spinwriter®

TERMINALS
PRODUCT DESCRIPTION

NEC
NEC Information Systems, Inc.
819-000060-6003
12-80

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Specifications remain subject to change to allow introduction of design improvements.

First Printing - October 1978
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- February 1980
- December 1980

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ILLUSTRATIONS

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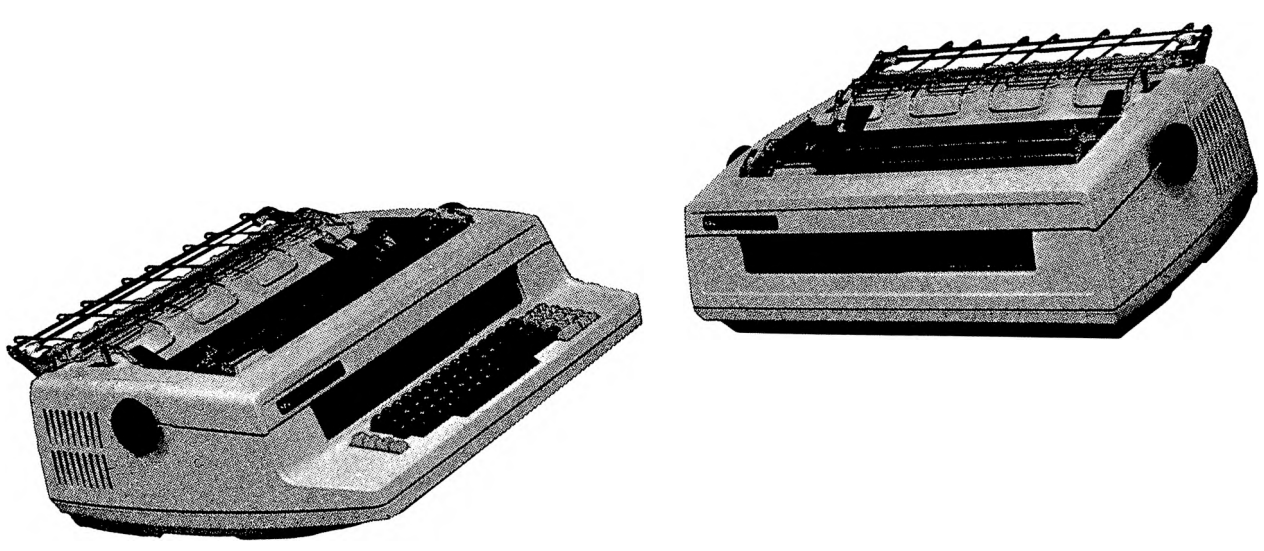


CHAPTER 1

GENERAL INFORMATION

This document describes the SPINWRITER Model 5510 Receive Only (RO) ANSI Terminal, Model 5515 RO Diablo 1610 Replacement Terminal, Model 5520 KSR ANSI Terminal, and Model 5525 KSR Diablo 1620 Replacement Terminal.

The SPINWRITER is a microprocessor controlled serial impact printer which prints fully formed characters bidirectionally under user control at a rate of up to 55 characters per second (maximum). It is designed for applications in which impeccable print quality and multiple copy capability are required. The SPINWRITER's excellent print quality permits the printer to be the ideal output device for word processing and Optical Character Recognition (OCR) applications.

Models 5510 and 5515 are RO printers for applications in which keyboard input is not required. Models 5520 and 5525 have a built-in keyboard complete with numeric pad to perform keyboard send/receive (KSR) functions. Options available include paper handling and a stand with forms receiving tray.

Interfaces include a serial RS-232-C interface and optional current loop interface. These interfaces are described in detail in Chapter 3.

1.1 FEATURES

The SPINWRITER Models 5510, 5515, 5520, and 5525 offer a range of standard and optional features that permit them to operate in most applications required of character printers.

1.1.1 Print Element

The SPINWRITER's unique small-diameter, low-mass print element is a low-cost, long-life, fiberglass reinforced plastic thimble. The thimble (Figure 1-1) is produced by cylindrically arranging and molding 64 individual spring action fingers on which two characters may be mounted, one above the other, for a maximum of 128 characters. With 125 characters on the print thimble, the last characters printed are fully visible to the operator.

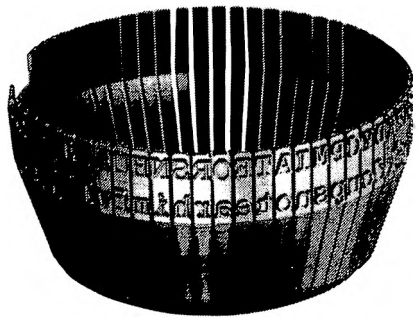


Figure 1-1 Print Thimble

Print thimble rotate motion is under servo control for fast, accurate bidirectional positioning, and under microprocessor control, which selects the fastest route to the next character to be printed. During operation, the print thimble rotates in a horizontal plane and is lifted up or down to the selected print position. The print hammer mounted within the print thimble strikes the selected finger, causing it to flex forward and impact against the ribbon (print medium), which transfers the character image onto the form in a manner similar to a standard typewriter.

The ribbon is contained in a cartridge which is easily replaced. The ribbons are available in black and red/black colors, and come in fabric and multi-strike film.

Character printing intensity is automatically controlled by an internal microprocessor in seven steps corresponding to each character. This feature extends print thimble life and produces high quality printed characters (regardless of type style used). Also, an impression control switch, accessible to an operator, can further adjust the character impressions to produce the desired print intensity.

1.1.2 Spacing and Forms Positioning

Advanced servomotor control design for carriage spacing and print element positioning, and stepper motor control of the paper movement and ribbon drive system result in exceptional print quality.

The SPINWRITER offers as a standard feature 10 and 12 pitch, and proportional spacing with bidirectional printing under user control. The printer can print 136 positions per line (10 pitch) or 163 positions per line (12 pitch).

Further versatility is offered by its superscripting and subscripting capabilities (Figure 1-2). Graphics and plotting capabilities are inherent SPINWRITER features. Character and line positions are directly addressable in four axes: left and

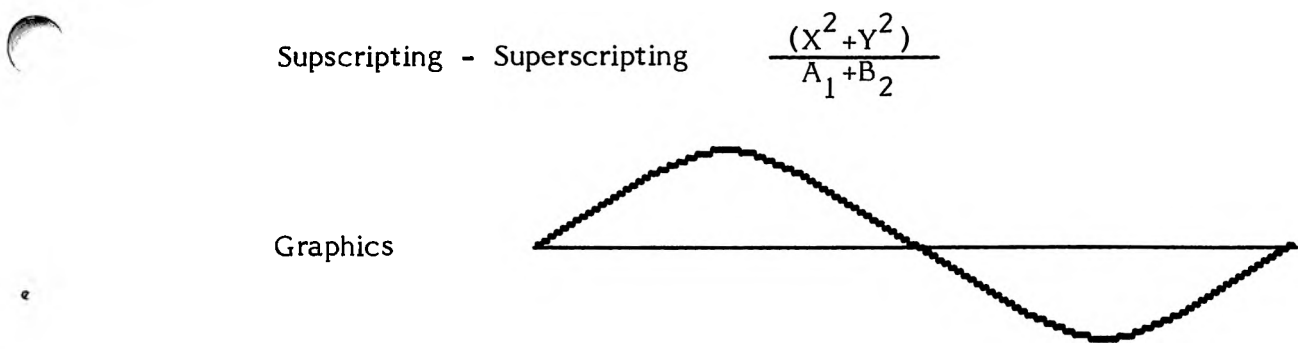


Figure 1-2 SPINWRITER Superscripting, Subscripting, and High Resolution Plotting

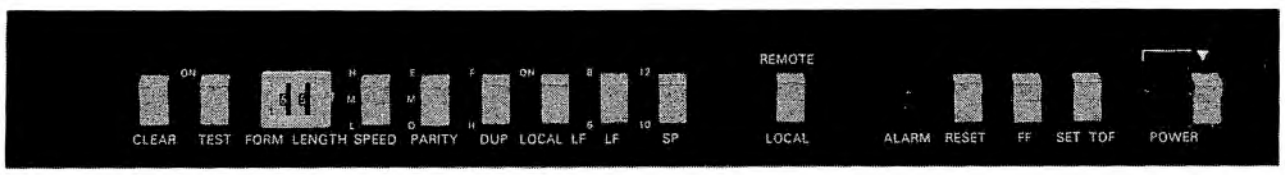
right horizontal with a resolution of 1/120th of an inch, and up and down vertical with a resolution of 1/48th of an inch (Figure 1-2). This horizontal and vertical spacing resolution results in 5,760 unique points per square inch.

The print rate is 55 characters-per-second at 12 characters-per-inch (maximum). Bidirectional printing enables the printer throughput to be increased while eliminating the time-consuming and non-productive carriage returns.

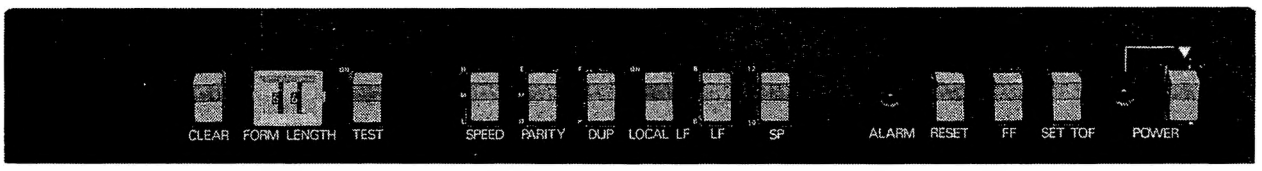
Microprocessor control of the preceding features allows absolute tabbing (tabbing directly to a specified print column or line without having previously set a tab stop) and motion minimization. The motion minimization feature combines a sequence of carriage and paper movement commands into one single operation which moves the print thimble via the shortest path to the position which would result from performing each individual operation. This feature reduces the time consumed by the printer to execute these commands.

1.1.3 Operator Control Panel

The operator control panel has an error RESET switch and control switches for Form Feed (FF), Set Top of Form (SET TOF), and POWER. In addition to these switches, the indicators for error (ALARM) and POWER, and an audible alarm buzzer are installed on the panel. The panel also provides switches for selection of data rate (SPEED), parity (PARITY), half/full duplex (DUP), LOCAL, line feed (LF), spacing (SP), CLEAR, FORM LENGTH, and TEST. The Model 5510 can come with an operator control panel that contains a REMOTE/LOCAL switch. These two types of operator control panels are illustrated in Figure 1-3.



For Model 5510 with Remote/Local Switch



For Models 5510, 5515, 5520, and 5525

Figure 1-3 Typical Operator Control Panel

1.1.4 Keyboard (Models 5520 and 5525 Only)

The keyboard has typewriter pairing arrays and a 15-key numeric keypad. In addition to these keys, such function keys as BREAK, Local/Remote (LOCAL), Upper Case Only (UC ONLY), and Automatic Line Feed (AUTO LF) are installed. All key inputs from the keyboard are transferred to the microprocessor in the same sequence in which the corresponding keys were pressed. Thus, useful keyboard data is never lost, regardless of the speed at which the keys are pressed.

The keyboard transmits 7-bit ASCII code. Using the ESC sequence, non-standard codes can be generated from the keyboard for special control functions, addressable horizontal and vertical tabbing, and addressable spacing and paper advance control. Details on the coding are contained in Chapter 4.

1.1.5 Communications Capability and Protocol

The standard communication interface in the SPINWRITER is designed to transmit and receive serial, asynchronous EIA RS-232-C/CCITT V.24 information via a modem or direct connection with a compatible communication multiplexer, controller, or central processor unit (CPU).

The SPINWRITER communicates in either half-duplex or full-duplex mode at six switch selectable baud rates from 110 to 1200 baud.

Communication protocol includes ETX/ACK, X-ON/X-OFF, and REVERSE CHANNEL capabilities.

1.1.6 Interface Functions and Maintenance Aids

The SPINWRITER incorporates additional interface functions such as Carrier Detect and maintenance aids such as Hammer Drive Enable/Disable. These are controlled by a switch located on the processor board. Detailed information is contained in Appendix A.

1.2 PAPER HANDLING

Rear feed and bottom feed are available for paper handling. Rear feed is similar to that for a typewriter - paper is inserted from the back of the printer. Any table can be used to hold the paper; there are no particular restrictions on the type of table.

With optional bottom feed, the paper is fed up through the SPINWRITER base. A bottom paper guide is included to mount the paper-out sensor and to facilitate paper loading. The paper is stored in front of and just below the SPINWRITER. Bottom feed requires a table with a paper slot or a similar storage medium under the printer.

The paper is advanced by a friction feed, pin feed, or tractor feed system. The parts required for each system are listed in Table 1-1. The paper widths that each feed system can accommodate are listed in Table 1-2.

1.3 OPTIONS

Options available for the Models 5510/5515 and 5520/5525 SPINWRITER includes forms handling equipment and a printer stand.

1.3.1 Forms Handling Equipment

The Models 5510, 5515, 5520, and 5525 come equipped with a friction feed platen as standard equipment. A number of other types of forms handling equipment are offered as options.

a. Friction Platen

This NEC forms handling device is designed for applications in which single or two part forms are used. If forms containing more than two parts are to be used, it is recommended that one of the many NEC tractor-type devices be used.

b. Friction Attachment

This unit mounts inside the printer and guides paper around the friction platen. It's use helps eliminate the need for operator adjustment when lining up the paper. This unit can only be used with friction feed.

Table 1-1 Parts Required for Paper Handling Systems

PARTS	FRICTION FEED	PIN FEED		TRACTOR FEED (VERTICAL & HORIZONTAL		BIDIRECTIONAL TRACTOR FEED	FRONT INSERTER FEED	CUT SHEET FEED	TWIN FEEDER
	REAR	REAR	BOTTOM	REAR	BOTTOM	REAR			
Friction Platen	X	-	-	X	X	X	X	X	X
Friction* Attachment	*	-	-	-	-	-	-	-	-
Pressure Bail	X	(#2)	(#2)	(#2)	(#2)	(#2)	(#3)	-	-
Silencer Hood	Long	Long	Long	Short+	Short+	Short	Short	Short	Short
Paper Net (Guide)	Short	Long	Long	Short	-	Short	X	-	-
Pin-Feed Platen*	-	X	X	-	-	-	-	-	-
Forms Tractors (Vertical)*	-	-	-	X	X	-	-	-	-
Forms Tractors (Horizontal)*	-	-	-	X	X	-	(#1)	-	-
Bidirectional Forms Tractor*	-	-	-	-	-	X	-	-	-
Bottom Guide*	-	-	X	-	X	-	-	-	-
Front Inserter*	-	-	-	-	-	-	X	-	-
Cut-Sheet Feeder*	-	-	-	-	-	-	-	X	-
Twinfeeder*	-	-	-	-	-	-	-	-	X

X = Required
- = Not Used
* = Options
+ = Use Long for Horizontal Tractor Feed

Note #1 - Allows the use of continuous forms
Note #2 - The pressure bail must be retracted when using the pin feed and tractor feed platens
Note #3 - Requires special pressure bail

Table 1-2 Paper Width Accommodations

FEED DIRECTION	PAPER WIDTH
Rear Feed	Friction Feed Platen: 16 in. (max) Pin Feed Platen: 4 in. to 16 in. (max) (3.5 to 15.5 in. pin-to-pin) Forms Tractor Assembly: 3 in. to 16 in. (max) (2.5 in. to 15.5 in. pin-to-pin)
Bottom Feed	Pin Feed Platen: 4 in. to 16 in. (max) (3.5 in. to 15.5 in. pin-to-pin) Forms Tractor Assembly 3 in. to 16 in. (max) (2.5 in. to 15.5 in. pin-to-pin)

c. Pin-Feed Platens

The NEC pin-feed platens are designed for those printing applications where one size continuous paper is required. Pin-feed platens are offered in many widths. A tear bar is provided for demand document applications. Width required should be specified by measuring paper width from hole center to hole center.

d. Forms Tractors (Vertical)

The NEC forms tractor is a general purpose device designed for use in printing applications where many different sizes of continuous forms are required. It accommodates one to seven-part forms.

e. Forms Tractors (Horizontal)

This low cost device is used for the same printing application as the form tractor. These NEC tractors however, are mounted horizontally, for use in applications having vertical height restrictions. One to four-part forms can be accommodated.

f. Bidirectional Forms Tractor

The NEC bidirectional forms tractor is designed for continuous forms applications where reverse paper motion is often required. It provides paper engagement on both sides of the platen for precise, trouble free paper drive in either direction. One to four-part forms can be accommodated.

g. Bottom Feed

This option allows paper to be fed from the bottom of the SPINWRITER when forms tractors are being used. It is especially useful for forms control when multiple part forms are used. A paper out switch is installed as part of this option.

h. Front Inserter (5510/5520 Only)

The NEC front inserter is a forms handling device designed for demand document applications where single sheet cut forms, ledger cards, etc. are used. This unit can be combined with the horizontal forms tractor, thus allowing the use of continuous forms as well. It features adjustable forms width from 4.4 to 14 inches, top or bottom sheet ejection, and top of form detection. It can be operated from the accessory panel, keyboard, or controller.

i. Cut Sheet Feeder

The cut sheet feeder features a 200 sheet capacity as well as paper out and paper jam detection. Paper widths from 5.5 to 12 inches can be accommodated.

1.3.2 Printer Stand

An optional printer stand is available with forms receiving tray for stacking printed outputs. The stand is designed for rear or bottom paper feed.

1.4 SUPPLIES AND ACCESSORIES

1.4.1 Print Ribbons

Print ribbons are contained in an easily replaceable ribbon cartridge. Single-color and two-color nylon ribbons are available as well as a multi-strike film ribbon.

a. Single Color Ribbon (Black)

This ribbon is made of nylon cloth. The ribbon is arranged in a continuous loop and can be used repeatedly. Average life of this ribbon is over 1.5 million impressions.

b. Two-Color Ribbon (Red/Black)

The two-color ribbon is also made of nylon cloth and arranged in a continuous loop. Average life of this ribbon is over 1 million impressions.

c. Multi-Strike Film Ribbon

The multi-strike film ribbon is used when extremely sharp printed characters are required. As this ribbon is not of continuous loop construction, it must be replaced after one pass. A ribbon end sensor detects the end of ribbon and stops SPINWRITER operation. Life of the multi-strike ribbon is approximately 180,000 impressions.

1.4.2 Print Thimble

The print thimble is a low cost, low mass, long life, fiberglass reinforced print element with 64 individual, spring action fingers cylindrically arranged and molded. Two characters may be mounted on each finger, giving total character capability of 128 characters. Contact the nearest NEC Information Systems, Inc. sales office for available fonts or special font requirements.

1.5 SPECIFICATIONS

Table 1-3 lists the Models 5510, 5515, 5520, and 5525 SPINWRITER mechanical, electrical, environmental and performance specifications.

Table 1-3 Models 5510, 5515, 5520, and 5525 Specifications

PERFORMANCE SPECIFICATIONS	
Print Speed	55 characters per second at 12 characters per inch (maximum) bi-directional With Serial Interface: 10 cps @ 110 baud, 30 cps @ 300 baud 15 cps @ 150 baud, 55 cps @ 600 baud (max) 20 cps @ 200 baud, 55 cps @ 1200 baud (max)
Print Line	136 columns at 10 characters/inch 163 columns at 12 characters/inch
Impression Control	3-step by operator
Paper Width	16 inches (maximum)
Character Set	128 characters (maximum), fully-formed
Copy Thickness Control	5-step switching by operator
Paper Thickness	Up to 0.027 inch
Paper Movement	Forward or reverse, up or down
Carriage Return Time	400 milliseconds (maximum)
Horizontal Resolution	120 increments per inch
Horizontal Tabulation	Normal and addressable - right and left
Vertical Resolution	48 increments per inch
Vertical Tabulation	Normal and addressable - up and down
Line Feed Speed	4.16 inch per second (53 ms settling time)
Spacing Speed	16 milliseconds at 12 characters per inch
Form Feed	1 to 99 lines (maximum)

Table 1-3 Models 5510, 5515, 5520, and 5525 Specifications (cont'd)

PERFORMANCE SPECIFICATIONS (cont'd)	
Line Feed	6 or 8 lines-per-inch (forward/reverse)
Test Print	Prints stored print test set
SERIAL INTERFACE SPECIFICATIONS	
Compatibility	Electrically compatible with EIA RS-232-C and CCITT V.24
Communication	ASCII, Half or Full Duplex
Error Detection	Even/Odd parity Framing/Overrun error detection
Transmission Rate	110, 150, 300 Baud 110, 200, 300 Baud 110, 300, 600 Baud 110, 300, 1200 Baud
Receive Buffer Transmit Buffer	256 Characters 16 Characters
Protocol	ETX/ACK or X-ON/X-OFF REVERSE CHANNEL
DIMENSIONS	
Models 5510 and 5515 (RO)	Width: 24.8 inches (630 mm) (including platen knobs) Depth: 16.34 inches (415 mm) Height: 8.68 inches (220.5 mm) 9.8 inches (250 mm) with higher silencer hood
Models 5520 and 5525 (KSR)	Width: 24.8 inches (630 mm) (including platen knobs) Depth: 21.1 inches (535 mm) Height: 8.68 inches (220.5 mm) 9.8 inches (250 mm) with higher silencer hood
POWER REQUIREMENTS	
Input Power	115 Vac, ±15%, 3.5 amps, 50/60 Hz, +5% -3% or 230 Vac, ±15%, 2 amps, 50/60 Hz, +5% -3%

Table 1-3 Models 5510, 5515, 5520, and 5525 Specifications (cont'd)

WEIGHT	
Models 5510 and 5515 (RO)	45.5 pounds (20.7 Kg)
Models 5520 and 5525 (KSR)	51.0 pounds (23.2 Kg)
ENVIRONMENTAL SPECIFICATIONS	
Operating Noise Level	60 dBA with cover 67 dBA without cover
Temperature	Operating: 40°F to 100°F (5°C to 38°C) Storage: -4°F to 158°F (-20°C to 70°C)
Humidity	Operating: 30% to 85% Storage: 10% to 95% (Without Condensation)
Altitude	Operating: Sea Level to 10,000 Ft. Storage: Sea level to 25,000 Ft.

WARNING

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. As temporarily permitted by regulation it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference. 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.

1.6 RELATED DOCUMENTS

The following documents, relating to the Models 5510, 5515, 5520, and 5525 SPINWRITER, are available from NEC Information Systems, Inc.

SPINWRITER Terminals Operator's Guide

SPINWRITER Maintenance Manual

SPINWRITER Theory of Operation Manual

CHAPTER 2
INSTALLATION

2.1 SYSTEM REQUIREMENTS

The SPINWRITER is easily and quickly installed. The considerations are: the operating environment, available space, and power requirements.

2.1.1 Operating Environment

Install the SPINWRITER in a clean, dust-free environment. The SPINWRITER operates reliably in a typical environment of 40 to 100°F with a relative humidity of 30 to 85%, without condensation.

2.1.2 Space and Weight Data

Little space, beyond the overall dimensions of the printer, is required. A minimum of 6 inches should be allowed on all sides for proper ventilation. Refer to Figures 2-1 through 2-4 for the SPINWRITER dimensions and to Table 1-3 for weight.

2.1.3 Power Requirements

Power supplied to the SPINWRITER should be within the range of 97-132 Vac, 47 to 63 Hz, or optional 195 to 265 Vac, 47 to 63 Hz. The SPINWRITER consumes approximately 170 watts.

2.2 INSTALLATION PROCEDURES

Installation of the SPINWRITER consists of visual inspection, power application, initialization, and self-test.

2.2.1 Visual Inspection

a. Ensure that the print carriage retaining ring is removed. (See unpacking instructions shipped with unit.)

b. Visually inspect the printer mechanism for any damage.

c. Remove the top cover (refer to the SPINWRITER Maintenance Manual).

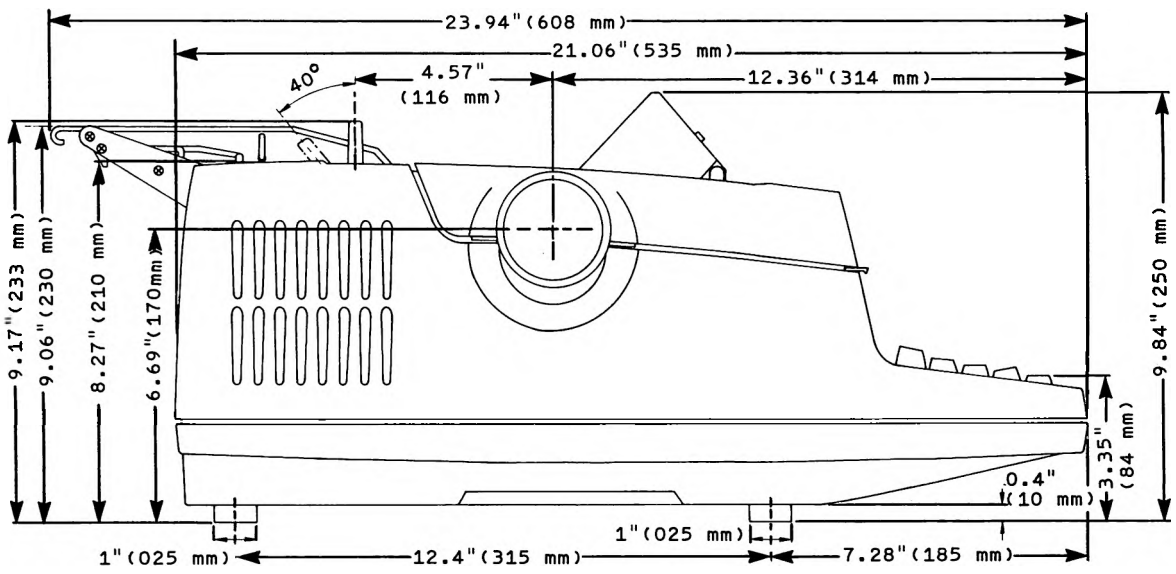


Figure 2-1 Models 5520 and 5525 SPINWRITER Dimensions, Left Side View

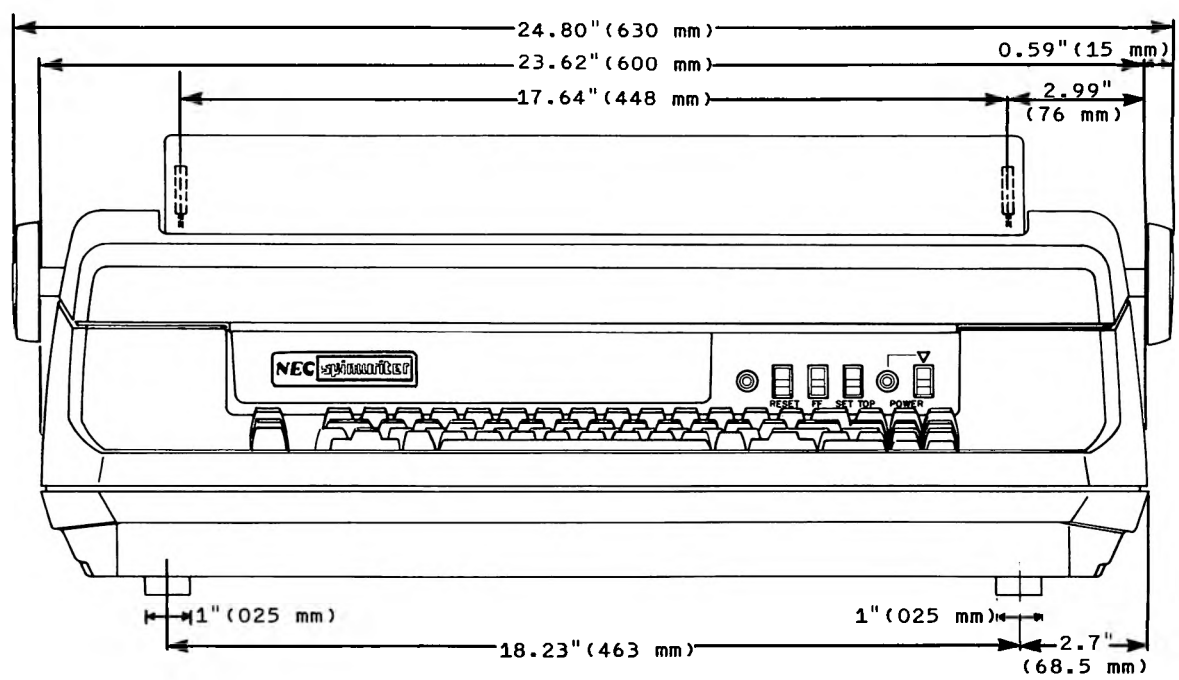


Figure 2-2 Models 5520 and 5525 SPINWRITER Dimensions, Front View

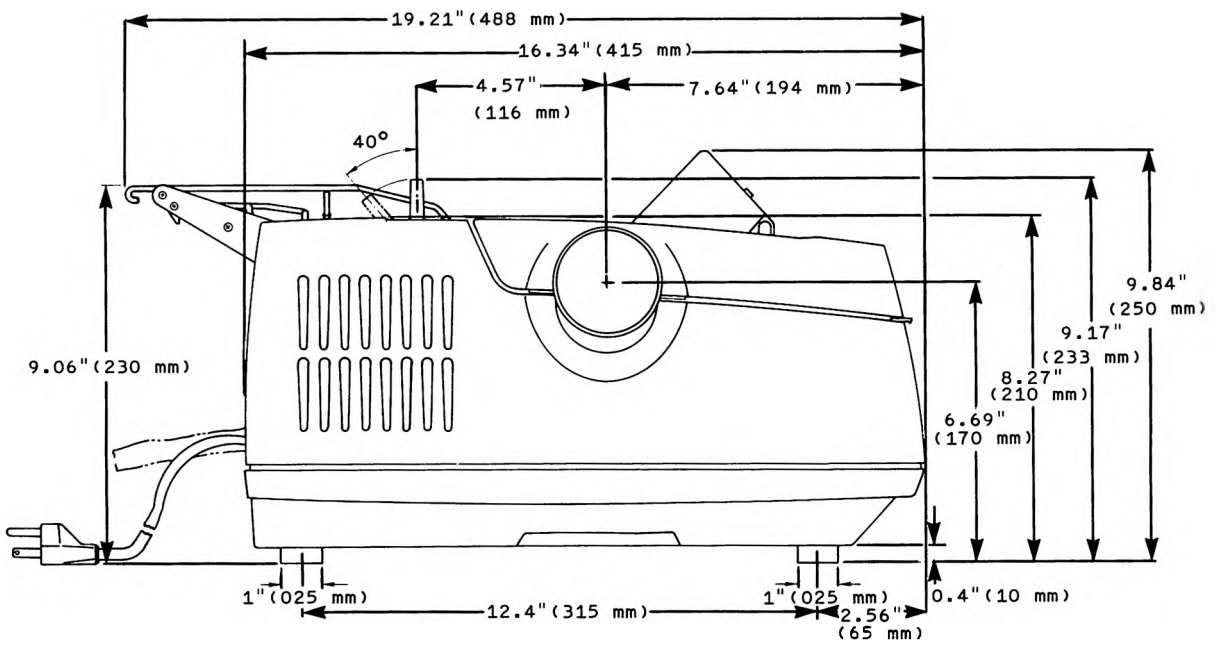


Figure 2-3 Models 5510 and 5515 SPINWRITER Dimensions, Left Side View

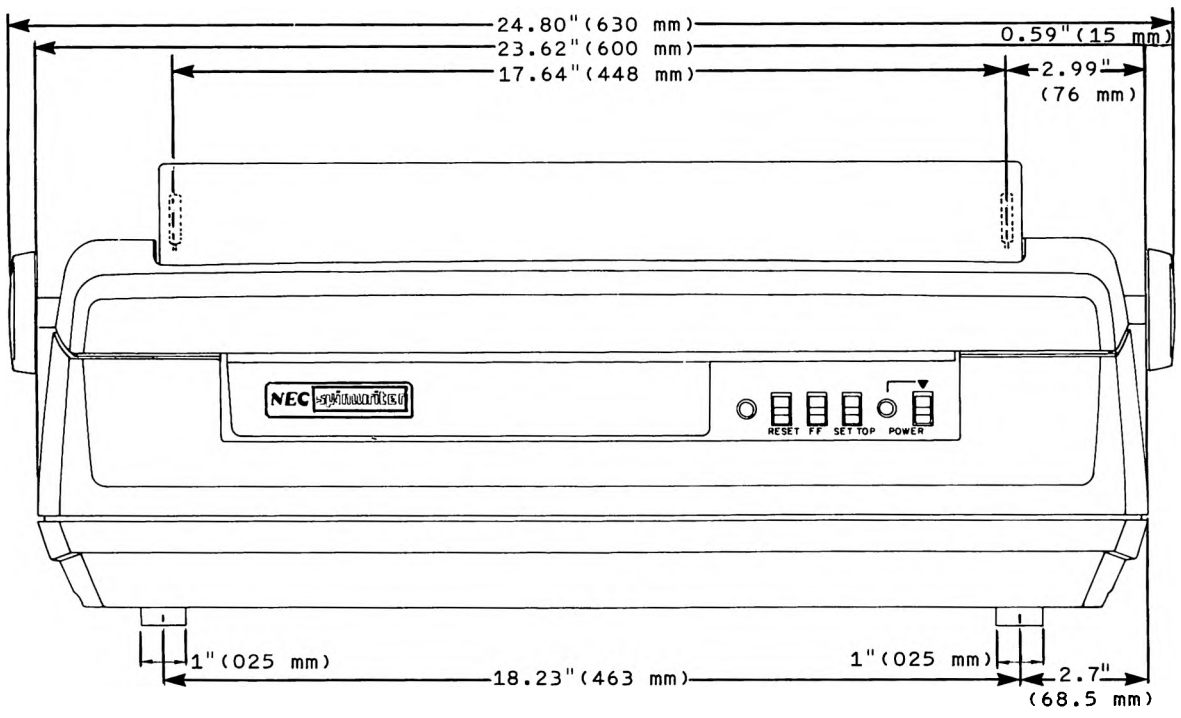


Figure 2-4 Models 5510 and 5515 SPINWRITER Dimensions, Front View

d. Ensure that all pc boards are properly seated and pc cables are connected.

e. Inspect for any loose hardware or extraneous parts or materials.

f. Replace the top cover.

2.2.2 Power On and Initialization Test

This test checks ac and dc power distribution, reset, and printer initialization.

a. Check that the ac power ON/OFF switches are OFF. These are located at the rear of the printer and on the operator control panel.

NOTE

Power ON to the printer can be controlled by either of the two switches. However, both switches must be OFF to remove power.

b. Connect printer power cord to appropriate facility ac receptacle.

c. Install print thimble and ribbon.

d. Move the carriage to the center of the platen.

e. Set front panel power switch to ON and look for the following conditions:

- The fan operates.
- The print carriage moves left to the first print position.
- The print thimble rotates to the "home" position.
- The ribbon is retracted to the down position.

f. If any of the above conditions do not function correctly, immediately push the power ON/OFF switch to OFF. Disconnect the power cord and call the service representative.

g. If the above conditions are met, proceed to the next test. Push ac power switch to OFF.

2.2.3 Self-Test

Self-test prints a stored message line-by-line in a repetitive pattern to allow checking printer line feed and ribbon feed operation as well as printed character quality.

2.2.3.1 Models 5510 and 5515 (RO) Self-Test

a. Check that the power ON/OFF switches at the rear of the printer and on the operator control panel are OFF.

NOTE

Use paper 16 inches wide.

b. Install paper in the printer (refer to SPINWRITER Operator's Guide).

c. Dial 13 into the FORM LENGTH switches.

d. On those models so equipped, set the LOCAL/REMOTE switch on the control panel to LOCAL.

e. Set the TEST switch on the control panel to ON.

f. Set the power ON/OFF switch to ON. The printer should initialize and print the test pattern repetitively. Character spacing of 10 or 12 pitch and line spacing of 6 or 8 lines-per-inch can be selected using the SP and LF switches on the operator control panel.

g. Run the test pattern for five minutes. Set the power ON/OFF switch to OFF and remove the printout. Examine the printout for the following:

- fully formed characters,
- proper line feed and ribbon feed operations, and
- print quality.

2.2.3.2 Models 5520 and 5525 (KSR) Self-Test

a. Check that the power ON/OFF switches at the rear of the printer and on the operator control panel are OFF.

b. Install paper in the printer (refer to Operator's Guide).

c. Dial 13 into the FORM LENGTH switches.

d. Depress in the LOCAL key on the keyboard.

e. Set the TEST switch on the control panel to ON.

f. Set the power ON/OFF switch to ON. The printer should initialize and repetitively print the test pattern shown in Figure 2-5, single line feed.

g. Run the test pattern for five minutes. Set the power ON/OFF switch to OFF and remove the printout. Examine the printout for the following:

- complete character set per specification,
- proper line feed and ribbon feed operations, and
- print quality.

2.2.4 Models 5520 and 5525 (KSR) Keyboard Check

a. Check that the power ON/OFF switches at the rear of the printer and on the operator control panel are OFF.

b. Install paper in the printer (refer to SPINWRITER Operator's Guide).

c. Press the LOCAL key on the keyboard.

d. Set the power ON/OFF switch to ON.

e. Press each of the keys and ensure that the printer responds correctly for each key operation.

```
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
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THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
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THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG 123 456 7890 +-X:=$%()   The quick brown fox jumps over the lazy dog / [] {} <> \ @ ? * #
```

THESE CHARACTERS ARE NOT PRINTED FOR MODELS 5510 AND 5520 THAT CONTAIN A G9GLB RS-232-C INTERFACE BOARD

Figure 2-5 Typical Self-Test Pattern

CHAPTER 3
INTERFACE INFORMATION

Interfaces available for the Models 5510, 5515, 5520, and 5525 SPINWRITER are as follows:

a. RS-232-C interface

b. Current-Loop interface (Optional)

3.1 RS-232-C/CCITT V.24 SERIAL INTERFACE

The SPINWRITER serial interface (Figure 3-1) transmits and/or receives serial, asynchronous, ASCII data via an Electronics Industries Association Standard RS-232-C and the International Consultive Committee for Telephones and Telegraphs recommendation (CCITT V.24).

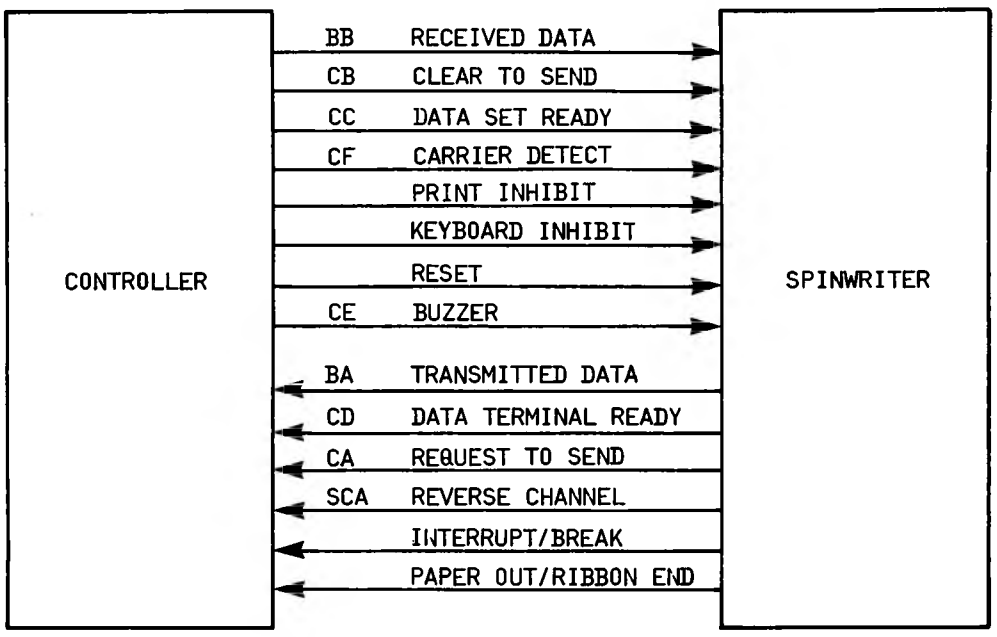


Figure 3-1 Serial Interface

3.1.1 Interface Signal Levels

The SPINWRITER can receive input signal levels of ±25 volts. However, the output signal level is set at approximately ±8 volts, hereafter referred to as ±12 volts (nominal). (See Figure 3-2.)

Data signals are -12 volts for logic "1" designated as MARK, and +12 volts for logic "0" designated as SPACE. This is illustrated in Figure 3-2A. All other signals are +12 volts ON or High, -12 volts OFF or Low. This is illustrated in Figure 3-2B.

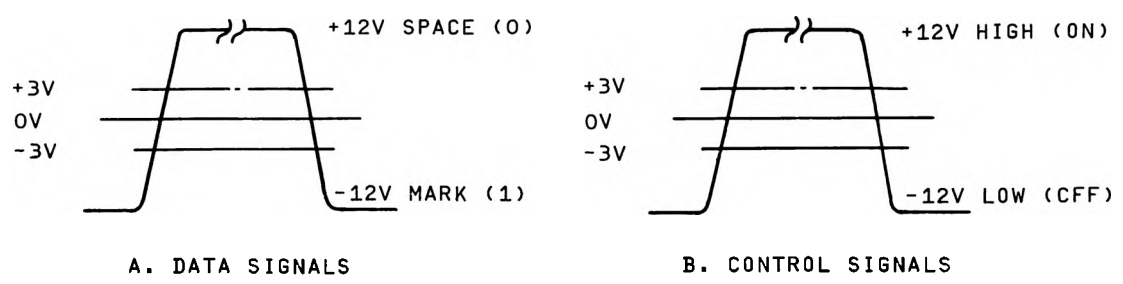


Figure 3-2 Interface Signal Levels

3.1.2 Interface Lines Description

Following is a brief description of the signal and control lines across the SPINWRITER serial interface. Additional details on the serial interface are contained in Chapter 4.

a. Carrier Detect (CF)

   This line must be high (ON) for the SPINWRITER to operate. The line goes high when the modem detects a carrier tone, indicating that the link is now usable.

b. Data Terminal Ready (CD)

   This line goes high (ON) when power is applied to the SPINWRITER, no errors are detected, and the SPINWRITER is in remote mode.

c. Data Set Ready

   This line must be high (ON) for the SPINWRITER to operate. The line goes high when modem power is on and the modem is not in a test mode.

d. Request to Send

   Goes high (ON) when the Data Terminal Ready is available and the modem replies with Data Set Ready.

e. Clear-To-Send

This line must be high (ON) for the SPINWRITER to operate. This input from the modem goes high (ON) when the modem is ready for the SPINWRITER to transmit.

f. Transmitted Data

ASCII coded digital data transmitted to the modem. This line is held at MARK (logic "1") when no data is being transmitted.

g. Received Data

ASCII coded digital data received by the SPINWRITER. This line must be held at MARK (logic "1") when no data is being received from the modem.

h. Reverse Channel

These lines go from low (OFF) to active high (ON) when any of the following occurs.

- Receive Buffer 7/8 full (224 characters)
- Paper Out
- Ribbon End
- Check Condition
- Cover Open
- Parity Framing Error

The line can be made to go from high (OFF) to active low (ON) to indicate any of the above conditions. This is accomplished by a switch setting on the operator control panel PCB. See Appendix A for additional details.

i. Interrupt/Break

This line goes high (ON) when any of the following occur.

- Buffer Overflow
- BREAK key on keyboard is pressed
- Paper Out
- Ribbon End

Operation of this feature is controlled by a switch setting on the operator control panel PCB. See Appendix A for additional details.

j. Keyboard Inhibit

This line when high (ON) inhibits keyboard data transmission.

k. Paper Out/Ribbon End

This line goes high (ON) when either the SPINWRITER is out of paper or the end of multi-strike ribbon is reached.

l. Reset

This line to the SPINWRITER initiates a restore sequence which:

- returns print thimble to "home" position (character address 00),
- returns carriage to "home" position (column 1),
- positions ribbon to down position, and
- clears all tab settings.

m. Buzzer

This line sounds the audible alarm for approximately one-half second, and is used by the host computer to attract the operator's attention.

3.1.3 Interface Cable and Connector Pin Assignments

The interface cable between the modem and the SPINWRITER is 10-feet long with AWG #22 wires. The modem connector is a 25-pin Cannon or Cinch DB-25 (or equivalent). The connector to the SPINWRITER has 16 pins and connects to CN30 on the G9CUR board (for earlier Models 5510 and 5520) or G9GLB board (for later Models 5510 and 5520), or G9DWH board (for Models 5515 and 5525). Table 3-1 lists the pin assignments on both connectors. Maximum cable length must not exceed 50 feet.

3.1.4 Timing

The bit period and the character period are a function of the baud rate as indicated below.

BAUD RATE	BIT PERIOD	CHARACTER PERIOD
110	9.09 msec	100 msec
150	6.67 msec	66.7 msec
300	3.33 msec	33.3 msec
1200	0.83 msec	8.3 msec

Table 3-1 Serial Interface Cable Connectors
Pin Assignments

EIA CONNECTOR PIN NO.	SPINWRITER CONNECTOR CN30	CIRCUIT		EIA SIGNAL NAME
		EIA	CCITT	
2	1	BA	103	TRANSMITTED DATA
3	2	BB	104	RECEIVED DATA
4	3	CA	105	REQUEST TO SEND
5	4	CB	106	CLEAR TO SEND
6	5	CC	107	DATA SET READY
7	6	AB	102	SIGNAL GROUND
8	7	CF	109	CARRIER DETECT
11	12	-	-	RESET*
18	10	-	-	KEYBOARD INHIBIT*
19	8	SCA	120	REVERSE CHANNEL
20	9	CD	108	DATA TERMINAL READY
21	11	-	-	PRINT INHIBIT*
22	13	CE	-	BUZZER*
23	14	-	-	PAPER OUT/RIBBON END*
25	15	-	-	INTERRUPT/BREAK*

* Used for direct connection applications only.

3.1.5 Interface Logic Elements

The interface logic elements are shown in Figure 3-3. Type-1489 line receivers are used as level converters for the input lines. Type-1488 line drivers are used as level converters for the output lines.

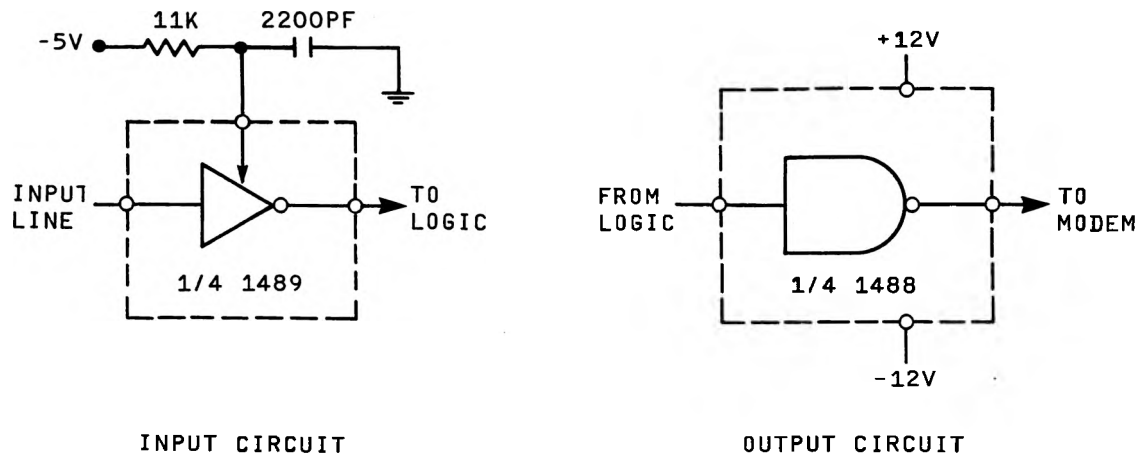


Figure 3-3 Serial Interface Logic Elements

3.2 CURRENT LOOP INTERFACE

The current loop interface is available with Models 5510, 5515, 5520, and 5525, and has the following characteristics:

- 20 or 60 mA,
- neutral Loop, and
- 48 volt open circuit voltage (max).

Interface connections within the SPINWRITER are made to CN42 on the G9BMY board. This is a separate PCB dedicated to the current loop interface. This board interconnects with the G9CUR processor board. Board connector CN42 mates with a corresponding cable connector. The other end of this internal interface cable is terminated in a 4-pin connector (CNIFC) mounted at the rear of the SPINWRITER. Table 3-2 lists the pin assignments on the interface cable connectors.

Table 3-2 Current Loop Interface, Connector Pin Assignments

CNIFC PIN NO.	SIGNAL
1	CUR IN +
2	CUR IN -
3	CUR OUT +
4	CUR OUT -

CHAPTER 4

INTERFACES, LINE PROTOCOL AND CONTROL CODES

This chapter contains additional information on the SPINWRITER relative to the RS-232-C serial interface, communications protocol, local and remote modes of operation, and the use of control codes and escape sequences. Detailed operating instructions are contained in the SPINWRITER Terminals Operator's Guide.

4.1 SERIAL DATA FORMAT

Figure 4-1 illustrates the serial, asynchronous ASCII data from either the transmit or receive data circuit. When no data is present on either circuit, that circuit should be held in the MARK state.

Each character consists of a start bit, seven data bits, appropriate parity bit, and one or two stop bits. Two stop bits are standard when operating at 110 Baud. The parity bit assigned (even, odd, or mark) is selected by the PARITY switch on the operator control panel. In the MARK position, parity testing of the received character is not performed and the transmitted parity bit is a "marking" bit.

Data received via the serial EIA RS-232-C/CCITT V.24 input/output port is assembled into 8-bit characters. Parity is checked and the character is stored in the 256-character receive buffer before being sent to the printer for character printing or function execution.

Keyboard data passes through a 16-character transmit buffer. The appropriate parity bit is assigned and the start and stop bits are assigned before character disassembly for transmission.

The data transfer rate Low, Medium, and High corresponds with 110, 300, and 1200 Baud and is selected on the operator control panel. Optional rates are 150, 200, and 600 Baud.

Half- and full-duplex operations are also selected on the operator control panel. In half-duplex, all keyboard data is printed and transmitted. In full-duplex, keyboard data is transmitted but not printed unless it is echoed back or returned by the receiving computer. This equates to local copy or no local copy (Echoplex) modes of operation. Line control does not change between full and half-duplex selections (i.e., line control remains full-duplex.

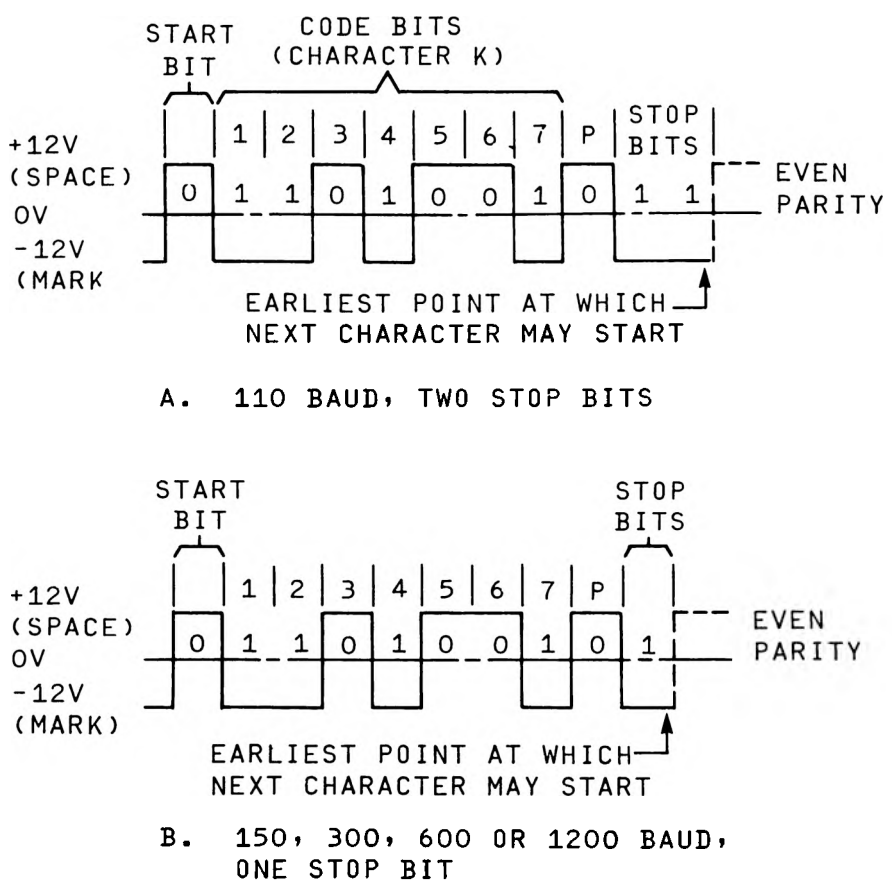


Figure 4-1 ASCII Data Format

4.2 MODELS 5520 AND 5525 LOCAL/REMOTE OPERATION

Local/remote mode of operation is controlled by the LOCAL key on the keyboard. Pressing the LOCAL key causes it to latch in the down position and places the SPINWRITER in the local mode. Releasing the LOCAL key places the SPINWRITER in the remote mode.

4.2.1 Local Mode

In the local mode, the Model 5520 and 5525 is off-line and can be operated similar to an electric typewriter. The interface status follows.

- Data Terminal Ready goes low (inactive).
- Request to Send goes low (inactive).
- Received Data is ignored.
- Transmitted Data is held at MARK.

4.2.2 Remote Mode

In the remote mode, the Models 5520 and 5525 receive and transmit data over the communications line. The interface status follows.

- Data Terminal Ready is high (active).
- When Data Set Ready goes high, Request to Send goes high.
- When Clear to Send goes high, Transmitted Data is enabled.
- When Carrier Detect goes high, Received Data is enabled.

The lines Data Terminal Ready and Request to Send go low for about 500 milliseconds if:

- Carrier Detect does not go high within one minute after DATA SET READY goes high or
- Carrier Detect goes low for more than 10 seconds after it once became high.

During a Check condition, the lines Data Terminal Ready and Request to Send go low and Received Data is ignored.

4.3 MODELS 5510 AND 5515 LOCAL/REMOTE OPERATION

Certain models of the 5510 and 5515 SPINWRITER are equipped with a switch which allows a unit status of on-line or off-line to the host controller.

The Models 5510 and 5515 Remote/Local has a REMOTE/LOCAL switch also located on the operator control panel. In the REMOTE position, the printer is on-line; in the LOCAL position the printer is off-line.

NOTE

Initialization will not occur if the carriage is beyond the left or right margin. The carriage in this case must be manually moved toward the center of travel.

4.4 INITIALIZATION

a. Initialization occurs under the following conditions.

- When the printer POWER switch is set to ON.
- When the operator control panel CLEAR switch is depressed.

- When the Reset signal is received from the interface during check state.

b. Initialization causes the following sequences.

- The carriage is moved to print column 1 and stops.
- Column 1 is set as the first printing position.
- At 10 characters-per-inch, the right margin is set to character position 136. At 12 characters-per-inch, the right margin is set to character position 163.
- The line feed position counter is cleared and the platen position, when cleared, becomes TOF. Paper does not move.
- The operator control panel switch settings of LF, SP, and FORM LENGTH are read into internal registers.
- The ribbon is set to the black color position.
- All horizontal and vertical tab stops are cleared.
- The forward print mode is enabled.
- Format set mode is turned off.
- The send buffer and receive buffer are cleared.
- The alarm circuit is cleared and the buzzer stops.

4.5 COMMUNICATIONS PROTOCOL

The communications protocol available in the SPINWRITER to indicate terminal status to the host computer is described in the following paragraphs.

4.5.1 ETX/ACK

To speed throughput and guarantee against receive buffer overflow, which could cause loss of data, the ETX/ACK full duplex protocol sequence is used. Each data block transmitted to the SPINWRITER must be less than 256 characters including an ETX. As the ETX character is withdrawn from the receive buffer, and the buffer is empty, the SPINWRITER transmits an ACK character to the host computer to indicate that the receive buffer is empty and available to receive the next block of data.

The ETX/ACK protocol is recommended when operating the SPINWRITER terminals on a commmunications link at a data transfer rate of over 30 characters per second.

The ETX/ACK protocol feature is enabled by a DIP switch setting on the operator control panel PCB. (Refer to Appendix A.)

4.5.2 X-ON/X-OFF

The SPINWRITER transmits an X-OFF code to the host computer, which interprets this as a priority interrupt. The host terminates transmission of data until the X-ON code is received.

a. X-OFF (DC3 control character) is transmitted under the following conditions.

- Buffer 7/8 Full (approximately 30 characters from capacity of 256 characters)
- Paper Out
- Cover Open
- Ribbon End (multi-strike)

b. X-ON (DC1 control character) is transmitted under the following conditions.

- Buffer Available (approximately 100 characters from bottom of buffer)
- Paper Out corrected - ALARM reset
- Cover Open condition ceases
- Ribbon is replaced - ALARM reset

The X-ON/X-OFF protocol feature is enabled by a DIP switch on the operator control panel PCB. (Refer to Appendix A.)

4.5.3 Reverse Channel

The reverse channel feature is well suited to direct connection (no modem) configurations. Reverse channel by means of a switch setting can be an active high (signal level changes low to high) or an active low (signal level changes high to low) to indicate SPINWRITER status when any of the following conditions occur.

- Buffer 7/8 full (approximately 30 characters from capacity of 256 characters)
- Paper Out
- Ribbon End
- Check Condition

- Cover Open
- Parity/Framing Error

The reverse channel level is selected by a DIP switch setting on the operator control panel PCB. (Refer to Appendix A.)

4.5.4 Break Signal

A break signal, 300 to 700 milliseconds in duration, is transmitted (TRANSMITTED DATA, Pin 2 on the RS-232-C interface) when any of the following conditions occur.

- Paper Out
- Buffer Overflow
- Ribbon End (multi-strike)
- BREAK key on the 5520 and 5525 keyboard is pressed

The Break signal is enabled by a DIP switch setting on the operator control panel PCB. (Refer to Appendix A.)

4.6 COMMUNICATIONS CONTROL CODES

The SPINWRITER control logic recognizes and processes the control codes listed in Table 4-1 received from the communications link. These control characters received over the communications link or from the keyboard are processed along with the 94 printable characters of the ASCII code set (see Appendix B).

Although not recognized by the SPINWRITER, the remaining control codes of the ASCII code set can be generated from the keyboard (Models 5520 and 5525).

When using the keyboard, a control code is generated (except ESC) by pressing the CTRL key and a second key simultaneously dependent on the control operation desired. All of the control codes in the ASCII code set are listed in Appendix C. They can all be generated from the keyboard.

The ESC control character is a 2 or 3-character sequence used to alter normal printing, carriage movement, or paper movement. This character initiates specific "escape" sequences when received from the communications link or the Model 5520 and 5525 keyboards. The basic ESC control codes are listed in Table 4-2 for the 5510/5520. The ESC sequences for the 5515/5525 are listed in Table 4-3. These are 2-character sequences. Three-character sequences are an extension of horizontal tab, vertical tab, character spacing, and forms advance length and are included in the following descriptions.

Table 4-1 Control Codes

CONTROL CODE	PRESS KEYS
ETX - End	CTRL C or c
ACK - Acknowledge	CTRL F or f
BEL - Bell (Sound Audible Alarm)	CTRL G or g
BS - Backspace	CTRL H or h (also BS)
HT - Horizontal Tab	CTRL I or i (also TAB)
LF - Line Feed	CTRL J or j (also LINE FEED)
VT - Vertical Tab	CTRL K or k
FF - Form Feed	CTRL L or l
CR - Carriage Return	CTRL M or m (also RETURN)
SO - Shift Out	CTRL N or n
SI - Shift In	CTRL O or o
DC1 - Device Control 1 (X-ON)	CTRL Q or q
DC3 - Device Control 3 (X-OFF)	CTRL S or s
ESC - Escape	ESC

Table 4-2 Escape Sequences (5510/5520)

PRESS KEYS	ESCAPE SEQUENCE
ESC 1	Set Horizontal Tab
ESC 2	Clear Horizontal Tab Stop (Individual)
ESC 3	Print in Red
ESC 4	Print in Black
ESC 5	Set Vertical Tab Stop
ESC 6	Reset Vertical Tab Stop (Individual)
ESC 7	Clear all Horizontal and Vertical Tabs and FF Length
ESC 9	Reverse Line Feed
ESC <	Reverse Print (Right-to-Left) On
ESC =	Read and Store Operator Control Switches
ESC >	Forward Print (Left-to-Right) On
ESC ?	Set Format Mode
ESC @ or `	Reset Format Mode
ESC J or j	Set Right Margin
ESC K or k	Reset Right Margin
ESC L or l	Set FF Length
ESC M or m	Set Left Margin
ESC O or o	Reset Left Margin

Table 4-3 Escape Sequences (5515/5525)

PRESS KEYS	ESCAPE SEQUENCE
ESC 1	Set Horizontal Tab Stop
ESC 2	Clear All Horizontal Tab Stops
ESC 3	Graphics On
ESC 4	Graphics Off
ESC 5	Forward Print On
ESC 6	Backward Print On
ESC 8	Clear Individual Horizontal Tab Stop
ESC 9	Set Left Margin
ESC 0	Set Right Margin
ESC A	Print in Red
ESC B	Print in Black
ESC D	Negative Half-Line Feed
ESC U	Half-Line Feed
ESC LF	Negative Line Feed
ESC HT (n)	Absolute Horizontal Tab
ESC VT (n)	Absolute Vertical Tab
ESC RS (n)	Define Vertical Motion Index (VMI)
ESC US (n)	Define Horizontal Motion Index (HMI)

4.6.1 5510/5520 Carriage Movement Control

The codes that affect Models 5510 and 5520 carriage movement are described in the following paragraphs.

4.6.1.1 Space (SP)

On receipt of the SP code, the selected space is performed. The operator selects the space for 1/10 or 1/12 inch using the SP switch on the operator control panel. Spacing does not operate beyond the right margin. In the reverse print mode, SP moves the carriage one print position to the left.

4.6.1.2 Backspace (BS)

On receipt of a BS code, the indicated backspacing is performed. The number of backspaces is set for 1/10 or 1/12 inch. This number is used for spacing, spacing after each character, and backspacing. Backspacing does not operate beyond the left margin. In the reverse print mode, BS moves the carriage one print position to the right.

4.6.1.3 Carriage Return (CR)

Receipt of a CR code causes the carriage to move to the left margin. It also causes a line feed if the AUTO LF key is depressed. CR also restores Reverse Print to Forward Print.

4.6.1.4 Normal Horizontal Tab

Normal tabbing is done using CTRL I. The carriage is moved to the desired tab positions and keys ESC 1 are pressed for each tab. Tabbing is executed with control code HT or by pressing the TAB key on the keyboard.

Key sequence ESC 2 clears individual horizontal tabs or all tabs (see Appendix A, SW1-2 on G9DGD board (5510)) or G9BNF board (5520).

Key sequence ESC 7 clears all horizontal tabs.

4.6.1.5 Absolute Horizontal Tab

Absolute horizontal tabbing does not require presetting of the tab stops. It allows positioning the carriage directly to any of 163 print positions from any other position.

Absolute tabbing is done using a 3-character escape sequence. The sequences are listed in Table D-1. For example, to tab directly to horizontal position 90, the following sequence is input for 5510/5520.

ESC (First character)
R (Second character)
Y (Third character)

4.6.1.6 Right Margin, Left Margin

On receipt of ESC J(j), the right margin is set at the present print position.

On receipt of ESC K(k), right margin is reset automatically to the extreme right print position (for 1/10 inch pitch at 136; for 1/12 inch pitch at 163). Also, when the printer is initially turned on, the right margin is set to the extreme right position.

On receipt of ESC M(m), the left margin is set to the present print position.

On receipt of ESC O(o), the left margin is reset to the extreme left print position automatically (the first print position).

4.6.1.7 Reverse Print, Forward Print

The sequence ESC < initiates the reverse print mode. In this mode, the characters are printed as the carriage moves from right-to-left. The paper feed codes and HT are executed as normally set.

The forward print mode (left-to-right) is restored by the sequence ESC > or a carriage return (CR).

4.6.1.8 Spacing Control

Using the ESC sequence, horizontal spacing can be controlled in increments of 1/120-inch (15/120 max). The escape sequence for this feature is a 3-character sequence listed in Table D-3.

4.6.2 5510/5520 Paper (Platen) Movement Control

The codes that affect Models 5510 and 5520 paper movement are described in the following paragraphs.

4.6.2.1 Format Mode

In the format mode ESC ?, the control codes for paper (platen) movement (LF, VT, FF, REVERSE LF) are inhibited, and no paper movement occurs. However, the line feed counter continues to function and responds to input LF commands. This feature allows setting vertical tab stops, FF and TOF without paper movement.

The ESC @ or ` sequence resets the format mode.

4.6.2.2 Line Feed (LF)

On receipt of the LF code, the selected line feed increment is performed. The operator selects the line feed for 6 or 8 using the LF switch on the operator control panel.

4.6.2.3 Reverse Line Feed

On receipt of ESC 9, the platen (and, hence, the paper) is reversed by one line. The distance the paper moves is determined by LF switch on the operator control panel, or pre-programmed vertical pitch setting.

4.6.2.4 Form Feed, Form Length

When the FF code is received, the paper is advanced to the top of the next page or TOF. Normally, the TOF is established by the operator setting the desired number of lines (99 maximum) into the FORM LENGTH switches and depressing SET TOF on the operator control panel.

The form length and TOF setting can also be done using the ESC sequence, as follows.

- Press ESC 7
- Press ESC ? (set format mode to inhibit paper movement)
- Issue the LF (line feed) command as many times as the desired number of lines (if 66 lines, issue LF 66 times)
- Press ESC @ or ` (Reset format mode)
- Press ESC L (establishes FF length)

Issuance of a FF command advances the paper to the TOF established above.

Key sequence ESC 7 clears the FF length established by pressing SET TOF or the ESC L sequence.

4.6.2.5 Normal Vertical Tab

Normal vertical tabbing is done using ESC 5. The paper (platen) is moved to the desired tab positions and keys ESC 5 are pressed for each tab. Tabbing is executed with control code VT.

Key sequence ESC 6 clears individual vertical tabs.

Key sequence ESC 7 clears all tabs.

4.6.2.6 Absolute Vertical Tab

Relative vertical tabbing does not require presetting the tabs. It allows positioning the paper to any of 63 vertical (line) positions forward or reverse from any other position.

Relative vertical tabbing is done using a 3-character escape sequence. The sequences are listed in Table D-2. For example, to tab forward 20 lines, the following sequence is input (see Table D-2).

ESC (First character)
Z (Second character)
T (Third character)

To return to the original position (reverse), the following sequence is input.

ESC
X
T

4.6.2.7 Forms Advance Control

Using the ESC sequence, form advance can be controlled in increments of 1/48-inch (16/48 max). The escape sequence for this feature is a 3-character sequence listed in Table D-3.

4.6.3 5510/5520 General Control

The codes that affect Models 5510 and 5520 red/black printing and read and store operator control switches are described in the following paragraphs.

4.6.3.1 Red/Black Printing

The printer is initialized for printing in black. To print in red, the ESC 3 sequence is issued. To print in black, the ESC 4 sequence is issued.

4.6.3.2 Read and Store Operator Control Switches (ESC =)

The sequence ESC = stores the settings of the spacing (SP) switch (10 or 12), line feed (LF) switch (6 or 8), and the FORM LENGTH switch in internal registers.

4.6.4 5515/5525 Carriage Movement Control

The codes that affect Models 5515 and 5525 carriage movement are described in the following paragraphs.

4.6.4.1 Space (SP)

On receipt of the SP code, the selected space is performed. The operator selects the space for 1/10 or 1/12 inch using the SP switch on the operator control panel. Spacing does not operate beyond the right margin. In the reverse print mode, SP moves the carriage one print position to the left.

4.6.4.2 Backspace (BS)

On receipt of a BS code, the indicated backspacing is performed. The number of backspaces is set for 1/10 or 1/12 inch. This number is used for spacing, spacing after each character, and backspacing. Backspacing does not operate beyond the left margin. In the reverse print mode, BS moves the carriage one print position to the right.

4.6.4.3 Carriage Return (CR)

Receipt of a CR code causes the carriage to move to the left margin. It also causes a line feed if the AUTO LF key is depressed. CR also restores Reverse Print to Forward Print.

4.6.4.4 Normal Horizontal Tab

Normal tabbing is done using CTRL I. The carriage is moved to the desired tab positions and keys ESC 1 are pressed for each tab. Tabbing is executed with control code HT or by pressing the TAB key on the keyboard.

Key sequence ESC 2 clears individual horizontal tabs or all tabs (see Appendix A, SW1-2 on G9DGD board (5515) or G9BNF board (5525).

Key sequence ESC 2 clears all horizontal tabs.

4.6.4.5 Absolute Horizontal Tab (ESC HT (n))

Using absolute horizontal tab, the carriage can be positioned directly to any of the first 126 print positions without the need for prior setting of tab stops. This is accomplished by providing an ESC character and the horizontal command (HT) followed by the ASCII character whose decimal value indicates the print position desired (see Table D-4). For example, set absolute horizontal tab at 65 and press keys ESC, CTRL with I, and A (print position desired plus one - see Table D-4).

4.6.4.6 Right Margin, Left Margin

On reciept of ESC 0, the right margin is set at the present print position.

On receipt of ESC 9, the left margin is set to the present print position.

4.6.4.7 Reverse Print, Forward Print

The sequence ESC 6 initiates the reverse print mode. In this mode, the characters are printed as the carriage moves from right-to-left. The paper feed codes and HT are executed as normally set.

The forward print mode (left-to-right) is restored by the sequence ESC 5 or a carriage return (CR).

4.6.4.8 Define Horizontal Motion Index

The Horizontal Motion Index (HMI) is the number of 1/120-inch increments that the carriage moves after spacing or printing a character. Minimum HMI is 0 (no spacing) and maximum is 125. The HMI is executed by a 3-character sequence ESC US (n), where (n) represents an ASCII character whose decimal value is one greater than the number of increments the carriage will move. For example, set HMI at 10, and press keys ESC, CTRL, SHIFT, _ (underline), and CTRL K (see Table D-4).

4.6.5 5515/5525 Paper (Platen) Movement Control

The codes that affect Models 5515 and 5525 paper movement are described in the following paragraphs.

4.6.5.1 Line Feed (LF)

On receipt of the LF code, the selected line feed increment is performed. The operator selects the line feed for 6 or 8 using the LF switch on the operator control panel.

4.6.5.2 Reverse Line Feed

On receipt of ESC LF, the platen (and, hence, the paper) is reversed by one line. The distance the paper moves is determined by LF switch on the operator control panel, or pre-programmed vertical pitch setting.

4.6.5.3 Half-Line Feed

On receipt of ESC U, a half-line feed is performed.

4.6.5.4 Negative Half-Line Feed

On receipt of ESC D, a negative half-line feed moves the form down one-half line.

4.6.5.5 Absolute Vertical Tab

Using absolute vertical tab, the form can be moved directly to any of the first 126 lines on the page from any other line on the page. This is accomplished by providing a 3-character sequence ESC VT (n), where the (n) represents an ASCII character whose decimal value is equal to the number of lines on the form to be reached (see Table D-4). For example; set vertical tab at 52 and press keys ESC, CTRL with K and 4 (print position desired plus one - see Table D-4).

4.6.5.6 Define Vertical Motion Index

Vertical Motion Index (VMI) is the number of 1/48-inch increments the platen (paper) moves for each line feed or negative line feed. Minimum VMI is 0 and maximum is 125. The VMI is executed by a 3-character sequence ESC RS (n), where (n) represents an ASCII character whose decimal value is one greater than the number of increments the paper will move. For example, set VMI at 53, and press keys ESC, CTRL, SHIFT, +, and 6 (see Table D-4).

4.6.6 5515/5525 General Control

The codes that affect Models 5515 and 5525 red/black printing and graphics are described in the following paragraphs.

4.6.6.1 Red/Black Printing

The printer is initialized for printing in black. To print in red, the ESC A sequence is issued. To print in black, the ESC B sequence is issued.

4.6.6.2 Graphics

On receipt of ESC 3, graphics mode is set and receipt of ESC 4 resets the graphics mode.

While in the graphics mode, carriage movement is completely separated from printing; that is, printing a character does not automatically move the carriage. The carriage is moved only by executing a tab, space, carriage return, or backspace.

The tab commands operate the same as they do in normal mode. In graphics mode, however, the space and backspace commands move the carriage only 1/60 inch instead of the horizontal index selected.

Paper movement commands can be used extensively in graphics. Vertical tab (VT) and FF operations are unchanged, but LF and ESC LF cause only 1/48 inch of paper movement, instead of the full line (VMI) movement performed in normal mode.

4.6.7 Procedure to Access 128 Characters

The 128 characters on the print thimble can be accessed by using the Shift Out/Shift In (SO/SI) control codes as follows:

a. Ninety-four (94) characters can be accessed by using the 94 ASCII codes (21 thru 7E).

b. The remaining 34 characters (for a total of 128 characters) can be accessed by using Control N (SO) followed by ASCII codes 3C, 3E, and 40 thru 5F.

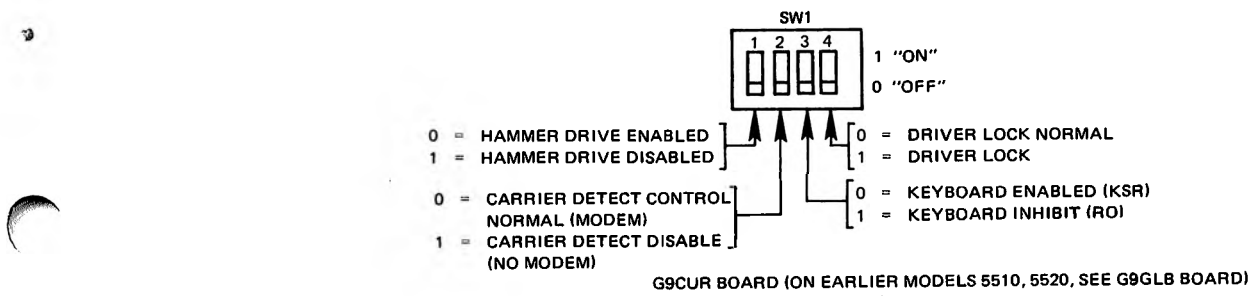
NOTE

In the case of dual font thimbles, ASCII codes for the upper case A-Z (41 thru 5A) will enable the secondary upper case alphabet characters.

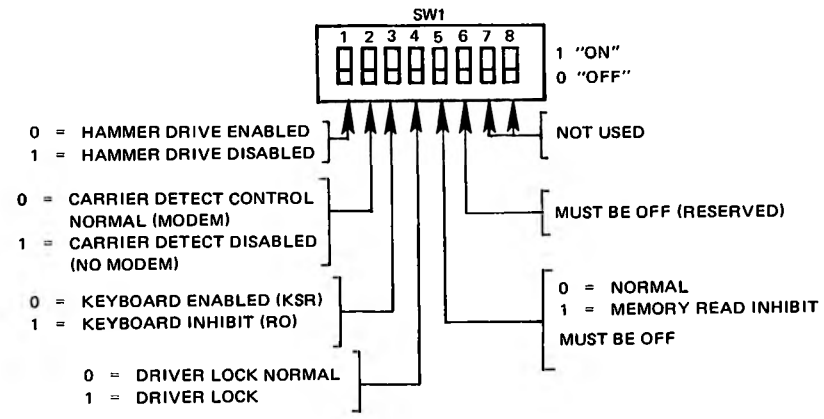
c. Control O (SI) enables printing of standard 94 characters.

APPENDIX A

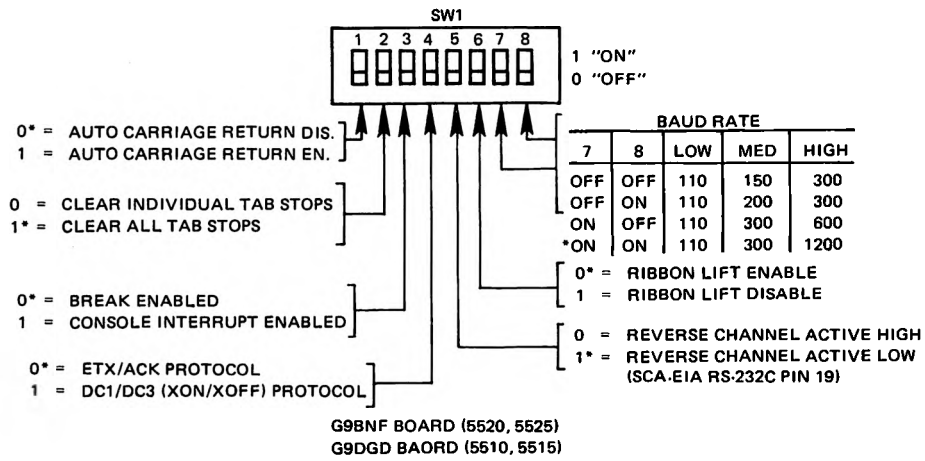
PRINTED CIRCUIT BOARDS SWITCH FUNCTIONS



G9CUR BOARD (ON EARLIER MODELS 5510, 5520, SEE G9GLB BOARD)
G9DWH BOARD (5515, 5525)



G9GLB BOARD (ON LATER MODEL 5510, 5520)



G9BNF BOARD (5520, 5525)
G9DGD BAORD (5510, 5515)

*INDICATES STANDARD CONFIGURATIONS

APPENDIX B

ASCII CODE TABLE

Table B-1 ASCII Code Table

					COMMUNI-CATION CODES *		PRINTABLE CHARACTERS					
b_7					0	0	0	0	1	1	1	1
b_6					0	0	1	1	0	0	1	1
b_5					0	1	0	1	0	1	0	1
$B_{i_{ts}}$	b_4 ↓	b_3 ↓	b_2 ↓	b_1 ↓	Column → / Row ↓	0	1	2'	3	4	5	6	7
	0	0	0	0	0	NUL	DLE	SP	0	@	P		p
	0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
	0	0	1	0	2	STX	DC2	"	2	B	R	b	r
	0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
	0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
	0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
	0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
	0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
	1	0	0	0	8	BS	CAN	(	8	H	X	h	x
	1	0	0	1	9	HT	EM	)	9	I	Y	i	y
	1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
	1	0	1	1	11	VT	ESC	+	;	K	[	k	{
	1	1	0	0	12	FF	FS	,	<	L	\	l	¦
	1	1	0	1	13	CR	GS	-	=	M	]	m	}
	1	1	1	0	14	SO	RS	.	>	N	^	n	~
	1	1	1	1	15	SI	US	/	?	O	_	o	DEL

†Generation of these codes from keyboard is as follows (5515/5525 only):

GS = CTRL ~
RS = CTRL +

Note

Both column 4 ~ 5 (capital letter) and column 6 ~ 7 (small letter) in ASCII code table of all ESC code sequences have same function when in upper-case mode. (Except DEL code)

APPENDIX C
CONTROL CODES

The SPINWRITER recognizes and processes the following control codes of the ASCII control code set.

ETX - End
ACK - Acknowledge
BEL - Bell (Sound Audible Alarm)
BS - Backspace
HT - Horizontal Tab
LF - Line Feed
VT - Vertical Tab
FF - Form Feed
CR - Carriage Return
SO - Shift Out
SI - Shift In
DC1 - Device Control 1 (X-ON)
DC3 - Device Control 3 (X-OFF)
ESC - Escape

All of the control codes in the ASCII code set are listed in Table C-1. They can all be generated from the keyboard. The codes are generated by pressing and holding down the CTRL key and then pressing the second key for the desired code.

Table C-1 contains a "Key Position" column. This is a physical locator for each key. For example, key position 34 is the A-key as shown in Figure C-1.

Table C-1 Control Codes

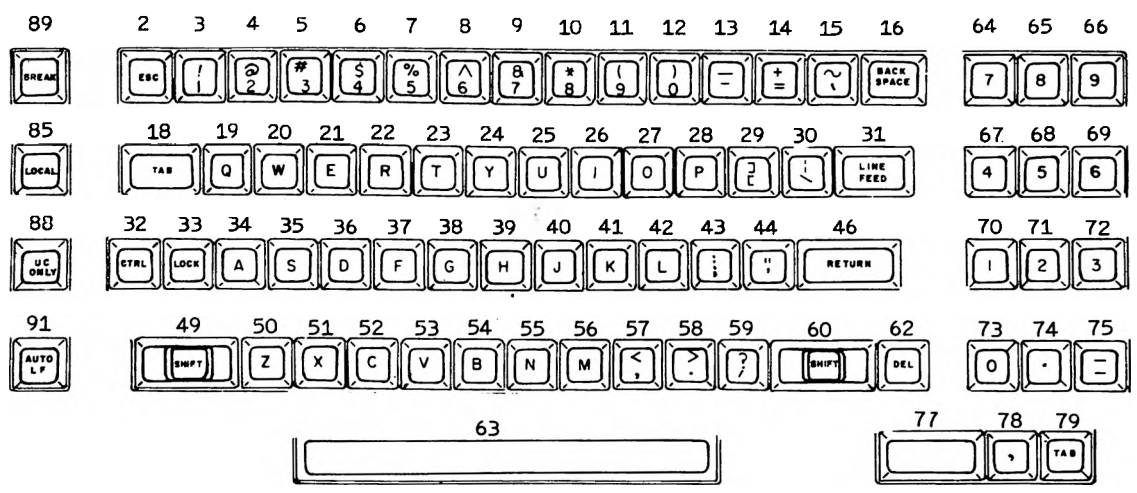
CONTROL CODE		PRESS KEYS		KEY POSITION
		SHIFTED*	UNSHIFTED*	
ESC	CTRL	ESC	ESC	2
NUL	CTRL	!	1	3
NUL	CTRL	@	2	4
NUL	CTRL	#	3	5
NUL	CTRL	$	4	6
NUL	CTRL	%	5	7
NUL	CTRL		6	8
NUL	CTRL	&	7	9
NUL	CTRL	*	8	10
	CTRL	(	9	11
	CTRL	)	0	12
US	CTRL	_ underline	- dash	13
RS	CTRL	+	=	14
GS	CTRL			15
BS	CTRL	BS	BS	16
HT	CTRL	HT	HT	18
DC1	CTRL	Q	q	19
ETB	CTRL	W	w	20
ENQ	CTRL	E	e	21
DC2	CTRL	R	r	22
DC4	CTRL	T	t	23
EM	CTRL	Y	y	24
NAK	CTRL	U	u	25
HT	CTRL	I	i	26
SI	CTRL	O	o	27
DLE	CTRL	P	p	28
ESC	CTRL			29
FS	CTRL			30
LF	CTRL	LF	LF	31
	CTRL		CTRL	32
	CTRL		LOCK	33
SOH	CTRL	A	a	34
DC3	CTRL	S	s	35
EOT	CTRL	D	d	36
ACK	CTRL	F	f	37
BEL	CTRL	G	g	38
BS	CTRL	H	h	39
LF	CTRL	J	j	40
VT	CTRL	K	k	41
FF	CTRL	L	l	42
;	CTRL	:	;	43
'	CTRL	"	'	44
CR	CTRL	CR	CR	46
	CTRL		SHIFT	49

* Refers to position of SHIFT key pressed down (shifted), up (unshifted).

Table C-1 Control Codes (cont'd)

CONTROL CODE		PRESS KEYS		KEY POSITION
		SHIFTED*	UNSHIFTED*	
SUB	CTRL	Z	z	50
CAN	CTRL	X	x	51
ETX	CTRL	C	c	52
SYN	CTRL	V	v	53
STX	CTRL	B	b	54
SO	CTRL	N	n	55
CR	CTRL	M	m	56
,	CTRL		,	57
.	CTRL		.	58
/	CTRL	?	/	59
	CTRL		SHIFT	60
DEL	CTRL	DEL	DEL	62
SP	CTRL	SP	SP	63
7	CTRL	7	7	64
8	CTRL	8	8	65
9	CTRL	9	9	66
4	CTRL	4	4	67
5	CTRL	5	5	68
6	CTRL	6	6	69
1	CTRL	1	1	70
2	CTRL	2	2	71
3	CTRL	3	3	72
0	CTRL	0	0	73
.	CTRL	.	.	74
-	CTRL	-	-	75
SP	CTRL	SP	SP	77
,	CTRL	,	,	78
HT	CTRL	HT	HT	79

* Refers to position of SHIFT key pressed down (shifted), up (unshifted).



NOTE: Numbers above keys refer to "Key Position" in Table C-1.

Figure C-1 Key Positions On Keyboard

APPENDIX D

ESCAPE SEQUENCES

This appendix contains tabular information on the following 3-character escape sequences.

5510/5520 Absolute Horizontal Tab - Table D-1

5510/5520 Absolute Vertical Tab - Table D-2

Spacing and Forms Advance Control - Table D-3

5515/5525 Tab and Motion Index - Table D-4

Table D-1 5510/5520 Absolute Horizontal Tab

1st	ESC											
2nd	P		Q		R		S		T		U	
3rd	@ 1	P 17	@ 33	P 49	@ 65	P 81	@ 97	P 113	@ 129	P 145	@ 161	
	A 2	Q 18	A 34	Q 50	A 66	Q 82	A 98	Q 114	A 130	Q 146	A 162	
	B 3	R 19	B 35	R 51	B 67	R 83	B 99	R 115	B 131	R 147	B 163	
	C 4	S 20	C 36	S 52	C 68	S 84	C 100	S 116	C 132	S 148		
	D 5	T 21	D 37	T 53	D 69	T 85	D 101	T 117	D 113	T 149		
	E 6	U 22	E 38	U 54	E 70	U 86	E 102	U 118	E 134	U 150		
	F 7	V 23	F 39	V 55	F 71	V 87	F 103	V 119	F 135	V 151		
	G 8	W 24	G 40	W 56	G 72	W 88	G 104	W 120	G 136	W 152		
	H 9	X 25	H 41	X 57	H 73	X 89	H 105	X 121	H 137	X 153		
	I 10	Y 26	I 42	Y 58	I 74	Y 90	I 106	Y 122	I 138	Y 154		
	J 11	Z 27	J 43	Z 59	J 75	Z 91	J 107	Z 123	J 139	Z 155		
	K 12	[28	K 44	[60	K 76	[92	K 108	[124	K 140	[156		
	L 13	\ 29	L 45	\ 61	L 77	\ 93	L 109	\ 125	L 141	\ 157		
	M 14	] 30	M 46	] 62	M 78	] 94	M 110	] 126	M 142	] 158		
	N 15	^ 31	N 47	^ 63	N 79	^ 95	N 111	^ 127	N 143	^ 159		
	O 16	_ 32	O 48	_ 64	O 80	_ 96	O 112	_ 128	O 144	_ 160		

CHARACTER KEY → / ← TAB POSITION

Table D-2 5510/5520 Absolute Vertical Tab

1st	Reverse				Forward			
	ESC				ESC			
2nd	X		Y		Z		[	
3rd	@ 0	P 16	@ 32	P 48	@ 0	P 16	@ 32	P 48
	A 1	Q 17	A 33	Q 49	A 1	Q 17	A 33	Q 49
	B 2	R 18	B 34	R 50	B 2	R 18	B 34	R 50
	C 3	S 19	C 35	S 51	C 3	S 19	C 35	S 51
	D 4	T 20	D 36	T 52	D 4	T 20	D 36	T 52
	E 5	U 21	E 37	U 53	E 5	U 21	E 37	U 53
	F 6	V 22	F 38	V 54	F 6	V 22	F 38	V 54
	G 7	W 23	G 39	W 55	G 7	W 23	G 39	W 55
	H 8	X 24	H 40	X 56	H 8	X 24	H 40	X 56
	I 9	Y 25	I 41	Y 57	I 9	Y 25	I 41	Y 57
	J 10	Z 26	J 42	Z 58	J 10	Z 26	J 42	Z 58
	K 11	[27	K 43	[59	K 11	[27	K 43	[59
	L 12	\ 28	L 44	\ 60	L 12	\ 28	L 44	\ 60
	M 13	] 29	M 45	] 61	M 13	] 29	M 45	] 61
	N 14	^ 30	N 46	^ 62	N 14	^ 30	N 46	^ 62
	O 15	_ 31	O 47	_ 63	O 15	_ 31	O 47	-- 63

CHARACTER KEY → / ← TAB POSITION

Table D-3 Spacing and Forms Advance Control

		Spacing		Form Advance	
1st	2nd	3rd	(inches)	3rd	(inches)
ESC	]	@	0	P	1/48
		A	1/120	Q	2/48
		B	2/120	R	3/48
		C	3/120	S	4/48
		D	4/120	T	5/48
		E	5/120	U	6/48 (1/8)
		F	6/120	V	7/48
		G	7/120	W	8/48 (1/6)
		H	8/120	X	9/48
		I	9/120	Y	10/48
		J	10/120 (1/12)	Z	11/48
		K	11/120	[	12/48
		L	12/120 (1/10)	\	13/48
		M	13/120	]	14/48
		N	14/120	^	15/48
		O	15/120	_	16/48

Table D-4 5515/5525 Tab and Motion Index

1st	ESC									
2nd	Absolute Horizontal Tab HT*			Absolute Vertical Tab VT*		Vertical Motion Index RS		Horizontal Motion Index US		
3rd	0 SOH	13 SO	26 ESC	39 (	52 5	65 B	78 O	91 \	104 i	117 v
	1 STX	14 SI	27 FS	40)	53 6	66 C	79 P	92]	105 j	118 w
	2 ETX	15 DLE	28 GS	41 *	54 7	67 D	80 Q	93 ^	106 k	119 x
	3 EOT	16 DC1	29 RS	42 +	55 8	68 E	81 R	94 _	107 l	120 y
	4 ENQ	17 DC2	30 US	43 ,	56 9	69 F	82 S	95 `	108 m	121 z
	5 ACK	18 DC3	31 SP	44 -	57 :	70 G	83 T	96 a	109 n	122 {
	6 BEL	19 DC4	32 !	45 .	58 ;	71 H	84 U	97 b	110 o	123 |
	7 BS	20 NAK	33 "	46 /	59 <	72 I	85 V	98 c	111 p	124 }
	8 HT	21 SYN	34 #	47 0	60 =	73 J	86 W	99 d	112 q	125
	9 LF	22 ETB	35 $	48 1	61 >	74 K	87 X	100 e	113 r	
	10 VT	23 CAN	36 %	49 2	62 ?	75 L	88 Y	101 f	114 s	
	11 FF	24 EM	37 &	50 3	63 @	76 M	89 Z	102 g	115 t	
	12 CR	25 SUB	38 '	51 4	64 A	77 N	90 [	103 h	116 u	

*Desired Position = number from chart + 1
Ex: Absolute horizontal tab to print position 1 = ESC HT SOH

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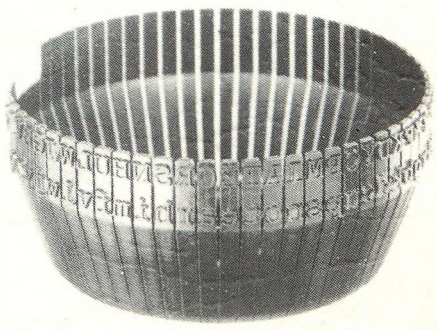

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