Burroughs

AP 9208 Printer

Programming Reference Manual

Relative to Mark 12.0 System
Priced Item
November 1985

Distribution Code SA
Printed in U.S.A.
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Caution: *This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions 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.*

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Introduction

Who Should Use This Manual

The AP 9208 Printer Programming Reference Manual is not written for a general audience. Though the information presented in this manual may be comprehensible to users with varied experience, it is written primarily to be used by someone with knowledge or experience in software or computer systems, such as a programmer or a systems analyst.

The Purpose Of This Manual

This programming reference manual has been prepared to provide you with detailed technical information describing your Burroughs AP 9208 desk-top, laser printer. Though the information presented herein is not essential to install, operate, or maintain your AP 9208 printer, it is information you may find useful for specific system configurations or operations as you require. Also, the information contained in this reference manual may not be provided by the other AP 9208 support documents described below.

Scope

Most of the information provided by this reference manual pertains to the AP 9208 command function control codes. However, the manual also provides information in other subjects including a description of the printer and its features, serial and parallel communications, DIP switch controls, fonts, and character sets. Safety requirements, radio/television interference, and consumables are also detailed.

Support Documents

AP 9208 Installation and Operation Guide

The AP 9208 Installation and Operation Guide provides you with information and instructions which are essential to install and operate your AP 9208 printer. The Installation and Operation Guide is written for a general audience and is available to the user with delivery of the printer. Additional manuals may be purchased from your local Burroughs representative.

Printer Description And Features

General Description

The AP 9208 printer is a low-cost, microprocessor-based, desk-top electrophotographic printer. Printing at a continuous-feed rate of eight pages per minute, the AP 9208 printer ideally serves as a high-quality output device for small to medium size data systems.

The AP 9208 printer prints in a resolution of 300 dots per inch (DPI) in both the vertical and horizontal direction. This high print density provides an image which approaches fully-formed (near letter) character quality.

The AP 9208's modular design, combined with consummables (photoconductor and toner) in cartridge form, provides for fast, simple operation and maintenance. The AP 9208 printer also features easy cutsheet paper loading (250 sheet capacity), and face-down stacking for a positive page collation.

In the manual-feed mode, the printer can accept special stock such as gummed labels, duplex copies, and transparencies.

Refer to the AP 9208 Installation and Operation Guide for a general description of the printer's major assemblies and their location and function.

Acoustic Noise Levels

- Printing: less than 60 dB
- Standby: less than 50 dB

Development Process

The development process in the AP 9208 printer is dry electrophotography.

Printer Dimensions

The following list provides the size and weight characteristics of the AP 9208 printer:

- Width: 20.9 inches (530 mm)
- Depth: 23.2 inches [16.5 inches (420 mm) without paper tray]
- Height: 14.5 inches (368 mm)
- Weight: 81.5 pounds (37 kgs)

Electrical Environment

Power Requirements

- 115 V Model: 90 to 128 V
- 220 V Model: 191 to 256 V

Power Consumption

Power consumption of the AP 9208 is 1K VA (maximum).

Environmental

Standard Operating Conditions (SOC) for the AP 9208 are:

- Power-on hours: 160 per month
- Pages per month: 10,000
- Duty cycle: 13 percent

Environment (Operating Conditions)

The AP 9208 should be operated in a normal office with the following conditions:

- Temperature, dry-bulb: 50° to 90°F (10° to 32°C), wet-bulb: 77°F (25°C) maximum
- Relative Humidity: 20 to 80 percent RH
- Illumination: less than 2000 Lux

- Power capacity: 10 amps (A)
- Altitude: 8250 feet (2,500 m) or lower
- Horizontal Level: The surface supporting the printer should not be tilted more than 5 mm from a horizontal position.

Environment (Nonoperating Conditions)

The environment of the AP 9208 printer in a nonoperating condition is the same as the operating environment with the following exceptions:

- Temperature, dry-bulb: -20° to 110°F (-29° to 43°C)
- Relative Humidity: 80 percent RH (maximum)

Environment (Shipping and Storage in Shipping Container)

- Temperature, dry-bulb: -20° to 110°F (-29° to 43°C)
- Relative Humidity: 80 percent RH (maximum)

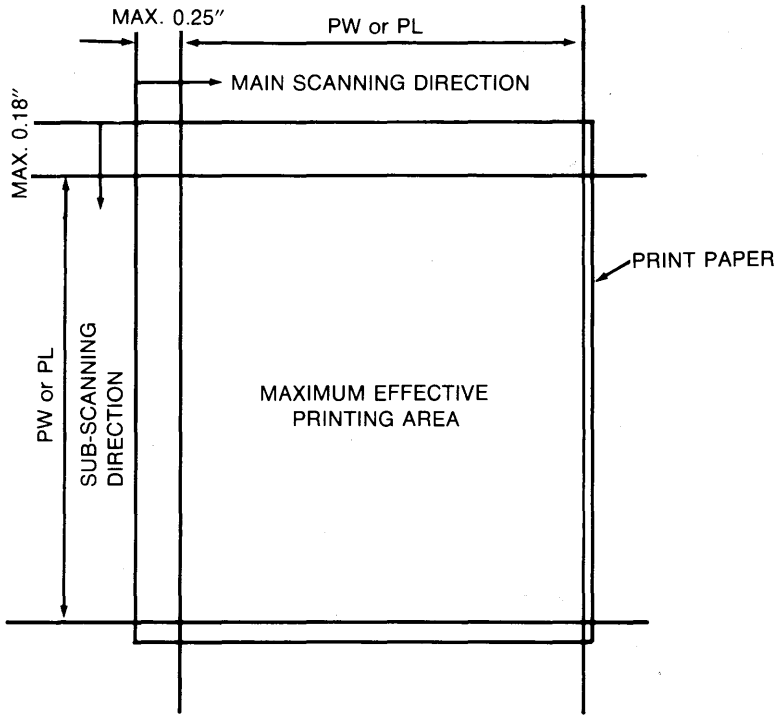
Page Dimensions

Table 1-1 details the AP 9208 printer's page dimensions and Figure 1-1 shows the AP 9208's maximum effective printing area. PW denotes page width and PL denotes page length.

Table 1-1 **Page Dimensions**

Paper Size	PW (inches) Portrait	PL (inches) Landscape	Portrait	Landscape
A4	7-4/5	11	11 (66 1pp)	7-4/5 (66 1pp)
8 ½X11	8	10 ½	10 ½ (63 1pp)	8 (66 1pp)

Figure 1-1 **Maximum Effective Printing Area**



Paper

The AP 9208 printer uses plain paper, cut sheet, either size A4 or letter (8-1/2 X 11 inch), 16 to 24 pound (60 to 90 g/m2).

Paper Tray Capacity

The capacity of the paper tray is 250 sheets (20 pound paper).

Paper Stacker Capacity

Paper ejects from the printer face down to provide for positive page collation in the stacker. Capacity is 250 sheets.

Operator Control And Indicator Panel

The AP 9208 printer operator control and indicator panel contains 11 indicators and two control buttons which also have indicator symbols. These 13 displays provide information on the printer's operational status, or of a situation which may require your attention.

Nine of the indicators and the two control buttons/indicators depict symbols when activated. Two other indicators display LED alphanumeric characters which are usually displayed in conjunction with a flashing symbol.

Refer to the AP 9208 Installation and Operation Guide for a general description of each control and indicator. The following information provides a more detailed description of the On-line/Off-line, Font Select, and Self-test switches, and the error displays.

Control Switches

On-line/off-line Switch

The on-line switch is used to alternately select the on-line and off-line modes. The default mode is on-line.

From On-line to Off-line

Once the device mode is switched from on-line to off-line, the printer stops printing once the current print operation is completed.

From Off-line to On-line

When the on-line mode is restored, the printer resumes print operation from the stop point.

Font Select Switch (Type Face Select Button)

On-line Mode

When in the on-line mode, the Font Select switch is ineffective.

Off-line Mode

When in the off-line mode, pressing the Font Select switch will display the alphanumeric character corresponding to the font currently selected. Subsequent operation of this switch results in sequential display of all font assignment numbers. The last font number is followed by the first font number. If the on-line mode is restored after selecting the font, the printer uses that font for subsequent print operations. Font numbers are displayed in the following order:

- Internal fonts: 1 through 9
- Upper ROM cartridge: U1 through U9
- Lower ROM cartridge: L1 through L9
- Download font: (No display or selection)

Note: *A selected font becomes the default font and can be used in program control from the host.*

Self-Test Switch

On-line Mode

When in the on-line mode, the self test print operation will not execute.

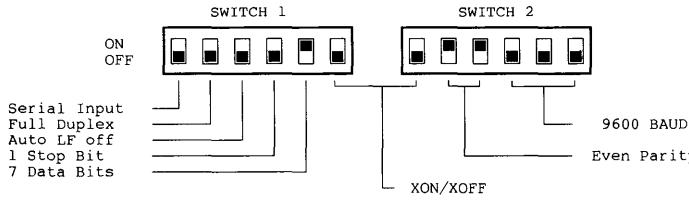
Off-line Mode

Pressing the Self-test switch will cause the printer to execute a self-test print when the printer is in the off-line mode. If print data exists in the page buffer, the printer prints that page followed by a test pattern (refer to Figure 1-2). If no print data exists in the buffer, the printer immediately starts printing the test pattern. If the self-test print feature is activated when the controller is in the error state due to a controller error, the printer prints a message describing the error. After the printer completes the self-test print operation, it clears the controller error and resumes print operations.

Figure 1-2 **Print Test Pattern**

```
   S U M M A R Y   S H E E T                LASER PRINTER Revision Level 2.1

Paper Size: 8.5 by 11        Total RAM: 476 KB        Available RAM: 407 KB
```




```
   FONTS IN SYSTEM

COURIER 10              1000 3 1000 P     1    !"#$%&'()*+,-./0123
COURIER 10              1000 3 1000 S     1
COURIER 12              1000 3 1000 P     2    !"#$%&'()*+,-./0123
COURIER 12              1000 3 1000 S     2
PRESTIGE ELITE          1000 3 1000 P     3    !"#$%&'()*+,-./0123
PRESTIGE ELITE          1000 3 1000 S     3
BOLD ITALIC PS          1000 3 2000 P     4    !"#$%&'()*+,-./0123
BOLD ITALIC PS          1000 3 2000 S     4
BOLDFACE PS             1000 3 2000 P     5    !"#$%&'()*+,-./0123
BOLDFACE PS             1000 3 2000 S     5
LETTER GOTHIC 12        1000 2 1000 P     6    !"#$%&'()*+,-./0123
LETTER GOTHIC 12        1000 2 1000 S     6
LETTER GOTHIC 15        1000 2 1000 P     7    !"#$%&'()*+,-./0123
LETTER GOTHIC 15        1000 2 1000 S     7
ORATOR 90%              1000 2 1000 P     8    !"#$%&'()*+,-./0123
ORATOR 90%              1000 2 1000 S     8
ROMCART                 1000 3 1000 P    21    !"#$%&'()*+,-./0123

   No errors
```

Note: *After completion of the self test print operation, the controller returns to its default settings except when Font Assign, DIP switch default set, and paper handling have been activated.*

Displays

Error Display Messages

The display shows no information when the printer and controller are in the ready status. If an error occurred, the numeric display shows the error details. For two-column displays, the display shows errors cyclically as follows:

(display)(display) (blank) (display)(display) (blank)...

Table 1-2 lists the alphanumeric character displays and the corresponding error messages they indicate. (Also see Fatal Errors, Operator Call Errors, Controller Errors, and Temporarily Busy Responses in Section 3.)

Table 1-2 **Error Display Messages**

Display	Error Description
1	Fusing error
2	Optical system error
3	1 and 2
4	OPC synchronous mark error
5	1 and 4
6	2 and 4
7	1, 2, and 4
8	Main motor error
9	1 and 8
A	2 and 8
B	1, 2, and 8
C	----
D	----
E	----
F	Engine CPU error
Flashing C	Cover left open
Flashing E	Paper jam inside or at exit
Flashing F	Paper feed jam

Table 1-2 **Error Display Messages (cont'd)**

Display	Error Description
12	Communication line error
13	Input buffer overflow
14	Cartridge has been removed while printing
15	Band to complex to print
16	Page exceeds page buffer memory
21	Not enough memory to rotate font
23	Not enough memory to download font
24	Bad data in downloaded font
25	Character not in selected font
26	Cannot select required font
27	No font present
31	Nonfatal lower RAM error
32	Trying to load too many fonts for table
34	Font table has been damaged
35	Downloading middle without beginning
36	Downloading code outside index range
41	Memory unavailable during memory reorganization
42	Loopback test failure
43	Glyph exceeds buffer size
71	Fatal lower RAM error
73	CRC error on firmware ROM
74	Error in one of the system timers

Product Safety

Warning: *Use of controls or adjustments, or performance of procedures other than those specified in this manual, may result in operator exposure to hazardous laser light.*

The AP 9208 printer contains a 5 milliwatt, 760-810 nanometer wavelength, GaA2As laser diode. Direct or indirect (reflected) eye contact with the laser beam may cause serious eye damage. Safety precautions and interlock mechanisms have been designed into the printer to prevent any possible laser beam exposure.

Electromagnetic Interference

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in strict accordance with the AP 9208 Installation and Operation Guide and this manual, may cause interference to radio and television communications. It has been type 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 in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, you are encouraged to try to correct the interference by following the corrective measures detailed below.

Perform one or more of the following instructions to correct electromagnetic interference:

1 Reorient the receiving antenna on the device being interfered with.

2 Relocate the printer with respect to the receiver.

3 Move the printer away from the receiver.

4 Connect the printer and the radio/television into different AC power outlets so that both devices are on different branch circuits.

If necessary, consult your local Burroughs representative or an experienced radio/television technician for additional suggestions. For further information, it is recommended that you obtain published information regarding electromagnetic interference prepared by the Federal Communications Commission.

Performance Characteristics

Unit Time

The printer becomes ready to print within 3 minutes after power is applied.

Print Rate

The first page is printed out in under 20 seconds. Thereafter, the typical print rate is eight pages per minute while printing text, providing data transfer rates are sufficiently maintained at 9600 baud from the host system.

Print Resolution

The AP 9208 printer prints in a resolution (density) of 300 dots per inch (DPI) both vertically and horizontally. This high resolution provides an image which approaches fully-formed (near letter) character quality.

Paper Feed

Cassette Feed

The printer can be fed normal paper (16 to 24 pounds/60 to 90 g/m^2) from the paper tray which has a capacity of 250 sheets. The printer can accommodate letter (8-1/2 X 11) or A4 paper sizes. Refer to the AP 9208 Installation and Operation Guide for paper loading instructions.

Manual Feed

The AP 9208 printer can be manually fed either normal paper or special stock (16 to 24 pounds) such as transparencies, gummed labels, or duplex copies. Any stock being printed on, paper or special stock, must not be less than 6.5 inches in length or more than 11-5/8 inches in length, and must not be more than 8-1/2 inches in width. Refer to the AP 9208 Installation and Operation Guide for instructions for manual loading.

Paper Output

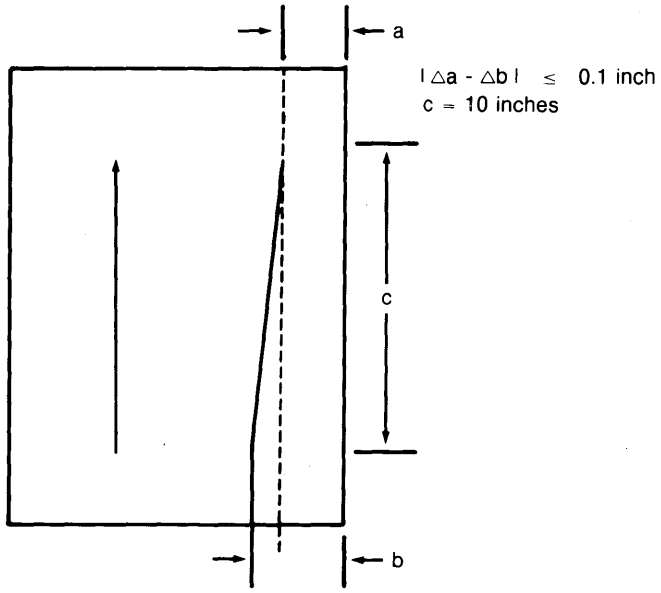
Printed material exits the printer face down on the paper stacker (250 sheet capacity), providing for positive page collation.

Print Quality

Vertical Skew

A vertical line printed parallel to the edge of the page does not deviate more than 0.1 inch over a length of 10 inches. Figure 2-1 shows vertical skew.

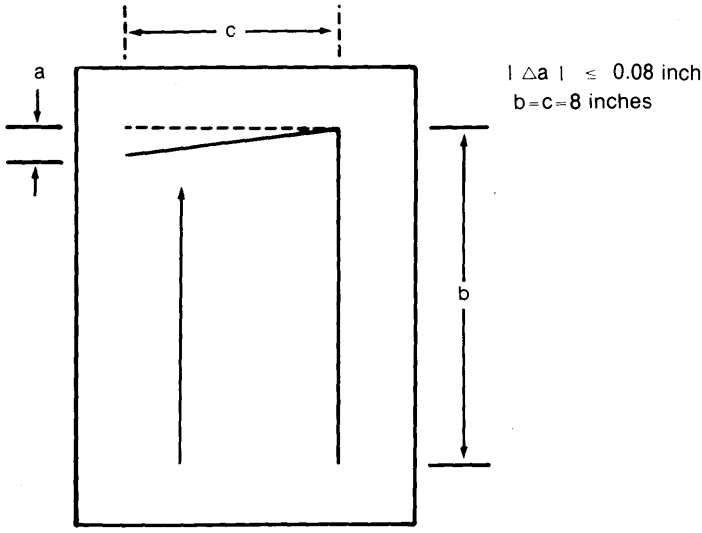
Figure 2-1 **Vertical Skew**



Registration

A horizontal line printed at right angles to a vertical line on the page is within 0.08 inch of 90 degrees at a distance of 8 inches from the vertical line. Figure 2-2 shows registration.

Figure 2-2 **Registration**



Solid Fill

Printing five 0.2-inch squares at each corner of the print area and one in the center of the page, the average density of the five squares is 0.6 minimum as measured with a Macbeth RD900 densitometer.

Background Density

Background density does not exceed .1 dU over 95 percent of the printed pages nor does it exceed more than .12 dU over the remaining 5 percent of the pages.

Fusing

The fixed image is fixed so that the entire image is fused permanently. No loss of density, smudging, smearing, or loss of character edge definition will occur when the page is riffled several times with moderate pressure using a clean tissue.

Programming Control Codes

General

This section details the Command Set Function Control Codes for the AP 9208 printer. These control codes are divided into nine major subsections according to the code's function: font control, page formatting, movement, word processing, tabulation, graphics, remote diagnostics, miscellaneous commands, and nonfunctional escape code sequences. This control code set includes codes for Diablo 630 commands. Those control codes which are exclusive to the AP 9208 printer are so identified.

Font Commands

The printer can incorporate many types of fonts, including built-in, internal extended, read-only memory (ROM) cartridge, and down-load fonts. The number of fonts available is restricted by the memory capacity of the printer.

A maximum of 16 fonts can be used at the same time, and these must have been previously assigned by an assign font command. After power is applied or a reset is performed, initial assignments are made in the following order:

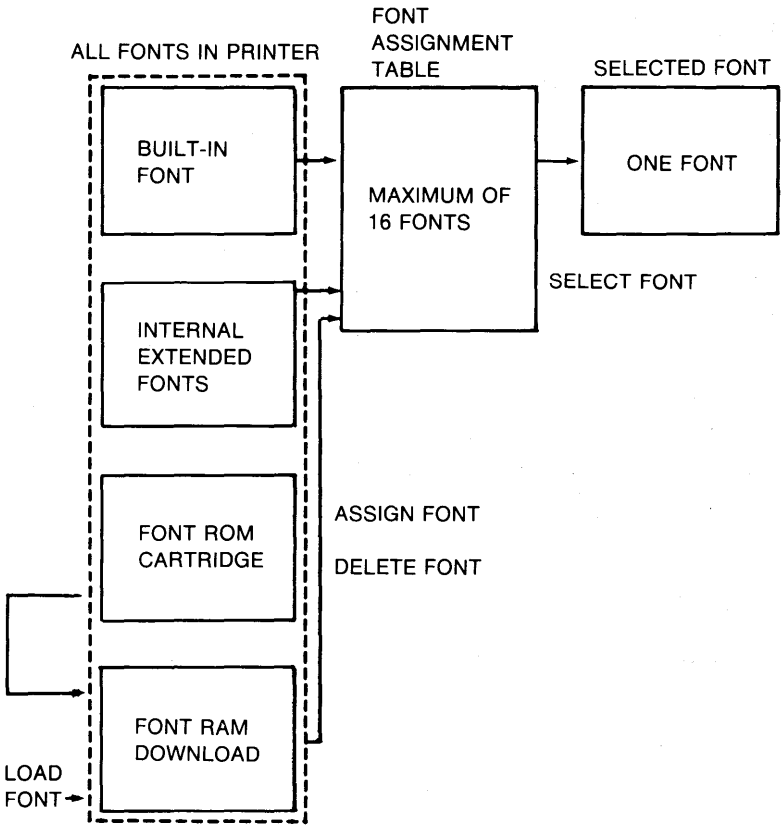
1 Built-in fonts (resident)

2 Internal extended fonts

3 Fonts in the font ROM cartridge(s)

Figure 3-1 shows font types and how assignments are made.

Figure 3-1 **Font Assignments**



The font to be used is selected from the 16 assigned fonts. The font with the smallest assignment number is given the highest priority and is selected as the default font.

Assign Font: ESC DC2 A m1, m2 @ <Font Name> ESC SP

Table 3-1 lists characteristics that may be selected for assigning a font. A value with no corresponding font is invalid. A multiple assignment is possible. The initial assignment of the internal and ROM cartridge fonts is determined by the order in which they were saved. Out-of-range m1 and m2 values are invalid. When downloaded fonts are used, font assignment should be performed.

Table 3-1 **Assigning Font Characteristics**

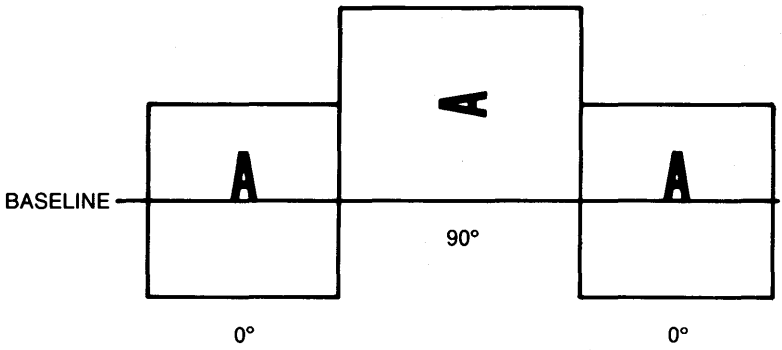
ASCII Code	Characteristics
m1	Font assignment number ($0 \leq m \leq 15$)
m2 = 1*	Character rotation: 0 degrees (portrait)
m2 = 2	Character rotation: 90 degrees (landscape)
<font name>	Maximum 20-character ASCII codes between 20H and 7EH

* Default

Select Font: ESC DC2 S m SP

The m value is an ASCII number ($0 \leq m \leq 15$). The font specified by the assignment number is selected. If the specified font is not assigned, it is an error. Printing continues even if the selected character rotation is different from the current print direction. For that case, however, the character baseline is positioned as shown in Figure 3-2.

Figure 3-2 **Character Baseline Positioning**



Load Font/Delete Font:

The format is:

ESC [m1, m2 @ font name
ESC [header
ESC SP spoke table (option)
ESC SP
ESC — m11, m12, m13, m14, m15, m16, m17 @ font data 1
ESC — m21, m22, m23, m24, m25, m26, m27 @ font data 2
:
:
ESC — mk1, mk2, mk3 mk4, mk5, mk6, mk7, @ font data k
ESC]

The m1 value is an ASCII number ($1 \leq m1 \leq 4$). Table 3-2 lists data format values that may be selected.

Table 3-2 **Data Format Values**

ASCII Code	Characteristic
m1 = 1	Vertical scanning format with eight dots
m1 = 2	Vertical scanning format with four dots
m1 = 3	Horizontal scanning format with eight dots
m1 = 4	Horizontal scanning format with four dots

Notes:

1 *For vertical scanning, the dot image is scanned down and then right in the cell, the uppermost bits being the most significant bits (MSB).*

2 *For horizontal scanning, the dot image is scanned right and then down in the cell, the leftmost bits being MSB.*

3 *In the eight-dot mode, the total number of dots is a multiple of 8. In the four-dot mode, the total number of dots is a multiple of 4.*

4 *In the four-dot mode, the code range is 40H to 4FH.*

The m2 value is an ASCII number ($1 \leq m2 \leq 2$). Table 3-3 lists character rotation angle values that may be selected.

Table 3-3 **Character Rotation Angle Values**

ASCII Code	**Characteristic**
m2 = 1	Rotation by 0 degrees (portrait)
m2 = 2	Rotation by 90 degrees (landscape)

The font name (an ASCII code) must consist of a maximum of 20 characters beginning with an alphabetic character. Upper case and lower case letters are interchangeable. The code range is 20H to 7EH. A code exceeding the limit is assumed to be a null character, and it ends the ESC code.

When downloading, the name used in this command is ignored, and the name in the header is used.

A font can be deleted by the command format:

ESC [m1, m2 @ font name ESC]
ESC [@ ESC]

The first command deletes the specified font and rotation angle from the download area, if it exists (m1 is a dummy parameter). The second command deletes all fonts from the download area and frees the memory. In either case, the deleted font name is also deleted from the assignment table, if it has been assigned to it. (Fonts in the RAM loaded from font ROM cartridge can be deleted by the same method as they are processed in a similar way.)

Table 3-4 **Character Set Characteristics**

ASCII Code	Characteristic
mk1	Character code
mk2	Number of effective horizontal dots
mk3	Number of horizontal offset dots
mk4	Horizontal cell width (centipoint)
mk5	Number of effective vertical dots
mk6	Number of vertical offset dots
mk7	Vertical cell width (centipoint)

The dot pattern data of the character is specified by mk1 to mk7. The number of data bytes is:

- (mk2 X mk5)/8 bytes in eight-dot mode.
- (mk2 X mk5)/4 bytes in four-dot mode.

The rules for the spoke-table option are:

1. A maximum of 128 characters may be downloaded in one operation.
2. All numeric values other than character codes are represented in ASCII decimal format.
3. Character codes must be in the range of either OOH to 7FH or 80H to FFH, but they must not occur in both ranges at the same time.
4. Characters may not be transferred in the code sequence.
5. Two fonts can be downloaded under one font name, allowing processing of a character set containing more than 128 characters.

Page Format Commands

Refer to Section 1 of this manual for page dimensions and characteristics. Table 3-5 lists and describes the notation used to identify page characteristics.

Page Width (PW) is determined by paper size and printing direction and cannot be changed. However, Page Length (PL) can be set by the set page length command. Left Margin (LM), Right Margin (RM), Top Margin (TM), and Bottom Margin (BM) can all be set by the set margin commands. Horizontal Motion Index (HMI), and Vertical Motion Index (VMI) can be set by the Set HMI and Set VMI commands, respectively.

The maximum effective printing area begins at a distance of 1/4 inch in the main scanning direction from the print paper left edge and at a distance of 1/4 inch in the subscanning direction from the print paper top edge. The effective printing area may begin at an arbitrary position in the main and subscanning directions. Figure 1-1 shows the maximum effective printing area.

Set Lines Per Page to (n), ESC FF (n)

This sequence causes the VMI to determine the page bottom [n X VMI: $1 \leq n \leq 126$]. If the page size exceeds the physical page length, then the page will be composed on two sheets of paper.

Print Orientation: ESC DC2 D (n) SP

If n is other than 1 (for portrait) or 2 (for landscape), it is invalid. If the print direction is changed while a page is printing, the change is effective immediately and the print position reverts to the new origin. This command does not change font. Font select command is required to select the desired print style.

Table 3-5 **Page Format Characteristics**

Nomenclature	Definition
PW	Page Width: maximum page width in printable area
PL	Page Length: maximum page length in printable area
LM	Left Margin: effective printing limit left side (default = LL)
RM	Right Margin: effective printing limit right side (default = RL)
TM	Top Margin: effective printing limit top end (default = TL)
BM	Bottom Margin: effective printing limit bottom end (default = BL)
HMI	Horizontal Motion Index: horizontal motion unit
VMI	Vertical Motion Index: vertical motion unit
LL	Left Limit
RL	Right Limit
TL	Top Limit
BL	Bottom Limit

Set Margin Commands

The rules for using margin commands are:

1 When the distance between TM and BM is smaller than the character cell height, print one line while drawing the baseline on BM. Then, printing occurs with new page motion.

2 When the distance between BM and TL is smaller than the character cell height, one line is printed on the shifted-down position by the baseline offset from TL.

3 When the distance between TM and BL is smaller than the character cell height, print one line while drawing the baseline on the top margin.

4 When the distance between LM and RM is smaller than the character cell width, printing occurs by fitting the left side of the cell to LM.

5 When the distance between LM and RL is smaller than the character cell width, printing occurs by fitting the right side of the cell to RL.

6 If LM is greater than or equal to RM or TM is greater than or equal to BM, the latest specified values are valid, and others are default values.

7 If LM is set on the right side of the active position (AP), P moves to the new LM.

8 If RM is set on the left side of AP, AP does not move.

9 When TM is set below AP, AP moves to the new TM.

10 When BM is set above AP, printing occurs.

11 LM can be exceeded up to LL by backspacing.

12 TM can be exceeded up to TL by negative LF.

13 If parameters are outside the page range, this command is invalid.

14 The specified length is converted to number of dots and any fraction is ignored.

15 Bottom margin can only be exceeded by an absolute or relative positioning command, then LF will cause printing.

Set Left Margin: ESC 9

This sequence causes the current print position to become the left margin.

Set Absolute Left Margin: ESC DC4 9 (n): HMI

This sequence determines the left margin using the HMI [(n - 1) X HMI: $1 \leq n \leq 126$: binary]. This sequence is invalid if the left margin falls outside the page area.

Set Absolute Left Margin: ESC DC2 9 (n) SP: n/120"

This sequence determines the left margin using 1/120 inch [(n) X 1/120", $0 \leq n \leq 9999$: ASCII]. All other aspects of this sequence are the same as for ESC DC4 9 (n) (described in the previous paragraph).

Set Right Margin: ESC 0

This sequence causes the right margin to be established at the current horizontal print position.

Set Absolute Right Margin: ESC DC4 0 (n): HMI

This sequence determines the right margin using the HMI [(n - 1) X HMI, where $1 \leq n \leq 126$: binary]. This sequence is invalid if the right margin's calculated position falls outside the page area.

Set Absolute Right Margin: ESC DC2 0 (n) SP: n/120"

This sequence determines the right margin by 1/120 inch [(n) X 1/120"]. The position is calculated from the page left side [n/120 when $0 \leq n \leq 9999$: ASCII].

Set Top Margin at Current Print Position: ESC T

This sequence establishes the top margin at the current vertical print position.

Set Absolute Top Margin: ESC DC4 T (n): VMI

This sequence determines the top margin using the VMI. The position is calculated from the page top [(n - 1) X VMI:

$1 \leq n \leq 126$: binary]. It is invalid if the top margin's calculated position falls outside the page area.

Set Absolute Top Margin: ESC DC2 T (n) SP: n/48"

This sequence determines the top margin by n/48 inch. The position is calculated from the page top [(n) X 1/48":

$0 \leq n \leq 9999$: ASCII).

Set Bottom Margin at Current Print Position: ESC L

This sequence causes the bottom margin to be established at the current print position.

Set Absolute Bottom Margin: ESC DC4 L (n): VMI

This sequence sets the exact bottom margin position calculated from the page top using VMI [(n - 1) X VMI: 1 ≤ n ≤ 126: binary]. It is invalid if the calculated position falls outside the page area.

Set Absolute Bottom Margin: ESC DC2 L (n) SP: 1/48"

This sequence sets the exact bottom margin position calculated from the page top using n/48 inch [(n - 1) X n/48: 0 ≤ n ≤ 9999: ASCII].

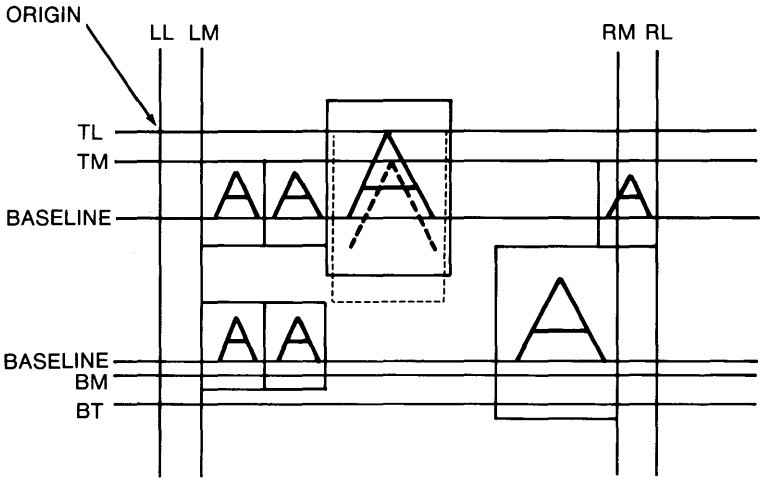
Clear Top/Bottom Margins: ESC C

This sequence clears the top and bottom margins and sets them to the default values according the to selected paper size.

Movement Commands

Figure 3-3 shows how movement occurs. LM and RM are associated with the character cell left side and right side, respectively. TM and BM are associated with the character cell baseline. RM is used only for the auto justification and auto centering functions.

Figure 3-3 **Movement**



The AP is in the baseline at the left side of the character cell. It moves as follows:

1 Immediately after Form Feed (FF), it moves to the position decided by TM plus the baseline offset of the current font.

2 Immediately after CR, it moves to LM.

The rules for movement commands are:

1 When the right side of the character cell exceeds RL during printing (character or spacing) operations, the actual operation varies according to whether the auto new line has been enabled. If auto new line has been enabled, a new line (LF CR) occurs; if it has been disabled, printing occurs with the character cell right side on RL. When several characters are transmitted, overprinting occurs.

2 When AP exceeds BM during printing by either a LF or a half-LF) operation, the printer immediately prints the current page and moves AP to TM on the next page.

3 If the font size or character scale is changed during printing, the printing position is determined by the baseline. If the character cell top exceeds the TL, the cell is shifted down until its top end matches the TL. In this case, AP does not move.

4 When moving AP by SP, BS, or character operations, the specified movement distance is converted to dots, and any fractions less than a dot pitch are accumulated. When the accumulated fraction reaches one dot pitch, this value is automatically added to the moving distance.

5 The HMI value is referred to only when deciding the SP moving distance for a proportional font.

6 The HMI value can be set to 0 (zero), in which case the movement distance is 0.

7 RM and LM are ignored for absolute or relative positioning. If LL or RL is exceeded, the associated command is invalidated.

8 RM is ignored for a HT movement. The HT operation is invalidated if no horizontal tab stops are found in the forward direction in the same line.

9 RM is ignored for character and SP movement. LM is ignored for a BS movement.

10 Successive BS movements move the AP backward repeatedly by the length of the last character printed.

Horizontal Movement Commands

Set HMI to (n - 1): ESC US (n)

This sequence specifies the unit of movement in the horizontal direction by integer multiplication of 1/120 inch [(n - 1) X 1/120 inch: $1 \leq n \leq 126$: binary]. HMI = 0 can be set to produce no horizontal movement. The HMI is calculated by dots, and fractional remainders less than one dot are added when the print position moves horizontally. When the added fraction exceeds one dot, movement by one extra dot occurs.

Set Default HMI: ESC S

This sequence sets the default HMI value for the selected font.

Set Absolute Horizontal Position (n): ESC HT (n)

This sequence moves the print position to an absolute position from the page left side [distance of movement: (n - 1) X HMI: 1 ≤ n ≤ 126: binary]. The HMI value is calculated by dots, and any fractional remainders are added together.

Set Absolute Horizontal Position: ESC DC4 H (n): HMI

This sequence moves the print position to an absolute position from the page left side [distance of movement: (n - 1) X HMI: 1 ≤ n ≤ 126: binary]. The HMI value is calculated by dots, and any fractional remainders are added together.

Set Absolute Horizontal Position: ESC DC2 H (n) SP: 1/120"

This sequence moves the print position to an absolute position from the page left side [distance of movement: n/120 inch: 0 ≤ n ≤ 9999: ASCII].

Set Relative Horizontal Position: ESC DC4 SP <+/-> n: HMI

This sequence moves the print position in a positive or negative direction from the current position [distance of movement: (n - 1) X HMI: 1 ≤ n ≤ 126: binary]. All values are calculated by dots, and any fractional remainders, including those for the current print position, are added together.

Set Relative Horizontal Position: ESC DC2 SP <+/-> n: 1/120"

This sequence moves the print position in a positive or negative direction from the current position [by the distance calculated by n/120 [(n) X 1/120", 0 ≤ n ≤ 9999: ASCII].

Space (One HMI): SP

This command advances the print position in the same line. The movement distance is determined by the HMI value. When the print position exceeds the right margin:

1 If the auto NL mode is enabled, a CR and LF operation is performed, and the print position moves to the left limit.

2 If the auto NL mode is disabled, the print position stops at the right limit and any additional characters will be overprinted.

Horizontal Tab: HT

This command advances the print position to the next tab set position. If no tabs are set in the forward direction, the command is ignored.

Carriage Return: CR

This command returns the print position to the left margin of the same line it is currently on. The response to this command may be modified to include a LF by the use of the default DIP switch setting or the define CR, LF, FF command.

Backspace: BS

This command returns the print position to the previous printed character position or the distance of one space in a right to left direction.

Backspace 1/120 Inch: ESC BS

This sequence returns the print position to a position 1/120 inch preceeding the current print position. The 1/120 inch is calculated by dots, and the fractional remainders of each movement calculation, including those for the current position, are added together.

Vertical Movement Commands

The rules for vertical movement commands are:

1 The VMI value can be set to 0 (zero), in which case the movement distance is zero.

2 When BL is exceeded for absolute or relative positioning, the associated command is invalidated.

3 TM can be exceeded up to TL for negative LF or negative half-LF.

4 A VT operation is invalidated if no vertical tab stops are found in the forward (subscanning) direction.

5 The VMI value is not changed by fonts. When the page direction is changed, the default value for the new direction is set.

Set VMI to (n - 1): ESC RS (n)

This sequence specifies the unit of movement in the vertical direction by integer multiplication of 1/48 inch [(n - 1) X 1/48 inch: $1 \leq n \leq 126$: binary]. The VMI is calculated by dots, and fractional remainders less than one dot are added when the print position moves vertically. When the added fractions exceeds one dot, movement by one extra dot occurs.

Set Absolute Vertical Position to Line (n): ESC VT (n): VMI

This sequence moves the print position to an absolute position calculated by VMI [(n - 1) X VMI: $1 \leq n \leq 126$: binary]. The VMI value is calculated by dots, and any fractional remainders are added together.

Set Absolute Vertical Position: ESC DC4 V (n): VMI

This sequence moves the print position to an absolute position calculated by VMI [(n - 1) X VMI: $1 \leq n \leq 126$: binary]. The VMI value is calculated by dots, and any fractional remainders are added together.

Set Absolute Vertical Position: ESC DC2 V (n) SP: 1/48"

This sequence moves the print position to an absolute position calculated by n/48 inch where 0 ≤ n ≤ 9999: ASCII.

Set Relative Vertical Position: ESC DC4 LF <+/-> n : VMI

This sequence moves the print position in a positive or negative direction from the current position [by the distance calculated by (n - 1) X VMI: 1 ≤ n ≤ 126: binary]. Values are calculated by dots, and any fractional remainders, including those for the current position, are added together.

Set Relative Vertical Position: ESC DC2 LF <+/-> n SP: 1/48"

This sequence moves the print position in a positive or negative direction from the current position [by the distance calculated by n/48 where 0 ≤ n ≤ 9999: ASCII].

Line Feed: LF

This command advances the print position to the same horizontal character position on the next line. The distance of movement is determined by the VMI. The response to this command may be modified to include a CR by the use of the define CR, LF, and FF command.

Form Feed: FF

This command advances the print position to the same horizontal character position on the top margin of the next page and executes printing. The response to this command may be modified to include a CR by the use of the define CR, LF, and FF command.

Vertical Tab: VT

This command advances the print position to the next vertical tab position. This command is ignored if no tabs are set in the forward (subscanning) direction.

Negative Line Feed: ESC LF

This sequence moves the print position backward by the VMI value to the same horizontal print position on the previous line.

Half-Line Feed: ESC U

This sequence advances the print position half the distance of the VMI value.

Negative Half-Line Feed: ESC D

This sequence causes the print position to move backward in the subscanning direction by half the distance of the VMI value.

Set Movement Mode Commands

Define CR, LF, and FF: ESC DC2 M (n)

Table 3-6 lists the values for n for these commands. All other values for n are invalid.

Table 3-6 **CR, LF, and FF Definitions**

n Value	CR	LF	FF
n = 1*	CR	LF	FF
n = 2#	CR + LF	LF	FF
n = 3	CR	LF + CR	FF
n = 4#	CR + LF	LF + CR	FF
n = 5	CR	LF	FF + CR
n = 6#	CR + LF	LF	FF + CR
n = 7	CR	LF + CR	FF + CR
n = 8#	CR + LF	LF + CR	FF + CR

* Default, #Auto Linefeed

Auto New Line Mode On: ESC ?

When the right side of the character cell is assumed to exceed the RL during character printing or SP operations in the enabled state, a new linefeed (LF CR) occurs, and the AP returns to the LM on the next line. When in the disabled state, it adjusts the printing position so that RL and the right side of the cell are aligned. If two or more characters are transmitted from the host, they are overprinted.

When the right side of the character cell is assumed to exceed RL during character movements or printing operations in the disabled state, printing occurs, aligning the right side of the character cell on the RL, with AP at RL. If two or more characters follow, they are overprinted.

Auto New Line Mode Off: ESC !

This sequence causes the active print position to stop at the physical limit. This is the default mode.

Enter Reverse Printing Mode: ESC <

This sequence is used to print leftward (backward in the scanning direction) for printing Arabic, etc. In the reverse mode, the CR, SP, HT, BS, LM, RM, and ESC BS horizontal motions are reversed. The active position starts at RM, and its movement is limited by the left limit. Absolute and relative positioning functions do not change. The backward print mode can be specified, moving the print position to the right.

Exit Reverse Printing Mode: ESC >

This sequence exits the reverse printing mode described in the previous paragraph.

Forward Print Mode On: ESC 5

This sequence returns the printer to the forward printing mode.

Backward Print Mode On: ESC 6

This sequence places the printer in the backward printing mode, in which each character printed causes incremental print position movement to the left, the opposite of print motion during forward printing. The actions of space and BS codes are reversed in backward printing. Note, however, that tabbing operations, carriage returns, and all paper movement functions are unaffected in this mode. CR exits the backward printing mode.

Word Processing Mode Commands

Proportional Space On: ESC P

This command configures the printer in the proportional space mode. In the proportional space mode, HMI values are dependant on character width.

Proportional Space Off: ESC Q

This sequence causes the printer to exit the proportional-space mode.

Offset Selection: ESC DC1 (n)

The normal way to change character spacing is to adjust HMI. For proportional-space printing, HMI is ignored, and table values are used. Thus, to add or subtract a constant to each table size, the sequence ESC DC1 (byte) is used. The byte character value is added to each table size value, or HMI if it is controlling size, as well as to the space character. This procedure continues until another ESC DC1 (byte) sequence is received, or until offset is cleared by a CR or ESC X sequence. The byte character is defined as follows:

Bits 0 through 5 = offset size (64 units maximum, 1/120 inch per unit)

Bit 6 = offset sign (1 = negative)

If a negative offset (smaller character size) is desired, Bit 6 should be set. If the resulting character size is zero or less, no carriage movement occurs. Note that because NUL and DEL cannot pass through the serial receiver, positive offset values range from 1 through 64, and negative values range from 0 through 63.

Auto Underscore On: ESC E

This sequence initiates automatic underscoring. The present print position is stored in memory as the start location. The area between the end and the start position is underscored. The end position is defined as the print position when one event listed in Table 3-7 occurs. No underscoring occurs in the area between the start and end locations if the ESC X sequence is received. Auto underscore is exited by ESC R or ESC X.

Table 3-7 **Automatic Underscoring**

Sequence	Definition
ESC R	The underscoring occurs, the print position moves to the first position after the underscore, and the printer exits the auto underscore mode.
CR	The underscoring occurs, and the print position moves to the left margin.
LF	The underscoring occurs, the print position moves to the first position following the underscore, and a line feed occurs.

Auto Underscore Off: ESC R

This sequence ends the underscore at the first position following the underscore off command.

Bold Print On: ESC O

This sequence causes each character to print twice, the first time at the regular print position and the second time at a position determined by the font.

Shadow Print On: ESC W

This sequence causes each character to print twice, the first time at the regular print position and the second time at a position determined by the font.

Bold/Shadow Print Off: ESC &

This sequence ends the bold and shadow print modes. (Bold and shadow modes are mutually exclusive.) Note that a CR, LF, or FF will also end the Bold/Shadow print modes.

Enable Auto Justification: ESC M

This sequence initiates automatic margin justification. Subsequent data are stored in a buffer memory until a CR or LF command is received. Data are then printed justified between the left and right margins. Auto justification remains enabled until the ESC X sequence is received. Auto justification functions in the fixed-pitch or porportional-space mode. All communication protocols still function normally.

Auto justification begins its justification calculations from the position of the first printable character after the CR, LF, horizontal tab (HT), or ESC M sequence, allowing unjustified leading spaces or tabs and partial line justification. Auto justification calculates the number of 1/120-inch offset units needed to fill out or condense the line so that it fits exactly between the first printable character and right margin. Offset units then are applied, first to the word spaces and then to the character and word spaces after the word spaces reach the maximum justified space width. The maximum justified space width is defined in the font file, header data. Typically, it is 200 percent of the normal space size. If the offset added to the character spaces exceeds seven units, the line is printed unjustified.

Auto Center On: ESC =

This sequence starts with ESC = and ends with a CR, LF, or FF. Sentences are centered between LM and RM.

The rules for auto centering are:

1 Printing can be done outside the left and right margins.

2 If the auto center command is requested under auto justify, the auto center command is invalid.

3 If the auto justify command is requested during an auto center command, auto justify is performed at the end of auto center.

4 If ESC X is received before the line terminator of CR, LF, or FF, auto center is not performed.

Cancel Word Processing Modes Except Proportional Spacing: ESC X

This sequence cancels word processing modes except for proportional spacing.

Print Suppression On: ESC 7

This sequence causes all printing to be suppressed. Each printable character is replaced with a space (SP). A CR command causes a return to normal printing.

Print Character for 20H: ESC Y

This sequence causes the character represented by 20H to be printed.

Print Character for 7FH: ESC Z

This sequence causes the character represented by 7FH to be printed.

Enter Program Mode: ESC SO M

After entering the program mode with ESC SO M, one character is printed per two bytes. The first byte specifies the spoke number of the Daisy Diablo 630. The ESC X or SI command exits the program.

The printer converts the spoke number to the printed character by referring to the spoke table in the font data. If the spoke table does not exist, the printer prints the spoke number as a character code.

Table 3-8 shows the data format for the program mode.

Table 3-8 **Program Mode Data Format**

Character	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1
1st Char	I/O	SP	SP	SP	SP	SP	SP
2nd Char	O	HE	HE	HE	RA	RA	RA

Key: I/O corresponds to G0/G1
SP: value gained by spoke number plus 32
HE: left hammer (invalidated by this controller)
RA: ribbon/space feeding quantity (when under the proportional space mode, use this space quantity)

Tab Commands

The rules for tab commands are:

1 The specified length is converted to a number of dots, and any fraction is ignored.

2 HT stops already set are unchanged. A maximum of 96 HT stops may be validated.

3 If the specified parameter value exceeds RL, the parameter is invalidated. However, the command is validated.

Set Horizontal Tab Stop at Current Horizontal Position: ESC 1

This sequence causes a tab to be set at the current horizontal print position. A maximum of 96 tabs can be set.

Absolute Horizontal Tab Stop: ESC DC4 HT (c1 n1 .. nm): HMI

This sequence determines the tab set position at a position calculated from the page left side by the current HMI [(n - 1) X HMI: n = 1 to 126: binary]. This sequence is given as a list. A maximum of 96 tabs can be set.

Absolute Horizontal Tab Stop: ESC DC2 HT (n1,..,nm SP): n/120"

This sequence determines the tab set position at a position calculated from the page left side [(n) X 1/120", n = 000 to 9999: ASCII]. This sequence is given as a list. A maximum of 96 tabs can be set.

Set Vertical Tab Stop at Current Print Position: ESC -

This sequence causes a vertical tab to be set at the current print position.

Absolute Vertical Tab Stop: ESC DC4 VT (c1 n1...nm SP): VMI

This sequence determines the tab set position at a position calculated from the page top using the current VMI [(n - 1) X VMI: n = 1 to 126: binary]. The sequence is given as a list. A maximum of 96 tabs can be set. The parameter C1 is a binary number for the number of tabs to be set.

Absolute Vertical Tab Stop: ESC DC2 VT (n1,...,nm SP): m/48"

This sequence determines the tab set position at a position calculated from the page top by m/48 inch [(n) X 1/48": n = 000 to 9999: ASCII]. This sequence is given as a list. A maximum of 96 tabs can be set.

Clear Tabs: ESC 2

This sequence causes all vertical and horizontal tabs to be cleared.

Clear Horizontal Tab at Current Position: ESC 8

This sequence causes the tab at the current horizontal position to be cleared.

Graphics Commands

Transfer Graphic Data: ESC DC2 G m1, m2, m3, m4, [m5],m6, m7 @

The graphic command is used to download a bit image and print it. The graphic is printed with the upper left corner at the current print position. The current print position is not affected. The first four parameters are required; the fifth is optional. Table 3-9 lists and describes parameters.

Table 3-9 **Graphic Data Description**

Parameter	Description
m1	Data format
m2	Horizontal length of data
m3	Vertical length of data
m4	Magnification numerator
m5	Magnification denominator (m5 should be 1)
m6	Horizontal starting position (m6/720 in.) (omissable)
m7	Vertical starting position (m7/720 in.) (omissable)

The data format has four valid values:

1 m1 = 1 → 8-dot vertical scan format, 00-FFh.

2 m1 = 2 → 4-dot vertical scan format, 40h-4Fh.

3 m1 = 3 → 8-dot horizontal scan format, 00-FFh.

4 m1 = 4 → 4-dot horizontal scan format, 40h-4Fh.

The vertical scan format presents the pixel data top to bottom, left to right. The top bit of the first scan is the most significant bit (MSB) of the first data byte. For this format, m2 will be the number of scans in the data, and m3 will be the number of bytes in each scan line times eight.

The horizontal scan format presents the pixel data left to right, top to bottom. The leftmost bit of the top scan is the MSB of the first data byte. For this format, m2 will be the length of a scan (8 times the number of bytes in the scan), and m3 will be the number of scans in the data.

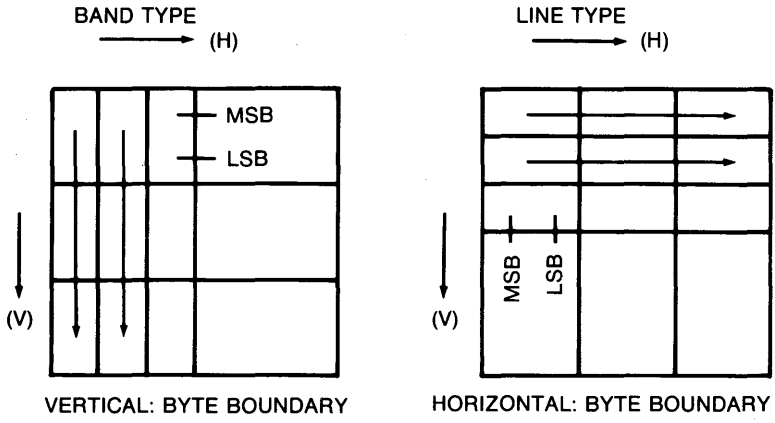
Eight-dot scan format indicates that each character received from the host is an 8-bit code representing eight pixels. The four-dot scan code is for use if the host interface transfers 7-bit characters. In the four-dot case, the four-dot scan is contained in the low nibble. The high nibble is a 4. The four-dot scan codes will be from 40h through 4Fh.

The magnification numerator, m4, has possible values of 1, 2, 3, and 4, and m5 always equals 1. The actual size of the image printed is m4/m5 times the size of the data.

The number of bytes to store the image will be: $m4^2$ X m2 X m3/8.

Figure 3-4 shows transfer graphic data print positions. When the starting positions are omitted, current active position is assumed.

Figure 3-4 **Graphic Data Print Positions**



Draw Ruling: ESC DC2 R m1, m2, m3, m4 SP

The rules for the draw ruling command are:

1 RM, LM, BM, and TM are ignored.

2 The specified length is converted to a number of dots and any fraction is ignored.

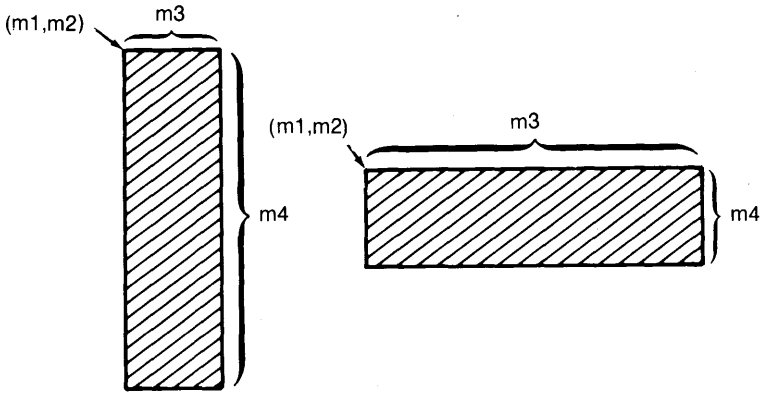
3 AP does not move.

Figure 3-5 shows the ruling print positions. Table 3-10 details the ruling characteristics.

Table 3-10 **Ruling Characteristics**

ASCII No.	Characteristic
m1: (0 ≤ m1 ≤ 9999)	Sets the horizontal starting position (X) at m1 x 1/720" from LL
m2: (0 ≤ m2 ≤ 9999)	Sets the vertical starting position (Y) at m2 x 1/720" from TL
m3: (1 ≤ m3 ≤ 9999)	Sets m3 x 1/720" as the distance from m1
m4: (1 ≤ m4 ≤ 9999)	Sets m4 x 1/720" as the distance from m2

Figure 3-5 **Ruling Print Positions**



Draw Box: ESC DC2 b m1, m2, m3, m4, m5 SP

The rules for the draw box command are:

1 RM, LM, BM, and TM are ignored. The specified length is converted to a number of dots and any fraction is ignored.

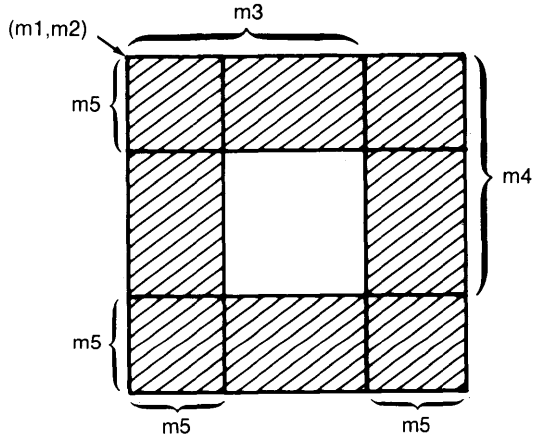
2 AP does not move.

Figure 3-6 shows the box print positions. Table 3-11 lists characteristics that may be selected for drawing boxes.

Table 3-11 **Box Characteristics**

ASCII No.	Characteristic
m1 (0 ≤ m1 ≤ 9999)	Sets the horizontal starting position at m1 x 1/720" from LL
m2 (0 ≤ m2 ≤ 9999)	Sets the vertical starting position at m2 x 1/720" from TL
m3 (1 ≤ m3 ≤ 9999)	Sets m3 x 1/720" as the distance from m1
m4 (1 ≤ m4 ≤ 9999)	Sets m4 x 1/720" as the distance from m2
m5 (1 ≤ m5 ≤ 9999)	Sets m5 x 1/720" as the line thickness m5 ≤ 1/2m4

Figure 3-6 **Box Print Position**



Graphics (D630 Emulation)

Graphics Mode: Enter Graphics: ESC 3; Exit Graphics: ESC 4

Note: *The graphic mode may also be ended by a CR.*

The rules for the graphic mode are:

AP does not move after printing. It is moved only by HT, SP, BS, CR, VT, FF, LF, negative LF, half-LF, and negative half-LF. SP, BS, LF, and negative LF move by the amount specified by ESC, hv. The amount of default movement is 1/60 inch for SP and BS and 1/48 inch for LF and negative LF.

Hyplot Mode

Table 3-12 lists and describes the Hyplot Vector plotting commands.

Table 3-12 **HyPlot Vector Plotting Commands**

Sequence	Definition
ESC G "Vect"	Enter hyplot absolute mode
ESC G BEL "Vect":	Enter hyplot absolute mode, including the first vector
ESC V "Vect":	Enter hyplot relative mode
ESC V BEL "Vect":	Enter hyplot relative mode including the first vector
ESC . (char):	Set plot character to "character"
ESC , hv:	Set plot precision: "h": increment unit for h/120 inch "v": increment unit for v/48 inch
ESC 4:	Exit HyPlot mode

Plotting is performed with specified plot characters and increment units following each mode.

The rules for plotting are:

1 In the absolute mode, LL and TL positions are used as the standard position, and positive directions are to the right and down.

2 In the relative mode, the position plotted most recently is used as the standard position. Use a 0 sign BIT to specify positive direction; a 1 sign BIT for negative direction.

3 If the data include the first vector, plotting is performed from that position. If the data do not include the first vector, the value is only movement.

4 The default plot character is a period.

5 The default plot precision is h = 2 and v = 1.

6 The plot precision value range is 0 to 31, corresponding to 20H to 3FH.

7 Vector values are 5 bytes in the absolute mode and 6 bytes, including the sign byte, in the relative mode. Vertical direction is the y direction, and horizontal direction is the x direction. The maximum parameter is 10 bits. Table 3-13 shows the vector data format. Figure 3-7 shows the bits.

8 Do not send the sign byte when in the absolute mode.

9 RM, LM, TM, and BM are ignored.

Figure 3-7 **Most, Intermediate, and Least Significant Bits**

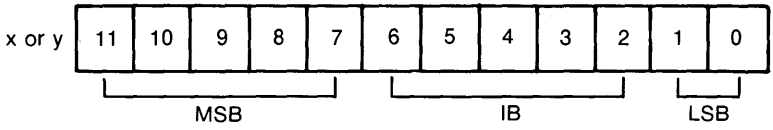


Table 3-13 **Vector Data Format**

	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Sign Byte	0	1	x	x	x	y sign	x sign
High y	0	1	[		5 MSBs	of y	
x low y	1	1	0	[2 LSBs	of y]	[2 LSBs	of x]
Low y	1	1	[	5 intermediate bits of		y]	
High x	0	1	[		5 MSBs	of x	]
Low x	1	0	[	5 intermediate bits of		x]	

Remote Diagnostics Commands

An ESC code followed by a SUB code is assumed to have the highest priority. This command is responded to immediately after being received by the interface. When a serial interface is used, this command is executed even if the printer is in the busy state. A status response is valid only for a serial interface. If such a command is received while another command is being processed, the processing is aborted.

Remote Restore (Hard): ESC SUB I

This sequence reinitializes the printer immediately (even if it is busy). This will cause the laser to stop and appear as half characters.

Remote Error Reset: ESC SUB R

This sequence causes the printer to reset any error conditions of the controller.

Request Status Byte 1: ESC SUB 1

For the serial interface only, this sequence causes the printer to send status byte 1 information. Table 3-14 lists the bit definitions. Output format is : STX < status word (byte)>.

Table 3-14 **Status Byte 1 Bit Definitions**

Bit	Definition
0	Toner exhausted
1	10 pitch; 1 when HMI equals 10 CPI
2	Paper out; 1 when there is no paper in the paper tray
3	Auto line feed enabled; 1 when mode selected by command or DIP switch
4	Cover open switch; 0 when all covers are closed
5	Printer idle; 0 when the printer is not busy and buffer is empty
6	Print in check; 1 when test print or diagnostics program is running
7	Parity bit; defined by parity mode select DIP switch and status bits 0 to 6

Request Status Byte 3: ESC SUB 3

For the serial interface only, this sequence causes the printer to place the second status byte in the bus. Table 3-15 lists the bit definitions. The output format is: STX <status word (byte)>.

Table 3-15 **Status byte 3 Bit Definitions**

Bit	Definition
0	Feed or transfer jam: = 1
1	Exit jam: = 1
2	Always 0
3	Always 0
4	Always 0
5	Always 0
6	Always 0
7	Parity bit; defined by parity mode select DIP switch and status bit 0 to 6

Request Status: ESC SUB # m SP

For the serial interface only, this sequence causes the printer to request status as listed in Table 3-16. The output format is: STX <status word (byte)>.

Note: *If m is other than specified, it is processed as 1.*

Table 3-16 **Status Requests**

ASCII No.	Status Request Type
m = 1*	Printer
m = 2*	Paper size
m = 4**	Download memory
m = 5**	Font
m = 6**	Selected font information

* Single-byte response

** Multiple-byte response

Single-Byte Responses (m = 1)

These responses may be fatal errors, operator calls, controller errors, or temporarily busy responses. The following four tables (tables 3-17 through 3-20) list fatal errors, operator calls, controller errors, and temporarily busy responses, respectively.

Table 3-17 **Fatal Errors**

Byte	Error Type
21H	Main motor error
22H	*OBM error
23H	Optical unit
24H	Fusing unit
28H	Firmware (ROM) CRC error
29H	Font ROM CRC error
2AH	Random-access memory (RAM) error
2BH	Interface error
20H	Undefined
25 through 27H	Undefined
2CH through 2FH	Undefined

* OPC belt error or missing belt cartridge

Table 3-18 **Operator Calls**

Byte	Call Type
31H	Jam -- paper eject area
32H	Jam -- transfer unit area
33H	Jam -- paper feed area
35H	Fusing unit cover open
36H	Developing unit installation incomplete
37H	Undefined
38H	Toner collector bottle overflow or missing
39H	No paper
3AH	Paper cover open
3OH	Undefined
34H	Undefined
3BH through 3F	Undefined

Table 3-19 **Controller Errors**

Byte	Call Type
41H	Font cartridge error; removed during online operation
42H	Page memory overflow
43H	Line memory overflow
44H	Input buffer memory overflow
45H	Download memory overflow
46H	Received data error (e.g., parity error, overrun)
47H	Data cannot be recovered (when jammed)
48H	Cartridge read-only memory (ROM) error
49H	Data cannot be transformed (into video image)
4AH	Undefined
4BH	Image data format incorrect
4OH	Undefined
4CH through 4FH	Undefined

Table 3-20 **Temporarily Busy Responses**

Byte	Call Type
51H	Warming up
52H	Self-test printing
50H	Undefined
53H through 5FH	Undefined

Single-Byte Responses (m = 2)

Table 3-21 lists and describes single-byte responses (m = 2).

Table 3-21 **Single-Byte Responses (m = 2)**

Byte	Call Type
60H	No paper
61H	A4 paper
62H	Letter size (8-1/2 X 11) paper
63H through 6FH	Undefined

Multiple-Byte Responses (m = 4)

Memory capacity, which can be used for downloading, is output as multiples of 2 KB. Data are formatted as STX ESC: m1 and m2 SP where m1 and m2 = $0 \leq n \leq 9999$: ASCII. The m1 value indicates the remaining capacity of the downloadable memory available to the user in 2 KB multiples. The m2 value indicates the entire capacity of the downloadable memory available to the user in 2 KB multiples.

Multiple-Byte Responses (m = 5)

This response type generates a list containing the rotation direction, pitch information, type, assignment status, and font name that can be used for printing. The output format is:

STX ESC [i1, j1, k1, 11 @ <font name 1> ESC SP

i2, j2, k2, 12 @ <font name 2> ESC SP
in, jn, kn, ln @ <font name n> ESC]

where n = total number of fonts

Table 3-22 lists the font characteristics.

Table 3-22 **Font Characteristics**

ASCII No./Code	Characteristic
i = 1	Font rotation direction: 0 degrees (portrait)
i = 2	Font rotation direction: 90 degrees (landscape)
j = 1	Font pitch: 10 characters per inch (CPI)
j = 2	Font pitch: 12 CPI
j = 3	Font pitch: 15 CPI
j = 4	Font pitch: 16.6 CPI
j = 0	Font pitch: proportional spacing
k = 1	Font type: resident
k = 2	Font type: downloaded
k = 3	Font type: cartridge
l = 1	Font assignment number [1 ($0 \leq 1 \leq 15$)] up to 16 fonts, each of which must have an assigned number, can be assigned
<font name>	Up to 20 characters with codes in the range of 20H to 7EH

Multiple-Byte Responses (m = 6)

This type of response generates a list of character widths of the presently selected fonts.

Miscellaneous Commands

Remote Restore (Soft): ESC CR P

This sequence causes the printer to reinitialize after all data received have been printed. It causes no data to be lost. Parameters are initialized as shown in appendix F, default conditions.

Select Number of Copies: ESC DC2 N (n) SP

The value specified in this command is validated until the next print operation occurs. After printing the sheets indicated, it is reset to the default (1). Note that a copy is considered the text containing this select number of copies command up to the next FF.

When auto print is also performed with a new paragraph, that is LF or half-LF, the number of sheets specified at that time is printed. However, the specified number of sheets remains unchanged and is not reset to the default.

The "m" must be an ASCII number in the range of 1 to 99. When m = 0, only one print is made; when m ≥ 99, 99 copies are made.

Transmit Form Overlay Data: ESC DC2 O m SP "TEXT" ESC DC2 O SP

This command and the following two commands download the text according to the m value or select the downloaded text according to the m value (invalidated if the text is not downloaded by the m value). The input data is used immediately as the text contents. The form overlay data is inserted at the current print position. Nesting of up to two levels is permitted in one command. Up to 99 different overlays can be downloaded, depending on memory required.

Delete Form Overlay Data: ESC DC2 O m SP ESC DC2 O SP

Refer to the information for Transmit Form Overlay Data, ESC DC2 O m SP "TEXT" DC2 O SP, in the previous paragraph.

Select Form Overlay Data: ESC DC2 U m SP

Refer to the information for Transmit Form Overlay Data, ESC DC2 O m SP "TEXT" DC2 O SP, previously described.

Shift Out: SO

This command causes seven-bit codes between 21H and 7EH to be converted to codes between A1H and FEH. The SI command ends this command. When eight-bit codes are used, this command is ignored.

Shift In: SI

This command ends the SO command.

ETX: ETX

This signal is included at the end of a data string transmitted to the printer faster than it can print. On finding ETX in the buffer, the printer immediately transmits an ACK signal to notify the sending system to send another data string. The ETX/ACK protocol is an alternative to the DCl/DC3 protocol. Its purpose is to free the sending system from having to monitor printer progress as it prints the print buffer contents.

ACK: ACK

This signal is transmitted over the communications link when an ETX is met in the print buffer.

Nonfunctional Diablo 630 Escape Code Sequences

The following is a list of Diablo 630 ESC code sequences that are ignored by the AP 9208 printer.

Increase carriage settling time: ESC %
Restore carriage settling time to normal: ESC N
Margin control on: ESC $
Margin control mode determined by MARG CONT: ESC *
Print in secondary color (red): ESC A
Print in secondary color (black): ESC B
Enter auto sheetfeeder operation: ESC EM( )
Enter program "Here is . . . " mode: ESC (
Exit program "Here is . . . " mode: ESC)
Enable auto backward printing: ESC /
Disable auto backward printing: ESC
Bell: BEL

Communications Interface

Serial Interface

RS-232 Electrical Interface

All signals conform to the EIA RS-232C electrical specifications. Figure 4-1 depicts interface nominal output signal levels. (Refer to Section 5 for DIP switch settings.) Figure 4-2 shows input circuits. Figure 4-3 shows output circuits.

Figure 4-1 **Nominal RS-232 Output Signal Levels**

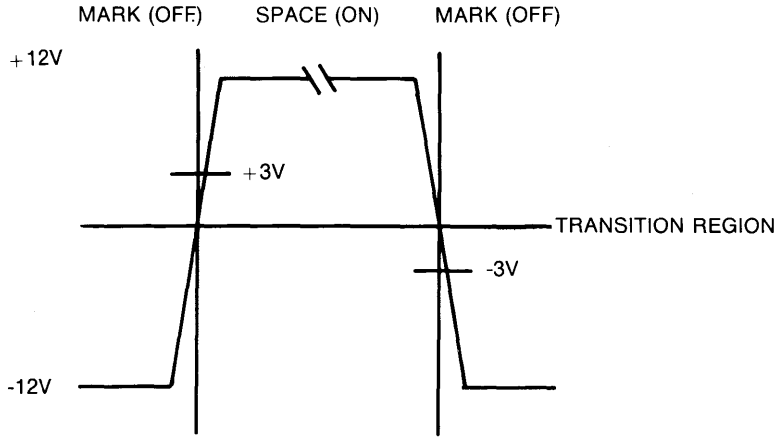


Figure 4-2 **Input Circuits**

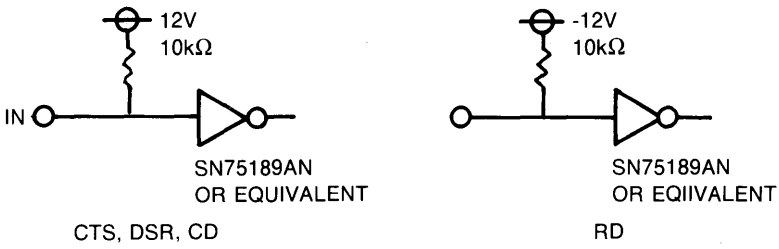
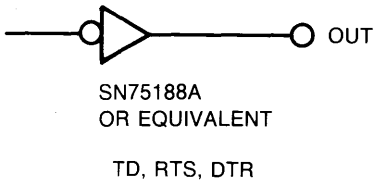


Figure 4-3 **Output Circuits**



Data Communications Protocols

The printer supports up to 19,200-baud transmission rates. It can use any one of three signaling methods, called handshaking. Two methods are based on software commands; that is, ASCII codes are sent back to the host system, indicating that the printer can no longer accept data. The third method uses a separate line (DTR, connector pin 20) to signal the computer by voltage level changes when the interface receive buffer is partially full or empty.

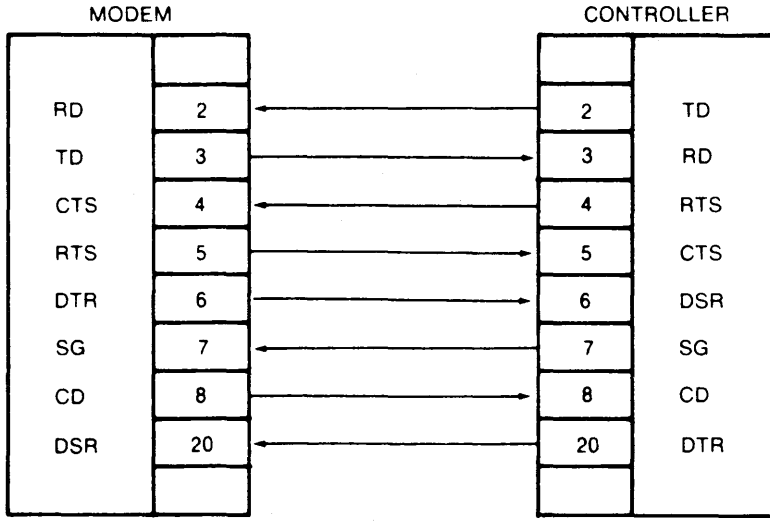
Handshaking protocols and other critical interface parameters, such as baud rate, parity, modem/no-modem, are set by the interface module Dual Inline Pack (DIP) switches. (Refer to Section 5 for DIP switch settings.)

Modem and No-Modem Operation

Modem Operation

The modem mode is required for use with a standard data set or may be used with a computer that can recognize program commands to stop or continue printing transmission. If modem operation is selected, the ETX/ACK or X-on/X-off DIP switches also must be set to select the software handshaking method that matches the host- system protocol. In modem operation, the Data Terminal Ready (DTR) line is always high (space, +12 V DC nominal). Figure 4-4 shows modem - controller connections for the modem mode.

Figure 4-4 **Modem-Mode Connections**

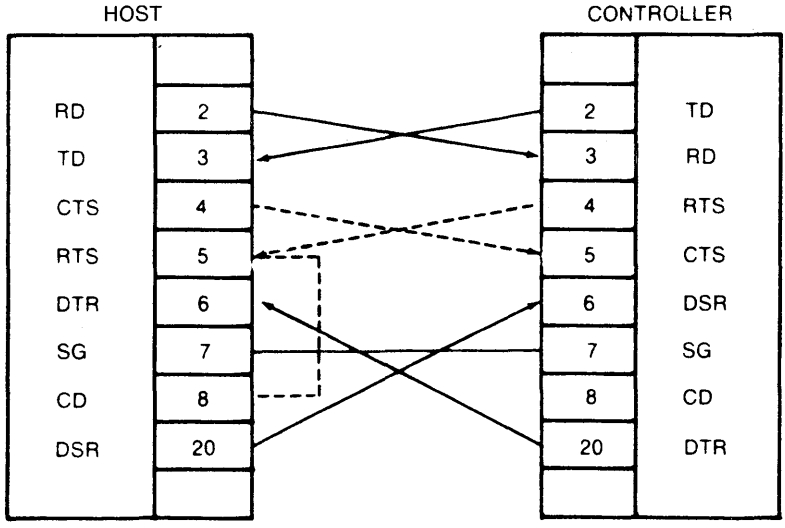


No-Modem Operation

No-modem operation (DTR active) is used typically when hardware handshaking is used to provide the host system the printer receive buffer full/empty status. The interface connector DTR line state indicates if the printer is ready for additional data. DTR is high (space, +12 V DC nominal) when the printer is ready to receive data. DTR is low (mark, -12 V DC nominal) when the printer is not ready to receive data. Figure 4-5 shows host - controller connections for the no-modem mode (DTR). The host processor controls data transmission while judging whether the controller is busy or ready according to the DTR signal. Timing of the DTR signal output is the same as for the X-on/X-off protocol.

When the printer receive buffer is within 64 characters of being filled, DTR goes low (mark) and stays so until the buffer is within 64 characters of being empty.

Figure 4-5 **No-Modem Mode Operations**



Handshaking Protocols

The printer can use any of the following three handshaking methods to signal the host system to stop or continue sending characters. Protocol is selected by the DIP switches.

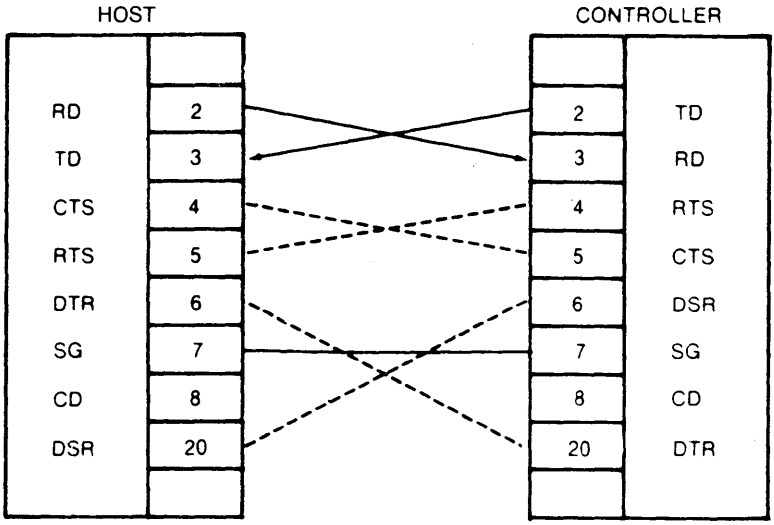
ETX/ACK

In this mode, the computer transmits blocks of data to the printer. Each block must have the ASCII code ETX as its last character. After sending a block of characters, the computer stops transmitting. The printer processes the characters (first in, first out), and, when it finds the ETX code, it transmits the ASCII code ACK back to the waiting computer, indicating to it that the last character in that data block has been processed and the printer is ready for another block ofdata.

X-on/X-off

In this mode, which is independent of modem/no-modem operation, the printer sends ASCII codes DC1 and DC3 to provide the computer with the printer receive buffer status. When this buffer is within 64 characters of being full, the printer transmits ASCII code DC3 (X-off) to the computer, indicating the computer should stop transmission. When the buffer is within 64 characters of being empty, the printer transmits DCI (X-on) to the computer, indicating that the computer may continue sending. When X-on/X-off is selected, DTR is always space. Figure 4-6 shows the cable connections for X-On/X-Off protocol. Connections of a minimum of three signals (TD, RD, and SG) enable communication.

Figure 4-6 **X-On/X-Off Protocol Cable Connections**



DTR

In this mode, a separate line (DTR, interface connector pin 20) signals the host system by voltage level changes if the printer receive buffer is full or empty. When DTR is on (space), the computer transmits characters to the printer until the receive buffer is within 64 characters of being full. DTR is then turned off (mark) until the receive buffer is depleted to within 64 characters of being empty.

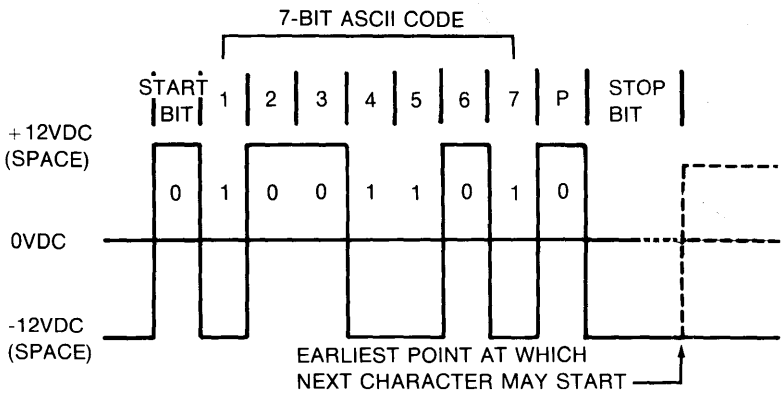
Full- and Half-Duplex Operation

The printer can be used in full- or half-duplex operation. If the computer to be used has an explicit requirement for printer duplex mode, the duplex switch (DIP switches) can be set to match.

Transmit-and-Receive-Data Format

The printer transmits and receives EIA RS-232C-compatible asyn- chronous serial data encoded as specified by ASCII. Figure 4-7 shows the transmit-and-receive format.

Figure 4-7 **Transmit-and-Receive-Data Format**



Receive and transmit signal voltages nominally are ±12 V DC. Each ASCII code includes 7 bits of binary data.

An EIA RS-232C data line is in the mark state (-12 V DC nominal) between code transmissions. Code transmission begins by the transmitting device raising the data line to a space state (+12 V DC nominal). The data line is left in the space state for a 1-bit time period. This bit time varies depending on the system baud rate; for example, 110 baud equals 0.09 millisecond per bit; 1200 baud equals 0.0833 milliseconds per bit). The first bit, called the start bit, identifies a code transmission start.

The next 7 data bits are the 7 ASCII code bits, least significant bit first. An ASCII code bit that is a logic "1" corresponds to an RS-232C data mark state (-12 V DC nominal).

Parity Bit

The eighth bit is called the parity bit. Its voltage level during transmission of any given character depends on the parity switch setting and the data in the 7 ASCII code bits (for odd and even parity).

The parity bit can be used in a communications system to detect certain types of transmission errors. This bit is transmitted in a mark or space state as follows:

Mark Parity

The printer ignores the parity bit state when receiving data and always sets the parity in the mark state when transmitting data.

Space Parity

The printer ignores the parity bit state when receiving data and always sets the parity in the space state when transmitting data.

Even Parity

When transmitting data, the printer sets the parity bit in the mark or space state as required so that an even number of logic 1 bits is transmitted (excluding start and stop bits). When receiving data, the printer checks to see if an even number of logic 1 bits is in the received code (excluding start and stop bits). If an odd number of logic 1 bits exists, a parity error has been detected. (Refer to Communications Errors below).

Odd Parity

When transmitting data, the printer sets the parity bit in the mark or space state as required so that an odd number of logic 1 bits is transmitted (excluding start and stop bits). If an odd number of logic 1 bits does not exist in received data, a parity error is detected.

Communications Errors

When a parity, framing, or overrun error is detected, the printer enters ASCII code 5E hex in the receive buffer. As a result, the printer prints the character designated by 5E hex instead of the character received in error.

Serial Interface Designations

Table 4-1 lists serial interface signals and provides a brief functional description.

Serial Interface Connector

The printer serial interface connector is a 25-pin male connector designed to mate with an AMP 207463-1 female connector containing AMP 66504-3 sockets.

Table 4-1 **Modem Converter Serial Interface Signals**

Pin No.	Signal	Description
2	BA (transmit)	Serial ASCII-coded data transmitted from the printer to the computer; logic 0 is space; logic 1 is mark; between characters, this line assumes a mark state.
3	BB (receive)	Serial ASCII-coded data received by the printer; logic 0 is space; logic 1 is mark; between characters, this line assumes a mark state.
4	CA [request to send (RTS)]	Printer output; active only when both modem and half-duplex are selected; if these DIP switches are selected, space indicates no data are to be sent; mark indicates the printer has data to send; when full-duplex and no modem are on, RTS is always space.
5	CB [clear to send (CTS)]	Printer input; signal not used by the printer.
6	CC [data set ready (DSR)	Printer input; signal not used by the printer.
7	AB (signal ground)	Ground reference for all data and control signals.
8	CF (carrier detect)	Printer input; signal not used by the printer.
20	CD [data terminal ready (DTR)	Printer output; active only when both no modem and DTR are selected; if these DIP switches are not selected, DTR is always space (+12 V DC nominal); if these DIP switches are selected, space indicates the printer is ready for data, mark indicates the printer is not ready; DTR is on (space) until the character-receive buffer is within 64 characters of being full; once DTR is deactivated, it is not activated again until the receive buffer is depleted to within 64 characters of being empty.

Parallel Interface

The AP 9208 printer can function in a parallel interface mode. This function is operator-selectable via DIP switches. Refer to Section 5 for DIP switch settings.

General

The printer can accept 8-bit parallel data from the host computer. Data transfer is executed on a demand/response basis. The printer controls data flow from the host by sending status signals to the host. When the printer is ready (on-line status), data are accepted. After the first character is received and placed in buffer memory, the printer momentarily raises a busy flag before it accepts the next character. This process repeats until all data have been received from the host. If the printer buffer becomes full, the busy flag remains active until the buffer can accept more data. When the printer is not ready (off-line status), the busy flag is always active, and no data are accepted.

Input/Output (I/O) Connector and Signals

Table 4-2 lists and describes pins and signals.

Host-to-Printer Signals

Data (DATA0-DATA7)

These eight lines provide both data and control information to the printer.

Data strobe (STROBE-) (low active)

This signal is normally high and is pulsed low for a minimum of 1.0 microseconds and a maximum of 1.7 microseconds to strobe the data into the printer off the data lines. The next STROBE- signal cannot occur for 1.0 microsecond after the trailing edge of the printer signal ACK- or the transition to the printer from the unselected to the selected mode.

Printer-to-Host Signals

Acknowledge (ACK-) (low active)

This signal is used to indicate that the printer has accepted the character previously sent as signaled by STROBE- and that another character can be sent. The pulse width required is between 0.1 and 7.0 microseconds.

ACK- must not be generated while STROBE- is low or when the select line is low (printer not selected). The host will wait up to 75 microseconds for ACK- before declaring a time out.

Table 4-2 **Parallel Input/Output Pins and Signals**

Pin No.	Signal	Source	Description
1	Data Strobe	Host	Active low; is pulsed low to clock data into the printer from the data lines.
2	Data 0	Host	Eight data lines: Data 0 is
3	Data 1	Host	the least significant bit
4	Data 2	Host	(LSB); Data 7 is the MSB.
5	Data 3	Host	
6	Data 4	Host	
7	Data 5	Host	
8	Data 6	Host	
9	Data 7	Host	
10	Acknlg	Printer	Acknowledge: active low; indicates a character has been accepted, and another character can be sent to the printer; this 5- to 7-microsecond low going pulse occurs at the trailing edge of the busy signal and is not generated while data strobe or select signals are low.
11	Busy	Printer	Active high; indicates to the host that the printer is busy and additional data should not be transmitted at this time.
12	PE	Printer	Paper empty: active high; normally low, this signal goes high at an out-of-paper condition.
13	Slct	Printer	Select: active high; indicates the printer is ready to receive data and print; when the printer is deselected, this signal is low.
14, 19-30	Sig gnd	---	Signal ground.

Select

This signal is normally low, indicating the unselected mode, and will go high to indicate that the printer has been selected and is ready to print.

Busy

This signal is used to inform the host that the printer is unable to receive print or format information.

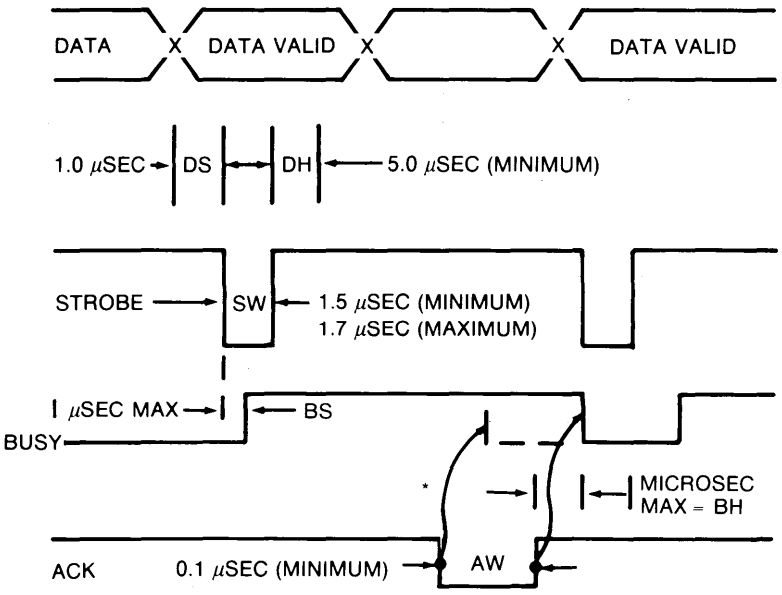
Paper Empty

This signal is normally low and goes high if the printer has sensed that it is out of paper.

Signal Timing Relationship

Figure 4-8 shows required timing between data lines, STROBE-, and ACK- signals.

Figure 4-8 **Parallel Signal Timing**



*Whether to output the ACK signal in early or late synchronism with busy is determined by the DIP switch setting (DSW5).

Signal Timing Characteristics

Table 4-3 lists signal timing characteristics.

Table 4-3 **Signal Timing Characteristics**

Parameter	Term	Time (Microseconds)
DS	Data setup to STROBE	1.0 (minimum)
SW	STROBE width	1.5 (minimum), 1.7 (maximum)
DN	Data held time after STROBE	5.0 (minimum)
AW	ACK width	0.1 (minimum), 7.0 (maximum)
BS	Busy stop time	1.0 (maximum)
BH	Busy hold time	1.0 (maximum)

Interface Circuits

Each printer signal must have noise immunity of 0.4V or greater given the characteristics described in the following paragraphs.

Logic Levels

Input

A logic zero (or low) signal is a voltage between 0.0 and 0.8 volts.

A logic one (or high) signal is a voltage between 2.0 and 5.0 volts.

Output

A logic zero (or low) signal is a voltage between 0.0 and 0.4 volts.

A logic one (or high) signal is a voltage between 2.4 and 5.0 volts.

Line Termination

Table 4-4 details line termination.

Table 4-4 **Line Termination**

Signal	Pullup to +5V (ohms)	Location
DATA0+ to DATA7+	470	Printer
BUSY+	470	Host
SELECT+	470	Host
PE+	470	Host
STROBE-	470	Printer
ACK-	470	Host

Drive Requirements

Printer-transmitted signals must source up to 0.32 milliamps at 2.4 volts for a high signal output, and sink up to 24 milliamps at 0.5 volts for a low output.

Requirements for host-transmitted signals are identical to those of printer-transmitted signals.

Receiver Requirements

Receiver devices for the STROBE- and ACK- signals must be Schmitt-Trigger type, such as a 74LS14, for its hysteresis characteristics with adequate clamping diodes. This device type should also be used for all other signals.

Internal Signal Length

The length of the signal from its connector to its point of source/drain must not exceed 2 feet (0.6096 meter).

Parallel Interface Connector

The printer parallel interface connector is an Anphenol 59 Series, 36-pin, female connector.

DIP Switch Controls

General

The configuration of the AP 9208 printer's DIP switches controls various printer functions. Some of the switches control certain functions by default when the function is not otherwise determined by the operator via the software.

Tables 5-1 and 5-2 detail the various DIP switch configurations and their corresponding functions. Figure 5-1 depicts the DIP switch arrangement on the back of the printer. Though the AP 9208 printer is shipped with the DIP switches preset at the factory for standard printer operations, you may need to change these settings to achieve a particular printing function or communication mode, or to accomodate the printer operational requirements of your host system.

Figure 5-1 **DIP Switches**

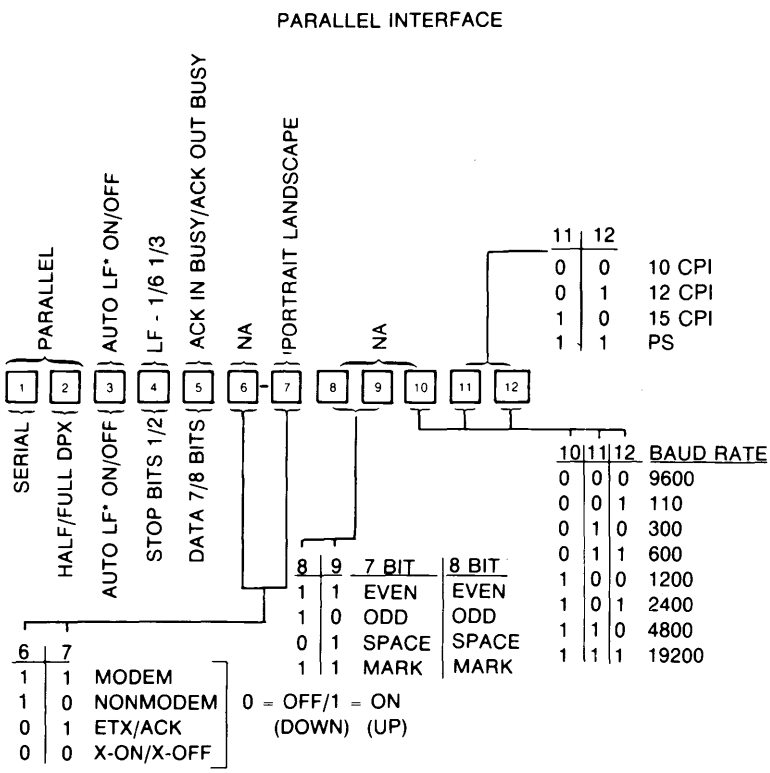


Table 5-1 **DIP Switch Configurations and Functions (Serial Mode)**

Switch Position			Function
1			Parallel/Serial
ON			Parallel
*OFF			Serial
2			Half Duplex/Full Duplex
ON			Half Duplex
*OFF			Full Duplex
3			Auto Line Feed On/Off
*ON			Auto Line Feed On
OFF			Auto Line Feed Off
4			Stop Bit 1 Bit/2 Bit
*OFF			Stop Bit: 1 bit
ON			Stop Bit: 2 bit
5			Data Bit 7 Bit/8 Bit
*ON			Data Bit: 7 bit
OFF			Data Bit: 8 bit
6	7		Protocol
ON	ON		Modem Mode
ON	OFF		Nonmodem Mode
OFF	ON		ETX/ACK
*OFF	OFF		X-On/X-Off
8	9		Parity
ON	ON		Even/Even
*ON	OFF		Odd/Odd
OFF	ON		Space/No
OFF	OFF		Mark/No
10	11	12	Baud Rate
OFF	OFF	ON	110
OFF	ON	OFF	300
OFF	ON	ON	600
ON	OFF	OFF	1200
ON	OFF	ON	2400
ON	ON	OFF	4800
*OFF	OFF	OFF	9600
ON	ON	ON	19200

* Preset at Factory

Table 5-2 **DIP Switch Configurations and Functions (Parallel Mode)**

Switch Position		Function
1		Parallel/Serial
ON		Parallel
OFF		Serial
2		Parallel
ON		(Always ON; 630)
3		Auto Line Feed On/Off
ON		Auto Line Feed On
OFF		Auto Line Feed Off
4		Line Feed 1/6" / 1/3"
ON		1/6 inch
OFF		1/3 inch
5		ACK In Busy/ACK Out Busy
ON		ACK In Busy
OFF		ACK Out Busy
6		No Function In Parallel
7		Portrait/Landscape
ON		Portrait
OFF		Landscape
8		No Function In Parallel
9		No Function In Parallel
10		No Function in Parallel
11	12	Character Spacing
OFF	OFF	10 CPI
OFF	ON	12 CPI
ON	OFF	15 CPI
ON	ON	Proportional Spacing

Switch 1 - Serial/Parallel

This switch allows for operator selection of either parallel or serial type communication from the host computer.

Switch 2 (Serial) - Half Duplex/Full Duplex

The full duplex mode permits independent simultaneous transmission and reception of data. The half duplex mode allows uni-directional (one way) transmission.

Switch 2 (Parallel)

This switch provides for command set selection in the parallel mode. Always select ON.

Switch 3 - Auto Line Feed On/Off

This switch provides for auto line feed on/off selection in either parallel or serial operations. When some computers send a line of characters to the printer, they end the line with only a carriage return. Unless a line feed is also issued, the paper does not advance. When auto line feed on is selected, a line feed is automatically generated at each carriage return. This feature saves you the trouble of rewriting your printer software driver to send both a carriage return and a line feed at the end of a line. When auto line feed off is selected, a return is generated and the carriage returns to the left margin, but it remains on the same printing line. A separate Line Feed command is then required if a new printing line is desired.

Switch 4 (Serial) - Stop Bit 1 Bit/2 Bit

When a computer sends data in serial mode, a defined protocol is used. This protocol uses either 1 or 2 stop bits at the end of the data byte. Switch 4 controls whether 1 or 2 stop bits will be used. This setting must conform to the transmission mode of the host computer.

Switch 4 (Parallel) - Line Feed 1/6" / 1/3"

In the parallel mode, this switch provides for operator selection of the size of line feed increments, either 1/6" (six lines per vertical inch) or 1/3" (three lines per vertical inch).

Switch 5 (Serial) - Data Bit 7 Bit/8 Bit

This switch controls whether the length of the data byte is 7-bit or 8-bit data. Seven-bit codes are in the form: XYYYYYYY, where X = 0 and Y = 7-bit ASCII data. Eight-bit codes are in the form: XXXXYYYY, where X = the high-order byte and Y = the low-order byte. Generally, the 7-bit mode is used in serial communication.

Switch 5 (Parallel) - ACK In Busy/ACK Out Busy

ACK In Busy permits Busy to become false while "Acknowledge" is true. ACK Out Busy provides that "Busy" will be set false after the occurance of "Acknowledge" as follows: 0 microsecond ?delay ? 1 microsecond. When operating in the parallel mode, the normal setting for this switch is ACK In Busy.

Switches 6 and 7 (Serial) - Protocol

Modem Mode/Nonmodem Mode

A modem is a device that converts printer and computer signals for long distance transmission via suitable communications lines. If you have a modem or a similar device connected, position the switches in the modem mode. Position the switches in the nonmodem mode if your printer is directly interfaced to your computer.

ETX/ACK, X-On/X-Off

These switches control handshaking signals. Handshaking is the method by which communication is coordinated between your computer and the interface.

Switch 6 has no function in the parallel mode.

Switch 7 (Parallel) - Portrait/Landscape

In the parallel mode, this switch provides operator selection of font rotation to either portrait or landscape printing.

Switches 8 and 9 - Parity

Parity is an error checking method used to detect if bits are changed during transmission. Set these switches to correspond with the type of parity used by your computer. Switches 4 and 5 have no function in the parallel mode.

Switches 10, 11, and 12 (Serial) - Baud Rate

In the serial communication mode, these three switches are set to the speed at which data is received and transmitted between the computer and the interface. A baud rate must be selected which matches the speed at which your computer transmits data. The interface supports the following switch selectable baud rates: 110, 300, 600, 1200, 2400, 4800, 9600, and 19200.

Switch 10 has no function in the parallel mode.

Switches 11 and 12 (Parallel) - Character Spacing

In the parallel communication mode, switches 11 and 12 provide for operator selection of character spacing to one of the following modes: 10 Characters Per Inch (CPI), 12 CPI, 15 CPI, or proportional spacing.

Font Selection And Image Rotation

General

When operating your AP 9208 printer, you may decide to print in a different font (type style). You may also wish to print a landscape image as opposed to a portrait image. A landscape image is an image in which the image is is oriented 90 degrees such that it lines up in parallel with the longer side of the page. This section provides instruction for changing the font and rotating the font image.

Fonts

Resident Fonts

The AP 9208 printer contains eight resident font sets. Each font style is 128 characters in length. Appendix A depicts the style of each font. The basic 94-character ASCII set (Appendix C) and the extended set (Appendix D) can be accessed in both 7-bit and 8-bit modes. In the 7-bit mode, the basic 94-character set is accessed directly. To access the extended set, the host must send an SO character. (See Appendix C.) After the SO character, all succeeding characters will be accessing the extended set. To return to the basic set, the host must send an SI character. (See Appendix B.) In the 8-bit mode, both the basic and extended sets can be accessed directly (see Appendix E.)

Font Selection (Manual)

Fonts may be selected via the indicator panel by pressing the type face selector pushbutton until the desired font code indication is displayed. Table 6-1 lists font selection codes and corresponding resident fonts.

Table 6-1 **Manual Font Selection**

Selector Display	Font
1	Courier 10
2	Courier 12
3	Prestige Elite
4	Bold Italic PS
5	Boldface PS
6	Letter Gothic 12
7	Letter Gothic 15
8	Orator 90%
U1 to U9	Upper ROM Cartridge
L1 to L9	Lower ROM Cartridge

Font Selection (Software)

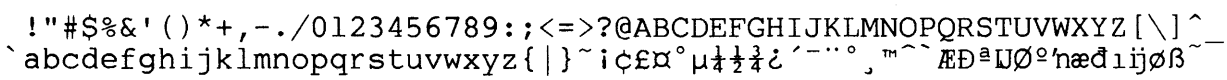
See the section on font commands in Section 3 of this manual for font selection using the command set.

Rotating the Image

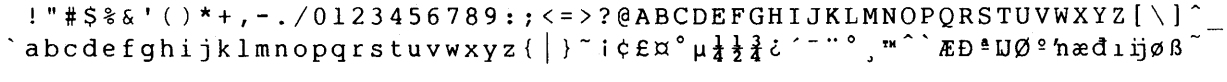
The printed image can be rotated from the default (portrait) to landscape using the font commands detailed previously.

Figure A-1 **Resident Fonts**

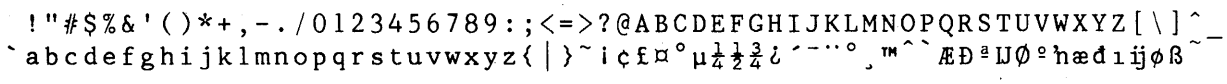
COURIER 10 Font No. 1



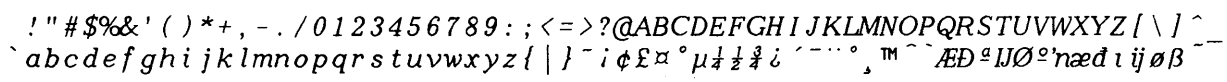
COURIER 12 Font No. 2



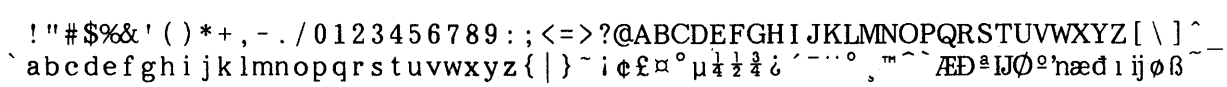
PRESTIGE ELITE Font No. 3



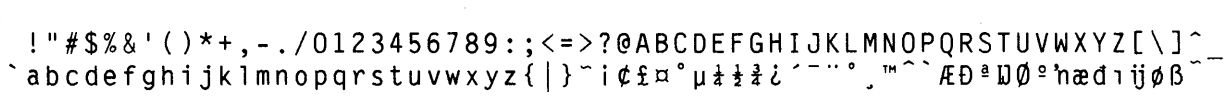
BOLD ITALIC PS Font No. 4



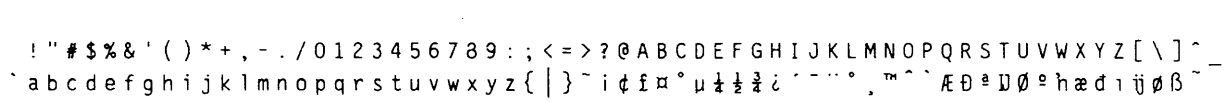
BOLDFACE PS Font No. 5



LETTER GOTHIC 12 Font No. 6



LETTER GOTHIC 15 Font No. 7



ORATOR 90% FONT NO. 8

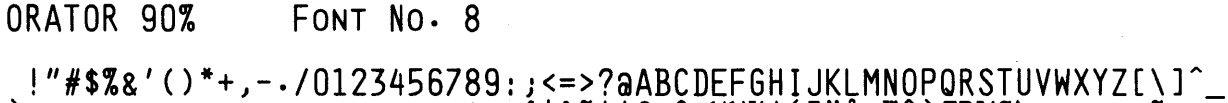


Table A-2. Graphic Representation of the Standard Character Set

Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character	Character Code (hexa-decimal)	Video Display Character
00		20		40	@	60	`	80		A0		C0		E0	
01		21	!	41	A	61	a	81		A1		C1		E1	
02		22	"	42	B	62	b	82		A2		C2		E2	
03		23	#	43	C	63	c	83		A3		C3		E3	
04		24	$	44	D	64	d	84		A4		C4		E4	
05		25	%	45	E	65	e	85		A5		C5		E5	
06		26	&	46	F	66	f	86		A6		C6		E6	
07		27	'	47	G	67	g	87		A7		C7		E7	
08		28	(	48	H	68	h	88		A8		C8		E8	
09		29	)	49	I	69	i	89		A9		C9		E9	
0A		2A	*	4A	J	6A	j	8A		AA		CA		EA	
0B		2B	+	4B	K	6B	k	8B		AB		CB		EB	
0C		2C	,	4C	L	6C	l	8C		AC		CC		EC	
0D		2D	-	4D	M	6D	m	8D		AD		CD		ED	
0E		2E	.	4E	N	6E	n	8E		AE		CE		EE	
0F		2F	/	4F	O	6F	o	8F		AF		CF		EF	
10		30	0	50	P	70	p	90		B0		D0		F0	
11		31	1	51	Q	71	q	91		B1		D1		F1	
12		32	2	52	R	72	r	92		B2		D2		F2	
13		33	3	53	S	73	s	93		B3		D3		F3	
14		34	4	54	T	74	t	94		B4		D4		F4	
15		35	5	55	U	75	u	95		B5		D5		F5	
16		36	6	56	V	76	v	96		B6		D6		F6	
17		37	7	57	W	77	w	97		B7		D7		F7	
18		38	8	58	X	78	x	98		B8		D8		F8	
19		39	9	59	Y	79	y	99		B9		D9		F9	
1A		3A	:	5A	Z	7A	z	9A		BA		DA		FA	
1B		3B	;	5B	[	7B	{	9B		BB		DB		FB	
1C		3C	<	5C	\	7C	|	9C		BC		DC		FC	
1D		3D	=	5D	]	7D	}	9D		BD		DD		FD	
1E		3E	>	5E	^	7E	~	9E		BE		DE		FE	
1F		3F	?	5F	_	7F		9F		BF		DF		FF	

Standard ASCII Character Set And Control

Chr	Dec	Hex	Chr	Dec	Hex	Chr	Dec	Hex	Chr	Dec	Hex
NUL	000	00	SP	032	20	@	064	40		096	60
SOH	001	01	!	033	21	A	065	41	a	097	61
STX	002	02	"	034	22	B	066	42	b	098	62
ETX	003	03	#	035	23	C	067	43	c	099	63
EOT	004	04	$	036	24	D	068	44	d	100	64
ENQ	005	05	%	037	25	E	069	45	e	101	65
ACK	006	06	&	038	26	F	070	46	f	102	66
BEL	007	07	'	039	27	G	071	47	g	103	67
BS	008	08	(	040	28	H	072	48	h	104	68
HT	009	09	)	041	29	I	073	49	i	105	69
LF	010	0A	*	042	2A	J	074	4A	j	106	6A
VT	011	0B	+	043	2B	K	075	4B	k	107	6B
FF	012	0C	,	044	2C	L	076	4C	l	108	6C
CR	013	0D	-	045	2D	M	077	4D	m	109	6D
SO	014	0E	.	046	2E	N	078	4E	n	110	6E
SI	015	0F	/	047	2F	O	079	4F	o	111	6F
DLE	016	10	0	048	30	P	080	50	o	112	70
DC1	017	11	1	049	31	Q	081	51	p	113	71
DC2	018	12	2	050	32	R	082	52	q	114	72
DC3	019	13	3	051	33	S	083	53	r	115	73
DC4	020	14	4	052	34	T	084	54	s	116	74
NAK	021	15	5	053	35	U	085	55	t	117	75
SYN	022	16	6	054	36	V	086	56	u	118	76
ETB	023	17	7	055	37	W	087	57	v	119	77
CAN	024	18	8	056	38	X	088	58	w	120	78
EM	025	19	9	057	39	Y	089	59	x	121	79
SUB	026	1A	:	058	3A	Z	090	5A	y	122	7A
ESC	027	1B	;	059	3B	]	091	5B	z	123	7B
FS	028	1C	<	060	3C	\	092	5C	l	124	7C
GS	029	1D	=	061	3D	[	093	5D	}	125	7D
RS	030	1E	>	062	3E	'	094	5E	'	126	7E
US	031	1F	?	063	3F	_	095	5F	DEL	127	7F

Note: *The Chr columns (Character) contain the ASCII control codes.*

Basic 94-Character ASCII Set (7-BIT)

Figure C-1 **Basic 94-Character ASCII Set (7-BIT)**

b,	b,	b,	b,		0	1	2	3	4	5	6	7
0	0	0	0	0				0	@	P		p
0	0	0	1	1			!	1	A	Q	a	q
0	0	1	0	2			"	2	B	R	b	r
0	0	1	1	3			#	3	C	S	c	s
0	1	0	0	4			$	4	D	T	d	t
0	1	0	1	5			%	5	E	U	e	u
0	1	1	0	6			&	6	F	V	f	v
0	1	1	1	7			'	7	G	W	g	w
1	0	0	0	8			(	8	H	X	h	x
1	0	0	1	9			)	9	I	Y	i	y
1	0	1	0	A			*	:	J	Z	j	z
1	0	1	1	B			+	;	K	[	k	{
1	1	0	0	C			,	<	L	\	l	|
1	1	0	1	D			-	=	M	]	m	}
1	1	1	0	E			.	>	N	^	n	~
1	1	1	1	F			/	?	O	_	o	

Extended Character Set

Figure D-1 **Extended Character Set**

b,	b,	b,	b,		b, 0	0	0	0	1	1	1	1
					b, 0	0	1	1	0	0	1	1
					b, 0	1	0	1	0	1	0	1
b,	b,	b,	b,		0	1	2	3	4	5	6	7
0	0	0	0	0				°			'	
0	0	0	1	1			¡				Æ	æ
0	0	1	0	2			¢				Ð	đ
0	0	1	1	3			£				ª	
0	1	0	0	4			¤			™		
0	1	0	1	5				μ	-			ı
0	1	1	0	6							IJ	ij
0	1	1	1	7								
1	0	0	0	8					¨			
1	0	0	1	9							ø	Ø
1	0	1	0	A					•			
1	0	1	1	B					♭		Ω	ß
1	1	0	0	C				¼				
1	1	0	1	D				½				
1	1	1	0	E				¾		∧		~
1	1	1	1	F				¿	∨		ŋ	

Character Set (8-BIT)

Figure E-1 **Character Set (8 BIT)**

				b,	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
				b,	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
				b,	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
				b,	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
b,	b,	b,	b,		00	01	02	03	04	05	06	07	08	09	A	B	C	D	E	F
0	0	0	0	0				0	@	P		p				°			’	
0	0	0	1	1			!	1	A	Q	a	q			i				Æ	æ
0	0	1	0	2			”	2	B	R	b	r			¢				Đ	đ
0	0	1	1	3			#	3	C	S	c	s			£				a̲	
0	1	0	0	4			$	4	D	T	d	t			¤			™		
0	1	0	1	5			%	5	E	U	e	u				μ	-			ı
0	1	1	0	6			&	6	F	V	f	v							IJ	ij
0	1	1	1	7			’	7	G	W	g	w								
1	0	0	0	8			(	8	H	X	h	x					¨			
1	0	0	1	9			)	9	I	Y	i	y							ϕ	Ø
1	0	1	0	A			*	:	J	Z	j	z					•			
1	0	1	1	B			+	;	K	[	k	{					̧		Ω	β
1	1	0	0	C			,	<	L	\	l	|				¼				
1	1	0	1	D			-	=	M	]	m	}				½				
1	1	1	0	E			.	>	N	⁀	n	~				¾		∧		~
1	1	1	1	F			/	?	O	—	o					¿	∨		ŉ	

Default Conditions

Default	Default Value	H/W Reset (On)	S/W Reset	Page Orien-tation	Page Length	Test Print	Font Select
HT set point	Clear State	yes	yes	yes	yes	yes	no
VT set point	Clear state	yes	yes	yes	yes	yes	no
Page length	Paper size	yes	yes	yes	---	yes	no
Margin	L,R,T,B	yes	yes	yes	yes	yes	no
VMI	6 LPI (DIP SW*)	yes	yes	yes	no	yes	no
HMI	Determined by font (DIP SW*)	yes	yes	yes	no	yes	no
Font assignment	ROM storage sequence	yes	no	no	no	no	yes
Font selection	Lowest font #	yes	no	no	no	no	---
Page orientation	Portrait (DIP SW*)	yes	yes	---	no	yes	no
Character modification	Diablo	yes	yes	yes	yes	yes	no
Auto LF	DIP switch	yes	no	no	no	no	no
# of copies	1 copy	yes	yes	yes	yes	yes	no
Reverse print mode	Exit state	yes	yes	yes	yes	yes	no
Backward print mode	Exit state	yes	yes	yes	yes	yes	no

* (DIP SW) for parallel interface

Consumables

General Description

These and other supplies can be ordered by contacting your Burroughs Service Center or representative.

Kit A

Supplies	Amount
Toner Cartridge	2 (150 g/cartridge)
Toner Collection Bottle	1
Toner Collection Bottle Cap	1
Cleaning Pad	2

Kit B

Supplies	Amount
OPC Cartridge	1
Shield Glass	1
Corona Unit	2
Ozone Filter	1

Note: *A separation roller assembly (see 150,000 page maintenance) can be obtained by order from your local Burroughs service center or representative.*

Paper:

Weight: 16 pounds - 24 pounds (60 g/m2 - 90 g/m2)

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NOTES

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