

1.0 General Description

The Datapoint Model 9601/9602 Character Printer is a 45 CPS microprocessor controlled, platen drive word processing printer. The parallel version (9602) interfaces with a Datapoint processor through a Datapoint parallel I/O bus; the serial version (9601) interfaces with a Datapoint processor or terminal through an RS-232-C interface. The 45 CPS printer is a low volume, low duty cycle letter-quality printer specifically designed for use in word processing correspondence applications. Use of the 45 CPS Printer in high volume data processing applications or other high duty cycle, high volume applications is not recommended and will reduce printer reliability.

The standard nominal primary power requirement is 120 VAC, 60 Hz; however, it is field configurable for operation with other primary power sources (see 6.3 Primary Power).

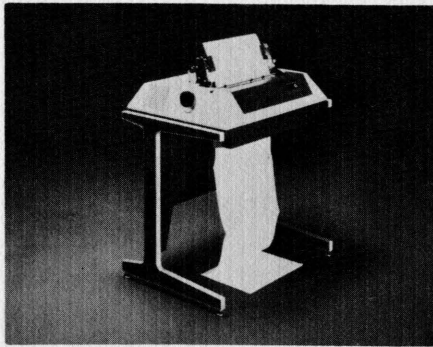
The Model 9601/9602 Character Printer will accept configuration commands for:

- Left margin
- Line spacing
- Character spacing
- Length of form
- Loading the table of character spacing and hammer pressure
- Initialization
- Default values

Printing is bidirectional, performed with an interchangeable printwheel. The standard character font is Courier 72. Other plastic printwheels are available.

The table of character spacing and hammer pressure is loaded by the user program. If no program is provided, default values are assumed.

Line width may be configured at 132, 158, or 198 columns per line. The standard default value is 132 columns per line.



45 CPS Printer (with optional legs and tractor feed).

45 CPS Character Printer 9601/9602

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2.0 System Requirements

A Datapoint interface assembly configures the printer to accept serial or parallel data from a Datapoint processor.

In its serial data version (Model 9601), the printer can connect to a Datapoint video workstation or to a Datapoint processor by conforming to RS-232-C signal levels, at up to 9600 baud.

The parallel version (Model 9602) connects directly to the I/O bus of a Datapoint processor. It is compatible with all Datapoint software that drives a local printer.

3.0 Technical Description

3.1 Hardware Specifications

3.1.1 Specifications

General performance specifications of the 45 CPS Character Printer.

Printing Method	Impact, rotating printwheel, bidirectional
Character Rate	45 characters per second average (@ 12 pitch) (See Section 3.1.2)
Characters per printwheel	96
Printwheels	Courier 72, standard (Model Code 80270) Pica 10, optional (Model Code 80271) Elite 12, optional (Model Code 80272)
Character spacing	10 characters per inch 12 characters per inch 15 characters per inch Proportional, variable in 1/60 inch increments (1/4 inch maximum)
Carriage return time	300 msec. maximum
Line width	132 columns @ 10 characters per inch 158 columns @ 12 characters per inch 198 columns @ 15 characters per inch
Line spacing	6 lines per inch default, programmable in 1/96 inch increments
Ribbon type	Mylar film, standard (Model Code 80496) Nylon fabric optional (Model Code 80497) Spool loaded
Paper speed	5 inches per second
Paper width	15 inches (38.1 cm) maximum, with optional forms tractor 16.5 inches (41.9 cm) maximum, with pressure platen 6 inches maximum
Paper length	11 inch assumed Configurable up to 21.25 inches in 1/96 inch increments
Paper feed	Pressure platen, top loading Tractor (optional), bottom feed
Paper type	Individual sheets or individual cut, multipart forms (maximum 6-part, 0.003 to 0.027 inches thick) with standard friction feed Fanfold (continuous forms) with optional tractor

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3.1.1.1 Character Set Font

The character font supplied with the printer (Courier 72) represents the standard ASCII 96 character set (octal 040 through 0177). The particular character printed for each code is determined by the interchangeable printwheel used.

3.1.1.2 Print Rate

The 45 CPS Printer will print the following test line at 45 CPS minimum.

"We sat there at noon on the corner bench in the railroad station and ate oranges while we waited. When the train came, we left for home."

Before starting the test, the printer must be set for 12 pitch and the carriage must be positioned to the left margin. The test line will be printed in a horizontal line. The speed will be averaged over at least four test lines with the time to do paper motions subtracted from the total time. There are 137 characters per line. Therefore, if the end of the test line is shortened to "...came, we left for.", and the test is repeated at 10 pitch, the speed will be 44 CPS minimum at 132 characters per line.

Paper motion commands are accumulated by the printer and executed as large steps rather than as a series of small steps. When sheets are manually fed around the platen, the maximum time to step paper is five (5) inches per second plus 0.050 seconds. An extra 0.200 seconds is required when the form is 2.5 inches past top-of-form.

If the optional tractor (Model 0515) is used, the speed is five (5) inches per second plus 0.110 seconds. An additional 0.200 seconds is required at 2.5 inches, and 0.100 seconds is required at bottom-of-form.

If the optional sheetfeeder (Model 9605) is used, the paper speed is five (5) inches per second plus 0.200 seconds at 2.5 inches from top-of form plus 2.34 seconds per sheet for insertion and ejection.

Carriage motion commands are also accumulated by the printer and executed as a single large step. A one inch step requires 0.080 seconds; two inches require 0.115 seconds, and each inch more than two requires an additional 0.017 seconds. For example, six inches require $0.115 + (6 - 2)(0.117) = 0.183$ seconds.

The print rate depends upon character spacing. See Figure 3-1 for an illustration of the print rates corresponding to character spacing.

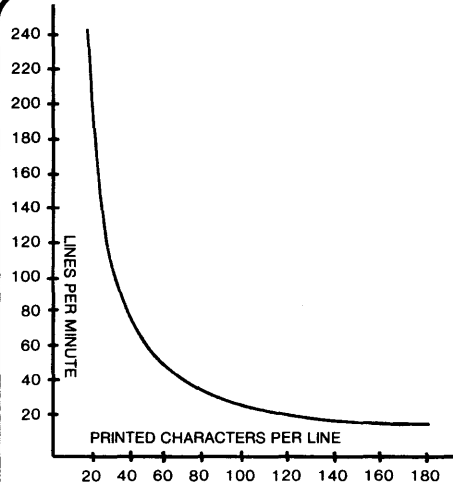


Figure 3-1: Print Rate (LPM)

3.2 Operator Controls and Indicators

The operator controls and indicators can be found in two areas: switch/indicator panel and operator controls area. (See Figure 3-2: Operator Controls and Indicators.) The following subsections define the controls and indicators in their respective areas.

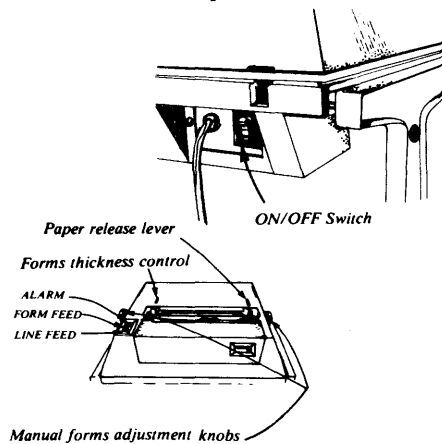


Figure 3-2: Operator Controls and Indicators

Indicator lights and conditions:

<u>ALARM</u>	<u>FORM FEED</u>	<u>LINE FEED</u>	<u>CONDITION</u>
Operator Correctable Conditions:			
Flash	On	Off	Cover Open
Flash	Flash	Flash	Power-on-reset, Initialize command
Off	Flash	Off	Pause command
Off	Flash	Off	Out of paper
Information Only Conditions:			
Off	On	On	No faults
Faulty Mechanism:			
Off	Off	Off	+5 volt failure
On	On	Off	ROM checksum
On	Flash	On	± 18 volt failure
On	Off	Off	Manual check
On	On	On	Carriage busy check
On	Flash	On	Paper feed busy check
On	Off	On	Carriage command rejected
On	Flash	Flash	Print wheel command rejected
On	Off	Flash	Paper feed command rejected

Table 3-1: Indicator Lights and Conditions

3.2.1 Switch/Indicator Panel

The switch/indicator panel is located on the left top of the printer cabinet. The switches and indicators are described below.

ALARM Switch/Indicator

The ALARM switch/indicator will light when a fault condition has occurred. After the fault has been cleared, press the ALARM switch to clear the fault indicator.

After Power-on-Reset, the ALARM, LINE FEED, and FORM FEED indicator lights flash to signal that the printer configuration is in the default mode. In a word processing environment, special software consideration and operator action are required to reconfigure the printer after power failure.

NOTE: If a mechanism fault occurs, pressing the ALARM switch will clear the printer's buffer. (See Table 3-1.)

LINE FEED Switch/Indicator

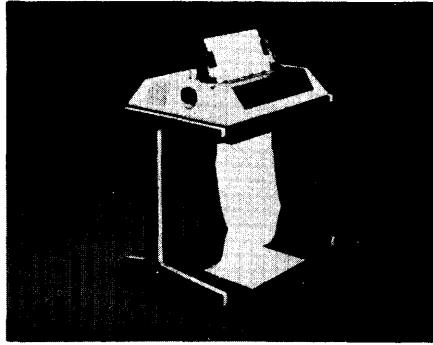
The LINE FEED switch, when pressed, advances the paper one line. This switch is not active during printing. See Table 3-1 for specific alarm or operational conditions when the LINE FEED indicator will be active.

FORM FEED Switch/Indicator

The FORM FEED switch, when pressed, positions the paper to the next top-of-form. This switch is not active during printing. The FORM FEED switch will be ignored if the paper is at the top-of-form.

If an out-of-paper condition is detected, printing will stop at the bottom of the form and the FORM light will flash. To enable printing to continue after paper has been installed, press the FORM switch. For other alarm or operational conditions, see Table 3-1 for the status of the FORM indicator.

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3.2.2 Operator Controls

Manual Forms Adjustment Knob

The manual forms adjustment knob, located on either side of the printer, permits the operator (when facing the unit) to adjust top of form by turning the knob either clockwise to advance the paper or counterclockwise to back the paper out of the printer.

Forms Thickness Control

The forms thickness control, located on the left top of the printer, is used to adjust for multipart and variable thickness forms. For thick forms, move the control toward the front of the printer. For thin forms, move the control to the rear.

Platen Release Lever

The platen release lever is located on the right top of the printer. When the optional tractor is being used, ensure that the lever is in the front-most position. When the platen feed is used, ensure that the lever is in the rear-most position.

Speaker

The printer is equipped with a speaker which emits a beep when the BELL control character is detected or when power is initially applied to the printer and the carriage returns to the center.

Power ON/OFF Switch

AC power may be applied to the printer by the power ON/OFF switch. This switch is located on the left rear side of the printer cabinet.

3.2.3 Preventive Maintenance/ Ribbon and Printwheel Replacement

For complete instructions on preventive maintenance, including ribbon and printwheel replacement procedures for the 45 CPS Printer, refer to the Guide to Operating the 45 CPS Printer (Document No. 60812).

3.2.4 Self-Test

To cause the printer to perform a printing self-test, hold the ALARM switch down and press the LINE switch. The self-test returns the printer to the default mode, so the self-test should not be run during a configured print cycle. Release the ALARM switch to allow the self-test to terminate. Self-test prints four lines of sliding deck pattern before terminating.

To enter the internal portion of the self-test, hold the ALARM switch down and press FORM. This test verifies that the printer is functioning properly and indicates printer options and firmware revision level of the unit. Successful completion of the internal portion of the self-test is indicated with a beep. Unsuccessful completion is indicated with a repeated beep.

3.3 Programming Considerations

3.3.1 Printing and Control Characters

The printer contains a FIFO (first-in, first-out) queue and line buffer of about 600 characters. The printer accumulates both printing and control characters until printing is initiated. Printing is initiated when either of these conditions has been fulfilled.

- 1) A full line has been buffered (lines terminated by paper motion or the attempt to place a character to the left of the previous character), or
- 2) The printer mechanism is idle and there are characters in the buffer.

The control characters (in octal notation) accepted by the printer are as follows. The letters n, x, he, e, and w represent multidigit decimal numbers composed of ASCII characters 0 through 9.

3.3.2 Configuration Commands

Initialize 033 0143

Equivalent to Power-on-Reset. All programmed values are reset to the default values. An internal self-test is executed and the interface firmware is restarted. The Initialize command is executed immediately regardless of printer state.

Default 033 0121

Sets all programmed values back to default and simulates a carriage return command. All commands in the buffer will be executed before this command.

Set Form Length
033 0133 n 073 x 0162

Allows form length to be programmed in n/1440 inch increments. The length is truncated to a multiple of 1/96 inch. The default value is 11 inches, and the maximum value of n is 30600 (21.25 inches). Top of form is redefined to the present position. The number x is ignored.

Set Left Margin 033 0133 n 0161

Sets the left margin to a position n/1440 inch to the right of the left edge of column 0. Carriage return and horizontal tab are relative to left margin. The default value is column 0, and the maximum value of n is 19008 (13.2 inches). The number n is truncated to a multiple of 1/120 inch.

Set Spacing SPI
033 0133 h 073 n 040 0107

Sets all character widths to the values specified by n/1440 inches. Hammer energy is not changed. The number n is truncated to a multiple of 1/60 inch, and its default value is 0.10 inches. Vertical line width is specified by h/1440 inches. The number h is truncated to multiples of 1/96 inch, and its default value is 1/6 inch. Either n or h can be omitted to cause default values to be used. The Set Spacing SPI command overrides the Load Character table command values for character widths. Maximum values for n and h are 360 (15/120 inch) and 945 (63/96 inch), respectively.

Load Character Table

033 0120 040 n 073 p 073 040e
073 040w 073 041e 073 041w
073 0176e 073 0176w 073 0177e
073 0177w 033 0134

Changes the character spacing and hammer energy used to print each character. The processor must load values which correspond to the printwheel being used. All commands in the printer buffer will be executed before the table is changed.

The number n is the width of the space character. The value p is the ASCII character to be substituted if a parity error is detected. Values 040e and 040w, etc., specify the hammer energy and character width, respectively, of the character at the octal position on the printwheel. Width parameters are character widths in 1/60 inch increments; the allowable range is 0 through 15 decimal. Hammer energy parameters are relative energies and have a range of 0 through 7 decimal. Default values for all character widths equal 1/10 inch and standard hammer energies for Courier 72 printwheel.

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The table contains the hammer energy and character width for each position on the printwheel, 040 to 0177, inclusive. Partial changes to the table are not permitted.

Pause 033 0120 044 MSG 033 0134

The character string MSG is ignored. When this command is executed, printing stops, the FORM indicator flashes and the Machine Available and Write Ready status bits are set false. Press the FORM switch to resume printing. If a CHECK condition occurs while in the Pause state, the printer will resynchronize the carriage and the printwheel when the FORM switch is pressed. The print position, data in the buffer, and the programmed configuration will be retained and the printed output will show no signs of the CHECK having occurred.

Printable Characters

Cause escapement based on their width value in the character table. Carriage motion is the sum of the 1/2 width of the current character and the 1/2 width of the previous character. Carriage return and tabs have a zero width.

3.3.3 Paper Movement Commands

Vertical Tab 033 0133 n 0145

Moves paper up $n/1440$ inch. The default value is $1/24$ inch. The number n is truncated to multiples of $1/96$ inch. The maximum value for n is 30600 (21.25 inches).

Micro Line Feed 016

Moves paper up $1/24$ inch.

Line Feed 012

Moves paper up one line space interval as specified by the set spacing command. Default value is $1/6$ inch.

Form Feed 014

Moves paper to the next top of form, line number zero. The Form Feed command is ignored while the printer is at top of form.

3.3.4 Carriage Movement Commands

Thin Space 033 0133 n 0141

Moves the print position $n/1440$ inch to the right. The default value is 12 ($1/120$ inch). The number n is truncated to a multiple of $1/120$ inch.

Space 040

Moves the print position to the right by the amount stored in the character table for the space character.

Horizontal Tab 033 0133 n 0140

Moves the print position to a position $n/1440$ inch to the right of the left margin. The following character will be printed $1/2$ its width to the right of this print position.

Carriage Return 015

Moves the print position to the left margin. The following character will be printed $1/2$ its width to the right of this print position.

Print 040 033 0116 041

Prints the character located at printwheel position 040.

Print 0177 033 0116 042

Prints the character located at printwheel position 0177.

3.3.5 Special Commands

Bell 007

Causes a 250 millisecond beep.

Delete 0177

Pad character, ignored by printer. It is not placed in the FIFO buffer.

Printer Off 024

Used to instruct terminals to stop sending data to the attached printer. Ignored by the printer.

4.0 Physical Description

Figure 4-1 shows the dimensions of the printer, which weighs approximately 100 pounds (45 kg) with the optional stand. Without the stand it weighs approximately 70 pounds (31.5 kg).

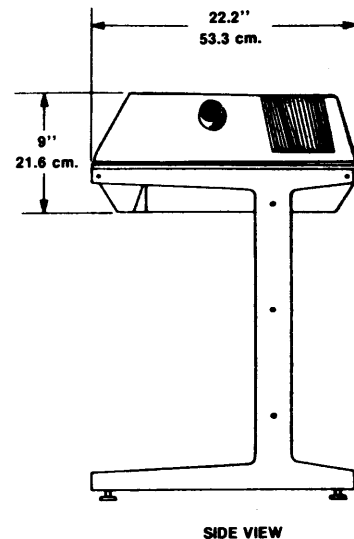
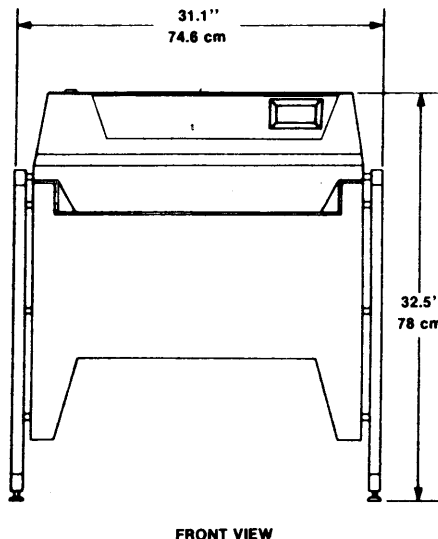


Figure 4-1: Printer Dimensions

5.0 Environmental Requirements

Temperature: 50 to 100 degrees F
10 to 38 degrees C

Humidity: 20 to 80% relative humidity,
non-condensing

Heat dissipation: 350 BTU/Hour, Idle
650 BTU/Hour, Printing

The printer may be stored in a non-corrosive, non-condensing atmosphere with a relative humidity between 0 and 80 percent and temperature between -28 and 65 degrees Celsius (-20 to 150 degrees Fahrenheit).

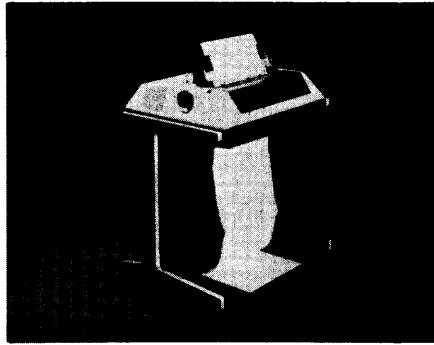
Warning: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

6.0 Interface Requirements

6.1 Parallel Interface (9602)

The parallel interface allows the printer to receive data and commands from the Datapoint processor via the Datapoint I/O bus. The printer responds to commands with status information.

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6.1.1 Connector Pin Assignments

Characters and commands are transmitted to the printer via an 8-bit parallel bus, AOUT. Signals and pin numbers are as follows:

Pin	Signal
44	AOUT0
45	AOUT1
46	AOUT2
29	AOUT3
30	AOUT4
31	AOUT5
32	AOUT6
33	AOUT7
34	AOUT8
16	PERR
19	EX WRITE
15	EX ADR
13	EX STATUS
20	EX COMM
8,9,10,11	I/O 5V
40,41,42,43	Signal Ground

Status is sent to the processor on an independent 8-bit bus, AIN:

Pin	Signal
1	AIN0
2	AIN1
3	AIN2
4	AIN3
5	AIN4
6	AIN5
7	AIN6
18	AIN7
17	AIN8
12	INPUT PARITY

6.1.2 Parallel Addressing

When the printer is to be accessed, the processor must select it by its address (octal 303, strappable). If the appropriate address value is given with an EX ADR command from the processor, the printer becomes addressed and returns a status signal to the processor. The printer remains addressed until an EX ADR signal is received with either a different address or incorrect parity or until the Power-on-Reset in the machine becomes active.

6.1.3 Transmitting Parallel Status Information

When the printer is addressed, it returns on the processor input bus Status Byte One with the following format:

Status Byte One

AIN0	Write Ready
AIN1	Machine Available
AIN2	Printer Addressed
AIN3 thru AIN6	Always False (0)
AIN7	Invalid Command

The Printer Addressed bit (AIN2) goes true (low) when addressed to indicate that the printer is connected to the I/O bus, powered, and addressed. If there are no faults—carriage jam, paper out, cover open—and the printer is

addressed, the Machine Available bit (AIN1) goes true. When the machine available bit is true and the interface is ready to accept a character or command, the Write Ready bit goes true. The Always False bits (AIN3 thru AIN6) are not used.

Status Word One is also selected when the printer is addressed and receives any of the following strobes:

INPUT
EX STATUS
EX WRITE
EX ADR with the printer address on the AOUT bus.

When the printer is addressed and receives an EX COM1 strobe, it returns Status Word Two on the input bus with the following format:

Status Word Two after EX COM1

AIN0 thru AIN4	Reserved
AIN5 and AIN6	False
AIN7	True

6.1.4 Parallel Data and Control Characters

Data is 8 bits parallel, with an additional bit providing odd parity. For non-parity operation, a jumper strap must be removed from the interface board.

If parity is enabled and an error occurs during an EX ADR strobe, the printer will drive PERR true. An error during any other strobe is ignored unless the printer is addressed. If addressed, the printer will drive PERR true and ignore the strobe and AOUT bus. Once PERR is true, it remains true until another strobe occurs with good parity.

If the Write Ready status bit is true, the desired data or control character can be put on the processor output bus and an EX WRITE command issued. This causes the Write Ready bit to go false until the printer stores the character in its buffer, at which time the Write Ready bit will go true again.

6.1.5 Data and Control Lines

All data, strobes, and status signals between the printer and the Datapoint processors are low (true) and high (false) TTL levels (negative true logic).

6.1.5.1 Receive Data and Parity Error Feedback

Data is received in 8 bits parallel (AOUT0 - 7) with an additional bit (AOUT8) providing odd parity. The parity bit is used only in 5500-type I/O bus operations. For non-parity operation, a strap is provided on the interface card to disable parity detection. AOUT0 - 7 are data bits or device address bits depending on the command strobe that accompanies them.

6.1.5.2 Parity Error Feedback (PERR)

If the sum of the true (low) bits received on the AOUT0-8 bus is even when the leading edge (i.e., negative going) of the command strobe (EX ADR, EX WRITE) is received, the PERR line back to the processor is set true (low). Once the PERR line has been set, it remains set until another strobe is received with good parity (not used with 2200 processor).

6.1.5.3 Execute Address (EX ADR)

The EX ADR command is a minimum two microsecond true (low) strobe which, when accompanied by the proper address on AOUT0-7, selects the printer to use the I/O bus. The printer's normal address is octal 303 but it may be optionally strapped to any legal peripheral address. Once addressed, the printer will remain addressed until one of the following occurs:

1. Repower-up (Turn printer power off and then on again).
2. Another EX ADR strobe with a different address on AOUT0-7.

6.1.5.4 Execute Write (EX WRITE)

The EX WRITE command is a minimum two microsecond true (low) strobe. The EX WRITE strobe is recognized by the printer only when it is addressed and parity is good. EX WRITE gates the data on the AOUT bus into the printer electronics.

6.1.5.5 Input (INPUT)

The INPUT command on the I/O bus is generated and used by the processor to gate printer status (AIN0-8) into the processor.

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6.2 Serial Interface (9601)

The serial interface contains the connector and electronics necessary to receive and transmit signals--conforming to RS-232-C specification--for modem control and asynchronous bit serial data.

6.2.1 Connector Pin Assignments

The standard signal character consists of a start bit, 8 data bits, and one stop bit. The standard printer ignores parity errors. A jumper option allows the printer to substitute a special character when an error is detected. The character defaults to "?."

The connector pin assignments are as follows:

Pin	Signal	Direction
40 thru 43	Signal Ground	Input
45	Receive Data	Input
46	External Clock	Input
49 and 50	Protective Ground	
1	Spare Output	Output
2	Spare Input	Input
17 and 36	Secondary	Output
	Request to Send	
30	Data Terminal Ready	Output
32	On-line	Output
34	Carrier Detect	Input
35	Data Set Ready	Input
37	Always True	Output
38	Always False	Output

6.2.2 Transmitting Serial Status Information

When the printer On-line bit is true and the Secondary Request to Send (SRTS) bit is true, the processor may send serial data to the printer. The printer sets the SRTS bit false when its buffer is within 64 characters of being full. The processor may monitor the SRTS bit to control the transmit rate, or pad characters (octal 177) may be embedded in the printer data to keep the processor from overrunning the printer's buffer.

The 64 character buffer will prevent overflow if a dial-up line involves a round-trip satellite link for the rates up to and including 1200 baud. Maximum propagation delays for higher baud rates are as follows:

2400 baud	250 ms
4800 baud	125 ms
9600 baud	62 ms

6.3 Primary Power

The 45 CPS Printer, as supplied from Datapoint, is to be operated at 120 VAC, $\pm 10\%$. However, it is field configurable for

operation with input voltage of 100, 110, 220, 230, 240 VAC $\pm 10\%$ at a frequency of 50 or 60 Hz, ± 3 Hz. The printer draws 2 amps (maximum) at 120 VAC.

7.0 Options

The following field-configurable options are available:

1. The printer is field configurable to several different primary input power sources (see 6.3 Primary Power).
2. The normal address of the printer is 0303 but it may be strapped to any legal peripheral address on the parallel interface assembly.
3. An option strap on the parallel interface assembly can be used to configure the parallel printer to accept data in either 6600/5500 or 2200 I/O modes. The printer is shipped in parity mode (5500/6600).
4. The serial printer can be strapped to operate at 9600, 4800, 2400, 1760, 1200, 880, 600, 440, 300, 220, 150, 110, 75, or 37.5 baud, or to operate from an external 8x or 16x clock. The printer is shipped programmed to operate at 9600 baud.
5. Tractor feed option, Model No. 0515. Legs, Model No. 9603, are required with the tractor feed option.
6. Forms insertion guide, Model No. 0505.
7. Legs, Model No. 9603 (required with tractor feed option). The optional legs are highly recommended for any application.
8. Cut sheetfeeder, Model No. 9605.
9. Optional printwheels, Datapoint supplied paper, Printer Cleaning kit, and many other supplies are available. Consult your Datapoint Customer Supplies Catalog for these supplies and their model numbers.

8.0 Shipping List

The following is a generalized shipping list of items shipped with the 45 CPS Character Printer:

Quantity	Item
1	Input/Output Cable (parallel only), Model No. 9010
1	Mylar Ribbon, Model No. 80496
1	45 CPS Character Printer Product Specification (Document No. 60802)
1	Courier 72 (10 characters per inch) printwheel, Model No. 80270
1	Guide to Operating the 45 CPS Character Printer (Document No. 60812)

Note: The above shipping list is for illustration purposes and may be amended from time to time by Datapoint Corporation.



Datapoint recommends that its customers use Datapoint Customer Supplies. These disks, diskettes, cassettes and ribbons are certified by Datapoint to meet all Datapoint hardware specifications for consistent optimum performance.