TEXAS INSTRUMENTS

Improving Man's Effectiveness Through Electronics

Model 990 Computer
Model 810 Printer
Installation and Operation

MANUAL NO. 939460-9701
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Model 990 Computer, Model 810 Printer Installation and Operation (939460-9701)

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Total number of pages in this publication is 72 consisting of the following:

PREFACE

This manual covers installation and operation instructions for the Model 810 Printer Subsystem described in Section I. The manual is intended for use by trained Customer Service Engineers or other qualified maintenance personnel. The manual is organized into four sections as follows:

I General Description – This section defines the Model 810 printer subsystem configurations and gives descriptive information on the subsystem components.

II Installation – This section provides detailed instructions for installing the components in the Model 810 printer subsystem.

III Programming – This section provides general operational programming information for the Model 990 computer interface with Model 810 printer.

IV Operation – This section provides detailed operating instructions and operator maintenance for the Model 810 printer subsystem.

The following related publications are available as reference material for support of this manual:

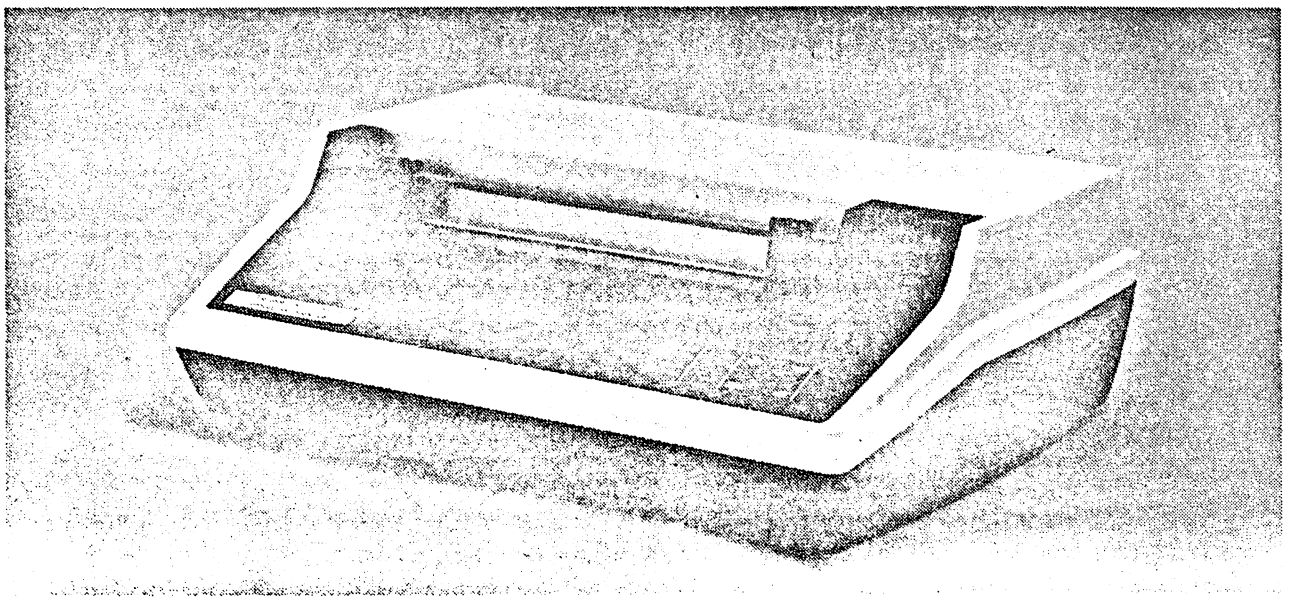
Title	Part Number
Model 990 Computer/TMS9900 Assembly Language Programmer's Guide	943441-9701
Model 990/10 Computer Hardware Reference Manual	945417-9701
Model 990/4 Computer Hardware Reference Manual	945251-9701
Model 990 Computer Family Maintenance Drawings	945421-9701, 945421-9702
Model 990 Computer Diagnostic Handbook	945400-9701
Model 810 Printer Operating Instructions Manual	994353-9701
Model 810 Printer Maintenance Manual	994386-9701

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES



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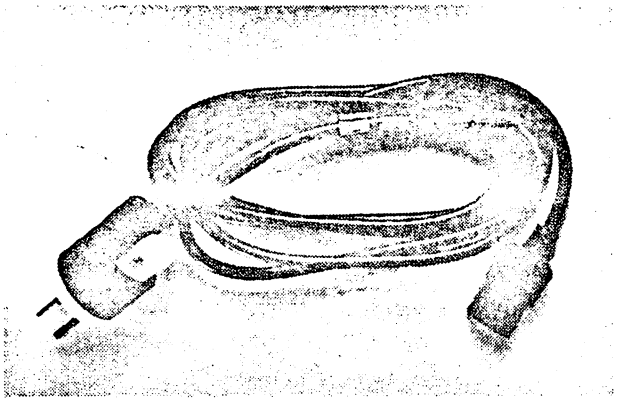
PART NO. 938152-1 THRU -6



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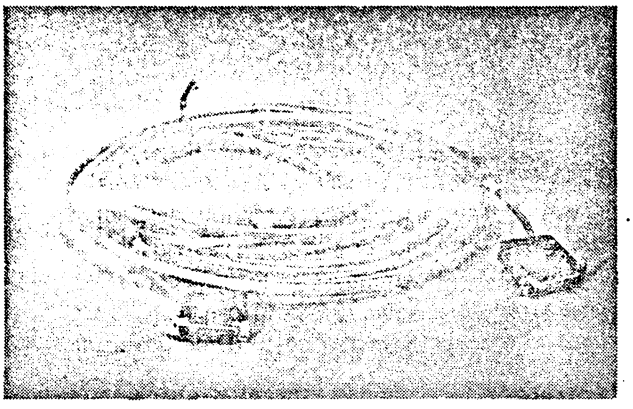
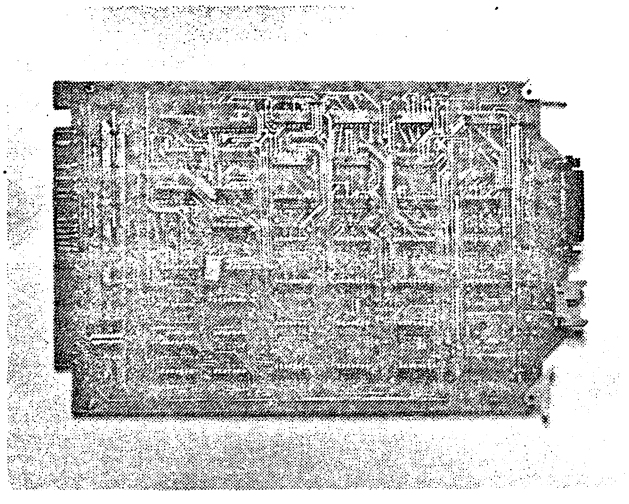


I/O CABLE ASSEMBLY,
PART NO. 938114-0001



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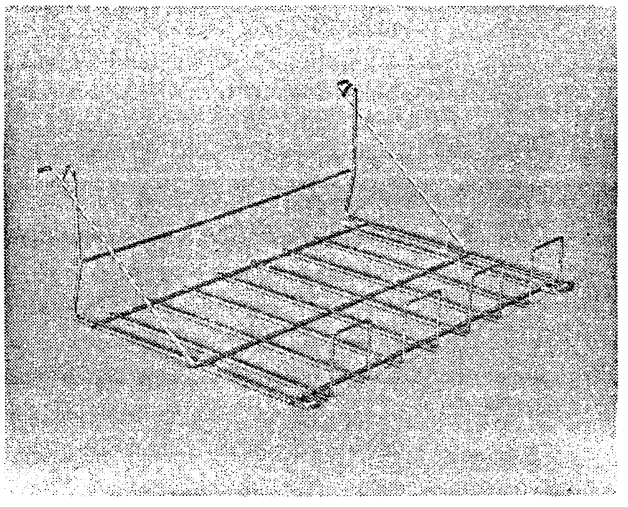

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PART NO. 994176-0001

Figure 1-1. Model 810 Printer Subsystem

SECTION I

GENERAL DESCRIPTION

1.1 GENERAL

This manual provides installation, operation and programming information required to install and operate a Texas Instruments Model 810 Printer Subsystem (figure 1-1) on a TI series 990 computer.

1.2 PURPOSE OF EQUIPMENT

The Model 810 Printer Subsystem installs on a CRU I/O channel of 990 Series Computer (as shown in figure 1-2) to provide bidirectional impact printing. The printer features an internal microprocessor system for control of all operations and may be easily programmed for a wide range of form sizes, character and line spacing and character fonts.

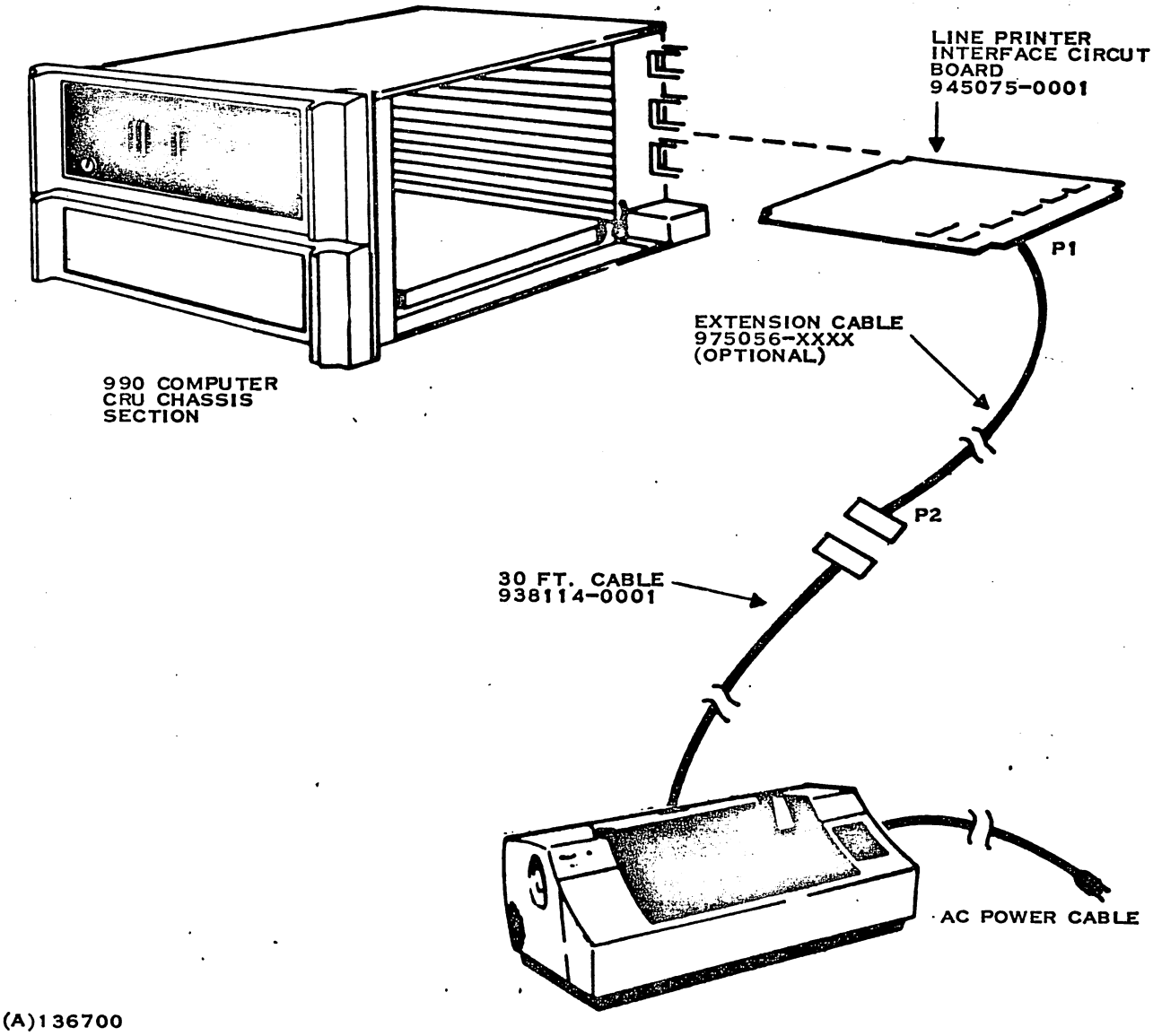


Figure 1-2. Model 810 Interconnection Diagram

The printer produces one original and up to five carbon copies using standard 12-pound bond paper and 7½ pound carbon paper. The print speed is 150 characters per second.

1.3 SYSTEM DESCRIPTION

The Model 810 Printer Subsystem consists of a TTY/EIA interface module that installs in a CRU card slot in either the 990 main chassis or CRU expansion chassis, an interconnecting cable (connects the TTY/EIA module to the printer) and a Model 810 Printer. A simplified diagram of the printer subsystem is shown in figure 1-2. The subsystem components are briefly described in the following paragraphs.

1.3.1 MODEL 810 PRINTER. The Model 810 Printer is a receive only, forms programmable impact printer that features an internal microprocessor. All operating commands to the printer's microprocessor originate either at the printer control panel (figure 1-3) or within the 990 computer under software control. Basic operating, data processing, and self-test routines for the microprocessor are ROM resident. The printer is also equipped with RAM memories for storage of up to eight nonvolatile programs which contain vertical format control routines that are subject to frequent change. These routines may be locally programmed from the control panel or remotely programmed by the execution of the user program in the 990 computer.

1.3.1.1 Bidirectional Printing. The printer uses a 1 X 7 tungsten wire matrix printhead and dense nylon weave ribbon system for impact printing at a rate of 150 characters per second. The printer is also equipped with a bidirectional carriage drive system and a two-line buffer to print from either direction. As the printer nears completion of one line of print, its microprocessor examines the next line to determine which print direction results in the shortest carriage positioning time.

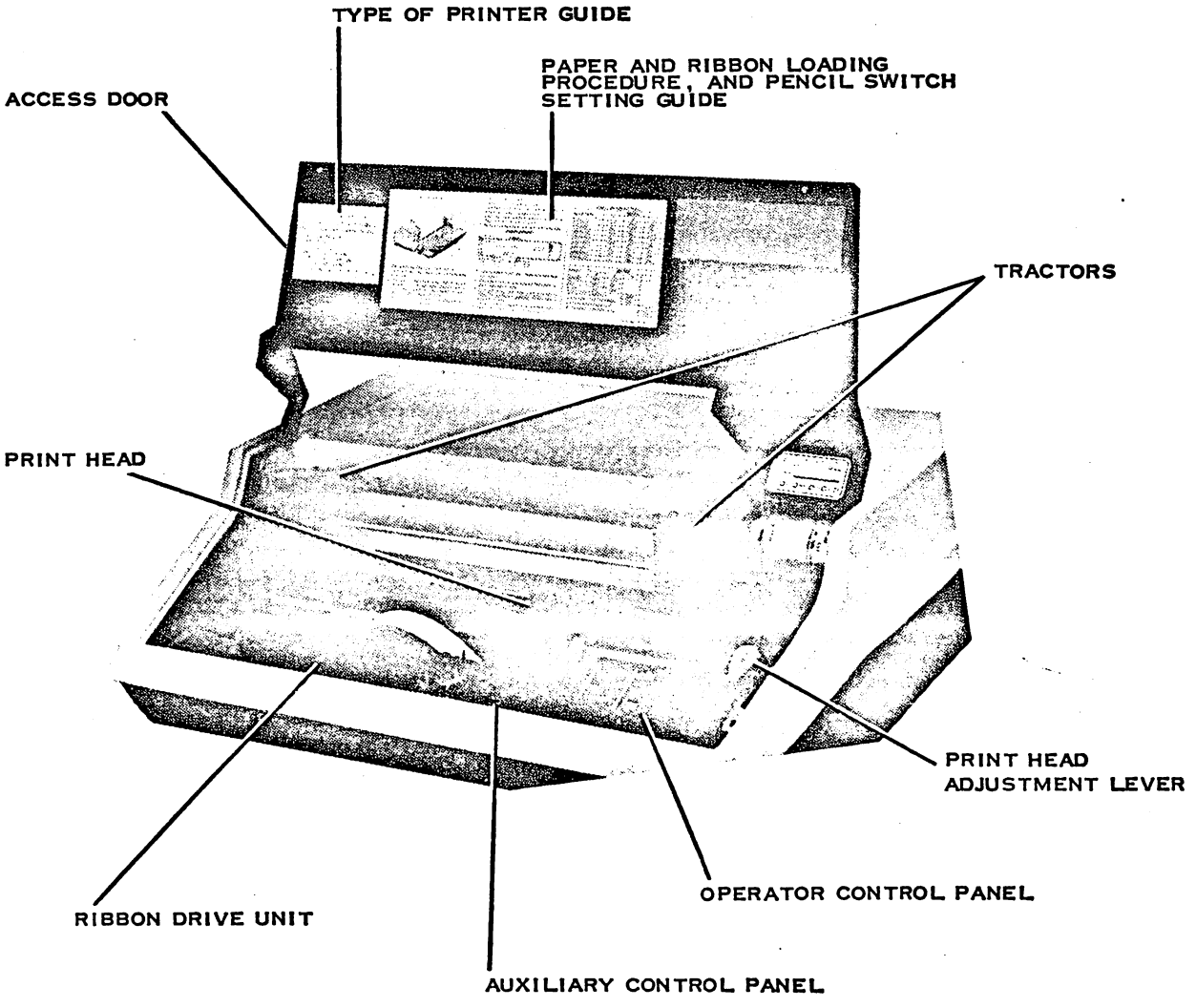
1.3.1.2 Line and Character Spacing. The Model 810 Printer uses a standard print format of 10 characters per inch horizontally and six or eight lines per inch vertically. In the compressed mode, VCO and FCO only, the printer uses the 16.5 characters per inch compressed print format.

1.3.1.3 Printer Character Set. The Model 810 Printer is available with either a limited ASCII character set (64 characters) or the full 96-character set. The 64 and 96 character sets are described in table 1-1. All characters are printed using a 7-row, 9-column dot matrix. The 1 X 7 matrix printhead sweeps across the 9 columns to form the 7 X 9 dot matrix for each character. The dot matrices for the printer's character set are shown in table 1-2.

1.3.1.4 Printer Options. A variety of Model 810 Printer kits are available. These include the standard subsystem set up for 120 Vac operation (part number 938120-1), interface module and cable kit (part number 938120-2), and a printer and paper basket kit (938120-3 through 938120-26). These kits are summarized in table 1-3.

1.3.1.5 Printer Accessories. The following items are available as accessories to the Model 810 Printer:

- Extension Cable – Part Number (refer to table 2-3)
- Floor Mounting Stand – Part Number 994423



(A)136701 (810-577-27-2)

Figure 1-3. Model 810 Printer Control and Indicators

Table 1-1. Model 810 Printer Character Set (ASCII Codes)

Hexadecimal Code	Decimal No.	Control Acronym or Character
0	0	NUL (Null)
1	1	SOH (Start of heading)
2	2	STX (Start of text)
3	3	ETX (End of text)
4	4	EOT (End of transmission)
5	5	ENQ (Enquiry)
6	6	ACK (Acknowledge)
7	7	BEL (Bell)
8	8	BS (Backspace)
9	9	HT (Horizontal tab)
A	10	LF (Line feed)
B	11	VT (Vertical tab)
C	12	FF (Form feed)
D	13	CR (Carriage return)
E	14	SO (Shift out)
F	15	SI (Shift in)
10	16	DLE (Data link escape)
11	17	DC1 (Device control 1)
12	18	DC2 (Device control 2)
13	19	DC3 (Device control 3)
14	20	DC4 (Device control 4)
15	21	NAK (Negative acknowledge)
16	22	SYN (Synchronous idle)
17	23	ETB (End of transmission block)
18	24	CAN (Cancel)
19	25	EN (End of medium)
1A	26	SUB (Substitute)
1B	27	ESC (Escape)
1C	28	FS (File separate)
1D	29	GS (Group separate)
1E	30	RS (Record separate)
1F	31	US (Unit separate)
20	32	SP (Space)

Table 1-1. Model 810 Printer Character Set (ASCII Codes) (Continued)

Hexadecimal Code	Decimal No.	Control Acronym or Character
21	33	! (Exclamation point)
22	34	" (Quotation mark)
23	35	# (Number sign)
24	36	$ (Dollar sign)
25	37	% (Percent)
26	38	& (Ampersand)
27	39	' (Apostrophe)
28	40	((Opening parenthesis)
29	41	) (Closing parenthesis)
2A	42	* (Asterisk)
2B	43	+ (Plus)
2C	44	, (Comma)
2D	45	- (Hyphen)
2E	46	. (Period)
2F	47	/ (Slant)
30	48	0 (Number)
31	49	1 (Number)
32	50	2 (Number)
33	51	3 (Number)
34	52	4 (Number)
35	53	5 (Number)
36	54	6 (Number)
37	55	7 (Number)
38	56	8 (Number)
39	57	9 (Number)
3A	58	: (Colon)
3B	59	; (Semicolon)
3C	60	< (Less than)
3D	61	= (Equal to)
3E	62	> (Greater than)
3F	63	? (Question mark)
40	64	@ (Commercial at)

Table 1-1. Model 810 Printer Character Set (ASCII Codes) (Continued)

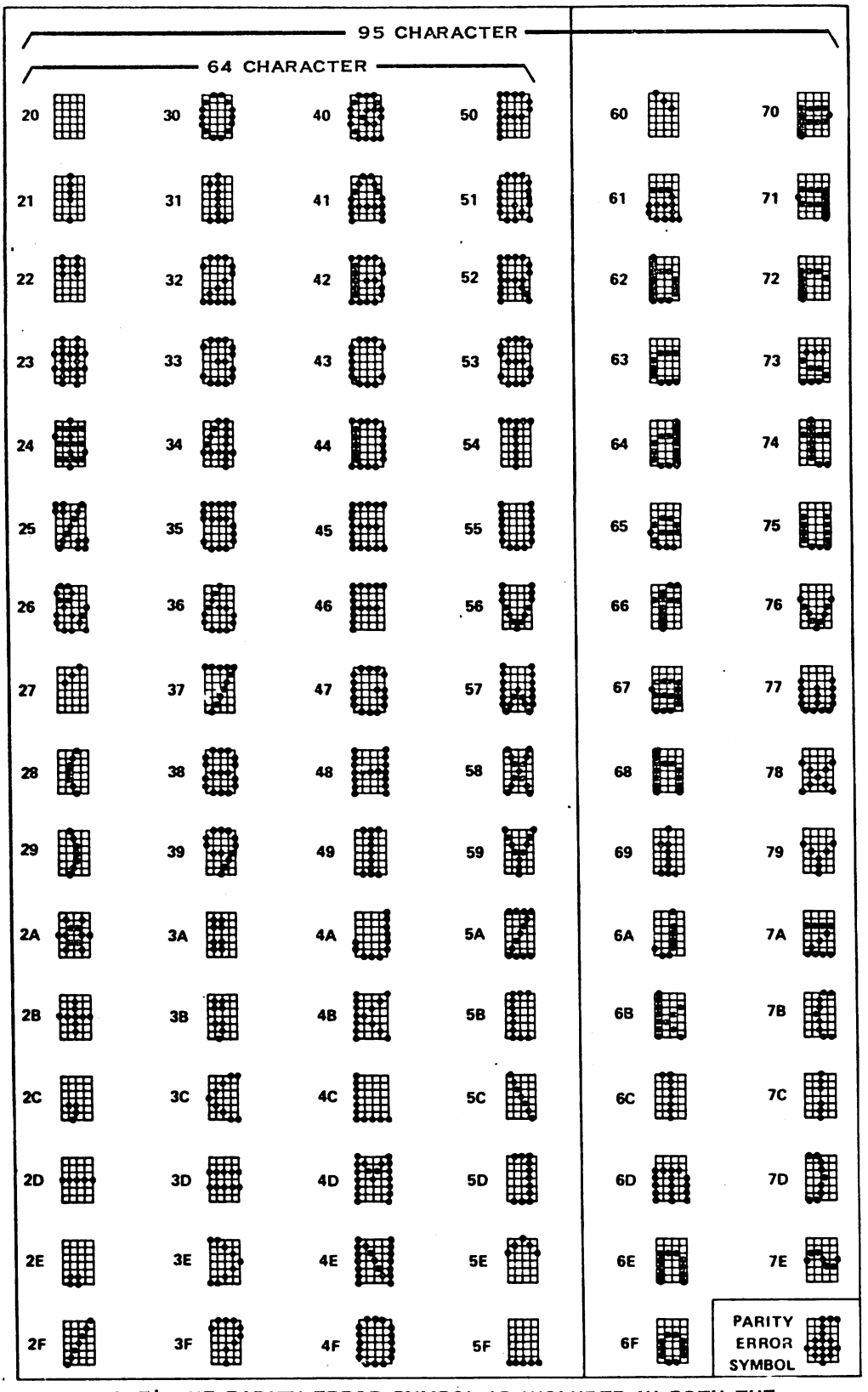
Hexadecimal Code	Decimal No.	Control Acronym or Character
41	65	A (Upper case letter)
42	66	B (Upper case letter)
43	67	C (Upper case letter)
44	68	D (Upper case letter)
45	69	E (Upper case letter)
46	70	F (Upper case letter)
47	71	G (Upper case letter)
48	72	H (Upper case letter)
49	73	I (Upper case letter)
4A	74	J (Upper case letter)
4B	75	K (Upper case letter)
4C	76	L (Upper case letter)
4D	77	M (Upper case letter)
4E	78	N (Upper case letter)
4F	79	O (Upper case letter)
50	80	P (Upper case letter)
51	81	Q (Upper case letter)
52	82	R (Upper case letter)
53	83	S (Upper case letter)
54	84	T (Upper case letter)
55	85	U (Upper case letter)
56	86	V (Upper case letter)
57	87	W (Upper case letter)
58	88	X (Upper case letter)
59	89	Y (Upper case letter)
5A	90	Z (Upper case letter)
5B	91	[(Opening bracket)
5C	92	\ (Reverse slant)
5D	93	] (Closing bracket)
5E	94	Λ (Circumflex)
5F	95	_ (Underline)
60	96	` (Grave accent)

Table 1-1. Model 810 Printer Character Set (ASCII Codes) (Continued)

Hexadecimal Code	Decimal No.	Control Acronym or character
61	97	a (Lower case letter)
62	98	b (Lower case letter)
63	99	c (Lower case letter)
64	100	d (Lower case letter)
65	101	e (Lower case letter)
66	102	f (Lower case letter)
67	103	g (Lower case letter)
68	104	h (Lower case letter)
69	105	i (Lower case letter)
6A	106	j (Lower case letter)
6B	107	k (Lower case letter)
6C	108	l (Lower case letter)
6D	109	m (Lower case letter)
6E	110	n (Lower case letter)
6F	111	o (Lower case letter)
70	112	p (Lower case letter)
71	113	q (Lower case letter)
72	114	r (Lower case letter)
73	115	s (Lower case letter)
74	116	t (Lower case letter)
75	117	u (Lower case letter)
76	118	v (Lower case letter)
77	119	w (Lower case letter)
78	120	x (Lower case letter)
79	121	y (Lower case letter)
7A	122	z (Lower case letter)
7B	123	{ (Opening brace)
7C	124	¦ (Vertical line)
7D	125	} (Closing brace)
7E	126	~ (Overline)
7F	127	DEL (Delete)

Note: Characters with hexadecimal codes 20 through 60 are part of the 64 character ASCII code. Characters with hexadecimal codes 20 through 7F are part of the 96 character ASCII code. All other characters are control codes.

Table 1-2. Character Dot Matrices



NOTE: THE PARITY ERROR SYMBOL IS INCLUDED IN BOTH THE 64 AND 96 CHARACTER SETS.

Table 1-3. 810 Printer Kit Configurations

Part Number	Kit Description
938120-0001	Kit, 990 MC-810 (VCO + FUL), 120V complete.
938120-0002	Kit, 990 MC-810, interface only.
938120-0003	Kit, 990 MC-810 (VCO + FUL), 120V printer only.
938120-0004	Kit, 990 MC-810 (VCO + FUL), 100V printer only.
938120-0005	Kit, 990 MC-810 (VCO + FUL), 220V printer only.
938120-0006	Kit, 990 MC-810 (VCO + FUL), 240V printer only.
938120-0007	Kit, 990 MC-810 (VCO), 120V printer only.
938120-0008	Kit, 990 MC-810 (VCO), 100V printer only.
938120-0009	Kit, 990 MC-810 (VCO), 220V printer only.
938120-0010	Kit, 990 MC-810 (VCO), 240V printer only.
938120-0011	Kit, 990 MC-810 (FCO), 120V printer only.
938120-0012	Kit, 990 MC-810 (FCO), 100V printer only.
938120-0013	Kit, 990 MC-810 (FCO), 220V printer only.
938120-0014	Kit, 990 MC-810 (FCO), 240V printer only.
938120-0015	Kit, 990 MC-810 (FCO + FUL), 120V printer only.
938120-0016	Kit, 990 MC-810 (FCO + FUL), 100V printer only.
938120-0017	Kit, 990 MC-810 (FCO + FUL), 220V printer only.
938120-0018	Kit, 990 MC-810 (FCO + FUL), 240V printer only.
938120-0019	Kit, 990 MC-810 (BSC + FUL), 120V printer only.
938120-0020	Kit, 990 MC-810 (BSC + FUL), 100V printer only.
938120-0021	Kit, 990 MC-810 (BSC + FUL), 220V printer only.
938120-0022	Kit, 990 MC-810 (BSC + FUL), 240V printer only.
938120-0023	Kit, 990 MC-810 (BSC), 120V printer only.
938120-0024	Kit, 990 MC-810 (BSC), 100V printer only.
938120-0025	Kit, 990 MC-810 (BSC), 220V printer only.
938120-0026	Kit, 990 MC-810 (BSC), 240V printer only.

NOTES:

1. Unless otherwise specified all Model 810 Printers include the following feature:

   DNB - "DATA TERMINAL READY" equals "ON LINE" and "NOT BUSY".

2. The following table defines the Model 810 Printer mnemonics:

MNEMONIC	DESCRIPTION
BSC	Basic Model 810 Printer.
FCO	Model 810 Printer with Form Length Control and Compressed Print.
VCO	Model 810 Printer with Vertical Forms Control and Compressed Print.
FUL	Full 96 character ASCII code.

3. If the full 96 character ASCII code (FUL) is not specified, the standard 64 character ASCII code is provided.

1.3.2 TTY/EIA INTERFACE MODULE DESCRIPTION. The TTY/EIA interface module is a 990 computer half-size circuit card assembly that provides an interface between the serially-oriented Communications Register Unit (CRU) I/O Channel in the 990 computer and the parallel interface used by the Model 810 Printer. The interface module accepts print data and commands, a bit at a time, from the 990 computer until a full character is packed into a register. The module then transmits the character to the Model 810 Printer using a start bit, 8-bit character, and stop bit.

The module also contains provisions for generating a CRU interrupt to gain processor attention. The computer Device Service Routine (DSR) responds to the interrupt by trapping to an interrupt service routine to read status from a multiplexer in the TTY/EIA module to determine the reason for the interrupt. The trailing or leading edge of the DSR signal from the printer generates the interrupt.

1.3.2.1 Diagnostic Mode. The TTY/EIA module may also be placed in a diagnostic mode by a diagnostic command (bit F) from the 990 computer. In this mode, the computer output print data and the output control signals are looped back to the multiplexer and read under diagnostic software control. In this manner, the data paths and control line in the TTY/EIA module may be checked under software control without disturbing the printer cabling.

1.4 GENERAL CHARACTERISTICS

A listing of general characteristics and specifications for the TTY/EIA interface module and the Model 810 Printer are provided in tables 1-4 and 1-5, respectively.

Table 1-4. TTY/EIA Interface Module Specifications

Characteristic	Specification
Peripheral Inputs	(EIA Data) -3V to -25V = Logic 1 (Marking) 3V to 25V = Logic 0 (Spacing) (EIA Control) 3V to 25V = Logic 1 (on) -3V to -25V = Logic 0 (off)
Module Outputs	(EIA Data) -5V to -11V = Logic 1 5V to 11V = Logic 0 (EIA Control) 5V to 11V = Logic 1 -5V to -11V = Logic 0
Power (from computer or expansion chassis)	(EIA Interface) +5Vdc at 0.38A ±12Vdc at 20 mA 20 mA
Transmission Rates Available	75, 110, 300, 1200, 2400, 4800, and 9600 baud (4800 used in this installation)

Table 1-5. Model 810 Printer Specifications

Characteristics	Specification
PRINTING	
Technique	Wire matrix impact
Character matrix	9 X 7 (9 wide, 7 high) dot matrix
Character set	64-character and 96-character ASCII
Characters per inch	10 and 16.5
Characters per line	132 maximum
Lines per inch	6 or 8 (operator and software selectable)
THROUGHPUT	
Print speed	150 characters per second
Lines per minute	64 at 132 characters per line, and up to 450 at 10 characters per line
Line feed	33 milliseconds
Paper slew	17.7 cm per second (7 inches per second)
PAPER HANDLING	
Paper width	Adjustable from 7.6 to 38.1 cm (3 to 15 inches)
Paper loading	Rear or bottom feed
Number of copies	One original and five copies
CONTROL SYSTEM	
Electronics	TMS 8080 microprocessor system
Printing method	Bidirectional
Buffer (FIFO)	256 characters
Horizontal tabs	Software programmable
Vertical format control	Software and operator programmable (8 channels)
Self test	Prints ASCII characters in a rotating pattern (barber pole)
Bell	Pulsing audible tone (can be disabled)
COMMUNICATIONS	
Interface	Serial (EIA RS-232-C)
Baud rates	110, 150, 300, 1200, 4800, 9600 (4800 used in this installation)
Parity	Odd, even, or ignore (even used in this installation)

Table 1-5. Model 810 Printer Specifications (Continued)

Characteristics	Specification
INPUT POWER	
AC voltage	100, 120, 220 or 240 Vac ±10% or -15%
Frequency	47 to 63 Hertz
Watts	200
Power fuse	100 or 120 Vac requires 5A, 250V fuse 220 or 240 Vac requires 2.5A, 250V fuse
ENVIRONMENTAL	
Mounting	Tabletop
Operating temperature	+5°C (+41°F) to +40°C (+104°F)
Storage temperature	-30°C (-22°F) to +70°C (+159°F)
Operating humidity	5% to 90% (no condensation)
Storage humidity	5% to 95% (no condensation)
Noise level	70 dBa maximum
PHYSICAL	
Weight	25 kilograms (55 pounds)
Height	20.3 centimeters (8 inches)
Width	65.4 centimeters (25 ¾ inches)
Depth	50.8 centimeters (20 inches)

SECTION II

INSTALLATION

2.1 GENERAL

This section provides information for planning the installation site, unpacking and setting up the equipment, and ensuring that the equipment is operating properly.

2.2 SITE REQUIREMENTS

The printer occupies a flat surface area 65.4 centimeters (25.75 inches) wide by 58.4 centimeters (23 inches) deep including cable clearance of 7.6 centimeters (3 inches). See figure 2-1 for printer outline dimensions. When the paper basket is used, the following additional space at the rear of the printer is required: 42.55 centimeters (16.75 inches) width by 32.39 centimeters (12.75 inches) depth. Space must be provided for adequate ventilation. Particularly, care must be taken that the cooling fan intake and exhaust louvers (on either side of the printer) are not blocked. An unobstructed paper feed path must be provided behind or below the printer for the paper supply. A method of (and space for) holding the printed output must also be provided if the optional paperbasket accessor is not used. The printer should be so located as to allow easy access to the operator controls. The printer should not be placed in an environment where humidity, temperature, or other specifications listed in Section I may be exceeded. A sturdy table capable of adequately supporting 25 kilograms (55 pounds) is suitable if the optional floor mounting stands are not used. Regardless of the mounting selected, care must be taken to ensure that the paper chute underneath the printer does not bear any weight of the printer and is not subjected to any pressure which could deform it.

2.3 INTERFACE MODULE UNPACKING

The TTY/EIA module is packed in one box and wrapped in a plastic bubble-pack sheet. Visually inspect the box for signs of damage. Open the box and remove the module from the bubble-pack wrapping. Verify that at least eight jumper plugs have been received (they are shipped plugged into the circuit board). Do not discard any packing material until all equipment has been accounted for.

2.4 INTERFACE MODULE INSPECTION AND PREPARATION FOR INSTALLATION

Perform the following steps prior to installing the module into a chassis slot:

1. Visually inspect the circuit board for cracks, corrosion, loose components, and loose connectors.
2. Compare the jumper locations on the module to the locations specified in table 2-1. Move the jumpers as required to match the configuration shown in table 2-1. Figure 2-2 shows the jumper locations.
3. Install a center card guide (if one is not present) for the selected chassis slot.

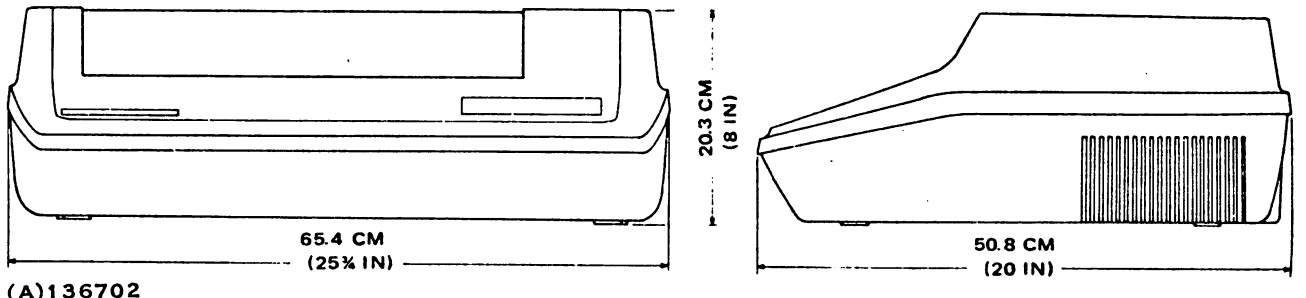


Figure 2-1. Printer Dimensions

Table 2-1. Interface Module Jumper Schedule

Option	Jumper From	To
Baud Rate: 4800	E1	E6
Logic Level: EIA	E8	E9
Code Format: 10-bit (receive)	E11	E12
Code Format: 10-bit (transmit)	E14	E15
Enable receive during RTS	E17	E18
Disable 110 baud	E20	E21
RTSE = DTRE	E26	E27

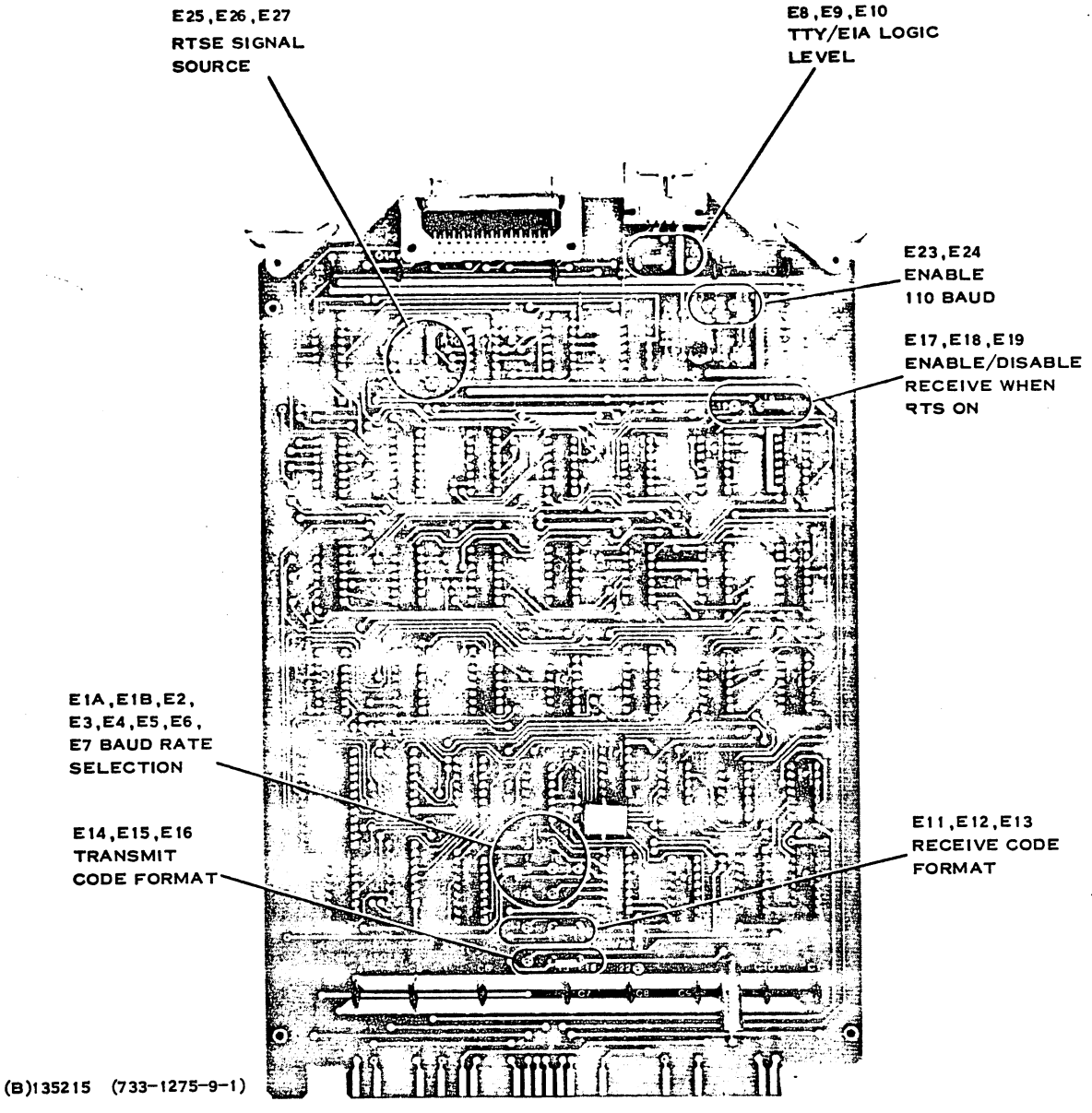


Figure 2-2. Jumper Socket Locations on Interface Module

2.5 INTERFACE MODULE INSTALLATION

The interface module can be installed in the CRU section of the computer chassis or in an expansion chassis connected to the computer. The assigned location of the interface module, whether installed in the computer chassis or in the expansion chassis, determines the CRU address used by computer software. The standard location for the interface module is slot 12 in the 13-slot chassis and slot 5 in the 6-slot chassis. In both cases, the CRU base address is 0060_{16} (left half of the slot) and the interrupt level is 14.

NOTE

The 990/4 computer does not recognize interrupt levels above 7. Interrupt jumpers are required for this computer in accordance with the software interrupt assignment.

If the interface module is installed in any other location than slot 12 or slot 5, a different base address must be considered in the software, and the interrupt jumper plug associated with the new card slot in the computer chassis must be changed. Refer to the applicable 990 Computer Systems Hardware Manual, listed in the preface to this manual, for instructions to change the interrupt jumper plug. After defining the location for the interface module, install the interface module in the selected slot location as follows:

1. Ensure that the chassis power is off.
2. Insert the circuit board, component side up, into the selected slot until the sides of the board slide into the card guides on either side of the slot (one guide is the center card guide, part number 945129-0001, which must have been installed before inserting the circuit board).
3. Gently push the board straight in until the card edge connector engages the slotted connector in the backpanel of the chassis.
4. Insert the appropriate cable into the external device connector.
5. Dress the cable out of the chassis (toward the center of a mainframe chassis, toward the bottom of an expansion chassis).
6. Connect the other end of the cable to the desired peripheral device in accordance with the installation instructions for the device.

2.6 PRINTER UNPACKING AND SETTING UP

To remove the printer from its shipping carton and to place the printer in its normal operating location, perform the following procedure:

1. Examine shipping carton for apparent damage. If any damage is observed, note nature of damage and follow local procedure for handling damaged shipments.
2. Place shipping carton on floor and open top of shipping carton.
3. Remove styrofoam block and other loose items from shipping carton.
4. Using two people, grip printer close to syrofoam end caps (at either end of printer), lift printer from shipping carton, and place printer on table or optional floor mounting stand.

5. Remove styrofoam end caps.

6. Remove four screws that hold two mechanism snubbers underneath printer.

7. Open access door, remove styrofoam block covering printhead, and manually slide printhead from stop to stop.

8. Check that printhead and attached wire rope that pulls the printhead from side-to-side move freely and that wire rope is not unstrung.

9. Close access door.

10. (If applicable) install optional paper basket.

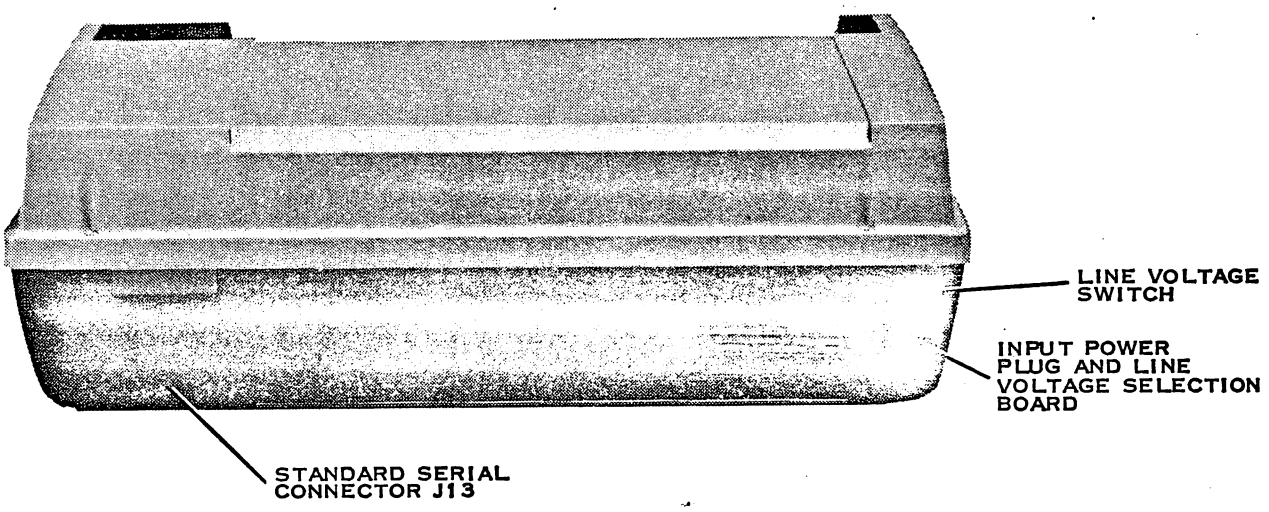
2.7 PRINTER CABLING AND GROUNDING INFORMATION

The communications interface connector (or connectors) is located at the left rear of the printer when facing rear of printer (figure 2-3). All printers have an EIA Standard RS-232-C interface connector for serial input. The logic (signal) ground is connected to the safety (chassis) ground by a jumper from E6 to E7 on the motherboard (figure 2-4). The logic ground can be isolated from the safety ground by cutting this jumper. To gain access to the ground jumper, remove the battery in accordance with the battery replacement procedure in paragraph 4.8.4. Refer to tables 2-2 and 2-3 for cable wiring diagrams.

NOTE

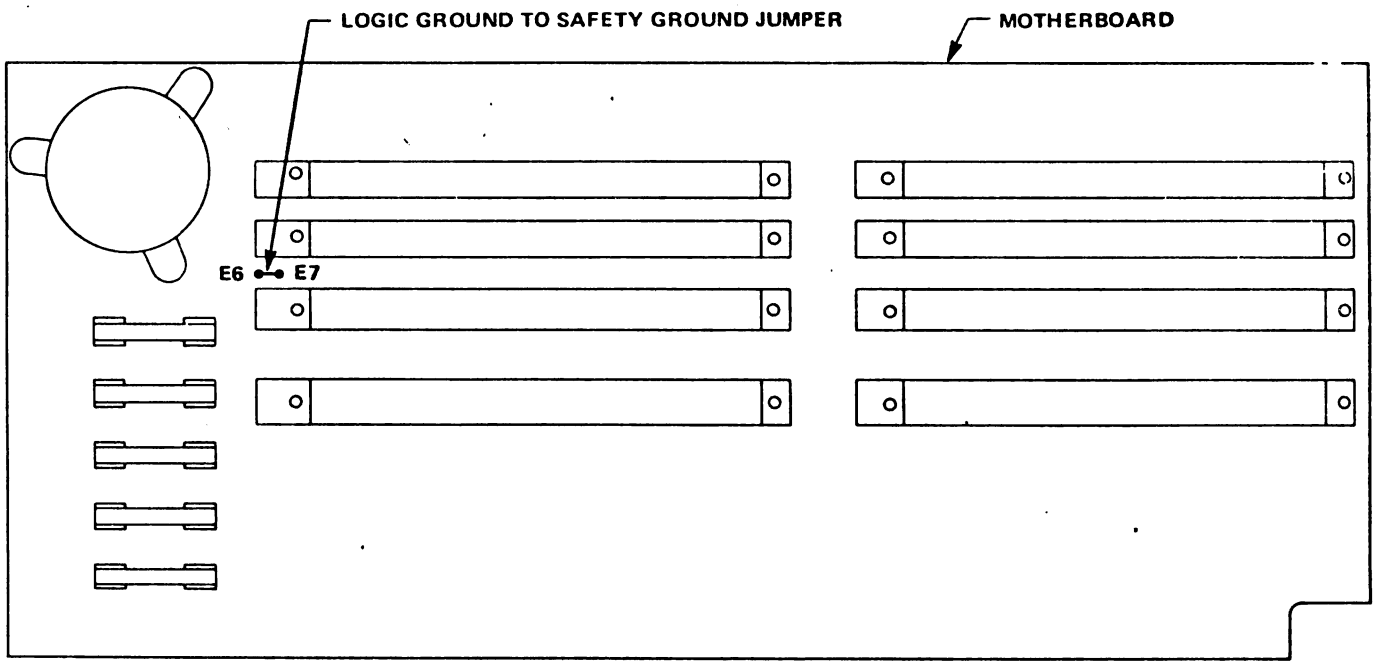
The extension cable is available in the following lengths:

Part Number	Length
975056-10	10 feet
975056-20	20 feet
975056-30	30 feet
975056-40	40 feet
975056-50	50 feet
975056-60	60 feet
975056-70	70 feet
957056-80	80 feet
957056-90	90 feet
957056-100	100 feet
957056-200	200 feet
957056-500	500 feet
957056-1000	1000 feet



(A)136704 (810-577-27-3)

Figure 2-3. Rear View of Printer



(A)136705

Figure 2-4. Ground Jumper on Printer Motherboard

Table 2-2. Basic Printer Cable Wiring List
Part Number 938114-0001 (30 ft)

Wire No.	Description	Printer End	Interface Module End	Remarks
1	BLK	P1-6	P2-6	DTRE
2	WHT	P1-20	P2-20	DSRE
3	BLK	P1-7	P2-7	SG
4	WHT	P1-3	P2-3	XMTDE
5	SHIELD	P1-1	P2-1	PROTECTIVE GND
6	NO 22 WHT	P2-6	P2-8	DCDE
7	NO 22 WHT	P1-6	P1-8	DCDE

Table 2-3. Extension Cable Wiring List
Part Number 975056-XXXX

Wire No.	Description	Printer End	Interface Module End	Remarks
1	BK	P1-6	P2-6	DTRE
2	WHT	P1-20	P2-20	DSRE
3	BK	P1-7	P2-7	SG
4	WHT	P1-3	P2-3	XMTDE
5	SHIELD	P1-1	P2-1	PROTECTIVE GND
6	NO 22 WHT	P2-6	P2-8	DCDE

2.8 SIGNAL LEVELS AND TERMINATIONS

Serial interface signal levels are defined by EIA Standard RS-232-C as follows:

	-25 to -3 Vdc	-3 to +3 Vdc	+3 to +25 Vdc
Data Signal	Marking	Not Defined	Space
Timing or Control	Off	Not Defined	On

The terminator load impedance is a noninductive 3,000 to 7,000 ohm resistance. Any open circuit driver voltage will not exceed 25V.

2.9 LINE VOLTAGE, BAUD RATE, AND PARITY SELECTION

Perform the line voltage, baud rate, and parity selection procedures in the following paragraphs as required.

2.9.1 PRINTER LINE VOLTAGE SELECTION. The printer operates on any one of four line voltages: 100, 120, 220, or 240 Vac. The standard line voltage is 120 Vac. To change the operating line voltage, refer to figure 2-5 and proceed as follows:

WARNING

To prevent a possible deadly electrical shock, do not attempt to change the printer operating line voltage without first making certain that the ac power is disconnected from the printer.

CAUTION

To prevent possible damage to the printer, do not apply power until the proper line voltage selection has been made.

1. Check the line voltage at the point of installation.
2. At left rear of printer, (disconnect power cord, if installed), slide clear plastic cover up to gain access to fuse compartment.
3. Remove line fuse by pulling out and upward on FUSE PULL lever.
4. Rotate FUSE PULL lever fully upward and use a ball point pen or similar device to remove PC board.
5. Select operating voltage. (Line voltage must be within +10% to -15% of voltage selected.)
6. Orient PC board so that selected voltage marking is at top and faces fuse area.
7. Push PC board firmly into slot. (Only selected voltage marking should be visible after the PC board is installed.)

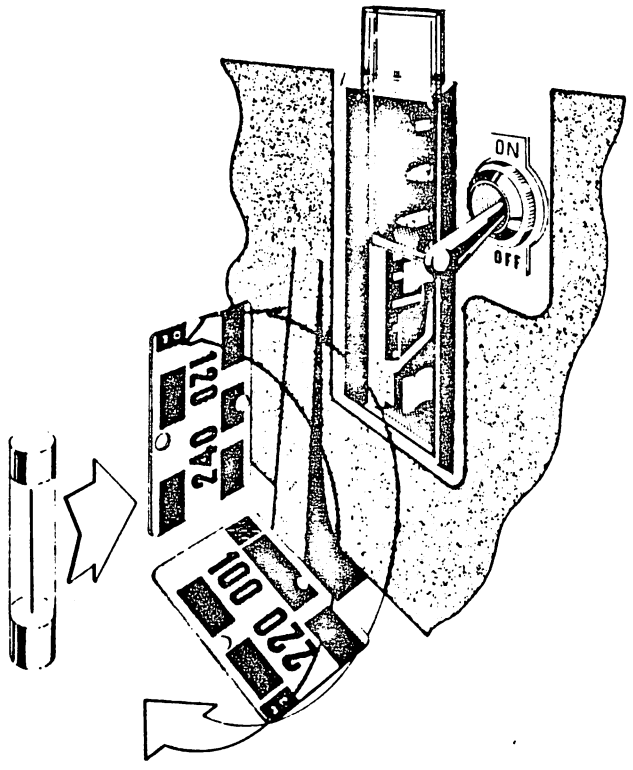
CAUTION

To prevent possible damage to the printer, be sure to use proper fuse value for the voltage selected.

8. Push FUSE PULL lever down, select proper fuse, and place fuse in fuse holder.

Voltage Selected	Fuse Type	TI Part Number
100 or 120 Volts	5.0 Ampere, 250V	416434-0503
220 or 240 Volts	2.5 Ampere, 250V	416434-0004

9. Slide clear plastic cover down.
10. Check that ON/OFF switch is in OFF position.
11. Connect power cord to receptacle and to power source.



(A)136706

Figure 2-5. Printer Line Voltage Selection

2.9.2 BAUD RATE SELECTION. To select the baud rate proceed as follows:

1. Open the access door.
2. Using a ball point pen or similar device, set the auxiliary control panel switches 1, 2, and 3 for a baud rate of 4800, as follows:

Baud Rate	Pencil Switches 1	2	3
110	OFF	OFF	OFF
150	ON	OFF	OFF
300	OFF	ON	OFF
1200	ON	ON	OFF
2400	OFF	OFF	ON
4800 (Standard)	ON	OFF	ON
9600	OFF	ON	ON
Parellel (Not Used)	ON	ON	ON

3. Close the access door.

2.9.3 PARITY SELECTION. Select parity as follows:

1. Open the access door.
2. Set the auxiliary control panel pencil switches for even parity, as follows:

	Pencil Switches 4	5
Ignore Parity	OFF	OFF
Odd Parity	ON	ON
Even Parity (Standard)	ON	OFF

3. Close the access door.

2.10 OPERATIONAL CHECKOUT

Perform the following operational checkout procedures on the Model 810 Printer Subsystem as applicable.

2.10.1 SELF–TEST DIAGNOSTIC PROCEDURE. With the power on (paragraph 4.6.1), perform the self-test as follows:

CAUTION

To prevent possible damage to the printhead, do not print without a ribbon or on paper too narrow for the printed line width. If the full 132-column line is used, the paper must be at least 14-7/8 inches wide for the standard 10 characters per inch spacing and at least 8-1/2 inches wide for the optional (FCO and VCO printers only) 16.5 characters per inch compressed print spacing.

1. Open access door.
2. Set auxiliary control panel NORMAL/TEST/VFC switch to TEXT/VFC.
3. Press control panel ON LINE switch and observe that the rotating character pattern (barber pole) starts.
4. Check that entire 64-character or 96-character set is printed for each line.
5. After several lines have been printed and checked, set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL and observe that barber pole stops.

2.10.2 INTERFACE MODULE DIAGNOSTIC PROCEDURE. Refer to Model 990 Computer Diagnostics Manual and to the TTY/EIA Interface Module Diagnostic Program Description, part number 937764-9901.

2.10.3 PRINTER DIAGNOSTIC PROCEDURE. Refer to Model 990 Computer Diagnostics Manual and to the 810 Printer diagnostic program description, part number 937945-9901.

SECTION III

PROGRAMMING

3.1 GENERAL

This section provides operational programming instructions for the Model 810 Printer Subsystem and includes the following information:

- Model 990 Computer CRU information.
- Interface data information.
- Software control information.
- Sample software program.

3.2 MODEL 990 COMPUTER CRU INFORMATION

The Model 990 computer CRU provides communication between the 990 Central Processor Unit (CPU) and the interface module for the line printer. CRU communication signals originate on the CPU located in slot 1 of the main 990 computer chassis. These CRU signals are connected through the computer chassis back panel to connector P1 and P2 of the remaining chassis slots. The interface module for the line printer is plugged into a chassis slot where contact is made with the CRU signals. The interface module forms part of the CRU when plugged into a chassis slot.

CRU data is transferred from the 990 CPU to the interface module over a 1-bit output bus and a 1-bit input bus. A 12-bit CRU address (figure 3-1) selects the destination in the interface module for each CRU output bit or the data source in the interface module for each CRU input bit. Inputs and outputs may be treated individually or in groups of up to 16 bits. Multibit read or write operations are performed by addressing the individual bits in sequence.

The 12-bit CRU address is comprised of three parts: a chassis select field, a module select field, and a CRU bit select field, The chassis select field specifies the 990 computer chassis or one of the seven possible CRU expansion chassis units. The chassis select decode is performed in the main chassis by the AU board(s) and in the expansion chassis by the CRU buffer cards. The module select field specifies one of 24 possible half card slots within the selected chassis.

NOTE

This positional addressing scheme requires that the hardware location of the interface module and the software address be coordinated.

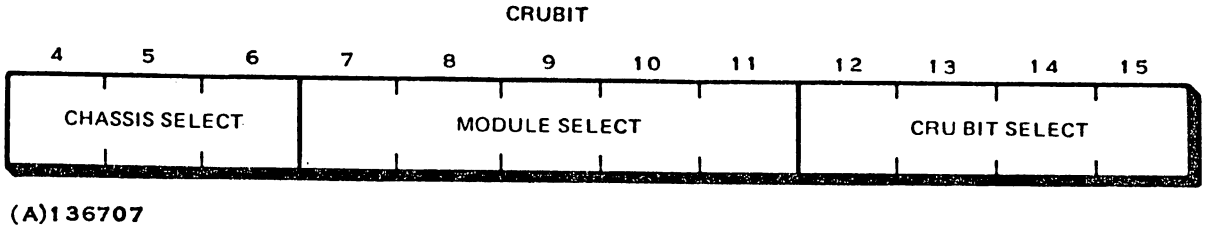


Figure 3-1. CRU Address Field Assignments

The remaining four least significant bits (CRUBIT 12-15) are used to define a 16-bit interface between the computer and the selected module.

The 990 CPU instructions (figure 3-2) that drive the CRU consist of single-bit and multiple-bit transfer instructions. Single-bit transfer instructions (SBO, SBZ, and TB) are used for control functions and include the following:

- Set Bit to Logic 1 (SBO) – This instruction sets the addressed CRU output bit to a logic 1, which is stored in the interface module register.
- Set Bit to Logic 0 (SBZ) – This instruction sets the addressed CRU output bit to a logic 0, which is stored in the interface module register.
- Test Bit (TB) – This instruction reads the addressed CRU input bit from the interface module, and sets the equal status bit in the 990 CPU status register to the value of the addressed CRU bit.

NOTE

The CRU address of the SBO, SBZ, and TB instructions is determined as follows: CRU base address (bits 3-14 of workspace register 12) + the user supplied displacement in the instruction with sign bit extended = the effective CRU address.

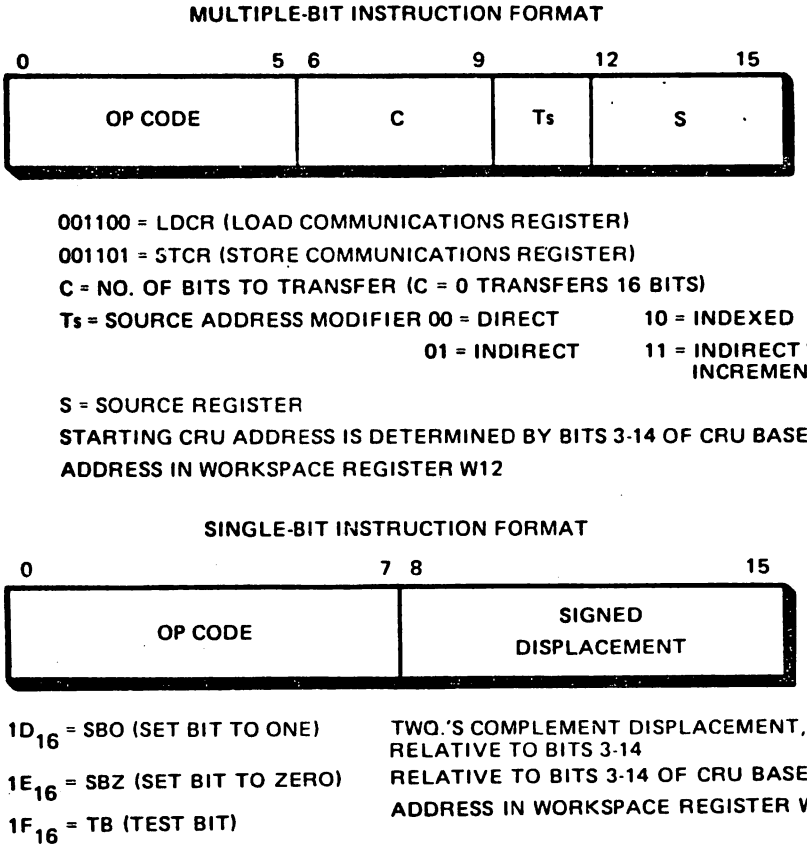


Figure 3-2. CRU Instruction Formats

Multiple-bit transfer instructions (LCDR and STCR) are used to transfer a specified number of data bits between the data module and the source register in the 990 CPU. Refer to figure 3-3. These instructions function as follows:

- Load Communications Register (LCDR) – This instruction transfers the number of bits (1-16) specified by the 'C' field of the instruction from the source register to the addressed bit registers in the data module. When the 'C' field contains zero, the number of bits transferred is 16. If the number of bits to be transferred is from one to eight, the source operand address is a byte address. If the number of bits to be transferred is from 9 to 16, the source operand address is a word address. These transferred bits constitute data, such as the print character codes and the software commands as described in paragraph 3.4.1. The CRU base address is determined by bits 3-14 of workspace register 12.

- Store Communications Register (STCR) – This instruction transfers the number of bits (1-16) specified by the 'C' field of the instruction from the addressed bit multiplexer locations in the data module to the source register. When the 'C' field contains zero, the number of bits transferred is 16. If the number of bits to be transferred is from one to eight, the source operand address is a byte address. If the number of bits to be transferred is from 9 to 16, the source operand address is a word address. These transferred bits constitute data, such as the data carrier detect and data set ready signals. The CRU base address is determined by bits 3-14 of workspace register 12.

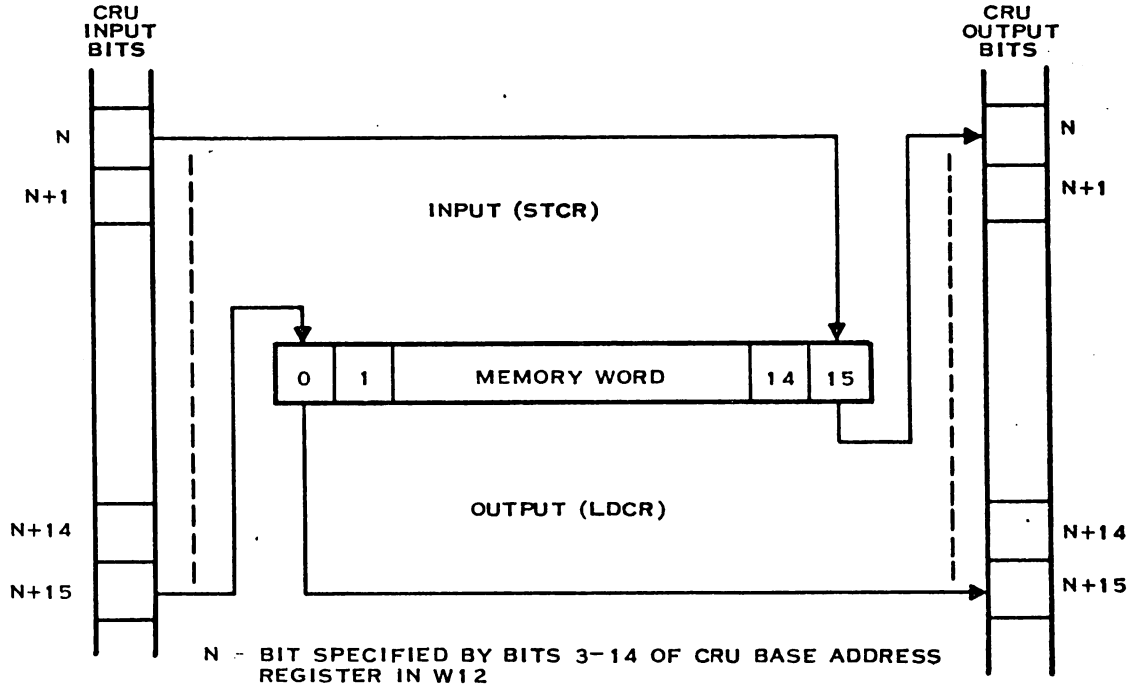


Figure 3-3. 990 Memory/CRU Data Transfer (STCR and LDCR Instructions)

The relation between the bits in the CPU memory word and the CRU data module input and output lines is shown in figures 3-4 and 3-5. Note that the LSB in the CPU memory word is bit F which coincides with bit 0 in the CRU data module input and output lines.

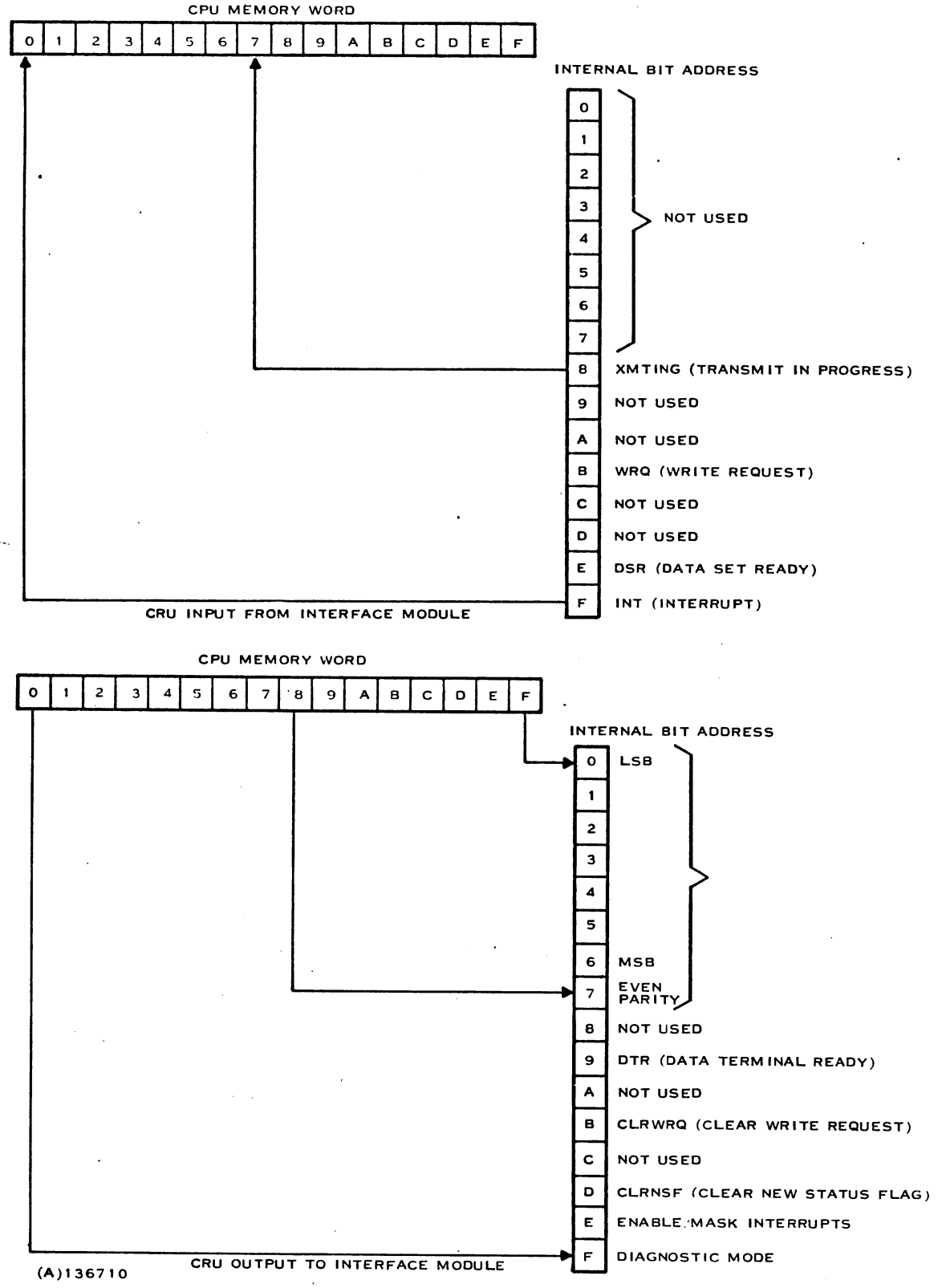
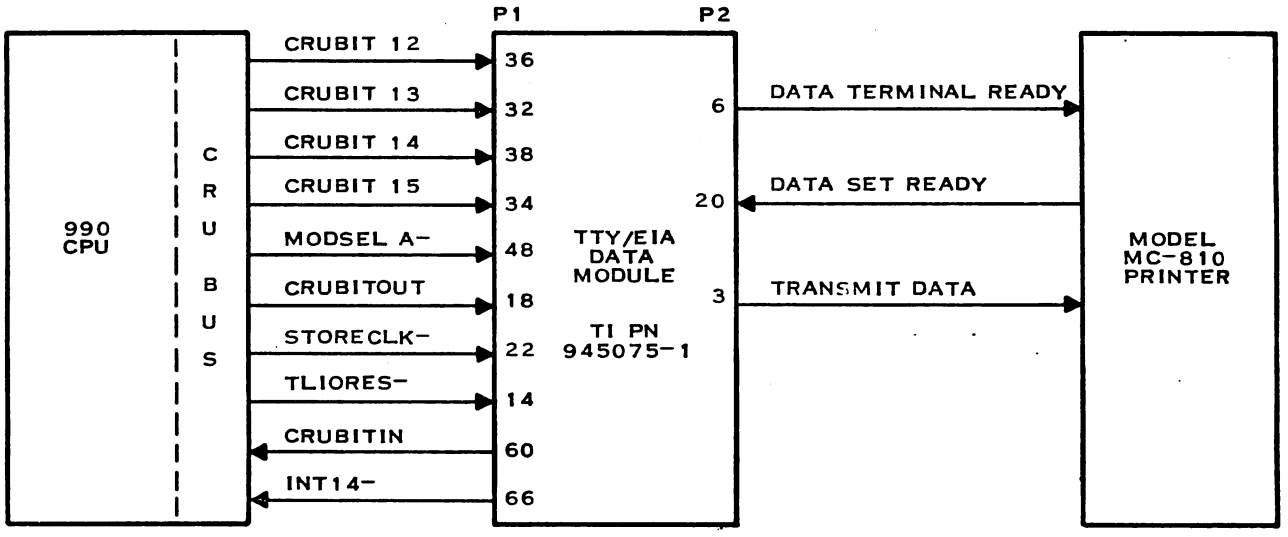


Figure 3-4. CRU Interface Module Output and Input Bit Assignments



(A)136711

Figure 3-5. Model 810 Printer Subsystem Interface Signals

3.3 INTERFACE DATA

The following paragraphs briefly describe all interface signals. Refer to figure 3-5.

3.3.1 **CRUBIT 12, 13, 14, 15.** CRUBIT (12-15) are address lines generated by the 990 CPU to select the destination of a data bit on the CRUBITOUT line (if STORECLK is present) or to select the source of a data bit being read from the data module to the 990 computer. CRUBIT (12-15) are high true.

3.3.2 **MODSEL A.** MODSEL A selects the data module when it is in slot 12, P1 (left half), its standard slot position on the 990 chassis. If the data module is mounted in any other slot on the 990 chassis, a different MODSEL line is used. MODSEL A is low true.

3.3.3 **CRUBITOUT.** CRUBITOUT is the serial or single bit data that is transferred, one bit at a time, to the addressed CRUBIT (12-15) 16-bit register locations in the data module. CRUBITOUT bits are synchronized with the positive edge of STORECLK. The CRUBITOUT signal is high true.

3.3.4 **STORECLK.** STORECLK is derived from the 990 CPU clock and is low true. STORECLK is true during write operations only. The positive going edge of the STORECLK signal indicates to the selected CRUBITOUT bit that a write operation exists.

3.3.5 **TLIORES.** TLIORES is a low true signal generated by the 990 CPU when its power supply is initially turned on or when a Reset instruction is executed.

3.3.6 CRUBITIN. CRUBITIN is the serial or single bit data that is transferred, one bit at a time, from the data module to 990 CPU memory. Each bit transferred is addressed by the CRUBIT (12-15) address code. The CRUBITIN line is driven by open collector gates and terminated by 470-ohm pull-up resistors in the 990 CPU.

3.3.7 INT14. INT14 is a low-active signal. The interrupt number in the signal signature indicates the priority of the interrupt at the 990 CPU. The INT14 line is driven by an open collector gate and terminated by 470-ohm pull-up resistors in the 990 CPU.

3.3.8 CRU INPUT SIGNALS. The CRU input bit assignments are listed in figure 3-4. The input bit numbers are hexadecimal. Input bits 0 through 7, 9, A, C and D are not used in this application. The active input signal descriptions to the CPU are as described in the subsequent paragraphs.

3.3.8.1 Transmitting-CRU Input Bit 8. This bit is a logic 1 whenever a character is being transmitted to the printer. The software should wait until this bit is a logic 0 or until the next Write Request occurs before another character is sent to the interface. This bit is set to a logic 0 during a power up sequence or whenever a reset instruction is executed.

3.3.8.2 Write Request-CRU Input Bit B. A logic 1 on this bit indicates that the Transmit Shift Register on the TTY/EIA module has finished sending a character to the printer and is ready to accept the next character from the CRU interface (provided that Data Set Ready is a logic 1). This bit is set to a logic 0 by addressing CRU output bit B, Clear Write Request. This bit can be in any state following a power up.

3.3.8.3 Data Set Ready (DSR) – CRU Input Bit E. A logic 1 on CRU input bit E indicates that the printer is selected and ready to accept characters from the TTY/EIA module. A logic 0 on this bit indicates that the printer is in a busy condition (i.e., deselected, out of paper, buffer full, etc.) and printer will not accept characters from the TTY/EIA module. If Data Set Ready is 0 because the printer is deselected, the user may send the printer an ASCII Select ON (11_{16}) and Data Set Ready will come true. The New Status Flag interrupt is set on either edge of Data Set Ready.

3.3.8.4 Interrupt (INT) – CRU Input Bit F. A logic 1 on CRU input bit F indicates that an interrupt has been generated on the TTY/EIA module. This bit and the interrupt can be cleared by addressing Clear Write Request if a Write Request caused the interrupt or by addressing Clear New Status Flag if a change of Data Set Ready caused the interrupt.

3.3.9 CRU OUTPUT SIGNALS. The CRU bit assignments are listed in figure 3-4. The output bit assignments are hexadecimal. Output bits 8, A, C, and F are not used in this application. The active output signal description to the Data Module are described in the subsequent paragraphs.

3.3.9.1 Transmit Data – CRU Output Bits 0-7. Executing an LDCR instruction to CRU output bits 0-7 causes the TTY/EIA module to transmit to the printer a 7-bit ASCII character. Bits 1 through 7 of the character appear on CRU bits 6 through 0, respectively. The parity bit (character bit 0) appears on CRU bit 7. The user must generate the correct parity bit (even or odd) from the character data; otherwise, the printer will print "◆" signs for characters received with wrong parity, unless the MC-810 printer is set to ignore parity.

3.3.9.2 Data Terminal Ready (DTR) – CRU Output Bit 9. A logic 1 to CRU output bit 9 enables characters sent by the TTY/EIA module to be received by the printer. A logic 0 on CRU output bit 9 prevents the characters sent by the TTY/EIA module from being received by the printer. After a power up, this bit is set to a logic 0 and must be set to a logic 1 before any characters will be accepted by the printer.

3.3.9.3 **Clear Write Request – CRU Output Bit B.** Addressing CRU output bit B clears the Write Request Status flag (CRU input bit B). Addressing this bit also clears the Interrupt input bit along with the interrupt if no other interrupts are pending (i.e., PTR).

3.3.9.4 **Clear New Status Flag – CRU Output Bit D.** Addressing CRU output bit D clears the New Status Flag that was caused by Data Set Ready changing state. Addressing this bit also clears the Interrupt input along with the interrupt if no other interrupts are pending (i.e., WRQ).

3.3.9.5 **Enable/Mask Interrupts – CRU Output Bit E.** CRU bit E controls the interrupt mask. When bit E is set to a logic 0 the interrupts are not enabled; i.e., they are masked. Setting CRU bit E to a logic 1 enables the interrupt circuits and allows the interface to report an interrupt.

3.3.10 **ASYNCHRONOUS DATA FORMAT.** Each character sent to the printer on the received data line consists of one start bit, seven data bits, one partiy bit, and one or two stop bits as shown in figure 3-6.

3.3.10.1 **Timing.** The printer accepts data when the input device has raised both the Data Set ready and the Carrier detect line to the positive level. The printer holds the Data Terminal Ready line at the positive level when the printer is on line or at the negative level when the printer is off line.

3.3.10.2 **Parity.** The bit immediately preceding the stop bit in the asynchronous data format is the parity bit (see figure 3-6). Characters received with incorrect parity are printed as "♦" signs and the control panel ERROR indicator lights. A parity error in a format statement will terminate the statement.

3.4 SOFTWARE CONTROL (990 COMPUTER)

The following paragraphs contain information and procedures required to control the printer through the communications interface. All printer functions which can be controlled by the sending device are described in tabular form. The more complex functions requiring a sequence of control codes are further described in step-by-step procedures.

3.4.1 **SOFTWARE COMMANDS.** Table 3-1 describes the action taken by the printer in response to the various received control characters. The second column of table 3-1 shows the actual ASCII control code characters (underlined) which are to be sent to the printer, while the letters "N" and "n" represent numbers which are to be sent as noted. The plus (+) sign indicates that the character which follows is to be sent next in the command sequence. All characters received by the printer are stored in a first-in-first-out (FIFO) buffer. When the printing mechanism is not busy, data characters are transferred from the FIFO to the line buffer. The contents of the line buffer are printed when any of the following occur:

1. A carriage return (CR) character or any of the paper movement characters, line feed (LF), vertical tab (VT), form feed (FF), or tab to line (DC2), is received.

2. One-hundred thirty-three printable characters (one character over a full line) have been received.

3. A deselect (DC3) character is received.

4. The operator has pressed the printer ON LINE switch (deselecting the printer) and then presses the printer LINE FEED switch.

5. The operator has pressed the printer FORM FEED switch.

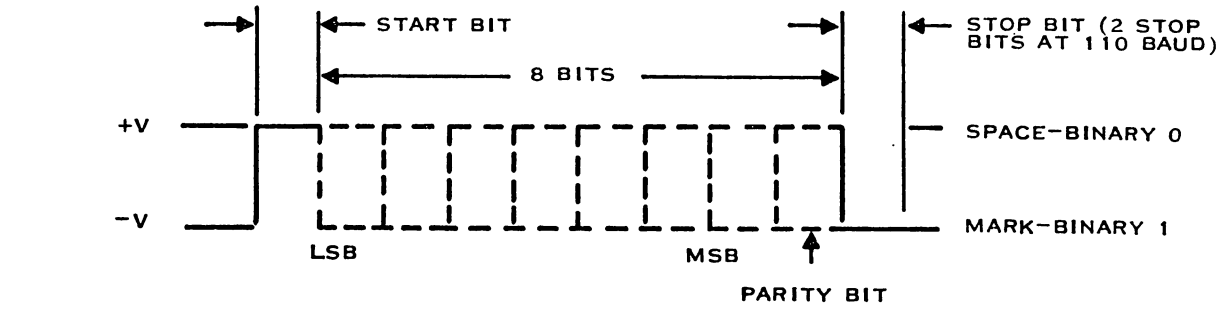


Figure 3-6. Asynchronous Data Format

Table 3-1. Software Commands

Command	ASCII Code Characters Received	Printer Action Taken
Carriage Return	*CR*	This command causes data, if any, in the line buffer to be printed. Because of the bidirectional printing capability of the printer, a carriage return is not executed. Instead, the carriage stops upon completion of printing a line. When the next line is received, the carriage is positioned to print forward or backward, whichever requires the least carraige movement.
Delete	*DEL*	In the standard printer, this command clears the line buffer. If the NDE (no delete) option has been installed, this command will be ignored.
Deselect	*DC3*	This command deselects the printer, causing it to ignore all incoming data and control characters except DC1 (select) after printing out the contents of the line buffer.
Form Feed	*FF*	This command causes data, if any, in the line buffer to be printed and advances the paper to the top of the next form.
Form Length Set	*ESC* + 2 + n (See Note 1)	This command sets the form length used by the Form Feed (FF) command to n lines (from 4 to 112 lines). See paragraph 3.4.2 for form length setting procedure.
Horizontal Tab	*HT*	This command causes spaces to be entered in the line buffer up to the next horizontal tab location, where printing will begin.

Table 3-1. Software Commands (Continued)

Command	ASCII Code Characters Received	Printer Action Taken
Horizontal Tab Set	*ESC*+3+n_1+ n_2...+n_k +*NUL* (See Note 1)	This command clears all existing horizontal tabs and sets new tabs at columns n_1, n_2, ..., and n_k (column 1 through 127). See paragraph 3.4.3 for horizontal tab setting procedure.
Line Feed	*LF*	This command causes data, if any, in the line buffer to be printed and advances the paper one line space.
Line Width Set	*ESC*+:+n (See Note 1)	This command causes the printer to print lines n columns wide. (Line width is automatically set to 132 columns at power-up). See paragraph 3.4.4 for line width setting procedure.
Line Width 132	*ESC* = ;	This command causes the printer to print lines 132 columns wide. (line width is automatically set to 132 columns at power-up).
Null	*NUL*	This command terminates the tab setting sequence for both horizontal and vertical tabs, otherwise it is ignored.
Recall	*ESC*+9+N (See Note 2)	This command recalls the stored vertical format information in the optional VFC channel N memory to the working memory. If the VFC option is not installed, this command is ignored. See paragraph 3.4.5 for the recall procedure.
Select	*DC1*	When power is applied to the printer, this command selects the printer, enabling it to receive data.
Store	*ESC*+8+N (See Note 2)	This command stores vertical format information from the working memory in the optional VFC channel N memory. If the VFC option is not installed, this command is ignored. See paragraph 3.4.6 for the store procedure.
Tab to Address	*DC4*+n (See Note 1)	This command causes spaces to be entered in the line buffer from the present column up to column n; n must be greater than the present column. If n is less than the present column this command will be ignored.

Table 3-1. Software Commands (Continued)

Command	ASCII Code Characters Received	Printer Action Taken
Tab To Line	*DC2*+n (See Note 1)	This command causes the paper drive system to slew to the line specified by n after printing contents of the line buffer (n must be greater than the present line). If n is less than the present line, this command will be ignored.
Vertical Tab	*VT*	This command causes data, if any, in the line buffer to be printed and advances the paper to the next vertical tab location or top of form, whichever occurs first. If no vertical tabs are set, this command causes the paper to be advanced to top of form.
Vertical Tab Set	*ESC+1*+n_1+ n_2+ . . . +n_k +*NUL*	This command clears all existing vertical tabs and sets new tabs at lines n_1, n_2, 111, and n_k. See paragraph 3.4.7 for the vertical tab setting procedure.
6 LPI	*ESC+4*	This command sets the paper drive system to 6 lines per inch. (The paper drive system is automatically set to 6 lines per inch at power-up).
8 LPI	*ESC+5*	This command sets the paper drive system to 8 lines per inch.
10 CPI	*ESC+6*	This command sets the carriage system to 10 characters per inch. (The carriage system is set to 10 characters per inch at power-up).
16.5 CPI	*ESC+7*	This command sets the carriage system to 16.5 characters per inch.

NOTE 1: The numer "n" as used in the DC2, DC4, ESC+1, and ESC+2, ESC+3, and ESC+: commands represents a seven-bit ASCII code. See table 1-1 for the ASCII character code which will transmit the desired binary number, shown in hexadecimal form.

NOTE 2: The number "N" as used in the ESC+8 and ESC+9 commands represents the ASCII coded numbers from one through eight, which correspond to the selected VFC channel.

3.4.2 SOFTWARE FORM SETTING. The following sequence, when received by the printer, causes the form length to be set at the line represented by "n". Any form length from four lines up to the maximum 112 lines may be set. If a parity is selected on the printer, a parity bit must be added to the seven-bit number "n" as the most significant (eighth) bit.

1. ESC
2. 2
3. The binary equivalent of the number "n" of lines in the desired form length.

NOTE

Use table 1-1 to select the ASCII code character which produces the required binary equivalent, shown in hexadecimal form.

Example:

ESC + 2 + @ sets the form length at 64 lines. The ASCII code character "@" produces a binary 0100 0000 (decimal 64).

3.4.3 SOFTWARE HORIZONTAL TAB SETTING. The following sequence, when received by the printer, causes all previous horizontal tabs to be cleared and new horizontal tabs to be set at the columns represented by "n" (where "n_1" is the first tabbed column and "n_k" is the last tabbed column). Horizontal tabs may be set any column up to and including the 127th column. If a parity is selected on the printer, a parity bit must be added to the seven-bit number "n" as the most significant (eighth) bit.

1. ESC
2. 3
3. The binary equivalents of the columns "n_1" through "n_k" where the horizontal tabs are to be set.

NOTE

Use table 1-1 to select the ASCII code character which produces the required binary equivalent, shown in hexadecimal form.

4. NUL

Example:

ESC + 3 + DLE + 4 + T + t + NUL sets horizontal tabs at columns 16, 52, 84, and 116. The ASCII code characters "DLE", "4", "T", and "t" produce the binary numbers 001 0000 (decimal 16), 011 0100 (decimal 52), 101 0100 (decimal 84), and 111 0100 (decimal 116), respectively.

3.4.4 SOFTWARE LINE WIDTH SETTING. The following sequence, when received by the printer, causes the line width to be set at the number of columns represented by "n". Any line width up to the maximum number "n" as the most significant (eighth) bit.

1. ESC
2. :
3. The binary equivalent of the number "n" of columns in the desired line width.

NOTE

Use table 1-1 to select the ASCII code character which produces the required binary equivalent, shown in hexadecimal form.

Example:

ESC + : + P sets the line width at 80 columns. The ASCII code character "P" produces a binary 101 0000 (decimal 80).

3.4.5 SOFTWARE VERTICAL FORMAT RECALL. The following sequence recalls the stored vertical format information in the optional VFC channel memory (channels 1 through 8) to the working memory after clearing the previous vertical format information from the working memory. The vertical format information stored in the VFC channel memory is not cleared. If the VFC option is not installed, this command will be ignored.

1. ESC
2. 9
3. The ASCII code character for the channel is selected.

Example:

ESC + 9 + 7 recalls the vertical format stored in VFC channel 7 to the working memory.

3.4.6 SOFTWARE VERTICAL FORMAT STORE. The following sequence stores the vertical format information in the working memory into the selected optional VFC channel memory (channels 1 through 8) after clearing the previous vertical format information from the selected channel. The vertical format information in the working memory is not cleared. If the VFC option is not installed, this command will be ignored.

1. ESC
2. 8
3. The ASCII code character for the VFC channel in which the vertical format information from the working memory is to be stored.

Example:

ESC + 8 + 3 stores the vertical format information in the working memory into VFC channel 3.

3.4.7 SOFTWARE VERTICAL TAB SETTING. The following sequence, when received by the printer causes all previous vertical tabs to be cleared and new vertical tabs to be set at the lines represetned by "n" (where "n_1" is the first tabbed line and "n_k" is the last tabbed line). Vertical tabs may be set at any line up to and including the 112th line. If a parity is selected on the printer, a parity bit must be added to the seven-bit number "n" as the most significant (eighth) bit. Commands to set tabs at lines beyond the 112th line will be ignored.

1. ESC
2. 1
3. The binary equivalents of the columns "n_1" through "n_k" where the vertical tabs are to be set.

NOTE

Use table 1-1 to select the ASCII code character which produces the required binary equivalent, shown in hexadecimal form.

4. NUL

Example:

ESC + 3 + DLE + 4 + T + t + NUL sets vertical tabs at lines 16, 52, and 84. The ASCII code characters "DLE", "4", "T", and "t" produce the binary numbers 001 0000 (decimal 16), 011 0100 (decimal 52), 101 0100 (decimal 84), and 111 0100 (decimal 116), respectively. The binary number 111 0100 (decimal 116) will be ignored since it is beyond the 112 line maximum.

3.5 SAMPLE PROGRAM (990 COMPUTER)

The program shown in figure 3-7 produced the printout shown in figure 3-8. Use this program as a guide when changing or preparing new service routines for the Model 810 printer.

```
810TST        SDSMAC 947075 ◆D   11:32:43 WEDNESDAY, AUG 17, 1977.
                                                          PAGE 0001

0001                    IDT  '810TST'
0002        0009  DTR     EQU  9
0003        000E  DSR     EQU  14
0004        000B  WR0     EQU  11
0005        00C0  CRUBSE  EQU  >C0
0006        1100  SELECT  EQU  >1100
0007              ◆
0008              ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0009.             ◆
0010        0000  XOUT    EQU  0
0011        0001  START   EQU  1
0012        0002  ICHAR   EQU  2
0013        0003  CHAR    EQU  3
0014        0004  ONE     EQU  4
0015        0005  COUNT   EQU  5
0016        0006  MCOUNT  EQU  6
0017        0007  ECHAR   EQU  7
0018        0008  CRCHAR  EQU  8
0019        0009  LFCHAR  EQU  9
0020              ◆
0021              ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
0022              ◆
0023 0000         TOP
0024 0000 02E0          LWPI PEGS                 SET UP WORKSPACE
     0002 0052'
0025 0004 1D09          SBO  DTR                  INITIALIZE INTERFACE
0026 0006 0203          LI   CHAR,SELECT
     0008 1100
0027 000A 06A0          BL   @OUT1                SELECT THE PRINTER
     000C 003A'
0028 000E D081          MOVB START,ICHAR
0029 0010         AGAIN
0030 0010 04C5          CLR  COUNT                CLEAR CHAR COUNT
0031 0012 D0C2          MOVB ICHAR,CHAR           SET UP FIRST CHAR IN LINE
0032 0014         LOOP
0033 0014 0690          BL   ◆XOUT                OUTPUT CHAR
0034 0016 B0C4          AB   ONE,CHAR             BUMP ASCII CODE
0035 0018 91C3          CB   CHAR,ECHAR           END OF PRINTABLE CHARS ?
0036 001A 1201          JLE  OVER                 NO.
0037 001C D0C1          MOVB START,CHAR           YES, RESET TO START OF ASCII
0038 001E         OVER
0039 001E 0585          INC  COUNT                BUMP CHAR COUNT
0040 0020 8185          C    COUNT,MCOUNT         80 CHARS YET ?
0041 0022 11F8          JLT  LOOP                 NO.
0042 0024 D0C8          MOVB CRCHAR,CHAR          YES, OUTPUT CR>LF.
0043 0026 0690          BL   ◆XOUT
0044 0028 D0C9          MOVB LFCHAR,CHAR
0045 002A 0690          BL   ◆XOUT
0046 002C B084          AB   ONE,ICHAR            BUMP FIRST CHAR OF LINE
0047 002E 91C2          CB   ICHAR,ECHAR          END OF ASCII CODE ?
0048 0030 12EF          JLE  AGAIN                NO.
0049 0032 10FF          JMP  $                    YES, HALT.
0050 0034 10E5          JMP  TOP
0051 0036         OUT
0052 0036 1F0E          TB   DSR                  WAIT FOR PRINTER READY
0053 0038 16FE          JNE  OUT
0054 003A         OUT1
0055 003A D0C3          MOVB CHAR,CHAR
0056 003C 1C07          JOP  SETPAR
0057 003E         OUT2
```

Figure 3-7. 990 Computer Sample Program (Sheet 1 of 3)

```
810TST        SDSMAC 947075 ♦D   11:32:43 WEDNESDAY, AUG 17, 1977.
                                                              PAGE 0002

0058 003E 3203          LDCR CHAR,8             OUTPUT CHAR
0059 0040         OUT3
0060 0040 1F0B          TB   WRQ
0061 0042 16FE          JNE  OUT3
0062 0044 1E0B          SBZ  WRQ
0063 0046 0243          ANDI CHAR,>7F00
     0048 7F00
0064 004A 045B          B    ♦11                RETURN
0065 004C         SETPAR
0066 004C 0263          ORI  CHAR,>8000
     004E 8000
0067 0050 10F6          JMP  OUT2
0068                    ♦
0069                    ♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦♦
0070                    ♦
0071 0052         REGS
0072 0052 0036'         DATA OUT                R0 = XOUT
0073 0054 2000          DATA >2000              R1 = START
0074 0056 0000          DATA $-$                R2 = ICHAR
0075 0058 0000          DATA $-$                R3 = CHAR
0076 005A 0100          DATA >100               R4 = ONE
0077 005C 0000          DATA 0                  R5 = COUNT
0078 005E 0050          DATA 80                 R6 = MCOUNT
0079 0060 5F00          DATA >5F00              R7 = ECHAR
0080 0062 0D00          DATA >D00               R8 = CRCHAR
0081 0064 0A00          DATA >A00               R9 = LFCHAR
0082 0066 0000          DATA 0                  R10
0083 0068 0000          DATA 0                  R11
0084 006A 00C0          DATA CRUBSE             R12
0085 006C 0000          DATA 0                  R13
0086 006E 0000          DATA 0                  R14
0087 0070 0000          DATA 0                  R15
0088                    ♦
0089      0000'         END  TOP
NO ERRORS
```

Figure 3-7. Computer Sample Program (Sheet 2 of 3)

```
S10TST          SDSMAC 947075 •D    11:32:43 WEDNESDAY, AUG 17, 1977.
LABEL      VALUE   DEFN  REFERENCES                                    PAGE 0003

$       R  0072          0049  0074  0074  0075  0075
AB                       0034  0046
AGAIN   R  0010    0029  0048
ANDI                     0063
B                        0064
BL                       0027  0033  0043  0045
C                        0040
CB                       0035  0047
CHAR       0003    0013  0026  0031  0034  0035  0037  0042  0044  0055  0055
                         0058  0063  0066
CLR                      0030
COUNT      0005    0015  0030  0039  0040
CPCHAR     0008    0018  0042
CPUBSE     00C0    0005  0084
DATA                     0072  0073  0074  0075  0076  0077  0078  0079  0080
                         0081  0082  0083  0084  0085  0086  0087
DSR        000E    0003  0052
DTR        0009    0002  0025
ECHAR      0007    0017  0035  0047
END                      0089
EQU                      0002  0003  0004  0005  0006  0010  0011  0012  0013
                         0014  0015  0016  0017  0018  0019
ICHAR      0002    0012  0028  0031  0046  0047
IDT                      0001
INC                      0039
JLE                      0036  0048
JLT                      0041
JMP                      0049  0050  0067
JNE                      0053  0061
JOP                      0056
LDCR                     0058
LFCHAR     0009    0019  0044
LI                       0026
LOOP    R  0014    0032  0041
LWPI                     0024
MCOUNT     0006    0016  0040
MOVB                     0028  0031  0037  0042  0044  0055
ONE        0004    0014  0034  0046
ORI                      0066
OUT     R  0036    0051  0053  0072
OUT1    R  003A    0054  0027
OUT2    R  003E    0057  0067
OUT3    R  0040    0059  0061
OVER    R  001E    0038  0036
REGS    R  0052    0071  0024
SBO                      0025
SBZ                      0062
SELECT     1100    0006  0026
SETPAR  R  004C    0065  0056
START      0001    0011  0028  0037
TB                       0052  0060
TOP     R  0000    0023  0050  0089
WRQ        000B    0004  0060  0062
XOUT       0000    0010  0033  0043  0045
```

Figure 3-7. Computer Sample Program (Sheet 3 of 3)

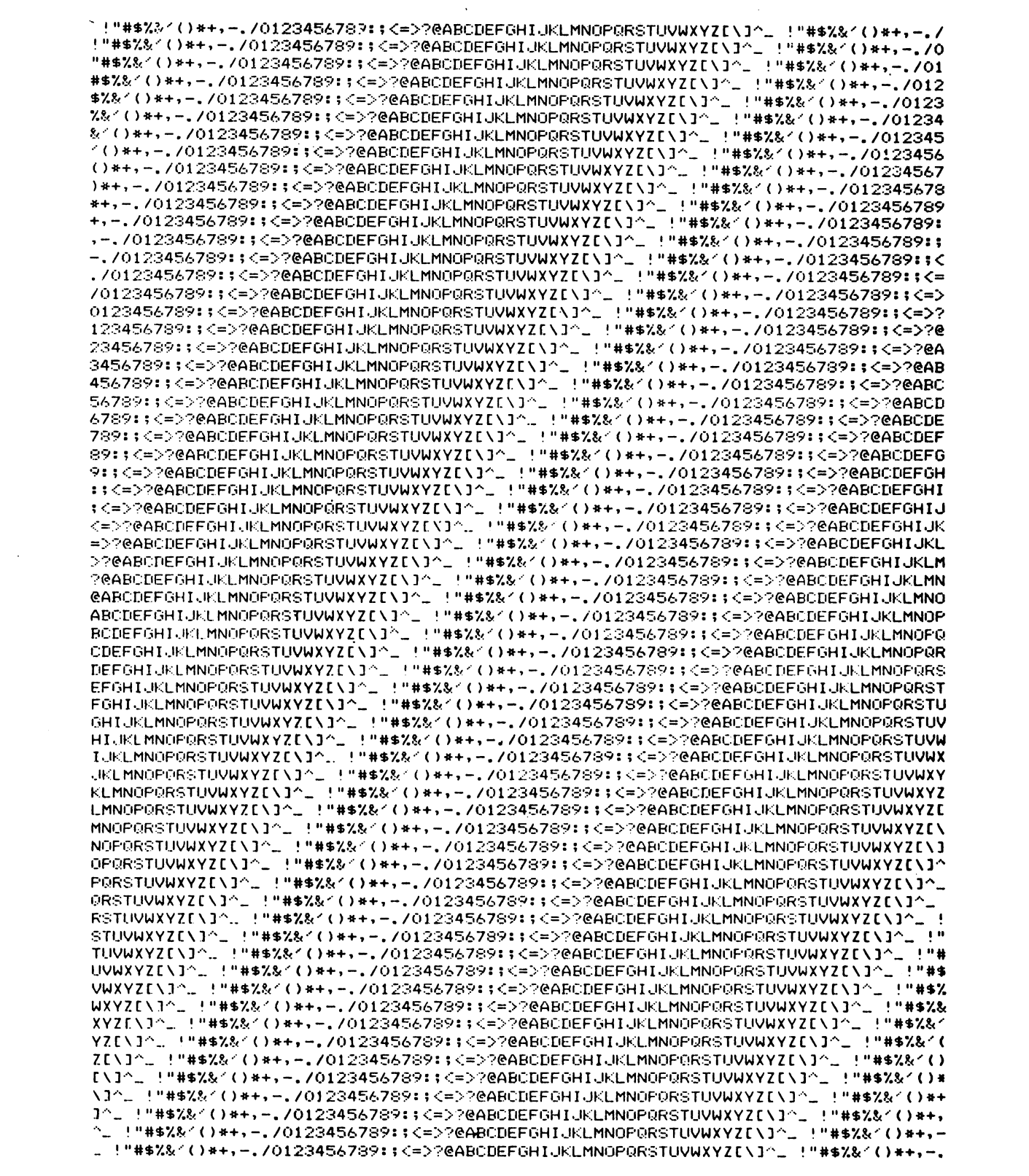


Figure 3-8. Sample Program Printout

SECTION IV

OPERATION

4.1 GENERAL

This section provides operation instructions for the Model 810 Printer Subsystem and includes the following information:

- Explanation of all controls and indicators.
- Paper loading instructions.
- Ribbon installation instructions.
- Operating procedures.
- Self-help procedures.
- Operator preventive maintenance.

4.2 OPERATOR CONTROL PANEL CONTROLS AND INDICATORS

The following paragraphs describe the control and indicator functions available at the control panel. There are five switches on the control panel which have an alternate function (marked in red) in the vertical format programming mode. These alternate functions are active only when the auxiliary control panel NORMAL/TEST/VFC switch is set to the TEST/VFC position. See figures 4-1 and 4-2 for the location and layout of the control panels.

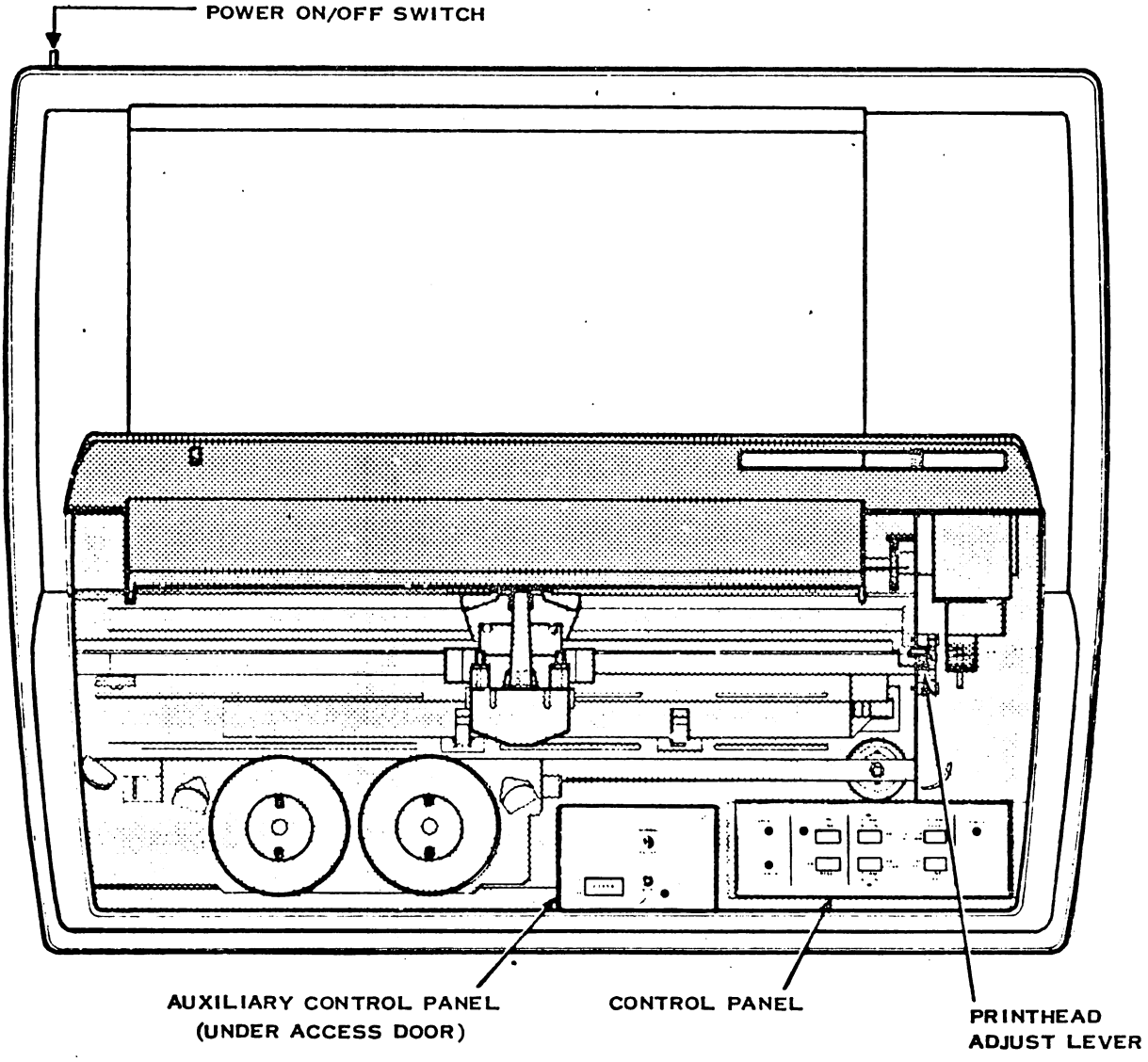
4.2.1 PAPER OUT INDICATOR. Indicator lights when paper out switch is activated. The audible tone (bell) beeps five times. This indicator is cleared when paper is loaded and the RESET switch is pressed.

4.2.2 ERROR INDICATOR. The ERROR indicator has two functions:

1. For a parity error, indicator lights steady when a parity error is detected. (A special parity error symbol "◆" will be printed.)
2. For a printhead carriage fault, indicator blinks if the printhead carriage runs into an obstacle or if the microprocessor loses tachometer pulses for any reason. Power to the printhead carriage motor is turned off. The audible tone (bell) beeps five times.

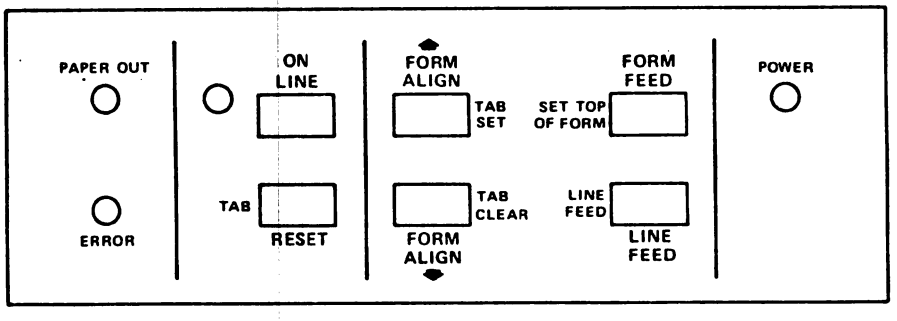
The RESET switch is used to clear these error indications.

4.2.3 ON-LINE SWITCH AND INDICATOR. Pressing this switch places the printer in the on-line condition. Pressing this pushbutton switch a second time places the printer in the off-line condition. The indicator lights to indicate on-line condition. The on-line condition allows the printer to receive data from an external source (EIA, TTY, or parallel interface). The printer also goes on-line by remote ASCII DC1 control code and off-line by remote ASCII DC3 control code (printhead initializes to the left margin). The off-line condition causes the interface to go busy; partial lines remain in the buffer.



(A)136713

Figure 4-1. Printer Control Panel Locations



(A)136714

Figure 4-2. Operator Control Panel

4.2.4 **RESET/TAB SWITCH.** The normal RESET function of this pushbutton switch clears the paper out condition or either of the two error conditions. The printhead realigns after clearing a carriage fault condition. The alternate TAB function of this switch is active only in the vertical format control mode. When active, pressing the switch advances the paper to the next vertical tab which has been set.

4.2.5 **FORM ALIGN (UP)/TAB SET SWITCH.** The normal FORM ALIGN (up) function of this pushbutton switch causes the paper to move up one-seventy-second of an inch. If the switch is held down, three small steps will be taken and then full line feeds will be executed to accelerate paper movement. This switch is active both off-line and on-line. The alternate TAB SET function of this switch is active only in the vertical format control mode. When active, pressing this pushbutton switch sets a vertical tab at the present line.

4.2.6 **FORM ALIGN (DOWN)/TAB CLEAR SWITCH.** The normal FORM ALIGN (Down) function of this pushbutton switch causes the paper to move down one-seventy-second of an inch. If the switch is held down, paper will continue to move in small increments. This switch is active both off line and on line. The alternate TAB CLEAR function of this switch is active only in the vertical format control mode. When active, pressing this pushbutton switch clears the vertical tab at the present line.

4.2.7 **FORM FEED/SET TOP OF FORM SWITCH.** The normal FORM FEED function of this pushbutton switch causes the paper to move to the top of the next form. Contents of the line buffer are printed before paper motion occurs. This switch is active both off-line and on-line. The alternate SET TOP OF FORM function of this switch is active only in the vertical format control mode. When active, pressing this pushbutton switch sets the top of form or reads the FORM LENGTH switch setting.

4.2.8 **LINE FEED/LINE FEED SWITCH.** Each time this pushbutton switch is pressed, the paper moves up one line (twelve steps for six lines per inch and nine steps for eight lines per inch). If the line buffer is not empty, its contents will be printed before paper motion occurs. This switch is active only off-line. The normal and alternate functions of this switch are the same.

4.2.9 **POWER INDICATOR.** The POWER indicator lights when power is applied to the printer.

4.3 AUXILIARY CONTROL PANEL CONTROLS AND INDICATORS

There are three versions of the auxiliary control panel:

Option Type	Configuration Code
Basic	BSC
Forms length and compressed print	FCO
Vertical format control and compressed print	VCO

These panels are illustrated and identified in figure 4-3. The following paragraphs describe the control and indicator functions. The letters in parenthesis after the name of the control or indicator refer to the configuration code of the control panels shown in figure 4-3.

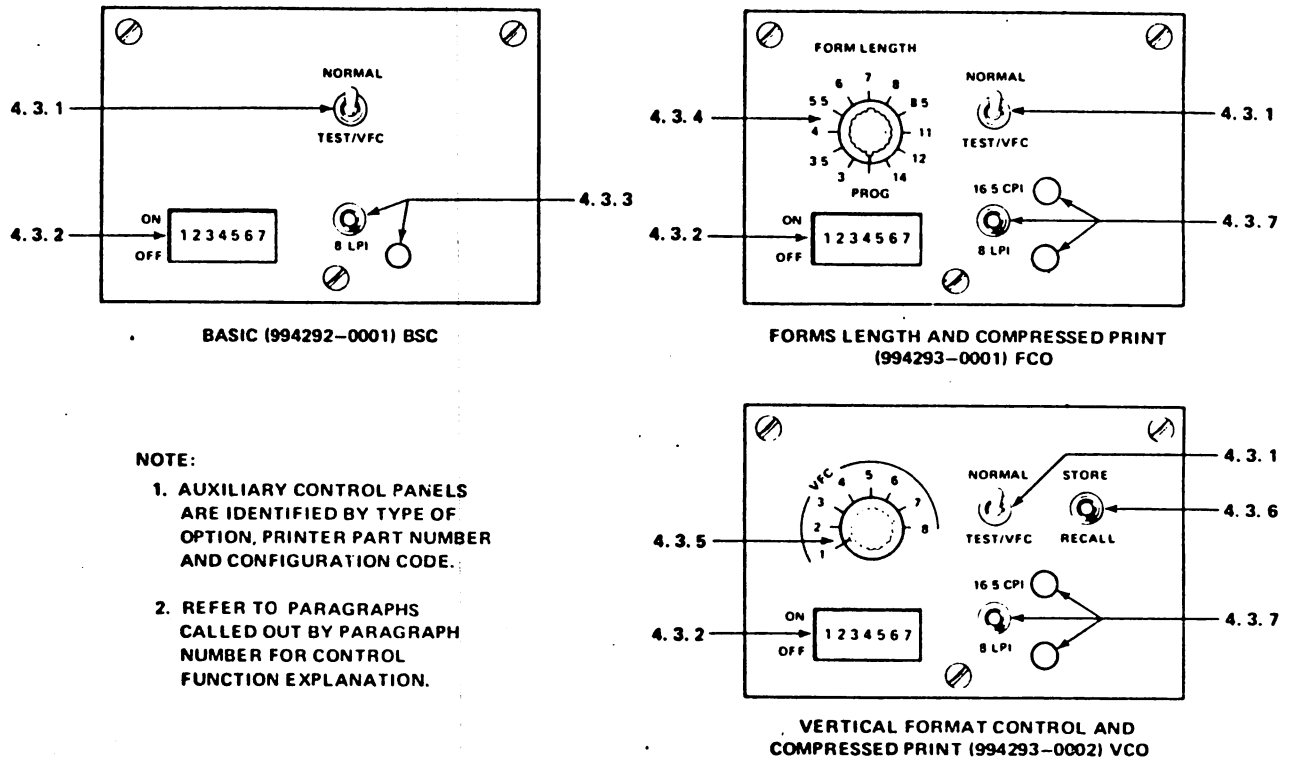


Figure 4-3. Auxiliary Control Panel

4.3.1 **NORMAL/TEST/VFC SWITCH (BSC, FCO, VCO).** In NORMAL position, this switch enables normal operation of the printer. With this switch in TEST/VFC position, pressing the ON LINE switch will initiate a rotating character test pattern (barber pole). With this switch in the TEST/VFC position(and as long as the ON LINE indicator is off), the alternate function switches TAB, TAB SET, TAB CLEAR, SET TOP OF FORM and LINE FEED are enabled for vertical format control programming.

4.3.2 **PENCIL SWITCHES (BSC, FCO, VCO).** All auxiliary control panels have seven pencil switches. Switches 1, 2, and 3 are used to select baud rates of 110, 150, 300, 1200, 2400, 4800, or 9600 baud. Switches 4 and 5 are used to select odd, even, or ignore parity. Switch 6 activates the automatic line feed. Switch 7 activates the top of form automatic perforation skip. The automatic performation skip causes the printer to skip three lines before printing the first line of the next form. Changes in pencil switch settings take effect when the printer goes on line.

4.3.3 **8 LPI SWITCH AND INDICATOR (BSC).** In the 8 LPI position, this momentary three-position, center-off switch selects the eight lines per inch mode. This mode is also software programmable through the communications interface. This indicator lights when the printer is in the eight lines per inch mode. Reactivating this switch returns the printer to the six lines per inch mode.

4.3.4 **FORM LENGTH ROTARY SWITCH (FCO).** The 12-position FORM LENGTH rotary switch allows the operator to select any one of the following 11 fixed form lengths: 3, 3.5, 4, 5.5, 6, 7, 8, 8.5, 11, 12, and 14 inches. In the PROG position, this switch allows the operator to program form lengths (from 4 to 112 lines) other than the 11 fixed form lengths.

4.3.5 VFC SWITCH (VCO). The eight-position vertical format control channel rotary switch selects one of eight nonvolatile vertical format programs. These eight channels are also software programmable through the communications interface.

4.3.6 STORE/RECALL SWITCH (VCO). In the STORE position, this momentary, three-position, center-off switch stores manually programmed vertical tabs, form length and lines per inch spacing in the selected VFC channel. In the RECALL position, the format program stored in the selected VFC channel is recalled into working memory. STORE and RECALL are active only in the vertical format control mode and both are software programmable through the communications interface.

4.3.7 16.5 CPI/8 LPI SWITCH AND INDICATORS (FCO, VCO). In the 16.5 CPI position, this momentary three-position, center-off switch selects the 16.5 characters per inch compressed print mode. This mode is also software programmable through the communications interface. The 16.5 CPI indicator lights when the printer is in the compressed print mode. Setting this switch to the 16.5 CPI position a second time returns the printer to the standard 10 characters per inch print mode. The printhead initializes to the left margin each time a change is made between 10 and 16.5 characters per inch. In the 8 LPI position, this switch selects the eight lines per inch mode. The 8 LPI indicator lights when the printer is in the eight lines per inch mode. This mode is also software programmable through the communications interface. Setting this switch to the 8 LPI position a second time returns the printer to the six lines per inch mode.

4.4 PAPER LOADING (ALL PRINTERS)

The printer uses continuous form paper with standard feed holes on each edge. Paper widths from 7.62 to 38.1 centimeters (3 to 15 inches) can be accommodated. Using either the rear (path A) chute or bottom (path B) chute (see figure 4-4), multiple-part forms, one original and up to five copies, can be printed on paper with the following weight specifications:

Single part forms:	15 to 20 pound.
Multiple part forms:	Original: 12 to 15 pound.
	Copies, 9 to 12 pound, last copy 15 pound.
Carbon paper:	7½ pound with medium hardness.

Card stock up to 0.1778 millimeter (0.007 inch) thick can be used as single part or last copy only when using the bottom chute. In any case, it is recommended that total form thickness not exceed 0.533 millimeter (0.021 inch). To load paper in printer, refer to figure 4-4 and proceed as follows:

NOTE

It is not necessary to turn the power off when loading paper.

1. Open access door.
2. If left paper feed tractor is not locked in desired position (normally at extreme left margin), loosen lock knob, adjust left paper feed tractor to desired position, and tighten lock knob.
3. Open doors on both paper feed tractors.
4. Using printhead lever, move printhead away from platen.

5. Load paper through rear chute as follows (or proceed to Step 6 for bottom loading):

   a. Place paper supply behind printer.

   NOTE

   If the printer is mounted on a table and the paper supply is placed on the floor, be sure the rear edge of the printer is located slightly over the edge of the table top to prevent the paper from catching on the edge of the table.

   b. Feed paper (path A, printing side down) into paper chute at bottom rear of printer until paper appears at platen.

   c. Proceed to step 7.

6. Load paper through bottom chute as follows:

   a. Align printer bottom chute with slot in table.

   b. Place paper supply under table and align paper path to prevent paper edges from rubbing against table slot or ends of bottom chute.

   c. Feed paper (path B, printing side forward) into bottom chute of printer until all paper appears at platen.

7. Loosen lock knob on right tractor and adjust tractor as necessary to accommodate paper.

8. Place top of paper in both tractors and check that holes in paper edges are engaged in corresponding tractor pins.

9. Close tractor doors. Adjust right tractor as necessary to remove slack in paper and tighten lock knob.

10. Check that paper supply is aligned with paper chute (paper must not rub sides of chute) and that paper out switch is actuated.

11. Readjust printhead adjust level and close access door.

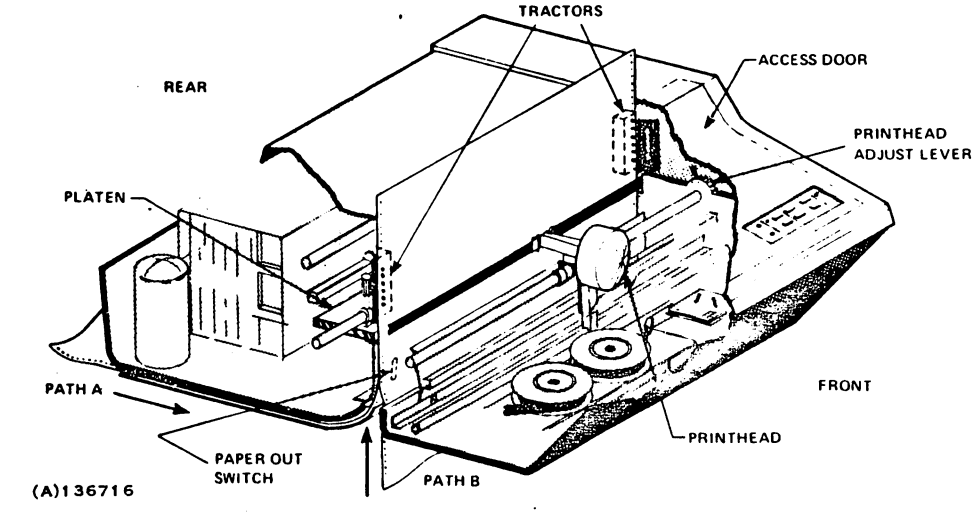


Figure 4-4. Paper Loading Diagram

4.5 RIBBON INSTALLATION (ALL PRINTERS)

The printer uses a ½-inch wide nylon ribbon (TI part number 996241-0001 or equivalent) mounted on two 3-inch spools. To install the ribbon, refer to figure 4-5 and proceed as follows:

1. Check that the power switch (at left rear of printer when facing the front of printer) is set to OFF (down).

2. Check that ribbon is attached to both spools.

3. Open access door.

4. (If original printhead clearance is to be maintained, note position of printhead adjust lever). Move printhead adjust lever slightly to right and completely toward front of printer (to move printhead away from platen).

5. Place empty spool on left spool hub with feed-out side of spool toward front of printer, and feed ribbon out along ribbon path as shown in figure 4-5.

CAUTION

Check that the ribbon eyelet is located on the side of the left ribbon shift arm closest to the spool hub (otherwise, the ribbon will not reverse). Also check that the ribbon is inside the left end plate (to prevent drag on the ribbon).

6. Place full spool on right spool hub and turn spool hubs as necessary to remove slack from ribbon.

7. Check that the ribbon is centered in slot on right ribbon shift arm. If ribbon is not centered, refer qualified personnel to the *Model 810 Printer Maintenance Manual* for adjustment.

8. If original printhead clearance is desired, return printhead adjust lever to position noted in step 3, otherwise, perform printhead adjustment (paragraph 4.6.3).

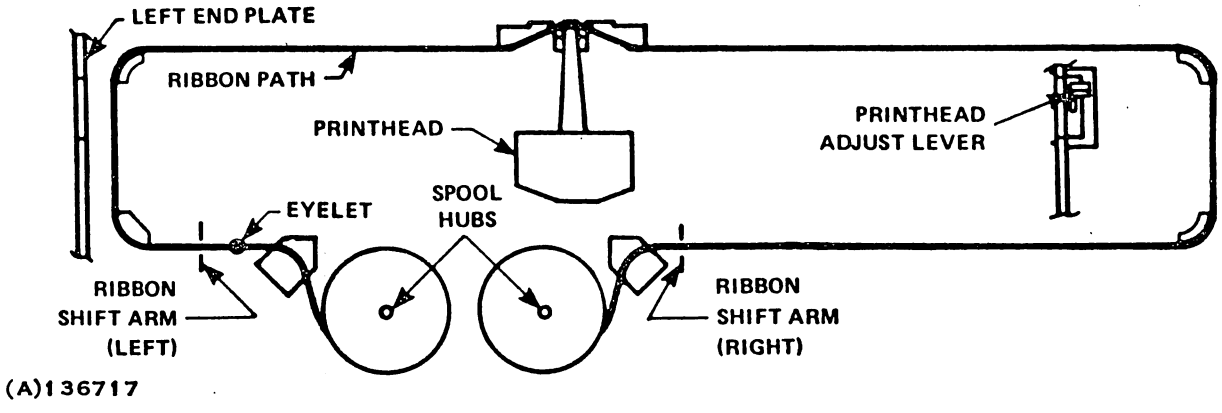


Figure 4-5. Ribbon Installation Diagram

4.6 OPERATING PROCEDURES

Before the printer can be placed in service, the operator must determine the following:

1. Printer configuration: BSC, FCO, or VCO. (See the configuration label on the underside of the access door, or identify the printer from figure 4-3 by the type of auxiliary control panel installed.)

2. Set pencil switches to the following positions:

Switch	1	2	3	4	5	6	7
Position	ON	OFF	ON	ON	OFF	ON	ON

Perform those procedures in the following paragraphs which apply to your printer configuration and your printing requirements. The title of each paragraph identifies (in parenthesis) the printer configuration to which it applies. If the printer does not perform as indicated in the following procedures or if the ERROR indicator 'lights' or if the audible tone (bell) is heard, consult the self-help procedures in paragraph 4.7.

4.6.1 TURN-ON PROCEDURE (ALL PRINTERS). To turn the printer "on", proceed as follows:

CAUTION

To prevent possible damage to the printhead, do not print without a ribbon or with paper too narrow for the printed line width. If the full 132-column line is used, the paper must be at least 14-7/8 inches wide for the standard 10 characters per inch spacing and at least 8 1/2 inches wide for the optional (FCO and VCO printers only) 16.5 characters per inch compressed print spacing.

1. Check that ribbon and paper are properly installed. (See paragraph 4.4 for paper loading and paragraph 4.5 for ribbon installation.)

2. Set power ON/OFF switch (at left rear of printer) to ON (up) position.

3. Observe that control panel ON LINE indicator is off and that printhead is at left margin.

At this point, the printer has the following initial conditions:

- The printer is off line.
- The form length is 11 inches for the BSC printer and also for the FCO printer if the auxiliary control panel FORM LENGTH switch is in the PROG position. The FCO printer is set to any fixed form length selected on the FORM LENGTH switch. The VCO printer is set to the form length of the last vertical format stored or recalled.
- The line spacing is six lines per inch for the BSC and FCO printers. The VCO printer is set to the line spacing of the last vertical format stored or recalled.
- The character spacing is 10 characters per inch.

- All horizontal tabs are cleared from the working memory. (Horizontal tabs can only be set by software.)
- All vertical tabs are cleared from the working memory of the BSC and FCO printers. The VCO printer retains the vertical tab settings of the last vertical format stored or recalled.
- The line counter is set to zero, causing the present line location to be the first line of the form.
- The line buffer is empty. (All previous printable characters have been cleared.)

This completes the turn-on procedure if:

- From previous operation, the forms (paper) are aligned as desired and the printhead adjust lever is properly set.
- No changes to the above initial conditions are desired.
- The pencil switches for the baud rate, parity, automatic line feed override, and automatic perforation skip override have been previously set as desired.

To change the printer from its initial conditions status, perform the procedures described in paragraphs 4.6.2 through 4.6.14 as applicable. After all applicable procedures have been completed, the printer is ready to receive data when placed on line by the operator or by receiving a DC1 (select) ASCII code character through the communications line. All the software commands listed in Section III can now be performed (to the degree permitted by the printer options) by the sending device.

4.6.2 TOP OF FORM ADJUSTMENT (ALL PRINTERS). With the power "on" (paragraph 4.6.1), set the top of form as follows:

CAUTION

To prevent possible damage to the printhead, do not print without a ribbon or on paper too narrow for the printed line width. If the full 132-column line is used, the paper must be at least 14-7/8 inches wide for the standard 10 characters per inch spacing and at least 8 1/2 inches wide for the optional (FCO and VCO printers only) 16.5 characters per inch compressed print spacing.

1. Press the FORM FEED switch.
2. Press the FORM ALIGN (up) switch or the FORM ALIGN (down) switch until the printhead is at the approximate point where the first line of the form is to be printed.

NOTE

A finer top of form adjustment can be made during the self-test (paragraph 2.10.1), or while data is being received, simply by pressing the FORM ALIGN (up) or FORM ALIGN (down) switch until the next line printed is exactly aligned on the form. If the printed line appears to move away from the desired line location, use the other FORM ALIGN switch.

3. If desired, place a piece of adhesive tape (or similar marker) on a tractor door at the point where the paper perforation is. This can be used as a reference mark for the top of the form.

4.6.3 PRINTHEAD ADJUSTMENT (ALL PRINTERS). The printhead adjust lever controls the clearance between the platen and the face of the printhead. This clearance must be adjusted in accordance with the thickness of the forms used. With the power "on" (paragraph 4.6.1), adjust the printhead for optimum print quality as follows:

CAUTION

To prevent possible damage to the printhead, do not print without a ribbon or on paper too narrow for the printed line width. If the full 132-column line is used, the paper must be at least 14-7/8 inches wide for the standard 10 characters per inch spacing and at least 8-1/2 inches wide for the optional (FCO and VCO printers only) 16.5 characters per inch compressed print spacing.

1. Open the access door.
2. Move printhead adjust lever slightly to right and completely toward front of printer.
3. Check that ribbon and paper are installed.

NOTE

The printhead adjustment can be made while the printer is on line and data is being printed, or while the self-test rotating character pattern (barber pole) is being printed.

4. (If barber pole method is to be used.) Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.
5. Press control panel ON LINE switch to start printing.
6. Move printhead adjust lever toward rear of printer until print quality is satisfactory.
7. If smudging occurs, printhead is too close and must be backed off.
8. Move printhead adjust lever until nearest detent is engaged.
9. (If barber pole method has been used.) Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.
10. Close access door.

4.6.4 LINES PER INCH SPACING (ALL PRINTERS). With the power on (paragraph 4.6.1), and if the eight lines per inch spacing is desired, proceed as follows:

1. Open access door.
2. Momentarily set auxiliary control panel 8 LPI (or 16.5 CPI/8 LPI) switch to 8 LPI.

3. Observe that 8 LPI indicator lights.

4. Close access door.

To return to the six lines per inch spacing (initial conditions), repeat the above procedure except observe that the 8 LPI indicator goes out.

4.6.5 CHARACTERS PER INCH SPACING (FCO, VCO). With the power "on" (paragraph 4.6.1), and if the optional 16.5 characters per inch spacing (compressed print) is desired, proceed as follows:

1. Open access door.

2. Momentarily set auxiliary control panel 16.5 CPI/8 LPI switch to 16.5 CPI.

3. Observe that 16.5 CPI indicator lights before next line is printed.

4. Close access door.

To return to the 10 characters per inch spacing (initial conditions), repeat the above procedure except observe that the 16.5 CPI indicators goes out before the next line is printed.

4.6.6 AUTOMATIC LINE FEED OVERRIDE (ALL PRINTERS). Open the access door and set auxiliary control panel pencil switch 6 to ON for automatic line feed override, or to OFF for automatic line feed. Close the access door.

4.6.7 AUTOMATIC PERFORATION SKIP OVERRIDE (ALL PRINTERS). Open the access door and set the auxiliary control panel pencil switch 7 to ON for automatic (three-line) perforation skip override, or to OFF for automatic (three-line) perforation skip. Close the access door.

4.6.8 VERTICAL TAB SETTING (ALL PRINTERS). All printers have a working memory in which vertical tabs can be set and retained as long as the power is "on". With the power "on" (paragraph 4.6.1) set vertical tabs as follows:

1. If form is not aligned as desired, perform top of form adjustment (paragraph 4.6.2).

2. Open access door.

3. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

4. Press control panel LINE FEED switch until line to be tab-set is at printhead.

5. Press control panel TAB SET switch.

6. Repeat steps 4 and 5 as necessary to set all desired tabs.

7. Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.

8. Press control panel FORM FEED switch.

9. Verify tab settings as follows:

   a. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

   b. Press control panel TAB switch and observe that desired (tab-set) line is at printhead. If desired (tab-set) line is not at printhead, press control panel TAB CLEAR switch. (This clears unwanted tabs from working memory.)

   c. Repeat Step 1 as necessary to verify that only desired tabs are now set.

   d. After last desired tab has been verified, press control panel TAB switch and observe that next form is aligned as desired in Step 1 (or top of form is at reference mark).

   e. Repeat Step D as necessary to clear unwanted tabs from working memory.

   f. Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.

10. Close access door.

4.6.9 VERTICAL TAB CLEARING (ALL PRINTERS). All printers have a working memory in which vertical tabs can be set (paragraph 4.6.8) and retained as long as the power is "on". With the power "on" (paragraph 4.6.1), these tabs can be cleared as follows:

1. Press FORM FEED switch.

2. Open access door.

3. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

4. Press control panel TAB switch.

5. If tab at the line location is to be cleared, press control panel TAB CLEAR switch; if not, press control panel TAB switch.

6. Repeat Step 5 as necessary to clear all unwanted tabs.

7. When top of the next form is reached, set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.

8. Close access door.

For the BSC and FCO printers, all vertical tabs can be simultaneously cleared by turning the power "off" (paragraph 4.6.14). This returns these printers to the initial conditions listed in paragraph 4.6.1 when the power is again turned "on".

4.6.10 FIXED FORM LENGTH SELECTION (FCO). On the FCO printer, the operator can select any one of 11 fixed form lengths. Selecting a fixed form length clears any previous form length (whether set by the operator or by software) from the working memory. With power "on" (paragraph 4.6.1), select a fixed form length as follows:

1. If form is not aligned as desired, perform top of form adjustment (paragraph 4.6.2).

2. Open access door.

3. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

4. Set auxiliary control panel FORM LENGTH rotary switch to desired fixed form length position.

5. Press control panel SET TOP OF FORM switch.

6. Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.

7. Close access door.

4.6.11 **PROGRAMMING FORM LENGTH (FCO).** On the FCO printer, the operator can program any form length from 4 to 112 lines. Programming the form length clears any previous form length (whether set by the operator or by software) from the working memory. With the power "on" (paragraph 4.6.1), program the form length as follows:

1. If form is not aligned as desired, perform top of form adjustment (paragraph 4.6.2).

2. Open access door.

3. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

4. Set auxiliary control panel FORM LENGTH rotary switch to PROG.

5. Press control panel SET TOP OF FORM switch. (This sets the line counter to zero.)

6. Press control panel LINE FEED switch until next form is aligned as desired (or paper perforation is at reference mark).

7. Press control panel SET TOP OF FORM switch.

8. Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL. (This sets the form length.)

9. Close access door.

4.6.12 **STORING VERTICAL FORMAT (VFO).** The VFO printer has a special vertical format control which can store a different vertical format in each channel of an eight-channel memory. Vertical formats can be stored by the operator or by software. The vertical format information which can be stored consists of the form length, the vertical tab locations, and the lines per inch spacing. The stored vertical formats are retained even with the printer power off. With the power "on" (paragraph 4.6.1), a vertical format is first entered into working memory and then stored as follows:

1. If form is not aligned as desired, perform top of form adjustment (paragraph 4.6.2).

2. Open access door.

3. Set auxiliary control panel VFC rotary switch to desired channel position.

4. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

5. If eight lines per inch spacing is desired, momentarily set auxiliary control panel 8 LPI (or 16.5 CPI/8 LPI) switch to 8 LPI and observe that 8 LPI indicator lights.

6. Press control panel SET TOP OF FORM switch. (This sets the line counter to zero.)

7. Press control panel LINE FEED switch until line to be tab-set is at printhead.

8. Press control panel TAB SET switch.

9. Repeat Steps 7 and 8 as necessary to set all desired tabs.

10. Press control panel LINE FEED switch until next form is aligned as desired (or paper perforation is at reference mark).

11. Press control panel SET TOP OF FORM switch.

12. Momentarily set auxiliary control panel STORE/RECALL switch to STORE.

13. Verify vertical format as follows:

    a. Press control panel TAB switch and observe that desired (tab set) line is at printhead. If desired (tab-set) line is not at printhead, press control panel TAB CLEAR switch. (This clears unwanted tabs from memory.)

    b. Repeat Step a as necessary to verify that only desired tabs are set.

    c. After last desired tab has been verified, again press control panel TAB switch and observe that perforation of next form is aligned as desired (or paper perforation is at the reference mark). If not, press control panel TAB CLEAR.

    d. Repeat Step c as necessary to clear unwanted tabs from memory.

14. Momentarily set auxiliary control panel STORE/RECALL switch to STORE.

15. Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.

16. Close access door.

4.6.13 RECALLING VERTICAL FORMAT (VFO). The VFO printer has a special vertical format control which allows previously stored vertical formats to be recalled into the working memory by the operator or by software. With the power "on" (paragraph 4.6.1), a vertical format in any one of the eight channels of memory can be recalled into the working memory by the operator as follows:

1. If form is not aligned as desired, perform the top of form adjustment (paragraph 4.6.2).

2. Open access door.

3. Set auxiliary control panel VFC rotary switch to desired channel.

4. Set auxiliary control panel NORMAL/TEST/VFC switch to TEST/VFC.

5. Momentarily set auxiliary control panel STORE/RECALL switch to RECALL.

6. Set auxiliary control panel NORMAL/TEST/VFC switch to NORMAL.

7. Close access door.

4.6.14 **TURN-OFF PROCEDURE (ALL PRINTERS).** To turn off the printer requires only that the power ON/OFF switch (at the left rear of the printer when facing the front of printer) be set to OFF. It should be remembered that when power is again applied to the printer, it will return to certain initial conditions according to the configuration of the printer. If conditions other than these are to be retained, they must be noted and reentered in the printer when power is again applied. For more complete information on the initial conditions of each printer configuration, refer to the turn-on procedure (paragraph 4.6.1).

4.7 SELF-HELP PROCEDURES

These produres (table 4-1) are designed to aid the operator in correcting minor problems in the operation of the printer. If these procedures do not correct the problem, qualified service personnel should refer to the *Model 810 Printer Maintenance Manual* for troubleshooting.

4.8 OPERATOR MAINTENANCE PROCEDURES

Operator maintenance consists of cleaning, lubrication, battery replacement, and fuse replacement as covered in the following paragraphs.

4.8.1 **PREVENTIVE MAINTENANCE SCHEDULE.** To ensure proper operation of the printer in normal usage, the following schedule must be followed:

Procedure	Period
Vacuuming	Every month
Oiling Guide Rods and Cleaning Ribbon Guides	Every two months
Optional Battery Replacement	Every 15 months

4.8.2 **VACUUMING PRINTHEAD AREA.** Carefully vacuum paper chaff from printhead and ribbon path areas.

Table 4-1. Self-Help Procedures

Problem	Probable Cause	Corrective Action
Power cord plugged in and power ON/OFF switch set to ON, but POWER indicator does not light.	Blown ac power fuse.	Replace blown fuse. (Refer to the Fuse Replacement procedure in paragraph 4.8.5).
PAPER OUT indicator lights and bell beeps five times (printer stops printing).	The printer is out of paper.	When the PAPER OUT indicator is on, a line will be printed each time the RESET switch is pressed. Press the RESET switch as often as required to complete the form, then load new forms in the printer. (Refer to the Paper Loading procedure in paragraph 4.4 or to the instruction label on the underside of the access door). After the new forms have been loaded, press the RESET switch to resume printing.
ERROR indicator blinks and bell beeps five times (printer stops printing).	Printhead movement blocked by paper jam or other obstruction.	Remove the paper jam or other obstruction. Press the RESET switch to resume printing.
ERROR indicator lights steady and special parity error characters are printed. are printed.	Parity error. (The printer has received a character code it can not recognize).	Press the RESET switch to turn the ERROR indicator off. Correct the portions of the data which contain the special characters. If parity errors occur frequently, have the communications line checked for excessive electrical noise.

4.8.3 OILING GUIDE RODS AND CLEANING RIBBON GUIDES. Oil guide rods and clean ribbon guides as follows:

CAUTION

Do not use chlorinated hydrocarbons (such as carbon tetrachloride) as a cleaning agent.

1. Clean both guide rods and all ribbon guides with a clean cloth soaked with a small amount of denatured alcohol (TI part number 230007-0000).

2. Lubricate both guide rods with a light machine oil (TI part number 199594-0001).

3. Slide printhead carriage back and forth several times to lubricate printhead carriage bearings.

4.8.4 BATTERY REPLACEMENT (VFO ONLY). The VFO printer uses a Mallory PX14 or equivalent battery (TI part number 996371-0001) which is locally available in most camera supply stores. To replace the battery have qualified service personnel refer to figure 4-6 and proceed as follows.

WARNING

This procedure is for qualified service personnel only. Disconnect power cord to prevent possible electrical shock.

1. Remove five screws securing cover.
2. Remove cover.
3. Loosen three screws on electronics cover.
4. Remove electronics cover.
5. Remove processor board with green ejectors (third board from front of printer).
6. On processor board, remove screw from battery strap and remove battery strap. (Save screw and battery strap.)
7. Install new battery plus (+) side down (touching printed circuit board) in battery retainer.
8. Replace battery strap on battery retainer.
9. Replace screw in battery strap and tighten.
10. Place sticker over battery and mark date of installation on sticker.
11. Replace processor board, electronics cover, and cover.

4.8.5 FUSE REPLACEMENT. To replace the power line fuse, proceed as follows:

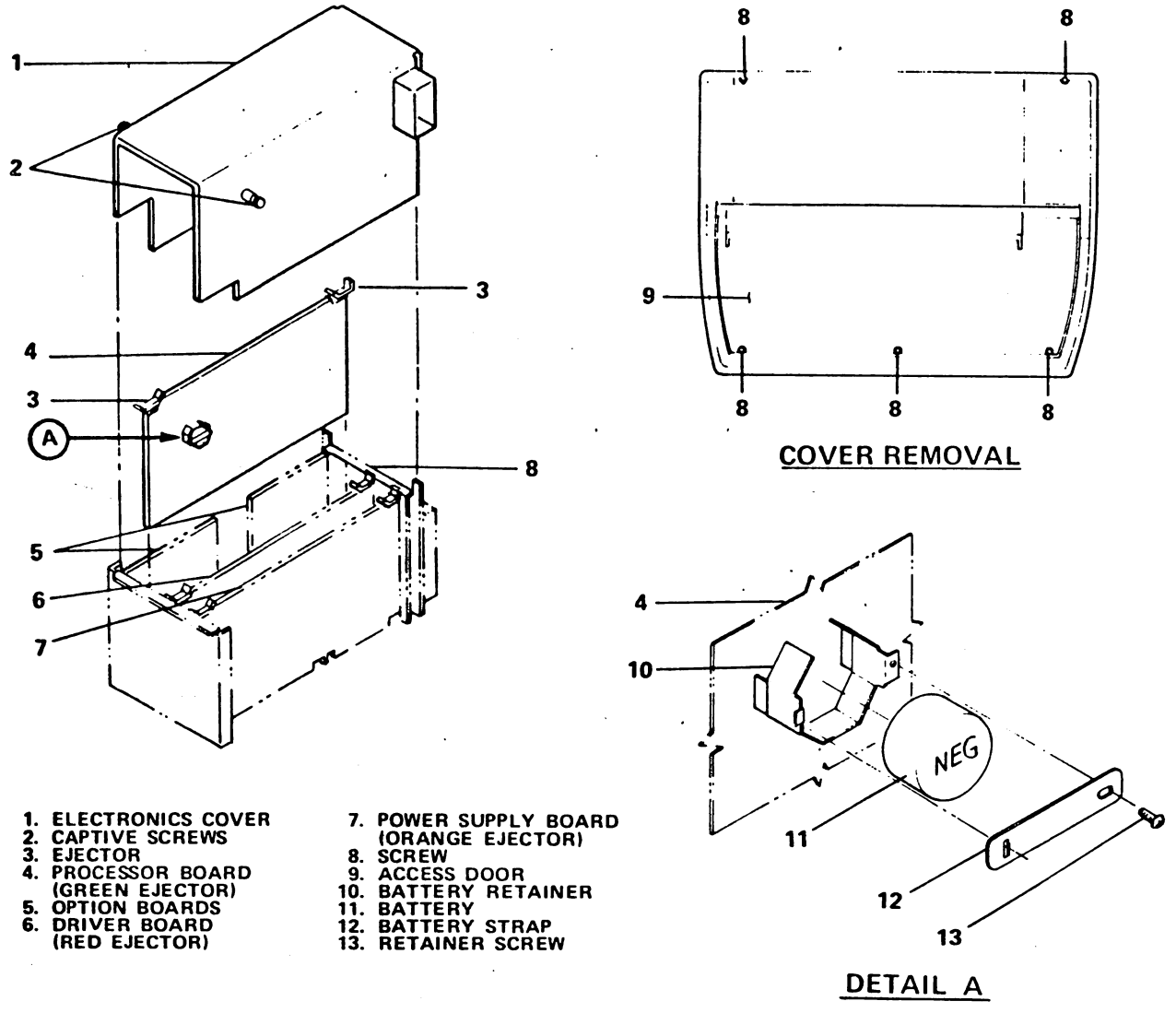
1. At left rear of printer (disconnect power cord, if installed), slide clear plastic cover up to gain access to fuse compartment.
2. Remove line fuse by pulling out and upward on FUSE PULL lever.
3. Push FUSE PULL level down.
4. Select proper fuse as follows:

AC Line Voltage	Fuse Type	TI Part Number
100 or 120 V	5.0 Ampere, 250 V	416434-0503
220 or 240 V	2.5 Ampere, 250 V	416434-0004

5. Place fuse in fuse holder.
6. Slide clear plastic cover down.

7. Check that ON/OFF switch is in OFF position.

8. Connect power cord to receptacle and to power source.



1. ELECTRONICS COVER
2. CAPTIVE SCREWS
3. EJECTOR
4. PROCESSOR BOARD (GREEN EJECTOR)
5. OPTION BOARDS
6. DRIVER BOARD (RED EJECTOR)
7. POWER SUPPLY BOARD (ORANGE EJECTOR)
8. SCREW
9. ACCESS DOOR
10. BATTERY RETAINER
11. BATTERY
12. BATTERY STRAP
13. RETAINER SCREW

Figure 4-6. Optional Battery Replacement

ALPHABETICAL INDEX

INTRODUCTION

The following index lists key words and concepts from the subject material of the manual together with the area(s) in the manual that supply major coverage of the listed concept. The numbers along the right side of the listing reference the following manual areas:

- Sections - References to Sections of the manual appear as "Section x" with the symbol x representing any numeric quantity.
- Appendixes - References to Appendixes of the manual appear as "Appendix y" with the symbol y representing any capital letter.
- Paragraphs - References to paragraphs of the manual appear as a series of alphanumeric or numeric characters punctuated with decimal points. Only the first character of the string may be a letter; all subsequent characters are numbers. The first character refers to the section or appendix of the manual in which the paragraph is found.
- Tables - References to tables in the manual are represented by the capital letter T followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the table). The second character is followed by a dash (-) and a number:

  Tx-yy

- Figures - References to figures in the manual are represented by the capital letter F followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the figure). The second character is followed by a dash (-) and a number:

  Fx-yy

- Other entries in the Index - References to other entries in the index are preceded by the word "See" followed by the referenced entry.