USER INSTRUCTION MANUAL
MODEL ETX™
THERMAL TICKET
PRINTERS
TYPE 2002, 2003

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LIMITED WARRANTY

TERMS

Practical Automation, Inc. warrants each new printer to be free from defects in materials and workmanship to the original purchaser. Our responsibility is limited to repair or replacement of the printer and/or accessory or part thereof at our option for a period of six months for ETX Series printers from the date of shipment, when, in our opinion, such repair or replacement is covered by warranty. When the product is not so covered, it will be repaired at the standard repair rate in effect at the time.

This limited warranty does not extend to any defect, malfunction or failure caused by or resulting from improper service, packing, maintenance or repair, abuse, neglect, accident, or any other cause beyond the control of Practical Automation, Inc., or to any product whose serial number has been removed, altered, replaced, defaced or rendered illegible.

Except and to extent provided herein, Practical Automation, Inc. makes no warranty, either express or implied, including any warranty of merchantability or fitness for a particular purpose.

Practical Automation, Inc. shall not be liable to the purchaser or to any other person or firm for any specified or consequential damages of any kind which result from the use or misuse by any person or loss of profits or product resulting from any defect in or malfunction or failure of this product.

No person, agent, distributor, service facility or company is authorized to change , modify, or amend the terms of this limited warranty in any manner or fashion whatsoever.

WARRANTY PROCEDURE

If you cannot resolve your equipment problem, notify Practical Automation, giving the model and serial number of your equipment. Describe your problem in detail.

Upon receipt of this information, Practical Automation will send you service information if the trouble is easily corrected. If the trouble requires factory service, we will so advise you and provide written return authorization in the case of warranty service. Loaner printers can be shipped within 24 hours during the work week by contacting Practical Automation. Customers are required to pay all shipping charges.

Refer also to the Warranty Terms and Packing and Shipping instructions before returning any equipment.

PACKING AND SHIPPING

1. Pack the unit in the original carton, if possible, using the original packing materials. If the original packing materials are not used please be sure to pack the unit securely. Poor packaging may cause severe damage with is not covered by warranty, will delay return of the repaired unit, and increase the cost to such repairs.
2. Plainly label the carton as FRAGILE.
3. Ship via United Parcel Service, Parcel Post or a freight carrier, insured and PREPAID. Collect shipments will be refused and returned.
4. Enclose a description of the difficulty encountered, being as specific as possible. Reference the unit's model and serial number. If non warranty, specify if an estimate of repairs is desired before work is preformed and to whom this estimate should be sent.
5. Do not return a unit before contacting our Service Department. We will issue a Return Material Authorization number. This number should be prominently displayed on the package and accompanying packing slip. Without an RMA, shipments will be refused at our receiving dock.

Specifications subject to change without notice.

Printed In U.S.A.

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SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This instruction manual provides programming and operating instructions for the Model ETX™ Thermal Ticket Printer, Types 2002 and 2003. (See Figure 1-1.) These high-speed, versatile printers provide flexible font and graphic capabilities to satisfy a wide variety of ticketing requirements and are compatible with all common computer interface configurations.

CAUTION

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

1-3. MODEL DIFFERENCES.

1-4. The main difference between types 2002 and 2003 is the ticket width. Type 2002 is designed to print 2-inch wide tickets, and type 2003 is designed to print 3.25-inch wide tickets. Standard ticket length is 5.5 inches; however, non-standard ticket lengths, from a minimum of approximately 2.5 inches to a maximum of 10.2 inches, can also be accommodated in the standard 200 dpi mode. (Programs written for 100 dpi dot density can be executed by reconfiguring the operating mode through front-panel switches.)

NOTE

Non-standard ticket lengths can be accommodated provided that the pre-printed registration marks on the ticket stock are positioned in accordance with Figure 1-2.

1-5. DESCRIPTION.

1-6. General. Model ETX™ printers produce an image on a ticket by means of heat. Ticket stock is moved through the printer by a stepper motor, and ticket stock position is sensed by two photocells. As the ticket moves through the printer, control and print data received over the printer interface and interpreted by a printer controller activate heat elements of a printhead. The activated heat elements cause a chemical reaction with the coating of the ticket stock, thereby producing black dot images on the ticket. Data is printed column by column. When all ticket data has been printed, the ticket is cut and ejected. The main components of the printer are a printhead, a stepper motor, a printer controller, a paper cutter, and a power supply.

1-7. Printhead. The printhead consists of square heat elements, each of which produces a 0.005-inch dot on the ticket when activated. Print data received over the printer interface is converted to the corresponding dot pattern structure by the printer controller and is stored. As the ticket stock is moved through the printer, column by column, the stored print data activate the proper heat elements of the printhead to produce the required dot pattern for each column. All selected heat elements in each column are activated simultaneously. Dot data for each column are clocked out serially to the printhead and, after all data for the column are loaded, the printhead is energized for approximately 1 millisecond to generate the printout.

1-8. Stepper Motor. The stepper motor is a 2-phase dc motor which moves the ticket stock through the printer in 0.005-inch increments. It is controlled by logic circuits on the printer controller, and can move tickets into or out of the printer.

1-9. Printer Controller. The printer controller is a microprocessor-based, solid-state device designed to perform all printer control functions. All components are mounted on one PC board. Connectors are provided for electrical connections to the front panel controls, print mechanism, power supply and to the I/O ports. The following functions are standard:

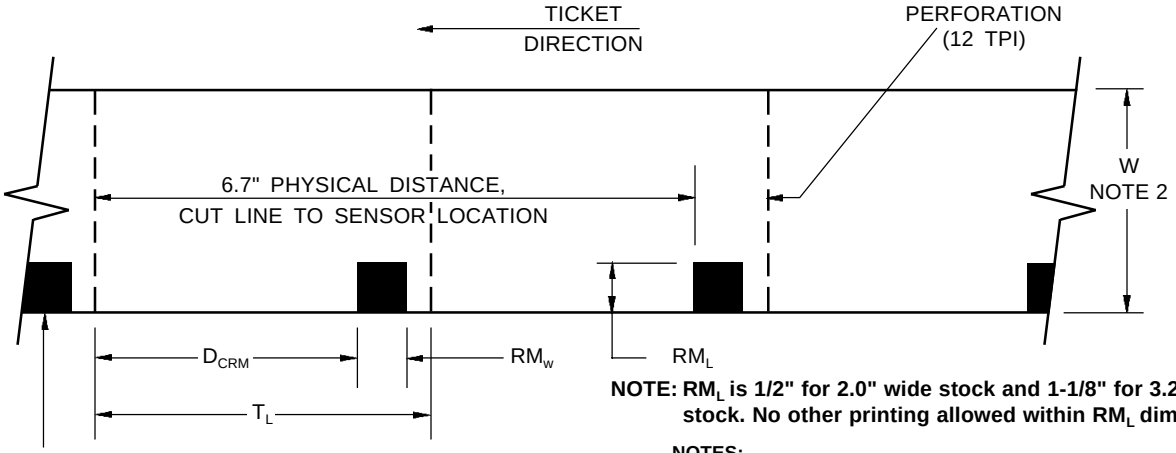
- **a.** Microprocessor control
- **b.** Character generation
- **c.** Serial interface
- **d.** Parallel interface
- **e.** Data buffers
- **f.** Dot addressable graphics
- **g.** Printhead drive electronics
- **h.** Motor controls
- **i.** Ticket stock position sensing
- **j.** Paper cutter drive
- **k.** Operator controls and displays
- **l.** Diagnostics
- **m.** DRAM image memory

1-10. Paper Cutter. The integral paper cutter cuts the ticket stock when printing of a ticket has been completed. Operation is controlled by the printer controller.

1-11. Power Supply. The power supply is a switching regulator supply designed to supply all power requirements of the printer controller and print mechanisms. It can be supplied for use with either 115 or 230 vac, 45 to 65 Hz ac lines. (The power circuits are factory wired per the customer order.) A line switch, line filter, and fuse are all included. Protective circuitry shuts down the power supply automatically if certain failure modes or overloads are detected to protect critical printer elements against damage.

1-12. SPECIFICATIONS.

1-13. Specifications for the printer are listed in Table 1-1.



NOTE: RM_L is 1/2" for 2.0" wide stock and 1-1/8" for 3.25" wide stock. No other printing allowed within RM_L dimension.

NOTES:
1. Thermally active surface opposite side.
2. Standard width 2.0" and 3.25" ±.015"

BLACK INK SPECIFICATION
Mfg By: Water Ink Technology
Mfg No: WTL004925 or Equivalent
Light Absorbing Ink.

RECOMMENDED:

Ticket Material:	APPLETON T0962A OPTIMA or equivalent
Thickness:	7.5 MILS ± 10%
Basic Weight (24" x 36"):	107# (500 Shts.)
Background Reflectance:	81% minimum
Color:	White
Image Color:	Black
Effective Activation Temp.:	185ºF/85ºC
Optium Activation Temp:	248ºF/120ºC
Image Intensity:	1.28 - 0.86

REGISTRATION MARK:

1/5 of light background, yielding 5:1 contrast ratio to infrared light

REGISTRATION MARK MUST BE POSTIONED ACCORDING TO FOLLOWING FORMULA:

$D_{CRM} = 6.7" - (T_L \times m)$

Where:

D_{CRM} = distance from cut line to registration mark

T_L = ticket length in inches

RM_W = registration mark width (.375" min.)

6.7" = mechanical separation from cut line to sensor

$m = 6.7"/T_L$ (multiple of tickets within 6.7" separation; integer value)

Examples:

$T_L = 5.5"$

$m = 6.7"/5.5" = 1$

$D_{CRM} = 6.7" - (5.5 \times 1) = 1.2"$

$T_L = 2.5"$

$m = 6.7"/2.5" = 2$

$D_{CRM} = 6.7" - (2.5" \times 2) = 1.7"$

NOTE

To avoid having the registration mark printed over the cut line (perforation), the ticket length (T_L) must be:

$$T_L \geq (D_{CRM} + RM_W)$$

or

$$T_L \leq D_{CRM}$$

Continued on next page.

Figure 1-2. Registration Mark Positioning Requirements for Non-standard Ticket Lengths (Sheet 1 of 2)

Often Asked Questions

Q1 What is the minimum size registration mark which can be used?

A1: The minimum mark width $RM_{W\text{-}Min}$ is 0.375" for the dimension which runs along the ticket's length. The minimum length RM_L is 0.5" for the dimension which runs along the ticket's width.

Q2 What is the location for these minimum marks?

A2: The center line for the sensors is 0.250" from the edge of the ticket for a 2" wide ticket printer. It is 0.875" from the edge of the ticket for a 3.25" wide ticket printer. The minimum marks are to be located along this centerline axis and placed on the calculated D_{CRM} dimension from the perforation (cut line).

Q3 What is the minimum width of the clear zone (area free of all printing except the registration mark)?

A3: The minimum clear zone is 0.4" wide running along the sensor centerline axis and extending the full length of the ticket.

Q4 What is the maximum ticket length?

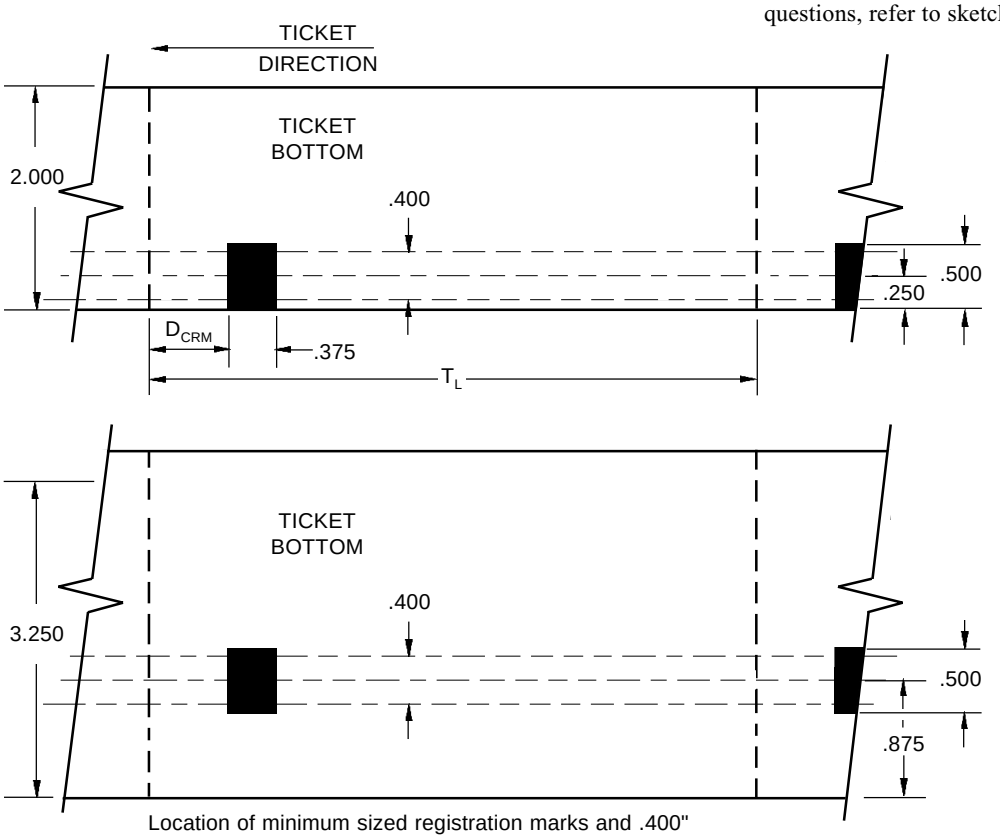
A4: For 200 DPI operation $T_{L\text{-}Max}$ = 10.25"; for 100 DPI emulation mode $T_{L\text{-}Max}$ = 20.5".

Q5 What is the minimum ticket length T_L?

A5: $T_{L\text{-}Min}$ = 2.5".

Q6 Is there a table of calculated D_{CRM} values for typical ticket lengths T_L?

A6: For this table and illustrations for the above questions, refer to sketch below.



Location of minimum sized registration marks and .400" wide clear of printing zone for both a 2" and 3.25" ticket

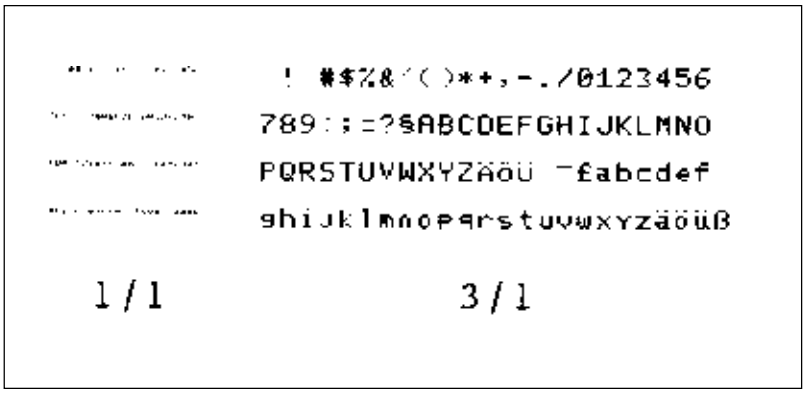
T_L	D_{CRM}
3.0	0.7
4.0	2.7
5.0	1.7
5.5	1.2
6.0	0.7
6.5	0.2
7.0	6.7
7.5	6.7
8.0	6.7
10.0	6.7

Note: All dimensions are in inches

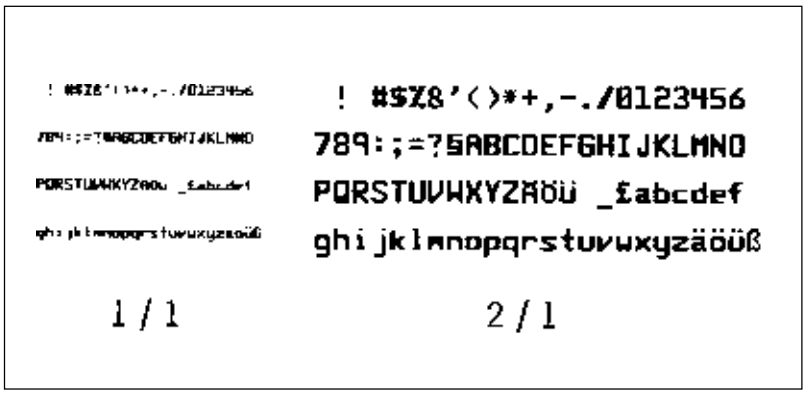
Figure 1-2. (Sheet 2 of 2)

TABLE 1-1. SPECIFICATIONS

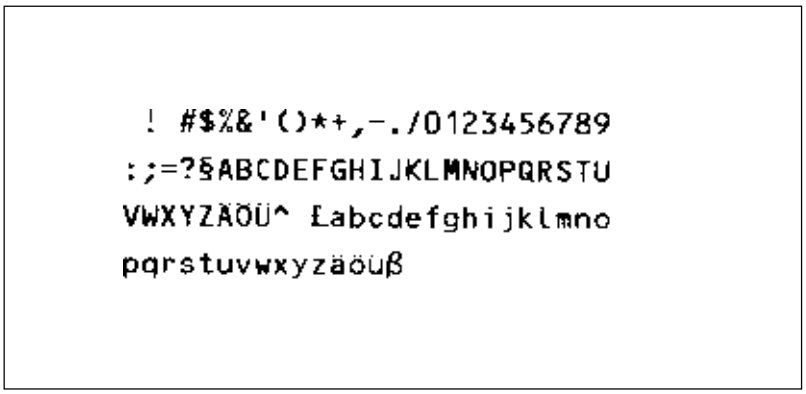
Characteristic	Specifications
Ticket Size:	
Model 1002	2 X 8.5 (max) inches
Model 1003	3.25 X 5.5 (max) inches
Print Technique	Thermal dot matrix
Dot Density	101.6 dpi
Print Speed	7.8 inches per second, maximum
Dot Spacing	0.010 inch
Font Types	5 x 7, 8 x 16, 17 x 31 (OCRA) 17 x 31 (OCRB), 5 x 9 (OCRA), and 30 X 52 (OCRB), programmable (Figure 1-3)
Enlarged Characters	Height and width expansion, separately programmable
Inverted and/or Rotated Characters	Programmable, NR, right (+90°), upside down (180°), left (-90°)
Character Sets	128 element standard ASCII, German character set, OCRA, OCRB, and British pound sign (Figure 1-4)
Print Buffer	12 kB circular
Graphics	Fully dot addressable
Resident Bar Codes	Code 39, Interleaved 2 of 5, EAN13, EAN8, UPC, USS-CODABAR, and Code 128, normal or expanded, with or without human readable interpretation line
Downloadable Fonts	4 sizes rotated and non rotated
Ticket Stock	Appleton T08620A or Ricoh 120TLA-TAG or equivalent
Interface	Centronics parallel and serial RS-232C
Input Voltage	115 or 230 vac (per customer order), 45 to 65 Hz
Operating Temperature	+5°C to +40°C
Dimensions	9" W X 12" H X 18-3/4" D (approx.)
Weight	21 lbs. (9 kg.)



Font 1 (5 x 7)

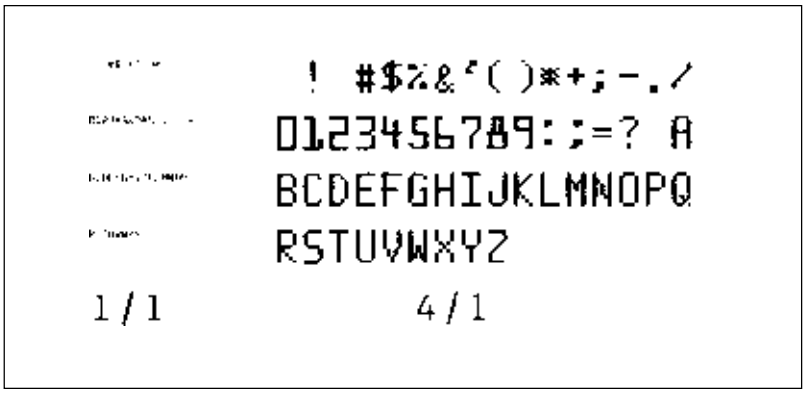


Font 2 (8 x 16)

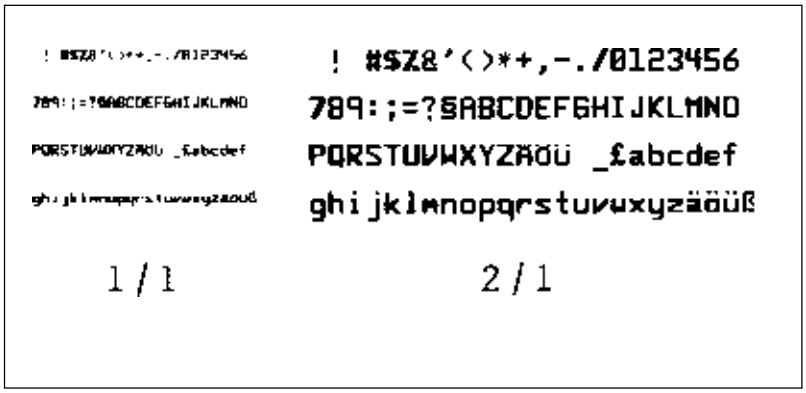


Font 3 (17 x 31) OCRB

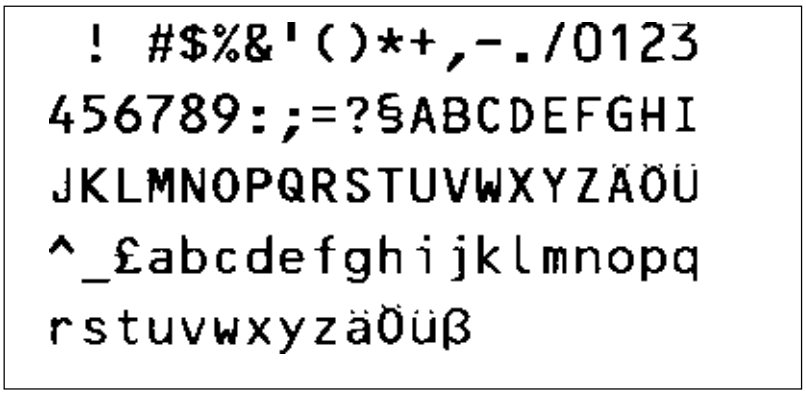
Figure 1-3. Printer Fonts (Sheet 1 of 5)



Font 4 (5 x 9) OCRA

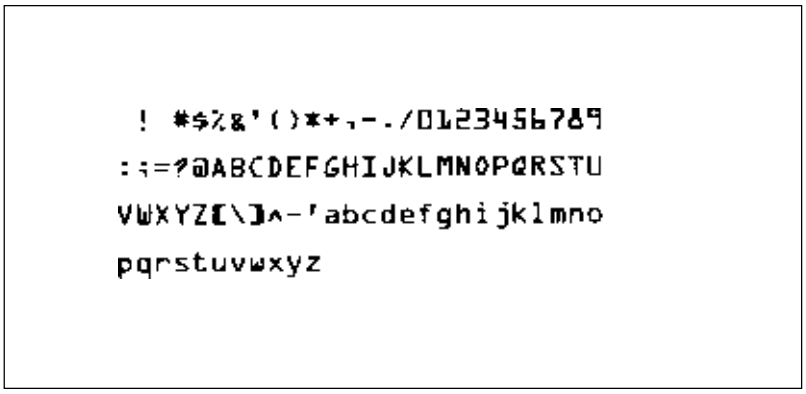


Font 5 (8 x 16) — Duplicate of Font 2, or space for customized font

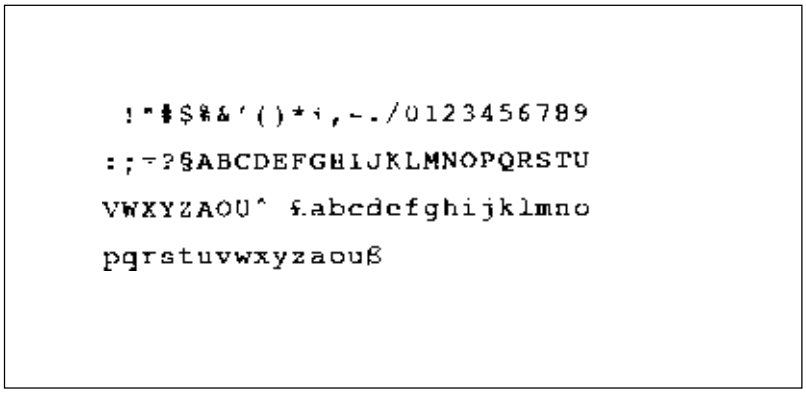


Font 6 (30 x 52) OCRB

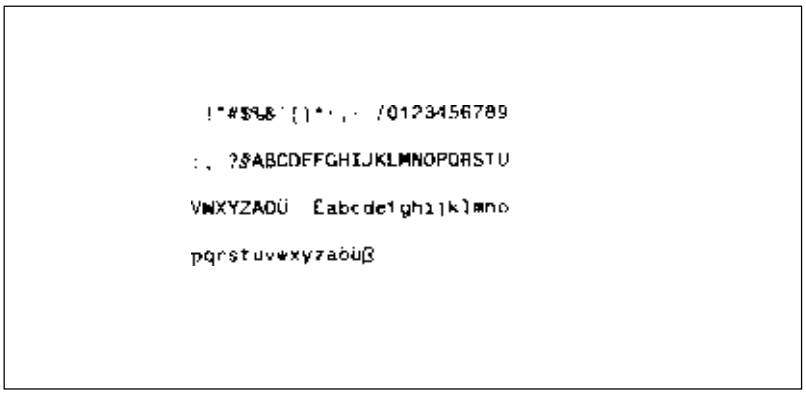
Figure 1-3. Printer Fonts (Sheet 2 of 5)



Font 7 (17 x 31) OCRA

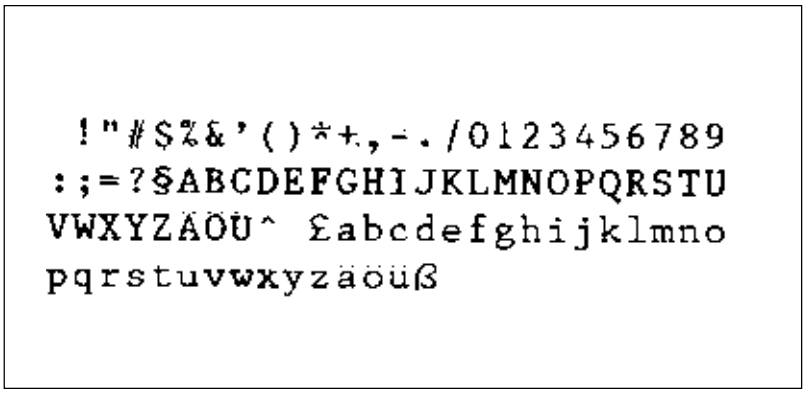


Font 8 (18 x 30) Courier

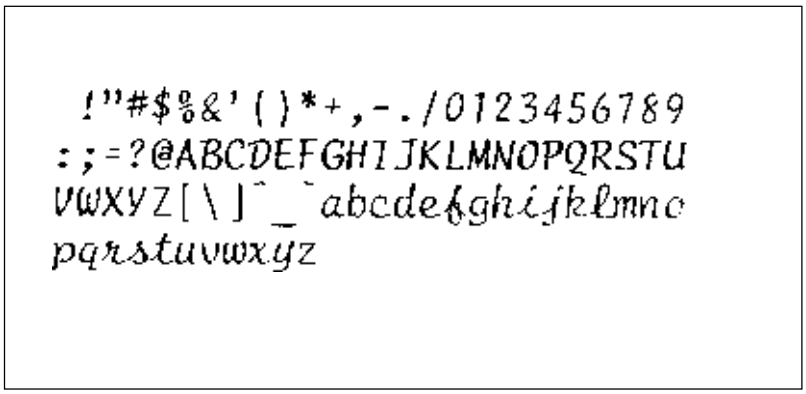


Font 9 (13 x 30) OCRB

Figure 1-3. Printer Fonts (Sheet 3 of 5)

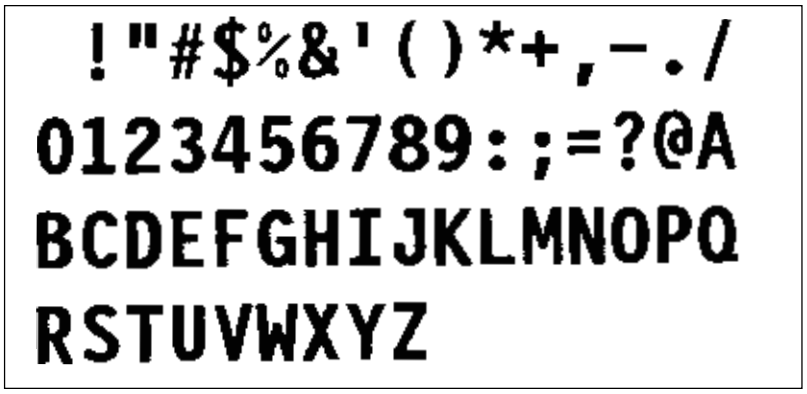


Font 10 (25 x 41) Bold Prestige

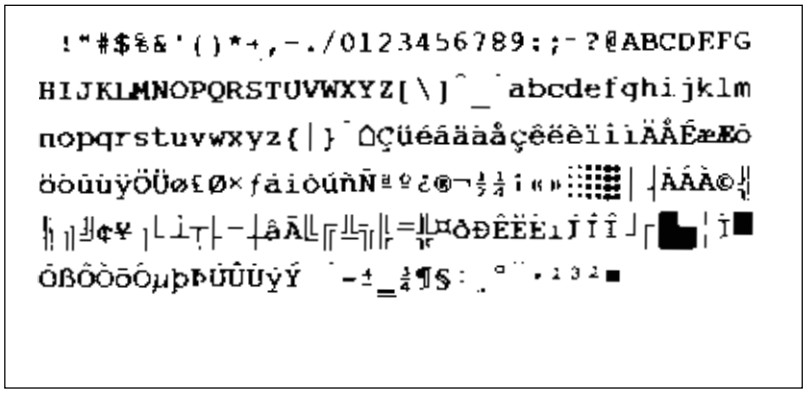


Font 11 (25 x 49) Script

Figure 1-3. Printer Fonts (Sheet 4 of 5)



Font 12 (49 x 91) Orator



Font 13 (20 x 40) Courier

Figure 1-3. Printer Fonts (Sheet 5 of 5)

ASCII CHARACTER SET

Char.	Dec.	Hex.	Char.	Dec.	Hex.	Char.	Dec.	Hex.
NUL	0	0	+	43	2B	V	86	56
SOL	1	1	'	44	2C	W	87	57
STX	2	2	-	45	2D	X	88	58
ETX	3	3	.	46	2E	Y	89	59
EOT	4	4	/	47	2F	Z	90	5A
ENQ	5	5	0	48	30	[*	91	5B
ACK	6	6	1	49	31	\ *	92	5C
BEL	7	7	2	50	32	] *	93	5D
BS	8	8	3	51	33	^	94	5E
HT	9	9	4	52	34	_ **	95	5F
LF	10	A	5	53	35	` ***	96	60
VT	11	B	6	54	36	a	97	61
FF	12	C	7	55	37	b	98	62
CR	13	D	8	56	38	c	99	63
SO	14	E	9	57	39	d	100	64
SI	15	F	:	58	3A	e	101	65
DLE	16	10	;	59	3B	f	102	66
DC1	17	11	<	60	3C	g	103	67
DC2	18	12	=	61	3D	h	104	68
DC3	19	13	>	62	3E	i	105	69
DC4	20	14	?	63	3F	j	106	6A
NAK	21	15	@ *	64	40	k	107	6B
SYN	22	16	A	65	41	l	108	6C
ETB	23	17	B	66	42	m	109	6D
CAN	24	18	C	67	43	n	110	6E
EM	25	19	D	68	44	o	111	6F
SUB	26	1A	E	69	45	p	112	70
ESC	27	1B	F	70	46	q	113	71
FS	28	1C	G	71	47	r	114	72
GS	29	1D	H	72	48	s	115	73
RS	30	1E	I	73	49	t	116	74
US	31	1F	J	74	4A	u	117	75
SP	32	20	K	75	4B	v	118	76
!	33	21	L	76	4C	w	119	77
"	34	22	M	77	4D	x	120	78
#	35	23	N	78	4E	y	121	79
$	36	24	O	79	4F	z	122	7A
%	37	25	P	80	50	{ *	123	7B
&	38	26	Q	81	51	¦ *	124	7C
'	39	27	R	82	52	} *	125	7D
(	40	28	S	83	53	¯ ****	126	7E
)	41	29	T	84	54	DEL	127	7F
*	42	2A	U	85	55			

SPECIAL CHARACTER SET — NOT TO SCALE

ASCII	GERMAN	OCRA	BRITISH	DEC.	HEX.
@	§			64	40
[	Ä			91	5B
\	Ö			92	5C
_		⅂		95	5F
`		⅃	£	96	60
{	ä			123	7B
¦	ö			124	7C
}	ü			125	7D
~	ß	⅄		126	7E

* - German characters
** - OCRA special characters
*** - OCRA special character or British pound sign
**** - OCRA special character or British pound sign

Figure 1-4. Character Sets

SECTION II
PREPARATION FOR USE

2-1. UNPACKING AND INSPECTION.

2-2. Unpack the printer as follows:

a. Inspect the shipping container for any signs of damage. If any damage is noted, file a claim with the freight carrier, not with Practical Automation.

b. Move the printer in its shipping container to the point where it is to be used. Make sure that the shipping container is right side up.

c. Open the shipping container carefully. Grasp the printer and lift it straight out.

d. Place the printer on a flat, firm surface. Remove any packing material. Inspect the printer thoroughly. Report any damage to the freight carrier.

e. Check the received items against the packing list. If any shortage is noted, contact our Customer Service Department immediately.

f. Save the packing material for possible reuse in shipment of the printer.

2-3. INSTALLATION LOCATION.

2-4. The printer may be installed either horizontally or vertically. The following recommendations apply:

a. Choose a cool (room temperature), clean, dry, well ventilated location.

b. Ensure that about 4 inches of space is provided between all sides of the printer and the nearest object to facilitate routine maintenance.

c. A fan at the rear of the printer provides forced air cooling for internal components of the printer. To ensure adequate cooling, do not install the printer inside a sealed cabinet.

d. Avoid placing the printer in a location where problems can be anticipated. For example, do not place the printer on a shelf from which it might fall or in a location where coffee or other liquids might spill onto the printer.

2-5. POWER CONNECTIONS.

2-6. Make power connections as follows:

a. Remove the cap from the fuse holder at the rear of the printer and check the fuse. For 115 vac operation, the fuse should be a 2-ampere, slo-blo type; for 230 vac operation, it should be a 1-ampere, slo-blo type.

b. Make sure that the power switch at the rear of the printer is set to OFF.

c. Connect the power cord supplied with the printer between the ac power source and the power receptacle at the rear of the printer.

NOTE

The printer is factory-wired for either 115 vac or 230 vac operation, as specified when ordering. Make sure that the printer is connected to a power source of the correct rating, as shown on a label on the rear panel.

2-7. INTERFACE CONNECTIONS.

2-8. General. The printer accepts both Centronics parallel and RS-232 serial interfaces through a common 25 Pin I/O connector located at the bottom rear of the printer (See Figure 2-1.). Interface selection is made using **internal connectors** and DIP switches on the internal printer controller PC board. When shipped from the factory, the printer is configured for serial operation.

CAUTION

If the rear 25-pin I/O connector is attached to a serial E.I.A. level interface while the internal ribbon cable interconnect is plugged into the parallel connector (J5) on the printer controller, damage may result to the TTL level parallel interface.

2-9. Flow Control. The host to printer data interface requires that the host system observe a flow control protocol in order to insure data transferred is not lost. This flow control protocol is slightly different for each of the three interfaces: ***Parallel; Serial-Busy protocol; Serial-Xon/Xoff protocol***. There is, however, a general flow control process which applies to all. Before this is explained an understanding of the general printer data organization is useful.

2-10. Printer Data Organization. The printer has an input data buffer (circular organization, 22 K bytes in length) and two image output buffers. Ticket commands and data are received over the interface and stored in the input data buffer. This input data buffer is emptied by a "commands processor" which interprets the commands and forms the printed ticket image into one of the output image buffers. Generally, one output image buffer is being printed (emptied) while the other is being filled. As data is emptied, from the data input buffer, space is dynamically created. As such, the physical 22 K bytes length does not limit the size ticket file which can be received. As the input data buffer or the output image buffers are emptied, they are cleared (written back with zeros.)

NOTE

Print and Hold command operation is an exception to this, for the image output buffer, for this circumstance only.

2-11. Parallel. The hardware flow control signals are Busy and Acknowledge. For the parallel interface, these signals respond on a character by character basis, as well as on a system ready for data basis. Each character, when received, causes the interface to go busy until it is read from the parallel port by the printer. When read, the interface removes the Busy and sends an Acknowledge pulse for each character. This character by character flow control sets the maximum transfer rate at which data can be sent to the printer.

2-12. Serial - Busy Protocol. The hardware flow control signal is the Busy. This signal does not respond on a character by character basis. It is controlled on a system ready for data basis. The maximum transfer rate at which data can be sent to the printer is limited by the selected baud rate.

2-13. Serial - Xon/Xoff Protocol. The hardware flow control is the reverse data channel. This channel is used to send codes which signal the Busy (Xoff = 13H) or not Busy (Xon = 11H) conditions. This signaling does not respond on a character by character basis. It is controlled on a system ready for data basis. The maximum transfer rate at which data can be sent to the printer is limited by the selected baud rate.

2-14. General Flow Control Process. As the data is received, the printer (all interfaces) will remain not Busy, as long as the system remains ready for data (i.e. there is space in the buffer, etc.). This not Busy state remains until a print command is received. When received, the Busy will be asserted in response to it. This action, (busy interlocking) serves to restrain the received data into packets, only permitting two tickets to be stored in the printer at any time. When the printer determines that an output image buffer is available, the Busy condition is removed, permitting data for the next ticket to be received.

2-15. Serial - Xon/Xoff Protocol (Ticket Acknowledge). In addition to the Xon/Xoff flow control, a ticket acknowledge is also sent. The ACK (06H) code is sent as each ticket is printed, at the completion of the print cycle. This is the default operation of the Xon/Xoff protocol. The commands <S3> and <S5> modify this operation (ref. 3-87 and 3-88).

2-16. Serial - Xon/Xoff Protocol (Other Status Codes). Additional status codes are sent as part of the Xon/Xoff protocol. These are: low paper = 12H; out of paper/tickets = 10H; jam = 18H. These are sent once, at occurrence. The <S5> command does not disable the sending of this status.

2-17. Interface Cabling. The interface cables (parallel or serial) should be shielded and properly terminated. A braided-shield cable with metal or metallized end bells on the connectors is recommended. The shield should be connected through a full 360 degree contact. Both connector end bells should be returned to chassis ground through a metal shield interface connector with a low impedance chassis connection. This type of installation will minimize electrically generated noise and ensure FCC compliance.

2-18. Centronics Parallel Interface. Selection of Centronics parallel interface is made by connecting the internal ribbon cable between the chassis mounted 25 Pin I/O connector and connector J5 on the printer controller PC board. (See Figure 2-1.) Set DIP switches SW1/1 and SW1/2 on the printer controller in accordance with DIP switch assignment Table 2-1. Pin assignments for the Centronics parallel interface connector are listed in Table 2-2.

2-19. RS-232 Serial Interface. Asynchronous transmission is used for data transfer between the data source and the printer, and also between the printer and a terminal. The data stream sent to the printer for each character consists of one start bit, seven data bits (eight for graphics) another bit which may be the most significant data bit or a parity bit, and one or two stop bits which signal the end of the data byte. Selection of serial interface is made by connecting the internal interface connector to connector J6 on the printer controller. (See Figure 2-1.) The serial baud rate, number of bits per character, and protocol are selected using DIP switches on the printer controller. (See Table 2-1.) Serial interface pin assignments are listed in Table 2-4.

2-20. Serial interface interconnections between a personal computer and the printer should be made as shown in Figure 2-2. Note that additional setup of the personal computer may be required when it is used to communicate with the printer in serial mode. This setup includes setting the baud rate, parity, bit length, etc. of the serial port of the personal computer.

Example: Assume that the printer is configured as follows:

Serial Operation
9600 baud
Parity disabled
Eight bits
COM port 1 (PC)

The required personal computer setup (batch file or manual entry at prompt is:

MODE COM1:9600,n,8,1,p
MODE LPT1:COM1

2-21. Auxiliary Serial Interface. An auxiliary connector on the rear panel of the printer may be used for transparent mode operation and for cash drawer control. When the printer is set to the transparent operating mode by an appropriate command, all serial data sent to the printer over this interface are transmitted directly out without being printed. When a cash drawer command is interpreted by the printer controller, a pulse is generated. This pulse is applied to a driver circuit in the printer controller and connections may be made to this circuit to control opening of a cash drawer. Pin assignments for transparent mode operation and cash drawer control are as follows:

Pin	Function
	TRANSPARENT MODE
2	Printer transmit (XD)
3	Printer receive (RD)
5	Ground
	CASH DRAWER
4	Auxiliary 23 vdc (500 mA) (JP-4)
7	Clamp diode collector
8	Open collector driver and clamp diode anode
9	Driver ground

2-22. Interface Cables. For customers who do not want to make their own cables, "off the shelf" cables can be purchased from a major computer supplies vendor INMAC (1-800-443-8566). These cables are for interconnect to a "PC-Compatible" computer only. Although these cables have been tested, due to subtle differences between computers, *it is mandatory that a user purchase one cable and insure it operates correctly with their computer before committing to additional purchases.* The parallel cables are wired straight through (Pin 1 to Pin 1 ...) all 25 connections. The serial cables are wired in a "null modem" configuration.

The wiring for cable # 0749-0 is:

P2—PC2; P3—PC3; P5,6—PC4; P7—PC5; P20—PC6,8.

The wiring for cable #1964-1 is:

P1—PC1; P2—PC3; P3—PC2; P7—PC7; P5,6,8—PC20; P20—PC5,6,8.

Cables: For ETX™:

- **Parallel Interface** use:
  INMAC Cable #0348-2 or equivalent
- **Serial 9-Pin Computer Interface** use:
  INMAC Cable #0749-0 or equivalent
- **Serial 25-Pin Computer Interface** use:
  INMAC Cable # 1964-1 or equivalent

NOTE

For serial the "Qualifiers" selection must be disabled to operate with these cables.

2-23. Auxiliary Cash Drawer Driver Interface. Typical application information is shown in figure 2-3.

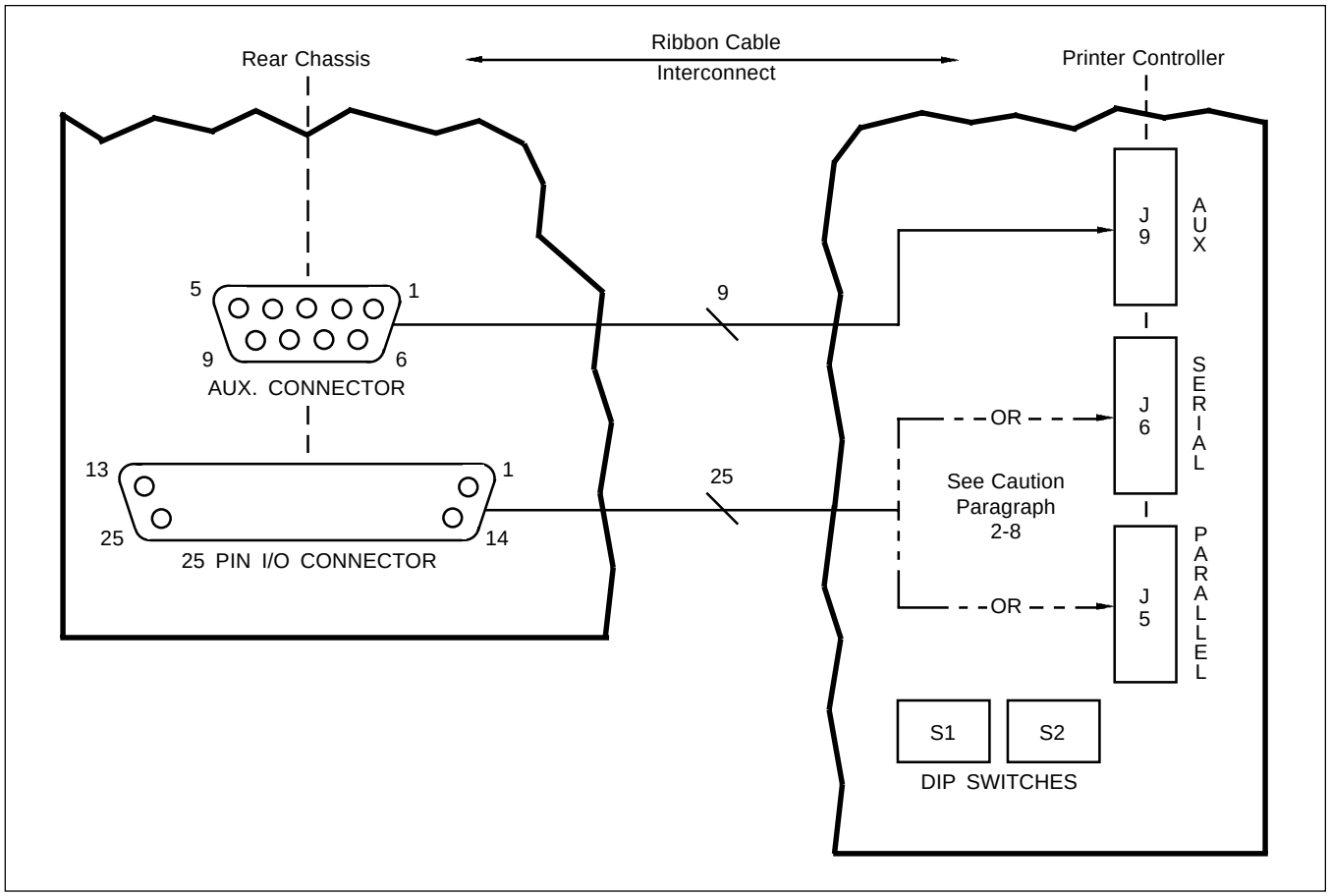


Figure 2-1. Printer International Interface Interconnections

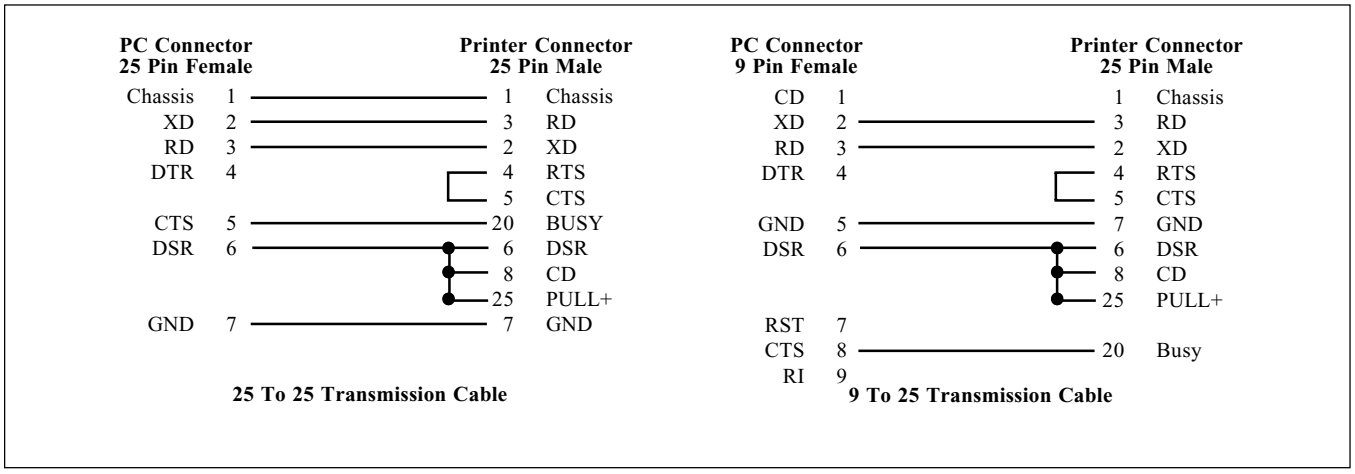
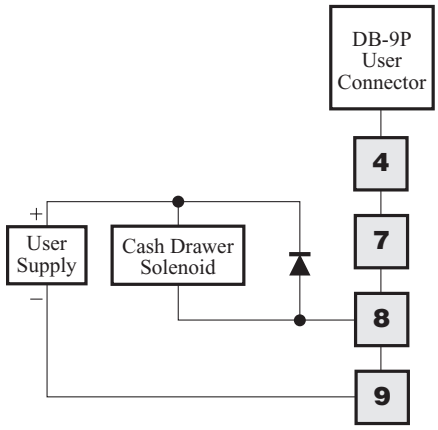
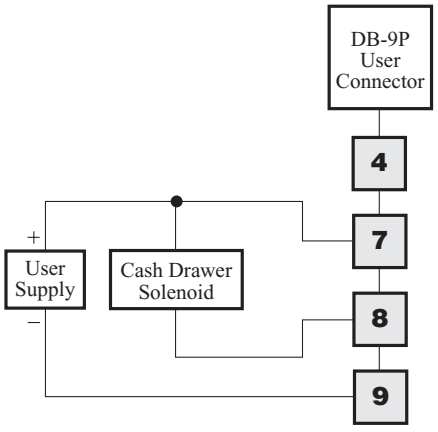


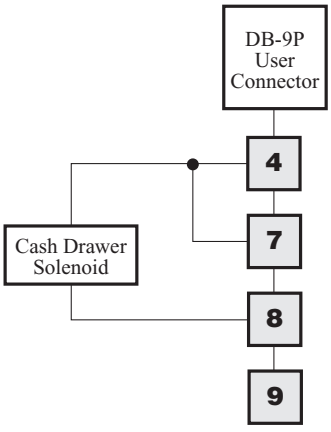
Figure 2-2. Serial Interface Interconnections, Personal Computer to Printer



For A User Supply And External Clamp Diode

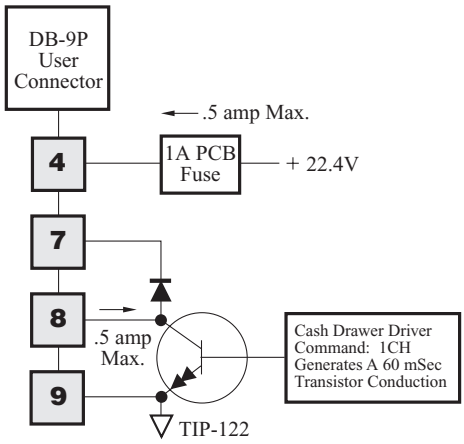


For A User Supply And Internal Clamp Diode



Using The ETX™-200X Internal Power Supply And Clamp Diode

Typical Applications Circuits



ETX Circuit Schematic

Figure 2-3. Cash Drawer Application Diagrams

TABLE 2-1. DIP SWITCH ASSIGNMENT

Function	Switch	Position	Comments
NOTE 1 = off, open, active 0 = on, closed, inactive			
Parallel Enable	SW1/1 SW1/2	0 0	If parallel interface is selected, SW1/3 through SW1/7 are ignored. If serial interface is selected, switches SW1/1 through SW1/7 are all active.
Serial 2400 Baud	SW1/1 SW1/2	1 0	
Serial 4800 Baud	SW1/1 SW1/2	0 1	
Serial 9600 Baud	SW1/1 SW1/2	1* 1*	
Data Length:			
7 Bits	SW1/3	0	
8 Bits	SW1/3	1*	
Serial Parity Check:			
Disable	SW1/4	0	
Enable	SW1/4	1*	
Serial Parity Type:			
Even	SW1/5	0	
Odd	SW1/5	1*	
Serial Busy Polarity:			
Space	SW1/6	1	
Mark	SW1/6	0*	
Protocol:			
Busy	SW1/7	0*	
XON-XOFF	SW1/7	1	
Serial Qualifiers:			
DSR-CTS Qualifiers Not Used	SW1/8	0*	
DSR-CTS Qualifiers Used	SW1/8	1	
PRINTHEAD:			
Print Intensity 1	SW2/1 SW2/1	1 0*	Switches SW2/1, 2, 3, 4 correspond to 16 energy/dot levels (binary weighted 0-15). Where 0 = minimum; 15 = maximum.
Print Intensity 2	SW2/2 SW2/2	1 0*	
Print Intensity 4	SW2/3 SW2/3	1* 0	
Print Intensity 8	SW2/4 SW2/4	1 0*	
Thermal Drive Mode 1	SW2/5 SW2/5	1 0*	Switches SW2/5, selects 1 of 2 engery tables. Where 0 = Min; 1 = Max.
History Off Time 1	SW2/6 SW2/6	1 0*	Switches SW2/6, 7 select 1 of 4 history operating points (binary weighted 0-3). Where 0 = minimum history control; 3 = maximum history control
History Off Time 2	SW2/7 SW2/7	1* 0	
EE PROM:			
Disabled	SW2/8	0	
Enabled	SW2/8	1*	
**Factory Settings:*			

2-24. DIP SWITCH SETTINGS.

2-25. Determine all operating parameters of the printer for its specific application, and set the DIP switches on the printer controller as required to select these operating parameters. Figure 2-4 identifies the DIP switches and Table 2-1 lists their settings for various printer functions. The DIP switches can be accessed by removing the printer cover. Alternately, the DIP switch functions can be accessed through the front panel switches. (Refer to Table 4-1.)

2-26. LOADING TICKET STOCK.

2-27. Type 2002 printers use 2-inch wide thermal ticket stock; type 2003 printers use 3-1/4-inch wide thermal ticket stock. To load ticket stock into the printer, proceed as follows:

a. Open the key lock.

b. Lift and swing the cover up to the rest position.

c. Turn on the rear panel power switch and check that the print head lever (Figure 2-5) is in the down position.

d. Load the ticket stock as shown in Figure 2-5, with the black registration marks on the bottom of the tickets and closest to the leading perforation.

e. Insert the front end of the ticket stock into the print mechanism approximately 7-1/4 inches from the entrance point to initiate the auto load sequence. The ticket stock will be captured and automatically advanced one ticket length, then will be retracted to the start position. The front panel READY light will illuminate, indicating that the printer is selected and ready to receive data.

2-28. PRE-OPERATIONAL CHECK.

2-29. After set-up, check the printer for proper operation as follows:

a. Set the rear panel power switch to the OFF position.

b. Set the rear panel power switch back to the ON position and wait approximately 10 seconds. During this period, the printer performs self-test and initialization. After successful completion of the self-test, the READY indicator should light.

NOTE

If a malfunction is detected during self-test, the printer will sound a series of beeps. (Refer to paragraph 4-16 for error codes.)

c. After successful completion of self-test, press the SELECT/F0 pushbutton switch on the front panel. The READY indicator should go off.

d. Press the Test/F1 pushbutton switch on the front panel. The printer should print a test ticket as shown in Figure 2-6.

e. Set the rear panel power switch to the OFF position.

TABLE 2-2. PARALLEL INTERFACE

Pin	Signal	Description
1	$\overline{\text{STROBE}}$	Character data input clock sent to printer controller
2-9	DATA 1-8	Character data sent to printer controller
10	$\overline{\text{ACK}}$	Pulse output sent from printer controller to indicate that character data has been received and printer controller is ready to accept next character; active low
11	BUSY	Sent from printer controller during character entry, off-line state, or error state to indicate that printer controller cannot receive data
12	PE	Signal sent from printer controller indicating that printer is out of ticket stock
13	SLCT	Signal sent from printer controller to indicate that printer is selected
15	$\overline{\text{FLT}}$	Signal sent from printer controller to indicate an error condition, out-of-ticket stock condition, or deselect; active low
16	$\overline{\text{RESET}}$	Signal received by printer controller to reset printer controller; active low
18 thru 25	Ground	Logic ground

TABLE 2-3. RS-232 SERIAL INTERFACE

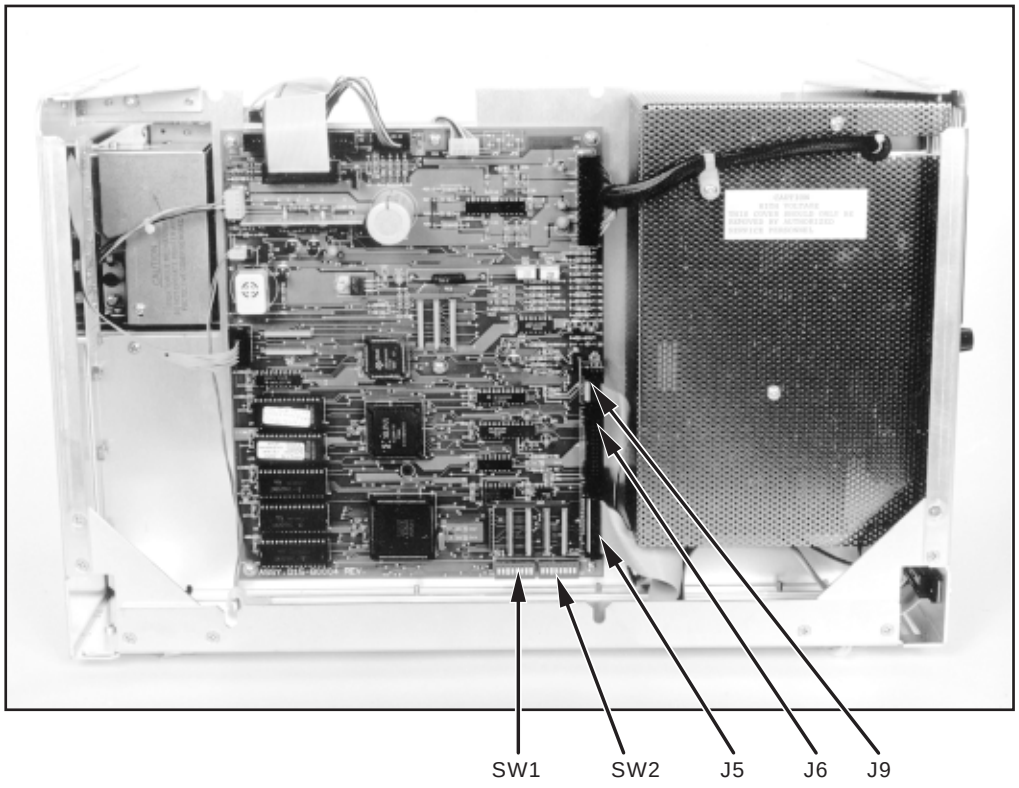
Pin	Signal	Description
2	Transmit data (XD)	Data sent from printer controller
3	Receive data (RD)	Data sent to printer controller
4	Request to send (RTS)	Signal sent by printer controller; active high
5	Clear to send (CTS)	Signal sent to printer controller; high level is required for printer controller to receive data
6	Data set ready (DSR)	Signal sent to printer controller; high level is required for printer controller to receive data
7	Ground	Signal ground
20	BUSY	Signal sent from printer controller; active level determined by serial busy polarity BIT switch setting (SW1/6) on printer controller; selected level indicates that printer controller can receive data; opposite level indicates that printer controller cannot receive additional data
25	P.U.	Space pull-up

NOTES

1. When not using CTS and DSR, tie pins 4 to 5 and 25 to 6, or disable qualifiers by setting DIP switch SW1/8 to 0 position.
2. When in the Busy protocol, the RTS output is conditioned to follow the paper status of the printer. This operates regardless of the setting of the "qualifiers" bit. The signal states are:

   RTS = Space (Positive Voltage) = Paper in Printer

   RTS = Mark (Negative Voltage) = Out of Paper



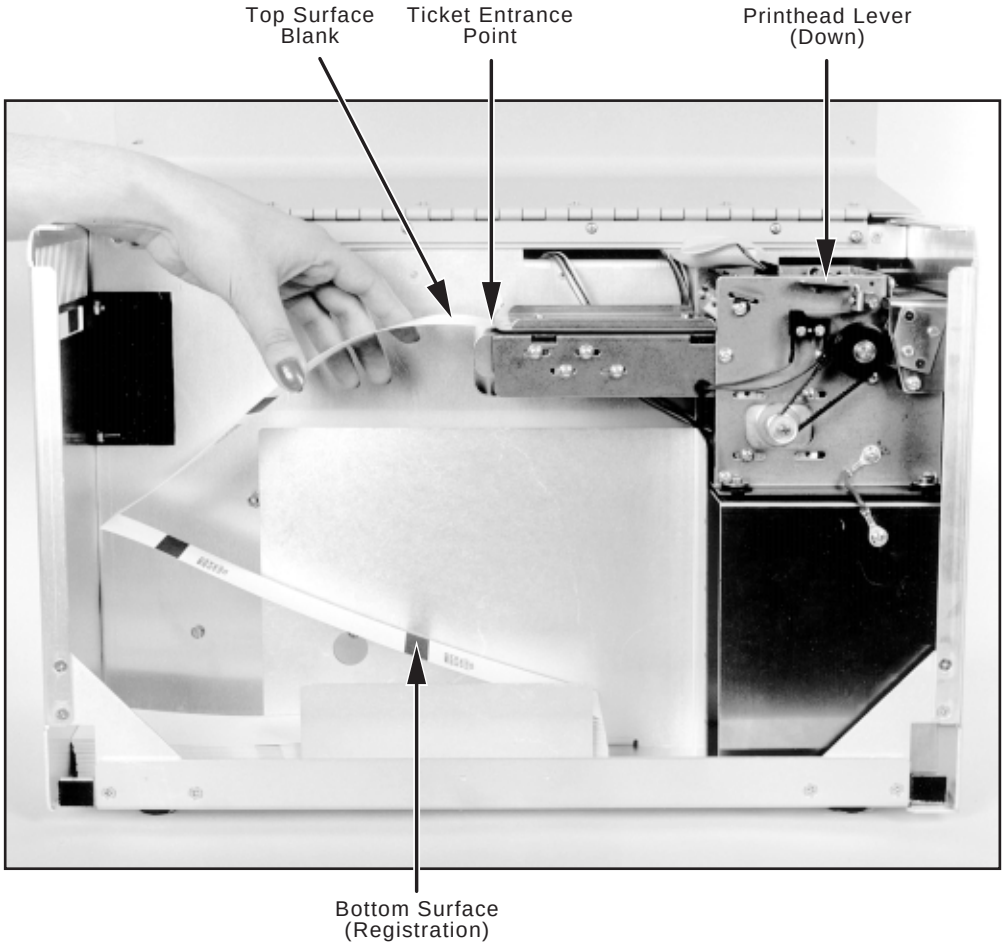


Figure 2-5. Loading Ticket Stock

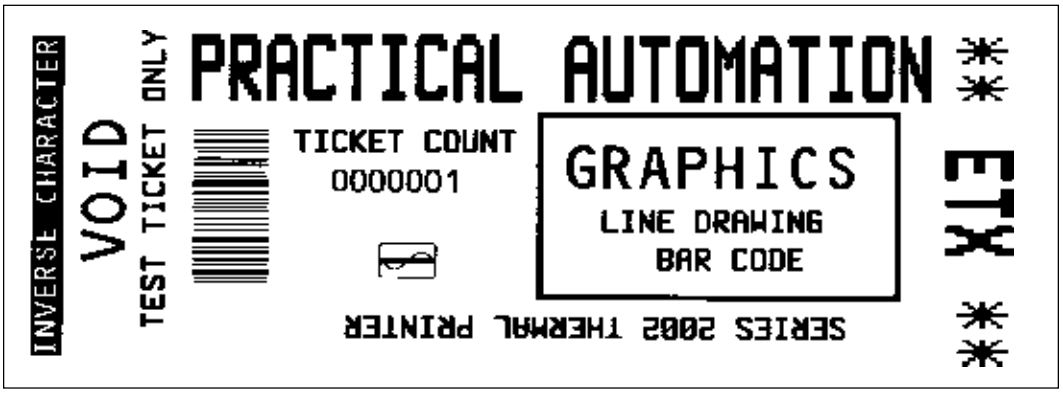


Figure 2-6. Typical Test Ticket

Blank Page *- please continue*

SECTION III
PROGRAMMING

3-1. INTRODUCTION.

3-2. This section provides programming information applicable to the printer. The printer utilizes a user-friendly, flexible program language that enables printing of characters, graphics, boxes, and bar codes anywhere on the ticket, in almost any orientation.

3-3. ROWS AND COLUMNS.

3-4. Print locations on the ticket are specified using row/column commands (see table 3-1). The horizontal rows are numbered from top to bottom, with the topmost row being row 0. The vertical columns are numbered from left to right, with the leftmost column being column 0. At a dot density of 203.2 dpi, there are 406 dot rows and 1117 dot columns for a standard 2 x 5.5 inch ticket, and 660 dot rows and 1117 dot columns for a standard 3.25 x 5.5 inch ticket. The top left corner position on each ticket is row 0, column 0 (0,0).
The end position for a standard 2-inch ticket is row 406, column 1117 (406,1117); for a standard 3.25-inch ticket, it is row 660, column 1117 (660,1117).

3-5. CHARACTER SETS.

3-6. Any of thirteen different size character sets can be selected by sending the corresponding fontsize command to the printer (see table 3-1). The character sets for the available fontsizes are shown in Figure 1-3. Fontsize 3 is the default fontsize. It consists of characters 17 dots wide by 31 dots high. For normal spacing of printed characters, the characters are top-left justified within a space (box) 20 dots wide by 33 dots high, providing a minimum spacing of 3 dots between characters horizontally and 2 dot vertically. The spacing can be changed by changing the box size with a suitable box size command. For example, sending the box size command <BS21,34> would provide an additional dot spacing both horizontally and vertically.

3-7. CHARACTER ORIENTATION.

3-8. Characters can be printed on the ticket in any of four orientations, selected by sending the appropriate rotation command to the printer (see table 3-1). The default orientation is non-rotated. Non-rotated <NR> characters appear on the ticket in the normal left-to-right orientation. Rotated right <RR> characters are rotated 90° clockwise from the non-rotated orientation and build from right to left on the ticket. Rotated upside down <RU> characters are rotated 180° from the non-rotated orientation and build upward from the starting position on the ticket. Rotated left <RL> characters are rotated -90° from the non-rotated orientation and build from left to right on the ticket.

3-9. CHARACTER POSITIONING.

3-10. The starting position for printing of any character on the ticket is specified by sending a row/column command to the printer. After the character is printed, the next character will start in the next box, unless a new row/column command or a return character (CR) is sent to the printer. If a return character is sent, the next character will be positioned at the start of the next line, with the same character orientation (unless a new rotation command is sent). For example, if a return character is sent while printing in a rotated right mode, the next character will be printed at the top of the ticket and one character line to the left of the previous line. (A character line is equal to the box height of the character.)

3-11. DATA SEQUENCE.

3-12. Data is usually sent to the printer one line at a time, but this is not mandatory because characters can be placed anywhere on the ticket with row/column commands. Each line of data may consist of several command sequences plus the actual characters to be printed, and should normally be terminated by a return (CR) character. If the next line of data contains a row/column command, the CR character is not necessary, and should not be sent. Many software programs send a return character automatically at the end of each line. In such cases, it may not be necessary to terminate the data line with a CR character; the automatic return character must also be suppressed when it is not required. The last line of ticket data should be terminated with a FF (0CH) or <p> if cutting and ejecting of the printed ticket is desired. If ticket cutting is not desired, a 1DH or <q> should be used instead of a FF. After a ticket is printed, the printer buffer is cleared automatically.

3-13. PRINTING LENGTH.

3-14. The printer measures the ticket length, in dot columns, automatically on power-up. To make this measurement, the ticket is moved past the printhead and then returned to the initial print position. Data can be printed across the entire length of the ticket minus 0.100 inch (20 dot columns). Because of variations in the distance between successive black marks on the ticket stock, the actual length of a ticket may differ slightly from the calculated length. It is therefore recommended that printing in the last two or three columns be avoided to prevent possible truncating of these columns.

3-15. SPECIAL REQUIREMENTS.

3-16. To prevent processing of the form feed character appended by certain printer drivers, the printer requires that printable data be received before printing can occur. At least one printable character or an ASCII print sequence (<p>, <q>, etc.) is required.

3-17. OVERPRINTING PRECAUTIONS.

3-18. Special care is required when using character rotation and expansion commands to avoid overlapping of printed characters. Keep in mind that all characters are top left justified in their boxes, according to their rotation. A rotated left character that starts at the bottom left corner of the ticket, for example, builds up and to the right on the ticket. Expanded characters build into adjacent rows and columns. When specifying such characters, make certain that the characters are not started in a row or column occupied by another character, and that the characters will not build into spaces occupied by other characters. For example, if a standard character is expanded by a factor of 2, it will occupy 16 dots vertically from its starting point instead of the normal 8; therefore, no character should be positioned less than 16 dot rows below the expanded character. After printing an expanded character, the printer will place the next character in the correct position to prevent overprinting automatically. If a return character is received by the printer, the printer will also position itself down enough lines to prevent overprinting automatically. The printer remembers only the parameters set up for the previous printed character; if a character sequence starting with normal characters and ending with expanded characters is printed across the ticket, a return will position the next character below the beginning of the printed line as though the printed line started with an expanded character. If such positioning is incorrect, the return character must be suppressed and a row/column command must be sent to position the next character at the desired location on the ticket.

3-19. ILLEGAL COMMANDS.

3-20. Size modifier and positioning commands must be used with care. Data sent outside the ticket boundaries and data sent following an illegal positioning command are usually ignored by the printer. In some cases, however, illegal data may be printed on the current ticket or the following ticket. Always check the data being sent to the printer if unexpected printing results occur.

3-21. INVERTED CHARACTERS.

3-22. Printing of inverted characters (negative images of the original) can be initiated by sending an <EI> (enable inversion) command to the printer. All following data except bar codes will be inverted until a <DI> (disable inversion) command is sent (see table 3-1). The printer uses an intelligent printhead employing dot history; it does not slow down when printing inverted fields or barcodes. The inverted mode must be used with caution; the entire ticket could be printed inverted if the <DI> command is forgotten. To improve readability, the printer adds border black around the inverted characters; therefore, inverted characters are slightly larger than normal characters. This size difference must be taken into consideration when positioning characters below inverted characters. It is recommended that a new row/column command be sent for each line that follows an inverted character line; otherwise, lines may be closer than expected.

3-23. BAR CODES.

3-24. Using appropriate bar code commands (see table 3-1), any of seven different bar codes can be selected and printed in either ladder or picket fence configurations. All barcodes are printed at normal speed. Because of individual bar code specifications, bar codes may not conform exactly to standard printer spacing requirements.

3-25. The bar code command sequence must specify the starting position, bar code size, orientation, and type. The unit dimension for bar code bars is 8 dots high and 1 dot wide. Bar code height may be changed in multiples of 8 dots using the unit size parameter in the bar code select command. The number sent as the unit size parameter represents the number of 8 dot high bars to be used to construct the bar code. For example, if a unit size of 3 is specified, the bar code height will be 24 dots.

3-26. The bar width can be expanded from the normal 1 dot width using the bar code expanded <X#> command. The numerical parameter in the bar code expanded command specifies the width of the bar in dots.

3-27. Printing of a bar code interpretation line can be specified by sending a bar code interpretation <BI> command in the bar code command sequence. Picket fence bar codes are constructed down and to the right of the starting point, with the bar code interpretation line, if selected, printed below. Ladder bar codes are constructed down and to the left from the starting point, with the bar code interpretation line, if selected, printed below. When specifying the starting position of any bar code, make certain that enough space is available to print the bar code fully. Note that the bar code interpretation line starts 2 dots below the bar code and is 8 dots high. A ladder bar code with a size of 3, for example, is 24 dots wide, and the bar code interpretation line requires an additional 10 dot positions. To print this bar code and bar code interpretation line fully, at least 34 dot columns are required, and the starting position must be at some point above column 34.

3-28. GRAPHICS.

3-29. Images, shapes, and logos can be constructed using the printer graphics mode, which permits any dot to be turned on or off. Each graphics character consists of one byte of data, and it can be positioned using a row/column command. The first graphics character will be printed starting at the row and column specified in the row/column command, and successive graphics characters will be printed in successive dot columns.

TABLE 3-1. COMMANDS

Command	Format	Function	Comments
ASCII graphics	<g#>byte1,byte2 ...byte#	Sets printer to ASCII graphics mode and sends graphics bytes to be printed	Refer to paragraph 3-29
Bar code expanded	<X#>	Expands width of bar code from 1 dot to # dots	Default = 1 dot
Bar code interpretation	<BI>	Causes bar code interpretation line to be printed under bar code	Active only for bar code that immediately follows
Bar code ratio adjust	<AXB#>string	Expands interleaved 2 of 5 or 3 of 9 bar code from 2:1 wide to narrow space ratio to 3:1 ratio	Usable only with interleaved 2 of 5 and 3 of 9 bar codes
Bar code select	<AB#>string	Selects bar code type and size and sends bar code data: A = U for UPC and EAN8 A = E for EAN13 A = N for 3 of 9 A = F for interleaved 2 of 5 A = C for USS-CODABAR A = O for code 128 B = P for picket fence B = L for ladder # = unit size of bar code	Default value for # = 4 (32 dot high bars)
Boxsize	<BSx,y>	Sets size of area in which printed characters sit to x dots wide, y dots high	Default = 20 x 33 dots
Cash drawer	1CH	Generates pulse to open cash drawer	No < > required
Chinese graphics	OEH	Moves row/column cursor to location directly under previous graphics byte and initiates another 16 byte graphics stream	No < > required
	OFH	Moves row/column cursor over 4 dot positions and up 1 byte position and initiates another 16 byte graphics stream	
Clear buffer	<CB>	Clears ticket buffer and sets all parameters to default conditions	Not normally needed; printer clears buffer automatically
Clear downloadable storage area	ESCc	Clears downloadable storage area of printer	
Clear offset data	<COD>	Sets offsets to default values and stores these values in EEPROM	Refer to paragraph 3-94
Disable inversion	<DI>	Terminates character inversion mode & returns printer to normal printing mode	
Dot offset	<DO#>	Changes row at which first point on ticket is printed by # dots	Dot offset set to 16 dots on power-up
Draw box	<BXr,c>	Causes printer to draw box r dots high and c dots wide starting at location specified by preceding row/column command	Refer to paragraph 3-30
Draw horizontal line	<HXc>	Causes printer to draw horizontal line c columns wide starting at location specified by preceding row/column command	Refer to paragraph 3-30
Draw vertical line	<VXr>	Causes printer to draw vertical line r rows long starting at location specified by preceding row/column command	Refer to paragraph 3-30
Enable inversion	<EI>	Causes following characters to be printed in inverted (negative) mode until disable inversion command is received	Ensure that <DI> command is used when inversion is to be terminated

TABLE 3-1. COMMANDS (CONTINUED)

Command	Format	Function	Comments
Fontsize	<F1>	Selects 5 x 7 dot characters	Default = font 3 (17 x 31 dot)
	<F2>	Selects 8 x 16 dot characters	
	<F3>	Selects OCRB characters (17 x 31 dot)	
	<F4>	Selects OCRA characters (5 x 9 dot)	
	<F6>	Selects OCRB characters (30 x 52 dot)	
	<F7>	Selects OCRA characters (17 x 31 dot)	
	<F8>	Selects Courier characters (18 x 30 dot)	
	<F9>	Selects OCRB characters (13 x 20 dot)	
	<F10>	Selects Bold Prestige characters (25 x 41 dot)	
	<F11>	Selects Script characters (25 x 49 dot)	
	<F12>	Selects Orator characters (46 x 91 dot)	
	<F13>	Selects Courier characters (20 x 40 dot)	
Graphics	<G>byte1,byte2... byte7 or <G#>byte1,byte2... byte#	Sets printer to graphics mode and sends graphics bytes to be printed	Refer to paragraph 3-28
Height/width	<HWx,y>	Multiplies normal character height by x and normal width by y	Default = 1,1; use <HW1,1> to return to normal size after expansion
Lable adjust	<LA#>	Changes columns at which first point on ticket is printed by # dots	Lable adjust set to 16 dots on power-up
Line thickness	<LT#>	Changes line width of lines and boxes from 1 dot to # dots	Lines revert to 1 dot default value after being drawn (refer to paragraph 3-39)
Load downloadable logo	ESC<RC0,0><G#> (byte1...byte#) <RC#,#><G#> (byte1...byte#)ESC	Loads user generated logo data printer memory	Refer to paragraph 3-57
Load ticket count	<TC1234567>	Preloads 7 digit ticket count into printer	Must contain 7 digits; loaded count is number of current ticket
Message disable	<MD>	Disables message function	Refer to paragraph 3-91
Message enable	<ME>	Enables sending of verbose status messages to CRT port	Refer to paragraph 3-90
Print	0CH (FF) or <p>	Causes printer to print and cut ticket	
PCX File Lead-in	<pcx>	Precedes the PCX file data	Refer to paragraph 3-33
Print and hold (cut)	<h>	Causes printer to print and cut ticket; print data buffer data is not cleared	Used when ticket has substantial graphics or logo data; puts printer in “replacement” mode (refer to paragraph 3-80)
Print and hold (no cut)	<r>	Causes printer to print but not cut ticket; Print data is not cleared	See <h> above
Print/no cut	1DH or <q>	Causes printer to print ticket without cutting	
Print downloadable logo	<LD#>	Causes printer to print user generated logo specified by # in location specified by preceding starting point command	Refer to paragraph 3-64
Printing length	<PL#>	Changes printing length from normal (actual ticket length) to number of units, where a unit equals .0098" or two dots.	Refer to paragraph 3-13 Roll mode only

TABLE 3-1. COMMANDS (CONTINUED)

Command	Format	Function	Comments
Print logo	<LO#>	Causes printer to print factory preloaded logo specified by # at location sprcified by preceding starting point command	Refer to paragraph 3-56
Print ticket count	<PC>	Causes printer to print ticket count on ticket	Must be sent for each ticket
Registration adjust positive	<R+#>	Adjust cut position	Moves ticket # dots foward before cutting ticket
Registration adjust negative	<R-#>	Adjust cut position	Moves ticket # dots reverse before cutting ticket
Repeat	<RE#>	Allows printing of # copies of ticket without retransmitting data	1 to 9999 valid for #
Rotation	<NR>	No rotation of following characters	Remains active until new rotation command is received; default = <NR>
	<RR>	Following characters rotated right (+90°)	
	<RU>	Following characters rotated upside down (+180°)	
	<RL>	Following characters rotated left (-90°)	
Row/column	<RCx,y>	Directs printer to start printing at row x, column y	
Row Offset	<RO#>	Changes row at which first point on ticket is printed by # byte positions (8 dots)	Row offset set to 2 (16 dots) on power-up
Save offset data	<SOD>	Stores offset values in EEPROM	Refer to paragraph 3-93
Starting point	<SPx,y>	Sets starting point for printing of logos to row x, column y	
Status request	<S1>	Causes printer to send 1 byte status message	Status enabled in Xon/Xoff mode only (refer to paragraphs 3-85 through 3-89)
	<S2>	Causes printer to send 7 digit ticketcount and software level of printer	
	<S3>	Causes acknowledge status byte to be sent by printer only after last ticket of run has been printed	Refer to paragraph 3-87
	<S5>	Disables all status except Xon/Xoff	Refer to paragraph 3-88
	<Sz>	Causes printer to return single ASCII status byte	Refer to paragraph 3-89
Transparent mode on	<t>	Causes following data to be transmitted out printer auxiliary port without being processed by printer	
Transparent mode off	<n>	Terminates transparent mode operation and returns printer to normal operation	
Load Downloadable Font	ESC ‘r’ n > (n *91 BYTES) ESC	n = # of bytes per character, loads user generated font data into printer memory.	Refer to paragraph 3-68
Print Downloadable Font	$<F_sW_1h_1><BSw_2h_2>$	S=font A,B,C, or D W_2=font width h_1=font height W_2= box width h_2= box height	Refer to paragraph 3-68

3-30. The normal graphics mode is selected by sending a graphics select command <G> or <G#> to the printer. Bytes of dot data for each column to be printed are sent immediately following the graphics select command. Each byte represents one column of 8 dots, with the most significant bit being the top dot. The leftmost column is sent first. A 1 in the character data byte will print as a black dot, and a 0 will result in a blank dot position. If the <G> command is used, the bytes must be sent in multiples of 7; if the <G#> command is used, the number of bytes must be equal to #. The graphics mode must be reselected after each group of bytes is sent so that the printer can distinguish between graphic bytes and command sequences (see table 3-1).

NOTE

For graphics mode, the interface must be configured for 8-bit data.

3-31. Some computers cannot send the full range of 8-bit data required for graphics. For that reason, the printer has been configured to received dot data bytes as ASCII characters as well as straight decimal interpretations of each column. For example, a column in which every other dot is 1 would be represented by the byte 01010101. This is equivalent to a straight decimal value of 85, and a byte with the value of 85 would be sent to the printer in normal graphics mode. This could be accomplished in Basic with a print chr$(85) statement. In ASCII graphics mode, the byte would be split into two ASCII bytes which represent the hex value (55H) of the byte, and would be sent to the printer as two bytes of ASCII 5s. In Basic, this could be done with a print "55" command. To select ASCII graphics mode, a small g is used in the graphics select command instead of a capital G. The ASCII graphics select command must specify the number of bytes to follow <g#>.

3-32. Image File Graphics (PCX File Format). The PCX file format is supported for graphics data input. These files can be sent directly to the printer. The PCX image data can be printed directly or stored as a logo for later printing. Permitting PCX files to be sent directly to the printer greatly enhances its graphics capability. The PCX graphics file format is commonly used. As such, a vast arrary of "Clip Art" and drawing software exists for PCX files. The file structure has built in data compression. This feature is preserved by the printer system. The reduced file size effectively increases the storage memory for graphics symbols. Additionally, the file is handled as a graphics block rather than a series of raster data segments. The printer system uses this attribute to permit image rotation (all four attitudes) as well as multiplication.

3-33. PCX Command Structure. The <pcx> command is a lead-in identifier for the PCX graphics file data. Existing printer commands are used in combination with this lead-in identifier to form PCX command strings.

NOTE

"pcx" must be lowercase.

3-34. PCX Supporting commands.

Command Description	Command
Row/Column Positioning:	<RCx,y>
Height/Width Multiplication:	<HWx,y>
Download Logo Escape Character Leader/Terminator:	ESC ... ESC
General Purpose Graphics Loading:	<G#>
Logo Starting Point:	<SPx,y>

Where:

ESC	=	The Escape Character (27d or IBH)
x,y	=	ASCII Decimal Numbers of Row (x); Column (y) Position
RC,HW,G,SP	=	Upper Case ASCII Characters as noted
#	=	ASCII Decimal Number for the total number of bytes contained in the PCX file. For example the DOS directory file size number can be used. (# max. = 32,740).

3-35. PCX Command Strings.

Command Description & Command String

Download PCX Logo Data to storage memory:
Command String:
ESC<pcx><G#>[PCX File]ESC

Load PCX Graphics Data for direct printing:
Command String:
<pcx><G#>[PCX File]

Printing a stored logo with a 2X multiplication and left rotation:
Command String:
<RL><HW2,2><SP50,100><LD1><p>

Sending and printing a PCX file directly to the ticket (1:1 multiplication):
Command String:
<RC25,50><HW1,1><pcx><G#>[PCX File]

Where:

[PCX File]	=	The complete PCX file. Note: The brackets [ ] are not sent.

3-36. PCX File. The PCX file must be in a single bit (non-color) format. The size of the file is dependent on its target location. If printed directly, the file size is limited by the output area of the ticket. For example, a 1.8" x 5.3" ticket (9.5 square inch image area) contains approximately 50 K bytes of data. For download logos, 32 K bytes of data space is available. The system programmer must not overflow this data space limit.

3-37. Graphics Storage Using PCX Files. Because the PCX file is stored in compressed format, it uses less memory space. Compression ratios of 2:1 or greater are typical. Also, having the ability to multiply the graphics image effectively leverages the use of memory space. Using uncompressed storage of image data, 32 K bytes of memory will hold approximately 6.4 square inches of graphics image (output at 203 x 203 DPI). For an image saved at compression ratio of 2:1 and multiplied in height and width by 2, the effective image storage capacity is 50.9" square inches. This is effectively equivalent to a storage memory of 256 K bytes.

3-38. Nonvolatile Memory. Optional nonvolatile memory is available for the download RAM. This feature permits user logos and ticket icons to be downloaded and permanently saved by the printer.

3-39. BOXES AND LINES.

3-40. The appearance of a printed ticket can be enhanced by printing boxes and lines at various points on the ticket. To print a box, the starting row/column position is sent, followed by a draw box command. The draw box command <BXr,c> includes the box dimensions in dot rows and columns. Vertical and horizontal lines can be printed anywhere on the ticket using draw vertical line <VXr> or draw horizontal line <HXc> commands, with the length in dots as the command parameter. Normal line thickness for boxes and lines is 1 dot; the line thickness can be increased by sending a line thickness <LT#> command before the draw box or draw line command. The thickness of box lines grows toward the center of the box, the thickness of a vertical line grows toward the right, and the thickness of a horizontal line grows toward the bottom of the ticket. Box line thickness may not be more than one-half the smallest box dimension; otherwise, the complete box will print black. All lines revert back to the default value of 1 dot after being drawn.

3-41. DEFAULT SETTINGS.

3-42. Default settings for the printer are as follows:

- **a.** Font type - font 3 (17 x 31 dot matrix)
- **b.** Character box size - 20 x 33 dot matrix
- **c.** Starting point - row 0, column 0
- **d.** Height - normal (1)
- **e.** Width - normal (1)
- **f.** Rotation - no rotation (NR)
- **g.** Ticket length - calculated automatically
- **h.** Printing length - equal to ticket length
- **i.** Bar code size - 4 units (32 dots)
- **j.** Dot row offset - 16 dots.
- **k.** Label adjust (left margin) - 16 dots.

3-43. Default settings are used by the printer if only text (no command sequences), is sent to the printer. The printer also returns to the default settings for all listed commands except dot row offset and label adjust after completing printing of a ticket. (Dot row offset and label adjust settings are **not** reset to the default values after printing of each ticket; they remain in effect until replaced by new values or until the printer is next powered up.) Settings can be changed at any time, in any combination, before printing a character by sending appropriate commands. Once changed, the settings will remain in effect until changed with a new command, or until a form feed is sent to the printer. When a form feed is received, the printer reverts back to the default settings for all commands except dot row offset and label adjust; therefore, any special settings for affected commands must be repeated for the next ticket.

3-44. COMMANDS.

3-45. A wide variety of standard commands can be used to control printing. Each command performs a specific function, and a number of different commands can be sent for each string to be printed. Valid commands are listed in Table 3-1. The < > characters are used to distinguish a standard command from text; the < is used as the front marker, and the > is used as an end marker. The printer interprets any data sent between these markers as a command. Some special commands and data to be printed on the ticket are sent without markers.

3-46. The < > markers must be used with each standard command. If a line of data contains more than one command, the front marker of the second command is sent immediately after the end marker of the first command, with no delimiter between commands (for example, <RC20,10><HW3,2>). Commands can usually be sent in any order, and the text to be printed on the ticket is sent after the end marker of the last command. All data must be sent as ASCII characters. Lower case and upper case letters in commands are <u>not</u> equivalent, and cannot be interchanged.

3-47. APPLICATIONS.

3-48. General. The following paragraphs illustrate the use of command sequences for various printer functions (see table 3-1). Figures 3-1 through 3-7 are test printouts of the various resident bar codes; the ASCII full representation of the data used to print each of the examples is included in the figures.

All bar code examples are printed in picket fence configuration; ladder configuration can be printed by changing the bar code select command <AB#> string,

where: B = P for picket fence configuration
B = L for ladder configuration.

NOTE

Each end of line of the bar code data contains both carriage return (CR) and line feed (LF) characters. LFs are ignored by the printer; CRs are processed as follows:

Current Column Pointer —> 0
Current Row Pointer —> Current row pointer plus current box height.

3-49. UPC Bar Codes. (Figure 3-1.) UPC bar codes are numeric only codes, consisting of a left hand border character, 6 left hand characters, a center character, 6 right hand characters, and a right border character. The left, center, and right border characters are defined as J, K, and L, respectively.

3-50. EAN8 Bar Codes. (Figure 3-2.) EAN8 bar codes are similar to UPC bar codes described in the previous paragraph, except they contain only 8 numerical digits, instead of 12.

3-51. Interleaved 2 of 5 Bar Codes. (Figure 3-3.) Interleaved 2 of 5 bar codes are numeric only bar codes which must contain an even number of numeric characters bracketed by start and stop (:) characters. These bar codes can be printed in either a 2:1 or 3:1 wide to narrow ratio, with the 2:1 ratio being the default setting.

3-52. EAN13 Bar Codes. (Figure 3-4.) EAN13 bar codes are numeric only bar codes, which consist of a variable parity bit, a front guard character (J), 6 left numeric characters, a center character (K), 6 right numeric characters, and an ending guard character (L). The parity of the left numeric characters is determined by the first (parity) bit. The last bit of the right side is the check digit, the value of which is recalculated by the printer firmware after transmission.

3-53. Code 39 Bar Codes. (Figure 3-5.) Code 39 bar codes are alphanumeric bar codes, with all data bracketed by an asterisk on each side. Code 39 bar codes can be printed in either a 2:1 or 3:1 wide to narrow ratio, with the 2:1 ratio being the default setting.

3-54. USS-CODABAR Bar Codes. (Figure 3-6.) USS-CODABAR is a numeric barcode with six special characters (-$:/.+) and four start/stop characters (a, b, c, d). Data must be bracketed by a start and a stop character.

3-55. Code 128 Bar Codes. (Figure 3-7.) Code 128 bar codes are alphanumeric bar codes. All data must be bracketed by a caret (^) on each side. Shift characters and check digits are calculated automatically by the printer.

3-56. Permanent Logos. As an available customer-specified option, permanent logos can be stored in the printer memory before the printer leaves the factory. The permanent logos can be accessed by use of the <LO#> command.

Example:

"<SP40,200> <LO3>"

(UPC) test data = J012345K678900L
(Leading 0 = NUMBER SYSTEM
Trailing 5 = CHECK CHARACTER)
Ratio = 2:1 (3:1 illegal)
<RC165,400> <B1> <X3> <UP18> J012345K678901L
<p>

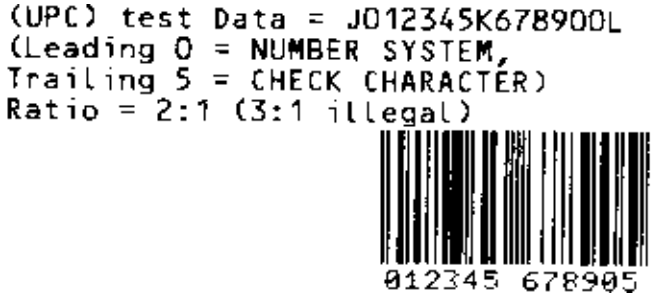


Figure 3-1. Sample UPC Bar Code Test Data and Resulting Printout

This command sequence will print permanent logo number 3 on the ticket, with row 40, column 200 as the starting position.

3-57. Loading Downloadable Logos. The user can generate his own logos and download the logo data into the printer for recall and printing throughout the day. The rules described in the following paragraphs must be observed.

3-58. The left-topmost corner of the logo is considered to be position 0,0. (See Figure 3-8.) The sequence for sending logo data to the printer is as follows:

ESC
"<RC0,0>"
"<G#>byte1,byte2,....byte#"
"<RCx,y> or CR"
"<G#>byte1,byte2,....byte#"
.
.
.
ESC

3-59. ESC characters must be used to bracket all downloaded logo data. Following the first ESC character, a row/column command (preferably <RC0,0>) is sent. Then, a <G#> command selects the normal graphics mode and indicates the number of graphics bytes of logo data to follow; # can be any number to a maximum of 32740. The actual data bytes for that line follow. This routine, except for the ESC character, is repeated for each remaining line of logo data. A CR could be used in place of the row/column command for following lines if the data is to start at the beginning of the next line.

3-60. The preceding procedure is repeated for each downloadable logo to be sent to the printer. The printer will automatically assign the next consecutive number as the logo number. These logo numbers are used to access the logo for printing. The logo numbers which are later used to address a logo for printing are assigned sequentially. The maximum number of logos stored is 40. The data space for download data is 32K bytes. The system programmer must not exceed this space limit.

EAN8 test data = J4015K3470L
(Leading 4 = NUMBER SYSTEM,
Trailing 6 = CHECK CHARACTER)
<RC155,380> <X3> <UP18> <BI> J4015K3470L
<p>

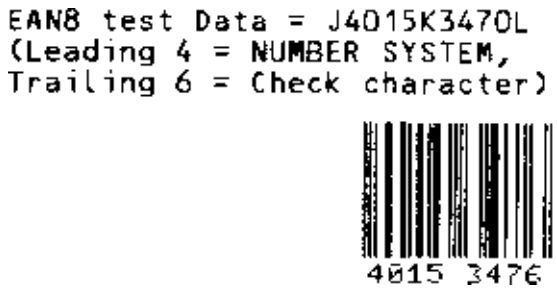


Figure 3-2. Sample EAN8 Bar Code Test Data and Resulting Printout

```
(2 OF 5) test data = :123456:
BAR CODE RATIO = 3:1
<RC165,400> <BI> <X5> <FXP18>:123456:
<p>
```

```
(2 of 5) test Data = :123456:
BAR CODE RATIO = 3:1
```

Figure 3-3. Sample Interleaved 2 of 5 Bar Code Test Data and Resulting Printout

```
(EAN13) test data = 5J012345K678905L
Ratio = 2:1 (3:1 illegal)
<RC155,380> <BI> <X3> <EP18> 5J012345K678905L
<p>
```

```
(EAN13) Test Data = 5J012345K678905L
Ratio = 2:1 (3:1 illegal)
```

Figure 3-4. Sample EAN13 Bar Code Test Data and Resulting Printout

(CODE 39) test data = ∗CODE39∗
BAR CODE RATIO = 2:1
<RC165,320> <BI> <X4> <NP18> ∗CODE39∗
<p>

(CODE 39) test Data = *CODE39*
BAR CODE RATIO = 2:1

Figure 3-5. Sample Code 39 Bar Code Test Data and Resulting Printout

(CODABAR) test data = A123456B
BAR CODE RATIO = 2:1 (3:1 illegal)
<RC165,320> <BI> <X4> <CP18> A123456B
<p>

(CODABAR) test Data = A123456B
BAR CODE RATIO = 2:1 (3:1 illegal)

Figure 3-6. Sample USS-CODABAR Test Data and Resulting Printout

3-61. Generation of Downloadable Logo Data.
To determine the proper logo data bytes required for a particular logo, proceed as follows:

a. On a sheet of graph paper, trace the desired logo pattern lightly.

b. Divide the graph into vertical bytes of 8 rows each. Each division will correspond to one line of logo data. For example, if the graph is divided into two bytes vertically, two lines of data will be sent to the printer.

c. Starting at the top of the first column of the first line, assign the proper binary value (1 or 0) for each row position in that column. If a dot is to be drawn at a row position, assign a 1; if no dot is to be drawn, assign a 0. The result will be an 8 digit number, with the top row position being the MSB. For example, a column with every other row blank would provide the number 10101010.

d. Convert this number to its equivalent decimal or hex value, depending on the graphics mode to be used to transmit the data. The converted data will represent the first data byte to be sent for the first line of the logo.

e. Repeat steps c and d for each of the remaining columns of the first line. If the line contains 21 columns, for example, 21 data bytes should be developed for that line.

f. Repeat steps c, d, and e for each of the remaining lines of the logo.

g. Use the computed values for the data bytes in the logo downloading sequence.

```
(CODE 128) test data = ^CODE128^
BAR CODE RATIO = 2:1 (3:1 illegal)
<RC165,320> <OP18> <BI> <X4> ^CODE128^
<p>
```

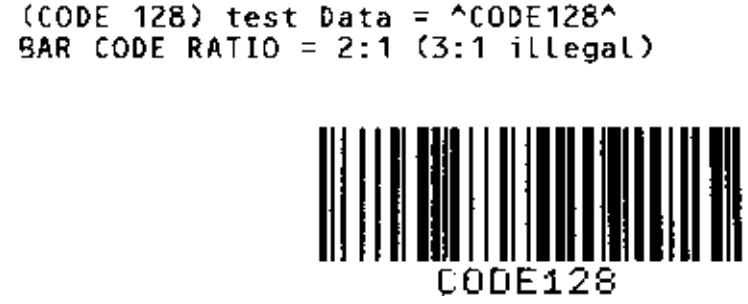


Figure 3-7. Sample Code 128 Bar Code Test Data and Resulting Printout

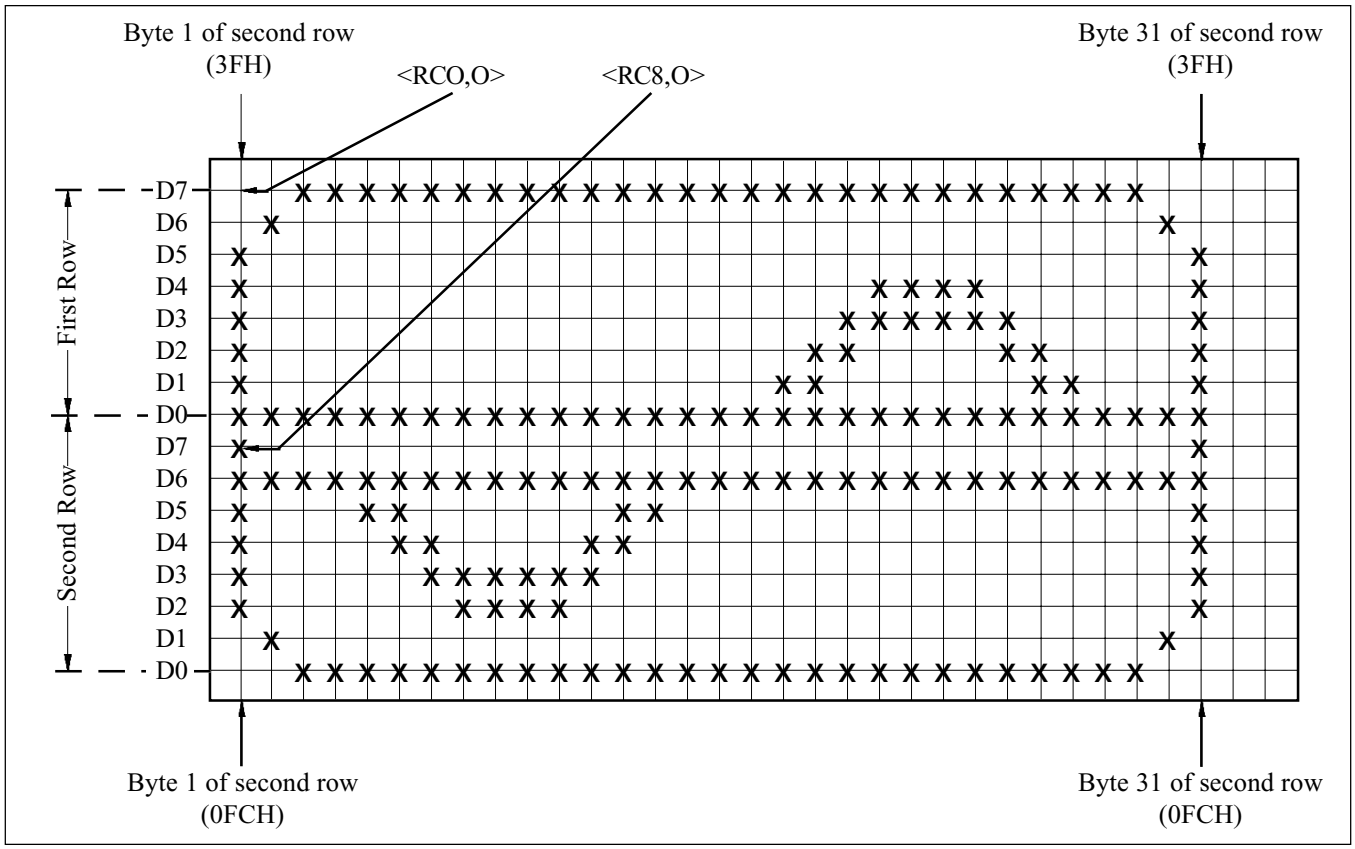


Figure 3-8. Downloadable Logo Data Bytes

3-62. The above procedure is illustrated in Figure 3-8. The folowing Basic program could be used to send this downloadable logo data to the printer. Note that the logo starting point should always be 0,0. The actual positioning of the logo on the ticket is accomplished with the starting point command <SPx,y>.

```
60   WIDTH 'LPT1;',255
70   ' — First clear the down load area
80   LPRINT CHR$(&H1B);
90   LPRINT "c"
100  LPRINT CHR$(27);   ' — LEADING ESCAPE FOR LOGO
110  LPRINT "<RC0,0>";  ' — Locate LOGO at 0,0
120  LPRINT "<G31>";  ' — Prepare to send 31 graphic bytes
130  ' — Send the 31 graphic bytes
140  FOR X% = 1 TO 31 : READ A: LPRINT CHR$(A); : NEXT X%
150  DATA & H3F, & H41, & H81, & H81, & H81, & H81, & H81, & H81, & H81, & H81
160  H81, & H81, & H83, & H87, & H8D
170  DATA & H99, & H99, & H99, & H99, & H8D, & H87, & H83, & H81, & H81, & H41
180  DATA & H3F
190  LPRINT "<RC8,0>"; ' — Locate next logo row at 8,0
200  LPRINT "<G31>"; ' — Prepare to send 31 more graphic bytes
210  ' — Send the bytes for the second row of the logo
220  FOR X% = 1 TO 31 : READ A: LPRINT CHR$(A); : NEXT X%
230  DATA & HFC, & H42, & H41, & H61, & H71, & H59, & H4D, & H4D, & H4D, & H4D
240  DATA & H59,& H71, & H61, & H41, & H41, & H41, & H41, & H41, & H41, & H41
250  DATA & H41 ,& H41, & H41, & H41, & H41, & H41, & H41, & H41, & H41, & H42
260  DATA & HFC, & H80, & H80, & H80
270  LPRINT CHR$(27); ' — Trailing ESCAPE for LOGO
280  ' — Now issue starting point command for logo printing
290  LPRINT "<SP100,100>";
300  ' — Now the print logo command. Note that if this is the
310  ' — first downloaded logo use the command <LD1>
320  LPRINT "<LD1>";
330  ' — Now finish with a normal print command
340  LPRINT "<RC0.0>DOWNLOADABLE LOGO TEST";
350  LPRINT "<p>";
```

The ESC characters that must bracket the data transmission are sent in lines 100 and 270 of this sample program. Line 110 sends the initial reference position (row 0, column 0) and line 120 indicates 31 graphics bytes will be sent. Semicolons are used to suppress spaces and carriage returns between bytes and commands since such extraneous data would cause undesired results. A return character (CHR$(13)) could be sent in place of the row/column command in line 190 since the second line of the logo begins directly under the start of the first line.

3-63. Logos can also be downloaded in ASCII format. All of the preceding rules must be followed, except that a small g is used instead of a capital G in the graphics command and the data bytes are sent as ASCII characters instead of decimal.

3-64. Printing Downloadable Logos. Downloadable logos stored in memory are accessed using the <LD#> command.

Example:

<SP30,60> <LD3>

This command sequence will print downloadable logo number 3 on the ticket, starting at row 30, column 60.

3-65. Boxes and Lines. Boxes and lines can be used to improve the appearance of the printed ticket. The following is an example of data sent to the printer by a computer to print the ticket shown in Figure 3-9.

<RC000,200> <LT8> <BX360,890>
<RL> <F6> <RC260,034> V O I D
<F2> <HW2,2> <RC340,130> TEST TICKET ONLY
<RC080,200> <LT4> <HX888>
<RC000,800> <LT8> <VX360>
<RC000,490> <LT4> <VX80>
<NR> <RC018,290> <F1> <HW2,2> TICKET NO.
<RC018,620> DATE
<RC018,920> PRICE
<RC150,280> <F3> <HW1,1> PRACTICAL AUTOMATION
<F3> <HW1,1> <RC230,280> BOX+LINE DRAW
<p>

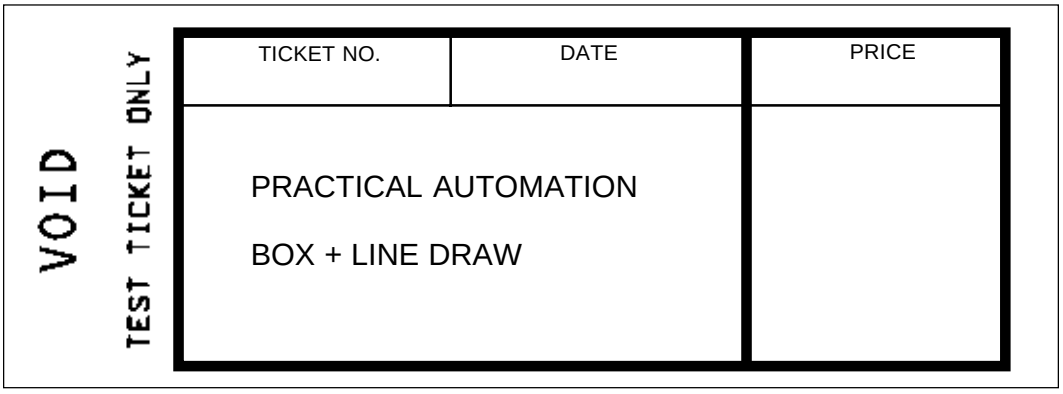


Figure 3-9. Sample Ticket Illustrating Use of Boxes and Lines

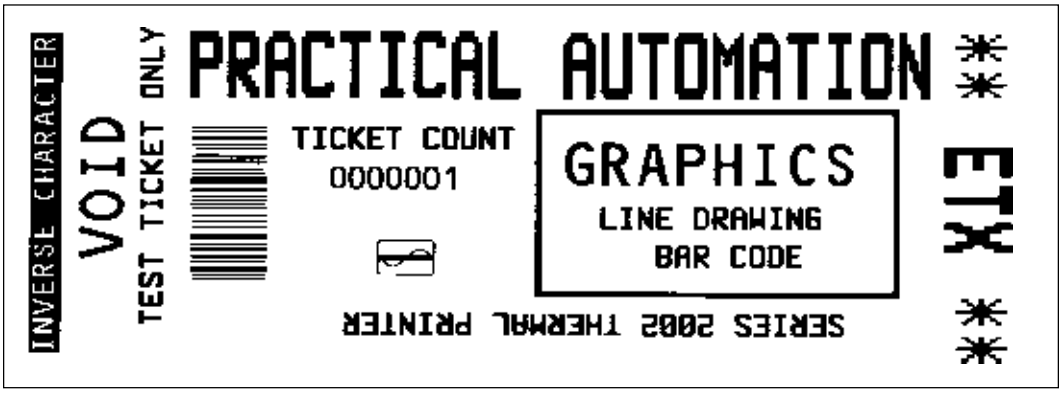


Figure 3-10. Ticket Printed With Sample Program

Figure 3-11. Font Data Listing

3-66. SAMPLE PROGRAMS.

3-67. The following is an example of data sent to the printer by a computer to print the ticket shown in Figure 3-10.

<F2> <HW6,4> <RC018,200> PRACTICAL AUTOMATION
<RL> <RC260,040> <F6> <HW1,1> VOID
<RC330,120> <F2> <HW2,2> TEST TICKET ONLY
<RR> <HW6,4> <RC020,1080> ** ETX **
<RU> <HW2,2> <RC340,880> SERIES 2002
THERMAL PRINTER
<RC140,300> <EL10> <X2> 9J14561K78012L
<NR> <F6> <HW1,1> <RC120,500> GRAPHICS
<F3> <RC180,520> LINE DRAWING
<F2> <RC220,580> BAR CODE
<F3> <RC260,460> <EI> INVERSE CHARACTER <DI>

3-68. DOWNLOADABLE FONTS.

3-69. Most applications for different font sizes can be satisfied using the fonts installed in the ETX at the factory. However in those instances where a special font size is required the printer is capable of receiving downloaded font data and storing it for as long as power is maintained to the printer. Shutting power off will reset the downloaded font data and the data must be resent to resume similar operation.

3-70. It is necessary to send the font data in groups representing 91 characters. The data for each character must be sent in the same order shown in figure 3-11. Characters may not be skipped even if they will not be used. However, a blank character (all zeros) may be in place of unused characters and for all the (nu) listings. The (nu) stands for not used characters usually reserved by the printer.

3-71. The number of bytes required for each character is dependent upon the font selected. Four different font sizes (fonts A,B,C,D) can be received by the printer. The maximum number of bytes selected can not exceed 32K including any preciously sent logo data. The first group of data sent is considered font A, the second font B, etc.

3-72. Escape characters must bracket all downloaded font data. The font escape character is sent first, then a small r followed by the number of bytes per character and the command character >. there is no beginning command character < as in a normal sequence. After the > character send all font character data bytes.

3-73. Nothing can be sent between characters. After the last byte send the closing escape character. This sequence is repeated for successive characters.

Example:

ESC r7>
characters 1-91
ESC

ESC Opening char. for downloadable font
r Down load font specifier - all rotations

NOTE

The above example contains spaces for clarity. They should not be sent to the printer.

7 Bytes per character
> Closes font definition field

Characters 1-91: Seven bytes per character must be sent.
ESC

3-74. Font listings To download font data to the printer each character must first be plotted on graph paper (see figure 3-12 a,b,c and d for examples). Any font size may be used without restriction provided the total font size does not exceed the download memory area of 32K. In the examples shown a 5x7 font size is used. Therefore each character is drawn 5 bits wide (columns) and 7 bits high (rows). Each 5x7 box is thought of as a series of rows. The character is 5 columns wide and 7 rows high. Each row is represented as bytes of data with 0 in a blank position and 1 in a printed position. A 5 dot wide character will take one byte per row to describe. Wider fonts require more than one byte per row:

5x7 font = 1x7 = 7 bytes per character

8x16 font = 1x16 = 16 bytes per character

10x16 font = 2x16 = 32 bytes per character

17x31 font = 3x31 = 93 bytes per character

3-75. Row 1 of figure 3-12a is represented by 11110xxx (xxx should be zeros but are not actually used by this font). Row 2 is 10001xxx and so on. Convert each byte to its decimal or hexadecimal equivalent. Row 1 = 240 decimal or FO hex. Row 2 = 136 Decimal or 88H. Send the printer 1 byte per row for each character. Note, if there are more than 8 columns, more than 1 byte per row must be sent. For example a font 10 bits wide will require the sending of 2 bytes per row, i.e. 10101010 11xxxxxx. 7 bytes per character are sent because there are 7 rows to this font size. When determining the font size to use you must plot the tallest and widest character. That will be the font size for all characters in that set.

3-76. The full number of rows must be sent even though a particular character does not fill all the rows. The characters will appear exactly as drawn, so spaces must be used to fill at the top and sides for characters that are shorter or narrower than the rest (see figure 3-12c).

3-77. PRINT FONTS

Command sequence: <F1w,h> <BSw,h>
Where:
F1 = font to be printed (A,B,C, or D, capitols only).
w = font width
h = font height
BS = boxsize

3-78. The boxsize and font size must be included when printing a downloadable font but is not necessary when printing a factory installed font. For the above example the correct command sequence to print text in the downloadable font mode would be <FA5,7><BS6,8>. Previously selected rotation will apply. A font command will remain in effect until a new font size is selected. Therefore, it is not necessary to send a given sequence more than once.

3-79. Sample Basic Program For Downloaded Fonts

A sample downloadable font program is shown below. All 91 characters must be sent as previously discussed.

```
10  CLS
20  OPEN "COM1:9600,N,8,1,RS,DS60000" AS #1
30  PRINT #1,CHR$(27);
40  PRINT #1,"r7>"
45  REMARK - Send bytes for all characters not
    used to A position
50  FOR X = 1 TO 7:  READ A:  PRINT #1,CHR$(A); :
    NEXT X
65  REMARK - Send the character B
70  FOR X = 1 TO 7:  READ A: PRINT #1,CHR$(A); :
    NEXT X
80  DATA 112,136,136,248,136,136,136
90  DATA 240,136,136,240,136,136,240
100 PRINT #1, CHR$(27);
110 END
```

3-80. PRINT AND HOLD FUNCTIONS.

3-81. Graphics and downloadable logos can be used to enhance ticket appearance; however, the time required to print a ticket can be significantly increased if the graphic or logo data is extensive. This increase in printing time can be eliminated by using the print and hold functions.

3-82. The printer ticket image buffer is normally cleared after each ticket is printed. If the ticket data is terminated with a print and hold (cut) command <h> or a print and hold (no cut) command <r>, the ticket image buffer is not cleared after the ticket is printed. Replacement data can then be sent to the printer to update only the variable fields on the ticket. This data will replace the data originally written.

3-83. Each additional ticket printed should be terminated with the print and hold (cut) command <h> or the print and hold (no cut) command <r>. The last ticket of a run should be printed using the normal print command <p>.

3-84. STATUS FUNCTIONS

3-85. <S1>. The <S1> status function returns a single character indicating the current state of the printer. <S1> status function is enabled only in Xon/Xoff mode. Data returned is as follows:

1 - 11H (Xon)	Printer on line with paper, ready to print
2 - 10H	Printer is out of tickets/paper
3 - 12H	Low paper condition (roll versions only)
4 - 18H	Jammed ticket (requires operator intervention)

3-86. <S2>. The <S2> status function returns an ASCII string that contains the current printer ticket count (7 digits), followed by the version number and date of the currently installed code and the version number and date of the currently installed character generator EPROM.

3-87. <S3>. Normally, if the printer is configured in the Xon/Xoff mode, an acknowledge (06) is returned after each ticket is printed. If the <S3> command is sent with the first or all tickets of a run, a single acknowledge is returned after all the tickets in the run have been printed. The <S3> function is cleared after the run of tickets has been printed.

3-88. <S5>. The <S5> function is used to disable all status with the exception of Xon/Xoff. Once invoked, it stays operational.

3-89. <Sz>. The <Sz> functions returns a single ASCII character indicating the current status of the printer. <Sz> status is enabled in the Xon/Xoff mode only. Data returned is as follows:

0	Printer on line and ready to print
1	Printer out of tickets/paper
2	Jammed ticket (requires operator intervention)
3	Printer off line (deselected)
4	Printer failure
5	Low paper condition (roll models only)

3-90. <ME>. The <ME> function causes a message to be sent to the CRT port. The message alerts the operator to a condition that requires immediate attention. Possible messages are as follows:

1	Out of tickets
2	Low tickets
3	Jammed tickets

3-91. <MD>. The <MD> function disables the <ME> function described in the preceding paragraph. This is the power-on default state.

3-92. SETUP FUNCTIONS.

3-93. Save Offset Data Command. The <SOD> command causes the following dot offset values to be stored in the EEPROM:

- **a.** Row offset (<R0#>)
- **b.** Dot offset (<D0#>)
- **c.** Label adjust (<LA#>)
- **d.** Registration adjust (<R+#> and <R-#>)
- **e.** Print length (<PL#>) — This command is applicable only to roll/strip printers.

<SOD> should only be used as a setup command. It should not be sent with each ticket. The EEPROM has a long but finite life (approximately 100,000 cycles).

3-94. Clear Offset Data Command. The <COD> command restores the following offset data to default values and causes these default values to be stored in the EEPROM:

- **b.** Dot offset — 26 dots
- **c.** Label adjust — 16 dots
- **d.** Registration adjust — 0 dot
- **e.** Print length — 5.5 inches — applicable only to roll/strip printers.

<SOD> should only be used as a setup command. It should not be sent with each ticket.

3-95. PRINT ENERGY ADJUSTMENTS

3-96. The printer provides 16 print energy selections with 2 drive modes, yielding a total of 32 print intensity selections. Additionally, four selections of "history off time" are available. Switches SW2/1 through SW2/4 select print intensity (energy); switch SW2/5 selects the thermal drive mode (peak resistor temperature); and switches SW2/6 and SW2/7 select the history off time. History off time selection 0 0 provides the minimum history, while selection 1 1 provides the maximum history. These history off time settings can be used in conjunction with test pattern generation (paragraph 4-27d) to achieve optimum print quality.

3-97. The 16 print intensity selections (at history off time = 0 0) represent a print energy/speed range of approximately 4 to 8 IPS.

3-98. The combination of the seven print intensity switches permits a wide range of adjustment to match the media response. Application trade-offs of print intensity/quality vs. speed can be managed with proper switch selections. Typical operation is as follows:

Print intensity — 4 to 7
Drive mode — 0 or 1
History off time — 0,0

EXAMPLE A

'P' Columns

Rows	7	6	5	4	3	2	1	0	Byte Value (HEX)	Byte Value (Decimal)
1	**1**	**1**	**1**	**1**	0	0	0	0	F0	240
2	**1**	0	0	0	**1**	0	0	0	88	136
3	**1**	0	0	0	**1**	0	0	0	88	136
4	**1**	**1**	**1**	**1**	0	0	0	0	F0	240
5	**1**	0	0	0	0	0	0	0	80	128
6	**1**	0	0	0	0	0	0	0	80	128
7	**1**	0	0	0	0	0	0	0	80	128

EXAMPLE B

'A' Columns

Rows	7	6	5	4	3	2	1	0	Byte Value (HEX)	Byte Value (Decimal)
1	0	**1**	**1**	**1**	0	0	0	0	70	112
2	**1**	0	0	0	**1**	0	0	0	88	136
3	**1**	0	0	0	**1**	0	0	0	88	136
4	**1**	**1**	**1**	**1**	**1**	0	0	0	F8	248
5	**1**	0	0	0	**1**	0	0	0	88	136
6	**1**	0	0	0	**1**	0	0	0	88	136
7	**1**	0	0	0	**1**	0	0	0	88	136

EXAMPLE C

'B' Columns

Rows	7	6	5	4	3	2	1	0	Byte Value (HEX)	Byte Value (Decimal)
1	**1**	**1**	**1**	**1**	0	0	0	0	F0	240
2	**1**	0	0	0	**1**	0	0	0	88	136
3	**1**	0	0	0	**1**	0	0	0	88	136
4	**1**	**1**	**1**	**1**	0	0	0	0	F0	240
5	**1**	0	0	0	**1**	0	0	0	88	136
6	**1**	0	0	0	**1**	0	0	0	88	136
7	**1**	**1**	**1**	**1**	0	0	0	0	F0	240

EXAMPLE D

'.' Columns

Rows	7	6	5	4	3	2	1	0	Byte Value (HEX)	Byte Value (Decimal)
1	0	0	0	0	0	0	0	0	00	00
2	0	0	0	0	0	0	0	0	00	00
3	0	0	0	0	0	0	0	0	00	00
4	0	0	0	0	0	0	0	0	00	00
5	0	0	0	0	0	0	0	0	00	00
6	0	**1**	**1**	0	0	0	0	0	60	96
7	0	**1**	**1**	0	0	0	0	0	60	96

Figure 3-12. Plotting Downloadable Fonts

SECTION IV
OPERATING INSTRUCTIONS

4-1. OPERATOR CONTROLS AND INDICATORS.

4-2. Ac line power is connected to the printer through the line cord, which plugs into the power receptacle at the rear of the printer. (See Figure 4-1.) An internal jumper is factory-installed to accomodate the user-specified line voltage. The ON/OFF switch turns the printer on and off, and the fuse protects the printer against overload. A 25 PIN I/O connector provides means for connecting the printer to the data source (serial RS-232C or Centronics parallel).

4-3. The front panel of the printer contains three LEDs and four switches for operator use. The functions of these items are described as follows.

4-4. OPERATOR INDICATOR LEDS

a. POWER Indicator. This LED is controlled by the dc output of the power supply. When lit, it indicates that the power supply is on.

b. READY Indicator. This LED, when lit, indicates that the printer has been selected and is on-line, ready to accept print data.

c. TICKET OUT Indicator. This LED, when lit, indicates that the printer has run out of ticket stock.

4-5. PANEL SWITCHES.

4-6. The four momentary type switches on the front panel can be used individually or in combination to select various operating functions. Selected functions, which depend on the printer status, are described in Table 4-1.

4-7. PRE-OPERATIONAL SETUP.

4-8. When setting up the printer initially or changing operating modes, DIP switches on the printer controller board must be set to select the desired operating parameters. (Refer to paragraph 2-13.) The front panel switches provide an alternate

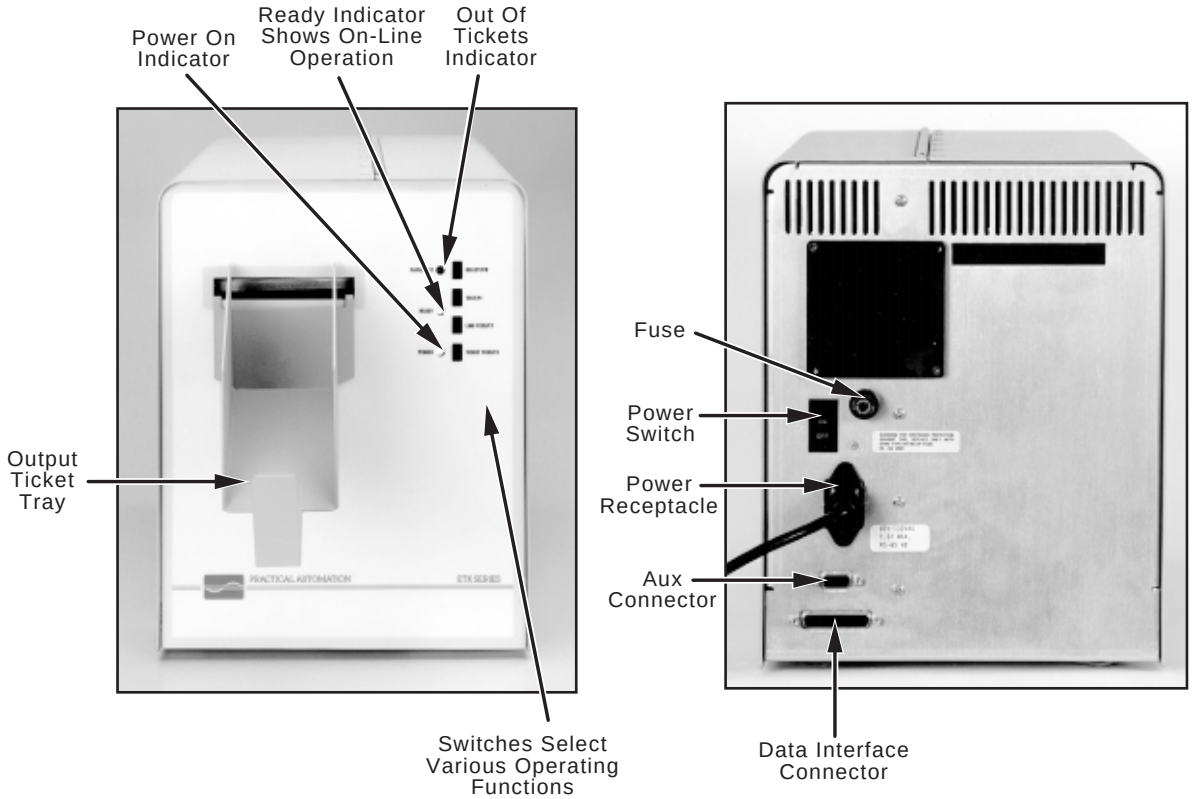


Figure 4-1. Operator Controls and Indicators

means for accessing DIP switch functions when the printer is operated in the EEPROM DIP switch select mode. DIP SW2/8 , must be at factory setting, EEPROM = 1 enabled to perform following:

4-9. To enter the EEPROM DIP switch select mode and reconfigure the DIP switch settings, proceed as follows:

a. If the rear panel power switch is set to the ON position, set the switch to the OFF position.

b. While holding down the front panel TICKET FEED/F3 switch, set the rear panel power switch to the ON position.

c. Wait for the printer to initialize and beep once.

d. Release the TICKET FEED/F3 switch.

e. Wait for a second beep.

f. Press and release the TICKET FEED/F3 switch, then quickly press and hold in the TICKET FEED/F3 switch until printing begins. The printer will print two tickets, one with the current DIP switch settings and the second (help ticket) with instructions for reconfiguring the DIP switch settings through the front panel controls. (See Figure 4-2.)

g. To change any of the DIP switch settings listed on the first ticket, follow the instructions on the help ticket.

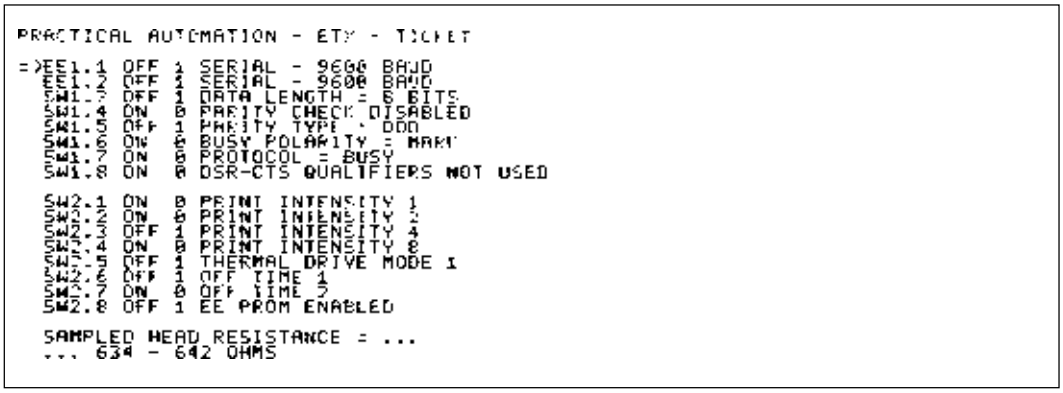
h. Note that the physical DIP switches are operational when the EEPROM DIP switch mode is selected. If a physical DIP switch setting is changed, the new DIP switch setting is operational; however, it may require two transfers of a physical DIP switch bit to accomplish the desired bit change.

4-10. LOADING TICKET STOCK.

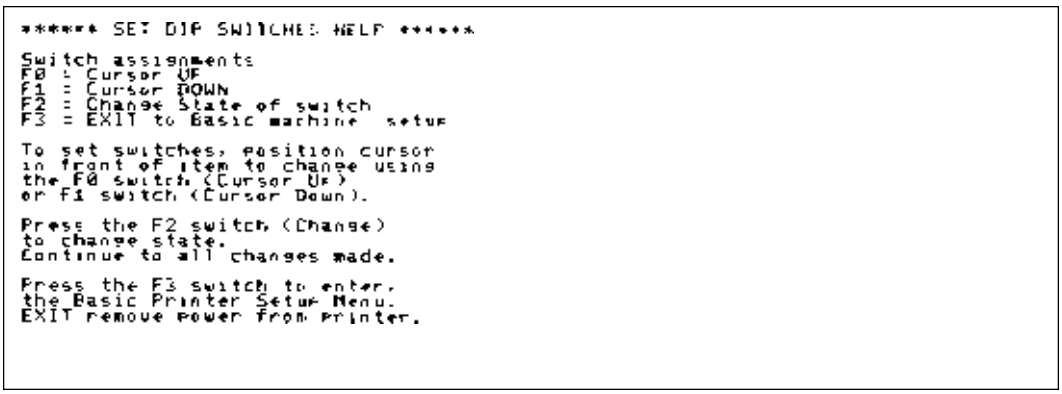
4-11. The need to reload ticket stock is indicated by lighting of the TICKET OUT indicator on the front panel. Refer to paragraph 2-26 for ticket loading procedures.

4-12. ADJUSTING PRINT INTENSITY.

4-13. The print intensity (darkness) can be adjusted using DIP switches SW2/1, SW2/2, SW2/3, and SW/4. The DIP switches, weighted 1, 2, 4, and 8, respectively, provide print energy selection capability from 0 (lowest) to 15 (highest). The energy level for each of these DIP switches



Current Dip Switch Settings



Help Ticket

Figure 4-2. Typical EEPROM DIP Switch Select Mode Printout

TABLE 4-1. FRONT PANEL SWITCH FUNCTIONS

Switch	Operating Function	Alternate (F) Function
SELECT/F0	On line/off line*	Cursor up in EEPROM DIP switch select mode. Enter self-test diagnostic mode (paragraph 4-26)
TEST/F1	Print test ticket	Cursor down in EEPROM DIP switch select mode
LINE FEED/F2	Advance ticket in approximately 0.1" increments	Change selected DIP switch state in EEPROM DIP switch select mode
TICKET FEED/F3	Advance to next ticket	Enter EEPROM DIP switch select mode (paragraph 4-9). Exit from EEPROM DIP switch select mode

*When manually placed off line (READY indicator is off), printer will "beep" at 10 second intervals as a reminder that the printer is deselected.

is active when the switch is set to OFF. As an example, energy level 5 is selected by setting switches SW2/1 (energy level 1) and SW2/3 (energy level 4) to OFF, and switch SW2/2 (energy level 2) to ON. (Energy level 4 is factory set prior to shipment of the printer.)

4-14. OPERATION.

4-15. To operate the printer, the operator need only set the ON/OFF switch to ON, press the SELECT/F0 switch, and monitor the front panel indicators. The POWER and READY indicators must both be lit for the printer to be selected and on-line; the TICKET OUT indicator must be off.

4-16. ERROR CODES (BEEPS).

4-17. On power-up, the printer will sound a sequence of beeps if certain internal malfunctions are detected. The beep sequences are repetitive. The number of beeps in each sequence defines the failure, as follows:

No. of Beeps	Malfunction
1	RAM test failed
2	Download RAM failed
3	PROM checksum failure
4	Character generator checksum failure
5	Bad printhead, or printhead not installed
6	EEPROM checksum error
7	Printhead lever is up (i.e. not contacting the paper).
8	Cutter failure
9	Registration failure
10	DRAM error

4-18. Dusty Sensor Warning. The printer checks the sensors at "power on" to determine if a quality signal exists for detecting registration marks reliability. It does this by examining the ticket's white background to insure a signal of sufficient amplitude is reflected from this surface. This signal can decrease over a long period of time with the accumulation of paper dust on the sensor lens. Periodic sensor cleaning is recommended. When a poor quality white signal is detected, a warning tone will be sounded: a single beep — a few seconds in duration — at "power on". The printer will very likely continue to work properly after the warning, however, with continued neglect it will not. Cleaning of the sensors should be done on a scheduled basis. Do not wait for this warning.

4-19. PREVENTIVE MAINTENANCE.

4-20. General. It is recommended that preventive maintenance be performed at least once per month; however, preventive maintenance may be required more often where the number of tickets printed is high or in hostile environments.

WARNING

Ensure that the printer is turned off and disconnected from the ac power source before performing any preventive maintenance procedure.

4-21. Print Mechanism Cleaning. Periodic cleaning of paper dust from the print mechanism with a small vacuum cleaner or a soft brush is recommended. Areas that should be cleaned are the cutter mechanism and the rubber drive roller. Clean the rubber drive roller when the printhead is being cleaned.

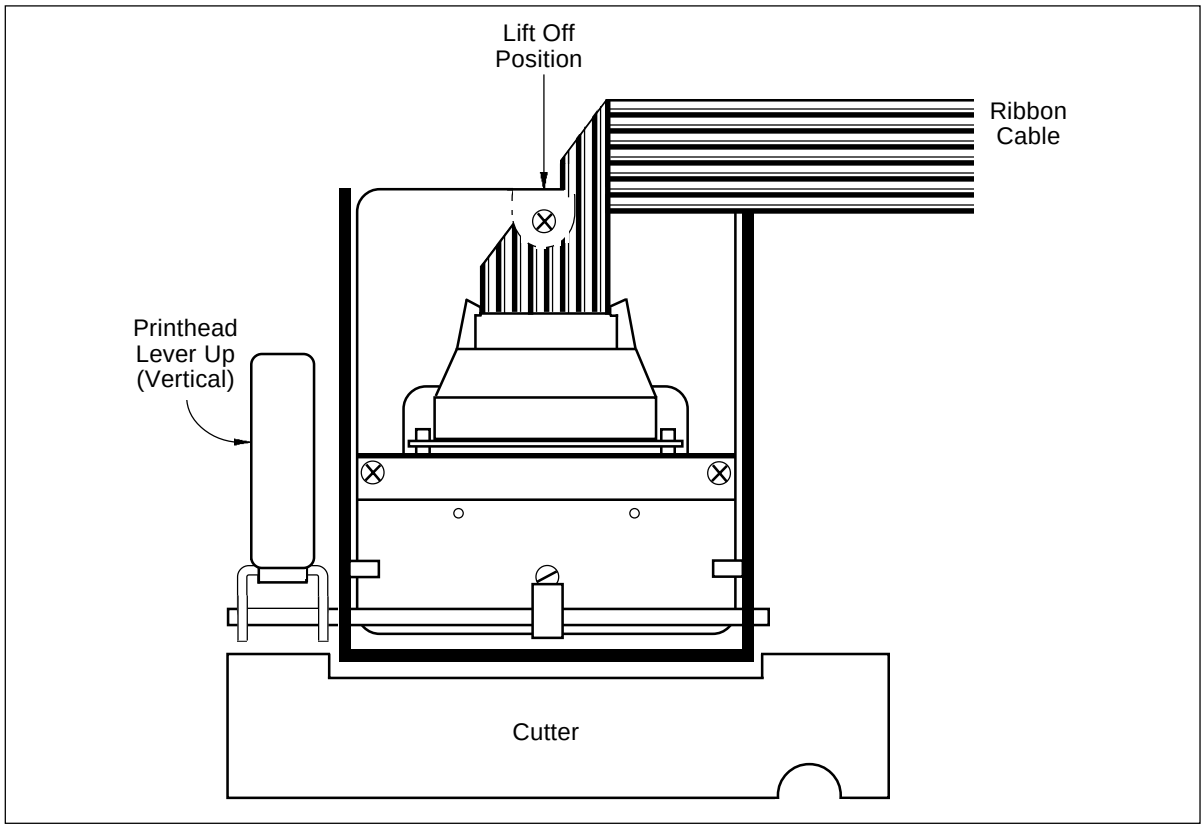


Figure 4-3. Printhead Removal

4-22. Printhead Cleaning. (Figure 4-3.) Accumulations of debris on the printhead can detract from print quality. Clean the printhead after every 100,000 tickets as follows:

- **a.** Set the rear panel power switch to the OFF position.
- **b.** Open the printer cover.
- **c.** Lift the printhead lever to the up (vertical) position.
- **d.** Apply finger pressure to the rear of the printhead mounting plate and use the pull tab. (Note: The ribbon cable connector can remain atttached for this procedure).
- **e.** Lift the printhead mounting plate off the post.
- **f.** Using a soft, lint-free cloth or swab dipped in isopropyl alcohol, gently wipe debris from the printhead elements (black line).
- **g.** Install the printhead mounting plate on the post and press the printhead lever to the down (horizontal) position.
- **h.** Install the printer cover.
- **i.** Set the rear panel power switch to the ON position.

4-23. Cleaning of Internal Surfaces. Using a small vacuum cleaner, clean the interior of the printer when there is a visible accumulation of dirt. Exercise care to avoid damage to component parts of the printer.

4-24. Printhead Replacement. It is recommended that the printhead be replaced every 500,000 tickets. The removal and installation procedure is similar to that described in paragraph 4-21.

4-25. TROUBLESHOOTING.

4-26. Self-Test and Diagnostics. Self-test and diagnostic capabilities are built into the printer to minimize the need for troubleshooting. To use these features, proceed as follows:

a. Perform the pre-operational checkout procedure described in paragraph 2-17. The printer will execute a self-test and print out a test ticket.

b. Set the rear panel power switch to the OFF position.

c. While holding down the front panel SELECT/F0 switch, set the power switch back to the ON position. Continue holding down the SELECT/F0 switch throughout the entire initialization cycle (approximately 10 seconds). During initialization, three beeps, one short, one long, and one short, will sound. At the end of the initialization cycle, the printer will print out the DIP switch settings, printhead resistance, diagnostic results, and firmware revision. (See Figure 4-4.) When the printout has been completed, the printer enters the ready state.

c. Check the printout to ensure that DIP switch settings are correct for the desired operating mode. Check the diagnostic results; if any test failed, the problem area will be pinpointed.

4-27. User-Selectable Diagnostics. The following additional user-selectable diagnostics are provided to facilitate trouble-shooting and adjustment of the printer.

a. Serial Channel Test. This test requires that loopback connectors be connected to serial channels 0 (25 pin) and channel 1 (9 pin). The loopback wiring details are printed on the loopback test result ticket. The serial channel loopback test is performed as follows:

1. Set the rear panel power switch to the OFF position.
2. While holding down the TEST/F1 switch, set the rear panel power switch to the ON position.
3. After initialization, the printer will sound one beep.
4. Release the TEST/F1 switch. A help ticket detailing the entry mode into diagnostics will be printed.
5. To perform the serial loopback test, press the TICKET FEED/F3 switch. The results of the test, along with a loopback wiring diagram, will be printed each time the TICKET FEED/F3 switch is pressed.

b. Sensor Adjust Mode. Two diagnostics are provided to facilitate mechanical adjustment of the paper sensor and the registration bar sensor. These sensors may need adjustment with new paper stock. The paper sensor adjustment is critical to ticket autoloading; the registration bar sensor controls the position of the cut relative to the ticket. To enter the adjust mode, perform steps 1 through 4 of paragraph 4-27a. As documented on the help ticket, press the SELECT/F0 switch for the paper sensor adjust diagnostics, or the LINE FEED/F2 switch for the registration bar sensor adjust diagnostics. After the selection has been made, the printer will sound one beep and enter the adjust mode. Once in the adjust mode, the front panel switches and indicators perform the following operations:

SELECT/F0 switch - Move ticket forward 1/2 step

TEST/F1 switch - Move ticket back 1/2 step

LINE FEED/F2 switch - Move ticket forward 1 step

TICKET FEED/F3 switch - Move ticket back 1 step

The READY indicator displays the on/off state of the selected sensor. The ticket may then be mechanically positioned properly and the selected sensor may be adjusted positionally while the READY indicator is observed for proper operation.

c. Hex Dump Mode. Host-to-printer cabling serial setup problems tend to be difficult to debug. To aid in debugging such problems, the hex dump mode is provided. When the printer is in the hex dump mode, the hexadecimal representation (as well as the printable ASCII equivalent, if available) for each character is printed. The printed output consists of two printed lines for groups of characters. The first line is the ASCII equivalent of the received character; if the character is not printable, a '..' is printed instead. The second line contains the hexadecimal representation of the received character. This mode does not attempt to print following the ETX command set. The data as received are printed.

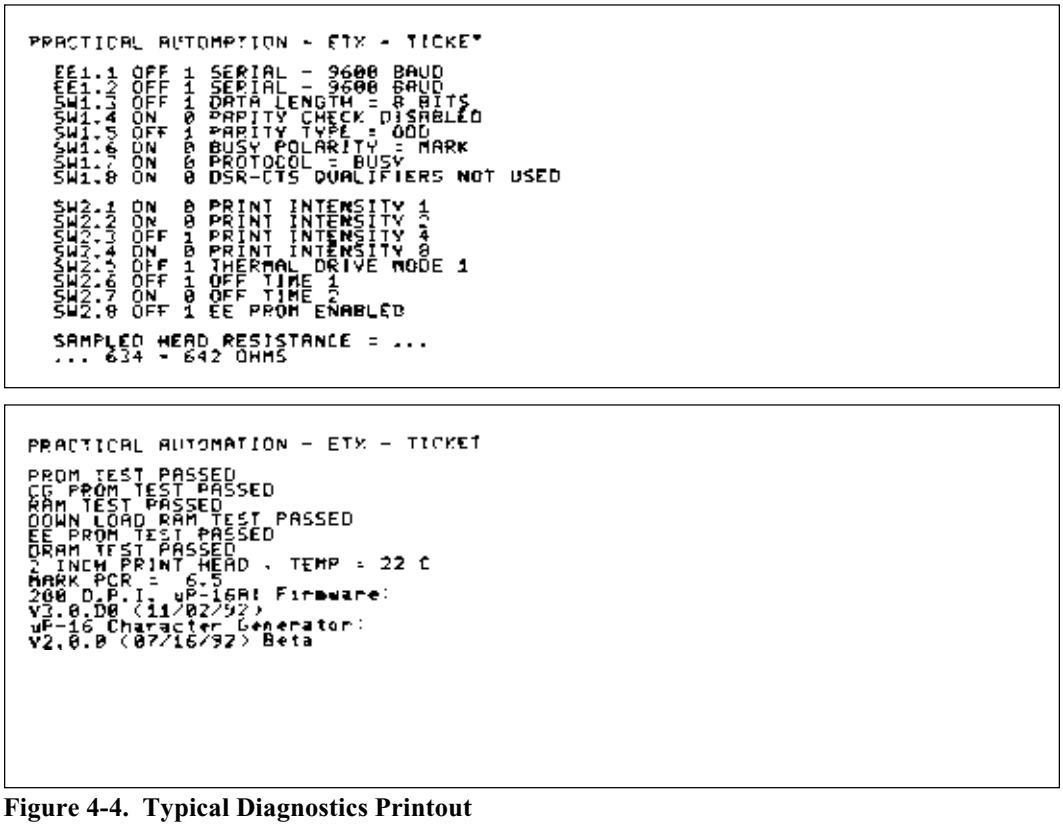


Figure 4-4. Typical Diagnostics Printout

This mode can be very useful when initially setting baud rate, parity, etc. when operating in the serial mode. To invoke the hex dump mode, proceed as follows:

1. Set the rear panel power switch to the OFF position.
2. While holding down the LINE FEED/F2 switch and the TICKET FEED/F3 switch, set the rear panel power switch to the ON position.
3. The printer will sound one beep.
4. Release the switches. The READY indicator will light. The printer is now in the hex dump mode.

d. Test Pattern Print Mode. To select the test pattern print mode to evaluate print intensity/off time settings, proceed as follows:

1. Perform steps 1 through 4 of paragraph 4-27a.
2. Press and release the TEST/F1 switch. The factory printer burn-in pattern will start printing.
3. Press the TEST/F1 switch again, and hold in the switch during the entire ticket printing operation.. The printer will print a test pattern. Examination of the printed patterns can be used to evaluate printer settings.
4. Set the rear panel power switch to the OFF position to stop the test.

4-28. Troubleshooting Chart. If the cause of a malfunction cannot be isolated through self-test and diagnostics, refer to Table 4-2, which lists common printer problems and remedies that are within the capability of the operator.

4-29. FACTORY SETUP.

4-30. The printers can be used in either ticket or roll mode. In the ticket mode, ticket length is determined by the distance between registration marks preprinted on the back of each ticket. In the roll mode, ticket length is derived from factory-set forms length data. Forms length is set to the nearest 0.1 inch; maximum forms length depends on the printer model and setup.

4-31. The printer is shipped from the factory in the mode requested by the customer at the time of purchase. Factory setup consists of the following:

1 - BASIC PRINTER TYPE (STANDARD)

a. Ticket — Standard ticket printer with registration mark sensing enabled (2 and 3.25 inch width printer)

b. Roll — Roll printer without registration mark sensing enabled (2 and 3.25 inch width printer)

c. Strip — Special configuration of roll printer; 1 inch wide strip printed (2 inch printer only)

d. Wrist — Special configuration of strip printer. Registration mark sensing enabled. Printer does not back up before printing.

e. Other — Special order

2 - CUTTER/TEARBAR

a. Cutter Enabled — Printer supplied with cutter mechanism

b. Tearbar Enabled — Printer supplied with tearbar mechanism

c. Disable Cut Command — The CUT COMMAND DISABLED position will allow the cutter to initialize and operate manually (via the front panel switches), however, the commands sent to the printer “FF” or “<p>” (print and cut) will be converted to “<q>” (print without cut). This provides a manual means to disable the cutter. The use of the commands “FF”; “<p>”; “<q>” are the preferred way to control the cut function, however, in cases where access to the driver software is not possible, this function may be useful

NOTE

This command must be disabled for normal cutter function to resume. For example, select “CUTTER ENABLED”.

3 - DENSITY

200 dpi and 100 dpi (see paragraph 4-40)

4 - PAPER INSERTION

a. Paper Insertion Enabled — Used in ticket mode for rigid tickets that allow for autoloading

b. Paper Insertion Disabled — Used in ticket mode for flimsy tickets that must be loaded manually

5 - LOW PAPER ALGORITHM #1; #2

Low paper detection inputs and printer reaction algorithms are provided by the pETX 200 systems. The low paper condition is signaled to the printer by contact closure, to ground, on the serial input connector (Pin 18, Pin 7 or Pin 23, with JP7 installed). A second low paper input is available on roll printers only. This second input operates by opening normally closed contacts between two pins on the sensor input connector (J7-Pin 3 - J7-Pin 6).

The selection of algorithm will depend on the type of printer in the system. A roll printer does not have tickets with registration marks defining the ticket length. Also the physical distance from the out of paper sensor to the print line is small. This short distance leaves very little paper in the printer when the out of paper condition is detected. Because of this, the last ticket will often not print completely. A ticket printer has registration marks on each ticket. Also the placement of the sensors for out of paper detection and registration mark detection provide a minimum of one ticket paper storage at out of paper.

For the above physical reasons, algorithm #1 is best suited to a roll printer. Algorithms #1 or #2 are usable for a ticket printer. When using algorithm #2, the last ticket will print because paper storage is provided by the registration mark system.

1. Low Paper #1 — When a low-paper condition is detected, all tickets in the print buffer(s) will be printed. After printing, the printer system beeps once and goes off line. The low paper condition is available to the host via status command inquiry (serial Xon/Xoff only). This algorithm is intended to insure the system prints the last ticket(s) in process and gracefully goes out of paper.
2. Low Paper #2 — If a low-paper condition is detected, the printer system will sound a single beep and flash the PAPER indicator for each ticket printed. This serves as a warning to the local operator that the paper needs refreshing. The tickets continue to be printed until the out of paper limit is reached. The printer will shut down at this point. This algorithm permits the system to continue to print with the stored paper residual after the low paper indication. The low paper condition is available to the host via status command inquiry (serial Xon/Xoff only). The liability of this algorithm is if the low paper condition is not reacted to by the time the low paper residual supply is exhausted, the last ticket(s) may not print correctly when the out of paper condition is reached.

6 - FORMS LENGTH (Roll/strip Mode Only)

Forms lengths 10, 1, and .1 are used to set the default forms length of printers configured to operate in the roll mode.

7 - NV DOWNLOAD
This selection bit enables or disables the support for nonvolatile download RAM memory.

8 - 100 DPI EMULATION MODE
This selection bit enables or disables the support for nonvolatile download RAM memory.

1. This is a product feature which permits the 200 dpi printer system to emulate the 100 dpi series printers. This can be a very useful tool to a systems integrator interested in easily upgrading to 200 dpi and still supporting applications in the field which have been written for the 100 dpi printer.
2. The 100 dpi emulation mode is selected as a control bit in the EEPROM Factory Setup menu (see paragraph 4-29). When this mode is enabled, the printer controller automatically uses the 200 dpi printhead to print at a 100 dpi resolution. The controller uses four 200 dpi dots to form each 100 dpi printed dot. Since the printer command set for 200 dpi units is upwardly compatible (same commands with new ones added and more fonts, features, etc), typically no changes will be required of the host driver software. The I/O interfaces are identical and when setup for 100 dpi emulation, will plug directly into a location where a 100 dpi unit had been operating. Since, however, some subtle differences may apply, *it is mandatory that the system integrator verify the emulation "fit" to his application before deploying a quantity of units to the field*. The factory, when possible, will assist in correcting or modifying firmware incompatibilities.
3. By using 200 dpi printers for both 100 and 200 dpi installations, inventory and repair considerations are simplified. The 200 dpi printer has more features, user friendliness and a higher thru-put than the 100 dpi systems.

4-32. CHANGING FACTORY SETTINGS.

4-33. To change factory settings, proceed as follows:

a. Enter the EEPROM DIP switch mode as described in paragraph 4-9. (Note that DIP switch SW2/8 must be in the OFF position to allow entry.)
b. After the EEPROM DIP switch mode has been entered and the help DIP switch tickets have been printed, press the TICKET FEED/F3 switch. (Note that the help ticket details the EEPROM setup particulars.)
c. The printer will now print a ticket detailing factory setups.
d. Position the cursor in front of the setup item to be modified using the cursor up (SELECT/F0) or cursor down (TEST/F1) switch.
e. After selecting the item to be modified, press the TICKET FEED/F3 switch to effect a change. Note that continuous operation of the TICKET FEED/F3 switch will increment the selection to its next position.
f. Use a similar procedure for changing the forms length setting. Position the cursor in front of the form length unit to be changed as in preceding step d. Each operation of the TICKET FEED/F3 switch will increment the selected form length unit. The parameter will roll over from 9 to 0.
g. When all required changes have been effected, set the rear panel power switch to the OFF position and restore switch SW2/8 to its original position.

4-34. SENSOR LEARN MODE.

4-35. If a ticket supplier did not follow the rules (see figure 1-2) when printing the back side of the tickets and placed some text in the "clear zone", there is a recovery path which may circumvent this problem. This operation is an "off-line" process. The tickets containing misplaced printing in the sensor "clear zone" are scanned by the printer and data is collected. This data is processed to determine new sensor detection thresholds. Based on the data collected from the "gray" areas, the thresholds are fixed to the "best" level for

TABLE 4-2. TROUBLESHOOTING CHART

Symptom	Probable Cause	Remedy
Printer completely inoperative	Power cord disconnected	Reconnect power cord.
POWER LED off	Blown fuse	Replace defective fuse.
POWER LED on, but tickets will not feed nor print	Ticket stock incorrectly loaded	Reload ticket stock (paragraph 2-15).
Ticket cutting erratic	Defective ticket stock	Ensure that black marks on stock are evenly spaced and dark.
	Jammed ticket path	Clear any obstruction in ticket path.
	Dirty rubber drive roller	Clean rubber drive roller (paragraph 4-18).
Print positioning erratic	Same as for preceding symptom	Same as for preceding symptom
Missing lines of data on ticket	Dirty printhead	Clean printhead (paragraph 4-19).
	Defective printhead	Replace printhead (paragraph 4-22).
Printer stops between tickets without cutting (when commanded to do so)	Ticket stock defective	Check black marks on ticket stock; replace ticket stock if missing or light (paragraph 2-15).
Tickets jam	Defective ticket stock	Reload with usable ticket stock (paragraph 2-15).
Poor print quality	Dirty printhead	Clean printhead (paragraph 4-19).
No data received and printed via interface	Printer off-line	Place printer on line by pressing SELECT/FO switch.
	Defective interface	Check interface connections and data source.
	DIP switches incorrectly set	Ensure that DIP switches are set for desired interface mode.
Spurious characters printed	Noisy data lines	Check grounding and connection of interface cable.
Incorrect characters printed	Incorrect baud rate or character length (serial)	Check setting of DIP switch SW1/1, SW1/2 and SW1/3/ (paragraph 2-13).
	Incorrect timing or defective parallel input bit	Check parallel interface source.

this ticket stock. For tickets which have excessively dark printing in the scan area, the system will warn the user that the thresholds were adjusted, however, the margins for adequate reliability were not achieved (may still work). After scanning, the fixed sensor thresholds remain in memory (EEPROM) until cleared. Because of this fixed mode, it is recommended that the thresholds remain in memory (EEPROM) until cleared. Because of this fixed mode, it is recommended that the sensors be cleaned prior to invoking the learn mode. Also a periodic cleaning and relearn cycle should be part of scheduled maintenance while operating with misprinted tickets. A “Q” tip with alcohol and blowing dry is all that is necessary for cleaning the sensors. This procedure provides the best signal strength, and with it, larger success margins. The fixed sensor mode is annunciated in the system’s data. The system’s data is printed out by “powering up” the printer while holding the SELECT/FO switch until a “beep” is heard. The threshold labels “CS” & “LS” (next to “MARK PCR”) are printed in inverse mode (black background).

4-36. In normal operation, the printer scans and adjusts the sensor thresholds each time the printer is “powered up”. The learn mode is a fixed sensor operating mode which uses data for the stock scanned. *It is not the recommended mode for normal operation.* It is only to be used as a temporary solution.

4-37. Initiating A Scan.

a. With the printer “powered off”, lift the head pressure level upward.
b. Manually insert the paper under the printhead and clamp the head pressure lever down to pinch the stock against the drive roller.
c. “Power up” the printer while holding all four front panel switches until a “beep” is heard.
d. Release all switches, another “beep” is heard, then press the “TEST/F1” switch.
e. The scanning process will move the paper approximately twenty inches into the printer and then stop.

4-38. Learn Mode Warnings. A single “beep” indicates success, two “beeps” indicates a marginal result (may still work), and continuing “beeps” indicates a failure of the process.

4-39. Clearing the Fixed Sensor Mode.

a. “Power up” the printer while holding all four front panel switches until a “beep” is heard.
b. Release the four switches, another “beep” is heard, then press the “TICKET FEED/F3” switch.
c. The printer will clear the fixed sensor mode and continue the normal “power on” sequence.