EXTECH DATA SYSTEMS

MSP/MPP II/III

COMPACT PORTABLE PRINTER

USER'S MANUAL

VERSION: 2.0

DATE: August 1995

<u>About this Manual</u>

Objective

This User's Manual supplies the necessary information for installing and operating Extech MPP/MSP compact portable printer series.

Contents

Chapter 1:

This chapter starts with the visual overview of your MSP/MPP printer series. Power, data, ribbon, paper and installation procedures are covered and supported with helpful diagrams. At the end of this chapter you are ready for the initial power-up and printer self-test.

Chapter 2:

This chapter starts with the operational overview of your MSP/MPP printer series. The features of each module comprising the printer are described. The printer operating modes are detailed. The character set, fonts, controls, characters and graphics print commands are listed.

Chapter 3:

In this chapter RS232C and 8 Bit Parallel Centronics interface input pins, operation and electrical characteristics are listed. The Serial Baud Rate and Parity selection and 8 bit parallel operation are described.

Appendix A:

Serial MSP/MPP Users guide.

Appendix B:

MSP/MPP printer trouble shooting guide.

Appendix C:

Magnetic Card Reader Option

Appendix D:

Infrared Data Input Option

NOTE:

FCC Part 15 Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. I F THIS EQUIPMENT DOES CAUSE HARMFUL INTERFERENCE TO RADIO OR TELEVISION RECEPTION, which can be determined by turning the equipment off and on, the user is encouraged to try too correct the interference by one or more of the following measures:

    -R eorient or relocate the receiving antenna.

    -Increase the separation between the equipment and the receiver.

    -Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

        -Consult the dealer or an experienced radio/TV technician for help.

Warranty

This printer is warranted by Extech Data Systems to be free of defects in parts and workmanship for a period of one year from date of shipment. (The customer is responsible for ensuring proper packing to prevent damage in transit.) This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. Extech specifically disclaims any implied warranties of merchantibility or fitness for a specific purpose and will not be liable for any direct, indirect, special, incidental or consequential damages. Extech's total liability is limited to the repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral is expressed or implied.

Warranty Service (Call 617 890 7440)

A Return Authorization number must be issued before a unit is returned to Extech for repair. Once a unit has been properly returnd to Extech, it will be repaired (estimates are provided first if the repair cost is estimated above $50.00) and returned via UPS ground. The customer may elect a faster mode of transport at their cost.

Contents

3.0 **OPERATING YOUR COMPACT PRINTER PART II**

1.0   INSTALLATION AND INITIAL POWER-UP

Thank you for selecting the Extech compact portable printer. The MPP/MSP printer series feature compact reliable, plain paper dot matrix printers capable of printing 24 through 42 columns and dot addressable graphics. Packaged in rugged Cycolac enclosure, it is designed for use as a table top or portable battery operated printer.

These printers are available in two types of interfaces, either serial RS232C or 8 bit parallel. All models feature 2048 character print buffer to free the host computer during the printing process. The serial RS232C printers (models MSP II or MSP III) support all standard serial communication handshakes, the communication rate and the protocol are set via dip switches. The 8 bit parallel printers (models MPP II or MPP III) support Centronics compatible communication handshakes.

1.1   MODEL NUMBER

To best meet OEM requirements, the Extech compact portable printers are manufactured in a variety of configurations. The Model number of your printer is shown on the front panel label (Figure 1.0).

The model number of the printer is comprised of three fields. The first field specifies the type of communication interface installed, the second field specifies print speed and the third field specifies the number of the print columns. The model number convention summarizing the features of the printer are listed below.

<div align="center">

MSP   -   II   -   24
(1)   (2)   (3)

</div>

(1) Printer interface type:
      MSP . . . . . . Serial RS232C interface
      MPP . . . . . . 8 bit parallel interface
(2) Print speed:
      II . . . . . . 40 Characters per second (CPS)
      III . . . . . . 60 Characters per second (CPS)
(3) Print columns:
      For II . . . . 24 or 42 columns
      For III . . . . 24 or 40 columns

The instructions in this manual apply to the following Extech compact printers.

MODEL #	DESCRIPTION		PART #
MSP-II -24	Mini Serial Printer	40CPS - 24 columns	76716F0
MSP-II -42	Mini Serial Printer	40CPS - 42 columns	76718F0
MPP-II -24	Mini Parallel Printer	40CPS - 24 columns	76916F0
MPP-II -42	Mini Parallel Printer	40CPS - 42 columns	76918F0
MSP-III-24	Mini Serial Printer	60CPS - 24 columns	76816F0
MSP-III-40	Mini Serial Printer	60CPS - 40 columns	76818F0
MPP-III-24	Mini Parallel Printer	60CPS - 24 columns	77016F0
MPP-III-40	Mini Parallel Printer	60CPS - 40 columns	77018F0

1.2   UNPACKING YOUR PRINTER

When you remove the printer from its shipping box, make sure it is in good condition. The package also includes an AC power adapter, rechargeable battery pack, paper roll, a warranty registration card. If any of the components are missing, contact Extech or your distributor for assistance.

Keep the packing material so you can repack the printer for storage or shipment. If there is any visible damage to the printer, record it on the freight bill, have the freight carrier acknowledge it and submit your claim to the carrier.

Caution: Do not install or operate damaged equipment as safety and performance may be affected.

1.3   FRONT PANEL LED INDICATORS

Five LED lights are used for various printer function indications. These LEDs are located on the front panel of the MSP/MPP Printer series. The functions assigned to these lights are as follows:

ON-Line indicator
The green LED, labeled <ON-Line>, illuminates if the printer is selected.

Low BAT indicator
The Yellow LED, labeled <Low BAT>, illuminates if the battery pack is depleted. Recharge battery pack if LED is on.

Charge indicator
The Yellow LED, labeled <Charge>, illuminates if battery is accepting charge. It turns off automatically at the end of the charge cycle.

Ready indicator
The green LED, labeled <Ready> is used for the following:

  -The <Ready> LED illuminates if the printer senses the presence of the AC power.
  -The <Ready> LED illuminates if a command to enable Magnetic card reader is
    received.

Error indicator
The red LED, labeled <Error>, is used for the following indication:

  - The <Error> LED flashing:
        The <Error> LED flashes at a rate of once per second for 5 seconds, before
        auto-shutoff of the printer.
  - The <Error> LED stays lit:
        The <Error> LED stays lit if the printer control card fails to turn on the printer
        mechanism, due to low battery or paper jam or if an error is detected while
        reading the magnetic card.

1.4   MEMBRANE SWITCH PANEL

Four membrane switches are provided on the left side of the MSP/MPP printers for various operator controls. The switches are labeled <SLCT>, <FEED>, <SET> and <ADVN>. The functions performed by these switches are summarized below.

<SLCT> or <ON>

The <SLCT> or <ON> switch is used to turn printer power on.
The green <ON-Line> LED is illuminated, if printer is selected.

<FEED>

The <FEED> switch is used to advance the paper by one line.

<SET> or <OFF>

The <SET> or <OFF> switch is used to turn the printer OFF. The <Error> LED   starts   flashing when set switch is pressed.

<ADVN> 0r <   >

The <ADVN> or <   > switch is used to advance paper by one line.

1.5   DATA CONNECTOR

The Data Connector of the MSP/MPP printer is located at the front of the printer. Figure 1.0 shows the front panel of the MSP/MPP Printer series. The serial and parallel input/output signals of the MSP/MPP compact printers are terminated on a 25 pin, DB25S female connector. Pin assignments and technical specifications for each type of interface are listed in Chapter 3.

1.6   POWER INPUT

The MSP/MPP compact printers receive DC power via Extech rechargeable battery pack or through a two (2) conductor Power Input Connector located on the right side of the printer.

> *NOTE: The printer must be operated with the battery installed when the Power Adapter is used. Failure to do so will invalidate the warranty.*

1.6.1   AC POWER ADAPTER

A wall mount UL listed power adapter is provided to operate the printer. The AC Power Adapter plugs directly into an AC power outlet while it's mating DC plug, on a 6 ft extension, connects to the printer. The center pin is the positive DC input, while the body of the connector is logic common or DC negative input.

The AC Power Adapter is internally fused and it's output is rated at 9 VDC/1.0A for MSP II   printer series and 9VDC/2.0A for MSP III. The Power adapter AC input is available for either 110 VAC or 220 VAC.

PART #	DESCRIPTION
152117	MSP/MPP II 110 VAC IN / 9VDC 1A Out
152220	MSP/MPP II 220 VAC IN / 9VDC 1A Out
153117	MSP/MPP III 110 VAC IN / 9VDC 2A Out
153220	MSP/MPP III 220 VAC IN / 9VDC 2A Out
151129	DC CAR ADAPTER

1.6.2   DC POWER CONNECTION (OPTIONAL)

For DC powered units, a two conductor power plug is provided. Refer to Table 1.0 to connect power to your DC unit. No internal fuse is provided with DC units. It is strongly recommended to install external fuses with the values shown in the table 1.0.

Table 1.0 below summarizes Voltage, Current and Fuse requirements for AC and DC configurations.

MODEL #	VOLTAGE	+/-	CURRENT	FUSE
MSP/MPP	110VAC	10%	.1A	INTERNALLY FUSED
MSP/MPP	220VAC	10%	.06A	INTERNALLY FUSED
MSP/MPP	7.5-13.6VDC	--	4 WATTS	1.0A SLB

Table 1.0
Voltages, Currents and Fuses

1.6.3   INSTALLING BATTERY

Install the battery pack provided into the battery compartment at the bottom of the printer.

The battery pack provided must be charged over night prior to its first use.

To charge the battery pack use the AC adaptor provided. 8-10 hours are required to recharge the battery pack.

The MSP/MPP printers are capable of delivering from one to two hours continuous printing on a full charge.

1.7   INSTALLING PAPER AND RIBBON

The printer is shipped from the factory with paper and ribbon installed, refer to this section to install new supply of paper and ribbon. The paper tray and ribbon cartridge of the MSP/MPP compact printers are located inside the printer enclosure. To access the paper tray and the ribbon cartridge the back cover must be removed. To remove the back cover, press in at the arrow mark while pulling the back cover up.

1.7.1   INSTALLING PAPER

⊦ Remove the back cover (section 1.7 and figures 1.1 and 1.3).
⊦ Turn on the printer by pressing the <SLCT> or <ON> switch.

┼ Tear and discard any paper remaining in the printer tray.
┼ Remove any paper remaining in the printer mechanism, using the <FEED> switch.
┼ **Do not REVERSE pull paper out of the printer mechanism - this will damage the printer mechanism**
┼ Feed the new roll of paper into the printer paper slot using the **<FEED>** switch.

1.7.2   INSTALLING RIBBON

┼ Remove the back cover (section 1.1 and figure 1.3).
┼ Remove the worn ribbon by pressing with one finger at the location labeled "EJECT" on the ribbon cartridge.
┼ Insert the new ribbon in place and press at the extreme ends of the ribbon cartridge to secure it in place.
┼ With your thumb, tighten the ribbon by rotating clockwise the ribbed wheel located on the front of the ribbon cartridge.
┼ Feed paper to insure that the paper passes through exposed ribbon and ribbon cartridge case.

1.8   INITIAL POWER-UP AND SELF-TEST

A self-test feature is built into your MSP/MPP compact printer series. To start the self-test, press the <FEED> switch during initial power-up of the printer (see below).

Once the battery is installed and all the front panel LED indicators are turned off (press the <OFF> or <SET> switch to turn off) press and hold down the <FEED> switch, then press the <SLCT> or <ON> switch, this will automatically start the self test. The self-test program checks the integrity of the operating program installed, the 2048 character print buffer, the processor watchdog, and the power supervision circuits. The printer performs an internal self-test and prints the self-test findings, current printer settings, and starts continuous print of the built-in printer character fonts. To stop the self-test process, press the **<FEED>** switch.

If no problems are found, the following messages are printed:

TEST PRINT	DESCRIPTION
2K BUFFER EXTECH V2.2 (C) 1994	This line shows the version of the installed Eprom and the size of print buffer.
INTERFACE: SERIAL	Type of interface selected SERIAL or PARALLEL.
MODE:2400,8,N,1	Baud=2400, number of Data bits=8, Parity= None, Stop bits = 1

Note:
*The red **<Error>** LED will turned on if any error is encountered during self test.*
*If any problem is encountered during self test. Refer to **APPENDIX C** for a brief trouble shooting guide.*

2.0   OPERATING YOUR COMPACT PRINTER PART 1

The MSP/MPP compact portable printer series is comprised of a microcomputer-based printer controller card, a printer mechanism module, a rechargeable battery pack and a high impact cycolac enclosure.

2.1   PRINTER CONTROLLER

The MSP Serial printers use the Extech Part Number EX075 circuit board while the MPP Parallel printers use the Extech EX076 circuit board. A powerful INTEL micro-controller on these highly integrated circuit boards manage's all the features supported by the printer. The circuit board incorporates the printer drivers, communication interfaces, 2K print buffer, the front panel switch inputs, battery charger and power regulator circuits.

Upon initial power-up, the Printer Controller goes through extensive self-test procedures. It verifies the amount of print buffer installed and restores the default printer settings. In the idle mode, the printer controller continuously checks the front panel controls, the data input interface, the print buffer, the DC and battery pack voltage levels and processor watchdog supervisor.

The data sent to the MSP/MPP printer series is received by the controller on an interrupt basis. The controller validates the data before saving it in the print buffer. The power regulator and battery charger features are summarized in section 2.3.

2.2   PRINTER MECHANISM

The MSP/MPP compact printers are designed using highly reliable high speed alphanumeric impact printer mechanisms. The MSP/MPP printer mechanisms require only +5VDC for operation and are guarded against possible malfunction by a special protection circuit included on the control card. The printer ratings are as follows.

	MSP - II	MSP - III
Reliability	1,000,000 character lines	1,500,000 character lines
Print speed	40 Characters per second	60 Characters per second

 The MSP/MPP III printer mechanisms are built with eight dot driver coils, while the MSP/MPP II printers have six dot driver coils. Both type of mechanisms include gears for fast paper feeding. Using a continuous, pre-inked ribbon cassette (part # 757131), they can print 5x7, 10x14, 5x14 or 10X14 dot matrix characters or user defined graphics image.

Below is a detailed specification on printed character size, line spacing and number of total dots for each mechanism used in MSP/MPP printer series.

Mechanism #	Columns	Character-size	Column-spacing	Line spacing	dots/line
EX180	24	1.7(W) X 2.6(H) mm	2.06 mm	3.78 mm	144
EX183	42	1.1(W) X 2.6(H) mm	1.29 mm	3.78 mm	252
EX190	24	1.7(W) X 2.6(H) mm	2.06 mm	3.78 mm	144
EX192	40	1.2(W) X 2.6(H) mm	1.35 mm	3.78 mm	240

2.2.1   PRINTER PAPER SPECIFICATION

The MSP/MPP printers use 2.25" wide, .0027" thick and 1.12" diameter rolls of common calculator paper. Three types of paper may be used in the printer, Single ply roll, Two ply pressure sensitive roll, Label stock Custom Kiss-cut with perforation. Below is the specification for each type of the paper.

PAPER TYPE	PART #	WIDTH	THICKNESS	LENGTH
Single Ply	757058 (5 rolls)	2.25"/57.5 mm	.0027" / .08 mm	25' / 6.3 m
Two Ply	757135 (5 rolls)	2.25"/57.5 mm	.0035" / .09 mm	16' / 4.0 m
Label stock	Custom made Kiss-cut w/perf.	2.25"/57.5 mm	label .066 mm carrier .058 mm	custom lengths

2.3   PRINTER POWER

Printer power, battery locations and characteristics were described in section 1.6. This section reviews the printer power and battery operation and specification.

Like any battery-power device, the battery pack supplied with the MSP/MPP printers have finite life. The maximum usage between recharge will be obtained when the following simple rules are followed.

- Turn off printer when not in use.
- Recharge until the **<charge>** LED turns off, indicating full charge.
- Use Extech power adapter to recharge the battery pack.
- Use "Logic Switching" capacity in your software to facilitate
  the auto turn on or turn off of the printer.

2.3.1   MANUAL POWER-UP AND POWER-DOWN

The **<SLCT> or <ON>** membrane switch is used to turn the printer ON manually. The **<ON-Line>** LED indicator is turned ON when <SLCT> or <ON> switch is pressed.

Press the **<SET> or <OFF>** switch to turn off the printer power. The red **<Error>** LED starts flashing momentarily, to indicate the start of the power down process. This process will last about 5 seconds.

2.3.2   AUTO POWER DOWN TIMER

The MSP/MPP printers have a built-in 30 second Power-Down-Timer. The timer is automatically restarted under any one of the following conditions.

- If any of **<SLCT> or <ON>**, **<FEED>** or **<ADVN> or <OFF>** switches are pressed.
- If a character is received via data interface.
Upon timeout of the Power-Down-Timer, the printer starts flashing the red **<Error>** LED to worn the operator and transmits the power down command string to the host.
The power down timer may be disabled by activating the **<RTS>** or **<SELECT>** signals on the interface connector.

2.3.3   POWER-UP VIA DATA INTERFACE

The MSP/MPP printer can be powered-up by transmitting a single character or activating **<RTS>** or **<SELECT>** signals on the interface connector.

To avoid the loss of data during "Logic Switching", the following software features must be implemented in the Host program.

After sending a wake up character or activating the **<RTS>** or **<SELECT>** signals.

> - Pause for 1.6 seconds before sending additional characters to the printer.
> - Verify the status of **<CTS> or <BUSY>** before sending additional characters.
> - Wait for the XON character from the printer.

The printer turns off power automatically, 30 seconds after the last character received or de-activation of the **<RTS>** or **<SELECT>** signals.

2.3.4   PRINTER BATTERY PACK

The MSP/MPP printer is designed to operate with a 5.0 VDC/ 800 mAH rechargeable Ni-Cd battery pack. The battery recharge and monitor circuits are located on the printer controller.

Two LED indicators showing the status of the battery pack are provided.

The **<Low BAT>** LED is turned on when the battery voltage drops below 4.1 volts.
The **<Charge>** LED is on while the battery is accepting charge. It turns off automatically at the end of the charge cycle, when battery voltage reaches 5.56 volts.

8 to 10 hours are required to fully recharge the batteries. Up to 216,000 characters can be printed with a fully charged battery pack.

The battery pack will hold charge for 800 to 1000 hours after complete recharge. Remove the battery pack from the printer battery compartment during long storage or shipping. Additional battery packs and a 4 pack battery charger are available. The part numbers and descriptions of these accessories are:

PART #   CAPACITY   DESCRIPTION

7A100002   700 mAH   700 mAH battery pack
7A100003   800 mAh   800 mAh battery pack
767500   Simultaneous 4 battery pack charger

The Extech AC adapters and their respective specification are listed in section 1.6.1 of this manual.

2.4   CONTROL CHARACTERS

The printer has a set of commands which provide control of printer functions. The printer also provides response commands informing the user of the printer status. In this section, the recognized control characters and the corresponding printer actions are summarized.

CHAR.	CON	H/D	CONTROL ACTION
EOT	^D	04/04	**End Of Text** printer sends an EOT character when buffer is empty. This is used to tell the host that printer is in idle mode.
BS	^H	08/08	**Back Space** remove previous character in print buffer.
HT	^I	09/09	**Horizontal Tab** Tab to 5,9,13,17,21,25,29,33,37 or to the beginning of next line.
LF	^J	0A/10	**Line Feed** Advance to beginning of next line.
VT	^K	0B/11	**Vertical Tab** Advance 5 lines.
FF	^L	0C/12	**Form Feed** Advance 10 lines.
CR	^M	0D/13	**Carriage Return** Advance to beginning of next line. clears double width or extended print pending.
SO	^N	0E/14	**Shift Out** All characters are printed in double width (10x7)
SI	^O	0F/15	**Shift In** All characters are printed in normal width (5x7).
XON	^Q	11/17	**Transmitter On** Printer to Host: Ready to receive data. Host to printer: The host is ready to accept data.
AUXON	^R	12/18	**Print on** Printer to Host: Print is on line. Transmitted after initial power up or clearing of printer jam.
XOFF	^S	13/19	**Printer receiver is off** Printer to Host: Print Buffer is full. Host to Printer: Host transmitter off.
NORM	^T	14/20	Return to normal print.

CHAR.	CONT	H/D	CONTROL ACTION
AUXOFF	^U	15/ 21	Printer to Host: printer is off transmitted to host before power down
CANCEL	^X	18/ 24	**Cancel and reset printer** If received, 2K print buffer is reset and printer placed in initial power-up default settings.
ESC	^[	1B/ 27	**Escape** Escape character precedes graphics and printer operating modes. Refer to escape command section.
EXTEND	^\	1C/ 28	**Extended print** All characters following this command are printed double high (5x14).
EXTEND OFF	^]	1D/ 29	**Extended print off/Normal print** All characters following this command are printed normal size (5x7)

2.5   BUILT-IN CHARACTER FONTS

The MSP/MPP printer has three built-in user select fonts. Below is the list of commands to select these fonts.

FONT TYPE   FONT DESCRIPTION   COMMAND STRING

Standard   ASCII and International character set   ESC+F+1
IBM PC   ASCII and IBM PC character set   ESC+F+2
Hebrew   ASCII and IBM PC character set   ESC+F+3

The characters are formed using a 5x7 matrix. The first 127 entries in the font tables are ASCII characters. Characters 0 through 31 are reserved ASCII printer control characters, while 32 through to 127, are the 96 ASCII Alpha numeric upper and lower case characters.
The alternate characters for each font type are from 128 to 255.

The printer defaults to Standard font on initial power-up or upon receiving the CANCEL character (^X,18H,24).

2.6   CHARACTER SIZE

Four character sizes can be selected through the communication interface, by sending control characters to the printer.

Character Size	Dot matrix size
Normal	5x7
Expanded (Double Wide)	10x7
Extended (Double Height)	5x14
Large (double wide and double height)	10x14

2.6.1   NORMAL CHARACTER

The Normal characters are formed using a 5x7 dot matrix. The printer defaults to 5x7 matrix Normal character size upon initial power-up.

2.6.2   EXPANDED CHARACTER

Expanded size or double wide characters are formed by using 10x7 dot matrix. Expanded print is selected by sending the EXPAND character command(0E/14) to the printer, all succeeding characters are printed in Expanded form. Sending the EXPAND OFF character (0F/15) or Carriage Return resets the Expanded print to normal print.

2.6.3   EXTENDED CHARACTER

The Extended or double height characters are formed by using a 5x14 dot matrix.

Extended Print can be selected through the communication interface by sending the EXTEND command (1C/28) character. EXTEND (1D/29) or Carriage return resets the Extended print to normal print.

2.6.4   LARGE CHARACTER

The Large characters are formed by using a 10x14 dot matrix. Large character print is selected if both Expanded and Extended print is selected. To reset large print to normal print, Expanded and Extended prints must be disabled or Carriage return sent to printer.

2.6.5   PRINTER CHARACTER SET

The following Table lists the entire printable character set, starting at ASCII code 32 (space character).

2.7   DOT ADDRESSABLE GRAPHICS

The MSP/MPP Compact Printers can print special symbols, graphs and characters if operated in the Dot Addressable Graphics mode.

During the Dot Addressable Graphics mode of operation, the printer prints one dot line at a time. Each horizontal dot line is made out of (1x6) dot cells, and the total number of dot cells per line is the same as the maximum number of columns on the printer.

For example, a model MSP-II-24 Column has a total of 24 (1x6) dot cells corresponding to its 24 column capacity.

Each dot in a (1x6) dot cell can be turned ON or OFF by sending specific ASCII characters.

The graphics mode is invoked by sending ASCII characters 'ESC' (1B/27) followed by 'G'. Dot line printing starts upon receiving enough dot cells to complete a dot line, or
ASCII 'CR' (0DH) or ASCII 'LF' (0AH).

The graphics mode is terminated by sending ASCII characters 'ESC', followed by 'A'.

2.7.1   GRAPHIC CHARACTER SET

The graphic character set extends from the character '?'(3FH) to TILDA (7EH). Bits 1 through 6 of the characters received are used to turn ON or OFF the dots in a dot cell.
If a bit is set (=1), a dot is enabled, otherwise the dot is disabled.

For example for ASCII '?' (3FH or 00111111B), bits 1 through 6 are set. Sending consecutive '?'s will form a one dot solid line across the paper.

2.7.2   GRAPHICS CHARACTER HEX DOT PATTERNS

The following table, Table 1, outlines the dot patterns and HEX codes for graphics operation. **Table 1**
Dot patterns and HEX codes

2.8   OPERATING MSP/MPP PRINTER IN MS-DOS ENVIRONMENT

To insure proper operation of the Extech MPP/MSP printers in DOS environment the following are required.

FOR MPP SERIES - Parallel Printer

1- Use DOS print command to print, or Write Direct to printer port.
2- Set the printer port for infinite retry using the dos MODE command.

> MODE LPT1:,,P

FOR MSP SERIES - Serial Printer

1- Use DOS print command to print, or Write Direct to printer port.
2- Set the PC's communication baud using DOS MODE command, printer
   and PC baud rate and parity have to match.

> Mode com1:9600,n,8,1,r

3- Redirect PC's serial (COM) port to parallel (LPT)

> mode lpt1:=com1:

4- Set the printer port for infinite retry using the dos MODE command.

> MODE LPT1:,,P

2.9   OPERATING MSP/MPP PRINTER IN WINDOWS ENVIRONMENT

To insure proper operation of the Extech MSP/MPP in a windows environment the following are required.

◆Select Generic/text only printer driver.
◆Use Windows printer manager.
◆For MPP Parallel printers, Set the PC's parallel (LPT1) port as follows.

- LTP1: Local Port
- Device not selected: 15
- transmission retry: 45
- Fast printing Direct to Port enabled

◆For MSP serial printers, Set the PC's serial port (COM1) baud rate and parity to match printer. Use printer Self-Test to verify baud rate and parity setting.

3.0   OPERATING YOUR COMPACT PRINTER PART 2

This chapter describes the input connections, operation, and electrical characteristics for all MSP/MPP printers.
- The operating features of the MSP Serial   printers are covered in section 3.1.
- The operating features of the MPP Parallel printers are covered in section 3.2.

3.1   MSP SERIES: SERIAL COMMUNICATION   SPEED   AND PARITY

The proper Baud Rate and protocol settings are required to communicate with a host computer. The standard factory setting is 9600 BAUD, 8 DATA BITS, NO PARITY BIT, and one STOP BIT.

A six position dip switch, located to the left of the paper tray, can be used to set the baud rate and parity (Figure 3.1). The printer reads these switches once on initial power-up.

Switches 1 and 2 are used to set the communication speed/baud rate.

SW1	SW2	BAUD RATE
ON	ON	1200
OFF	ON	2400
ON	OFF	4800
OFF	OFF	9600

Switch 3 selects number of data bits.

SW3	DATA BITS
OFF	8 DATA BITS
ON	7 DATA BITS

Switches 4 and 5 are used for parity selection

SW4	SW5	PARITY BIT
OFF	OFF	No parity
OFF	ON	No parity
ON	OFF	Odd parity
ON	ON	Even parity

The printer self-test can be used to print and verify the current serial settings.
A sample test print is shown in SECTION 1.8.

3.1.1 MSP SERIES - SERIAL COMMUNICATION PROTOCOL

Two communication protocols are supported by the MSP printer series - SERIAL BUSY PROTOCOL and XON/XOFF PROTOCOL.

3.1.2 MSP SERIES - SERIAL BUSY PROTOCOL

In this mode, Pins 4 (RTS - From Host) and 5 (CTS - From Printer) are used to control data flow to and from the printer. This protocol is available for serial RS232C version printers.

The **<RTS>** signal from the Host (pin #4) is used to enable the printer, the printer raises **<CTS>** (pin #5) when it is ready to accept data.The printer lowers **<CTS>** line when either the Print Buffer has less than 64 unused locations or when TEST OR FEED is selected. The **<RTS>** signal is monitored during data transmission from the Printer to Host. The printer transmits data to Host only if **<RTS>** is high.

3.1.3 MSP SERIES - XON/XOFF PROTOCOL

The Printer transmits XON when it is ready to accept data, and XOFF for conditions A and B listed above. Under XON/XOFF protocol, the data flow out of the printer's Serial Port is halted on receipt of XOFF from Host and resumed on receipt of XON.

3.1.4 MSP SERIES - RS232C CONNECTIONS

The RS232C Interface signals for the MSP printer series are terminated on a DB25S female connector located at the front of the printer. Six connections are provided from the Serial Interface to the host computer for proper operation of this option. A minimum of two connections are required for operation, RXD-pin2 and Common-pin3.

The table below lists the Serial Interface signals and pinouts on the DB25S female connector.

MSP DB25S CONNECTOR PIN #	FUNCTIONAL DESCRIPTION	SIGNAL NAME
1	Protective Earth Ground	GND
2	RS232 from Host (INPUT)	RXD
3	RS232 from Printer (OUTPUT)	TXD
4	Request to send from Host (INPUT)	RTS
5	Clear to send from Printer (OUTPUT)	CTS
7	Logic common	COM

3.1.5 MSP SERIES - OPTIONAL RJ11 - RS232C CONNECTOR

The table below lists the Serial Interface signals and pinouts for the Extech MSP printer series with RJ11 type space saving data connector.

The six (6) pin RJ11 data connector is located at the left side of the printer adjacent to power input connector. The pin # 1 is on the left side of the connector.

Five connections are provided from the Serial Interface to the host computer for proper operation of this option. A minimum of two connections are required for operation, RXD-pin3 and Common-pin1 or pin5.

MSP RJ11 CONNECTOR PIN #	FUNCTIONAL DESCRIPTION	SIGNAL NAME
1 and 5	Logic common	COM
2	RS232 serial output From Printer to Host	TXD
3	RS232 serial input From Host to Printer	RXD
4	Clear To Send output From Printer to Host	CTS
6	Request To Send input From Host to Printer	RTS

3.1.6 MSP SERIES - RS232C TECHNICAL SPECIFICATIONS

RS232C technical specifications are as follows:

DATA TRANSFER RATE: 1200 Through 9600 Baud
Dip switch select

WORD LENGTH: 1 Start bit
7 Or 8 Data bits
1 Or 2 Stops bits

SIGNAL LEVELS: Mark or Logical 1 = -3 to -15VDC
Space or Logical 0 = +3 to +15VDC

HANDSHAKING: RTS/CTS or XON/XOFF

3.2   MPP SERIES - 8 BIT PARALLEL INTERFACE

The Parallel Interface signals for the MPP printer series are terminated on a 25 pin IBM PC parallel printer output type connector located on the front panel of the printer.

The table below lists the Parallel Interface signals and the connector pinouts. A (/) before a signal name indicates the signal is ACTIVE LOW; otherwise, the signal is ACTIVE HIGH.

PIN#	SIGNAL NAME	DIRECTION	FUNCTION
1	/STROBE	INPUT	DATA READY FROM HOST
2	DATA 1	INPUT	DATA BIT 1 FROM HOST
3	DATA 2	INPUT	DATA BIT 2 FROM HOST
4	DATA 3	INPUT	DATA BIT 3 FROM HOST
5	DATA 4	INPUT	DATA BIT 4 FROM HOST
6	DATA 5	INPUT	DATA BIT 5 FROM HOST
7	DATA 6	INPUT	DATA BIT 6 FROM HOST
8	DATA 7	INPUT	DATA BIT 7 FROM HOST
9	DATA 8	INPUT	DATA BIT 8 FROM HOST
10	/ACK	OUTPUT	RECEIVE ACKNOWLEDGE FROM PRINTER
11	BUSY	OUTPUT	BUSY OUTPUT FROM PRINTER
12	COMMON		SIGNAL COMMON
13			4.7K PULL UP TO VCC
14	/PAPER-FEED	INPUT	PAPER FEED REQUEST FROM HOST
15			4.7K PULL UP TO VCC
16			NO CONNECTION
17	SELECT-IN	INPUT	SELECT PRINTER FROM HOST - OPTIONAL
18 THRU 25			SIGNAL COMMON

A minimum of 12 connections are required for the parallel interface operation (pin 1 through 12).

3.2.1   MPP SERIES - PARALLEL INTERFACE OPERATION

Pin #1 of the Parallel Interface connector carries the </STROBE> signal from the host computer to the printer. This signal is held at TTL HIGH level normally, and lowered by the computer when the data is ready for the printer. The fact that the signal went low is latched by the printer control card and the processor is interrupted to read, validate, and save the data received.

Also, the <BUSY> signal (Pin#11) is set to indicate that the printer is busy reading data received.

Upon saving the received data, the printer lowers </ACK> (Pin #10) to acknowledge that the data has been received, and lowers the BUSY signal.

3.2.2   MPP SERIES - PARALLEL INTERFACE SPECIFICATIONS

DATA TRANSFER RATE: 6000 Characters/second
SYNCHRONIZATION: Via </STROBE> line
HANDSHAKING: </ACK> and <BUSY> Signals
SIGNAL LEVELS: Compatible with CMOS and TTL levels.

3.2.3   MPP SERIES - PARALLEL INTERFACE TIMING DIAGRAMS

3.2.4   MSP/MPP SERIES - DATA CONNECTOR

Appendix A

Serial MSP/MPP Users guide
This Guide summarizes the operating and maintenance feature of Extech MSP or MPP printer series. Refer to user's and operators manual for additional information.

Initial preparation
- Install the battery pack in the battery compartment located on the back of the printer.
- Recharge battery pack overnight by using the Extech power adapter provided.
- Connect the Data Connector located on the front of the printer.
- Set the communication parameters (serial printers only).
- If interfacing to PC, set MS-DOS and Windows variables.

Initial power up and self-test
- Press <SLCT> or <ON> switch to turn on   printer.
- Press <SET> or <OFF> to turn off printer.
- To start self-test Hold <FEED> switch then press <SLCT> or <ON>.

Install Paper
- Remove the back cover
- Turn on the printer by pressing the <SLCT> or <ON> switch.
- Tear and discard any paper remaining in the printer tray.
- Remove any paper remaining in the printer mechanism, using the <FEED> switch.

Do not REVERSE pull paper out of the printer mechanism - this will damage printer.

- Feed the new roll of paper into the printer paper slot, press the <FEED> switch to advance the paper.

Install Ribbon
- Remove the back cover

- Remove the worn out ribbon by pressing with one finger at the location labeled "EJECT" on
   the ribbon cartridge.

- Insert the new ribbon in place and press at the extreme ends of the ribbon cartridge to secure
   it in place.

- With your thumb, tighten the ribbon by rotating clockwise the ribbed wheel located on the front
   of the ribbon cartridge.

- Feed paper to insure the that paper passes through exposed ribbon and ribbon cartridge case.

Membrane Switch Functions

<SLCT> or <ON>

The <SLCT> switch is used to turn printer power on. The green <ON-Line> LED is turned on, if printer is selected.

<FEED>

The <FEED> switch is used to advance the paper by one line.

<SET> or <OFF>

The <SET> switch is used to turn the printer OFF. The red <Error> LED starts flashing when <SET> switch is pressed.

<ADVN> or < >

The <ADVN> switch is used to advance paper by one line.

Front Panel Indicators

<ON-Line>   Green - If illuminated the printer is selected.

<Low BAT>   Yellow - If illuminated the battery pack is depleted. Recharge battery pack if LED is on.

<Charge>   Yellow - If illuminated the battery is accepting charge.
Turns off automatically at the end of the charge cycle.

<Ready>   Green - illuminated if the printer senses the presence of the AC power.
Green - illuminated if a command to Enable Magnetic card reader is received.

<Error>   Red - Flashing indicates start of power down process.
Red - illuminated steady if the battery is
too low to turn on the printer mechanism.
Red - illuminated steady Magnetic card
reading Error.

Appendix B

Trouble Shooting Guide

PROBLEM	POSSIBLE CAUSE	SOLUTION
Printer will not turn on	Discharged Battery	Recharge battery overnight.
Charge LED not lighting when AC adapter is plugged in	No AC power	Check AC outlet and adapter.
	Bad AC Adapter	Battery pack fully charged.
Battery not Charging	Battery incorrectly installed or no AC.	Check Battery installation and AC adapter.
Poor print Quality	Worn ribbon	Replace ribbon.
Paper not feeding	Obstruction in paper path or improperly installed.	Check the paper path. Verify installation. Use paper with the right thickness
Error LED on Steady	Print Mechanism Jam Low Battery	Press <FEED> to clear problem. If problem persists recharge battery or cycle power.
Low-BAT LED on Steady	Low AC or Battery.	Recharge Battery
Prints illegible characters	Improper Baud rate and parity.	Verify the printer and Host setting. Match, use test print to verify Printer setting. In MS-DOS use write direct to port In WINDOWS use Generic printer driver, print manger and direct write to port.
Printer will not print	Improper cabling.	For MSP verify that PC's pins 6,8 and 20 tied together. For MPP make proper cable is in use, all 25 pins connected straight through.

APPENDIX C

Magnetic Card Reader Option

Introduction

An optional Magnetic Card Reader is available for the MSP/MPP series printers. This option is designed to read Magnetic Cards conforming to ISO standards (ABA, IATA, MINTS and THRIFT), convert the encoded signals to ASCII format and transmit the information to the host computer or terminal.

Three Types of Magnetic Card Reader Heads are available. The part number, Model number and functional description of each type are summarized in Table 1. The Model number of the Magnetic Card Reader installed in the printer is shown on a label located inside the printer battery compartment.

Part #	Model #	Track #	Functional Description Track # - Max. capacity/ data bits Recording method/Recording Density
7A070007	MR-2105	1 & 2	Track 1 - 79 characters / 7 bit RecM: F2F : RecD:210BPI Track 2 - 40 characters / 5 bit RecM: FM : RecD: 75BPI
7A070005	MR-1102	2	Track 2 - 40 characters / 7 bit RecM: FM : RecD: 75BPI
7A070011	MR-2106	2 & 3	Track 2 - 40 characters / 7 bit RecM: FM RecD: 75BPI Track 3 - 107 characters / 5 bit RecM: F2F RecD:210BPI

Table 1
Note: All readers will accept odd or even Parity

Interfacing to the Magnetic Card Reader

This section details the software steps required to access the Magnetic Card Reader from a computer or from a terminal.

Select the MSP/MPP printer

The Host Selects the MSP/MPP printer by activating the RTS input line or sending wake-up character to the printer.

The Printer Sends the XON command to the Host to indicate ready to receive Command strings. The host has to wait for XON before proceeding.

Select the Magnetic Card Reader

The Host sends ASCII serial command string to enable the Magnetic Card Reader. The printer turns on the <**READY**> LED if the proper command string is received.

Receive the ASCII Data Output from printer

Once the magnetic card is swiped by the operator, the printer transmits in ASCII format <Track Data> or <Error Message>. A good read automatically turns off the reader. The printer turns on the red <**ERROR**> LED if an error is encountered.

Magnetic Card Command String	Description
ESC - M - nn - 1 - CR	Read Track1 only
ESC - M - nn - 2 - CR	Read Track2 only
ESC - M - nn - 3 - CR	Read Track3 only
ESC - M - nn - 4 - CR	Read Track1 and Track2 simultaneously
ESC - M - nn - 5 - CR	Read Track2 and Track3 simultaneously
ESC – C	Cancel Read Turns off the <**READY**> LED

Table 2
(nn = ASCII "01" through "99" seconds)

Recognized Magnetic Card command strings

Six Magnetic Card command strings are recognized by the printer, these commands are summarized in Table 2.
The command syntax is as follows:

> *ESC   M   n n   Track # CR*
>
> **(1)   (2)   (3)   (4)**

(1) Turn On the Card Reader
The first two characters "ESC" and "M" will turn on the Card Reader.

(2) Set the Card Read Timeout
The next two digits "01" through "99" sets the timeout in seconds before the printer turns off the Card Reader. A good read automatically turns off the reader.

(3) Select Track number to read

The Fifth character specifies the Track number(s) to read.
Sending "1", "2" or "3" enables read of single track 1, 2 or 3.
Sending "4" enables simultaneous read of tracks 1 and 2.
Sending "5" enables simultaneous read of tracks 2 and 3.
There is no command to read tracks 1, 2 and 3 simultaneously.

(4)   Terminate command string

The MSP/MMP waits for Carriage return character before start of the Magnetic card read process.

Table 2 summarizes the recognized Magnetic card command strings.

Track Data Output Format

The <Track Data> retrieved from magnetic card is transmitted to the Host in ASCII format. The <Track Data> format is as follows:

> /1/ <TRACK 1 DATA> <CR> <LF>
> /2/ <TRACK 2 DATA> <CR> <LF>
> /3/ <TRACK 3 DATA> <CR> <LF>

The first three characters (/,1,/) flag the track number. The track data follows the third character, CR-LF terminates the <Track Data> string.

Read Error Messages

All error messages are prefaced by <ESC><E> characters. Following these two characters is a comma, the error number in ASCII (01 through 99), another comma, English description of the error encountered and finally CR-LF terminating the <Error Message> string. The syntax is as follows:

> <ESC><E>, nn, Error text in ASCII, <CR><LF>

Where nn is error number encountered. Nine (9) types of Read Error messages may be transmitted by the Mag card reader. The following messages terminated with CR-LF are returned by the firmware:

Error #	Error Message Transmitted
01	Parity Error
02	Checksum Error
03	End Sentinel Not Found
04	Too Many Characters
05	Timeout Expired
06	Invalid Character
07	Invalid Track Number
08	Unsupported Track Selected
09	Cancel Request

Read Error Messages description

Error #	Error Message Description
01	The Parity of the character read is opposite of the card default parity.
02	The Checksum calculated did not match the one on the card. The checksum is calculated by Exclusive-OR' ing all the valid data on the card including Begin Sentinel and End Sentinel, but excluding the checksum byte.
03	End Sentinel must exist on all cards, Reader did not find the End Sentinel.
04	The Maximum number of characters allowed for a track was exceeded. This may happen if End Sentinel is not found. Refer to Table 1 for further details.
05	The command timeout has expired.
06	The Track Reader Escape command string transmitted by Host contained an invalid character.
07	Invalid Track Number is selected. Tracks "1", "2" or "3" can be selected.
08	Unsupported Track is Selected. Tracks "1", "2" or "3" can be selected.
09	"Cancel Request" error string is transmitted if Host cancels Magnetic card read in process.

Sample Interface Program in C

```c
#include <stdio.h>        // MSC Standard I/O
#include <com.h>          // C Run-Time Interrupt Driven Comm
#include <vdsp.h>         // C Run-Time Video Display Functions
#define PRINTSPECS  CM_SERIALFSM | CM_9600BAUD | CM_NOPRTY |
CM_8BITS| CM_1STOP
void readtrk( int );
void exit( void );
char  buf[80];            // Rcv'd data buffer.
char *cp = buf;            // Next buffer loc to use.

void main( void )
{
  int   i, status;
/****  Enable Printer   ****/
  if ((status = comopen( COM1, PRINTSPECS, "", CS_NODSP)) !=NOERR)
        exit();
/****  SELECT XON communication    ****/
  comxoff( COM1, YES);
/****  Read Tracks    ****/
  readtrk( 1 );
  readtrk( 2 );
  readtrk( 3 );
  comclose( COM1, CS_NODSP);
}
void readtrk( int tn )
{
  char cmd[12];
  cp = buf;
  vdspls( 4, 11, "Req track read    ");
  sprintf( cmd, "%cM%02d%1d\r", 27, TIMEOUT, tn); /* read Track */
  vdspls( 4, 11, "Read track %d      ", tn);     /* display   */
}
```

Appendix D

Infrared Data Input Option

Introduction

This appendix summarizes the operating features of the Extech MSP Series printers with built in **I**nfra**R**ed **D**ata Receiver Interface **(IRD)**. The **IRD** Interface is designed for reception of **IRD-ASK** format serial data and no interconnecting cables are required for data transfer.

The **IRD** data transfer is a one way link, in the current version of the printers. The printer has circuitry to receive **IRD-ASK** data but there is no circuit allowing **IRD** to be transmitted back.

For reliable serial data transfer, software timing must be implemented in the **IRD-ASK** transmitter. It is the transmitters responsibility to be sure the printer's 2000 Byte buffer never overflows.

IRD-ASK Receiver Specification

The **IRD-ASK** receiver consists of photodiode IR detector, automatic gain control amplifier and 500KHZ bandpass filter.

The amplifier prevents saturation of the receiver if strong IR signal is applied, while the bandpass filter rejects any IR signal without the 500KHZ carrier signal.

The Operating Characteristics of IR Receiver are summarized in TABLE 1.

Transmission Wavelength	900 to 1,050 nanometers
Modulation Frequency	500KHZ ± 50
Modulation Process	Amplitude Shift Key (ASK)
Range	1 meter
Data Rate	1200 - 9,600 Bits per second/ DIP switch select baud rate and parity.

Table 1
IR Receiver Operating Characteristic

Printer Power-up through IRD-ASK Interface

The MSP printer can be powered-up by transmitting a single character. To avoid the loss of data during "Logic Switching", pause for 1.0 seconds before sending additional characters to the printer.

The MSP printers have a built-in 30 second Power-Down-Timer. The timer is automatically restarted under any one of the following conditions.

- If side panel **<ON>, <FEED>** or **<ADVN>** switch is pressed.
- If a character is received via IRD-ASK data interface.

Upon timeout of the Power-Down-Timer, the printer starts flashing the red **<Error>** LED to warn the operator, before turning power off.

Serial Baud Rate and Parity

Since **IRD-ASK** data transfer is serial, The proper Baud Rate and parity settings are required to communicate with a Host computer.

Refer to MSP User's manual to set the desired baud rate and parity.

Software Interface Overview

This section details the software steps required for reliable serial **IRD-ASK** data transfer,

> **STEP 1**   <u>Select the Printer</u>
>
> The Host Selects the MSP printer by sending wake-up character to the printer.
>
> To avoid the loss of data during printer select process, the Host pauses for 1.0 seconds before sending additional characters to the printer.
>
> **STEP 2**   <u>Initialize the Printer</u>
>
> The MSP User's Manual list the printer operating modes such as character set, character width and height and graphics mode. These are all set to their default state on printer power up.
>
> To Initialize the Printer, the Host sends ASCII serial command string to enable the desired operating mode.
>
> **STEP 3**   <u>Transmit the ASCII Data to printer</u>
>
> Since the IRD-ASK data transfer is in one direction, from Host to the printer, it is the Host responsibility to be sure the printer's 2000 Byte buffer never overflows.
>
> The following simple timing technique can be implemented in the **IRD-ASK** transmitter.
>
>> - Treat every line to be printed as a complete line, independent of the number of characters on that line.
>> - Keep track of the number of lines sent.
>> - Before sending a line, check to see if print buffer is full.
>>> (50 lines for 24 column printers)
>>> (28 lines for 40/42 column printer).
>> - If print buffer is full, Wait 2 seconds before sending the next line.

Figure 1.0
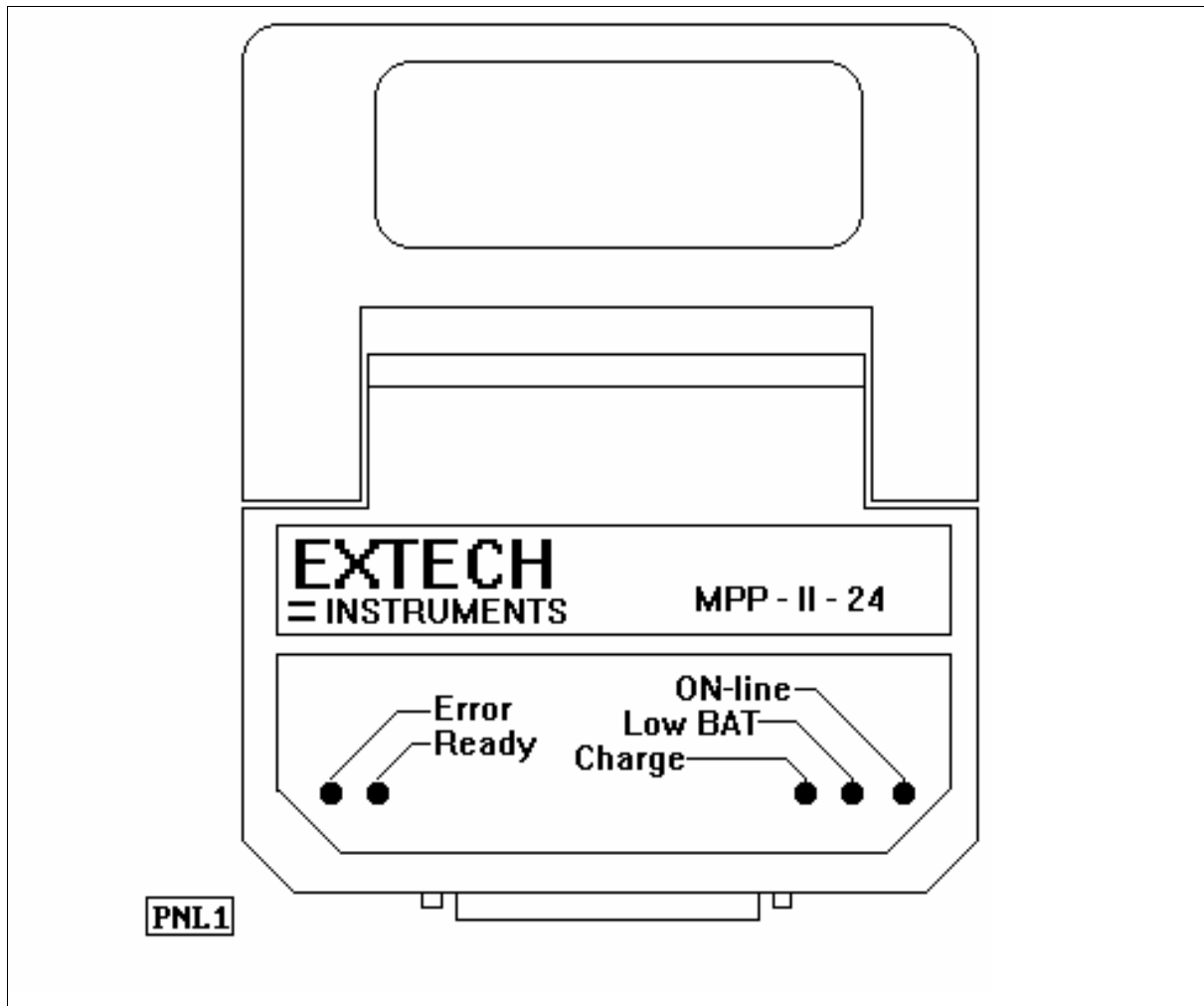**Showing front labels (including charge indicators) and model number**

Figure 1.1
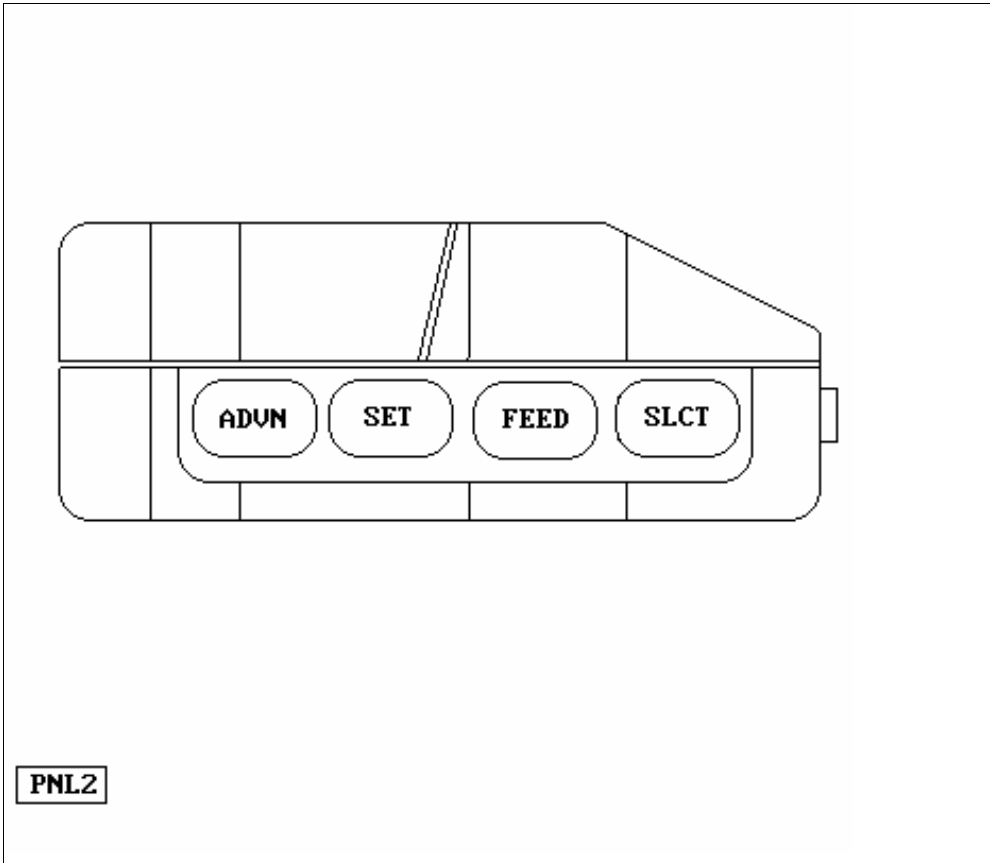**Membrane Switch panel showing <SLCT>, <FEED>, <SET> and <ADVN> switches.**

Figure 1.3

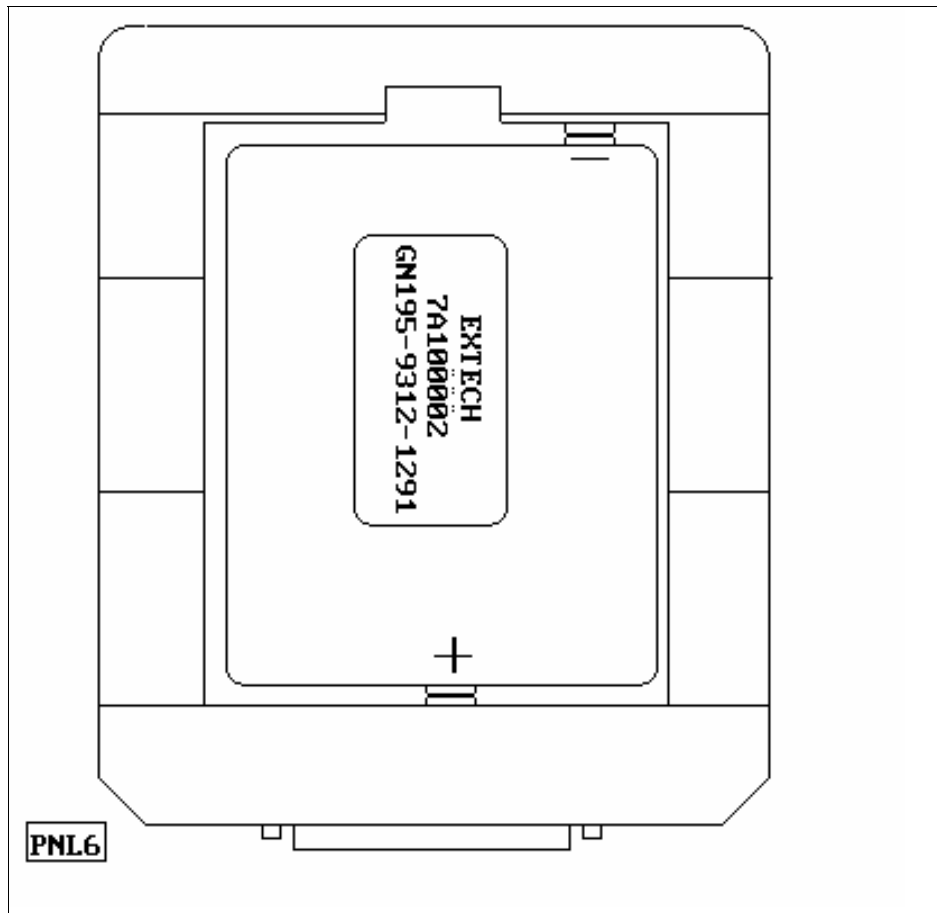**Battery compartment view showing battery pack, polarity and part number**
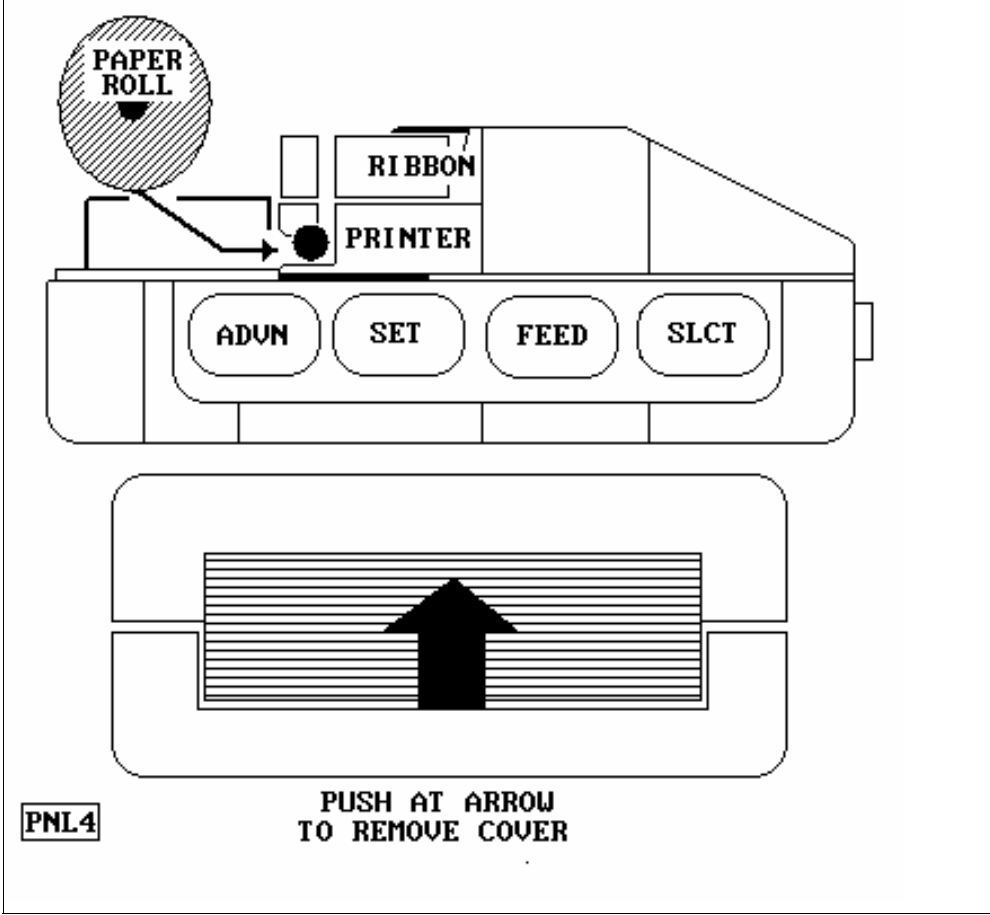
Figure 1.4
Showing Paper Roll installation

Figure 1.5
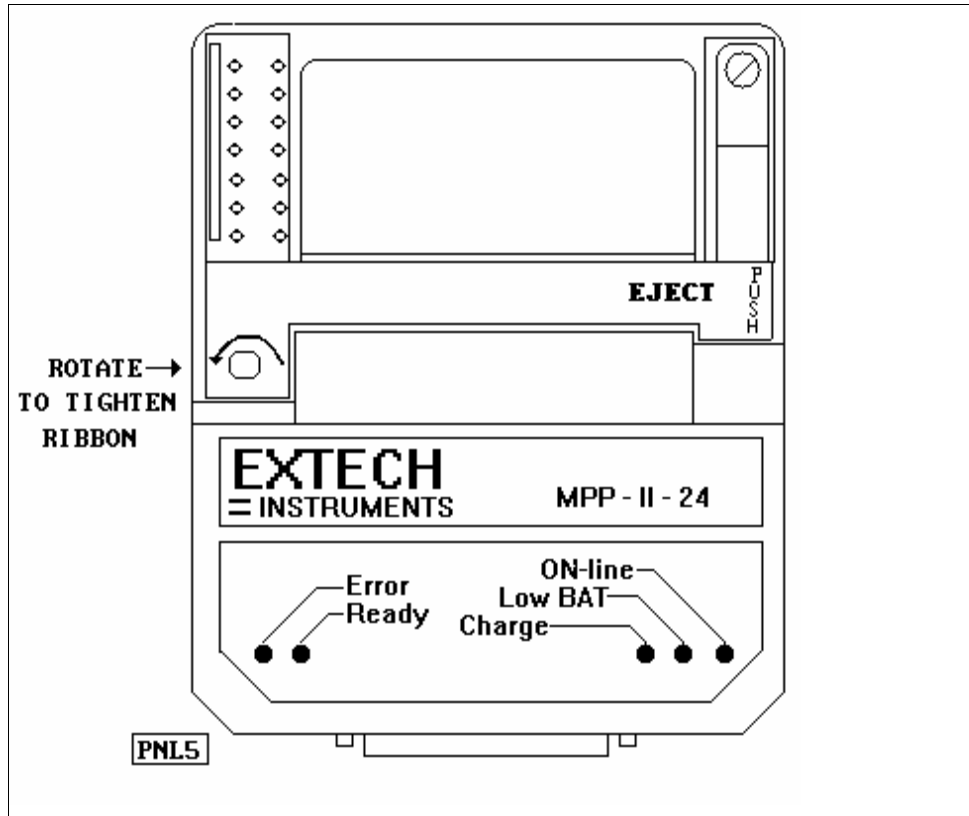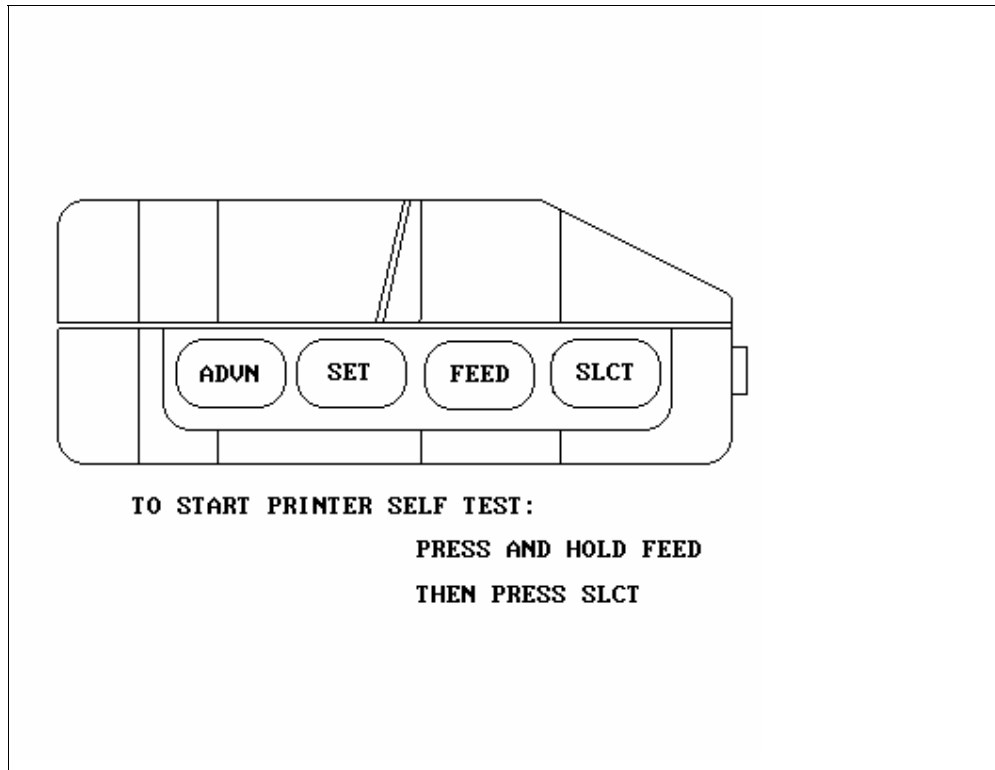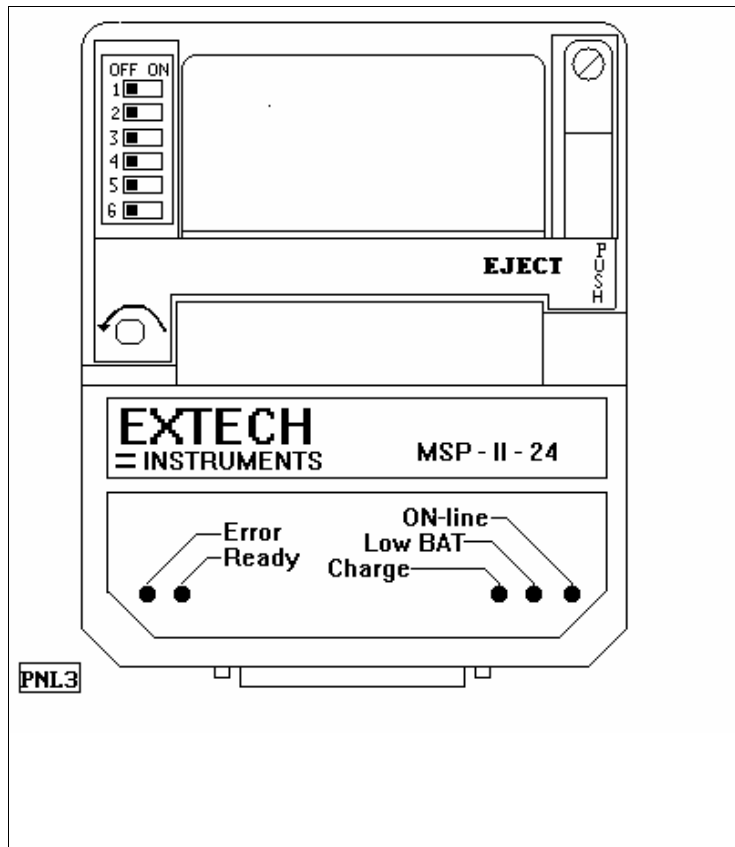**Showing Ribbon Cartridge**

Figure 1.6
Performing Power-Up and Self-Test

TO START PRINTER SELF TEST:

        PRESS AND HOLD FEED

        THEN PRESS SLCT

Figure 3.1
Showing Dip switch location

Figure 2.2
parallel interface timing

Parallel Interface Timing Diagram
Showing timing relations of
DATA BITS 1 THROUGH 8, $\overline{STROBE}$, BUSY and $\overline{ACK}$

DATA BITS

$\overline{STROBE}$

BUSY

$\overline{ACK}$

T1
T2
T3
T4

Minimum timing	
T1	0.5 µSec
T2	1.0 µSec
T3	1.0 mSec
T4	1.0 µSec

PNL9

13   1

25   14

MSP/MPP DB25S DATA CONNECTOR
FRONT VIEW
SHOWING PIN # LOCATIONS

1   6

MSP RJ11 DATA CONNECTOR
FRONT VIEW
SHOWING PIN # LOCATIONS

PNL10