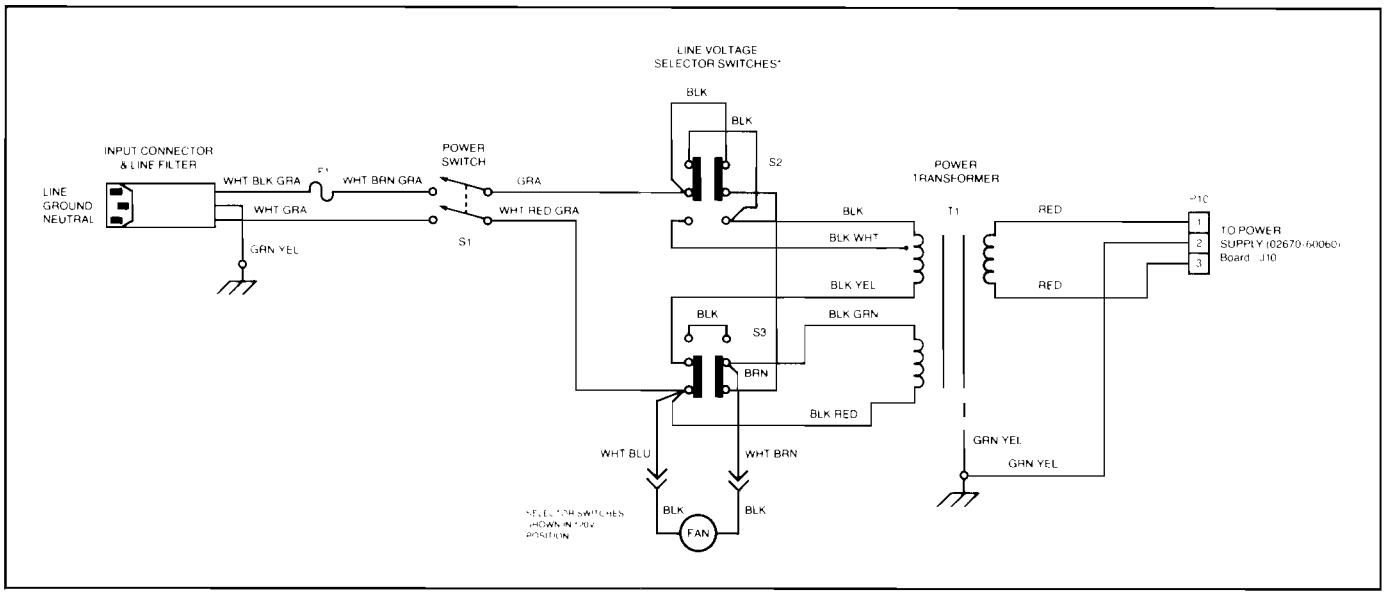


Figure 4-2. Back Panel Wiring.

TPM PROBLEMS ..... For replacement purposes, the TPM is divided into four sections:

1. *Print head cable assembly, P/N 02670-60014*
2. TPM mechanical module (minus print head and PCA), P/N 02670-69091
3. TPM PCA, P/N 02670-60085
4. Cable assemblies:
   (a) TPM power cable, P/N 8120-3388
   (b) TPM logic cable, P/N 8120-3440

If during one of the self tests the self test character display LED displays a "–5.1.0" or a "–5.2.0", the failure is probably in the TPM PCA or cable assemblies. If the TPM is not printing correct characters or if certain dots are missing, the problem may be a faulty print head or TPM PCA. To determine if the print head is defective, use the head load assembly (02670-60029) to check the status of the print mechanism's dot matrix scheme.

CAUTION

A defective TPM PCA may cause a print head replacement to become defective. Before replacing the print head, use the Head Load Assembly to determine if the TPM PCA is working properly.

To use the Head Load Assembly, proceed as follows:

1. Turn off terminal power and open paper door.
2. Raise paper latch and remove paper roll.
3. Carefully disconnect the flex end of the print head cable from the TPM PCA connector (see **Figure 4-3**).

Figure 4-3. Removing Print Head Flex Cable Connector

4. Plug the long connector side of the Head Load Assembly into the TPM PCA connector (see **Figure 4-4**). Ensure that the Head Load Assembly is seated fully into the TPM mainframe.

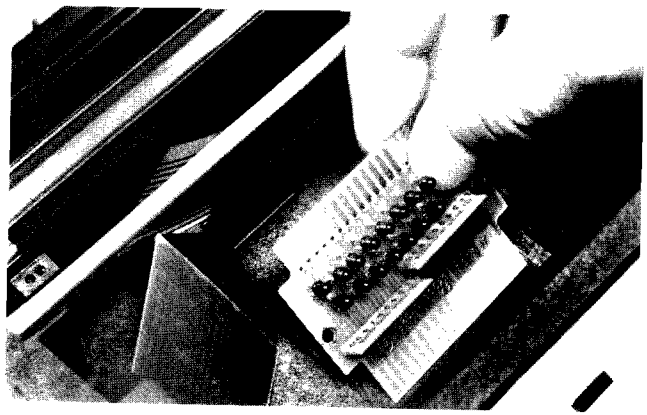


Figure 4-4. Installing Head Load Assembly

5. Place a small piece of paper over the opto-switch (**Figure 4-5**) located inside TPM mainframe near the right side. It may help to tape this piece of paper down to prevent the print head movement from sweeping it away.

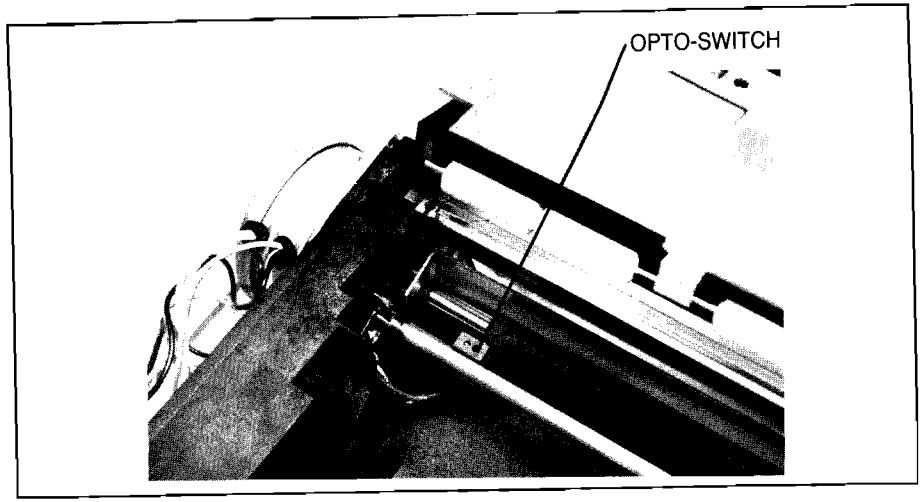


Figure 4-5. Opto-Switch Location

6. Lower and close paper latch.

7. Power the printer up and **press** the TEST key.

8. **Press** the ▶▶ key once, then **depress** the SELECT key. The printer will begin to execute the Print Mech Test.

9. Observe the LED's on the Head Load Assembly. During the test, each LED should blink at least once. If any LED stays on or off continuously during the test, then the TPM PCA is probably defective.

INTERNAL WIRING ..... **Figure 4-6** shows all signal and voltage connections for each cable within the printer.

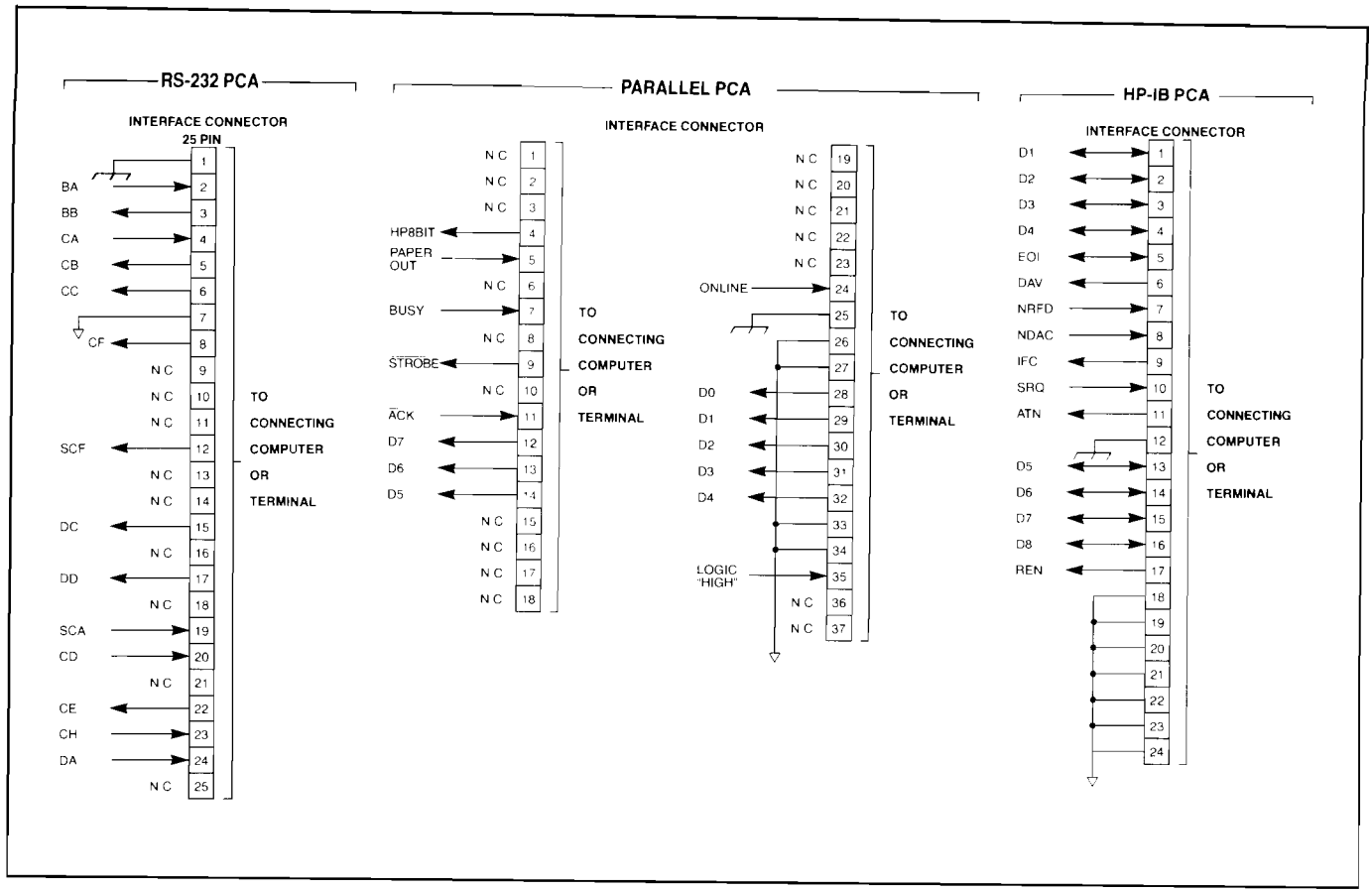


Figure 4-6. Wiring Interconnection

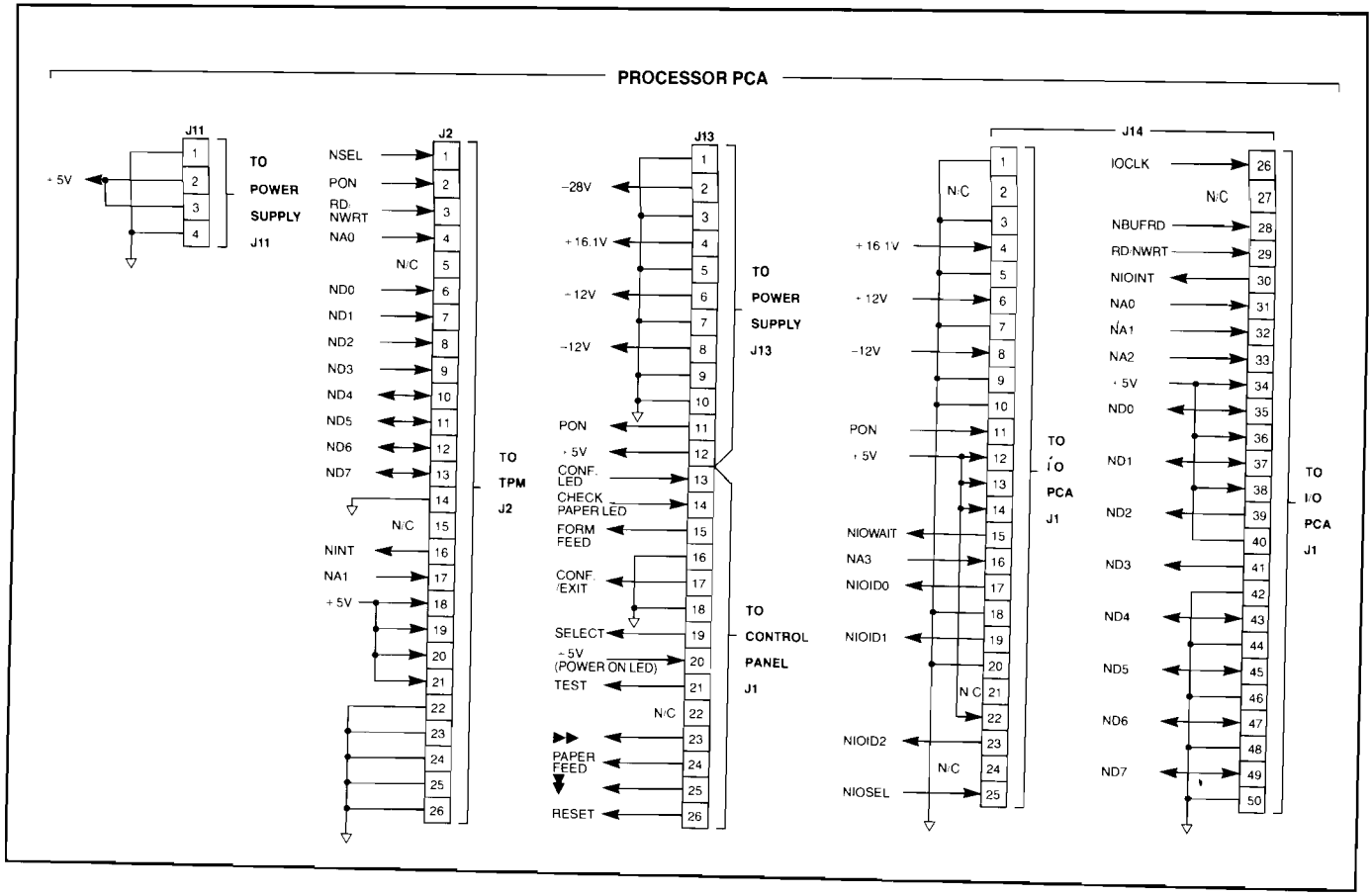


Figure 4-6. Wiring Interconnection

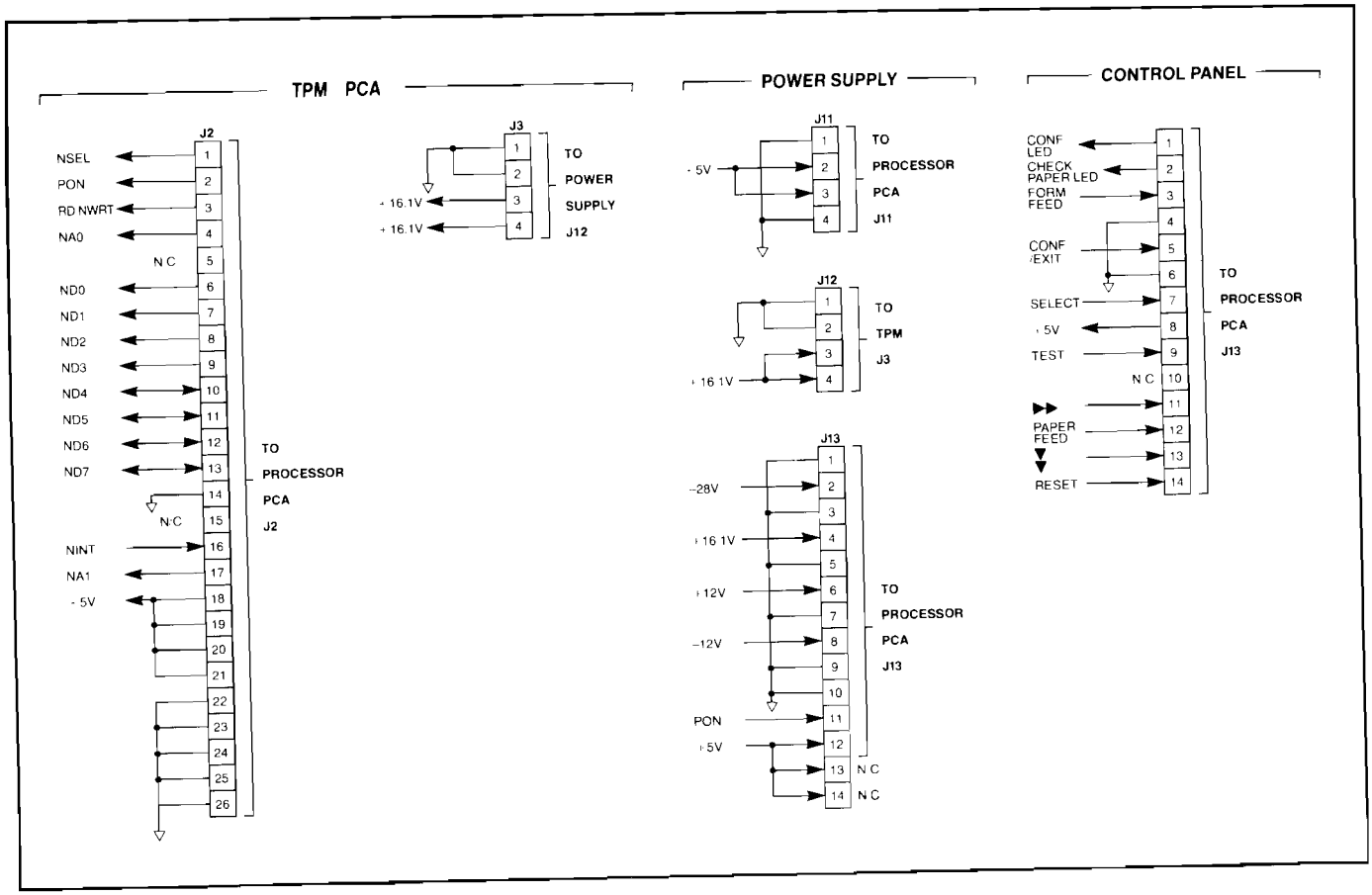


Figure 4-6. Wiring Interconnection

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
6			Character set ROM error	
	1		Standard character set ROM (U501)	
	2		Optional character set ROM or Demo ROM (U601)	
		1	Missing ROM (std. only)	– Rom # 5 (U501) missing – Bad ROM # 5 (U501) – Processor board
		2	Incorrect ROM ID	– ROM in incorrect slot – Bad ROM – Processor board
		3	Checksum error	– Bad ROM – Processor board
7			Timer error	
	1	0	Non-functional	– Processor board – Z80
	2	0	Too fast	– Processor board – Z80
	3	0	Too slow	– Processor board – Z80

(continued on next page)

TABLE 4-1
Error Isolation Codes

ERROR CODES A	ERROR CODES B	ERROR CODES C	MEANING	PROBABLE CAUSES
.8			Basic kernal failure, testing not begun	– Z80 – ROM #1 (U101) – Processor board – ROMs 2 - 6 – RAMs 1 - 3
1			Z80 Processor error	– Z80 – Processor board – ROM #1 (U101) – RAMs 1 - 3
2			Firmware ROM error	
	1		Error with first 8K ROM (U101)	
	2		Error with second 8K ROM (U201)	
	3		Error with third 8K ROM (U301)	
	4		Error with fourth 8K ROM (U401)	
		1	Missing ROM	– ROM not present – Bad ROM – Processor board
		2	Incorrect ROM ID	– ROMs in incorrect slot – Bad ROM – Processor board
		3	Checksum error	– Bad ROM – Processor board

(continued

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
3			RAM error	
	1	0	Error with first 2K of RAM	– Bad RAM 1 (U102) – Processor board – Z80
	2	0	Error with second 2K of RAM	– Bad RAM 2 (U202) – Processor board – Z80
	3	0	Error with third 2K of RAM (optional)	– Bad RAM 3 (U302) – Processor board – Z80
4			Subroutine CALL/stack error	
	1	0	Stack usage error	– Z80 – RAMs 1 - 3 – Processor board
5			TPM error	
	1	0	Not connected	– Cable connections – TPM board – Processor board
	2	0	Self-test failure	– TPM board – TPM assembly – Processor board – Cable connections

(continued on next page)

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
6			Character set ROM error	
	1		Standard character set ROM (U501)	
	2		Optional character set ROM or Demo ROM (U601)	
		1	Missing ROM (std. only)	– Rom # 5 (U501) missing – Bad ROM # 5 (U501) – Processor board
		2	Incorrect ROM ID	– ROM in incorrect slot – Bad ROM – Processor board
		3	Checksum error	– Bad ROM – Processor board
7			Timer error	
	1	0	Non-functional	– Processor board – Z80
	2	0	Too fast	– Processor board – Z80
	3	0	Too slow	– Processor board – Z80

(continued on next page)

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
9			EAROM error	
	1	0	Not initialized	– Perform POWER ON Configuration or RESET CONFIGURATION (see section 3) – EAROM missing or bad (if replaced, will have to be reinitialized) – Processor board – Power Supply
	2	0	Checksum error	–EAROM (if replaced, will have to be reinitialized) – Processor board
A			Datacomm error	
	1	0	Hardware missing	– I/O board missing or bad – Processor board – Z80 – Ribbon cable between Processor and I/O board
	2	0	HP-IB register access error	– HP-IB interface – Processor board – Z80 – Ribbon cable between Processor and I/O board
	3		RS-232C error	
		1	False datacomm interrupt detected	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board

(continued on next page)

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
A	3		RS-232C error (continued)	
		2	False transmit ready state detected	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board
		3	False receiver interrupt detected	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board
		4	Datacomm interrupt not detected	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board
		5	Transmit ready state not detected	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board
		6	Receiver ready state not detected	– RS-232C interface – Processor board – Ribbon cable between Processor and I/O board
		7	Wrong character seen on loopback test	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board

(continued on next page)

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
A	3	7	Wrong character seen on loopback test (continued)	– Interface cable – Failure in external interface
		8	No character returned on loopback test	– RS-232C Interface – Processor board – Printer configured for EXT baud rate, and/or no baud rate present from external loopback device – Ribbon cable between Processor and I/O board – Interface cable – Failure in external interface
		9	Framing error	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board – Interface cable
		A	Parity error	– RS-232 Interface – Processor board – Ribbon cable between Processor and I/O board – Interface cable
		B	Baud rate too fast	– RS-232 Interface – Processor board – Ribbon cable between Processor and I/O board – Interface cable

(continued on next page)

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
A	3		RS-232C error (continued)	
		C	Baud rate too slow	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board – Interface cable
		D	Control signal malfunction	– RS-232C Interface – Processor board – Ribbon cable between Processor and I/O board – Interface cable
b			Printing character set test pattern during manufacturing burn-in test or print mechanism test.	– Paper path problem – TPM – Processor board
C			Control panel error	
	1		Stuck key on control panel keypad	
		1	FORM FEED key	– Control panel – Processor board – Z80
		2	TEST key	– Control panel – Processor board – Z80

(continued on next page)

TABLE 4-1. Error Isolation Codes (continued)

ERROR CODES			MEANING	PROBABLE CAUSES
A	B	C		
C	1		Control panel error (continued)	
		3	CONFIG. EXIT key	– Control panel – Processor board – Z80
		4	SELECT key	– Control panel – Processor board – Z80
		5	PAPER FEED key	– Control panel – Processor board – Z80
		6	RESET key	– Control panel – Processor board – Z80
		7	▼ key	– Control panel – Processor board – Z80
		8	▶▶ key	– Control panel – Processor board – Z80
E			Non-fatal error encountered during a self-test (if printable, will be displayed in a printed error message). Also displayed after user has overridden a fatal error condition with the RESET key.	

Table 4-2
Self Test Messages

NOTE
This table should be used with Table 4-1 to define the error isolation codes, A, B, and C.

MESSAGE	MEANING
CHARACTER ROM FAILURE ABC	Failure in Standard or Optional character set ROM, or Demo ROM.
CONFIGURATION ROM FAILURE ABC	Failure in EAROM test or configuration.
CONTROL PANEL FAILURE ABC	Stuck key encountered during Control Panel test.
DATACOMM FAILURE ABC	Failure in Datacomm interface test.
DATACOMM LOOPBACK HOOD NOT DETECTED	During Manufacturing Burn-in test, the RS-232C datacomm test could not fully test at level 2 due to the absence of the loopback test hood.
EXT BAUD RATE configuration limits datacomm test	Unit is configured for external baud rate; reconfigure for some standard baud rate to fully run DATACOMM test.
IGNORING FAILURE ABC	User has overridden an error condition with the RESET key; printer is reinitialized.
INTERNAL TIMER FAILURE ABC	Failure in System Timer test.
Level 0 Datacomm Test (no loopback device detected)	Entering Level 0 of RS-232C Datacomm test, no test hood or external interface detected.
Level 1 Datacomm Test (external loopback device assumed)	Entering Level 1 of RS-232C Datacomm test, external interface sensed.

(continued on next page)

Table 4-2. Self Test Messages (continued)

MESSAGE	MEANING
Level 2 Datacomm Test (loopback test hood detected)	Entering Level 2 of RS-232C Datacomm test, test hood present.
RESET abort of Manufacturing Test	User has overridden the Manufacturing self test loop with the RESET key.
Self Test OK	Successful completion of self test.

PARTS LIST

5

INTRODUCTION ..... This section includes listings of field replaceable parts and procedures for ordering those parts.

ORDERING REPLACEABLE PARTS ..... To order replaceable parts for the printer or options and accessories, address the order to your local Hewlett-Packard Sales and Service Office listed at the end of this manual. The following information should be included in the order for each part:

1. Complete printer model number (including options and accessories) and serial number.
2. Hewlett-Packard part number.
3. Complete part description as provided in the replacement parts list.

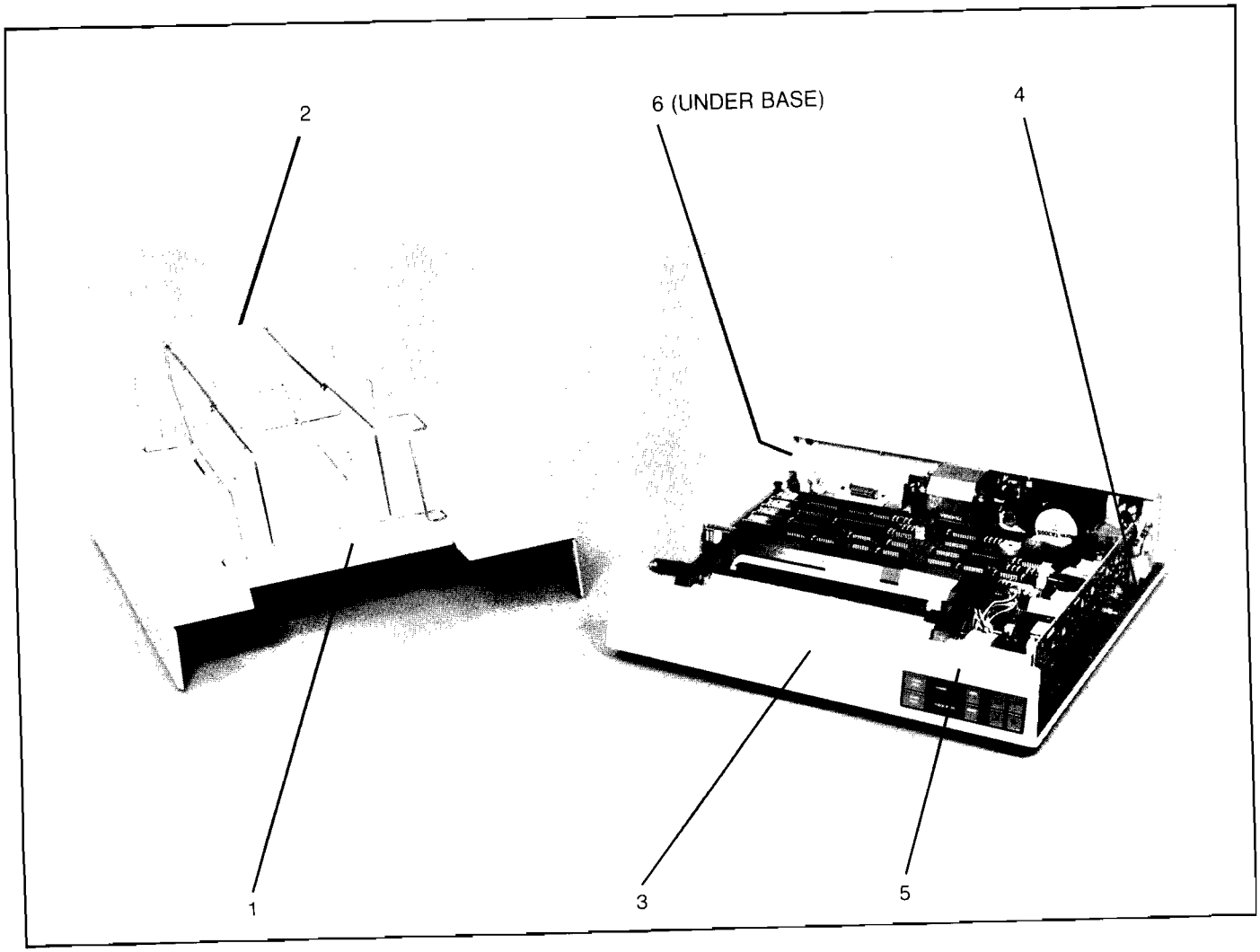


Figure 5-1. External Parts

Table 5-1. External Parts

FIG. & INDEX #	HP PART #	UNITS PER ASSEMBLY	DESCRIPTION
5-1-1	02670-60093	1	Top Cover Assembly
5-1-2	02670-20012	1	Paper Stacker
5-1-3	02670-40038	1	Front Panel
5-1-4	02670-40037	1	Base
5-1-5	7121-2212	1	Nameplate, 2673A
5-1-6	5040-7223	2	Foot, Bottom

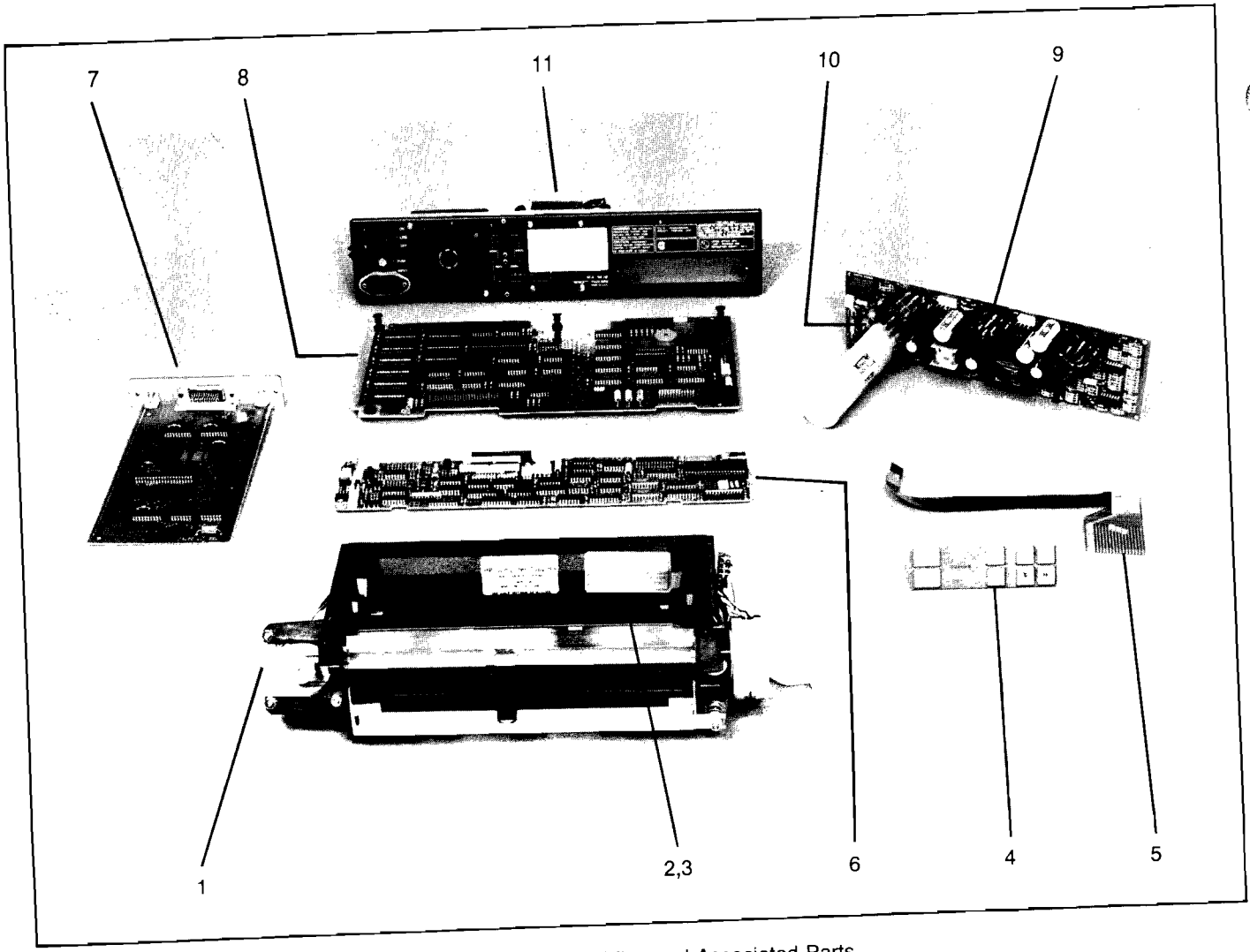


Figure 5-2. Assemblies and Associated Parts

Table 5-2. Assemblies and Associated Parts

FIG. & INDEX #	HP PART NUMBER	UNITS PER ASSEMBLY	DESCRIPTION
5-2-1	02670-69091*	1	Printer Mechanism
5-2-2	1390-0281	2	Snap In Plunger
5-2-3	1390-0104	2	Snap-In Grommet
5-2-4	02670-60081	1	Control Panel
5-2-5	02670-60014	1	Print Head Assembly
5-2-6	02670-60085	1	TPM PCA - DOT
5-2-7	02670-60067	1	HP-IB Interface
5-2-7	02670-60068	1 (Opt 040)	RS-232C Interface
5-2-7	02670-60069	1 (Opt 044 or 042)	Parallel (or Centronics) Interface
5-2-8	02670-60066	1	Processor PCA (without socketed parts)
5-2-9	02670-60060	1	Power Supply
5-2-10	2110-0030	1	Fuse, 5.0A
5-2-11	02670-60063	1	Rear Panel Assembly

*Exchange Part

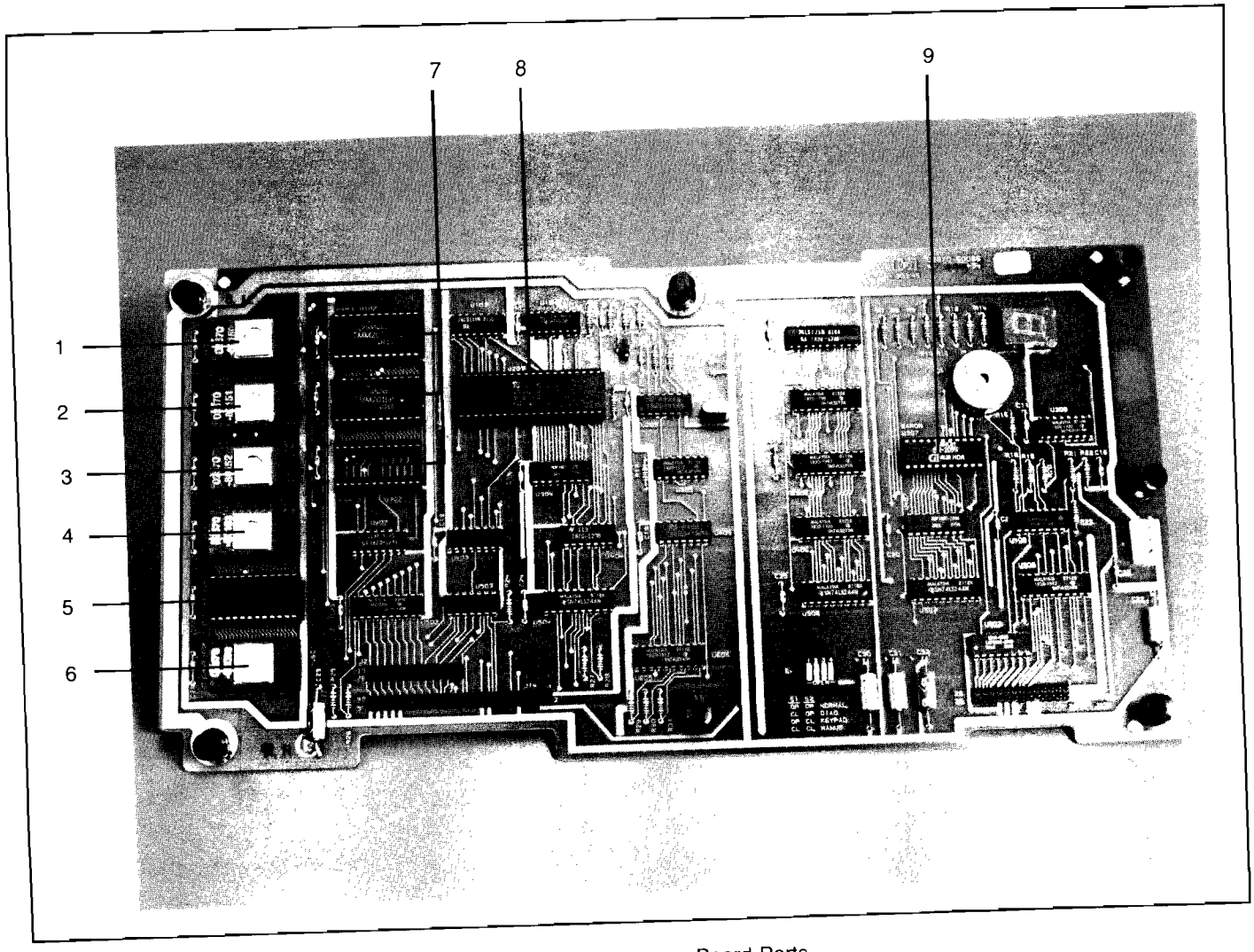


Figure 5-3. Processor Board Parts

Table 5-3. Processor Board Parts

FIG. & INDEX #	HP PART NUMBER	UNITS PER ASSEMBLY	DESCRIPTION
5-3-1	1818-1777	1	ROM # 1
5-3-2	1818-1778	1	ROM # 2
5-3-3	1818-1779	1	ROM # 3
5-3-4	1818-1823	1	ROM # 4
5-3-5	1818-1760	1	Character ROM
5-3-6	N/A	–	Optional Character ROM
5-3-6	02670-80099	–	Optional Demo ROM
5-3-7	1818-1611 or 1818-1718	2 (U302 is optional)	RAM, 2kX8
5-3-8	1820-2298	1	Z80A Microprocessor
5-3-9	1818-1757	1	EAROM

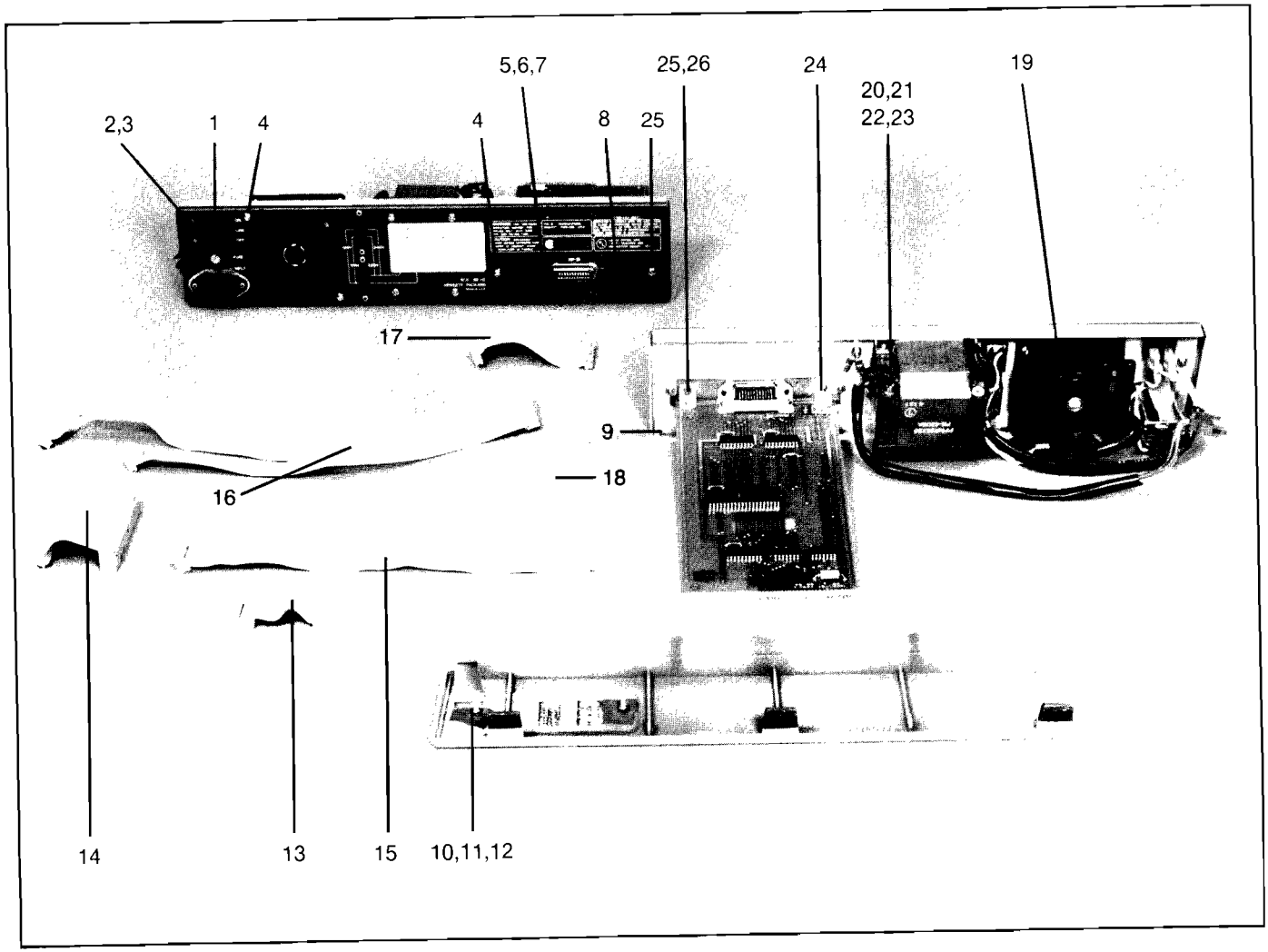


Figure 5-4. Miscellaneous Parts

Table 5-4. Miscellaneous Parts

FIG. & INDEX #	HP PART NUMBER	UNITS PER ASSEMBLY	DESCRIPTION
5-4-1	3101-0402	1	AC Power Switch
5-4-2	2110-0002	1	Fuse, 2.0A (115V)
5-4-2	2110-0094	1	Fuse, 1.25A (230V)
5-4-3	2110-0565	1	Fuseholder Cap
5-4-4	0515-0212	6	Screw, M3.5 × 6mm
5-4-5	0380-1332	2	Hex Jackpost
5-4-6	2190-0074	2	Lock Washer
5-4-7	3050-1072	2	Washer #10
5-4-8	02670-00023	1	HP-IB Panel
5-4-8	02670-00020	1	RS-232C Panel
5-4-8	02670-00018	1	Parallel Panel
5-4-9	0515-0210	4	Screw, M4 × 8mm
5-4-10	0535-0004	2	Hex Nut, M3
5-4-11	2190-0584	2	Lock Washer, 3.0M
5-4-12	3050-0891	2	Flat Washer, M3

(continued on next page)

Table 5-4. Miscellaneous Parts (continued)

FIG. & INDEX #	HP PART NUMBER	UNITS PER ASSEMBLY	DESCRIPTION
5-4-13	8120-3441	1	5V Power Cable
5-4-14	8120-3422	1	I/O Processor Cable
5-4-15	8120-3388	1	TPM Power Cable
5-4-16	8120-3421	1	Control Cable
5-4-17	8120-3440	1	TPM Logic Cable
5-4-18	1400-0611	1	Cable Clamp
5-4-19	02670-60071	1	Fan Assembly
5-4-20	0515-0156	2	Screw, M4 × 60mm
5-4-21	2190-0586	2	Washer, M4 Split Lock
5-4-22	3050-0893	2	Washer, M4 Flat
5-4-23	0390-0006	2	Bushing, Flanged
5-4-24	1400-1130	2	Bracket
5-4-25	2190-0007	4	Washer, Lock #6
5-4-26	0535-0007	2	Hex nut, M3.5

REMOVAL AND REPLACEMENT

6

INTRODUCTION

This section provides instructions for removing and replacing printer assemblies and components designated as field replaceable.

WARNING

Hazardous voltages are present inside the printer. Removal and replacement procedures contained in this section should be performed only by qualified service personnel.

COVER REMOVAL

With the printer power switch set to the OFF position and the power cable disconnected, proceed as follows:

1. Turn printer upside down so that it is resting on its cover.
2. Use a flat-head screwdriver to loosen the six screws that secure the cover to the base.

3. While holding the cover and base firmly together, turn the printer right side up.

4. Lift the rear of the cover first and then lift cover straight up to remove.

COVER REPLACEMENT

1. Ensure the front panel is up and latched into place.

2. With the printer door up for visibility, tilt the cover forward and place over the two flanges on the front panel.

3. Rotate the cover into place and secure from the bottom with the six flat-head screws in the base.

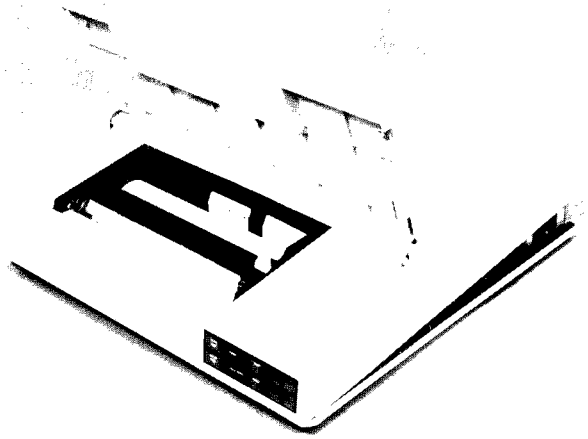


Figure 6-1. Installing Top Cover

PROCESSOR PCA ..... With the cover removed from the unit, remove the Processor PCA as follows:

1. Unsnap the seven snap fasteners that hold the Processor board to the base. The snap fasteners will pull up but not out.
2. Disconnect the four cables that attach to the connectors on the board.
3. Pull the cables clear and lift the Processor board free of the unit.

I/O PCA ..... Remove the I/O PCA as follows:

1. Remove the two pozidrive screws and grounding washers holding the interface card to the rear panel.
2. Slide the PCA out of its connector by pulling rearward on the PCA and remove assembly through the rear panel. The cable connector will remain fixed in its snap-in tab holder.
3. Insert new assembly through rear panel opening and slide along guides until the contacts are firmly seated into the cable connector and the two panels are flush against one another.

POWER SUPPLY PCA ..... With the cover removed, remove the power supply as follows:

1. Remove the Processor PCA as described above.
2. Press in on the tabs that hold the transformer cable to J10 and separate the connectors.
3. Remove the cables that attach to J11, J12, and J13.
4. Remove the PCA by pulling it straight up through the guides on each side.
5. On replacement, ensure both edges of the PCA are set into the guides and the cables are reinstalled.

CONTROL PANEL ..... With the cover removed, remove the control panel as follows:

1. Lift the tab on the right side of the front panel and swing the top of the front panel forward.
2. Remove the cable from the Control Panel.
3. Remove the two hex nuts and washers holding the assembly in place and remove it from the front.

REAR PANEL ..... With the cover removed, replace the rear panel as a complete assembly as follows:

1. Disconnect the transformer cable from the power supply PCA at J10.
2. Remove the two screws on the front of the transformer holding it to the base.
3. Remove the two screws holding the I/O panel to the rear panel and slide the PCA out the rear.
4. Remove the four screws holding the rear panel to the base and remove the panel.

PRINT MECHANISM REMOVAL

..... With the cover removed, replace the print mechanism as follows:

1. Lift the tab latch on the right side of the front panel and swing the top of the front panel forward.

2. Raise the paper latch and remove paper from printer.

3. Unsnap the two snap-fasteners from the bottom of the printer well. The snap fasteners will pull up but not out.

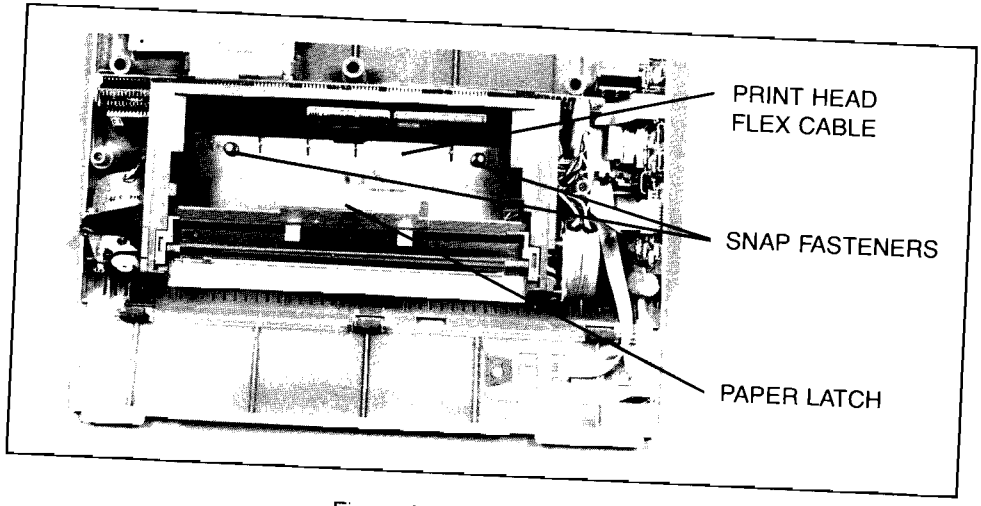


Figure 6-2. Printer Removal

4. Raise the rear of the mechanism approximately ¼ inch so the snap fasteners clear the base and slide it forward approximately ¼ inch.

5. Disconnect the ground strap and the two cables from the rear of the mechanism and lift the assembly free.

PRINT MECHANISM REPLACEMENT

Replace the print mechanism as follows:

1. Place the mechanism on the base and slide it forward so that the two hooks at the bottom of the mechanism drop through the two holes in the base.

2. Connect the two cables. Ensure the 4-wire connector is fully seated.

3. Slide the mechanism backward until the hooks engage the base and the two snap fasteners seat in the corresponding holes.

4. Ensure the bottom of the mechanism sits flush on the base; then press the two snap fasteners into place and connect the ground strap.

PRINTER PCA ..... With the print mechanism removed, remove the printer PCA as follows:

1. Remove the three pozidrive screws at the bottom of the printer PCA.

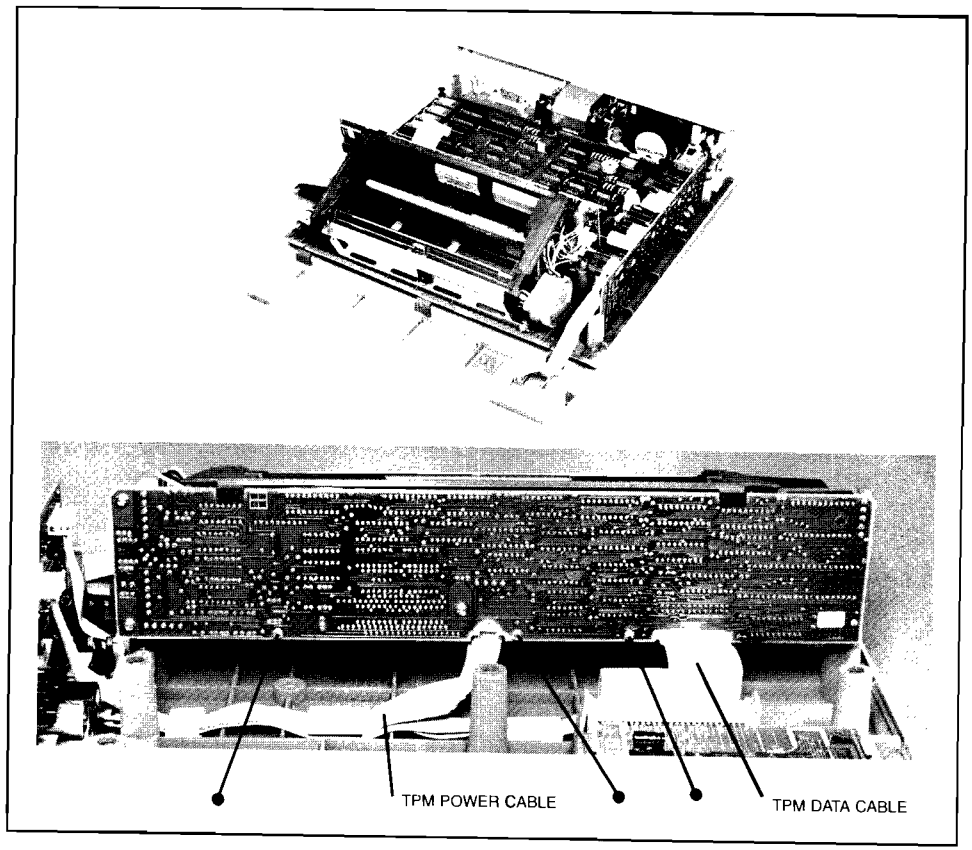


Figure 6-3. Printer Cable Removal

2. Disconnect the cables from the PCA.

PRINT HEAD REMOVAL

Disconnect power cord, remove cover and front panel, and proceed as follows:

CAUTION

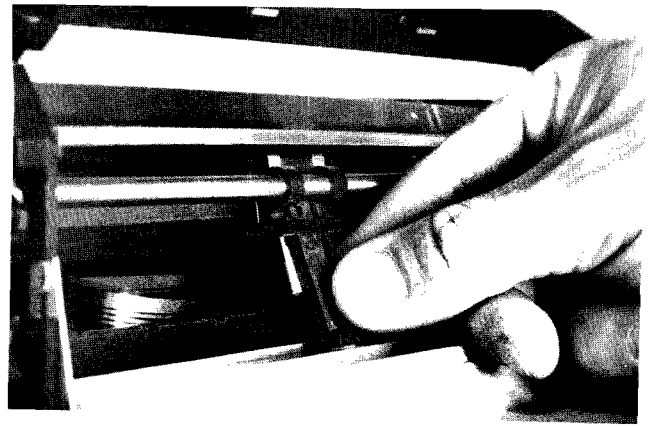
A defective TPM PCA may cause a print head replacement to become defective. Before replacing the print head, use the Head Load Assembly to determine if the TPM PCA is defective. (See Section 4, Troubleshooting.)

1. Remove paper roll and rod.
2. Raise paper latch to gain access to print head.
3. Carefully disconnect print head flex cable from TPM PCA connector (see **Figure 6-2**).
4. Unlatch the two bottom hooks of the head clip securing the print head to the carriage.
5. Remove print head by carefully sliding print head downward through its guide.
6. Remove head and flex cable through front of printer.

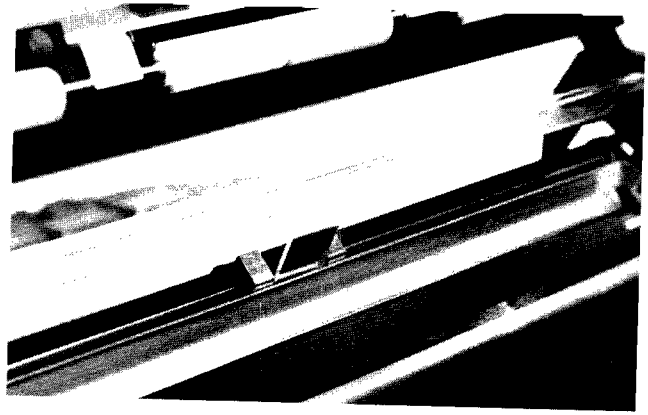
PRINT HEAD REPLACEMENT

Replace the print head as follows:

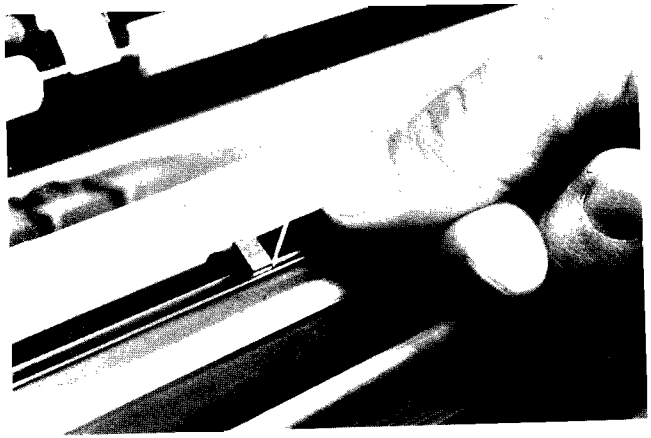
1. With ceramic side facing out, place print head cable underneath rubber roller and gently slide print head into opening underneath head clip.



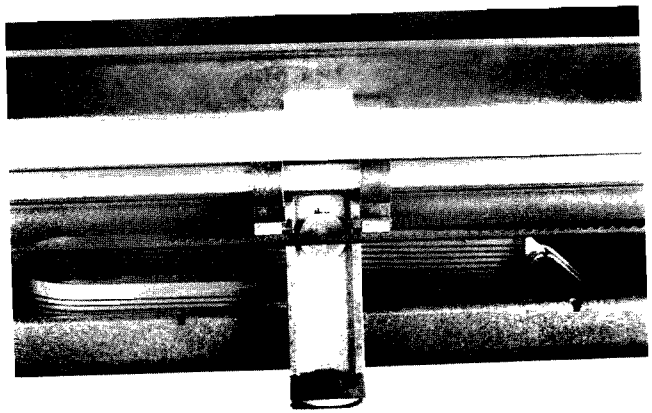
2. Guide print head up through opening in head clip. Print head should extend above metal guide rail by 3/8-inch.



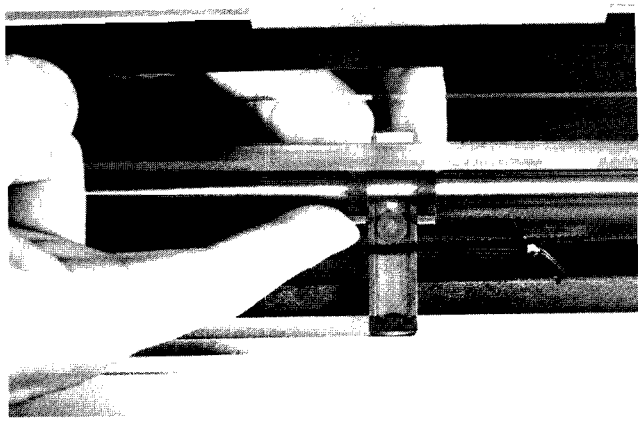
3. Gently push print head down until it bottoms out against a stop.



4. Look through the square hole of the print head carriage and ensure that the print head ceramic is seen in half of the square hole.



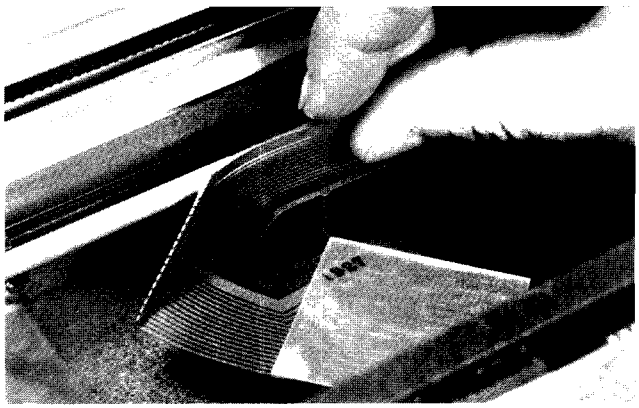
5. Latch the two bottom hooks of the head clip.



6. Make similar fold in flex cable as in defective flex cable and route along TPM trough.

NOTE

To ensure correct folding of flex cable, the replacement cable has been previously creased.



7. With insulated side up, install flex cable into TPM PCA connector (slot in TPM mainframe). Ensure that flex cable is seated fully into TPM PCA connector.

8. Reinstall front panel and top cover.

9. Raise TPM door and paper latch and install paper roll and rod. Lower and secure paper latch.

10. Close TPM door securely and reconnect power cord.

FUNCTIONAL OPERATION

7

INTRODUCTION

The printer consists of a processor assembly, power supply, thermal print mechanism, interface board, and TPM PCA. This section contains a block diagram and theory of operation for each of the modules within the printer.

PROCESSOR

The 02670-60066 Graphics Processor board serves as the main controller for all functions within the printer. The board's functional blocks are described in the following text and illustrated in **Figure 7-1,** Processor Block Diagram.

Microprocessor

The microprocessor circuit forms the core of the Graphics Processor Board. This circuit consists of a Z-80A microprocessor, an oscillator and clock drive circuit, and a wait-state generator circuit. The Z-80A executes programs stored in ROM on this board. These programs implement the feature set of the 2673A. The oscillator and clock drive circuit operate at 4.0 MegaHertz, which dictates the rate that the microprocessor executes its programs. The wait-state generator synchronizes the timing between the Z-80A and the ROM currently being accessed.

The microprocessor most frequently performs one of two basic operations: Memory or I/O. The 2673A Graphics Processor Board treats the ROM and RAM as memory and each of the other functional blocks as I/O. The main difference between memory and I/O operations is in which microprocessor the control lines are used.

ROM ..... The Graphics Processor Board provides 6 sockets for Read-Only Memories. Each of these ROMs is 8K Bytes (64K bits). The four lower order slots (address 0000H – 7FFFH) contain the programs to be executed by the microprocessor. The next order slot (address 8000H – 9FFFH) contains the Character ROM. The Character ROM is a large lookup table filled with Dot Matrix information used in "building" characters. The last ROM slot (address C000H – DFFFH) is for an Option ROM. The Option ROM may be either an additional Character ROM, additional program ROM, or a Demonstration ROM.

RAM ..... There are 3 RAM slots on the board; each will accommodate a 2K Byte (16K bit) Static RAM. The two lower order (address A000H – AFFFH) RAMs are always resident in a standard 2673A. These two RAMS are used to maintain system variables, stacks, system buffers, input buffers, etc. The third RAM is optional and if loaded will be used to expand the input buffer from 2K bytes to 4K bytes (address B000H – B7FFH).

I/O Decoding ..... The I/O Decoding circuit decodes the most significant I/O address lines (A7 – A3) when enabled by the proper Z-80 control lines. This decoding circuit will then enable or clock one of the ten I/O devices on the board.

Interrupt Bank ..... The System Timer, TPM, and I/O Board can all interrupt the microprocessor through circuits in the Interrupt Bank. A combinational logic circuit is used to generate a Z-80 interrupt if any of those devices request interrupt service. The interrupt status of each of those three devices is always presented to the Interrupt Bank. Therefore, by reading the bank, the Z-80 can determine which device is requesting service.

The Z-80 can obtain additional information by reading the Interrupt Bank. The state of two switches resident on the board may be read. These switches are used to invoke one of three self-test modes. Three other lines fed into the Interrupt Bank are used to determine the type of I/O board resident in the 2673A.

System Timer ..... The system timer is used to give the microprocessor a reference for timing long events, such as debouncing the keys on the control panel and programming the non-volatile memory. The timing source is a free-running oscillator with a frequency of 500 Hz (period = 2mS). The 500 Hz source is fed into a counter which performs a divide-by-8 function. This provides an interrupt through the Interrupt Bank to the Z-80 every 16mS.

TPM Interface ..... The Graphics Processor Board drives the TPM through the use of an 8-bit bidirectional bus. This is read and written by the Z-80. Performing a read of the TPM yields its current status (Interrupt Pending, Write Register Ready, Printer On-Line, Printer Ready). Writes may be made to three logical registers on the TPM board; each register performs a different function. The Dot Data Register is used to pass Dot Matrix information to the TPM for printing. The Command register receives functional commands, such as linefeed, selftest, clear, print right or left, etc. The Mask Register allows the processor board to enable and disable interrupts emanating from the TPM.

I/O Board Interface ..... This is a general-purpose interface. It provides the processor board with the ability to read or write up to 16 logical registers on the I/O board. The type of I/O board is determined by the Z-80 through the use of three control lines on this interface. Power for the I/O board is also supplied through this interface; the voltage levels available are +16vdc, +/−12vdc, and +5vdc. Various other signals are also available, including Z-80 read and write cycles.

Control Panel Interface ..... During normal operation, the eight keys on the control panel are scanned by the Z-80 every 16mSec. The Z-80 will respond to the key depressions by initiating the appropriate actions. In many instances, the bell is activated and produces a 500 Hz tone. The bell is considered part of this circuit because it provides part of the user interface. The POWER indicator on the control panel will illuminate whenever +5 volts is applied by the power supply. The CONFIGURE and CHECK PAPER indicators are also controlled from the processor board.

Non-Volatile Memory ..... The Graphics Processor Board provides 64 bytes of non-volatile memory. This is accomplished through the use of a device called an EAROM (Electrically Alterable ROM). The EAROM will maintain the integrity of its data in a power down state for an excess of ten years. Each byte of information contained in this device must be individually erased and written. This operation requires 400mSec per byte to accomplish. The information stored in the EAROM is, for the most part, used in configuration of the 2673A and in certain cases self-test information.

Self-Test Display ..... This simple circuit involves an 8-bit latch driving a seven-segment display. The display is used strictly to provide results of the self-tests executed by the Z-80.

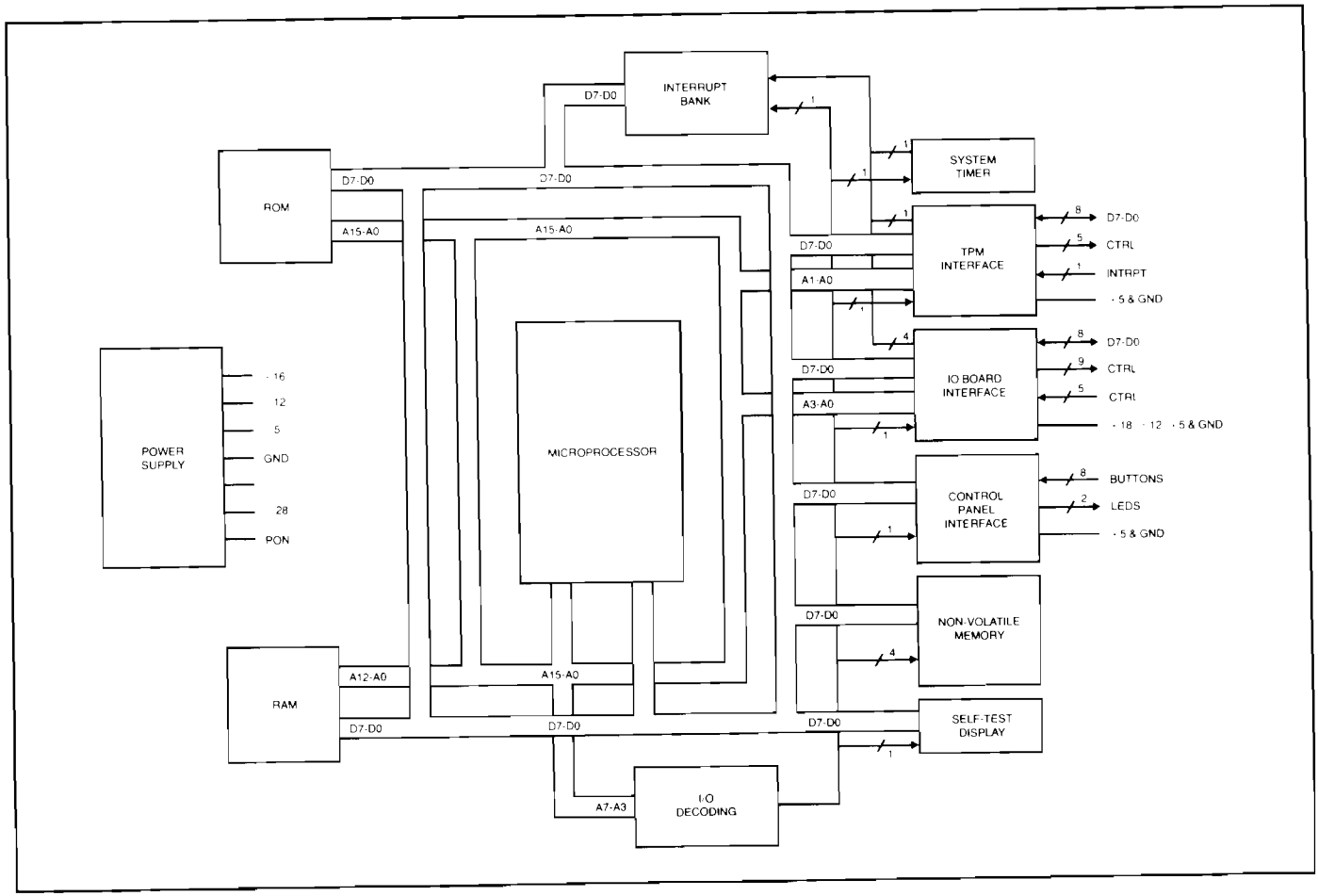


Figure 7-1. Processor Block Diagram

HP-IB I/O

The control lines to the I/O card have been buffered from the host processor and are used by the TPM as well. **(See Figure 7-2, HP-IB Block Diagram.)** Controls going to the 8291A HP-IB Controller chip are A0-A2, POR, and I/O CLK; the only line driving the processor board is the INT line. The eight bidirectional data lines to the controller are also buffered and inverted, thereby programming the chip in a positive-true sense. The Combination Logic circuit uses three control lines (read, write, and enable) to control the read and write functions of the chip and the direction of data flow through the data buffer.

The 8291A Controller IC is an LSI register-oriented chip that handles all standard HP-IB functions. Data intended for printing is received over the bus and passed through the Data Buffer to the 8291A. Should the host request status information, the direction of data flow through the buffer reverses and data passes from the controller to the HP-IB. All data flow is performed under control of the handshake lines (DAV, NRFD, NDAC) as well as the special function HP-IB control lines. See **Figure 2-2** for a pinout of the HP-IB connector.

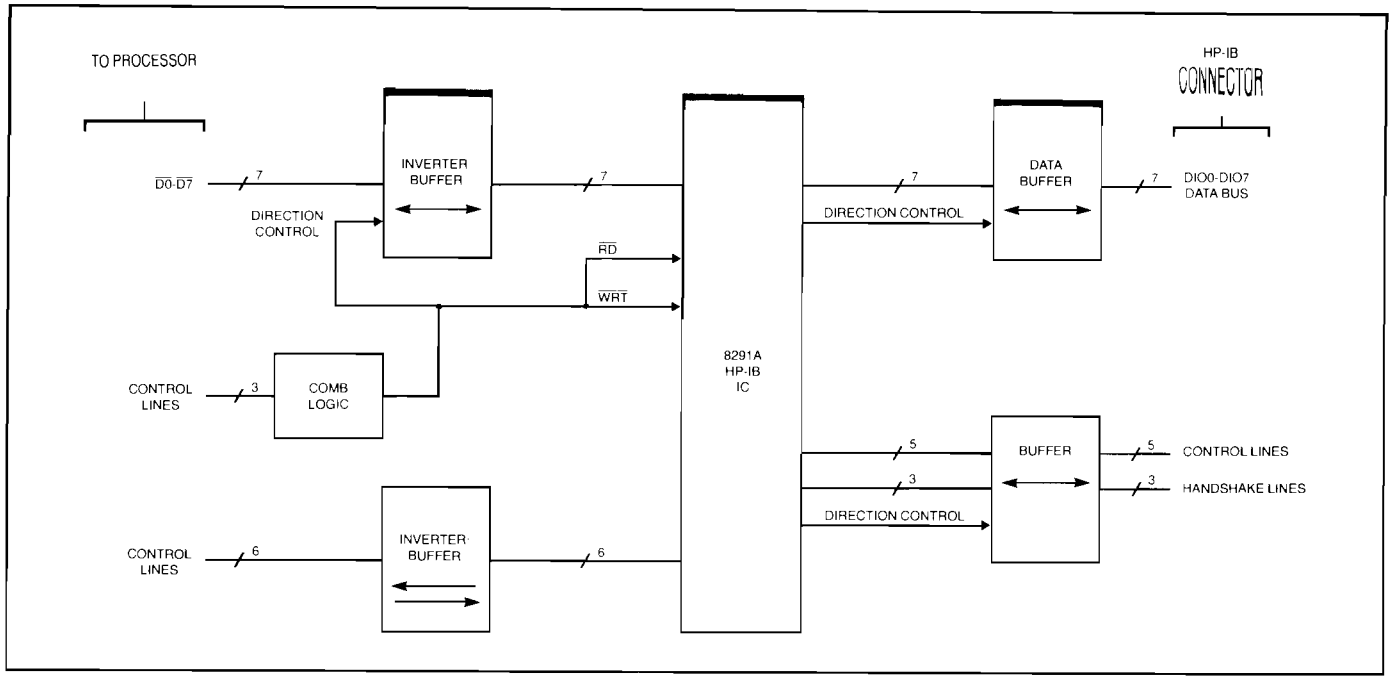


Figure 7-2. HP-IB Block Diagram

RS-232C I/O

The 02670-60068 RS-232C I/O board handles all elements of communication between the printer and the host when Option 040 is ordered. (See Figure 7-3.) The 8251A RS-232C Interface IC is the heart of the board, since it converts the incoming serial data into the parallel data that the printer uses internally. Also, the 8215A converts the printer's parallel status information into serial data for transmission to the host.

On power on, the Processor board writes one byte into the Control Latch. This data controls the Baud Rate Generator as determined by the previously selected Power-On Configuration. The select lines control divider circuits within the generator that divide the 4MHz clock signal to produce a specific output frequency (baud rate). When INT CLK (internal clock) is selected, it is this signal that controls the rate of data flow through the 8251A Interface IC. The 8251A divides this frequency by 16 to produce the actual baud rate. When EXT CLK (external clock) is selected, the host determines the data rate; therefore the 8251A passes data at the same rate as the externally-provided clock. Typically, the generator is driven in the INT/ASYNC mode. In the synchronous mode, the baud rate clock is the same as the bit rate. When the asynchronous mode is selected, the baud rate clock is 16 times the bit rate.

All data is written into the board and read from the board through the Data Bus Buffer. The Combination Logic circuit controls the direction of data flow through the buffer. This circuit also sends signals to other parts of the board, including the 8251A, to control read and write operations and register clocking. The RS-232C Drivers/Receivers block controls miscellaneous lines that are typically used with modems and multipoint pods.

Data to the printer is received on the RECEIVE DATA line, while status data to the host is sent out on the TRANSMIT DATA line. During self test, proper operation of the board and, in particular, the 8251A is checked by writing data to the 8251A, sending it back on itself through the Loopback Logic, and reading that byte back to the processor for comparison.

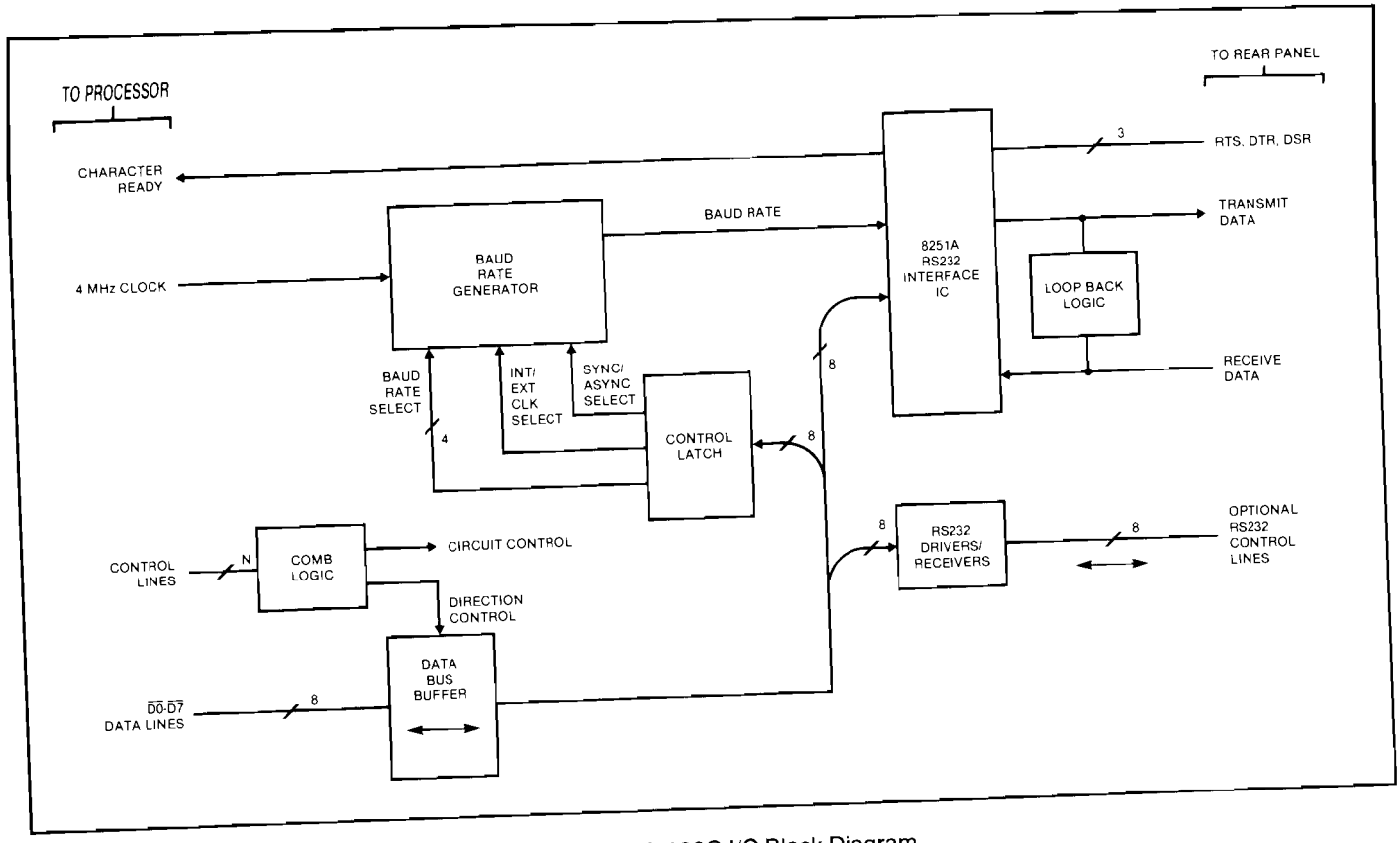


Figure 7-3. RS-232C I/O Block Diagram

PARALLEL I/O

The 02670-60069 board can function as either an HP Parallel Interface or a Centronics interface, depending on the state of the HP 8-BIT line (See **Figure 7-6**.) In the HP mode, data passes through the input latch when the DATA STROBE line is set low by the terminal. The strobe pulse sets the CHAR READY line low; this line is examined when the processor board periodically reads the status of the interface board. The processor recognizes a new data byte is present and reads the data register when buffer space is available. The processor reads this register by writing a specific code to the Decoder Register, which generates a low on the READ DATA line.

Once the processor reads the data byte, it writes another code to the Decoder Register to pull the ACK line low (see **Figure 7-4**). The terminal responds by pulling DATA STROBE high. It is then ready to place another byte on the data bus.

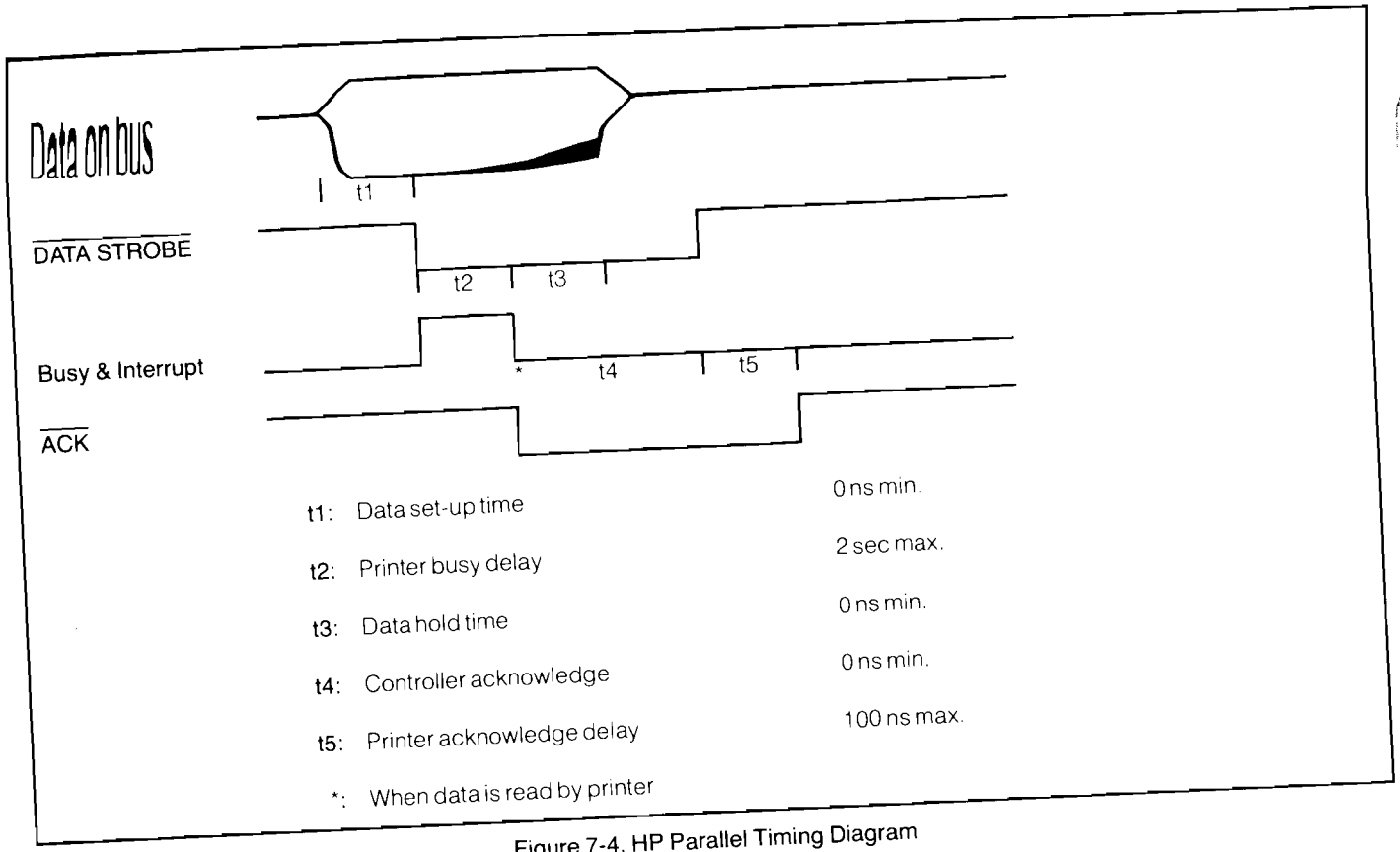
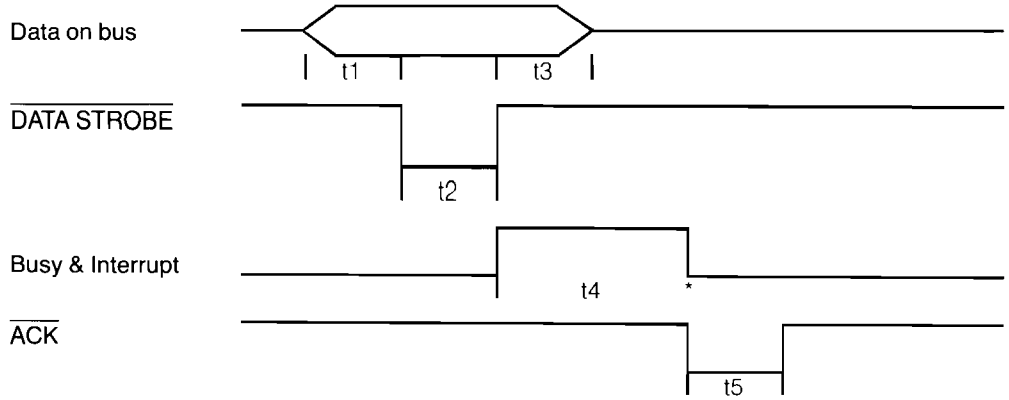


Figure 7-4. HP Parallel Timing Diagram

When operating in the Centronics mode, data is actually stored in the 8-bit Data Latch on the rising edge of a negative-going $\overline{\text{DATA STROBE}}$ pulse. The combination logic circuit immediately sets the BUSY line high to prevent further data transfer and also signals the processor, via the $\overline{\text{CHAR READY}}$ line, that a new character is ready. See Centronics Interface Timing Diagram, **Figure 7-5.** Once the processor reads the data, it then pulses $\overline{\text{ACK}}$ low, which clears the BUSY signal.



t1:	Data set-up time	1μs min.
t2:	Data strobe width	1 to 500 μs
t3:	Data hold time	1μs min.
t4:	Printer busy	2 sec. max.
t5:	Acknowledge pulse width	4μx (approx.)
*:	When data is read by printer	

Figure 7-5. Centronics Interface Timing Diagram

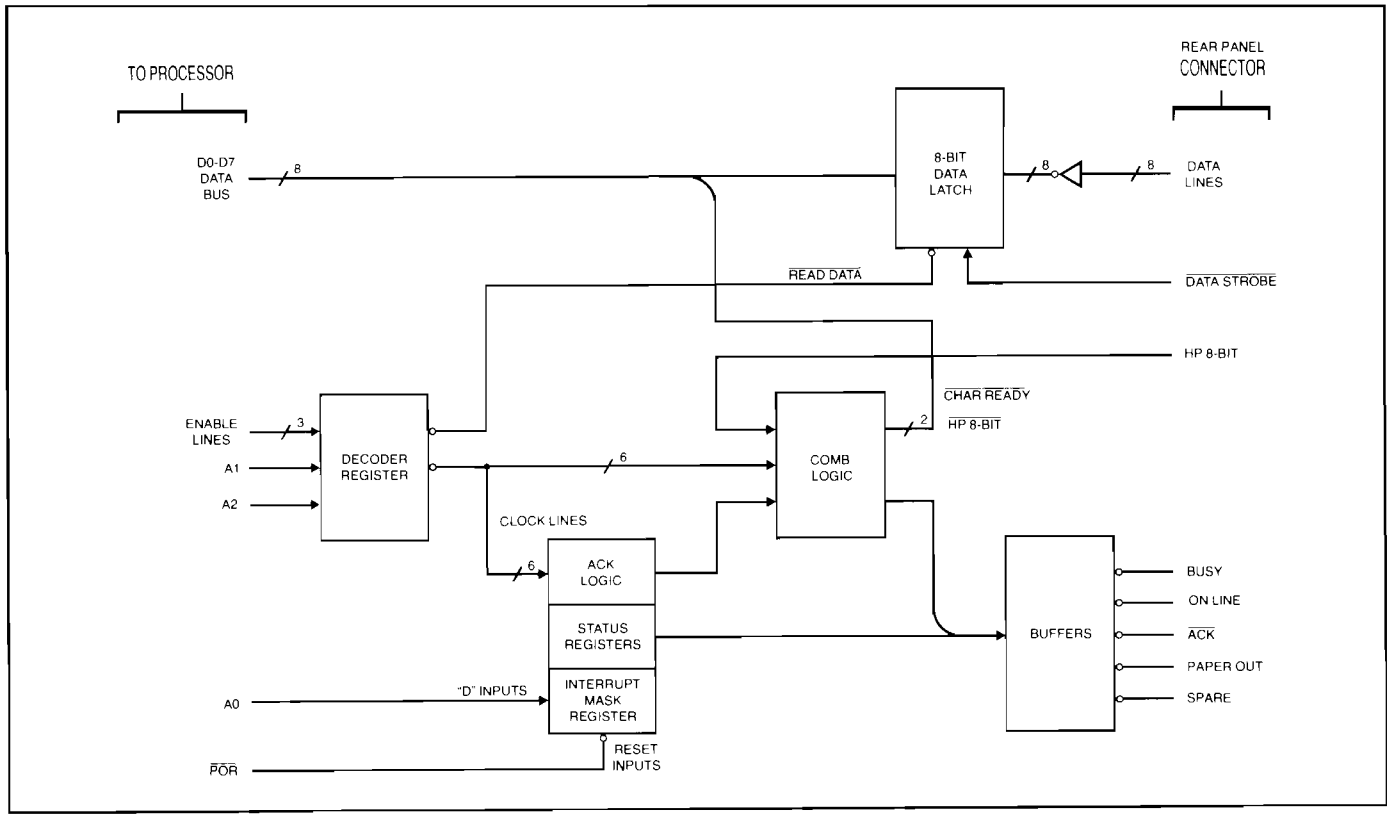


Figure 7-6. Parallel I/O Block Diagram

POWER SUPPLY

The 02670-60060 Power Supply is a secondary switching-type supply that provides +16.1V and +5V to the other circuits within the printer. Refer to **Figure 7-7, Power Supply Block Diagram.** The bridge rectifier converts the 28 Vac from the rear panel transformer into d.c., which is used by the 18V Linear Regulator and the 16.1V Series Switch.

The +18V Linear Regulator supplies power to several circuits on the board. Among these is the +2.5V Reference Circuit against which feedback voltages can be measured. The +2.5V is also fed back to its source (the 18V supply) as a reference. Both these voltages are used by the Ramp Generator, which produces a 25kHz sawtooth waveform for use by the two switching supplies.

The Series Switch Transistor in the 16V supply is driven by a circuit that compares the ramp signal to an error signal from the Feedback Amplifier. This amplifier compares the 16V output to the +2.5V reference and generates a d.c. level that changes relative to the ramp signal thereby producing pulses that vary in length depending on the output requirements of the supply. The wider the pulses, the longer the series transistor is turned on to increase the output level. The output is smoothed to d.c. by T1 and C1.

The flyback signal of T1 is rectified and filtered to produce −12V and −28V. The +12V supply is produced by a series, 3-terminal regulator, fed by the +16V line.

Circuit protection is provided by the Current Sense circuit and VR1. Should the load start to draw excessive current, the Current Sense Circuit will produce a large bias voltage to the Feedback Amplifier. The resultant error voltage will bias the Pulse Width Modulator out of its operating range and turn off the series switch. Should the series switch short and place high voltage on the output, zener diode VR1 will conduct to the gate of SCR1 and blow the fuse.

The +5V supply operates in the same basic manner as does the +16V supply. One exception, however, is the input voltage to the regulator. Since higher voltages are not necessary, this supply uses the +16V line for switching. Also, should the output voltage rise too high, the zener diode VR2 would conduct and turn on SCR1, blowing the fuse.

The Power On Reset circuit causes the Power On line to stay low for a short time until the two supplies can reach their normal operating level. This line is used throughout the unit as a reset signal to set initial operating conditions.

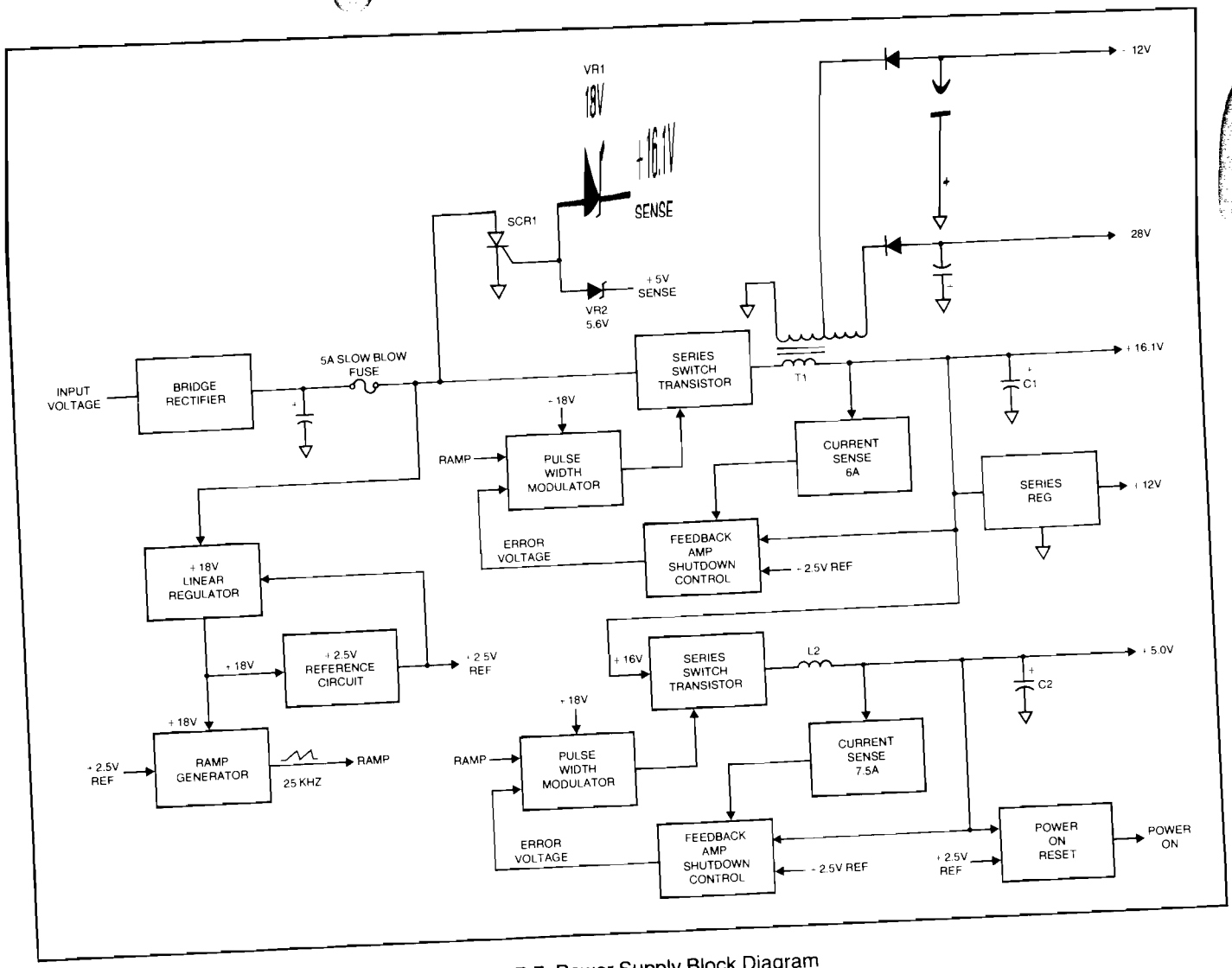


Figure 7-7. Power Supply Block Diagram

TPM PCA ..... The diagram shown in **Figure 7-8** is a generalized representation of the TPM Controller board. The function of the board is to drive the printer mechanism itself as dictated by the interface commands. It will print both normal (18 × 15 dot cell), compressed (11 × 15 dot cell), and expanded (36 × 15 dot cell) characters, each of these with full interstitial dots. It also supports commands that perform graphics, linefeeds, formfeeds, two types of self tests, clearing and movement of the printhead less than 18 dot positions.

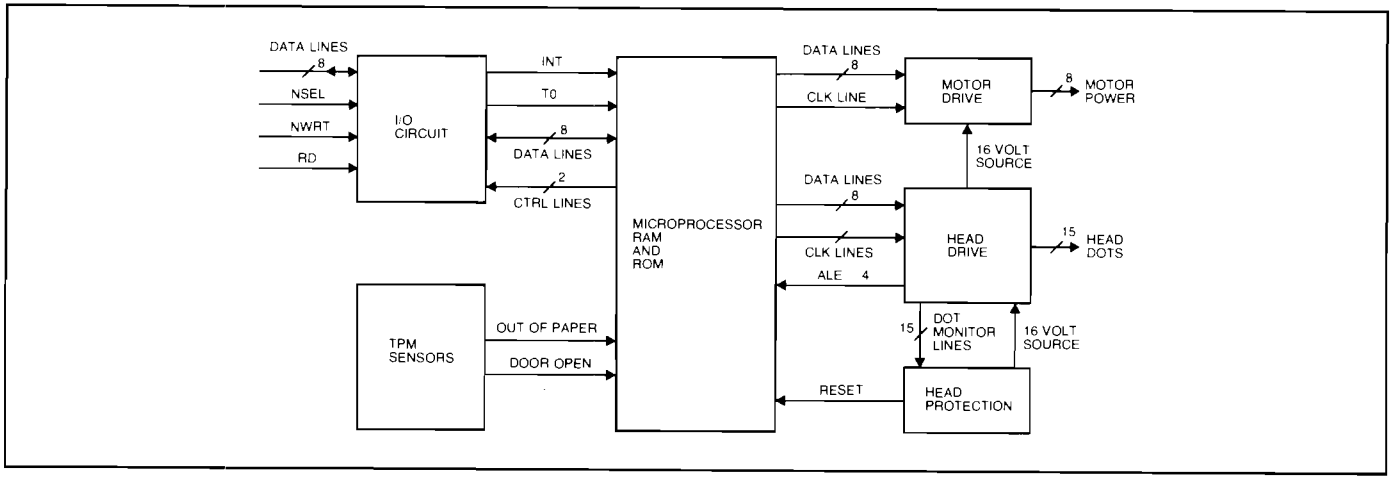


Figure 7-8. TPM PCA Block Diagram

MICROPROCESSOR, RAM AND ROM ..... The microprocessor is responsible for management of all functions performed on the board. It accepts three types of inputs from the I/O circuit: masks, data and commands. Masks are used to enable or disable interrupts emanating from this board. Data is virtual dot data that is passed across the interface in a structured fashion. Commands are used to request the TPM to perform a specific function, such as print one expanded character to the left, move to the right 13 dot columns, or linefeed once.

The most common function performed is printing. This is accomplished by first accepting 30 bytes of data. This data is received in a horizontal format and stored in one of two input buffers. The data is followed by a command. This will initiate processing of the data by swapping input buffers and then executing a transposition algorithm. The algorithm transforms the horizontal data of the input buffers into vertical data in one of the two output buffers. Following this, two other output buffers are filled, one with timing constants and the other, stepper motor phases. The processor must then initiate the smooth transition between the current TPM operation and the next.

The microprocessor is an 8049, or an 8039 with 2K bytes of external ROM code. Either of these configurations will be executing code at 11 MHz. The controller also uses 256 bytes of external and 128 bytes of internal RAM for buffering, registers, and processor variables.

I/O CIRCUIT ..... The basic functions of the I/O circuit are to trap data coming in on the data bus and to report status back to the requesting host. The incoming data is presented by the host on an 8 bit parallel data bus. It is latched onto the controller board by two external signals: NSEL and NWRT. The data bus and the state of two external address lines are locked at the same time. These tell us whether the trapped data is mask, command or data. All of this information is read by the 8049 in its external interrupt service routine. The status of the TPM is continuously held available to the host in an 8 bit latch. It may be read by the host via two control signals NSEL and RD.

TPM SENSORS ..... There are two TPM sensors, one to detect the presence of paper and the other to detect whether or not the mechanism door is open. The presence of paper is detected through the use of an opto reflective device (an LED and Opto-transistor combination). If paper is present, the light emitted by the diode is absorbed by the paper. If the paper is absent, the light is reflected by metalized tape adjacent to this device. The position of the door is detected by a micro-switch mounted such that if the door is open, the switch is also. Therefore, if the switch is open, operation of the TPM is halted immediately.

MOTOR DRIVE ..... These circuits are responsible for converting the motor phase signals generated by the 8049 into high power drive signals for the paper and head motors. Both of these are four-phase stepper motors that are being driven in half-step mode. The 8049 generates all of the timing necessary to ramp these motors up and to operate them in a smooth manner at constant velocity.

HEAD DRIVE ..... The printhead is a set of 15 thin-film resistors on a substrate that is swept across the thermally reactive paper. These 68 Ω resistors are pulsed at the appropriate times to develop the desired characters on the paper. The first time that a given dot is turned on, it is held on for 430 micro-seconds. This time period is controlled by a counter circuit (referred to as the first dot compensation circuit). If this same dot is turned on in the next column, it is held on for 150 micro-seconds. This timing is controlled by the 8049, and is referred to as second dot compensation. The resistors on the head are driven by 15 individual darlingtons which are turned on and off by a pair of 8 bit latches.

TPM PROTECTION ..... This circuit detects faulty head drive operation. When a fault is detected, the 16 volt source to the head is turned off and the entire controller board is reset. Dot current and processor operation are monitored by the protection circuit. If the head is left on too long, or if the processor does not execute its program correctly, the power to the head is disabled and the TPM controller is reset.

SETTING THE INTERNAL SWITCHES ..... The following switches on the TPM PCA should be set to the *closed* position:

Switches 8 and 10 if only a microprocessor is installed, **OR**

Switches 2, 9, and 10 if an external ROM and microprocessor are installed.

APPENDIX A

ESCAPE SEQUENCES

The table below shows the escape sequences recognized by the HP 2673 printer. The escape sequences are arranged first, according to the number of characters in the sequence, and secondly, in the order of the character values.

NOTE

Any escape sequences received by the HP 2673A that are not recognized will be treated as an escape sequence containing an error: the printer will ignore all characters following the error until it receives an uppercase terminator.

TWO-CHARACTER ESCAPE SEQUENCES

ESC1	Sets horizontal tab at current print head position.
ESC2	Clears horizontal tab at current print head position.
ESC3	Clears all horizontal tabs.
ESC4	Sets left margin at current print head position.
ESC5	Sets right margin at current print head position.
ESC9	Clears margins to the maximum allowable settings.
ESC?	Returns printer status (RS-232C requires a DC1 transmit trigger).
ESCE	Resets printer to power-on state.
ESCI	Executes horizontal tab.
ESCU	Advances print head to top of next page.
ESCY	Turns on Display Functions.
ESCZ	Turns off Display Functions.
ESC^	Transmits primary printer status. (Status information is located in Appendix B.)
ESCf	Disconnects modem (effective over RS-232C only).
ESCg	Soft reset: clears all error and I/O operations, and leaves input buffers unchanged.
ESCz	Initiates printer self-test.

(continued on next page)

ESCAPE SEQUENCES (continued)

MULTI-CHARACTER ESCAPE SEQUENCES

ESC&a sequences — Cursor Addressing

ESC&a‹integer›C	Move print head to the column indicated by the integer. (The first character position = column 0, second character position = column 1, etc.) Column numbers are defined in terms of the current print mode.
ESC&a+‹integer›C	Move print head ‹integer› columns to the right.
ESC&a–‹integer›C	Move print head ‹integer› columns to the left.
ESC&a‹column›L	Set left margin at column indicated. The Column in the sequence may be any number from 1 to 132 (any number greater than 132 will default to 132). Columns are defined in terms of the current print mode.
ESC&a‹column›M	Set right margin at column indicated. The Column in the sequence may be any number from 1 to 132 (any number greater than 132 will default to 132). Columns are defined in terms of the current print mode.
ESC&a+‹integer›R	Move paper upward ‹integer› lines. The Integer in the sequence is any number less than or equal to 63 (any number larger than 63 will default to 63).
ESC&a‹column›T	Set a horizontal tab stop at the column indicated. The Column in the sequence may be any number from 1 to 132 (numbers greater than 132 will default to 132). Columns are defined in terms of the current print mode.
ESC&a‹column›U	Clear the horizontal tab stop at the column indicated. The Column in the sequence may be any number from 1 to 132 (numbers greater than 132 will default to 132). Columns are defined in terms of the current print mode.

(continued on next page)

ESCAPE SEQUENCES (continued)

ESC&d sequences

Print Enhancements

ESC&d‹terminator› .....Turns underlining, framing, and/or bold print on or off, depending on the Terminator. Possible terminators and their effects are shown in the table below.

TERMINATOR	UNDERLINE	FRAMING	BOLD PRINT
@			
A			•
B		•	
C		•	•
D	•		
E	•		•
F	•	•	
G	•	•	•
H			•
I			•
J		•	•
K		•	•
L	•		•
M	•		•
N	•	•	•
O	•	•	•

(continued on next page)

ESCAPE SEQUENCES (continued)

ESC&k sequences — **Printer Latching Functions**

ESC&k0E .....Enhancements are defined to be enabled on a line-by-line basis and turn off automatically at the end of each line.

ESC&k1E .....Enhancements are defined to be semi-permanent functions, which, when enabled, are on until specifically disabled.

ESC&k0F .....Allows shift-out control code to be effective on a line-by-line basis.

ESC&k1F .....Allows shift-out control code to be effective on a semi-permanent basis, remaining in effect until specifically disabled.

ESC&k‹parameter›G .....Defines specific meaning of line terminator. Parameters are as follows:

0 = $^{C}_{R}$ maps to $^{C}_{R}$; $^{L}_{F}$ maps to $^{L}_{F}$; $^{F}_{F}$ maps to $^{F}_{F}$

1 = $^{C}_{R}$ maps to $^{C}_{R}{}^{L}_{F}$

2 = $^{L}_{F}$ maps to $^{C}_{R}{}^{L}_{F}$; $^{F}_{F}$ maps to $^{C}_{R}{}^{F}_{F}$

3 = $^{C}_{R}$ maps to $^{C}_{R}{}^{L}_{F}$; $^{L}_{F}$ maps to $^{C}_{R}{}^{L}_{F}$; $^{F}_{F}$ maps to $^{C}_{R}{}^{F}_{F}$

ESC&k0I .....Allows character set selection only through use of the shift-in and shift-out control codes.

ESC&k1I .....Enables eighth-bit mode: the active character set will be selected only by the state of the eighth bit.

ESC&k‹parameter›S .....Select active print mode.
Parameters are as follows:

0 = Normal mode, 10.0 cpi (80 characters/line)

1 = Expanded mode, 5.0 cpi (40 characters/line)

2 = Compressed mode, 16.2 cpi (132 characters/line)

(continued on next page)

ESCAPE SEQUENCES (continued)

ESC&k sequences (continued) — Printer Latching Functions

ESC&k0U .....Disables Save Paper mode.

ESC&k1U .....Enables Save Paper mode.

ESC&k0W .....Disables bidirectional printing.

ESC&k1W .....Enables bidirectional printing.

ESC&l sequences — Page Formatting

ESC&l‹integer›F .....Set text length to ‹integer› lines (the Integer in the sequence may be any number from 1 to 255; numbers larger than 255 will cause the command to be ignored).

ESC&l0L .....Disable Auto Page mode.

ESC&l1L .....Enable Auto Page mode.

ESC&l‹integerP .....Set page length to ‹integer› lines (the Integer may be any number from 1 to 255; numbers greater than 255 will cause the command to be ignored).

ESC&s sequences — Set Straps/Switches

ESC&s0C .....Enables end-of-line wraparound.

ESC&s1C .....Disables end-of-line wraparound.

ESC&s1Z .....Disables parity checking (RS-232C only).

ESC&s0Z .....Enables parity checking (RS-232C only).

(continued on next page)

ESCAPE SEQUENCES (continued)

ESC(and ESC) sequences — **Character Set Selection**

ESC(@ ..... Select USASCII as primary character set.

ESC(A ..... Select Roman Extension as primary character set.

ESC(B ..... Select Line Drawing as primary character set.

ESC(‹set code› ..... Select the specified character set as the primary character set. Character Set Codes are given in the table below.

ESC)@ ..... Select USASCII as secondary character set.

ESC)A ..... Select Roman Extension as secondary character set.

ESC)B ..... Select Line Drawing as secondary character set.

ESC)‹set code› ..... Select the specified character set as the secondary character set. Character Set Codes are given in the table below.

CHARACTER SET IDENTIFICATION CODES

Code	Character Set
0D	ISO Danish/Norwegian
0E	Roman Extension
1E	ISO United Kingdom
0F	ISO French
0G	ISO German
0K	JASCII (Japanese ASCII)
0L	Line Drawing
0S	ISO Swedish/Finnish
1S	ISO Spanish
0U	USASCII
5U	HPL (HP 9825A Keyboard Set)
0Z	All Blanks (Security)

(continued on next page)

ESCAPE SEQUENCES (continued)

Graphics: Binary Commands

ESC*b sequences

ESC*b‹0-999›V	Write partial data block. The number represents the number of bytes of graphics data which follow the terminator.
ESC*b‹0-999›W	Write full data block. A block of graphics data is equal to one raster row. The number represents the number of bytes of graphics data which follow the terminator.
ESC*b‹0-9999›X	Execute temporary horizontal offset from start of data. The value represents the number of pixels to add to the beginning of the raster row. Applies to next block transfer only.
ESC*b‹0-9999›Y	Execute temporary vertical offset from current vertical position. The value represents the number of raster rows to skip before starting to print the picture. Will be executed immediately.
ESC*bZ	No operation.

Raster Commands

ESC*r sequences

ESC*rA	Prepare to receive raster dump. Sets printer up to receive image and activates all current graphics settings, up to and including any commands immediately preceding the ESC*rA command.
ESC*rB	End of raster dump. Empties graphics buffer and temporarily resets all graphics features to their default settings (Current settings may be reactivated with an ESC*rA).
ESC*rC	Execute Form Feed.
ESC*rD	Execute Form Feed.
ESC*rE	Return raster status. RS-232C requires a DC1 transmit trigger.
ESC*r‹pictures›G	Turn on graphics auto-centering. Pictures is a number from 1 to 255, representing the number of same-length images to be centered on the currently-defined page.

(continued on next page)

ESCAPE SEQUENCES (continued)

ESC*r sequences (continued) — **Raster Commands**

ESC*rH .....Turn off graphics auto-centering.

ESC*rI .....Initialize graphics settings (reset to power-on values).

ESC*rJ ..... Return raster size status. Printer will return, " **720,9999** $^{C_R L_F}$ ". (RS-232C requires DC1 transmit trigger.)

ESC*rK ..... Return model number status. Printer will return " **2673A** $^{C_R L_F}$ ". (RS-232C requires DC1 transmit trigger.)

ESC*r‹pixels›M ....Set horizontal window starting address. Pixels is a number from 0 to 9999 representing the number of dots to ignore at the beginning of each received raster row.

ESC*r‹rows›N .....Set vertical window starting address. Rows is a number from 0 to 9999 representing the number of raster rows to ignore at the beginning of each received picture.

ESC*r‹pixels›P .....Set horizontal window dimension. Pixels is a number from 0 to 9999 representing the width of the window image, measured in dots.

ESC*r‹rows›Q .....Set vertical window dimension. Rows is a number from 0 to 9999 representing the length of the window image, measured in raster rows.

ESC*r‹pixels›S ....Define source image size. Pixels is a number from 0 to 9999 representing the width of the full, unwindowed image to be transmitted, measured in dots.

ESC*r‹rows›T .....Define source image size. Rows is a number from 0 to 9999 representing the length of the full, unwindowed image to be transmitted, measured in raster rows.

ESC*r‹pixels›X .....Set horizontal raster origin offset. Pixels is a number from –9999 to 9999 representing the distance to move the received image horizontally from the raster origin. A positive number will move the image the specified number of dot-positions to the right, and a negative number will move the image to the left.

(continued on next page)

ESCAPE SEQUENCES (continued)

ESC*r sequences (continued)

Raster Commands

ESC*r‹rows›Y ..... Set vertical raster origin offset. Rows is a number from –9999 to 9999 representing the distance to move the received image vertically from the raster origin. A positive number will move the image downward the specified number of raster rows, and a negative number will move the image upward.

ESC*rZ ..... No operation.

ESC*s sequences

ESC*s^ ..... Return model number status (RS-232C interface requires DC1 transmit trigger). Printer responds by returning " 2673A $^{C_R}{}_{L_F}$ ".

APPENDIX B

PRINTER STATUS

INTRODUCTION ..... The HP 2673 printer will respond to several different requests for status information. The information in the following paragraphs concerns status requests and responses not yet discussed in this manual.

MODEL NUMBER STATUS ..... The Model Number Status Request is a means for the host system to accurately identify the printer by model number. When it receives a Model Number Request, the printer will respond with 2673A $^{C}_{R}$ $^{L}_{F}$. The three valid requests are shown below. Model Number Status is effective over HP-IB and RS-232C only. A DC1 transmit trigger must be sent immediately after the command over the RS-232C interface.

Model Number Status Request

ESC*rK (The RS-232 interface requires use of a DC1 transmit trigger)
ESC*s^
ESC*s1^

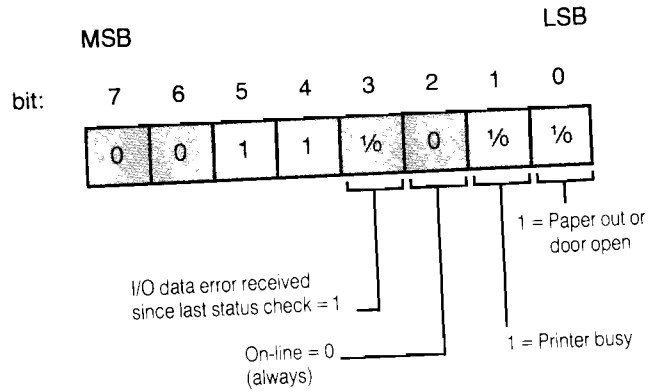
I/O STATUS

The status request shown below is effective over RS-232C only and must include a DC1 transmit trigger.

I/O Status Request (RS-232C only)

ESC?DC1

When it receives the request for I/O status, the printer returns one data byte, followed by a ^{C}R and ^{L}F. This status byte may be interpreted as shown in the diagram below.



PRIMARY STATUS .....

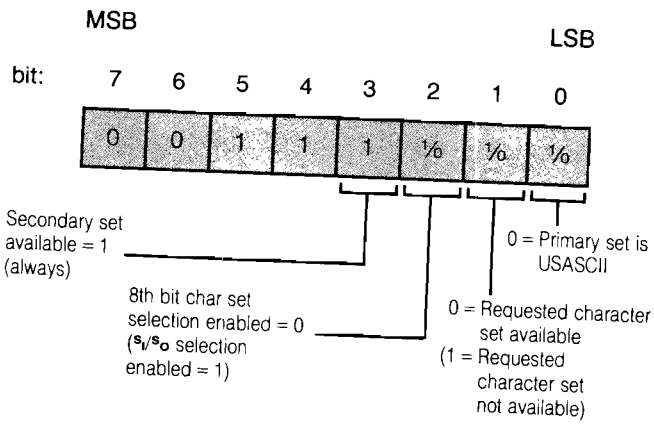
The Primary Status Request causes the printer to return information on character set status, print modes, line density, power-on configuration modes, and hardware status. The format for the status request and the general format of the printer response are shown below. Details on the printer response follow.

Primary Status

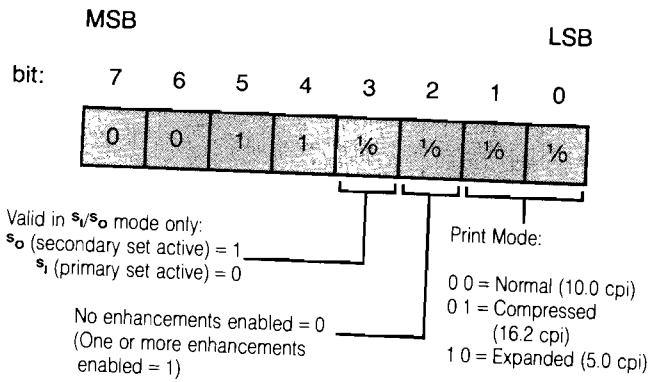
Request: ESC^ (RS-232C requires the use of a DC1 trigger)

Response: ESC\ ‹six status bytes› c_R l_F

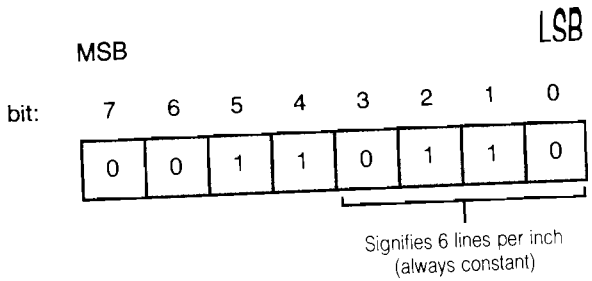
BYTE 0 – Character Set Status



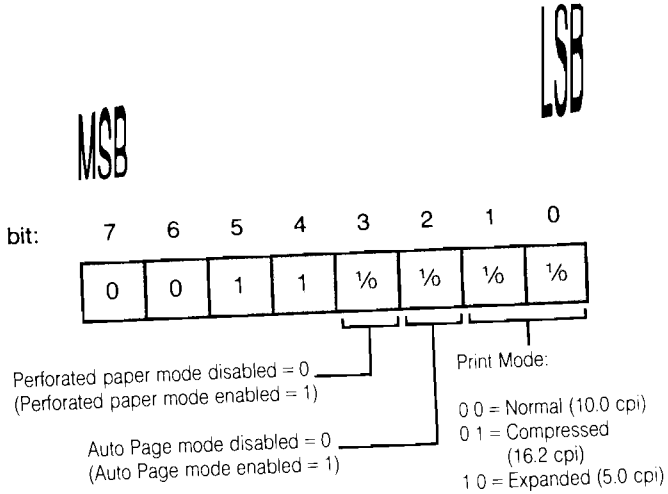
BYTE 1 – Current Print Mode Status



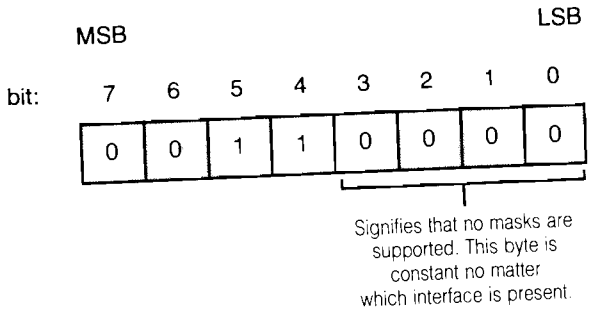
BYTE 2 – Current Line Density



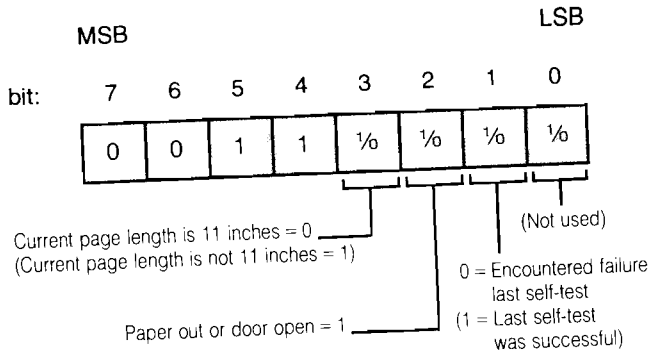
BYTE 3 – Power-on Configuration Modes



BYTE 4 – HP-IB Status



BYTE 5 – Hardware Status



Raster Status

INTRODUCTION

The HP 2673 recognizes three different requests for status in raster mode: Raster Display Size Request, Model Number Status Request, and Raster Status Request. These three commands and the printer's responses are discussed in the following paragraphs.

NOTE:
Because the printer needs to respond to each of these commands, it can respond to only one request at a time; if more than one status request appears in a combined escape sequence, the printer will respond to only the last request.

RASTER DISPLAY SIZE REQUEST

The Raster Display Size Request allows the host system to find out how much graphics data it may send to the printer without data loss or image truncation. The printer's response to the raster size request is: 720,9999 $^{C}_{R}$ $^{L}_{F}$. The 720 represents the number of printable pixels in each raster row, and 9999 represents the number of raster rows the printer can accept. If the Auto Page or Perf Skip mode is enabled, any picture larger than the currently-defined page will be broken, but no data will be lost.

Raster Display Size Request	
ESC*rJ	(RS-232 requires a DC1 trigger)

MODEL NUMBER STATUS REQUEST

The Model Number Status Request is a means for the host system to accurately identify the printer by model number. When it receives a Model Number Request, the printer will respond with 2673A $^{C}{}_{R}{}^{L}{}_{F}$. The three requests are shown below.

Model Number Status Request

ESC*rK (A DC1 transmit trigger is required over an RS-232 interface.)
ESC*s^
ESC*s1^

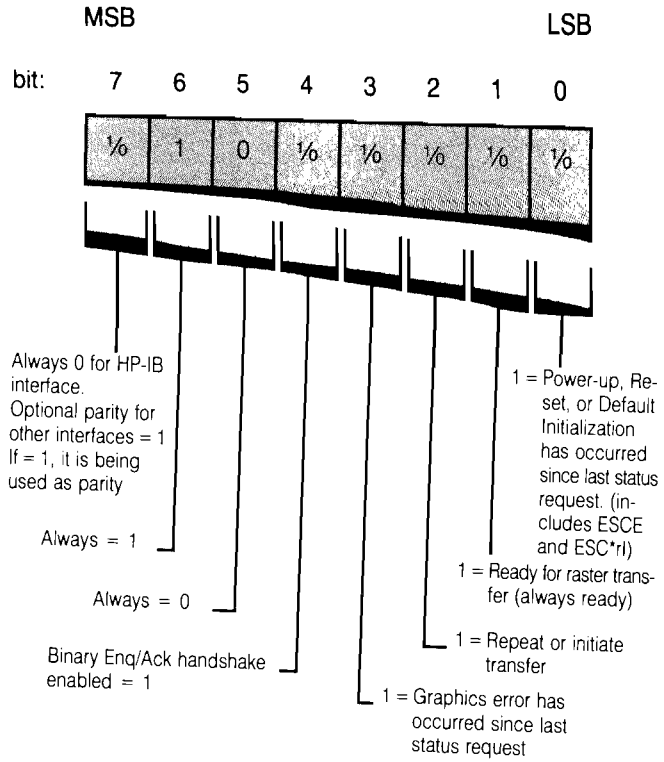
RASTER STATUS REQUEST

The HP 2673 will report its graphics status after receiving the status request shown below.

Raster Status Request

ESC*rE (RS-232C requires DC1 trigger)

The graphics status is sent in one byte, which may be interpreted as shown in the following diagram.


MSB
LSB
bit: 7 6 5 4 3 2 1 0
% 1 0 % % % % %
Always 0 for HP-IB interface. Optional parity for other interfaces = 1 If = 1, it is being used as parity
Always = 1
Always = 0
Binary Enq/Ack handshake enabled = 1
1 = Graphics error has occurred since last status request
1 = Repeat or initiate transfer
1 = Ready for raster transfer (always ready)
1 = Power-up, Reset, or Default Initialization has occurred since last status request. (includes ESCE and ESC*rI)

APPENDIX C

SELF-STUDY EVALUATION

INTRODUCTION ..... This appendix to the manual is offered as a training aid for the service repairperson. It is composed of a series of questions intended to emphasize and reinforce major points within the manual that may prove helpful when servicing the printer. It is assumed the reader has reac all previous sections in the manual.

QUESTIONS .....

1. What should the customer do to the printer when it first arrives?
2. What is the allowable range of HP-IB address settings?
3. What part is needed to convert an HP Parallel board into a Centronics-compatible interface?
4. What is the standard size of the input buffer for the RS-232C interface? Does the buffer size differ when using other interfaces?
5. What is the exchange part number in the printer?

6. What will need to be done when replacing the Processor board, P/N 02670-60066?
7. If the transformer needs replacing, what part number should be used when ordering?
8. How is a feature changed in the EAROM?
9. How is a feature changed in the CURRENT configuration without altering the EAROM contents?
10. What is the maximum number of characters per line when in EXPANDED mode?
11. If PERFORATED PAPER mode is enabled, what is the minimum TOP MARGIN LENGTH?
12. Enabling what feature prints a " . " for a CR, FF, or LF?
13. How do you enable SECONDARY COMMANDS and LISTEN ALWAYS simultaneously?
14. What ESCAPE sequence allows you to enable PARITY CHECKING for RS-232C I/O?
15. What should a user do to prevent buffer overflow when the printer is receiving data from a host device?
16. How should you check the Power supply when F1 (located on the Power Supply) is blown?
17. What signals the successful completion of a self-test?
18. What user-invocable tests are similar to the POWER-ON test?
19. What functional block does the POWER-ON test not check? How is this area checked?
20. What test prints out ROM identification data?
21. What exclusive test should be selected for testing the Parallel Interface?

22 When executing the DATACOMM test, how does the RS-232C Interface detect that an external loopback device is connected?

23. When executing the DATACOMM test on a RS-232C Interface, what will be the effect if using the test hood and configured for EXTERNAL baud rate?

24. Without an RS-232C Interface, what Power Supply voltage may measure out of tolerance?

25. When will the Self-test Character Display LED display an error?

26. What effect does the RESET key have when a fatal error is being displayed in the Self-test Character Display LED?

27. What is the most probably cause of a " .8 " failure code encountered during power-up?

ANSWERS .....

1. The customer should install the proper fuse and set the line voltage switches to match the line voltage. The unit will arrive with the switches set to 240V and without a fuse installed.
2. Any number from 0 to 29 can be selected for an HP-IB address. However, this drops to 0 to 7 when parallel polling or secondary commands are used.
3. An adapter cable (P/N 02670-60094) will provide the proper pinout for a Centronics interface.
4. The standard buffer size for all interfaces is 2k.
5. The print mechanism (without print head and TPM PCA) is the only exchange assembly in the printer. Its part number is 02670-69091.
6. The Processor board does not include the socketed parts (ROMs, RAMs, etc.). These parts must be taken off the bad board and installed in the new one.
7. The transformer should not be ordered individually. In this case, order the entire Rear Panel assembly, P/N 02670-60063.
8. Use the CONFIGURE POWER-ON feature and change feature through use of the front panel keys.
9. Use an ESCAPE sequence.
10. 40 characters.
11. 2 lines.
12. SAVE PAPER MODE.
13. You can't; enabling SECONDARY COMMANDS automatically disables LISTEN ALWAYS.
14. ESC&s0Z.

15. Ensure that the printer is configured for the same type of handshaking as the host device.

16. Turn printer off; disconnect J11, J12, J13; replace F1; turn printer back on. If F1 blows again, Power Supply is defective and should be replaced.

17. 2673A beeps, all front panel LEDs turn off except POWER ON, and message **"Self Test OK"** is displayed.

18. Non-destructive Confidence Test; Destructive Controller Test; Manufacturing Burn-in Test; Diagnostic Test.

19. Control Panel. Select CONTROL PANEL parameter from front panel array of tests, or select through opening Switch 1 and closing Switch 2.

20. Destructive Controller Test.

21. There is no self-test available for checking the Parallel Interface.

22. By the presence of the CLEAR-TO-SEND control signal.

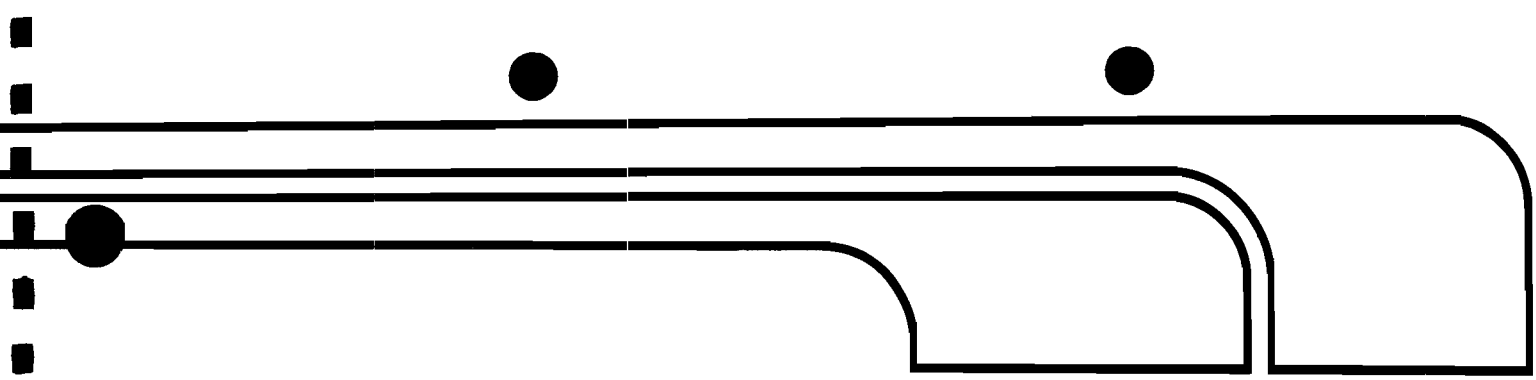
23. No data loopback tests will be performed, plus the message **"EXT BAUD RATE configuration limits datacomm test"** will be printed.

24. –12 VDC.

25. When the error is a fatal error, or when the user is running the Diagnostic Test.

26. Causes the message **"IGNORING FAILURE ABC"** to be printed, plus the printer will attempt to reinitialize itself.

27. Defective Z80 processor.



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Technisches Büro Berlin
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D-1000 **BERLIN** 30
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Telex: 018 3405 hpbln d
A, C, M, CS, E, X, M, P

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Herrenberger Strasse 110
D-7030 **BÖBLINGEN**
Tel. (07031) 667-1
Telex: 07265739 bbn of 07265743
A, C, M, CP, E, MP, P

Hewlett-Packard GmbH
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Emanuel-Leutze-Strasse 1
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Technisches Büro Neu Ulm
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D-7910 **NEU ULM**
Tel.
Telex
C, E

Hewlett Packard GmbH
Technisches Büro Nürnberg
Neutheyerstrasse 90
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Technisches Büro München
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Tel. (089) 6117-1
Telex: 0524985
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GREAT BRITAIN
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Cheshire WA14 1NU
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A, C, E, M

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Tel. 36806
Telex: 444302
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Tel. (0727) 24400
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C, E

Hewlett Packard Ltd
Tradax House, St. Mary's Walk
MAIDENHEAD
Berkshire SL6 1ST
Tel. 0628-39151
E, P

Hewlett Packard Ltd
308-314 Kings Road
READING, Berkshire
Tel. 61022
Telex: 84 80-68
C, M, P

Hewlett Packard Ltd
Quadrangle
106-118 Station Road
REDHILL, Surrey
Tel. 01737-68655
Telex: 947234 C, E

Hewlett Packard Ltd
Westminster House
190 Stratford Road
SHIRLEY, Solihull
West Midlands B90 3BJ
Tel. (021) 7458800
Telex: 339105
C

Hewlett Packard Ltd
King Street Lane
WINNERSH, Wokingham
Berkshire RG11 5AR
Tel. 0734-784774
Telex: 847178
A, C, E, M

GREECE
Kostas Karayannis
8 Omirou Street
ATHENS *133*
Tel. 32 30 303, 32 37 371
Telex: 21 59 62 RKAR GR
E, M, P

INDEX

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