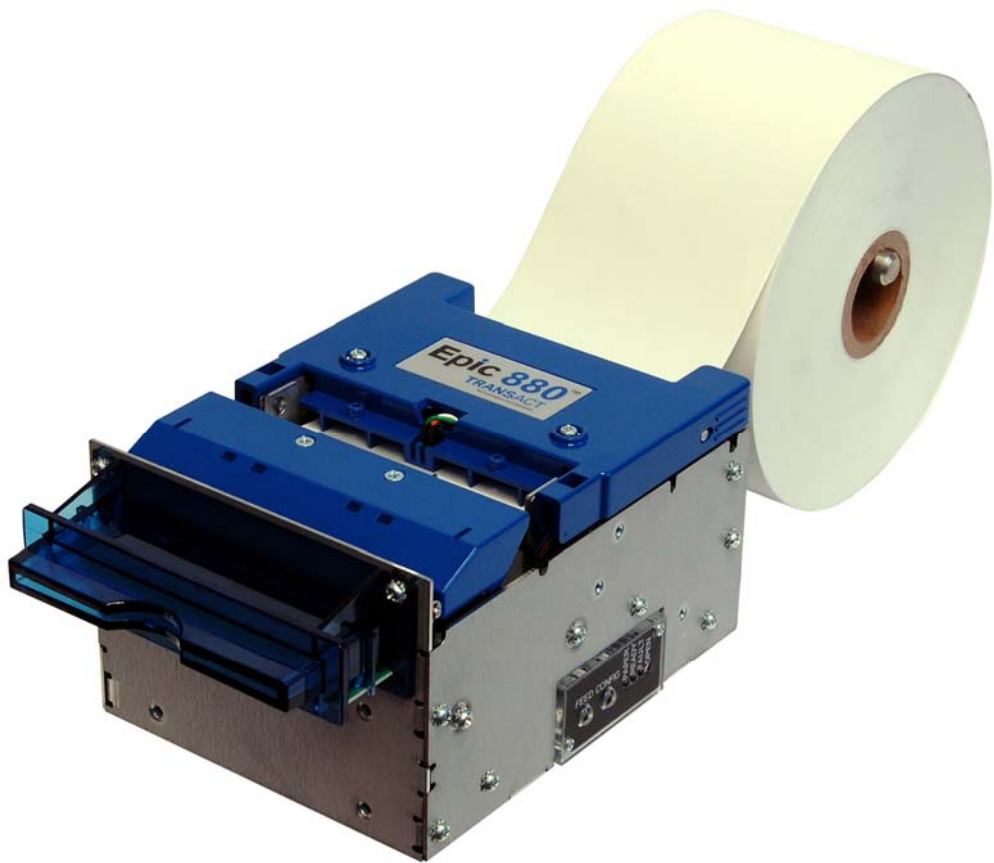


Epic 880™

OEM Integration Manual



TRANSACT
Technologies Incorporated

P/N 100-88002
Rev B, February 2009

Change History

| | | |
|-------|--|----------|
| Rev A | Initial Release | Jan 2009 |
| Rev B | Style and formatting update Added USB Watch dog Added several internal code pages. | Feb 2009 |

Federal Communications Commission Radio Frequency Interference Statement

The *Epic 880™* Printer complies with the limits for a Class A computing device in accordance with the specifications in Part 15 of FCC rules. These regulations are designed to minimize radio frequency interference during installation; however, there is no guarantee that radio or television interference will not occur during any particular installation. Interference can be determined by turning the equipment off and on while the radio or television is on. If the printer causes interference to radio or television reception, try to correct the interference by one or more of the following measures:

1. Reorient the radio or television receiving antenna
2. Relocate the printer with respect to the receiver
3. Plug the printer and receiver into different circuits

If necessary, the user should consult their dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful: *How to Identify and Resolve Radio/TV Interference Problems*. This booklet is available from the US Government Printing Office, Washington, DC 20402. Ask for stock number 004-000-00345-4.

Canadian Department of Communications Radio Interference Statement

The *Epic 880™* Printer does not exceed Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Regulatory Compliance

FCC Class B
CE Mark
EN 60950-1
UL 60950-1
CAN/CSA-C22.2 NO. 60950-1
EN55022
EN55024
ROHS

Disclaimer

NOTICE TO ALL PERSONS RECEIVING THIS DOCUMENT:

The information in this document is subject to change without notice. No part of this document may be reproduced, stored or transmitted in any form or by any means, electronic or mechanical, for any purpose, without the express written permission of TransAct Technologies, Inc. ("TransAct"). This document is the property of and contains information that is both confidential and proprietary to TransAct. Recipient shall not disclose any portion of this document to any third party.

TRANSACT DOES NOT ASSUME ANY LIABILITY FOR DAMAGES INCURRED, DIRECTLY OR INDIRECTLY, FROM ANY ERRORS, OMISSIONS OR DISCREPANCIES IN THE INFORMATION CONTAINED IN THIS DOCUMENT.

TransAct cannot guarantee that changes in software and equipment made by other manufacturers, and referred to in this publication, do not affect the applicability of information in this publication.

Copyright

© 2008, 2009 TransAct Technologies, Inc. All rights reserved.

Revision Level B

February 2009

Printed in USA

Trademarks

Some of the product names mentioned herein are used for identification purposes only and may be trademarks and/or registered trademarks of their respective companies.

BANKjet, 50Plus, Insta-Load, Ithaca, "Made to Order. Built to Last", Magnetec, PcOS, POSjet, PowerPocket and TransAct are registered trademarks and Epic 880™, Flex-Zone, Import, ithaColor, iTherm, KITCHENjet, Momentum, QDT and TicketBurst are trademarks of TransAct Technologies, Inc.

Table of Contents

| | |
|--|-----|
| Change History | ii |
| Federal Communications Commission Radio Frequency Interference Statement | iii |
| Canadian Department of Communications Radio Interference Statement | iii |
| Regulatory Compliance | iii |
| Disclaimer | iv |
| Copyright | iv |
| Trademarks | iv |
| Table of Contents | v |
| Figures | x |
| Tables | x |

Introducing your Epic 880™ Printer 1

| | |
|--|---|
| About your TransAct® Epic 880™ Printer | 3 |
| Who Should Read This Guide? | 4 |
| What Is Included in This Guide? | 4 |
| Technical and Sales Support | 5 |
| On-line Technical Support | 5 |
| Telephone Technical Support | 5 |
| Return Materials Authorization and Return Policies | 6 |
| Service Programs | 6 |
| Sales Support | 6 |
| Contact Information | 7 |

Epic 880™ Specifications and Requirements . 9

| | |
|---|----|
| Epic 880™ Specifications and Requirements | 11 |
| Standard Features | 11 |
| Optional Features | 12 |
| General Specifications | 13 |
| Printer Dimensions | 13 |
| Weight | 13 |
| Interface Type | 14 |
| Printer Type | 14 |
| Printer Environmental Conditions | 14 |
| Reliability | 14 |
| AC Power Requirements | 15 |
| DC Power Requirements | 15 |
| Power connector | 17 |
| Test Standards | 17 |
| Accoustic Noise: | 17 |
| Printing Specifications | 18 |
| Paper Roll Specifications | 18 |
| Auto Cutter Position | 18 |
| Paper Out | 18 |
| Communications Interface | 19 |
| RS232 Serial Communications Interface | 19 |
| USB Interface | 20 |

Operational Procedures 23

| | |
|--|----|
| Operational Procedures | 25 |
| How to Operate the Epic 880™ Printer | 25 |
| Indicator Lights (LED) | 25 |

| | |
|---|-----------|
| The FEED button | 25 |
| The Diagnostics/Config button | 27 |
| Using Self-Test | 28 |
| Level 0 Diagnostics | 30 |
| Boot Loader Mode | 30 |
| Printer Status LED's | 31 |
| Auto Error Recovery | 32 |
| Loading Paper | 34 |
| Cleaning the Print Head | 34 |
| Configuring Your Epic 880™ Printer | 37 |
| Configuration Mode Overview | 39 |
| Most Frequent Configuration Incompatibilities | 39 |
| How to Change Configuration Settings | 39 |
| Entering into Configuration Mode | 39 |
| Setting up for Color Paper | 40 |
| Custom Color | 40 |
| Remote Configuration | 40 |
| Remote Boot Load | 40 |
| Field Configuration Feature | 41 |
| Mounting Requirements | 43 |
| Mounting Requirements | 45 |
| Bezel Mounting Specifications | 46 |
| Spindle Mounting Options | 47 |
| 45° Up Spindle Mounting | 47 |
| Straight Back Spindle Mounting | 48 |
| 45° Down Spindle Mounting | 48 |
| Straight Down Center Spindle Mounting | 49 |
| Straight Down Rear Spindle Mounting | 50 |
| Control Panel Side Spindle Mounting | 50 |
| Retract Opening | 51 |
| Printer Sensors | 53 |
| Printer Sensors | 55 |
| Paper Out Sensor | 55 |
| Cover-Open Switch | 55 |
| Top-of-Form Sensor | 55 |
| Paper Low Sensor | 56 |
| Anti-Jam Sensor | 56 |
| Transport Ticket Taken Sensor | 56 |
| Transport Ticket Retract Sensor | 57 |
| Electrical Connections | 59 |
| Communications Interface | 61 |
| Cable connection locations | 62 |
| Printer Block Diagram | 63 |
| Control Codes | 65 |
| Control Codes Overview | 67 |
| Nomenclature | 67 |
| Standard Emulation | 68 |
| IPCL Codes | 68 |
| Other Emulations | 68 |

| | |
|---|------------|
| Application Development..... | 68 |
| TransAct Control Codes and Commands..... | 68 |
| PcOS Printer Control Codes..... | 68 |
| Quick PcOS Reference Chart..... | 70 |
| Low Level Paper Motion Control..... | 76 |
| Horizontal Motion Control..... | 77 |
| Vertical Motion Control..... | 79 |
| Feed to Black Dot..... | 86 |
| Character Pitch..... | 88 |
| Character Font..... | 93 |
| Character Sets and Code Pages..... | 94 |
| Double-Byte and Multi-Byte Code Page Description Files..... | 96 |
| Code Page Selection..... | 96 |
| Page Mode..... | 106 |
| Graphic Mode..... | 115 |
| Graphics Compression..... | 120 |
| Simple Raster Graphics..... | 121 |
| User Store (Graphic Save and Macros)..... | 122 |
| Legacy User Macros..... | 129 |
| Bar Codes..... | 131 |
| Electronic Journal..... | 141 |
| Transport Control..... | 152 |
| Miscellaneous Control..... | 154 |
| Remote Power Control..... | 160 |
| Documented Extended Control commands..... | 161 |
| Printer Status..... | 162 |
| Inquire Commands..... | 163 |
| Double Level Loader..... | 177 |
| Entering Field Boot Load Mode..... | 177 |
| Epic 880™ Color Graphics | 179 |
| Printing Graphics..... | 181 |
| Character Graphics..... | 181 |
| APA Graphics..... | 182 |
| Epic 880™ Universal Color Graphics..... | 183 |
| Print File Graphics..... | 184 |
| Store Graphics in the printer:..... | 184 |
| How universal color graphics is done..... | 185 |
| How to use IPCL commands in text strings..... | 186 |
| Cautions..... | 186 |
| Universal Graphics Command Descriptions..... | 187 |
| Bitmapped File Graphic Support..... | 189 |
| Epic 880™ Coupon-Cut-Logo Feature..... | 190 |
| Unicode and Fonts | 191 |
| Fonts..... | 193 |
| Character Generation..... | 193 |
| Internal Fonts..... | 196 |
| Custom Fonts..... | 196 |
| Stacked or Linked fonts..... | 197 |
| Font Storage..... | 197 |
| Bitmap Fonts..... | 199 |

| | |
|--|------------|
| Unicode | 202 |
| Unicode Encoding..... | 202 |
| File system and the POR.INI file | 204 |
| Font Size and Spacing | 210 |
| Font Size and Spacing command interactions..... | 211 |
| Legacy Printer Features that Have Changed | 217 |
| User Defined Characters | 217 |
| Dynamic Code Page Definition | 217 |
| File System | 219 |
| File System Interface..... | 221 |
| File System Commands..... | 221 |
| Epic 880™ Extended Printer Control | 227 |
| Remote Printer Reset | 232 |
| Reset in Serial Mode..... | 232 |
| Miscellaneous Communication Features..... | 233 |
| Power-cycle Recovery | 233 |
| Off-line Control..... | 233 |
| Remote Boot Load Mode | 234 |
| USB Recovery Watch Dog..... | 235 |
| Recovery from Mechanical Errors | 237 |
| Epic 880™ Programmers Notes | 239 |
| General Notes | 241 |
| What Drivers Are Needed..... | 241 |
| Definitions..... | 241 |
| Do you want to use the standard USB printing device interface? | 241 |
| Do you want to use USB and simulate a communication port? | 242 |
| Are you using OPOS (UnifiedPOS/UPOS)? | 242 |
| Do you want to print from a Windows application? | 242 |
| Windows Printer Driver | 243 |
| PC Hardware | 243 |
| GDI | 243 |
| OPOS driver | 244 |
| PC Hardware | 244 |
| USB driver: | 245 |
| POSPrinter Activex Control (POSPrinter OCX): | 246 |
| PC Hardware | 246 |
| Appendix A: Unicode Character Addresses | 247 |
| Appendix B: WGL4.0 Character Addresses | 249 |
| Appendix C: GB18030 Character Addresses | 254 |
| Appendix D: Typical Code Page Definition. | 261 |
| Appendix E: Internal Code Pages | 263 |
| Appendix F: ASCII Code Table..... | 265 |
| Appendix G: Ordering Supplies | 266 |
| Index | 267 |

Figures

| | |
|--|-----|
| Figure 1. Epic 880™ Printer..... | 11 |
| Figure 2. Epic 880™ Dimensions. | 13 |
| Figure 3. Temperature and Humidity Ranges..... | 14 |
| Figure 4. Control panel with FEED and Diagnostics/CONFIG buttons and indicator lights..... | 25 |
| Figure 5. Location of Diagnostics/Config Button. | 27 |
| Figure 6. Auto-feeding a Paper Roll. | 34 |
| Figure 7. Startup message in Field Configuration mode. | 41 |
| Figure 8. Sample pre-loaded configuration. | 42 |
| Figure 9. Epic 880™ Mounting Locations..... | 45 |
| Figure 10. Bezel Mounting and Hardware Requirements..... | 46 |
| Figure 11. 45° Up Spindle Location..... | 47 |
| Figure 12. Straight Back Spindle Location..... | 48 |
| Figure 13. Angle Down Spindle Location..... | 48 |
| Figure 14. Straight Down Center Spindle Location..... | 49 |
| Figure 15. Straight Down Rear Spindle Location..... | 50 |
| Figure 16. Retract Opening. | 51 |
| Figure 17. Dimensions for Retract Opening. | 52 |
| Figure 18. Sensor Breakdown and Locations..... | 55 |
| Figure 19. Transport Ticket Taken Sensor..... | 56 |
| Figure 20. Transport Ticket Retract Sensor..... | 57 |
| Figure 21. Communication PCB Location and Connector Info..... | 61 |
| Figure 22 Power and RS232 Left hand Exit..... | 62 |
| Figure 23 Power and USB Left hand Exit..... | 62 |
| Figure 24 Page Mode Entry Orientations..... | 106 |
| Figure 25 Page mode set printable area..... | 110 |
| Figure 26 Default Page mode printed area..... | 110 |
| Figure 27 Defined Page mode printed area..... | 111 |
| Figure 28 Code 39 Full 128 Character Encoding..... | 133 |
| Figure 29 Expanded Function Coding..... | 134 |
| Figure 30 Code 128 Encoding Values..... | 136 |
| Figure 31 Example of Character Graphics..... | 181 |
| Figure 32 Windows Driver..... | 243 |
| Figure 33 OPOS (UPOS) Driver..... | 244 |
| Figure 34 USB Driver..... | 245 |
| Figure 35 POSPrinter OCX..... | 246 |

Tables

| | |
|---|-----|
| Table 1. Input Power Requirements..... | 16 |
| Table 2 Serial Interface Pin-outs..... | 19 |
| Table 3 Character Pitch..... | 91 |
| Table 4 Inter-character Spacing..... | 92 |
| Table 5 Language Table ID's..... | 97 |
| Table 6 Euro Character Substitution Matrix..... | 98 |
| Table 7 Paper Sensor Commands..... | 156 |
| Table 8 Paper Sensor Commands..... | 157 |

| | |
|--|-----|
| Table 9. Possible Character Pitches | 195 |
| Table 10 Requested CPI and Resulting CPI | 196 |
| Table 11 Character Pitch | 217 |

Chapter 1

Introducing your Epic 880™ Printer

This page intentionally left blank

About your TransAct® Epic 880™ Printer

The TransAct® Epic 880™ printer represents the very latest technology for use for thermal receipt printing, specifically designed for the needs of gaming and kiosk applications. It builds upon the architecture of TransAct's proven thermal printers, together with a host of features specifically designed to improve the performance of your receipt printing applications, including:

- Integrated printer mechanism/main controller PCB architecture
- Paper roll bracket/spindle allowing paper roll to be mounted behind or below printer mechanism
- High-speed (6 inches per second) thermal receipt printing
- Barcode printing capabilities.
- Up to six (6) inch (152 mm) diameter paper roll
- Long-life ticket cutter
- Standard variable length presenter capable of handling from 63.5 to 254 mm. (2.5 -10 inches) length tickets
- Stroke-based fonts capable of supporting Asian and Latin characters
- Standard ticket retract feature
- Standard illuminated bezel assembly (Translucent blue)

These features and more let you quickly and easily integrate reliable ticket printing in your gaming and kiosk applications, while giving you the quality, durability and uptime you have come to expect from TransAct® printers.

Who Should Read This Guide?

This document provides information useful to original equipment manufacturers (OEM) who will integrate the Epic 880™ printer into their products.

What Is Included in This Guide?

This Integration Manual includes information on the mechanical, electrical and command language requirements of the Epic 880™ printer. It provides the following information to support your integration efforts:

- Warranty and technical support information.
- Specifications and functionality description.
- Mounting requirements and mounting locations.
- Power and interface connections.
- Operational procedures.
- Programming information, including documentation of low-level and high-level command interfaces, as well as sample scripts to guide your own implementation efforts.

We want you to have a trouble-free implementation with your TransAct® printer. For any issues not covered in this guide, quality technical support is available on-line at www.transact-tech.com, or by telephone or fax - consult the following pages for more details about our support services.

Technical and Sales Support

Your printer is backed by the resources of TransAct Technologies, a global technology firm with dedicated technical support and sales assistance. Here is how we can help you:

On-line Technical Support

Our web site at www.transact-tech.com is your on-line portal to obtaining technical assistance with your TransAct® printer. Click on the Technical Support link to find support information for your printer. Our on-line support site also includes a convenient e-mail assistance request form, where you can submit support requests 24 hours a day, and receive a return contact from a TransAct support technician during regular business hours.

Telephone Technical Support

Live telephone support is available Monday through Friday from 8 AM to 5 PM local time, excluding holidays. We can provide general information about programming for your Epic 880™ printer, technical support, documentation, or assistance in sending a printer for service. To obtain telephone support, contact the number below for your region and ask for Technical Support.

United States: 1.877.7ITHACA (1.877.748.4222), Fax: 607.257.3911
Europe, Middle East and Africa (EMEA): 011-44-170-977-2500, Fax: 011-44-170-977-2505

To help us serve you faster, please have the following information ready when you call:

- The Model Number and Serial Number of the printer.
- A list of any other peripheral devices attached to the same port as the printer.
- What application software, operating system, and network (if any) you are using.
- What happened and what you were doing when the problem occurred.
- How you tried to solve the problem.

Return Materials Authorization and Return Policies

If a support technician determines that the printer should be serviced at a TransAct facility, and you want to return the printer for repair, we will issue you the Returned Materials Authorization (RMA) number that is required before returning the printer. Repairs are warranted for 90 days from the date of repair or for the balance of the original warranty period, whichever is greater. Please prepare the printer being returned for repair as follows:

- Pack the printer to be returned in the original packing material.
- Packing material may be purchased from TransAct's Ithaca Facility.
- Do not return any accessories unless asked to do so by a support technician.
- Write the RMA number clearly on the outside of the box.

Service Programs

TransAct Technologies Incorporated has a full service organization to meet your printer service and repair requirements. If your printer needs service, please contact your service provider first. If any problems still persist, you can directly contact the Technical Support department at the numbers listed above for a return authorization. Customers outside the United States and United Kingdom should contact your distributor for services. TransAct offers the following service programs to meet your needs.

- Extended Warranty.
- Depot Repair.
- Maintenance Contract.
- Internet Support.

Sales Support

To order supplies, receive information about other Ithaca products, or obtain information about your warranty, contact our Sales Department at the contact telephone or fax numbers listed below. To receive information on International distribution, visit our web site at **www.transact-tech.com**.

Contact Information

TransAct Technologies Incorporated
Ithaca Facility
20 Bomax Drive
Ithaca, NY 14850 USA

TransAct Technologies
World Gaming Headquarters
& Western Regional Repair Center
6700 Paradise Road
Suite D
Las Vegas, NV 89119 USA

| | |
|-----------------------|---|
| Telephone | 877.7ithaca or 607.257.8901 |
| Main fax | 607.257.8922 |
| Sales fax | 607.257.3868 |
| Technical Support fax | 607.257.3911 |
| Web site | www.transact-tech.com |

Western United States: 877.822.8923, Fax: 702.254.7796
United Kingdom: 011-44-170-977-2500, Fax: 011-44-170-977-2505

Chapter 2

Epic 880™ Specifications and Requirements

This page intentionally left blank

Epic 880™ Specifications and Requirements

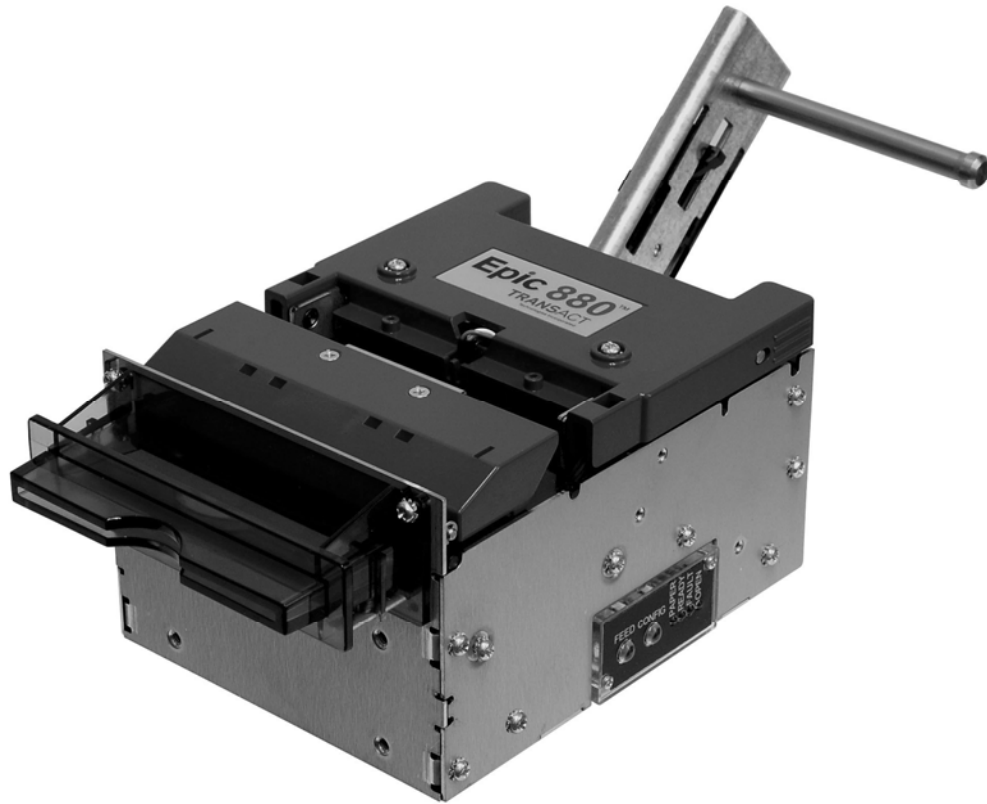


Figure 1. Epic 880™ Printer.

Standard Features

The following features are standard for Epic 880™ printers:

- Integrated printer mechanism/main controller PCB architecture
- Variable length presenter, capable of handling from 63.5 to 254 mm. (2.5 -10 inches) length tickets
- Full-cut auto-cutter module as part of printer mechanism
- Minimum 150 mm (6.0")/second print speed (monochrome black text)
- 203 dpi print resolution (8 dots/mm.)
- Special print scalable to 8x with reverse, underscore, italic, and bold print
- 44/57 characters per line for 80 mm paper width
- Face-up print orientation
- ASCII and Unicode character encoding
- Ladder and fence barcode printing supporting UPC-A, UPC-E, EAN13, EAN8, Code39, ITF, CODABAR, Code93, Code 128, Code31, and Interleaved 2 of 5
- Serial RS232C and USB interfaces built into main controller PCB
- Selectable baud rates

- Drivers for Windows XP and XPe
- 4 MB minimum flash memory and 8 MB RAM
- Ithaca command set emulation
- Power: 24 VDC
- Power Connector: 4 pin Molex
- Paper Out, Paper Cover-Open, Paper Low, Top-Of-Form, Jam Detection, Transport Ticket Taken, Head Temperature, and Ticket Retract sensors
- Ticket retract feature
- Power and error LED(s)
- Paper feed button
- Easy paper loading
- Portrait or landscape printing under Windows
- Internal counters to track number of hours on, cuts completed, lines fed, and error conditions
- Capable of handling a 152 mm. (6.0 inch) diameter, 82.5mm. wide paper roll
- Compliant with RoHS (Restriction on Hazardous Substances)
- Bezel assembly with LEDs (translucent blue)

Optional Features

The following options are available:

- 80mm paper guide
 - Lower paper guide
 - Additional or custom fonts or character sets.
 - Custom emulations (Epson, Custom)
 - Universal power supply (100-240 VAC, 47-63 Hz)
-

General Specifications

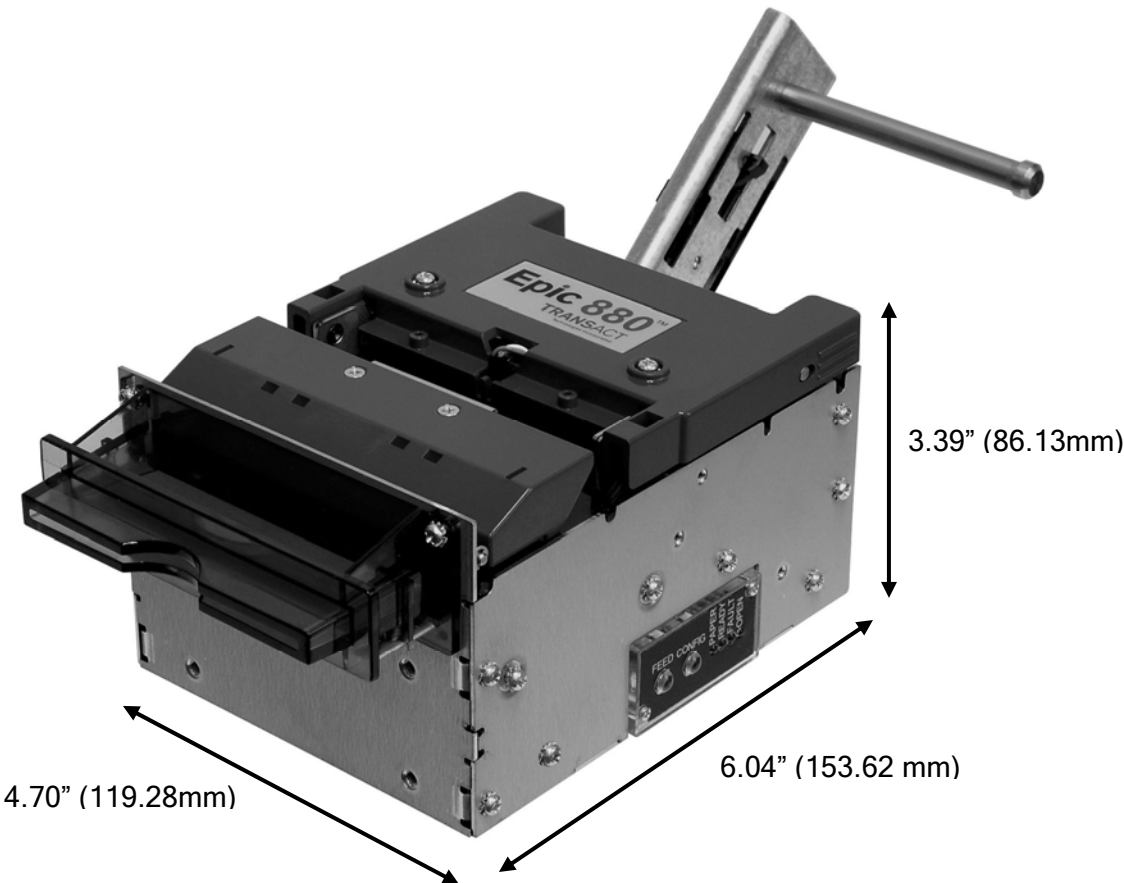


Figure 2. Epic 880™ Dimensions.

Printer Dimensions

| Max Dimensions | | | | |
|------------------------|-------|-----------------|--------------------------------------|------|
| | W | D (w/out paper) | D (with paper guide and w/out paper) | H |
| Dimensions inches | 4.77 | 6.05 | 7.02 | 3.48 |
| Dimensions millimeters | 121.2 | 153.7 | 178.2 | 88.4 |

(fully assembled as single unit)

Weight

Approximate weight 4 lb 1.8 Kg

Interface Type

Bi-directional serial RS-232 or USB

Printer Type

Fixed 80 mm linear thermal head.

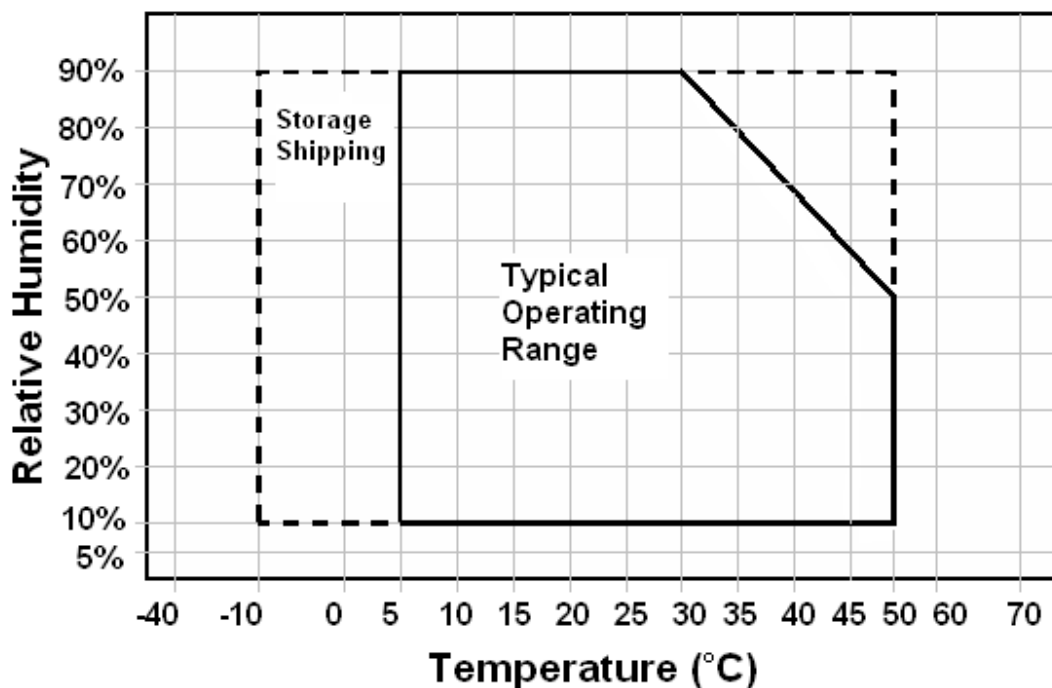


Figure 3. Temperature and Humidity Ranges.

Printer Environmental Conditions

| | |
|-------------------------------------|--|
| Operating Temperature Range: | 5° - 50°C (41°F - 122°F) |
| Shipping/Storage Temperature Range: | -10° - 50°C (14°F - 122°F) |
| Operating Humidity Range: | 10% - 90% non-condensing |
| Shipping/Storage Humidity Range: | 10% - 90% non-condensing (excluding paper) |

Reliability

| | |
|------------------|------------------------------|
| Printer Life: | 10,000,000 print lines |
| Print Head Life: | 100Km. min. |
| Cutter Life: | 1,000,000 cuts (POS Grade) |
| | 750,000 cuts (Lottery grade) |

AC Power Requirements

90-264 VAC at 47-63 Hz.

DC Power Requirements

Thermal printers require high peak currents based on how many print elements are being used and how often. High density printing requires much more current than low density printing. High density printing in the horizontal axis will put extreme peak loads on the power supply. These high peak currents can cause power supplies to sag, roll back or even shut down. A power supply with an average rating sufficient to meet the average printer requirements may not be sufficient to meet the peak requirements. The power supply selection is critical to proper printer operation.

Typical power supplies are designed to provide a continuous well regulated voltage at an average current that does not fluctuate too much and will typically have a wattage rating based on that average current. A power supply suitable for the Epic 880™ could have a wattage rating of 48 watts but unless it can provide peak currents of 8 amps (192 watts) and maintain 24VDC output, it will not function properly.

Some power supplies are designed to provide multiple voltages. These power supplies typically provide a logic supply voltage that requires close regulation. The other voltages are not as well regulated or have post regulation. In this case when the 24 volt output is required to provide high peak currents, the circuitry within the power supply must maintain the logic voltage and the 24 volt supply will sag. In some cases the high peak load will actually shut down the complete supply.

Thermal printing has specific power requirements to develop the thermal paper. The Epic 880™ printer monitors the incoming voltage and will increase its current requirements if the voltage is low. The printer will adjust the print element burn time and that will result in increased average current requirements. Input voltage ranges from about 20 to 27 volts can be accommodated by the Epic 880™. If the input voltage is outside the acceptable range, the printer will issue a fault and will not function.

A suitable power supply for a thermal printer will provide a constant voltage over a wide range of loads with a low average current requirement.

Consider the following when selecting or designing a power supply for the Epic 880.

- 1) It must be able to provide quick response to step loads
- 2) Current will range widely with peaks at least 4 times the average
- 3) Load requirements for the power supply are as shown in the table below.
- 4) Consider a dedicated power supply for the printer.
- 5) If the printer is expected to print dense graphics, increase the average and continuous current requirements by at least 25%.
- 6) Use power cables that are as short as possible and use adequate wire size based on the cable length. Typically AWG 18 is the minimum wire size provided the length is less than 3 ft (1 m).
- 7) Make sure the power supply uses a low ESR capacitor of at least 2200uF and preferably larger in the output circuit.

- 8) When the printer prepares to print, it will activate the print head power and charge a bulk capacitor attached to the print head. This current spike can be up to 15 amps for up to 200uS depending on the charge state of the capacitor.
- 9) Make sure the power supply specification includes any bezel current requirements.
- 10) Consider that the frame ground and the 24V return are connected together in the printer.
- 11) Use connectors in the power interconnect that are rated for the maximum average current.

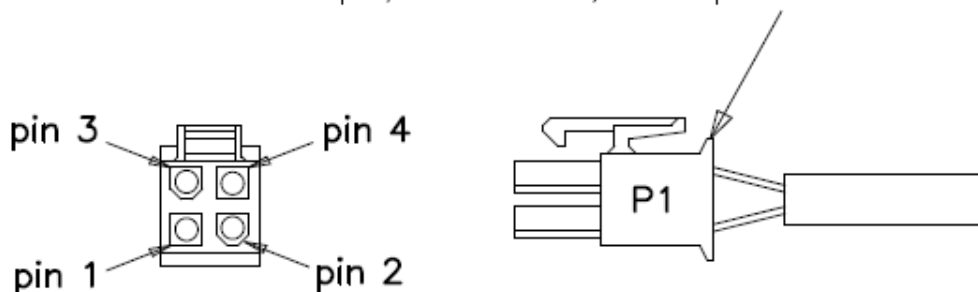
| | |
|--|---|
| Voltage Under all line, load and environmental conditions | 24VDC \pm 8.5% |
| Load Current | 0A min 1.87A continuous 3.5A continuous - 1 minute maximum. 8A peak load 23.38% duty cycle 2ms period .1A/us slew rate 200 ms maximum NOTE: This load current does not include the optional Bezel drive requirement. |
| Max. Ripple | 240mv p-p |
| Over voltage Protection | < 30V |
| Over current Protection | Output equipped with auto restart short circuit protection < 7amps when $t_{short} > 10ms$ |

Table 1. Input Power Requirements

Power connector

Housing — Molex, 4 Position Mini-Fit Jr, p/n: 39-01-2040

Terminal — pin, 18-24 AWG, Molex p/n: 39-00-0059



| SIGNAL | pin # |
|---------|-------|
| +24V | 1 |
| 24V RTN | 2 |
| — | 3 |
| FRAME | 4 |

Note: Power may be applied through the 14 pin connector. See the Communications Interface section for more information.

Note: The 24V RTN and FRAME pins are connected inside the printer.

Test Standards

CE MARK (1998)

FCC CLASS B

EN 60950-1

IEC 60950 (1991) Second Edition with Amendments 1,2,3,4

ROHH/WEEE

Acoustic Noise:

58 dbA average (sound pressure level) while printing a rolling ASCII format. Microphone positions are at 10 different positions spaced around the printer as defined in ISO 779.

Printing Specifications

| | |
|---------------------------------------|-----------------------------------|
| Printing method: | Thermal Sensitive Line Dot System |
| Vertical/Horizontal dot pitch: | 0.125 mm. |
| Resolution: | 8 dots per mm (203 DPI) |
| Line feed pitch: | 3.2 mm. (.125 inches) |
| Print zone (typical) | 80 mm (3.15 inches) |
| Print speed (monochrome): | 6 inches per second |
| Number of print elements: | 640 dots in-line |

Paper Roll Specifications

| | |
|------------------------------------|--|
| Paper Type: | One ply thermal paper |
| Paper Width: | 79.5 +/- .05 mm (3.13 +/- .02 inches) or 82.0 +/- 0.5 mm. (3.23 +/- .02 inches) |
| Paper Thickness | 0.076 mm to 0.09 mm (.0022 to .0035 in.) thick |
| Roll Diameter: | 152 mm (6.0 in.) |
| Roll Core Inside Diameter: | .445 to .635 inches |
| Roll Core Outside Diameter: | .730 to .860 inches |
| Paper Grades : | POS and Lottery grades |

Paper Usage Precautions:

Use only specified thermal paper. If other paper is used, print quality, head life, and cutter life may deteriorate. Contact TransAct customer service for approved papers.

Auto Cutter Position

A full cut auto-cutter is a standard feature with all TransAct® Epic 880™ printers.

| | |
|------------------------------|--|
| Cutter type | Guillotine |
| Media width | 82.5 mm. (3.25 inches) |
| Media thickness range | 0.0022 to 0.0035 inch |
| Cut to line of print | 0.38 inch |
| Cutter life | 1,000,000 cuts (POS grade) 750,000 cuts (Lottery grade) |
| Cut time: | Less than 750 milliseconds |

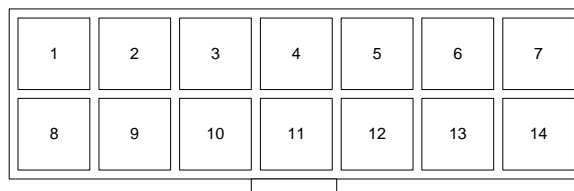
Paper Out

A receipt paper out sensor is provided as a standard feature, which senses when approximately .5 inches length of paper is left on the paper roll.

Communications Interface

RS232 Serial Communications Interface

The RS232 Serial interface connector is a 14 position Molex Minifit Jr®, part number 39-30-1140, which mates with Molex part number 39-01-2140 or equivalent.



| 14-pin | Direction | Description |
|--------|-----------|---------------------|
| Pin 1 | - | No connect |
| Pin 2 | IN | Data Set Ready |
| Pin 3 | - | No connect |
| Pin 4 | IN | Clear to Send |
| Pin 5 | - | Signal Ground |
| Pin 6 | - | +24V |
| Pin 7 | - | Signal Ground |
| Pin 8 | - | +24V |
| Pin 9 | - | No connect |
| Pin 10 | - | Frame Ground |
| Pin 11 | IN | Receive Data |
| Pin 12 | OUT | Transmit Data |
| Pin 13 | OUT | Data Terminal Ready |
| Pin 14 | OUT | Request to Send |

Table 2 Serial Interface Pin-outs

Signal Voltage and Current levels

The serial interface meets EIA RS232 interface specifications:

| | | |
|----------------|-----------------|-----------|
| Voltage Levels | Max | +15 Volts |
| | Min | +3 Volts |
| Mark = Off = | -3 to -15 Volts | |
| Space = On = | +3 to +15 Volts | |

Note: Power may be applied through this connector or the 4 pin power connector. See the DC Power Requirements section for 24 volt power requirements.

Note: GND is the 24V return.

Note: FGND and GND are connected in the printer.

USB Interface

The USB interface supports USB Version 2.0 High speed or full speed. The standard USB interface is implemented through a standard Series “B” receptacle as defined in the USB Specification. The printer is self-powered and does not draw power from the standard type B USB interface cable.

The Standard USB Type B connector has the following pin functions:

Pin Signal

1 Vbus (+5 V dc¹) (This is used to select between Interfaces)

2 Minus data

3 Plus data

4 Ground

Note: The standard USB interface does not have enough power to run the printer. It is not possible to power the printer with the USB cable alone.

USB Configuration

To allow the application to use a virtual serial port or a USB printer port to interact with the printer, the EPIC 880™ supports both ports, and can be configured to support a Virtual COM port or a USB Printer device. The USB section of the configuration allows USB Mode, USB Enumeration, and whether the printer will perform a normal Windows plug and play operation to be configured. The default is printer port, use description, with Windows PnP on.

You should configure these options based on how you want the printer to perform in your system. Typically only the Virtual COM or USB printer driver is required: to load the Transact Virtual COM port driver, disable the USB printer port. Typically you can use the description as the enumeration ID, representing how the printer is uniquely identified to the host. If you select a description, all Epic 880's will be the same, and you can interchange printers without affecting the port location, subject to the limitation that no more than one Epic 880 can be connected to the same host. If that is a requirement, select ID by serial number or allow the ID number to be assigned by windows based on the connection.

You can also disable the Windows PnP sequence. This will prevent the Windows system from receiving the printer driver selection sequence. This will allow you to manually assign a driver to the USB printer connection and not have Windows keep asking for a printer driver.

The adapter will support a high speed USB interface if the host also supports high speed. If the host does not support high speed the printer will revert to full speed. It is possible to disable high speed operation by setting a configuration option. The printer does not support the USB low speed protocol.

¹ The Vbus signal is used to disable the serial port. If the USB is connected the RS232 serial port is not active.

The most reliable USB interface is as a USB printing device. The Virtual COM driver is an added layer of code that allows legacy software to believe it is interacting with a serial port. Note that a limitation of serial communications port virtualization is that each version of windows is slightly different, and not all RS232 features are supported: only features such as receive, transmit and ready/busy are supported, while other features such as on hook, off hook, ring, and break are not supported.

Chapter 3

Operational Procedures

This page intentionally left blank

Operational Procedures

How to Operate the Epic 880™ Printer

Your Epic 880™ printer contains two buttons (FEED and CONFIG) and four (LED) indicator lights: Paper, Ready, Fault, and Open. These are located on a panel on the right-hand side of the printer.



Figure 4. Control panel with FEED and Diagnostics/CONFIG buttons and indicator lights.

Indicator Lights (LED)

The four Epic 880™ indicator lights are:

- **Paper LED** Indicates paper status (paper low or out)
- **Ready LED** Indicates printer activity and non-recoverable errors
- **Fault LED** Indicates problems and probability of recovery
- **Open LED** Indicates the cover is open

The FEED button

The FEED button will provide various functions, depending upon how long it is pressed.

Pressing this button will provide one of three functions. The function is time-dependent, and the display indicators will change to indicate the next mode, as follows:

- The feed button is a multifunction button. By pressing and releasing the Feed button, the printer will feed about 5 inches of paper while printing the printer firmware version. This is intended to clear the printer and align the next ticket for print.
- By pressing and holding the feed button for a longer time, two additional features may be activated. Pressing and holding the button for about two seconds will enter journal maintenance mode.
- Holding the button for about 4 seconds will enter configuration mode.

To aid in selecting the correct mode, the Fault LED will illuminate as soon as the button is pressed and indicates that FEED is selected. After about 2 seconds the Fault LED will go out and the PAPER indicator will illuminate. This indicates that Journal mode is selected. After about 4 seconds, the Cover LED will illuminate indicating configuration mode is selected

The Diagnostics/Config button

The printer has a configuration and diagnostics button on the right side of the printer, labeled CONFIG.

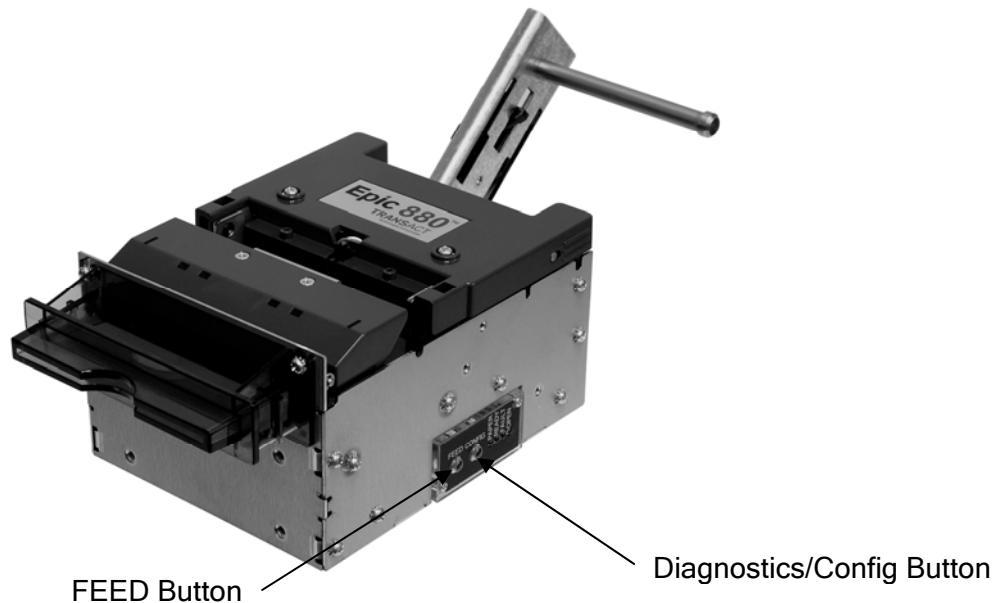


Figure 5. Location of Diagnostics/Config Button.

The Diagnostics/Config button is a multifunction button. By pressing and releasing the Diagnostics/Config button, the printer will enter self test mode. This is intended to verify the printer's operation.

By pressing and holding the Diagnostics/Config button for a longer time, two additional features may be activated. Pressing and holding the button for about two seconds will enter hex dump mode. Holding the button for about 4 seconds will enter configuration mode.

To aid in selecting the correct mode, the Fault LED will illuminate as soon as the button is pressed and indicates that self test is selected. After about 2 seconds the Fault LED will go out and the PAPER indicator will illuminate. This indicates that hex-dump mode is selected. After about 4 seconds, the Cover LED will illuminate indicating configuration mode is selected.

Using Self-Test

Self-Test Mode allows you to perform a series of tests to show if the printer is functioning correctly.

To enter self test, momentarily press² the Diagnostics/Config button on the side of the printer.

The Epic 880™ has several Self-Test options. Some are designed to be useful when performing on-site print evaluations. Others are designed for factory setup by TransAct.

Once in test mode, the FEED button is used to select the test to be run.

Testing the printer

Use the first three TEST options when verifying basic printer operation. The last three options are for factory test.

Operation -Ticket Print

The receipt test is the primary test option to use when determining if the printer is functioning correctly.

The ticket test is mostly used during the early stages of troubleshooting, to eliminate the possibility that the problem is occurring with the printer. If the printer experiences a failure, and the error indicator light is activated, call TransAct's Technical Support department.

Operation - Head Test

This test performs a test pattern that will print all the head print elements and verify that the drive roll is free from defects or debris. The print head has two heating elements per dot position. A print element is not considered bad unless both elements are missing. If the head test shows that there is an inconsistency in the print there may be debris on the drive roll. If debris is indicated, cleaning the drive roll should correct the problem. If this does not correct the problem, contact TransAct's Technical Support department.

Operation - Marker Calibration

The printer is equipped with several sensors in the paper path, which are adjustable and will handle a wide range of paper under normal operation. However, if there appear to be problems associated with any sensor's operation, the Marker Calibration test will attempt to adjust the sensors for optional operation with the paper installed. The Top-of-Form, Paper Out and Jam sensors will be recalibrated. To run this test,

² The Diagnostics/Config button is a multifunction button. By pressing and releasing the Diagnostics/Config button, the printer will enter self test. By pressing and holding the Diagnostics/Config button for a longer time, two additional features may be activated: pressing and holding the button for about two seconds will enter hex dump mode, and holding the button for about 4 seconds will enter configuration mode. To aid in selecting the correct mode, the Error LED will illuminate as soon as the button is pressed and indicate that self test is selected. After about 2 seconds the Error LED will go out and the PAPER indicator will illuminate, indicating that hex dump is selected. After about 4 seconds, the Cover LED will illuminate, indicating that configuration mode is selected.

simply select it. The printer will automatically position the paper and adjust the sensors. If the paper installed does not have black dot markings, the Top-of-Form sensor will be adjusted based on the white level of the paper only.

Factory Test

The printer is equipped with several factory test modes. These test options are only used for factory burn-in and testing.

Operation - Continuous

Operation - Burn-in

Operation - Rolling ASCII

Level 0 Diagnostics

Level 0 diagnostics are only run at power up, e.g. when power is first applied. These diagnostics perform the following tasks:

Power On

1. Basic System Integrity
2. Vector Integrity
3. RAM Test
4. Flash Boot Loader Integrity
5. Flash Firmware Integrity (NOTE: If the firmware is corrupted, the printer will remain in boot load.)
6. USB Controller Diagnostics and verify.
7. Start Normal Firmware
8. Verify Configuration Integrity
9. Interface Configuration
10. File System Integrity
11. Start Kernel, Verify Multitasking, Start Tasks

Once the kernel is running, the following tests must pass to allow operation. However, if any test fails (except the knife home test), the remaining tests will generate recoverable faults and normal operation will start as soon as the fault is cleared. These tests are also run when operation is resumed from OFF.

12. Cover Closed Check
13. Knife Home
14. Paper Present
15. Clear Paper Path.
16. Place Printer On-line, Start Normal Operation

The first phase of testing consists of step 1-5, and determines that the boot loader is accurate and the printer firmware is correct. Tests 1 through 4 produce non-recoverable errors if they fail, in which case the power must be removed from the printer and the printer returned for service. If the boot loader is intact, but the main firmware is corrupted, the printer automatically enters boot loader mode, where the firmware can then be reloaded into the printer.

Boot Loader Mode

The boot loader may be entered during normal operation through special commands. Normal boot load operation is by manually starting boot load mode. Boot loader mode can be entered in one of three ways: (1) when Level 0 Diagnostics finds that the firmware check (also known as a cyclical redundancy check, or CRC) is bad, (2) manually, or (3) through the use of a special boot load command.

To manually enter the boot loader, hold the Diagnostics button in the side of the printer while the power is applied. The FAULT Indicator comes on, and the READY indicator blinks. At this time, the firmware boot program is operating and the boot load file may be sent to the printer. When the printer receives the boot load file, the printer will automatically restart if the firmware load was successful. If the load fails, the printer will remain in boot load mode. If the load fails, reset the printer by removing the power and restarting it, and then try again.

Note: In this download mode, the printer will only accept data on the serial port. A second level loader, described in more detail in the command section of the *Epic 880™ OEM Integration Manual*, supports the USB interface.

Note: In rare cases, it may be required to load the firmware twice. The Epic 880™ contains a flash file system. The complete flash image is sometimes distributed as part of a firmware update. If the file system image is not compatible with the previous firmware configuration, the new firmware may need to reformat the file system. If this occurs, the firmware will have to be reloaded after the flash is reformatted. The indications that this is happening will be an excessively long startup after a firmware update after which the printer will not print: tickets are presented, however only graphics are printed, and fonts will be missing. In this case it is important that the reformat be allowed to complete, as it can take up to 30 seconds to reformat the entire flash system.

Printer Status LED's

The Epic 880™ printer has four indicator lights to indicate various operating states of the printer. In general these are Fault, Cover Open, Paper Status, and Ready.

The printer may be in normal operation, self test or in one of two boot load modes. The Ready and Fault indicators will indicate which mode by a unique blink pattern:

TransAct Boot Load Mode

In TransAct Boot Load Mode, the power LED will blink slowly with a 50% duty cycle. It will repeat this cycle about every 2 seconds (1 Sec on, 1 Sec off). There will be a red indication on the Error LED indicator until the down load is started.

Self Test Mode

When the printer is in Self Test Mode, the power indicator will blink slowly with a 50% duty cycle at a 2 second rate. This is very similar to TransAct Boot Load Mode, however, the red error indicator will not be present.

Normal Operation

During Normal operation, the Power LED will remain on unless an error is being indicated. There are two classes of errors, soft errors and hard errors. Soft errors are recoverable without power cycling the printer; conversely, recovering from hard errors requires removing the power from the printer, correcting the problem, and then reapplying power.

| Status | LED response |
|-------------------------|-----------------------------|
| Power On, Printer Ready | Ready LED on (Not Blinking) |
| Paper Low | Paper LED Blinking |

Soft Errors

Soft errors may be recovered by the host, or by opening and closing the printer cover. Each of these errors is indicated by a 5 second repeating blink pattern on the Power LED with the red Fault LED continuously on.

| | | |
|-------------------------|----------|----------------------------|
| Out of Paper | 2 Blinks | Paper LED will also be on. |
| Cover Open ³ | 4 Blinks | |

³ The printer may be configured to beep if the cover is open.

| | | |
|------------------------|----------|----------------------------|
| Jam Detected | 5 Blinks | |
| Missed Top of Form | 6 Blinks | Paper LED will blink fast. |
| Illegal or Bad Command | 7 Blinks | Paper LED will blink fast. |
| Printer Over Temp | 8 Blinks | Fault LED will blink slow. |
| Bad Power | 8 Blinks | Fault LED will blink fast. |

Hard Errors

Hard errors have a similar blink pattern to soft errors, except that they are slower and repeat every 10 seconds. In general, these errors occur during level 0 diagnostics and are not recoverable. In these cases, the Error and Power LEDs will blink at the same time.

| | |
|-------------------------|-----------|
| EEPROM read fault | 2 Blinks |
| EEPROM write fault | 3 Blinks |
| Error Vector Taken | 4 Blinks |
| Knife Error | 5 Blinks |
| User Store Format Error | 7 Blinks |
| User Data Store Error | 8 Blinks |
| Flash Read/Write Error | 9 Blinks |
| Memory Error | 12 Blinks |
| Com Adapter | 14 Blinks |
| Kernel Fault | 15 Blinks |
| File system Fault | 16 Blinks |

Auto Error Recovery

The Epic 880™ printer has the ability to auto recover from some internal errors.

Flash Format Errors

The internal flash that is used to store graphic images is formatted to assure data integrity. If this format is corrupted, the printer will automatically delete and reformat the flash. The host can then reload the images.

Input Power Fault

The printer monitors the power input to the printer. If it is found to be greater than 26 volts or less than 20, the printer will stop and wait for the power to return to specification.

Head Temperature Fault

The printer monitors the head temperature. If the head temperature is greater than 60° C, the printer will start to slow down. If the head exceeds 65° C, the printer will stop. The printer will heat the head to maintain a head temperature of 25° C. If the printer cannot maintain a head temperature of 0° C, the printer will stop. In all cases, the printer will automatically recover when the head temperature is within range.

Configuration Fault Recovery

The printer maintains an operating configuration in EEPROM. Information such as the printer's serial number, operating configuration, and running totals are stored in this memory. Each section of this memory maintains a check character to signal that the data is valid. If this memory is found to be corrupted, the printer will restore it based on a backup copy saved in flash. This flash copy is generated when the printer was

electronically configured using the TransAct® configuration tool. Any configuration parameters altered during normal operation will not be saved in the flash copy. The EEPROM will be restored to the value set by the configuration program.

Loading Paper

The Epic 880 printer uses a continuous roll of POS or Lottery grade thermal paper, with specifications outlined in the chapter *Epic 880™ Specifications and Requirements*.

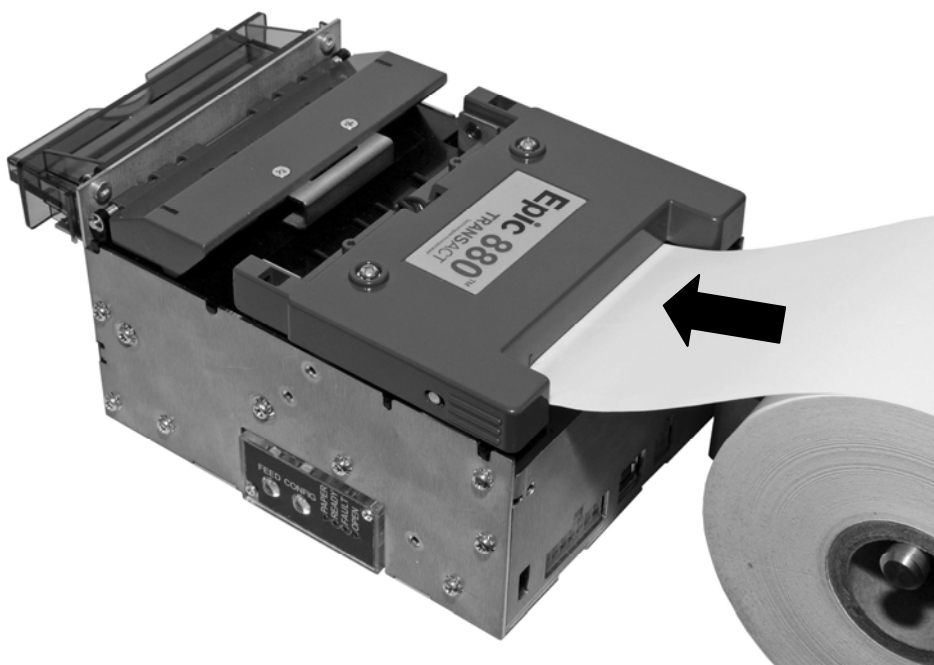


Figure 6. Auto-feeding a Paper Roll.

Instructions for auto-feeding the paper are as follows:

1. Place a roll of new paper on the spindle, with the end of the paper unloading from the back to the front of the printer, as shown in the figure.
2. Thread the free end of the paper under the top cover as shown.
3. Push the end of the paper forward until it engages the Paper Out sensor, located under the center of the top cover.
4. Paper will feed automatically, and then print and eject a test ticket.

Cleaning the Print Head

Once the unit is opened, the paper path is accessible for cleaning or clearing paper. Use a soft brush to clean the paper dust from inside the printer. The paper dust should also be removed from the sensor optics. If streaking on the printed ticket is evident, the thermal print head may need to be cleaned. This can be with a cotton swab moistened with an alcohol solvent (ethanol, methanol, IPA).



Warning: After printing, the print head can be very hot. Be careful not to touch it and let it cool down before you clean it. Do not damage the print head by touching it with your fingers or any hard object.

Chapter 4

Configuring Your Epic 880™ Printer

This page intentionally left blank

Configuration Mode Overview

There are two ways to configure the Epic 880™ printer: the first is to use the manual configuration sequence by using the CONFIG and FEED key, and the second is to use TransAct's remote configuration software. TransAct Technologies offers the use of a remote CONFIG program as a fast, easy way for system integrators to configure or reconfigure your Epic 880™ printer. To obtain more information, or the latest version of the CONFIG program, call TransAct's Sales Department or Technical Support.

Most Frequent Configuration Incompatibilities

- Emulation
- RS-232 Serial Interface (baud rate)

How to Change Configuration Settings

Entering into Configuration Mode

- 1) Press the CONFIG⁴ button for approximately 4 seconds.
- 2) Select configuration mode.
- 3) Follow the printed instructions.
 - Press and hold the FEED button for the next option.
 - Press and Release the FEED button to change the option.
 - Power cycle to exit without changing.
 - Press CONFIG to save and Exit

After you enter Configuration Mode, the printer will print the current configuration, the current totals and the error logs, if any. Save this printout as a guide to changing the configuration. It's also useful in case you wish to return the printer to the previous configuration.

Each emulation may have different configurable features. If you are changing the emulation, note that the printout that was printed at the beginning of the configuration process may be incorrect for the new emulation, and the configurable features may be different. If you are using this printout as a configuration guide, and you are changing the emulation, you may wish to save the new emulation and then re-enter Configuration Mode to change other options. This will print all the available features for the new emulation.

⁴ The CONFIG button is a multifunction button. By pressing and releasing the CONFIG button, the printer will enter self test. By pressing and holding the CONFIG button for a longer time, two additional features may be activated: pressing and holding the button for about two seconds will enter hex dump mode, and holding the button for about 4 seconds will enter configuration mode. To aid in selecting the correct mode, the Error LED will illuminate as soon as the button is pressed and indicate that self test is selected. After about 2 seconds the Error LED will go out and the PAPER indicator will illuminate, indicating that hex dump is selected. After about 4 seconds, the Cover LED will illuminate, indicating that configuration mode is selected.

Setting up for Color Paper

The Epic 880™ may be configured to print two color thermal paper. For good print quality, the printer should be configured to print the paper being used. If the paper you are using is included in the list of papers displayed during printer configuration, that configuration should be used. If not, the printer should be set to Generic Color. If this does not produce acceptable print quality, you may select Custom Color.

Custom Color

When using Custom Color, start with a read setting of about 0.12 mJ/sq.mm and a black energy of 0.24 mJ/sq.mm. First, adjust the black level to produce acceptable black print.



DO NOT EXCEED 0.40 mJ/sq.mm, or the paper may start to stick to the print head and cause paper jams. Setting the Black energy too high will also slow the printer down. All color papers tested by TransAct will operate with black levels less than 0.35 mJ/sq.mm. When the Black energy is set, adjust the Color value.



NEVER exceed the Black energy with the Color energy. The color level can be very critical. Do not attempt to make the color darker by increasing the energy to the point where black starts to appear, the print quality will not be consistent.

Remote Configuration

Remote configuration is provided for all printers, and is accessed through a series of extended diagnostic and configuration commands. The TransAct® universal configuration program will allow the configuration to be read, edited, and written back to the printer. It will also allow the configuration of one printer to be recorded and replicated over a number of printers. The program is available from TransAct Technical Support or by downloading it from the Internet - consult the section On-line Technical Support for further details.

Remote Boot Load

The Epic 880™ printer is equipped with a special boot loader feature that will allow field updates of the printer's firmware. This loader is started by command and then a TransAct® firmware load image is sent to the printer. When the load image is successfully received by the remote boot loader, the printer will automatically reset and operate with the updated code. If the firmware update fails for any reason, the printer will remain in Remote Boot load mode until a successful load is accomplished.

Field Configuration Feature

A field configuration feature allows easy setup and configuration of your Epic 880 printer. This feature provides a one-time prompt, on initial power-up, that lets you select from a number of configurations that are pre-loaded for you at the factory.

This feature is an option, and must be set up and activated by TransAct. It stores a specified number of complete, commonly-used configurations in the printer, together with a text description and configuration summary.

Using Field Configuration

When the FEED button is pressed for over 6 seconds, the printer will either enter field configuration mode or comprehensive configuration mode, depending on whether the field configuration feature is present.

The initial print out will be as shown in Figure 7:

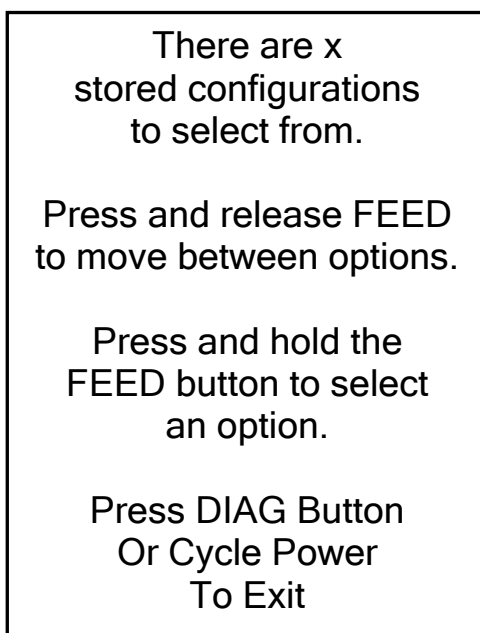


Figure 7. Startup message in Field Configuration mode.

Note: The “x” value shown in this figure will be the actual number of loaded configurations, and can range from 2 to 20.

The first option presented is an option to print all the stored configurations in summary form. Press and hold the FEED button after this option is displayed to select it. This summary includes the configuration name, a text description and a brief list of features for each pre-loaded configuration.

After the “Print all option”, each configuration is sequentially presented by name with its description. Press the FEED button once to move to the next configuration in the

list, or press and hold the FEED button to select the displayed configuration. A sample configuration is shown in Figure 8.

```

ID: xxxxxxx

Configuration description:
Ithaca normal with transport

Configuration Summary:
Emulation
Emulation mode -Ithaca PcOS

Paper Selection
Print Energy Control:
Paper          -Generic Black

RS232 Serial Interface
Baud Rate      : 19200 BPS
Mode : 8 Bit No Parity 1 Stop Bit
Handshaking    : Ready/Busy
Receive Error  : Prints '?'
DTR/RTS Signal : RTS and DTR
CTS/DSR Signal : None

General Options
Code Page      : 437
CPI : 17
Carriage Return : Normal
Off-Line Option : Normal
Line Spacing    : 8.1 LPI
Input Buffer     : 8192 Char.

And so on
    
```

Figure 8. Sample pre-loaded configuration.

Once a selection is made, a summary will be printed, and the user will be asked to confirm the selection by pressing the FEED button. If not confirmed, the printer resets and the process starts over. The printer will not exit this mode until one of the predefined configurations is selected and accepted.

If confirmed, the selected configuration is recorded in the printer and made active, after which the printer then resets. Once a selected configuration is activated, the configuration will remain active until changed.

Note: It is possible to require that a configuration be activated before the printer can be used. In this case the printer will request a configuration be selected every time it is turned on until a valid configuration is actually selected. At that time the printer will operate normally.

Chapter 5

Mounting Requirements

This page intentionally left blank

Mounting Requirements

The compact Epic 880 design architecture can be easily configured into end applications, and has multiple mounting points. (Note: All dimensions are shown in inches, and printer is shown without bezel and paper bracket/spindle)

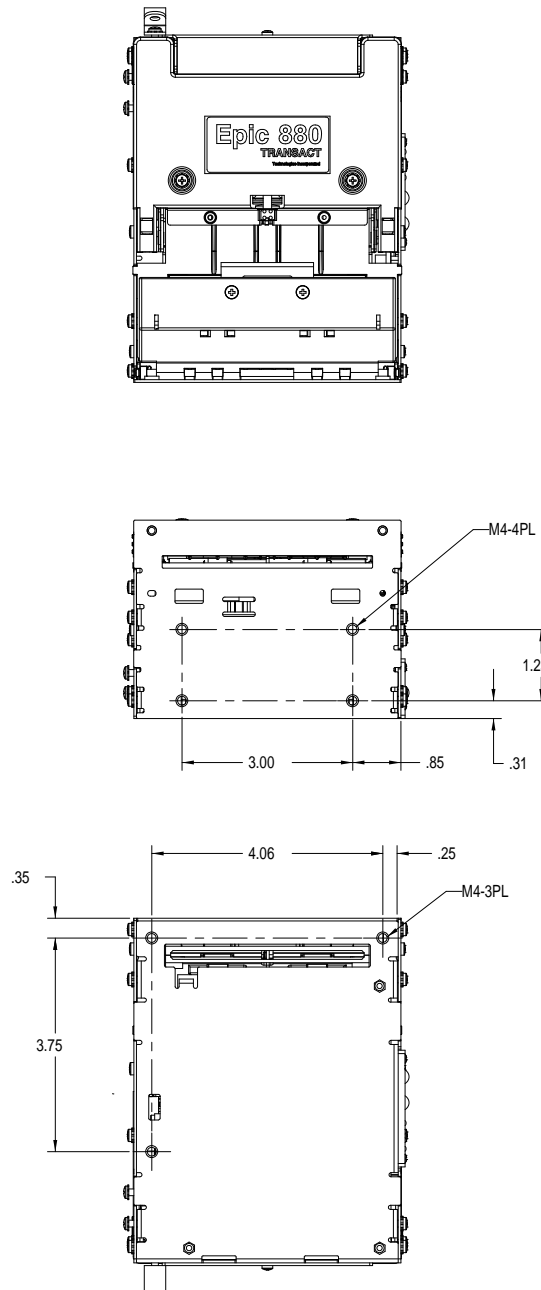


Figure 9. Epic 880™ Mounting Locations

Bezel Mounting Specifications

Bezel to Printer Mechanism mounting points

Epic 880™ printers are designed to accommodate a bezel assembly that is mounted following the hardware and mounting dimensions as listed. The following drawing shows the positioning and dimensions of the Epic 880™ bezel's mounting points.

Front: 2x M3x 0.5 screws and interface with custom bezel.

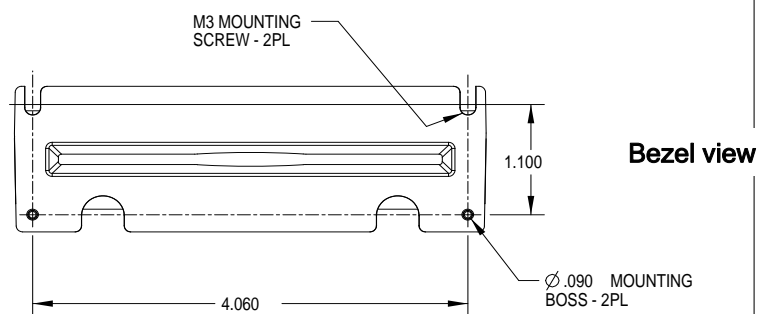


Figure 10. Bezel Mounting and Hardware Requirements

Spindle Mounting Options

The Epic 880™ spindle assembly can be mounted in one of five locations on the left side of the printer or one of four locations on the control panel side.

The following figures show typical mounting locations and cable dressing options.

45° Up Spindle Mounting

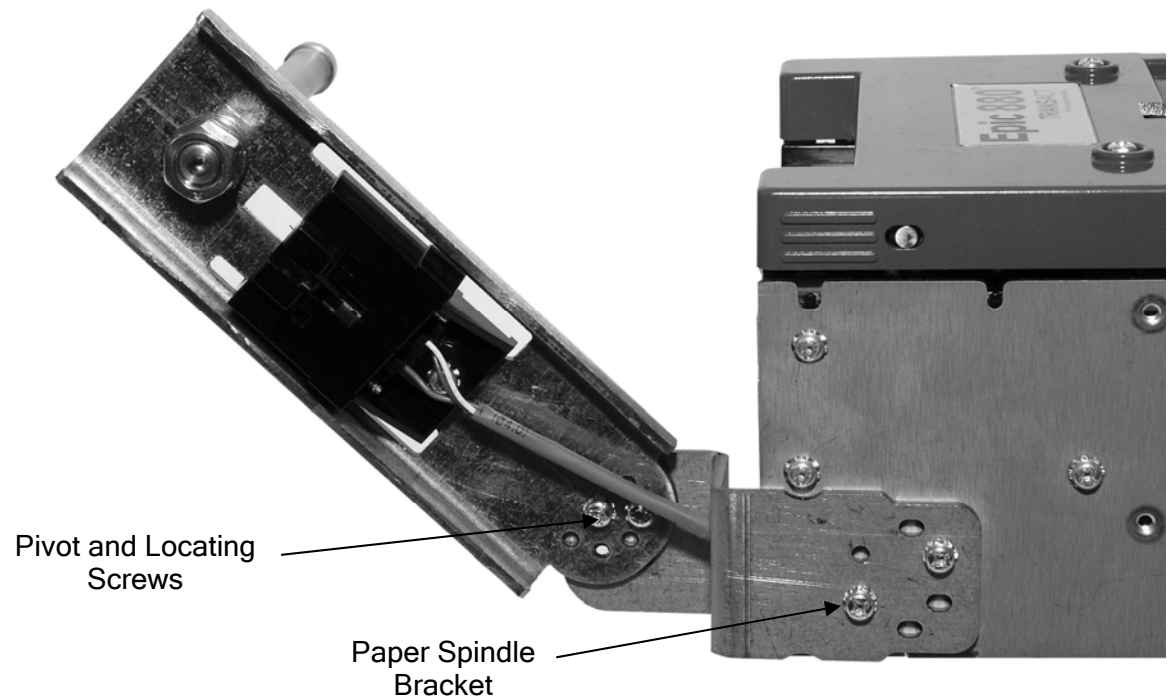


Figure 11. 45° Up Spindle Location

Figure 11 shows the 45° Up spindle position with the arm at a 45° angle up. Note the location of the pivot and mounting screws.

Straight Back Spindle Mounting

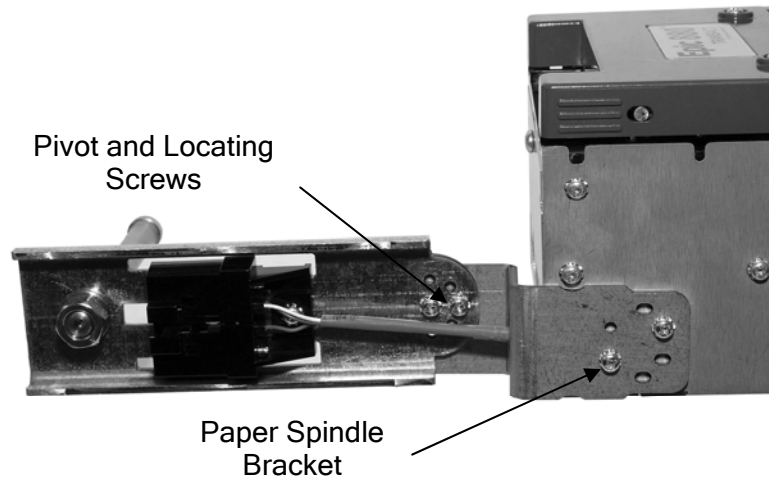


Figure 12. Straight Back Spindle Location

Figure 12 shows the straight back spindle position. Note the location of the pivot and mounting screws.

45°Down Spindle Mounting

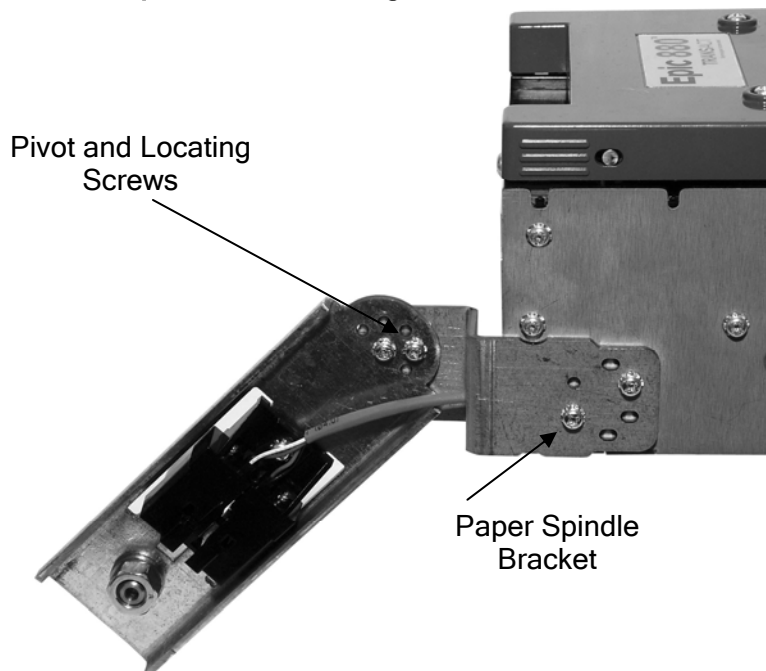


Figure 13. Angle Down Spindle Location

Figure 13 shows the angle down spindle position with the arm at a 45° angle down. Note the location of the pivot and mounting screws.

Straight Down Center Spindle Mounting

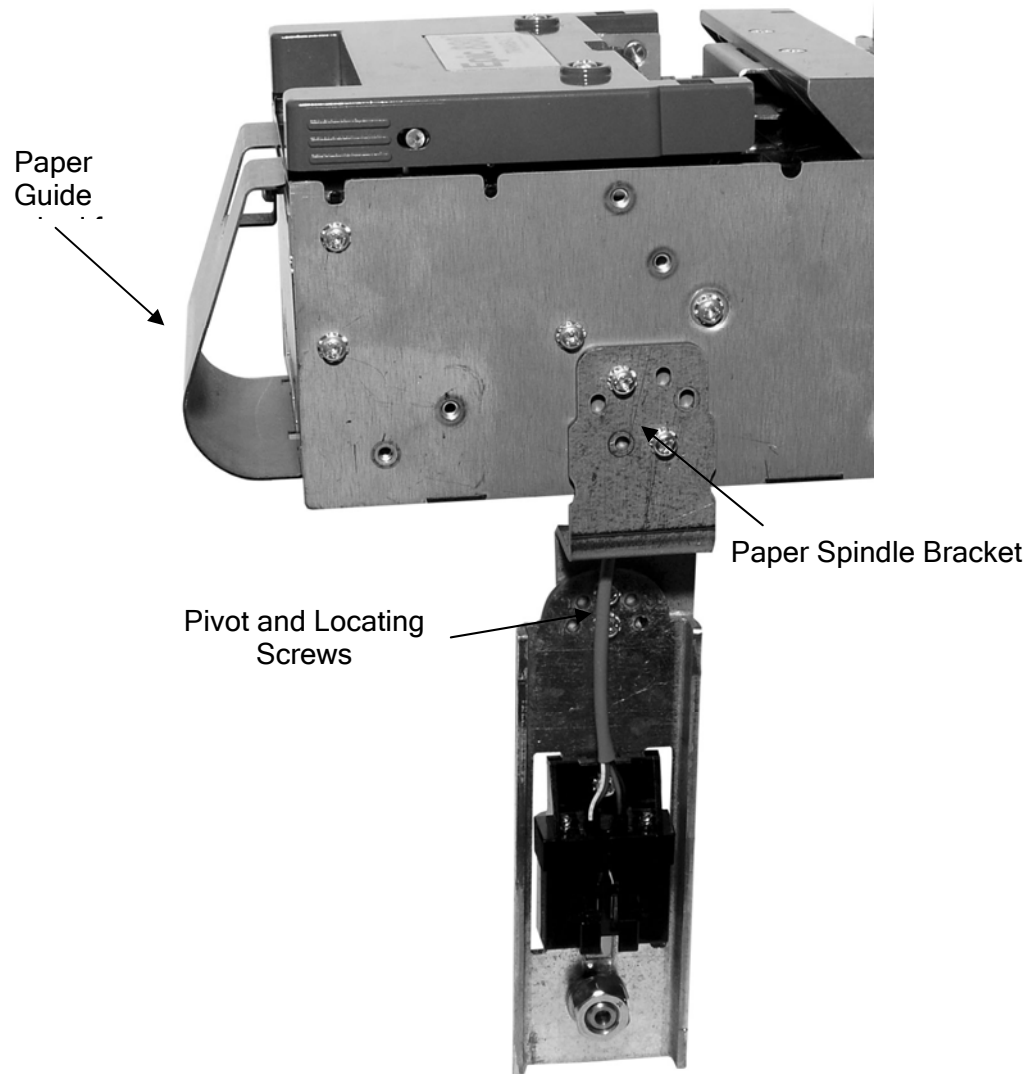


Figure 14. Straight Down Center Spindle Location

Figure 14 shows the straight down center spindle position with the arm at a 90° angle down. Note the location of the pivot and mounting screws. This location requires that the paper guide be mounted to the printer to assure that the cabling does not interfere with the paper path.

Note: The printer is larger with the paper guide installed.

Straight Down Rear Spindle Mounting

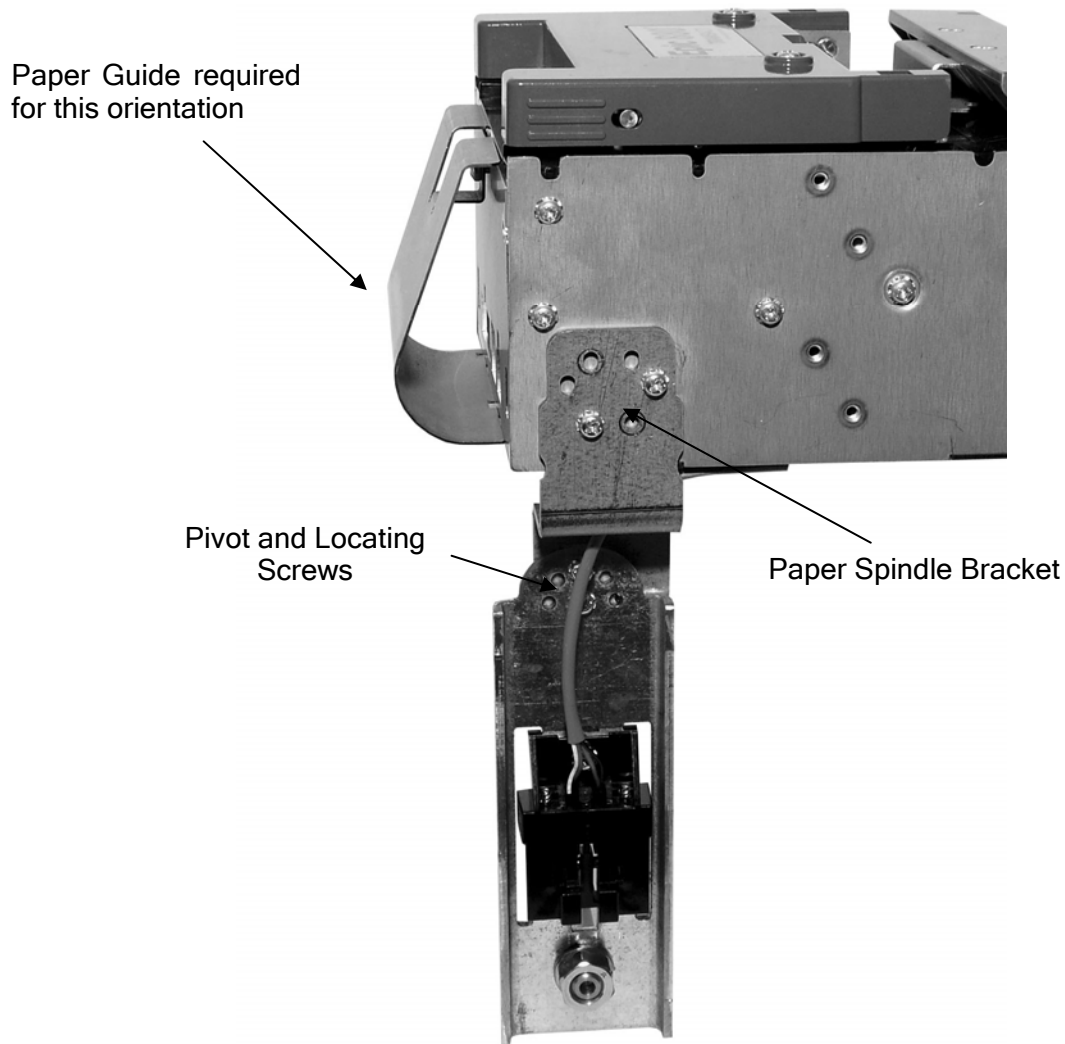


Figure 15. Straight Down Rear Spindle Location

Figure 15 shows the straight down rear spindle position with the arm at a 90° angle down. Note the location of the pivot and mounting screws. This location requires that the paper guide be mounted to the printer to assure that the cabling does not interfere with the paper path.

Note: The printer is larger with the paper guide installed.

Control Panel Side Spindle Mounting

All five positions can be duplicated on the control panel side of the printer with the exception of the straight down center location shown in Figure 14 as the control panel occupies that location.

Retract Opening

When mounting the Epic 800™ printer, clearance must be allowed for a ticket retract opening located on the underside of the front of the unit as shown.

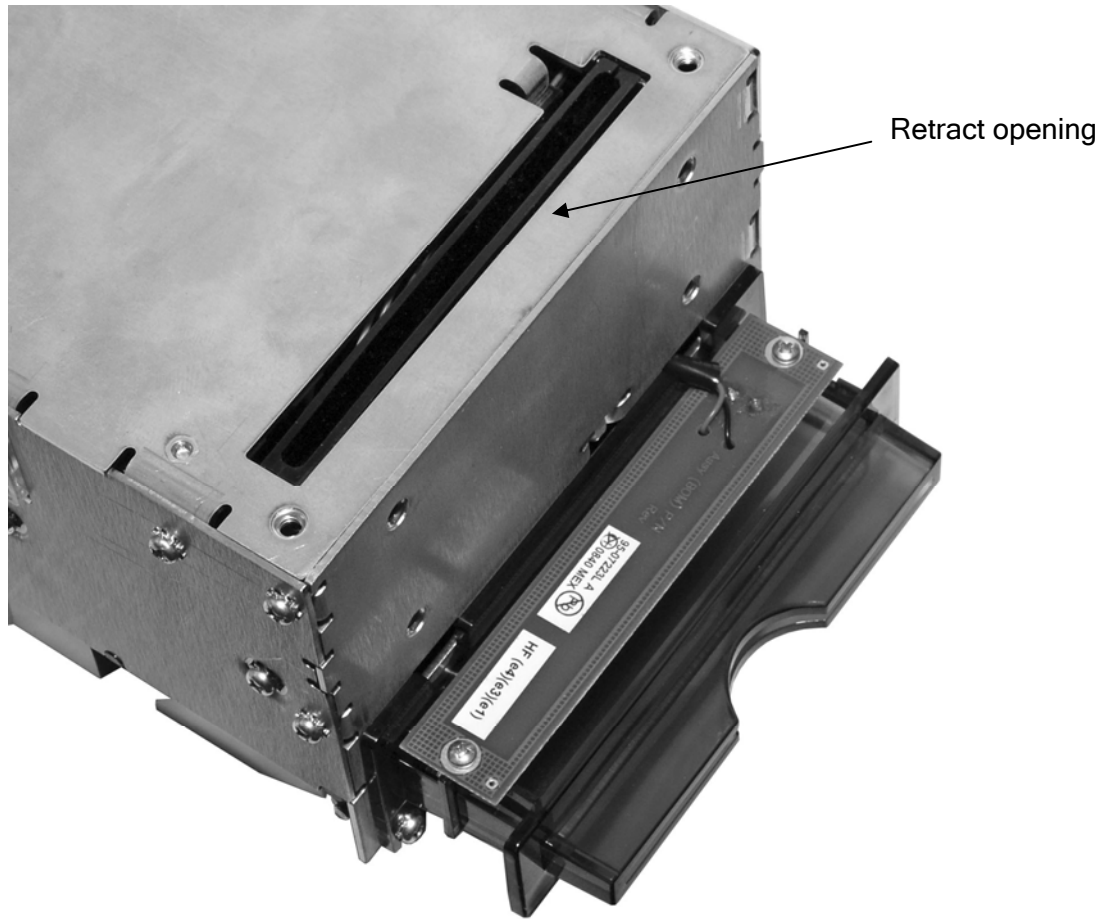


Figure 16. Retract Opening.

The dimensions of this opening are as shown in Figure 17.

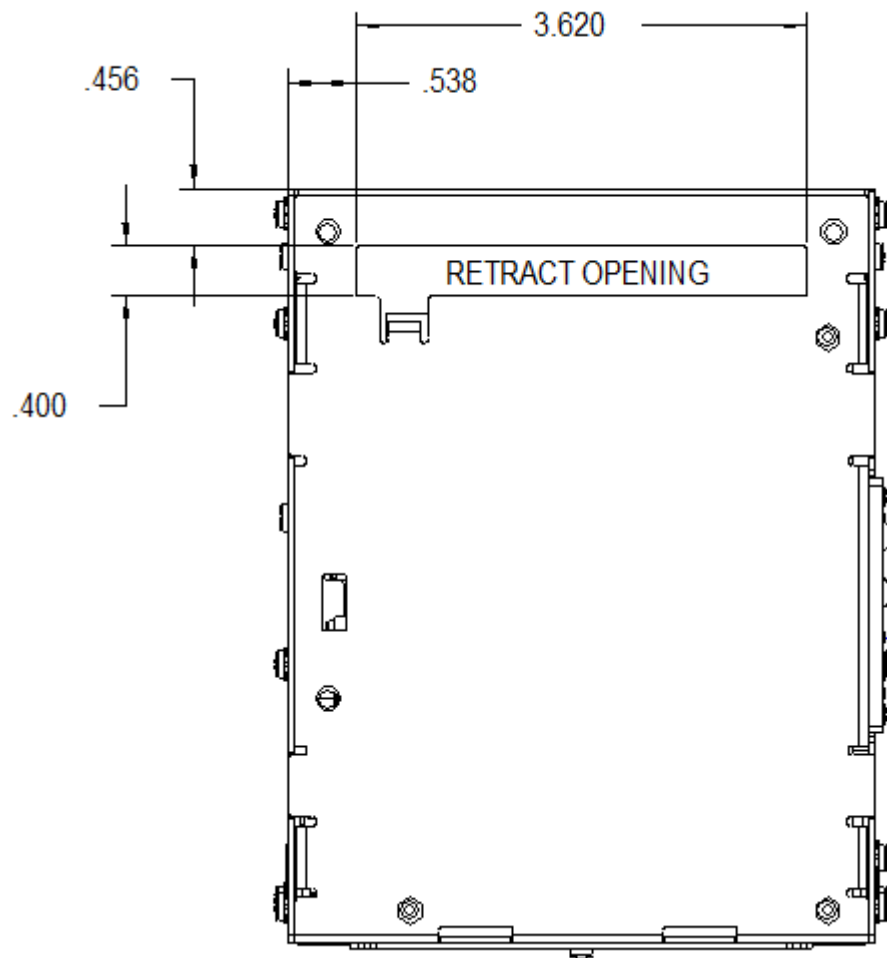


Figure 17. Dimensions for Retract Opening.

Chapter 6

Printer Sensors

This page intentionally left blank

Printer Sensors

The Epic 880™ printer uses several sensors to provide feedback to the host system, as pictured in the figures below.

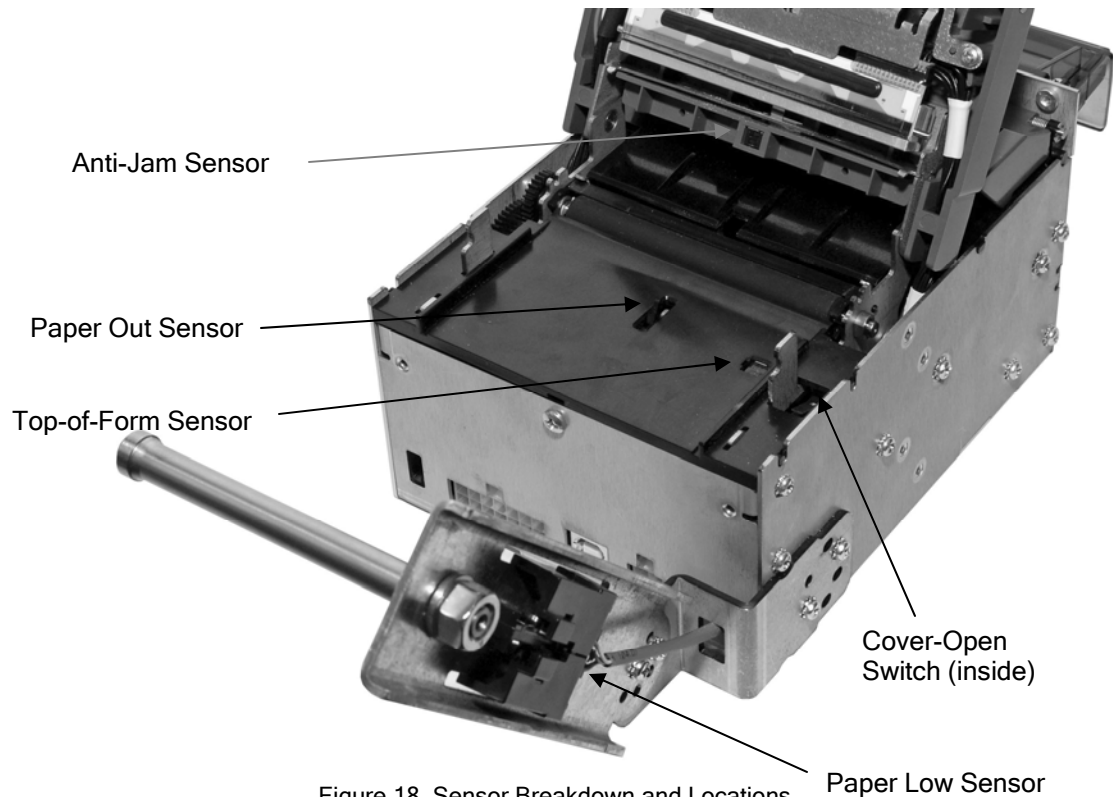


Figure 18. Sensor Breakdown and Locations.

Paper Out Sensor

A Paper Out Sensor, mounted to the Lower Paper Guide, optically senses a Paper Out flag located in the ticket path. When the sensor detects the flag, it indicates that the ticket roll is depleted.

Cover-Open Switch

A Cover-Open Switch, mounted to the inner left side plate, is activated when the Top Cover is closed and the latch depresses the switch arm. When the Top Cover is opened, the Cover Open switch trips, and the printer goes off-line.

Top-of-Form Sensor

A Top-of-Form Sensor is mounted in the paper path, and senses a pre-printed black dot (if present) on the ticket stock. This black mark is used to position the paper for printing on a preprinted form. Typically the ticket is pre-positioned to the Top-of-Form and when the ticket is complete, the paper is fed to the Top-of-Form and then cut.

Paper Low Sensor

The Epic 880™ has a Paper Low Sensor. This sensor is mounted to the paper spindle and will provide an indication that the paper is getting low. The length of paper remaining when paper low is sensed is dependent on the paper roll core diameter.

Anti-Jam Sensor

An Anti-Jam Sensor is mounted to the knife frame, and senses the presence of a ticket immediately before and after a knife cut. Under normal conditions, right after a knife cut, a ticket is fed into the transport and presented to the customer. If a ticket is not fed properly into the transport (for example, when a ticket jams) the Anti-Jam Sensor detects the jammed ticket and stops printer operation.

Transport Ticket Taken Sensor

A Ticket Taken Sensor, mounted in the Ticket Transport, is used to detect the lead edge of the ticket as well as determine when customers have actually taken the printed ticket.

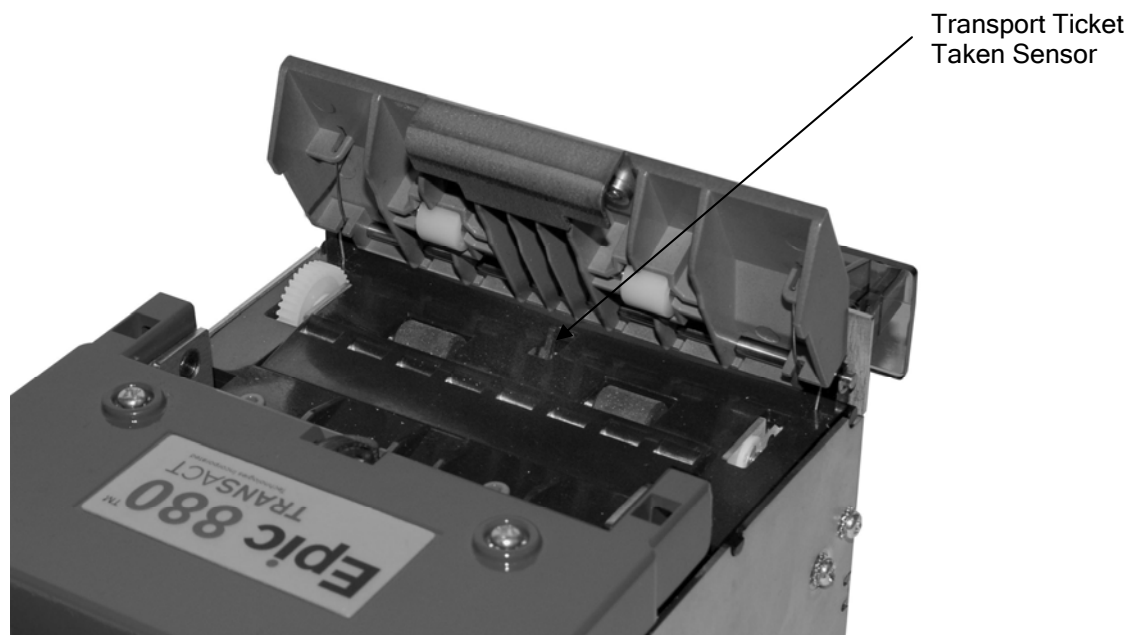


Figure 19. Transport Ticket Taken Sensor.

Transport Ticket Retract Sensor

The Ticket Retract Sensor, mounted in the Ticket Transport retract path, is used to detect the presence of the ticket in the retract path. Under normal operation, the retract path should be clear after the retract.

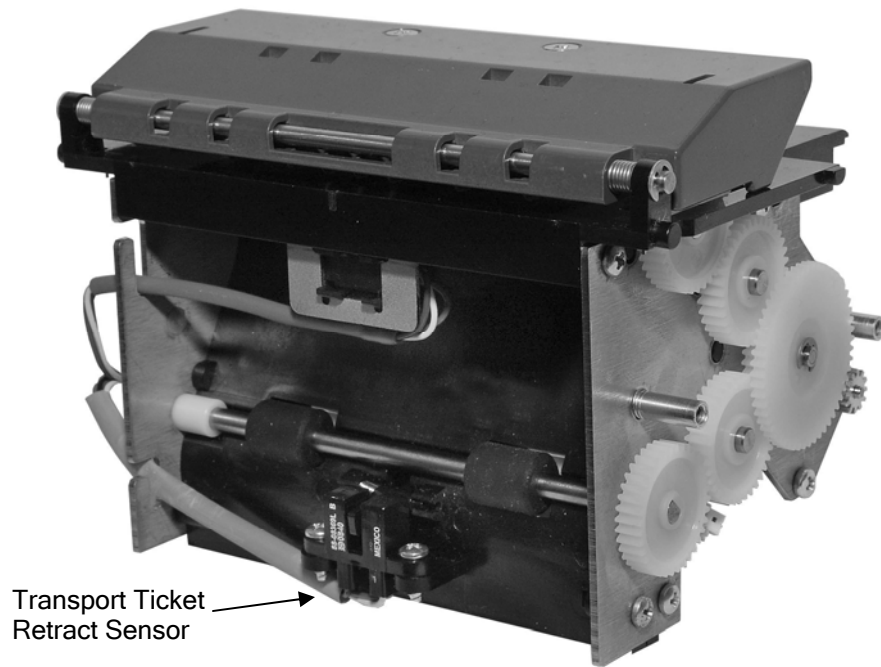


Figure 20. Transport Ticket Retract Sensor.

Chapter 7

Electrical Connections

This page intentionally left blank

Communications Interface

USB and RS-232 communications are supplied through interface connections at the rear of the printer, as illustrated in the figure. The Serial RS-232 interface connector is a locking Molex connector and the USB interface is a standard USB B connector. Power is supplied through a locking 4-pin Molex connector as shown.

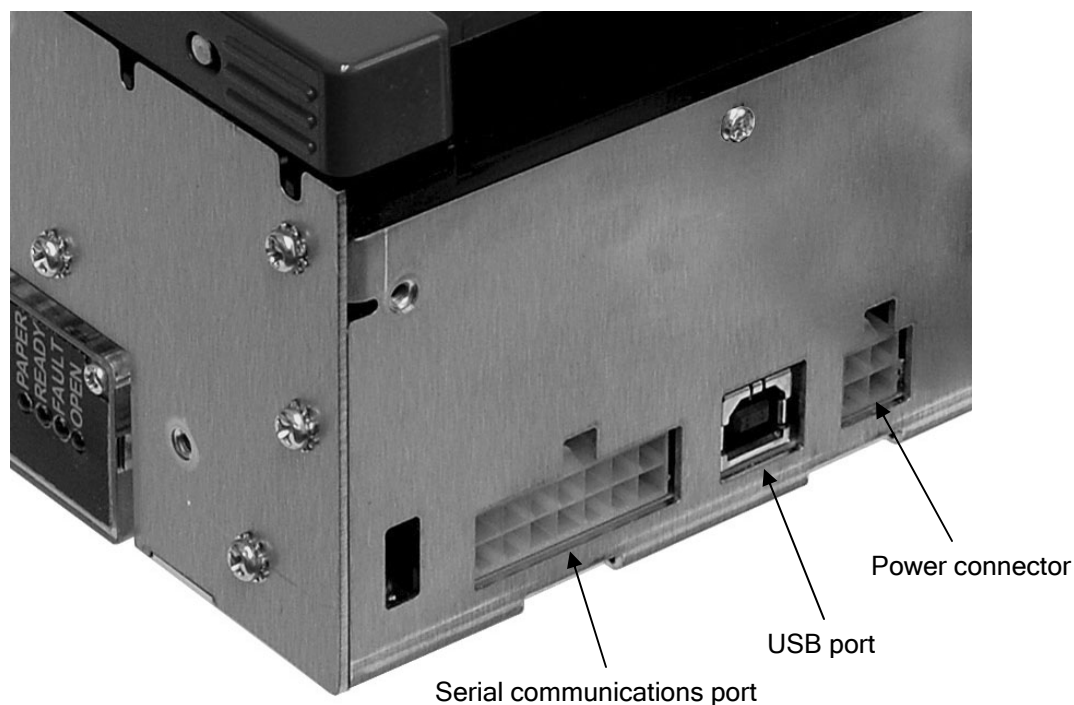


Figure 21. Communication PCB Location and Connector Info.

Note: Pin-out configurations for these interfaces are documented in Chapter 2, Epic 880™ Specifications and Requirements.

Cable connection locations

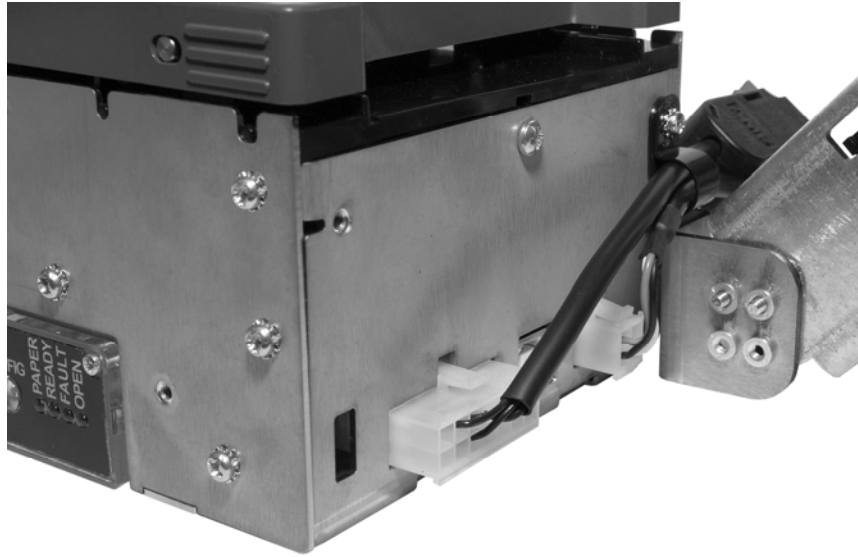


Figure 22 Power and RS232 Left hand Exit

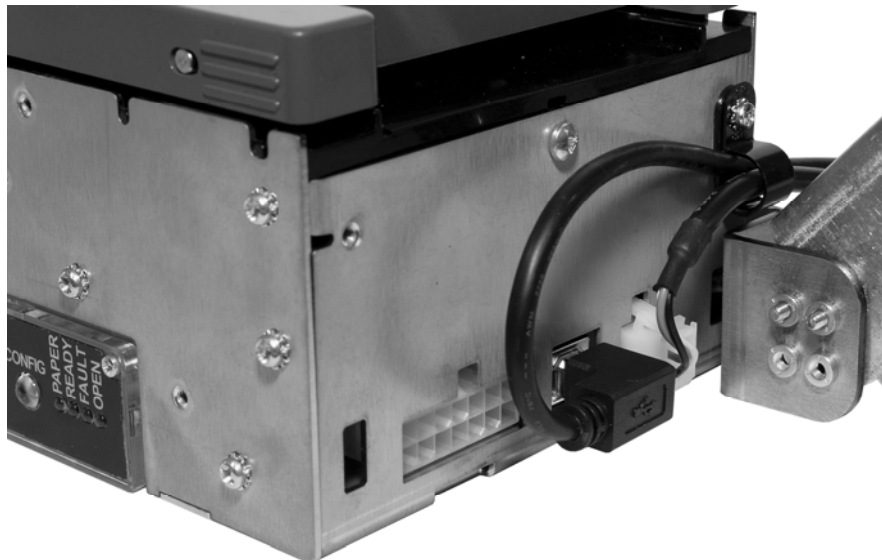
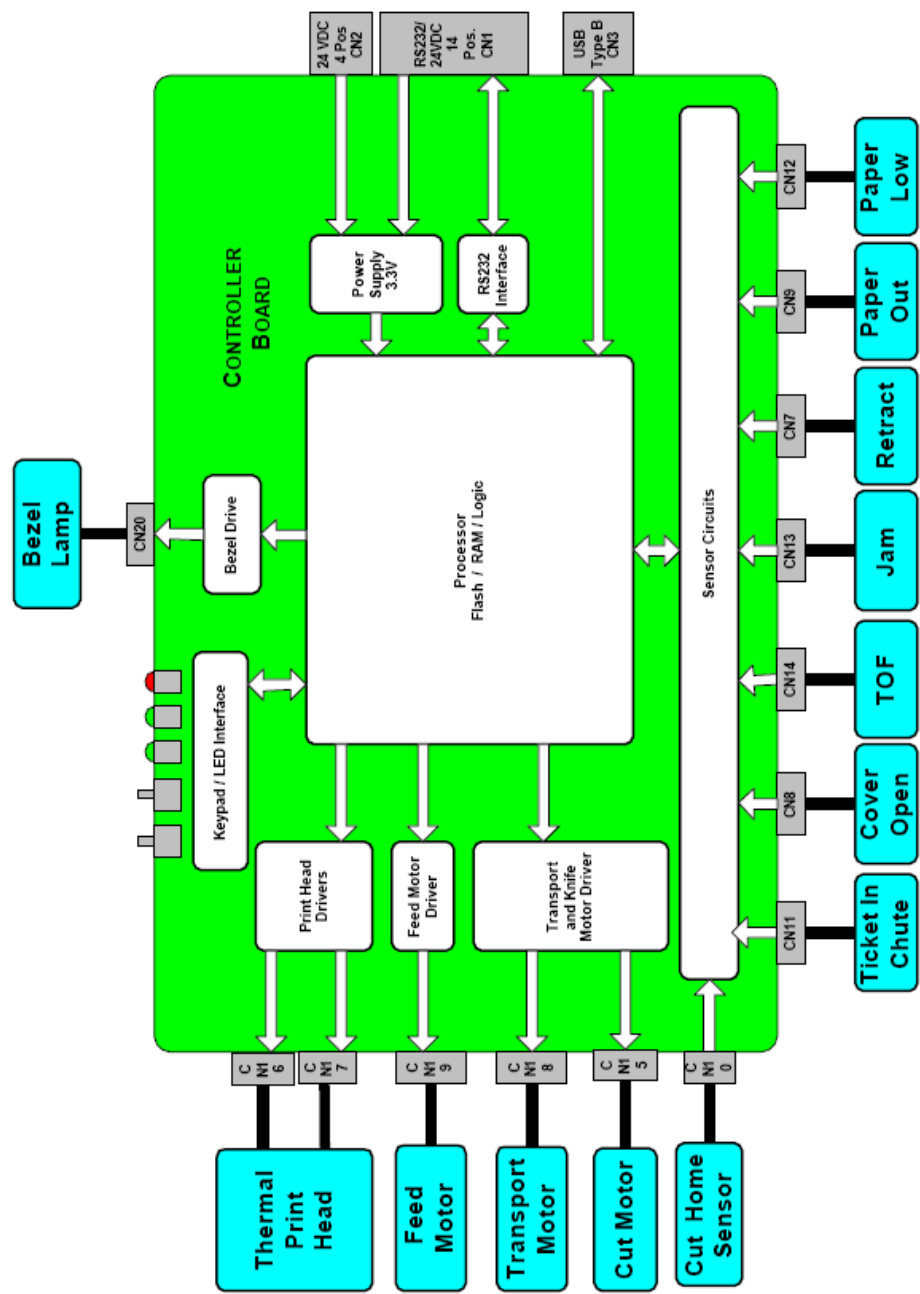


Figure 23 Power and USB Left hand Exit

Note that the Power and communications cables can also be routed to the right. The unused mounting location in the upper right corner should be used to restrain the cables in a similar fashion as the left exit.

Printer Block Diagram



Chapter 8

Control Codes

This page intentionally left blank

Control Codes Overview

This OEM Integration Manual is designed to help users of the Epic 880™ printer develop applications. Because Epic 880™ printers are specialized point-of-sale printers with several features not normally found on general-purpose printers, they have unique control codes that are documented in this manual.

Nomenclature

When describing control codes, confusion often occurs as to whether the description is decimal, hexadecimal, or ASCII. To minimize the problem, this OEM Integration Manual uses the following nomenclature when describing control code sequences.

- [] Encloses a control character. [] represents a single, 8-bit value as defined in the standard ASCII tables. The ASCII Code Table in Appendix B lists the control codes. An example would be [ESC], which would represent a 1BH or 27 decimal.

- < > Encloses an 8-bit value in decimal format. The value is from zero to 255. An example is <2>, which represents 02H or 2 decimal.

- <n> Indicates a variable parameter. The variable parameter, <n>, can have a value from zero to 255. The meaning of <n> is described and defined in the description of the command.

- <n₁> <n₂> Indicates that there are two parameters, <n₁> and <n₂>, where both can have values from zero to 255.

- <m₁> <m₂> Is an TransAct® Printer Control Language (IPCL) parameter consisting of two digits where <m₁> and <m₂> are ASCII characters from zero to nine. The parameter is combined to form a value from zero to 99. If <m₃> is included, the parameter is combined to be from zero to 999. If two values are specified, there must be two bytes added to the IPCL code. That is, if the command specifies <m₁> <m₂> and the desired value is five, it must be specified as 05.

- X All other characters in control strings represent ASCII characters. For example, [ESC] 1 represents 1BH followed by 31H.

In many cases, applications require that control sequences be specified in hexadecimal or decimal codes. In most cases, commands are specified in ASCII, hexadecimal, and decimal. The **ASCII Code Table** in Appendix D lists ASCII, hexadecimal, and decimal equivalents.

Standard Emulation

The standard control codes for the Epic 880™ Printer are extensions and subsets of the PcOS emulation provided on other TransAct® products.

The Epic 880™ printer also supports an emulation of the Epson ESC/POS control language, as well as a Custom VKP80 emulation capability. For details about these emulations, contact TransAct Technical Support.

IPCL Codes

TransAct® Printer Control Language (IPCL) codes are part of PcOS and designed to control a printer without using control characters (i.e. characters less than 20H). Only the standard PcOS emulation supports IPCL.

In rare cases, an IPCL code will interfere with the text that is to be printed. The IPCL translator can be disabled with an [ESC] y <4> command.

Other Emulations

The Epic 880™ Printer supports a basic Epson emulation.

Note: Specific EPSON compatibility features, such as its Automated Status Back (ASB) feature, are available as an option from TransAct Technologies. Command codes pertaining to these features are documented as “licensed” within the command description.

It is intended that the standard TransAct® PcOS emulation be used for new applications. Not all features of Epic 880™ Printers are supported by other emulations.

Application Development

To aid application development, several chapters in this manual are designed to help the programmer understand the Epic 880™ Printer. The next chapter provides a detailed description of each of the commands. Subsequent chapters provide explanations of how the printer works, including a description of the internal print buffer, communications link, and interaction between the host computer and printer.

TransAct Control Codes and Commands

Throughout this OEM Integration Manual, charts and tables list commands and features. In most cases, the charts cross-reference the page that describes the command. Code summary charts, arranged by code and function, are provided to help quickly find commands.

PcOS Printer Control Codes

The following section defines the Epic 880™ TransAct® PcOS emulation. The native, TransAct® PcOS emulation provides the most flexibility and control over the printer. It is consistent with most previous TransAct® PcOS products, and should be used when the printer is placed in a new application. Alternatively, an emulation is offered for the Epson ESC/POS language, as well as a customer emulation; contact TransAct Technical Support for further information on these options.

TransAct does not recommend that you generate drivers for emulations other than PcOS. In addition, TransAct has created several tools that can be used to generate and maintain graphic images and files for print on the Epic 880™. Information about drivers and tools are available on the TransAct web site and on a *TransAct® Software Developer's Toolkit*. For more information about either of these options, contact TransAct Technical Support.

Quick PcOS Reference Chart

| Description | ASCII | Hex | IPCL equivalent code | Page |
|--|--|-------------|---|------|
| Low Level paper Motion | | | | |
| Line feed. | [LF] | 0AH | &%LF | 76 |
| Carriage return. | [CR] | 0DH | &%CR | 76 |
| Horizontal Motion | | | | |
| Back space. | [BS] | 08H | &%BS | 77 |
| Horizontal tab. | [HT] | 09H | &%HT | 77 |
| Set horizontal tab stops. | [ESC] D <n ₁ > <n ₂ > ... <n _i > <0> | 1BH 44H | none | 77 |
| Set horizontal position. | [ESC] n <n ₁ > <n ₂ > | 1BH 6EH | &%HP<m ₁ > <m ₂ > <m ₃ > | 78 |
| Set justification. n=0 Left n=1 Center n=2 Right n=8 Left (No line feed) n=9 Center (No line feed) n=10 Right (No line feed) | [ESC] a <n> | 1BH 61H | &%JR {n=2} &%JC {n=1} &%JL {n=0} | 78 |
| Reset horizontal and vertical tab stops. | [ESC] R | 1BH 52H | &%HV | 78 |
| Set left/right print margins. n ₁ = Left margin, n ₂ = Right margin | [ESC] X <n ₁ ><n ₂ > | 1BH 58H | none | 154 |
| Select minimum character height and width in points | [ESC] + P<w><h> | 1BH 50H | none | 215 |
| Select minimum character height and width in ¼ points | [ESC] + p<w><h> | 1BH 70H | none | 216 |
| Vertical Motion | | | | |
| Perform a fine line feed. | [ESC] J <n> | 1BH 4AH | &%FM <m ₁ > <m ₂ > <m ₃ > | 79 |
| Set 1/8-inch line spacing. | [ESC] 0 | 1BH 30H | &%ST | 79 |
| Set 7/72-inch line spacing. | [ESC] 1 | 1BH 31H | &%SG | 80 |
| Begin variable line spacing. (Enable [ESC] A <n>). | [ESC] 2 | 1BH 32H | none | 80 |
| Set variable line spacing to n/216 inch. | [ESC] 3 <n> | 1BH 33H | &%SV <m ₁ > <m ₂ > <m ₃ > | 79 |
| Set variable line spacing to n/72 inch. | [ESC] A <n> | 1BH 41H | none | 80 |
| Set Line spacing in points | [ESC]+V<n> | 1BH 2BH 56H | None | 215 |
| Set Line spacing in ¼ points | [ESC]+v<n> | 1BH 2BH 76H | None | 216 |
| Select minimum character height and width in points | [ESC] + P<w><h> | 1BH 50H | none | 215 |
| Select minimum character height and width in ¼ points | [ESC] + p<w><h> | 1BH 70H | none | 216 |
| Feed <n> lines at current spacing. | [ESC] d <n> | 1BH 64H | &%FL <m ₁ > <m ₂ > | 82 |
| Set vertical tab stops. | [ESC] B <n ₁ > <n ₂ > <n ₃ >...<n _i > 0 | 1BH 42H | none | 83 |
| Vertical tab. | [VT] | 0BH | &%VT | 82 |
| Form feed. | [FF] | 0CH | &%FF | 83 |
| Feed to black dot | [ESC][VT] | 1BH 0BH | None | 86 |

| Description | ASCII | Hex | IPCL equivalent code | Page |
|--|--|-------------|--|------|
| Set top of form. | [ESC] 4 | 1BH 34H | &%TF | 84 |
| Set form length in lines. | [ESC] C <n> | 1BH 43H | &%SL <m ₁ > <m ₂ > | 84 |
| Begin auto line feed. (n=0, end n=1) | [ESC] 5 <n> | 1BH 35H | &%CA {n=0} &%MA {n=1} | 85 |
| Set form length in inches. | [ESC] C [NUL] <n> | 1BH 43H | &%SI <m ₁ > <m ₂ > | 84 |
| Transport Control | | | | |
| Set Transport Mode | [ESC]i<f><v> | 1BH 69H | None | 152 |
| Feed Transport | [ESC]j<n> | 1BH 6AH | None | 152 |
| Deliver ticket from transport | [ESC]k | 1BH 6BH | None | 152 |
| Transport ticket retract | [ESC]m | 1BH 6DH | None | 153 |
| Character Pitch | | | | |
| Set character spacing in points | [ESC]+l<n> | 1BH 2BH 49H | None | 213 |
| Set character spacing in ¼ points | [ESC]+i<n> | 1BH 2BH 69H | None | 214 |
| Set character spacing in points with adjustment | [ESC]+J<n> | 1BH 2BH 4AH | None | 214 |
| Set character spacing in ¼ points with adjustment | [ESC]+j<n> | 1BH 2BH 6AH | None | 215 |
| Begin 10 CPI character pitch. | [DC2] | 12H | &%F3 | 90 |
| Begin 12 CPI character pitch. | [ESC] : | 1BH 3AH | &%F2 | 90 |
| Begin 17 CPI character pitch. | [SI] | 0FH | &%F1 | 90 |
| Set character pitch. | [ESC] [P <n> | 1BH 5BH 50H | &%F<n> | 91 |
| Set inter-character spacing. | [ESC] V <n> | 1BH 56H | none | 92 |
| Begin 24 CPI character pitch | [ESC][SI] | 1BH 0FH | &%F4 | 90 |
| Select Minimum character Height and Width in points | [ESC] + P<w><h> | 1BH 50H | none | 215 |
| Select Minimum character Height and Width in ¼ points | [ESC] + p<w><h> | 1BH 70H | none | 216 |
| Character Font | | | | |
| Select font | [ESC] + 3 <ID> | 1BH 2BH 31H | none | 206 |
| Select font by name | [ESC] + N Filename<0> | 1BH 2BH 4EH | none | 206 |
| Define Stacked Font | [ESC] + S <ID ₁ > <ID ₂ > ... | 1BH 2BH 53H | none | 206 |
| Set stroke font Brush Size | [ESC] + B <w> | 1BH 2BH 42H | none | 216 |
| Select Minimum character Height and Width in points | [ESC] + P<w><h> | 1BH 50H | none | 215 |
| Select Minimum character Height and Width in ¼ points | [ESC] + p<w><h> | 1BH 70H | none | 216 |
| Begin 12 x 12 draft print. | [ESC] # <0> | 1BH 23H 00H | &%QT | 93 |
| Set print size (legacy mode). n=0 Draft (12 x 12) n=1 Large draft (12 x 14) n=2 NLQ (24 x 16) n=3 NLQ (24 x 16) n=4-7 Repeats 0-3 | [ESC] I <n> | 1BH 49H | &%QT {n=0} &%QU {n=1} &%QL {n=2} &%QS {n=3} | 93 |
| Select character code page. ASCII Mode only. | [ESC] [T <n ₁ > <n ₁ > | 1BH 5BH 54H | &%CP <m ₁ > <m ₂ > <m ₃ > <m ₄ > | 97 |
| Select Codepage by name. ASCII Mode only | [ESC] + C | 1BH 2BH 43H | None | 98 |

| Description | ASCII | Hex | IPCL equivalent code | Page |
|---|---|-----------------|--|------|
| Insert Euro character. | [ESC] [C <n> | 1BH,5BH, 43H | &%EU | 98 |
| Print control character. | [ESC] ^ <n> | 1BH,5EH | &%CC <m ₁ > <m ₂ > <m ₃ > | 98 |
| Print Unicode character | [ESC] “ <n _L ><n _H > | 1BH,22H | &%PU <m ₁ > <m ₂ > <m ₃ > <m ₄ > <m ₄ > | 98 |
| Character Attributes | | | | |
| Select color. | [ESC] c <n> | 1BH,63H | &%CL <m ₁ > | 100 |
| Begin one-line double-wide print. | [SO] | 0EH | &%MW | 100 |
| Cancel one-line double-wide print. | [DC4] | 14H | &%MN | 100 |
| Multi-line double-wide double-high mode. n=0 Standard mode n=1 Double-wide n=2 Double-high 3 = Both | [ESC] W <n> | 1BH,57H | &%FS {n=0} &%FD {n=1} &%FH {n=3} | 101 |
| Enable/disable Strike through. n=0 End n=1 Begin | [ESC] _ <n> | 1BH,5FH | &%CO {n=0} &%MO {n=1} | 101 |
| Begin underline mode. n = 0 End n = 1 Begin | [ESC] - <n> | 1BH,2DH | &%CU {n=0} &%MU {n=1} | 103 |
| Begin enhanced print. | [ESC] G | 1BH,47H | &%ME | 103 |
| End enhanced print. | [ESC] H | 1BH,48H | &%CE | 103 |
| Begin emphasized print. | [ESC] E | 1BH,45H | &%MM | 104 |
| End emphasized print. | [ESC] F | 1BH,46H | &%CM | 104 |
| Set print style. (See command description.) | [ESC] [@ ... | 1BH,5BH, 40H... | &%DH &%SH | 102 |
| Select superscript. | [ESC] S <0> | 1BH,53H, 00H | &%SP | 104 |
| Select subscript. | [ESC] S <1> | 1BH,53H, 01H | &%SB | 104 |
| End superscript or subscript. | [ESC] T | 1BH,54H | &%SE | 105 |
| Begin italics. | [ESC] % G | 1BH,25H, 47H | &%MI | 105 |
| End italics. | [ESC] % H | 1BH,25H, 48H | &%CI | 105 |
| Page Mode | | | | |
| Select page mode | [ESC] t <n> | 1BH,74H | &%PM | 107 |
| Set page mode page size | [ESC] u <n ₁ > ... | 1BH,75H | &%PS | 112 |
| Set page mode page position | [ESC] o <n ₁ > ... | 1BH,6FH | none | 114 |
| Set Page Mode Size Enhanced | [ESC][SUB]S | 1BH, 1AH 53H | none | 109 |
| Set Page Mode Printed Area | [ESC][SUB]W | 1BH, 1AH 57H | none | 111 |
| Set Page Position Enhanced | [ESC][SUB]A | 1BH, 1AH 41H | &%PY | 114 |
| Set Page Position Relative | [ESC][SUB]R | 1BH, 1AH 41H | none | 114 |
| Exit page mode | [FF] | 0CH | &%FF | 114 |
| APA Graphics | | | | |
| Print single-density graphics. <n ₁ >=0...255 <n ₂ >=0...3 len=<n ₁ > + 256 * <n ₂ > | [ESC] K <n ₁ > <n ₂ > | 1BH,4BH | none | 115 |
| Print half-speed double-density graphics. | [ESC] L <n ₁ > <n ₂ > | 1BH,4CH | none | 115 |
| Print full-speed double-density graphics. | [ESC] Y <n ₁ > <n ₂ > | 1BH,59H | none | 116 |
| Print quad-density graphics. | [ESC] Z <n ₁ > <n ₂ > | 1BH,5AH | none | 116 |

| Description | ASCII | Hex | IPCL equivalent code | Page |
|---|--|---------------------|--------------------------|------|
| Select bidirectional or unidirectional print. n=0 Bidirectional n=1 Unidirectional | [ESC] U <n> | 1BH,55H | &%GU {n=1} &%GB {n=0} | 117 |
| Print graphics in mode <m>. | [ESC] * <m> <n ₁ > <n ₂ > | 1BH,2AH | none | 116 |
| Reassign graphic mode. | [ESC] ? <m><n> | 1BH,3FH | none | 116 |
| Horizontal Graphics | | | | |
| Process horizontal graphics data. | [ESC] h <color> <length> <format> <data> | 1BH,68H | none | 118 |
| Set horizontal graphic mode. | [ESC] * <m> <0> <0> | 1BH,2AH | none | 119 |
| Bitmap Graphic File Support | | | | |
| Print Bitmap graphics from file. | [ESC] [FS] P <s> FileName<0> | 1BH,1CH, 50H | none | 189 |
| Print Bitmap graphics from bitmap data | [ESC] [FS] p <BitmapFileData> | 1BH,1CH, 50H | none | 189 |
| User Store | | | | |
| Begin named macro record. | [ESC] [US] b <Name..> <0> | 1BH,1FH, 62H | &%UB <Name..><0> | 125 |
| Save macro data in user store. | [ESC] [US] m <Name..> <0> | 1BH,1FH, 6DH | &%UM <Name..><0> | 125 |
| End named macro record. | [ESC] [US] e <Name..> <0> | 1BH,1FH, 65H | &%UG <Name..><0> | 125 |
| Load item from user store. | [ESC] [US] l <Name..> <0> | 1BH,1FH, 6CH | &%UL <Name..><0> | 126 |
| Run macro data from user store. | [ESC] [US] r <Name..> <0> | 1BH,1FH, 72H | &%UR <Name..><0> | 126 |
| Flag item as a start-up macro. | [ESC] [US] s <Name..> <0> | 1BH,1FH, 6DH | &%US <Name..><0> | 126 |
| Delete item from user store. | [ESC] [US] d <Name..> <0> | 1BH,1FH, 64H | &%UD <Name..><0> | 127 |
| Flush information from user store. | [ESC] [US] f ALL <0> | 1BH,1FH, 66H,00H | &%UF | 127 |
| Report on user store. | [ESC] [US] q <Name..> <0> | 1BH,1FH, 72H | &%UQ <Name..><0> | 127 |
| Return a report on user store | [ESC] [US] ? <Name..> <0> | 1BH,1FH, 72H | &%UQ <Name..><0> | 127 |
| Process user macro. | [ESC] g <0> | 1BH,67H, 00H | &%GP | 129 |
| Start macro record. | [ESC] g <1> | 1BH,67H, 01H | &%GS | 129 |
| Stop macro record. | [ESC] g <2> | 1BH,67H, 02H | &%GE | 129 |
| Stop macro record and save | [ESC] g <3> | 1BH, 67H, 03H | &%GW | 129 |

| | | | | |
|---|--|--------------|--|-----|
| Bar Codes | | | | |
| Print bar code. n=0 Interleave 2 of 5 n=1 Code 39 n=2 Code 128 n=3 UPC A n=4 EAN-13 n=5 UPC E n=6 EAN-8 n= 7 Code 93 n = 8 Codabar | [ESC] b <n> ... [ETX] | 1BH,62H | &%25 {n=0} &%39 {n=1} &%12 {n=2} &%UP {n=3} &%EA {n=4} &%UE {n=5} &%E8 {n=6} &%93 {n=7} | 131 |
| PDF 417 bar code control | [ESC] [EM] E <f> <v> | 1BH 19H 45H | none | 138 |
| Set bar code height. n=0 Restore defaults n=1 - 9 Number of passes (0.11 inch per pass) | [ESC] [EM] B <n> | 1BH,19H, 42H | &%BH <m ₁ ><m ₂ > | 139 |
| Set bar code width | [ESC] [EM] W <n> | 1BH 19H 57H | &%BW <m> | 140 |
| Set bar code justification, HRI print mode, and print direction. | [ESC] [EM] J <n> | 1BH,19H, 4AH | &%BJ<m ₁ > <m ₂ > | 139 |
| Electronic Journal | | | | |
| Electronic journal initialize and set password | [ESC][GS]I <Password> <0> | 1BH 1DH 49H | %&EI | 142 |
| Electronic journal erase the electronic journal | [ESC][GS]E <Password> <0> | 1BH 1DH 45H | &%EC | 142 |
| Print the electronic journal | [ESC][GS]P< S _i > <S _h >< L _i > <L _h > | 1BH 1DH 50H | &%EP | 143 |
| Report the electronic journal | [ESC][GS]R< S _i > < S _h >< L _i > <L _h > | 1BH 1DH 52H | &%EQ | 143 |
| Electronic journal begin entry | ESC I <3> | 1BH 6CH | %&EB | 150 |
| Electronic journal suspend entry | [ESC] <2> | 1BH 6CH | &%ES | 151 |
| Electronic journal resume entry | [ESC] <1> | 1BH 6CH | &%ER | 151 |
| Electronic journal end entry | [ESC] <0> | 1BH 6CH | &%EE | 151 |
| Electronic journal mode begin (journal station) | [ESC]{ | 1BH 7BH | None | 150 |
| Unicode | | | | |
| Initiate Unicode UTF-16BE encoding | [ESC] + H | 1BH 2BH 48H | none | 207 |
| Initiate Unicode UTF-16LE encoding | [ESC] + L | 1BH 2BH 4CH | none | 207 |
| Initiate Unicode UTF-8 encoding (MBCS) | [ESC] + M | 1BH 2BH 4DH | none | 208 |
| Initiate Unicode UTF-8 Text only encoding (MBCS) | [ESC] + T | 1BH 2BH 54H | none | 208 |
| Initiate normal 8-bit ASCII character encoding | [ESC] + A | 1BH 2BH 41H | none | 209 |
| File System Commands | | | | |
| Open File | [ESC][RS] O<Mod> FileName<0> | 1BH 1EH 4FH | none | 221 |
| Return Free Space for Open File | [ESC][RS] S | 1BH 1EH 53H | none | 222 |
| Return Free Space for Partition | [ESC][RS] s | 1BH 1EH 73H | none | 222 |
| Return Last File Command Status | [ESC][RS] ? | 1BH 1EH 3FH | none | 224 |

| | | | | |
|--|---|-----------------------|---|-----|
| Close File | [ESC][RS] C | 1BH 1EH 43H | none | 223 |
| Close All Files | [ESC][RS] K | 1BH 1EH 4BH | none | 223 |
| Open File | [ESC][RS] O FileName<0> | 1BH 1EH 4FH | none | 221 |
| Set/Clear File Attributes | [ESC][RS] A <Atb> FileName<0> | 1BH 1EH 41H | none | 223 |
| Write File Data | [ESC][RS] W <L _L > <L _H > <data> | 1BH 1EH 57H | none | 224 |
| Read File Data | [ESC][RS] R <L _L > <L _H > | 1BH 1EH 52H | none | 225 |
| File Directory File | [ESC][RS] I | 1BH 1EH 49H | none | 225 |
| Delete all Files in partition | [ESC][RS] E <p> | 1BH 1EH 45H | none | 225 |
| De-fragment File system | [ESC][RS] F | 1BH 1EH 46H | none | 225 |
| Verify File System | [ESC][RS] V | 1BH 1EH 56H | none | 226 |
| Miscellaneous Commands | | | | |
| Set left/right margins. N ₁ = Left margin n ₂ = Right margin | [ESC] X <n ₁ ><n ₂ > | 1BH 58H | none | 154 |
| Clear print buffer. | [CAN] | 18H | &%RP | 154 |
| Query marker. | [ESC] q <n> | 1BH 71H | none | 155 |
| Perform Auto Cut | [ESC] v | 1BH 76H | &%FC | 155 |
| Initialize printer. | [ESC] @ | 1BH 40H | none | 155 |
| Inquire status. (Refer to command descriptions.) | [ENQ] <n> | 05H | none | 163 |
| Activate Periodic Status back | [ESC] [EM] P <n> | 1BH 19H 50H | none | 176 |
| Control Periodic Status back | [ESC] [EM] p <n> | 1BH 19H 70H | none | 176 |
| User control of Bezel lamp | [ESC] ~z | 1BH, 7EH, 7AH | &%BF | 157 |
| Extended Diagnostics | | | | |
| Set control feature commands. | [ESC] y <n> | 1BH, 79H | &%Y0 - 9 or &%YX<m1> <m2><m3> (for numbers >9) | 158 |
| Extended diagnostics. | [ESC] ~ <n> | 1BH, 7EH | none | 159 |
| Return Firmware Checksum | [ESC] ~ Z | 1BH, 7EH, 5AH | none | 161 |
| Return Firmware ID | [ESC] ~ F | 1BH, 7EH, 46H | none | 161 |
| Verify File System and Firmware | [ESC][RS] V | 1BH 1EH 56H | none | 226 |
| Enter Remote Down load | [ESC] ~ <14> % | 1BH, 7EH, 0EH, 25H | none | 234 |

Low Level Paper Motion Control

Print/Paper Motion

| | |
|-------------|------------------------|
| [CR] | Carriage return |
|-------------|------------------------|

| | | |
|-------------|------|-----|
| ASCII | [CR] | |
| Hexadecimal | | 0DH |
| Decimal | <13> | |
| IPCL | &%CR | |
| EPOS | 0DH | |

Description The [CR] command prints the contents of the print buffer (if any) and resets the next character print position to the left margin. A line feed is not performed unless auto-feed is active. The print rotation direction and the left margin command define the left margin.

| | |
|-------------|------------------|
| [LF] | Line feed |
|-------------|------------------|

| | | |
|-------------|------|-----|
| ASCII | [LF] | |
| Hexadecimal | | 0AH |
| Decimal | <10> | |
| IPCL | &%LF | |
| EPOS | 0AH | |

Description The [LF] command prints the contents of the buffer (if any) and advances paper one line at the current default line spacing. The next character print position is not reset to the left margin unless auto-CR is active.

Horizontal Motion Control

Several commands can be used to control the horizontal position of characters. Many applications use space control to position fields. However, the Epic 880™ Printer has the ability to control character position with horizontal tab stops. This is done using the horizontal tab [HT] to move to those tab stops.

[HT] Horizontal tab

ASCII [HT]
 Hexadecimal 09H
 Decimal <9>
 IPCL &%HT
 EPOS [HT]

Description The [HT] command inserts spaces in the print buffer up to the next tab stop. The default tab locations are every eight spaces.

[BS] Back space

ASCII [BS]
 Hexadecimal 08H
 Decimal <8>
 IPCL &%BS
 EPOS [BS]

Description The [BS] command moves the print buffer one character width to the left. The pointer position cannot be moved to the left of the left margin. [BS] does not cause the buffer to be printed; rather, the following data is OR'ed with the previous data.

[ESC] D Set horizontal tab stops

ASCII [ESC] D <n₁> <n₂> <n₃> ... <n_i> 0
 Hexadecimal 1BH 44H <n₁> <n₂> <n₃> ... <n_i> 00H
 Decimal <27> <68> <n₁> <n₂> <n₃> ... <n_i> <0>
 IPCL none
 EPOS [ESC] D <n₁> <n₂> <n₃> ... <n_i> 0

Description The [ESC] D <n₁> <n₂> <n₃> ... <n_i> 0 command sets tab stops at the character columns specified by <n>. The end of the settings is specified by a <0>. All previously set tabs will be cleared. Column sizes are in accordance with the current character pitch. Setting tabs that are beyond the station width is possible. A [CR] is inserted when the tab is used. Printing begins at the home position. The power up default is every eight spaces, i.e., 9, 17, 25, and so on; use the restore-default procedure [ESC] R to set these default tabs rather than re-specify the tabs.

| | |
|---------|---|
| [ESC] R | Reset horizontal and vertical tab stops |
|---------|---|

| | |
|-------------|-----------|
| ASCII | [ESC] R |
| Hexadecimal | 1BH 52H |
| Decimal | <27> <82> |
| IPCL | &%HV |
| EPOS | none |

Description The [ESC] R command resets horizontal and vertical tab stops to the power up configuration. The power up horizontal default is every eight spaces, i.e., 9, 17, 25, and so on. The vertical default is every line.

[ESC] a Set Justification

| | |
|-------------|------------------|
| ASCII | [ESC] a <n> |
| Hexadecimal | 1BH 61H <n> |
| Decimal | <27> <97> <n> |
| IPCL | &%JL, &%JC, &%JR |
| EPOS | [ESC] a <n> |

Description The [ESC] a <n> command sets the horizontal justification.

Where <n> 0 = Left justified &%JL
1 = Center justified &%JC
2 = Right justified &%JR

The print format of the printer can be right, center, or left justified. The value of <n> specifies the justification. The power on default is left justified.

Note: This command will print any data received before the command. IE. You can't print left and right justified data on the same line.

Note: The justify commands also affect graphics.

[ESC] n Set horizontal position

| | |
|-------------|--|
| ASCII | [ESC] n <n ₁ > <n ₂ > |
| Hexadecimal | 1BH 6EH <n ₁ > <n ₂ > |
| Decimal | <27> <110> <n ₁ > <n ₂ > |
| IPCL | &%HP <m ₁ > <m ₂ > <m ₃ > |
| EPOS | [ESC]\$ <n ₁ > <n ₂ > |

Description The [ESC] <n> <n₁> <n₂> command sets the print position to <n₁> + <n₂> * 256 in 1/196 inches.

Vertical Motion Control

[ESC] j Perform a fine line feed

ASCII [ESC] J <n>
Hexadecimal 1BH 4AH <n>
Decimal <27> <74> <n>
IPCL &%FM <m₁> <m₂> <m₃>
EPOS [ESC] J <n>

Description The [ESC] J <n> command prints the contents of the buffer and performs a line feed of n/216 inch. The default line spacing value is not changed. The next character print position is reset to the left margin if the Auto-CR mode is set.

Notes:

- In EPOS mode, the command performs feeds in n/144-inch increments.
- Immediately after APA graphics, the command is adjusted for the difference between 72 dpi graphics and 96 dpi print.

[ESC] 3 Set variable line spacing to n/216 inch

ASCII [ESC] 3 <n>
Hexadecimal 1BH 33H <n>
Decimal <27> <51> <n>
IPCL &%SV <m₁> <m₂> <m₃>
EPOS [ESC] 3 <n>

Description The [ESC] 3 <n> command sets the default line spacing to n/216 inch, where n = 1 to 255. The line feed spacing used by [LF] is set to values other than 1/8 or 7/72 inch. The command takes effect immediately.

Note: In EPOS mode, the command performs line feeds in n/144-inch increments.

[ESC] 0 Set line spacing to 1/8 inch

ASCII [ESC] 0
Hexadecimal 1BH 30H
Decimal <27> <48>
IPCL &%ST
EPOS [ESC] 2

Description The [ESC] 0 command sets the default line spacing to 1/8 inch (27/216 inch), which is the standard eight lines per inch line spacing at initial power-up.

Note: In EPOS mode, the command sets 1/6-inch spacing or six lines per inch.

[ESC] 1 Set line spacing to 21/216 inch or 7/72 inch

ASCII [ESC] 1
Hexadecimal 1BH 31H
Decimal <27> <49>
IPCL &%SG
EPOS none

Description The [ESC] 1 command sets the default line spacing to 21/216 inch. Use 21/216-inch line spacing for all-points-addressable (APA) graphics printing.

[ESC] A Set variable line spacing to n/72 inch

ASCII [ESC] A <n>
Hexadecimal 1BH 41H <n>
Decimal <27> <65> <n>
IPCL none
EPOS none

Description The [ESC] A <n> command sets the default line spacing to n/72, where n = 1 to 85. Variable line spacing does not take effect until enabled by the [ESC] 2 command. The command is provided to maintain backward compatibility with the TransAct® Series 50, OKIDATA, IBM, and other printers. It can also be used to print on preprinted forms.

[ESC] 2 Enable [ESC] A <n> variable line spacing

ASCII [ESC] 2
Hexadecimal 1BH 32H
Decimal <27> <50>
IPCL none
EPOS none

Description The [ESC] 2 command is a companion to the [ESC] A <n> command and puts the specified line spacing into effect. It remains in effect until another line spacing command is issued.

| Function | Set minimum Line Spacing in Points | All |
|-------------|------------------------------------|-----|
| ASCII | [ESC] + V <d> | |
| Hexadecimal | 1BH 2BH 56H | |
| Decimal | <27> <43> <86> | |
| Range | d = 0, 4 - 72 | |

The [ESC] + V command will set the line spacing in points, where one point is defined as 1/72nd of an inch.

If d = 0 variable spacing is selected.

Note: This is the minimum spacing. If the character height setting requires a larger spacing, the character height will override this setting.

| Function | Set minimum Line Spacing in ¼ Points | All |
|-------------|--------------------------------------|-----|
| ASCII | [ESC] + v <d> | |
| Hexadecimal | 1BH 2BH 76H | |
| Decimal | <27> <43> <118> | |
| Range | d = 0, 16 - 255 | |

The [ESC] + v command will set the line spacing in ¼ points, where ¼ point is defined as 1/288th of an inch.

| | |
|-------------|-----------------|
| ASCII | [ESC] + v <d> |
| Hexadecimal | BH 2BH 76H |
| Decimal | <27> <43> <118> |
| Range | d = 0, 16 - 255 |

If d = 0 variable spacing is selected.

Note: This is the minimum spacing. If the character height setting requires a larger spacing, the character height will override this setting.

[ESC] d Feed <n> lines at the current spacing

ASCII [ESC] d <n>
Hexadecimal 1BH 64H <n>
Decimal <27> <100> <n>
IPCL &%FL <m1> <m2>
EPOS [ESC] d

Description The [ESC] d <n> command prints the contents of the buffer (if any) and performs <n> line feeds at the current line spacing. The command does not change the default line spacing value. The next character print position is reset to the left margin.

Note: The IPCL command prints from 00 to 99 lines. For example, if you wish to feed 12 lines, the IPCL command would be as follows: &%FL12.

Function Reverse feed <n> lines at the current spacing

ASCII [ESC] e <n>
Hexadecimal 1BH 65H <n>
Decimal <27> <101> <n>
IPCL &%FB <m1> <m2>
EPOS [ESC] e

Description The [ESC] e <n> command prints the contents of the buffer (if any) and performs <n> reverse line feeds at the current line spacing. The command does not change the default line spacing value. The next character print position is reset to the left margin.

Note: The reverse feed is limited to 2 lines. Do NOT attempt to reverse feed more than 2 lines or the paper could jam.

Note: The IPCL command prints from 00 to 99 lines. For example, if you wish to feed 12 lines, the IPCL command would be as follows: &%FL12.

[VT] Vertical tab

ASCII [VT]
Hexadecimal 0BH
Decimal <11>
IPCL &%VT
EPOS (VT)

Description The printer sets a line counter to the top of the form at reset and when a set top of form command is issued. By setting vertical tab stops, various form positions can be reached with a [VT] operation.

[ESC] B Set vertical tab stops

ASCII [ESC] B <n₁> <n₂> <n₃> ... <n_i> 0
Hexadecimal 1BH 42H <n₁> <n₂> <n₃> ... <n_i> 00H
Decimal <27> <66> <n₁> <n₂> <n₃> ... <n_i> <0>
IPCL none
EPOS [ESC] B <n₁> <n₂> <n₃> ... <n_i> 0

Description The [ESC] B <n₁> <n₂> <n₃> ... <n_i> 0 command sets tab stops at line positions specified by <n>. The end of the setting is specified by a <0>. All previously set tabs will be cleared. If n_n is less than n_{n-1}, then the command is in error, and all of the following information is printed. In other words, tab stops must be entered sequentially in order to be accepted. A total of 64 tab stops can be specified. (The power on default is a vertical tab on every line).

[ESC] R Reset horizontal and vertical tab stops

ASCII [ESC] R
Hexadecimal 1BH 52H
Decimal <27> <82>
IPCL &%HV
EPOS none

Description The [ESC] R command resets horizontal and vertical tab stops to power up configuration. The power up horizontal default is every eight spaces, i.e., 9, 17, 25, etc. The vertical default is every line.

[FF] Form feed

ASCII [FF]
Hexadecimal 0CH
Decimal <12>
IPCL &%FF
EPOS none

Description The [FF] command performs a form feed to the top of the form.

Note: The form feed command can be disabled by setting the form length to zero.

Note: In page mode this command ends page mode. It does not position the paper to top of form.

[ESC] 4 Set top of form

ASCII [ESC] 4
Hexadecimal 1BH 34H
Decimal <27> <52>
IPCL &%TF
EPOS [ESC] L

Description The [ESC] 4 command sets the top of form to the current position.

Note: This command does not operate in or affect page mode.

[ESC] C Set form length in lines

ASCII [ESC] C <n>
Hexadecimal 1BH 43H <n>
Decimal <27> <67> <n>
IPCL &%SL <m₁> <m₂>
EPOS [ESC] C <n>

Description The [ESC] C <n> command sets the form length to <n> lines at the current line spacing. If the current page position is greater than the new page length, the command also sets the current position as the top of form.

Note: This command does not set the page size in page mode.

[ESC] C [NUL] Set form length in inches

ASCII [ESC] C [NUL] <n>
Hexadecimal 1BH 43H <0> <n>
Decimal <27> <67> <0> <n>
IPCL &%SI <m₁> <m₂>
EPOS none

Description The [ESC] C [NUL] <n> command sets the form length to <n> inches. If the current page position is greater than the new page length, the command also sets the current position as the top of form. If zero inches are specified, the form feed and vertical tab commands are ignored.

Note: This command does not set the page size in page mode.

[ESC] 5 Begin auto line feed

| | |
|-------------|---------------|
| ASCII | [ESC] 5 <n> |
| Hexadecimal | 1BH 35H <n> |
| Decimal | <27> <53> <n> |
| IPCL | &%MA (Begin) |
| IPCL | &%CA (End) |
| EPOS | none |

Description The [ESC] 5 <1> command sets auto line feed mode. [ESC] 5 <0> command ends auto line feed mode.

Note: The begin and end auto line feed command overrides the configuration setting.

Feed to Black Dot

Epic 880™ printers are available with an optional black dot sensor, supported by a feed to black dot command as well as an additional function to adjust the width and offset of the black dot.

Note: This is a special order option, and requires an additional sensor and modified firmware. It is not possible to field retrofit a standard Epic 880™ with a black dot sensor.

| Function | Feed to Black Dot |
|----------|-------------------|
|----------|-------------------|

| | |
|-------------|---------------|
| ASCII | [ESC][VT]<n> |
| Hexadecimal | 1BH, 0BH, <n> |
| Decimal | <27><11><n> |
| IPCL | None |
| EPOS | [GS][VT]<n> |

Where n <n> is the number of inches to feed while looking for the black marker.

Description The [ESC][VT] command performs feeds the paper until the black dot is positioned as configured.

This command keeps track of the location of the black dot and will feed paper until the black dot is positioned as configured.

There are three configurable Black Dot parameters. The Dot Width, and the Offset may be adjusted to operate with a specific paper. The Calibration is preset and should not be changed.

| Function | Adjusting the width and offset of the Black Dot |
|----------|---|
|----------|---|

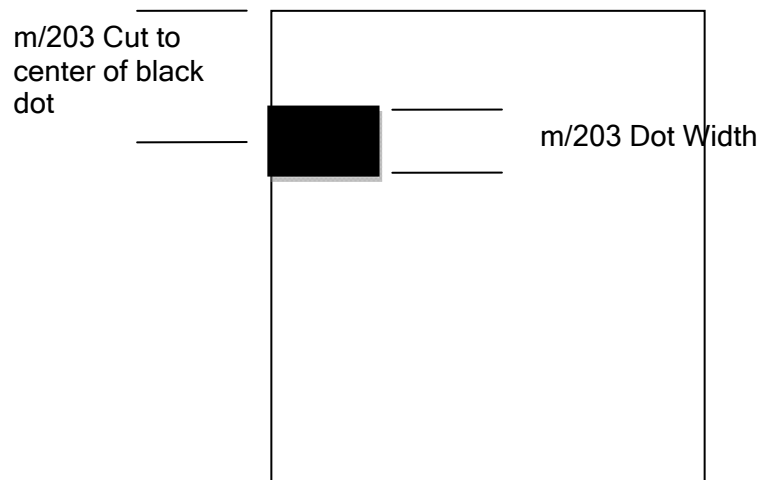
| | |
|-------------|-------------------|
| ASCII | ESC ~ W nl nh m |
| Hexadecimal | 1B 7E 57 nl nh m |
| Decimal | 27 126 87 nl nh m |

Where n = The offset adjustment of the Black dot in n/203 inches where n = nl + 256*nh. Default is 304 or 1.5 inches. Values greater than 368 will set n to 368.

M = The Width of the black dot in m/203 inches. The default is 76 or 0.375 inches. Values less than 51 will be ignored.

The offset adjustment is the position of the black dot in relation to the cut point. If n = 0 the cut point will be in the center of the black dot. If the value of n = 304, the cut point will be 1.5 inches above the black dot.

Note: This command may be issued as part of an application. If the values in the configuration match the requested values, no operation occurs.



Note: This command interacts with the Feed to Black Dot command. If the Black Dot paper option is set, the black dot position specified by this command will be used for the Cover Close operation.

Character Pitch

| Function | Set Character spacing in points. | All |
|-------------|----------------------------------|-----|
| ASCII | [ESC] + I <d> | |
| Hexadecimal | 1BH 2BH 49H | |
| Decimal | <27> <43> <73> | |
| Range | d = 0, 4 - 72 | |

The [ESC] + I command will set the character spacing in points, where one point is defined as 1/72nd of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + J command in that all characters are centered on the fixed cell size. If the character is too big for the cell, it may overlap the previous and next character. The character size is not adjusted to fit the cell.

If d = 0 variable spacing is selected.

Note: If the current character size is too large for the selected spacing, the characters will overlap. Variable spacing is recommended.

| Function | Set Character spacing in ¼ points. | All |
|-------------|------------------------------------|-----|
| ASCII | [ESC] + i <d> | |
| Hexadecimal | 1BH 2BH 69H | |
| Decimal | <27> <43> <105> | |
| Range | d = 0, 16 - 255 | |

The [ESC] + i command will set the character spacing in points, where ¼ point is defined as 1/288th of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + j command in that all characters are centered on the fixed cell size. If the character is too big for the cell, it may overlap the previous and next character. The character size is not adjusted to fit the cell.

If d = 0 variable spacing is selected.

Note: If the current character size is too large for the selected spacing, the characters will overlap. Variable spacing is recommended.

| Function | Set Character spacing in points with adjustment. | All |
|-------------|--|-----|
| ASCII | [ESC] + J <d> | |
| Hexadecimal | 1BH 2BH 4AH | |
| Decimal | <27> <43> <74> | |
| Range | d = 0, 4 - 72 | |

The [ESC] + J command will set the character spacing in points, where one point is defined as $1/72^{\text{nd}}$ of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + I command in that if the character is too large for the cell, the cell will be expanded in multiples of <d> until the character fits.

If d = 0 variable spacing is selected. However, note that the cell adjustment flag will remain set and if legacy commands are used they will allow the cell to be expanded.

Note: If the current character size is too large for the selected spacing, the cell size will be expanded

| Function | Set Character spacing in points with adjustment. | All |
|-------------|--|-----|
| ASCII | [ESC] + j <d> | |
| Hexadecimal | 1BH 2BH 6AH | |
| Decimal | <27> <43> <106> | |
| Range | d = 0, 16 - 255 | |

The [ESC] + j command will set the character spacing in points, where $\frac{1}{4}$ point is defined as $1/288^{\text{th}}$ of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + i command in that if the character is too large for the cell, the cell will be expanded in multiples of <d> until the character fits.

If d = 0 variable spacing is selected. However, note that the cell adjustment flag will remain set and if legacy commands are used they will allow the cell to be expanded.

Note: If the current character size is too large for the selected spacing, the characters will overlap. Variable spacing is recommended.

[DC2] Begin 10 cpi character pitch (Legacy Command)

ASCII [DC2]
 Hexadecimal 12H
 Decimal <18>
 IPCL &%F3
 EPOS [ESC][SP] <n>

Description The [DC2] command sets 9.905 characters per inch print pitch.

[ESC] : Begin 12 cpi character pitch (Legacy Command)

ASCII [ESC] :
 Hexadecimal 1BH 3AH
 Decimal <27> <58>
 IPCL &%F2
 EPOS [ESC] [SP] <n>

Description The [ESC] : command sets 12.235 characters per inch print pitch.

[SI] Begin 17 cpi character pitch (Legacy Command)

ASCII [SI]
 Hexadecimal 0FH
 Decimal <15>
 IPCL &%F1
 EPOS [ESC] [SP] <n>

Description The [SI] command sets 17.333 characters per inch print pitch.

[ESC] [SI] Begin 24 cpi character pitch (Legacy Command)

ASCII [ESC] [SI]
 Hexadecimal 1BH 0FH
 Decimal <27> <15>
 IPCL &%F4
 EPOS [ESC] [SP] <n>

Description The [ESC] [SP] command sets 23.111 characters per inch print pitch.

[ESC] [P Set character pitch

ASCII [ESC] [P <n>
Hexadecimal 1BH 5BH 50H <n>
Decimal <27> <91> <80> <n>
IPCL &%F1, &%F2, &%F3, &%F4, &%F5, &%F6, &%F7
EPOS [ESC] [SP] <n>

Description The [ESC] [P <n> command sets character per inch print pitch to <n>. The printer resolution limits the exact print pitch. The following table lists the exact pitch for various values on <n>.

| <n> | Resulting Characters per Inch | IPCL |
|-----|-------------------------------|------|
| 1 | 1.00 | |
| 2 | 2.00 | |
| 3 | 3.01 | |
| 4 | 4.00 | |
| 5 | 4.95 | |
| 6 | 5.94 | |
| 7 | 6.93 | |
| 8 | 8.00 | &%F7 |
| 9 | 9.04 | |
| 10 | 9.90 | &%F3 |
| 11 | 10.95 | |
| 12 | 12.23 | &%F2 |
| 13 | 13.00 | |
| 14 | 13.87 | |
| 15 | 14.86 | &%F6 |

Shaded selections are not recommended.

| <n> | Resulting Characters per Inch | IPCL |
|-----|-------------------------------|------|
| 16 | 16.00 | |
| 17 | 17.33 | &%F1 |
| 18 | 17.33 | |
| 19 | 18.91 | |
| 20 | 20.8 | &%F5 |
| 21 | 20.8 | |
| 22 | 23.11 | |
| 23 | 23.11 | |
| 24 | 23.11 | &%F4 |
| 25 | 23.11 | |
| 26 | 26 | |
| 27 | 26 | |
| 28 | 26 | |
| 29 | 29.71 | |
| 30 | 29.71 | |

Table 3 Character Pitch

This command disables any right-side spacing set by the [ESC] V command. In addition, when font changes are made, the character pitch is maintained.

[ESC] V Set inter-character spacing (Legacy Command)

Mode Global
ASCII [ESC] V <n>
Hexadecimal 1BH 56H <n>
Decimal <27> <86> <n>
IPCL none
EPOS [ESC] [SP] <n>

Description The [ESC] V <n> command sets inter-character spacing by adding white space between characters. The value of <n> sets the spacing in 216ths of an inch. The printer can only set the spacing in 208ths of an inch and converts 216ths to the nearest 208th of an inch. Each font has a basic size, and the inter-character spacing value is added to the basic size. Therefore, the affect of this command on characters per inch (cpi) will depend on the font selected.

Note 1: The [ESC] V <n> command disables any pitch settings established by pitch set commands that establish a cpi (like [ESC] [P <n>). After a set right-side spacing command is issued, the pitch will vary with font selection. Font selections use the current, active, right-side spacing.

Note 2: With the inter-character spacing command, the pitch cannot be set less than the font size. Therefore, it is not as effective as the pitch command, [ESC] [P <n>. The following table lists the cpi equivalent for several values of <n>.

The following table lists the cpi equivalent for several values of <n>.

| <n> | Small Draft (cpi) | Large Draft (cpi) | NLQ (cpi) |
|-----|-------------------|-------------------|-----------|
| 0 | 17.33 | 14.86 | 13 |
| 1 | 16 | 13.9 | 12.24 |
| 2 | 14.86 | 13 | 11.6 |
| 3 | 13.9 | 12.24 | 10.9 |
| 4 | 13 | 11.6 | 10.4 |
| 5 | 12.24 | 10.9 | 9.90 |

Table 4 Inter-character Spacing

Character Font

[ESC] # Begin 12 x 12 print mode (Legacy Command)

ASCII [ESC] # <0>
Hexadecimal 1BH 23H 00H
Decimal <27> <35> <0>
IPCL &%QT
EPOS [ESC] ! <n>

Description The [ESC] # <0> command begins 12 x 12 draft like print mode. Draft print is provided to maintain compatibility with other TransAct® products.

[ESC] I Set print size mode (Legacy Command)

ASCII [ESC] I <n>
Hexadecimal 1BH 49H <n>
Decimal <27> <73> <n>
IPCL &%QT 12 x 12 draft mode
 &%QU 12 x 14 large draft mode
 &%QL 24 x 16 near letter quality (NLQ) mode
 &%QS 24 x 16 near letter quality (NLQ) mode
EPOS [GS] ! <n> and/or [ESC] ! <n>

Description The [ESC] I <n> (e.g. capital “I”) command begins draft, large draft or near letter quality print mode.

Where n 0 = 12 x 12 like draft
 1 = 12 x 14 like large draft
 2 = 24 x 16 like near letter quality (NLQ)
 3 = 24 x 16 like near letter quality (NLQ)
 4 - 7 repeats 0 - 3

Note 1: The all characters printed by the Epic 880™ are generated from scaleable fonts. All these mode selections configure the font rendering code to generate fonts that are approximately equivalent to the matrix sizes indicated.

Character Sets and Code Pages

The Epic 880™ Printer is primarily intended to be used in Unicode based systems. However to provide legacy support, the printer supports 8 bit and double byte ASCII encoding with code pages.

When not using Unicode or double byte encoding, the printer is restricted to the 8 bit ASCII character set. To support international languages, the characters that are assigned to each of the 256 possible locations can be remapped to any character in the Unicode standard. Typically, the first 32 characters are reserved for control characters. The next 72 are typically fixed to alpha numeric and punctuation. The upper 128 characters are typically redefined to characters that support the specific language or country. These mappings are generally referred to as codepages.

The Epic 880™ provides several legacy commands to select a country code or codepage maps. However, they all simply select an ASCII to Unicode translation map. Several predefined mappings to provide legacy support are internal to the printer, but the majority of the maps are placed in the printer's file system. This allows any preexisting codepage mapping to be defined as well as the ability to define custom mappings unique to your application.

Codepage description files

The format of the codepage description file is somewhat flexible. The basic format is that each line will specify an ASCII character ID and the Unicode character that is to appear in that ASCII ID location.

The file format is one character per line with the first value being the ASCII ID and the second value being the Unicode address. The file should be something like this:

```
0x00      0x0000      # NULL
0x01      0x0001      # START OF HEADING
0x02      0x0002      # START OF TEXT
0x03      0x0003      # END OF TEXT
...
or
\Language = USA
\Code Page = 437
0x00      0x0000      ; 0      NULL
0x01      0x263A      ; 9786  WHITE SMILE
0x02      0x263B      ; 9787  BLACK SMILE
0x03      0x2665      ; 9829  BLACK HEART SUIT
0x04      0x2666      ; 9830  BLACK DIAMOND SUIT
0x05      0x2663      ; 9827  BLACK CLUB SUIT
...
or
0 0        ; NULL
1 9786 ; WHITE SMILE
2 9787 ; BLACK SMILE
3 9829 ; BLACK HEART SUIT
4 9830 ; BLACK DIAMOND SUIT
5 9827 ; BLACK CLUB SUIT
```

```

...
or
SYMBOL SET = WE
/name = Windows 3.1 Latin 2
/pcl char = E
...
/symbols =
32 0x0020 ; Space Code, Prntabl Thin Space
33 0x0021 ; Exclamation
34 0x0022 ; Neutral Double Quote
5  0x0023 ; Number
36 0x0024 ; Dollar
...
or
\Language = USA
\Code Page = 437
0x00 - 0x0000 ; 0 NULL
0x01 - 0x263A ; 9786 WHITE SMILE
0x02 - 0x263B ; 9787 BLACK SMILE
0x03 - 0x2665 ; 9829 BLACK HART SUIT
0x04 - 0x2666 ; 9830 BLACK DIAMOND SUIT
0x05 - 0x2663 ; 9827 BLACK CLUB SUIT
...
or
\Language = USA
\Code Page = 437
0x00 = 0x0000 ; 0 NULL
0x01 = 0x263A ; 9786 WHITE SMILE
0x02 = 0x263B ; 9787 BLACK SMILE
0x03 = 0x2665 ; 9829 BLACK HART SUIT
0x04 = 0x2666 ; 9830 BLACK DIAMOND SUIT
0x05 = 0x2663 ; 9827 BLACK CLUB SUIT

```

Numbers beginning with 0x... are treated as hexadecimal, all other as decimal. Any line beginning with a non-numeric value is ignored. Any information after the Unicode value is ignored. Not all of the ASCII ID's need to be present, however, only ID's present will be affected.

There are two ways to select a codepage file. The first is by using the standard code page select command. If this command is used, the file name is critical; it must follow the format of Cpxyz.CPM. The xyz is the code page number that is being selected in the command. For example CP850.CPM would be referred to as 850. If the legacy commands are to be used to select file based code page mapping, the selection mode must be selected in the printer's configuration.

The second form is by name. This command is free form and will select any file present which will then be to use it as a code page definition. If the file is not a code page file, you will get unexpected results. If the file does not exist, the command is ignored. Any extension may be used for a codepage map, however, it is best to use the .CPM extension, with a descriptive filename recommended. For example ISO8859-1.CPM would be a good choice for the ISO8859-1 code page.

Double-Byte and Multi-Byte Code Page Description Files

In ASCII mode the Epic 880™ Printer supports double byte code pages. Currently there are 4 double-byte codepages available and one multi-byte.

Double Byte code pages available are: Code page 932, 936, 949 and 950

Multi-byte code page available are GB18030-2000.

These code pages require an appropriate Unicode font be loaded that support all the characters in the requested code page.

Due to the large number of characters in these code pages. These files are not supported in a customer definable ASCII form like the Code page descriptions files described above. They are compiled and compressed into a 2 or 3 file code description set. One file is like the Code page description file in that it may be referenced just like the normal code page description files. The other two files are double byte and multi-byte decode files and are referenced in the master code page description. These files not distributed with the standard printer but are available from Transact upon request.

Code Page Selection

In ASCII mode the Epic 880™ Printer supports many different international character sets. In IBM and EPOS printers, there are two ways of selecting a character set.

One way substitute's international characters in the upper 128 characters of a standard character set. The substitution technique supports a few different countries. However, as more and more countries were added, too many characters were being replaced, and it became a problem for the application to match the characters displayed and printed.

To solve this problem, a second method of selecting a character set was developed - code pages. The printer and display use the same code page, and the application displays and prints the same characters. IBM and EPOS defined new commands to select code pages, and left the old commands in effect.

The Epic 880™ Printer supports international character sets as well as code pages. To allow the most flexibility for the application programmer, both methods are extended in the Epic 880™ Printer. In IBM mode, there are 19 character sets and 60 code pages. In EPOS mode, there are 57 character sets and five code pages.⁵

The Epic 880™ Printer allows the IBM code page selection command to choose character sets as well as normal IBM code pages. The EPOS character set select command has been extended to allow additional character sets over and above the 11 defined by EPOS. The EPOS code page select command has not been extended because there is no EPOS definition beyond the first six ID's.

All characters in code pages as well as character sets are addressed as zero through 255. (Characters below 32 must be addressed with the [ESC] ^ <n> command.) Code pages may be changed at any time and are active for all features including rotated

⁵ Epson provides limited code page support through ID to code page translation. Only six translations are defined.

print. To allow other code pages to be created by an application, a redefine character set command is provided.

As discussed above, there are two commands for language selection in IBM mode. The first is [ESC] !, which selects one of 19 international character sets. The [ESC] ! command does not allow all of the possible character sets to be selected, it is provided for compatibility with older programs only. The second is [ESC] [T, which selects any of the 58 code pages. In EPOS mode, the [ESC] R command has been expanded to select any of the 59 international character sets or code pages.

[ESC] ! Select international character set (Legacy Command)

ASCII [ESC] ! <n>
 Hexadecimal 1BH 21H <n>
 Decimal <27> <33> <n>
 IPCL &%CS <n>
 EPOS [ESC] R <n>

Description The [ESC] ! <n> command selects international character set <n>. In standard mode, the value of <n> is as follows.

Note: This command is supported in ASCII mode only.

| <n> | Language | <n> | Language |
|---------|------------------------|---------|-----------------|
| 64- '@' | ASCII (slashed zero) | 73- 'I' | Italian |
| 65- 'A' | ASCII (unslashed zero) | 74- 'J' | French Canadian |
| 66- 'B' | British | 75- 'K' | Spanish |
| 67- 'C' | German | 76- 'L' | Swedish II |
| 68- 'D' | French | 77- 'M' | Swedish III |
| 69- 'E' | Swedish | 78- 'N' | Swedish IV |
| 70- 'F' | Danish | 79- 'O' | Turkish |
| 71- 'G' | Norwegian | 80- 'P' | Swiss I |
| 72- 'H' | Dutch | 81- 'Q' | Swiss II |

Table 5 Language Table ID's

[ESC] [T Select character code page

ASCII [ESC] [T <n_h> <n_l>
 Hexadecimal 1BH 5BH 54H <n_h> <n_l>
 Decimal <27> <91> <84> <n_h> <n_l>
 IPCL &%CP <m₁> <m₂> <m₃> <m₄>
 EPOS [ESC] t <n>

Description The [ESC] [T <n_h> <n_l> command selects character code page <n_h> <n_l>. The Epic 880™ Printer supports many code pages. The following code pages are supported.

Note: This command is supported in ASCII mode only.

Note: See Appendix E: Internal Code Page Definitions for the internally defined code pages. Additional code pages may be defined and loaded as Codepage definition files.

Note: The code page field is a 16-bit field that is a function of the code page numbers $\langle n_h \rangle$ and $\langle n_l \rangle$, e.g. $(\langle n_h \rangle * 256) + \langle n_l \rangle$. For example, $1 * 256 + 181 = 437$. For the IPCL command, the page is specified in ASCII as a 4-byte field.

Note: If the requested code page is not found in the internal maps, the file system is searched for the definition.

| | | |
|--------------------|--|------------|
| Function | Select character code page by name. | All |
| ASCII | [ESC] + C Codepage.CPM <0> | |
| Hexadecimal | 1BH 2BH 43H | |
| Decimal | <27> <43> <67> | |
| CodePage | File name from 5 to 30 characters. | |

Description The [ESC] + C command will select and read a code page encoding file. If the file does not exist, the current code page will be selected. If the code page definition is not complete, only the character locations defined by the file will be effected.

Note: Code page translations only occur in ASCII mode. This command has no effect in Unicode mode.

| | | |
|--------------------|------------------------------|-------------|
| [ESC] [C | Insert Euro character | PcOS |
| ASCII | ESC] [C <n> | |
| Hexadecimal | 1BH 5BH 43H <n> | |
| Decimal | <27> <91> <67> <n> | |
| IPCL | &%EU | |

Description The [ESC] [C <n> command allows an application to replace any character in the currently active code page with the Euro character. The character to be replaced is defined by <n>. For example, if the currently active character set is CP 850 (multi-lingual) and 0D5H character is to be the Euro character, "1BH 5BH 43H 0D5H" replaces the character at 0D5H with the Euro symbol. This command is only valid in ASCII mode when code pages are active.

Note: This command is effective only in ASCII mode.

| Typical Euro Character Substitution Locations | | | |
|---|-------|------|---------------------------------|
| Name | Epson | IBM | Code Page Insertion Point (hex) |
| 850 | 26 | 850 | 0xD5 |
| Turkey 857 | 57 | 857 | 0xD5 |
| Win Cyrillic | 52 | 1022 | 0X88 |
| Win Turkish | 51 | 1021 | 0X80 |
| Win Greek | 50 | 1020 | 0X80 |
| Win Hebrew | 62 | 1032 | 0X80 |
| Win Baltic | 68 | 1034 | 0X80 |

Table 6 Euro Character Substitution Matrix

| | |
|----------------|--------------------------------|
| [ESC] ^ | Print control character |
|----------------|--------------------------------|

ASCII [ESC] ^ <n>
Hexadecimal 1BH 5EH <n>
Decimal <27> <94> <n>
IPCL &%CC <m1> <m2> <m3>
EPOS [ESC] ^ <n>

Description The [ESC] ^ <n> command allows characters from zero to 31 codes to be printed. During normal operation, characters from zero to 31 are control characters. The command turns off control code translation for the following character. <n> can range in value from zero to 255.

[ESC] “ Print Unicode character

ASCII [ESC] “ <n_L><n_H>
Hexadecimal 1BH 22H <n_L><n_H>
Decimal <27> <34> <n_L><n_H>
IPCL &%PU<m1> <m2> <m3><m4> <m5>
EPOS [ESC] “ <n_L><n_H>

Description The [ESC] “<n_L><n_H> command allows any Unicode character to be directly addressed and inserted into the print data. <n_L><n_H> can range in value from zero to 65535.

Character Attributes**[ESC] c Select color**

ASCII [ESC] c <n>
Hexadecimal 1BH 63H <n>
Decimal <27> <99> <n>
IPCL &%CL <m₁>
EPOS none

Description The [ESC] c <n> command selects the print color.

Where <n> 0 = Black

1 = Red

2 = Green

3 = Blue

[SO] Begin one-line double-wide print

ASCII [SO]
Hexadecimal 0EH
Decimal <14>
IPCL &%MW
EPOS none

Description The [SO] command causes subsequent characters to be printed at twice the currently selected character width. For example, ten cpi becomes five cpi, 17 cpi becomes 8.5 cpi, etc. The [SO] command remains in effect until a valid line terminator is received ([CR], [LF], or [ESC] J <n> (fine line feed)); the command is canceled; or the maximum number of characters per line is reached and the printer performs an auto-print.

[DC4] Cancel one-line double-wide print

ASCII [DC4]
Hexadecimal 14H
Decimal <20>
IPCL &%MN
EPOS none

Description The [DC4] command cancels one-line double-wide mode set by the [SO] command and allows single- and double-wide characters to be printed on the same line.

[ESC] _ Enable/Disable Strike Through

ASCII [ESC] _ <n>
Hexadecimal 1BH 5FH 01H
Decimal <27> <95> <n>
IPCL &%MO (Begin)
IPCL &%CO (End)
EPOS [ESC] ! <n>

Description The [ESC] _ <1> command begins over-score print mode. All subsequent text, leading spaces, and trailing spaces are over-scored. [ESC] _ <0> ends the mode.

Note: In EPOS mode, [ESC] ! <n> performs a similar function; however, near letter quality (NLQ) is not available.

[ESC] W Multi-line double-wide and double-high mode

ASCII [ESC] W <n>
Hexadecimal 1BH 57H <n>
Decimal <27> <87> <n>
IPCL &%FD {n = 1}
 &%FS {n = 0}
 &%FHA {n = 3}
 (Note: Single-wide, double-high mode is not available in IPCL mode.)
EPOS [ESC] ! <n>

Description The [ESC] W <n> command controls multi-line double-wide or double-high mode, where n specifies the mode:

n = 0 is standard single-wide and single-high;
 n = 1 begins double-wide;
 n = 2 begins double-high; and
 n = 3 begins double-wide double-high.

| Where n Bits | 76543210 | Function |
|--------------|----------|----------------------------------|
| 1----- | | Underline |
| --1----- | | Double-wide |
| ---1---- | | Double-high |
| -----X | | Font: 0 = draft; 1 = large draft |

Note: The [ESC] W <n> command does not affect line spacing.

Note: In EPOS mode, [ESC] ! <n> performs a similar function; however, near letter quality (NLQ) is not available.

[ESC] [@ Set print style: double-wide, double-high, italic control

ASCII [ESC] [@ [EOT] [NUL] <k> [NUL] <n> <m>
Hexadecimal 1BH 5BH 40H 04H 00H <k> 00H <n> <m>
Decimal <27> <91> <64> <04> <0> <K> <0> <n> <m>
IPCL &%DH Double-high, double-wide, and double-space
 &%SH Single-high, single-wide, and single-space
 Also, see [ESC] W above.

Description The [ESC] [@ [EOT] [NUL] <k> [NUL] <n> <m> command sets double-wide, double-high, and italic print mode.

| | | |
|---------------------|---|-------------------------------|
| Where k bits | k | 76543210 |
| -----xxxxx | | Italic control |
| 0 ----0000 | | No change |
| 1 ----0001 | | Italics On |
| 2 ----0010 | | Italics Off |
| Where n bits | n | 76543210 |
| -----0nnn | | Height multiplier (Maximum 4) |
| 0 ----0000 | | No change |
| xxxx----- | | Line spacing |
| 0 0000---- | | No change |
| Where m bits | m | 76543210 |
| -----0nnn | | Width multiplier (Maximum 4) |
| 0 ----0000 | | No change |

Note: The maximum height and width multiplier is four.

[ESC] - Begin underline

ASCII [ESC] - <n>
Hexadecimal 1BH 2DH 01H
Decimal <27> <45> <n>
IPCL &%MU (Begin)
IPCL &%CU (End)
EPOS [ESC] ! <n>

Description The [ESC] - <1> command begins underline print mode. All subsequent text, leading spaces, and trailing spaces are underlined. [ESC] - <0> ends the mode.

Note: In EPOS mode, [ESC] ! <n> performs a similar function; however, near letter quality (NLQ) is not available.

[ESC] G Begin enhanced print

ASCII [ESC] G
Hexadecimal 1BH 47H
Decimal <27> <71>
IPCL &%ME
EPOS [ESC] G <1>

Description All subsequent text is printed in enhanced print mode (two passes with a vertical offset). Enhanced printing provides a deeper resolution of each character and may enhance multiple part forms printing.

[ESC] H End enhanced print mode

ASCII [ESC] H
Hexadecimal 1BH 48H
Decimal <27> <72>
IPCL &%CE
EPOS [ESC] G <0>

Description The [ESC] H command cancels enhanced print mode and returns to the currently selected font.

[ESC] E Begin emphasized print mode

| | |
|-------------|-------------|
| ASCII | [ESC] E |
| Hexadecimal | 1BH 45H |
| Decimal | <27> <69> |
| IPCL | &%MM |
| EPOS | [ESC] E <1> |

Description The [ESC] E command begins emphasized print mode (one pass with horizontal offset). Emphasized print is bolder than normal print.

[ESC] F End emphasized print mode

| | |
|-------------|-------------|
| ASCII | [ESC] F |
| Hexadecimal | 1BH 46H |
| Decimal | <27> <70> |
| IPCL | &%CM |
| EPOS | [ESC] E <0> |

Description The [ESC] F command cancels emphasized print mode.

[ESC] S <0> Select superscript

| | |
|-------------|---------------|
| ASCII | [ESC] S <0> |
| Hexadecimal | 1BH 53H 00H |
| Decimal | <27> <83> <0> |
| IPCL | &%SP |
| EPOS | none |

Description The [ESC] S <0> command selects superscript. The following characters are printed half size on the upper side of the print line.

Note: Superscript is not available in all print modes.

[ESC] S <1> Select subscript

| | |
|-------------|---------------|
| ASCII | [ESC] S <1> |
| Hexadecimal | 1BH 53H 01H |
| Decimal | <27> <83> <1> |
| IPCL | &%SB |
| EPOS | none |

Description The [ESC] S <1> command selects subscript. The following characters are printed half size on the bottom side of the print line.

Note: Superscript is not available in all print modes.

[ESC] T End superscript or subscript

ASCII [ESC] T
 Hexadecimal 1BH 54H
 Decimal <27> <84>
 IPCL &%SE
 EPOS none

Description The [ESC] T command ends superscript or subscript.

[ESC] % G Begin italics

ASCII [ESC] % G
 Hexadecimal 1BH 25H 47H
 Decimal <27> <37> <71>
 IPCL &%MI
 EPOS [ESC] 4

Description The [ESC] % G command begins italic print mode.

Note: Italics are not available in all print modes.

[ESC] % H End italics

ASCII [ESC] % H
 Hexadecimal 1BH 25H 48H
 Decimal <27> <37> <72>
 IPCL &%CI
 EPOS [ESC] 5

Description The [ESC] % H command ends italic print mode.

Page Mode

The Epic 880™ supports two operational modes, standard and page mode. In standard mode, as a line of text is received it is buffered and printed when the line feed is received. In page mode the printer waits for a complete “page” (a number of lines) to be received before printing the complete page. The advantage of page mode is that text and/or graphics can be placed anywhere on the page, in any order, and in any of 4 orientations.

How to use page mode

Page mode requires two phases to operate correctly.

1. Page definition
 - a. Define the master page size either just before or just after entering page mode.
 - b. Optionally define a sub page.
The master page defines the maximum page size, all sub pages must be smaller and contained within the master page. Master and sub page definitions are always done base on the 0 degree orientation not the current rotation.
 - c. Optionally set an orientation. This may be 0, 90, 180 or 270 degrees.
 - d. Optionally set the entry position. This is based on the current sub page and the current rotation.
 - e. Enter text or graphics.
 - f. Go to step b to define additional sub pages or step c to change the orientation.
2. Print the page.

Page Definition

The [ESC]t command will start page definition and define the initial orientation. An [ESC]t command during page definition will change the orientation and reset the entry location back to the top left corner of that orientation.

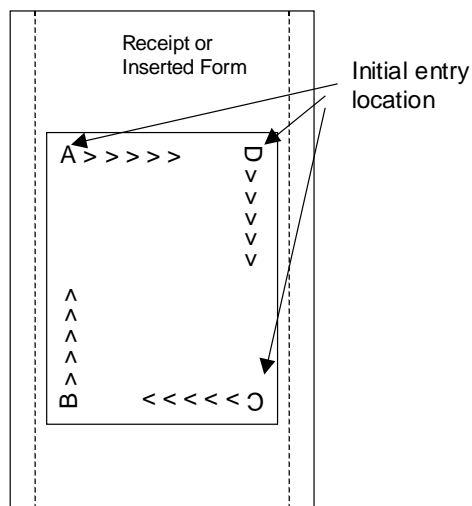


Figure 24 Page Mode Entry Orientations

The [ESC] u command sets the maximum page dimensions. Note that these dimensions are always based on 0 degree rotation. After this, you can enter text and/or graphics as required.

Auto-cutter and page mode

You may embed an auto-cutter command with in a page definition. The auto-cut command may be placed anywhere in the page definition, however, it will be processed after the page is printed. To prevent the cut from occurring in the page, it will be preceded with a feed that will place the end of the page about 0.125 inches above the auto-cut position.

Mechanism commands in page mode

In general, mechanism commands received during page mode will be processed if the result will not affect the printed result.

Stopping page mode definition

The following operations will stop a page mode definition:

- 1) [ESC]@ Printer initialize command.
- 2) Real time reset request [ENQ]<10>
- 3) Turning the printer off.

Printing the page

The [FF] command starts the printing process.

Printing starts at the current paper position. The complete page definition is printed excluding any blank information at the bottom of the page.

If the [FF] command is used to print the page, the memory used to store the page image is not maintained and is released to be used by other functions.

| Function | Select page mode |
|-------------|-------------------------------|
| ASCII | [ESC] t<x> or [ESC] [SUB] t |
| Hexadecimal | 1BH 74H<x> or 1BH 1AH 74H |
| Decimal | <27><116><x> or <27><26><116> |
| IPCL | &%PM<x ₁ > |
| EPOS | [ESC] L |

Description This command activates page mode and sets the orientation.

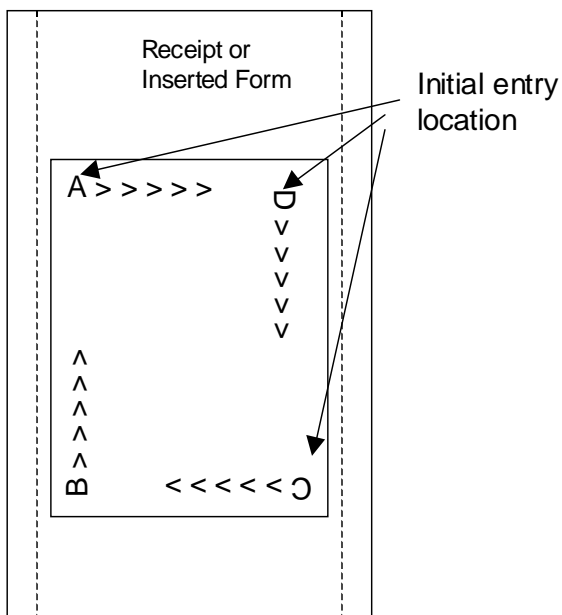
This command may also be issued during page definition. When issued in page mode it resets the orientation and entry position, but does not cause the currently defined image to be erased or printed.

Where x = 0 for standard orientation (Direction A).

x = 1 for 270° Rotation (Direction B)

x = 2 for 180° Rotation (Direction C)

x = 3 for 90° Rotation (Direction D)



Note 1: This command saves the current right and left margin and sets them to the maximum values for the orientation currently defined.

Note 2: During page mode definition almost all printer commands are active. The following table lists the exceptions.

| Command | Active | Action |
|-----------------------------------|---------|--|
| Cash drawer commands | Yes | Immediate action |
| Bell command | Yes | Immediate action |
| Auto cut commands | Delayed | The printer will perform a feed to cut and then operate the auto cutter after the page is printed. The cut command may be anywhere in the definition. If the page is printed twice, the Auto cut command must be reissued after the first print to generate additional cuts. |
| Electronic journal station select | No | This command is like a station select and is not active. You cannot store page mode images in the electronic journal. A page mode command in journal station mode will exit journal mode. |
| Electronic journal entries | Yes | You can make journal entries as part of a page description. They are saved as text and not part of the page. |
| Status requests | Yes | The status is returned during definition. |
| Printer initialize command | Yes | Cancels page mode definition and returns the printer to standard mode. |
| Set top of form | No | You must set the top of form outside of page mode. The form position is maintained after the page is printed. |
| Vertical tab | No | The definition of a vertical tab is ambiguous in page mode and is ignored. |
| Macro definitions | No | You can not define or delete a macro while in page mode. You can, however, invoke a macro or stored graphic. You can not enter page mode while in a macro definition. |

Note 3: Unless specified by a page mode set page size command, the default page size is the full paper width for about 14 inches. Printing starts at the current paper

position. The complete page definition is printed excluding any blank information at the bottom of the page.

| Function | Set Print Area in Page Mode | Enhanced |
|-------------|--|----------|
| ASCII | [ESC] [SUB] S <XO _L ><XO _H ><<YO _L ><YO _H ><W _L ><W _H >< H _L ><H _H > | |
| Hexadecimal | 1BH 1AH 53H <XO _L ><XO _H ><<YO _L ><YO _H ><W _L ><W _H >< H _L ><H _H > | |
| Decimal | <27><26><83><XO _L ><XO _H ><<YO _L ><YO _H ><W _L ><W _H >< H _L ><H _H > | |
| IPCL | None | |
| EPOS | [ESC] W | |

Description This command Sets the position and size of the initial area in page mode and sub pages.

Where:

| | | |
|--------------------------------------|------------------------|----------|
| <XO _L ><XO _H > | the x direction offset | Min 0 |
| <YO _L ><YO _H > | the y direction offset | Min 0 |
| <W _L ><W _H > | the width in dots | Max 576 |
| <H _L ><H _H > | the height in dots | Max 3000 |

This command should always be sent before or immediately after page mode is entered to define the initial page size.

Once in page mode (after the [ESC]t command) the command can be sent multiple times so that several different print areas, aligned in different print directions, can be developed in the printer's page buffer before being printed using the Print Page Mode commands (FF or ESC FF).

The starting position of the print area is the upper left of the area to be printed. The Yoffset is in the y direction and is YO dots and the Xoffset is in the x direction and is XO dots in. The length of the area to be printed in the y direction is set to H dots. The length of the area to be printed in the x direction is set to W dots.

The set print area command may be invoked multiple times while in page mode. The first invocation specifies the initial master page size. Following invocations will define smaller windows within the initially defined page. If the Set page size command is not used, the page size will default to the maximum size.

The orientation of the set print area command is always based on 0 degrees regardless of the current orientation setting. This includes if the command is sent before the start page mode command, after the start page mode command, or as a sub-page.

Note: The maximum printable area in the x direction is 576/203 or 3.15 inches.

Note: The maximum printable area in the y direction is 2999/203 or 14.78 inches.

Note: Only the used portion of the page is printed. That is the page length will only include what actually has print data. See illustration below.

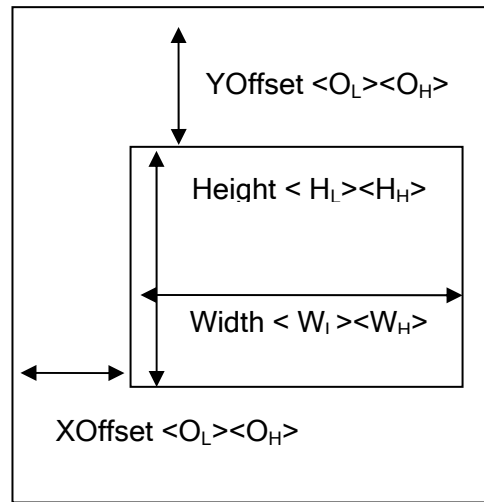


Figure 25 Page mode set printable area

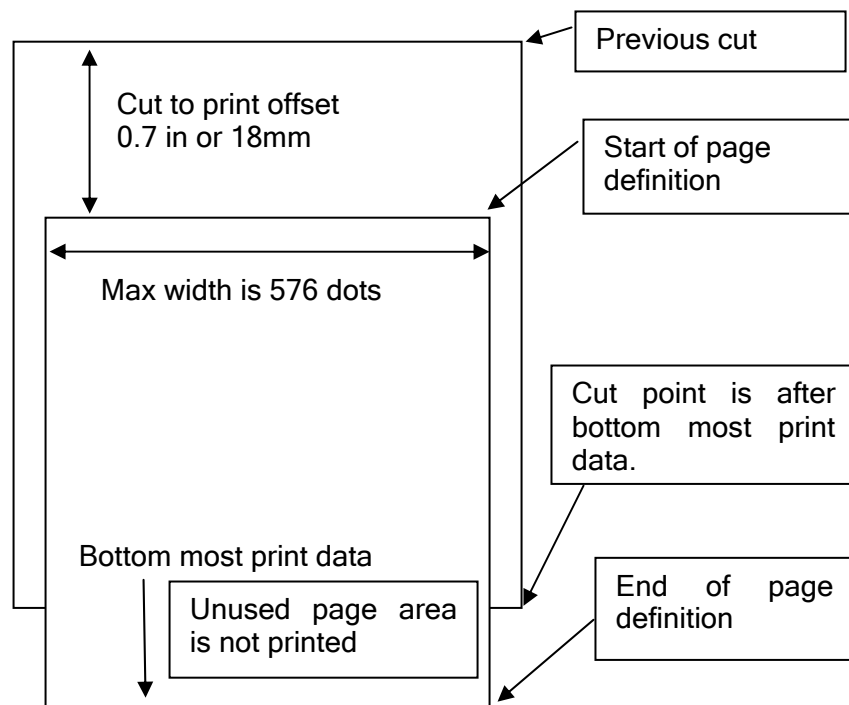


Figure 26 Default Page mode printed area

| Function | Set Printed Area in Page Mode | Enhanced |
|-------------|--|----------|
| ASCII | [ESC] [SUB] W <XO _L ><XO _H ><<YO _L ><YO _H ><W _L ><W _H >< H _L ><H _H > | |
| Hexadecimal | 1BH 1AH 57H <XO _L ><XO _H ><<YO _L ><YO _H ><W _L ><W _H >< H _L ><H _H > | |
| Decimal | <27><26><87><XO _L ><XO _H ><<YO _L ><YO _H ><W _L ><W _H >< H _L ><H _H > | |
| IPCL | None | |
| EPOS | [ESC] W | |

Description This command is similar Set Print Area in Page Mode command above, however it will force the complete page to be printed rather than only what is used. It will define sub pages, however is intended to set the initial page size.

Where:

| | | |
|--------------------------------------|------------------------|-----------|
| <XO _L ><XO _H > | the x direction offset | Min 0 |
| <YO _L ><YO _H > | the y direction offset | Min 0 |
| <W _L ><W _H > | the width in dots | Max(576) |
| <H _L ><H _H > | the height in dots | Max(3000) |

This command should always be sent before or immediately after select page mode command and will define the initial page size. This command differs from the Set Print Area in Page Mode command in that it does not allow the page to be shortened. The complete page is printed even if it is not used.

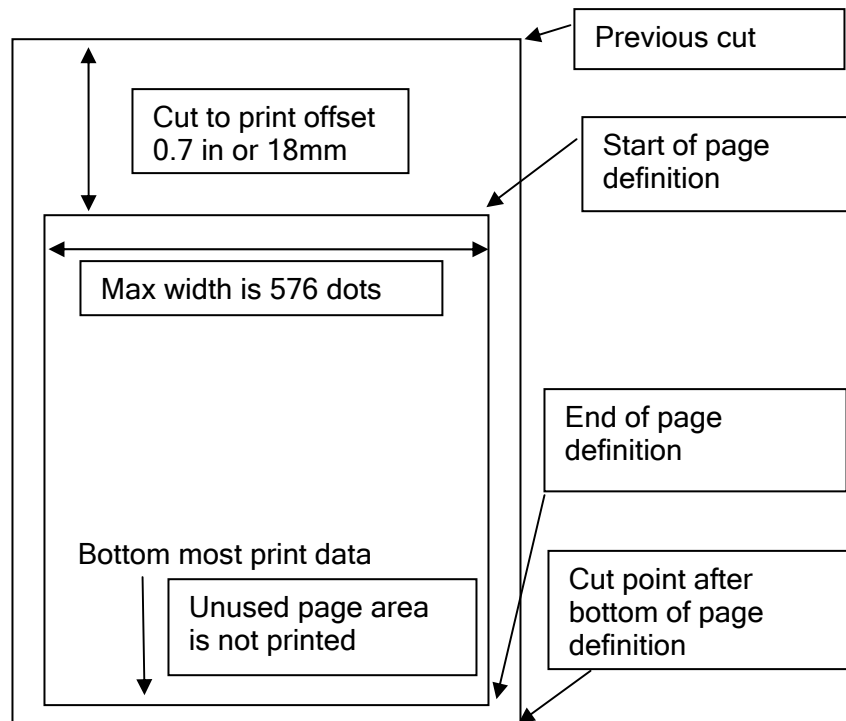


Figure 27 Defined Page mode printed area

| Function | Set Print Area in Page Mode | Legacy Support Command |
|-------------|--|------------------------|
| ASCII | [ESC] u <O _L ><O _H ><W _L ><W _H >< H _L ><H _H > | |
| Hexadecimal | 1BH 75H <O _L ><O _H ><W _L ><W _H >< H _L ><H _H > | |
| Decimal | <27><117><O _L ><O _H ><W _L ><W _H >< H _L ><H _H > | |
| IPCL | &%PS<0000><WWWW><HHHH> | |
| EPOS | [ESC] W | |

Description This command Sets the position and size of the printing initial area in page mode and sub pages.

Where:

<O_L><O_H> the y direction offset Default(0)
 <W_L><W_H> the width in dots Default(576)
 <H_L><H_H> the height in dots Default(3000)

This command should always be sent before or immediately after page mode is entered to define the initial page size.

Once in page mode (after the [ESC]t command) the command can be sent multiple times so that several different print areas, aligned in different print directions, can be developed in the printer's page buffer before being printed using the Print Page Mode commands (FF or ESC FF).

The starting position of the print area is the upper left of the area to be printed. The offset is in the x direction and is O dots. The length of the area to be printed in the y direction is set to H dots. The length of the area to be printed in the x direction is set to W dots. (Note that the Y offset is always 0)

The set print area command may be invoked multiple times while in page mode. The first invocation specifies the final page height. Following invocations will define smaller windows within the initially defined page. If the Set page size command is not used, the page size will default to the maximum size.

The orientation of the set print area command is always based on 0 degrees regardless of the current orientation setting. This includes if the command is sent before the start page mode command, after the start page mode command, or as a sub-page.

Note: The maximum printable area in the x direction is 576/203 or 3.15 inches.

Note: The maximum printable area in the y direction is 2999/203 or 14.78 inches.

Note: The printed page length will only include what actually has print data.

| Function | Set Page Mode Entry Position |
|----------|------------------------------|
|----------|------------------------------|

| | |
|-------------|--|
| ASCII | [ESC] [SUB] A <X _L ><X _H ><Y _L ><Y _H > |
| Hexadecimal | 1BH 1AH 41H <X _L ><X _H ><Y _L ><Y _H > |
| Decimal | <27><26><65><X _L ><X _H > <Y _L ><Y _H > |
| IPCL | &%PY<XXXX><YYYY> |
| EPOS | [ESC] W |

Description This command sets the horizontal and vertical entry position to anywhere on the page. It is only valid in page mode. If the value specified is beyond the page boundary, the command is ignored. (X and Y refers to the current active orientation specified by the [ESC]t command, and is not same as the page definition of X and Y.)

The X and Y positions are in dots.

$Y = Y_h * 256 + Y_l$ dots from the top

$X = X_h * 256 + X_l$ dots from the left

Note: You can also use the [ESC]J, [ESC]M, [ESC]d and [ESC]e commands to position the print on the page.

| Function | Set Page Mode Entry Position Relative |
|----------|---------------------------------------|
|----------|---------------------------------------|

| | |
|-------------|--|
| ASCII | [ESC] [SUB] R <X _L ><X _H ><Y _L ><Y _H > |
| Hexadecimal | 1BH 1AH 52H <X _L ><X _H ><Y _L ><Y _H > |
| Decimal | <27><26><82><X _L ><X _H > <Y _L ><Y _H > |
| IPCL | None |
| EPOS | [ESC] W |

Description This command sets the horizontal and vertical entry position to anywhere on the page. It is only valid in page mode. If the value specified is beyond the page boundary, the command is ignored. (X and Y refers to the current active orientation specified by the [ESC]t command, and is not same as the page definition of X and Y.)

The X and Y positions are in dots.

$Y = Y_h * 256 + Y_l$ dots from the current Y

$X = X_h * 256 + X_l$ dots from the current X

Note: You can also use the [ESC]J, [ESC]M, [ESC]d and [ESC]e commands to position the print on the page.

| Function | Set Page Mode Entry Position | Legacy Support |
|-------------|---|----------------|
| ASCII | [ESC] o <X _L ><X _H ><Y _L ><Y _H ><F> | |
| Hexadecimal | 1BH 6FH <X _L ><X _H ><Y _L ><Y _H ><F> | |
| Decimal | <27><111><X _L ><X _H > <Y _L ><Y _H ><F> | |
| IPCL | None | |
| EPOS | [ESC] W | |

Description This command sets the horizontal and vertical entry position to anywhere on the page. It is only valid in page mode. If the value specified is beyond the page boundary, the command is ignored. (X and Y refers to the current active orientation specified by the [ESC]t command, and is not same as the page definition of X and Y.)

The X and Y positions are in dots.

$Y = Y_h * 256 + Y_l$ dots from the top

$X = X_h * 256 + X_l$ dots from the left

The F parameter is a flag that specifies if this command is an absolute position command or relative to the current position. If its value is <1> the command is processed as a relative position command, and if its value is <0> the command is interpreted as an absolute position command.

Note: You can also use the [ESC]J, [ESC]M, [ESC]d and [ESC]e commands to position the print on the page.

| Function | Exit Page Mode |
|-------------|----------------------|
| ASCII | [FF] or [ESC][SUB] P |
| Hexadecimal | 0CH or 1BH 1AH 50H |
| Decimal | <12> or <27><26><80> |
| IPCL | &%FF |
| EPOS | [FF] |

Description This command exits page mode definition and starts the print process. If the printer is not in page mode, this command is treated as a normal form feed command.

Note: When page mode finishes printing, the left and right margins are restored to the values before the select page mode command. All other format changes are preserved.

Graphic Mode

The Epic 880™ Printer conforms to the basic definition of IBM all-points-addressable (APA) graphic commands. It is not designed to print large quantities of graphical data. The printer only prints graphics that are 2.5 inches wide. At this time, there is no graphics mode for Epson emulation.

The Epic 880™ Printer always prints in one of the native resolutions of 203 x 203 dpi. To provide compatibility with the standard IBM APA resolutions, the printer internally modifies the graphics to print as expected. The printer converts the vertical resolution by altering the [ESC] J command (which is typically used for vertical spacing) and adjusting it so that horizontal passes touch as expected. The requested horizontal resolution is converted by data scaling. Because the vertical dpi of the printer is always greater, the resulting APA graphics printed on the Epic 880™ Printer may be slightly smaller or larger than the same graphic printed on an impact printer. All of this is done transparently to the application; however, loss of resolution may result in some modes. If desired the [ESC] * <m> command can be used to select the native resolution.

Note 1: If the Epic 880™ Printer is used with programs that convert text to graphics, the printer is slower than if the printer is sent ASCII text. The Epic 880™ Printer is supported by a Windows' print driver that allows applications to select internal supported fonts.

Note 2: Generally, the horizontal graphic commands provide faster print than the APA graphic commands.

Standard APA Graphics

[ESC] K Print single-density graphics (60h x 72v dpi)

| | |
|-------------|---|
| ASCII | [ESC] K <n ₁ > <n ₂ > |
| Hexadecimal | 1BH 4BH <n ₁ > <n ₂ > |
| Decimal | <27> <75> <n ₁ > <n ₂ > |
| IPCL | none |

Description The [ESC] K <n₁> <n₂> command prints <n₁> + 256 * <n₂> bytes of single-density graphics (60 dpi).

[ESC] L Print half-speed double-density graphics (120h x 72v dpi)

| | |
|-------------|---|
| ASCII | [ESC] L <n ₁ > <n ₂ > |
| Hexadecimal | 1BH 4CH <n ₁ > <n ₂ > |
| Decimal | <27> <76> <n ₁ > <n ₂ > |
| IPCL | none |

Description The [ESC] L <n₁> <n₂> command prints <n₁> + 256 * <n₂> bytes of double-density graphics (120 dpi) at half speed, allowing full and half dots to be printed.

[ESC] Y Print full-speed double-density graphics (120h x 72v dpi)

ASCII [ESC] Y <n₁> <n₂>
Hexadecimal 1BH 59H <n₁> <n₂>
Decimal <27> <89> <n₁> <n₂>
IPCL none

Description The [ESC] Y <n₁> <n₂> command prints <n₁> + 256 * <n₂> bytes of double-density graphics (120 dpi) at full speed with no consecutive dots. (The mode is generally used to print 120h by 144v dpi resolutions in two passes).

[ESC] Z Print quad-density graphics (240h x 72v dpi)

ASCII [ESC] Z <n₁> <n₂>
Hexadecimal 1BH 5AH <n₁> <n₂>
Decimal <27> <90> <n₁> <n₂>
IPCL none

Description The [ESC] Z <n₁> <n₂> command prints <n₁> + 256 * <n₂> bytes of quad-density graphics (240 dpi) at half speed with no consecutive dots. (The mode is generally used to print 240h by 144v dpi resolutions in two passes).

Extended APA Graphics**[ESC] * Print graphics in mode <m> (60h/ 120h/ 240h x 72v dpi)**

ASCII [ESC] * <m> <n₁> <n₂>
Hexadecimal 1BH 2AH <m> <n₁> <n₂>
Decimal <27> <42> <m> <n₁> <n₂>
IPCL none

Description The [ESC] * <m> <n₁> <n₂> command selects the graphic resolution graphic modes as specified by <m>.

Where <m>

| Mode | Resolution |
|------|------------|
| 0 | 60 dpi |
| 1 | 120 dpi |
| 2 | 120 dpi |
| 3 | 240 dpi |
| 4 | 80 dpi |
| 5 | 72 dpi |
| 6 | 90 dpi |

| Mode | Resolution |
|-------|---------------|
| 7 | 144 dpi |
| 8,9 | Not supported |
| 10 | 102 x 102 dpi |
| 11 | 203 x 102 dpi |
| 12 | 102 x 203 dpi |
| 13 | 203 x 203 dpi |
| 15,16 | Not supported |

[ESC] ? Reassign graphic mode

ASCII [ESC] ? <m> <n>
Hexadecimal 1BH 3FH <m> <n>
Decimal <27> <63> <m> <n>
IPCL none

Description The [ESC] ? <m> <n> command reassigns graphic resolution <m> to resolution <n>. Possible values for <m> are K, L, Y, or Z referent to the [ESC] K, [ESC] L, [ESC] Y, and [ESC] Z APA graphics commands. Resolutions, <n>, are zero to sixteen as follows:

Where <m>

| Mode | Resolution |
|------|------------|
| 0 | 60 dpi |
| 1 | 120 dpi |
| 2 | 120 dpi |
| 3 | 240 dpi |
| 4 | 80 dpi |
| 5 | 72 dpi |
| 6 | 90 dpi |

| Mode | Resolution |
|-------|---------------|
| 7 | 144 dpi |
| 8,9 | Not supported |
| 10 | 102 x 102 dpi |
| 11 | 203 x 102 dpi |
| 12 | 102 x 203 dpi |
| 13 | 203 x 203 dpi |
| 15,16 | Not supported |

Note: Modes 11 through 13 are designed to support horizontal graphics and are not intended for APA graphics.

[ESC] U <1>

Select unidirectional print

ASCII [ESC] U <1>
 Hexadecimal 1BH 55H 01H
 Decimal <27> <85> <1>
 IPCL &%GU
 EPOS [ESC] U <1>

Description The [ESC] U <1> is a legacy command used in impact printers to provide better graphics. It forces the printer to print all data in unidirectional print mode to improve line to line registration for graphical data. This command has no effect in this printer.

[ESC] U <0>

Select bidirectional print

ASCII [ESC] U <0>
 Hexadecimal 1BH 55H 00H
 Decimal <27> <85> <0>
 IPCL &%GB
 EPOS [ESC] U <0>

Description The [ESC] U <0> command prints all data in bi-directional, logic-seeking print mode. This command has no effect in this printer.

Horizontal Color Graphics

The Epic 880™ Printer supports monochrome and color graphics sent as horizontal scan lines. Individual scan lines of graphic data are sent to the printer one line at a time. The Epic 880™ Printer supports only two color printing, however, the horizontal graphic command interface gives full color support for printer graphics. Full color support is provided to establish a full color standard for future printers. Color data is sent in one of three color planes. Typically, a red plane or scan line is sent, then green and blue. The sequence of lines defines one row of dots that is printed on the paper.

The horizontal graphic commands do not include resolution information. Therefore, at least once before sending graphics data, set the graphics resolution by sending the [ESC] * command with a zero length (no data). The graphic resolution sets the internal graphic mode of the printer. The printer stays in graphic mode until it is changed by another command. Note that the bar code generation and other graphic commands change graphics mode. The format of the horizontal graphic command follows.

| [ESC] h | Process horizontal graphics data |
|---------|----------------------------------|
|---------|----------------------------------|

| | |
|-------------|--|
| ASCII | [ESC] h <color> <length> <format> <data> |
| Hexadecimal | 1BH 68H |
| Decimal | <27> <104> |
| IPCL | None |
| EPOS | None |

Description The [ESC] h <color> <length> <format> <data> command processes horizontal graphic data, where <color> is a byte that specifies the color of the data being sent.

<color> =

- 0 Use Previously Selected Color
- 1 Red
- 2 Green
- 4 Blue

<length> = byte specifying the length of the data including the format byte, ranging from 0 to 254 (255 is reserved for future use.)

<format> = byte specifying the format of the graphics data.

- 0 for raw data
- 1 for bit wise RLE compression
- 8 for byte wise RLE compression
- 254 for difference compression
- 255 for same as previous scan line data

<data> = the data bytes that define the graphics to be printed.

Note 1: Red, green, and blue pixels set to one at the same location result in a white dot, while red, green, and blue pixels set to zero form a black dot. For black print, one represents a black dot and zero represents a white dot.

Note 2: More than one color may be set at a time - for example, setting the color to six would set green and blue simultaneously.

[ESC] * Set horizontal graphic mode

ASCII [ESC] * <m> <0> <0>
 Hexadecimal 1BH 2AH <m> <0> <0>
 Decimal <27> <42> <m> <0> <0>
 IPCL none

Description The [ESC] * <m> <0> <0> command selects one of the three graphic modes specified by <m>. The two bytes after the mode must be zero.

Where <m>0,2,3,4,5,6,7 Standard Graphic Modes

(See ESC * command documentation in previous section.)

| Mode | Resolution |
|---------------|---|
| 0,2,3,4,5,6,7 | Standard Graphic Modes (See ESC * command documentation in previous section.) |
| 8,9 | Not supported |
| 10 | 102 x 102 dpi |
| 11 | 203 x 102 dpi |
| 12 | 102 x 203 dpi |
| 13 | 203 x 203 dpi |
| 15,16 | Not supported |

Note 1: Only modes 10 through 13 should be selected for horizontal graphics.

| Example | Command | Comment |
|---------|---|--------------------------------|
| [ESC] * | <10> <0> <0> | Set resolution to 102x102 dpi. |
| [ESC] h | <1> <9> <0> <eight data bytes> | Send 8-bytes red pixels. |
| [ESC] h | <2> <9> <0> <eight data bytes> | Send 8-bytes green pixels. |
| [ESC] h | <3> <9> <0> <eight data bytes> | Send 8-bytes blue pixels. |
| LF | Send line feed to force print of any buffered data not yet printed. | |

Graphics Compression

Although the printer compression algorithms are documented, it is recommended that our Windows printer driver be used to generate a graphic image. Our Windows' printer driver selects the best compression method to use on a scan line by scan line basis. The print driver can be directed to print to file, creating a .prn file. When creating a .prn file, it is recommended that the Start/End Doc settings be cleared in the Start/End Doc tab of the printer properties page. After the .prn file is created, it can be read and sent to the printer by the host application.

Bit wise RLE. In bit wise RLE compression, the Most Significant Bit (MSB) compression of each data byte denotes if the compressed data represents one or zero bits. Bits zero through six indicate how many bits are represented as a one or zero. A 34 Hex (34H) represents 34H bits set to zero. A 97H represents 17H bits set to one.

[ESC] h <1> <5> <1> <34H> <97H> <8fH> <09H>

Byte wise RLE. In byte wise RLE compression, data is represented in byte Compression pairs. The first byte is a count, and the second is the graphics data. The graphics data byte is repeated the number of times represented by the count byte.

[ESC] h <1> <5> <8> <09H> <ffH> <02H> <55H>

Where <09H> <ffH> means repeat ffH nine times and <02H> <55H> means repeat 55H two times.

Difference Compression. In difference compression, data is represented in byte pairs. In compression, the first byte is an index into the byte stream, as it would exist if sent in an uncompressed format, while the second byte is the data that is different in the new scan line data; in other words, "The scan line is the same as the previous except for the byte at a specific position."

[ESC] h <1> <5> <254> <03H> <d5H> <0bH> <51H>

Where <03H> <d5H> means use the previously transmitted scan line data but change byte 3 to a d5H and change byte 11 (0bH) to a 51H.

Same-as-previous Compression. In same-as-previous compression, the command does not contain any graphics data. The command specifies that the printer is to use the previous scan line data for the current scan line.

[ESC] h <1> <1> <255>.

Simple Raster Graphics

Simple Raster Graphics prints a horizontal raster of graphics data one or multiple times. Horizontal offset and number of data bytes are variable and specified by parameters. This is a legacy support command and intended to be replaced by horizontal graphics commands. This command does not support compression or color graphics.

[ESC] . Simple raster graphic mode

ASCII [ESC] . *m n rL rH d1...dn* * <m> <0> <0>
 Hexadecimal 1BH 2EH *m n rL rH d1...dn*
 Decimal <27> <46> *m n rL rH d1...dn*
 IPCL none

Description The [ESC]. command is a simple method of printing raster graphics, however the format does not support compression or color.

Where:

m: horizontal offset from left margin = 8 x m dots
 n: number of data bytes that compose the raster
 r : number of times the raster is to be printed = 256x rH + rL
d1...dn: data bytes

Range: 0 <= m <= 80
 0 <= n <= 80
 0 <= r <= 65535
 0 <= d1..dn <= 255

Note: This command can produce graphics that are difficult to print and hard on the power supply. Avoid multi-line repeats of very dark lines. In normal graphics, the printer does a look ahead at impending print and tries to adjust it's speed to limit power consumption. This command can easily produce graphics that make that very difficult. For example a completely white space followed by a black group of lines that are less than 20 lines long will provide a transient load on the power supply that may overload it. The printer does not recognize the black data until it is too late to slow down. Normal graphics generally does not contain that kind of data.

User Store (Graphic Save and Macros)

The Epic 880™ Printer maintains about 2.5 Megabytes of flash memory to save user information. The information can be either macros or graphic images.

To allow the host application to maintain these groups of data, a series of user store maintenance commands are available. As referenced earlier in this manual, the user can define a limited number of custom characters and define a macro. These character/macro definitions can also be saved in user store. However, only one character definition and one macro can be active at any time. One macro definition can be flagged to load and run at startup. If a flag is set, the printer will automatically process the macro at initialization.

Programming Considerations

The flash (nonvolatile) memory has a limited number of write cycle operations. Consequently, the number of saves should be limited. The buffer should not be saved on a transaction by transaction basis, but rather a maximum of once per day.

The buffer is initially about 16K⁶ bytes long. All commands⁷ and print data are placed in the buffer and must be included in the size limits. The printer does not indicate when the buffer is full. The application must make sure that the buffer is not overfilled. The printer simply stops saving information when it is full. As the buffer fills, the input data is printed normally. The effect of the macro start command is to clear the buffer and to start to save the input data. The macro stop command stops saving data and initializes internal pointers for the next print. To store the data in the nonvolatile flash, it must be named and saved by one of the user-store save commands.

When the macro buffer is inserted into the data stream, configuration commands (like font or pitch changes) remain in effect after the macro is processed. Illegal commands are placed in the buffer and take up space.

Horizontal graphics should be sent to the printer compressed. If the data is not compressed, it is saved in the macro buffer. If the buffer is saved into the user-store nonvolatile flash, there must be enough room in the user store for all of the data. As user-store space is used, the macro buffer will be larger than the available space in user store. Only the used space is saved, but it is possible to define a macro that does not fit in the remaining user-store space.

Defining Macros

Macros can be defined two ways. The first is by using the begin and end named macro commands. These commands start the recording process and automatically save the macro when it is complete. The macro data is not processed, as it is sent to the printer.

⁶ The actual buffer is smaller because of the overhead.

⁷ IPCL commands are converted by the printer into an equivalent [ESC] code and then placed in the save buffer. The equivalent [ESC] code should be used to calculate the size of the save buffer data.

The second saves the received data to a RAM buffer and then saves the buffer by command. In this case data is actually processed as it is received.

Begin/End Macro Without proceeding data

| Function | Begin named macro record |
|----------|--------------------------|
|----------|--------------------------|

ASCII [ESC] [US] b <Name..> <0>

Then send the data to be recorded. The printer does not process the data. The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

| Function | End name macro record |
|----------|-----------------------|
|----------|-----------------------|

ASCII [ESC] [US] e <Name..> <0>

Begin/End Macro While proceeding data

The second way to define macros is to use [ESC] g commands to define the macro, and then the save macro data command to save the data. The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

| Function | Save macro data |
|----------|-----------------|
|----------|-----------------|

ASCII [ESC] [US] m <Name..><0>

Saving User-defined Characters. To save user-defined characters, first define the character set.

User Store Commands

Function Load item from user store

ASCII [ESC] [US] I <Name..> <0>

Description If the item referenced is a user-defined character set, it is loaded into the current definition. If it is a macro, it is loaded into the macro buffer. It is not processed or printed.

To help maintain the user-store area, the following commands can be used.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Function Flag as a start-up macro

ASCII [ESC] [US] s <Name..> <0>

Description The [ESC] [US] s <Name..> <0> command flags the referenced item to be processed at startup. No more than one user character definition and user data item may be flagged.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Function Remove item from user store

ASCII [ESC] [US] e <Name..> <0>

Description The [ESC] [US] e <Name..> <0> command removes an item from user store and frees up its space. The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Function Flush information from user store

ASCII [ESC] [US] f ALL <0> Base User Store
or [ESC] [US] f EXT <0> Extended User Store.

Description The [ESC] [US] f ALL <0> command clears all of the information to the user store and frees the data space. The [ESC] [US] f EXT <0> command clears all of the information in the extended the user store.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Function Report on user store

ASCII [ESC] [US] q <0>

Description The [ESC] [US] q <0> prints or returns information about the contents of and available space in user store.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Note: A configuration option is available that locks the user store data. The configuration option prevents the occurrence of new user store data operation until the lock is manually reset and accidental deletion of the saved information. The user-defined character buffer and/or user data buffer may be redefined and used but cannot be stored.

| Function | Begin named macro record |
|----------|--------------------------|
|----------|--------------------------|

| | |
|-------|------------------------------|
| ASCII | [ESC] [US] b <Name..mac> <0> |
|-------|------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 62H |
|-------------|-------------|

| | |
|---------|----------------|
| Decimal | <27> <31> <98> |
|---------|----------------|

| | |
|------|-------------------|
| IPCL | &%UB <Name..> <0> |
|------|-------------------|

| | |
|------|------|
| EPOS | none |
|------|------|

Description The [ESC] [US] b <Name..> <0> command erases the current macro, initializes the macro buffer structure, and redirects the following data to the macro buffer. It uses the <Name..> field as a reference. If the name already exists in the flash user store, the command is ignored. The command must be followed by the “End name macro record” command with the same name. If the data that follows is larger than the macro buffer (about 16K), the macro definition is terminated without saving any data.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Note: User defined macros must use a .mac extension.

| Function | End named macro record |
|----------|------------------------|
|----------|------------------------|

| | |
|-------|-------------------------------|
| ASCII | [ESC] [US] e <Name..mac > <0> |
|-------|-------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 65H |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <101> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%UG <Name..> <0> |
|------|-------------------|

| | |
|------|------|
| EPOS | none |
|------|------|

Description The [ESC] [US] e <Name..> <0> command ends the macro record operation and saves the macro to flash. It uses the <Name..> field to verify the command end and must match the “Begin named macro record” command. If the name already exists in the flash user store or the macro memory is exceeded, the command is valid, and the <Name..> field prints. If there is not enough room in the flash user store for the macro, the save is not performed, but the macro buffer is valid.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Note: User defined macros must use a .mac extension.

| Function | Save macro data in user store |
|----------|-------------------------------|
|----------|-------------------------------|

| | |
|-------|--------------------------------|
| ASCII | [ESC] [US] m <Name.. mac > <0> |
|-------|--------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 6DH |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <109> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%UM <Name..> <0> |
|------|-------------------|

| | |
|------|---|
| EPOS | [GS] -...<Name..> <0> is from one to 15 characters and must be null terminated. |
|------|---|

Description The [ESC] [US] m <Name..> <0> command saves the current macro buffer structure into the flash user-store area. It uses the <Name..> field as a reference name. If the name already exists in the flash user store, the command does not store the data.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Note: User defined macros must use a .mac extension.

| Function | Load item from user store |
|----------|---------------------------|
|----------|---------------------------|

| | |
|-------|--------------------------------|
| ASCII | [ESC] [US] l <Name.. mac > <0> |
|-------|--------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 6CH |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <108> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%UL <Name..> <0> |
|------|-------------------|

| | |
|------|--|
| EPOS | [GS] 0<Name..> <0> is from one to 15 characters and must be null terminated. |
|------|--|

Description The [ESC] [US] l <Name..> <0> command loads the referenced item into the appropriate structure. If the item referenced is a user-defined character set, it is loaded into the current user-character definition, which does not affect the active state of user-defined characters. If it is a macro, it is loaded into the macro buffer, but it is not inserted into the data stream. [ESC] g <0> inserts the macro buffer into the data stream. If the named item does not exist, the command does nothing.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT>n> on page 128.

Note: User defined macros must use a .mac extension.

| Function | Run macro data from user store |
|----------|--------------------------------|
|----------|--------------------------------|

| | |
|-------|--------------------------------|
| ASCII | [ESC] [US] r <Name.. mac > <0> |
|-------|--------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 72H |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <114> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%UR <Name..> <0> |
|------|-------------------|

| | |
|------|--|
| EPOS | [GS] 0<Name..> <0> is from one to 15 characters and must be null terminated. |
|------|--|

Description The [ESC] [US] r <Name..> <0> command loads the referenced macro into the macro buffer. The macro buffer is then inserted into the data stream. If the named item does not exist or is not a macro, nothing happens.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Note: User defined macros must use a .mac extension.

| Function | Flag item as a start-up macro |
|----------|-------------------------------|
|----------|-------------------------------|

| | |
|-------|--------------------------------|
| ASCII | [ESC] [US] s <Name.. mac > <0> |
|-------|--------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 73H |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <115> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%US <Name..> <0> |
|------|-------------------|

| | |
|------|--|
| EPOS | [GS] 0<Name..> <0> is from one to 15 characters and must be null terminated. |
|------|--|

Description The [ESC] [US] s <Name..> <0> command flags the referenced item to be processed at startup. Only one user character definition and one macro may be flagged to run at startup.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128

Note: If a character definition is loaded at startup, it is automatically made active.

Note: User defined macros must use a .mac extension.

| Function | Delete item from user store |
|----------|-----------------------------|
|----------|-----------------------------|

| | |
|-------|------------------------------|
| ASCII | [ESC] [US] d <Name..mac> <0> |
|-------|------------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 64H |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <100> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%UD <Name..> <0> |
|------|-------------------|

| | |
|------|---|
| EPOS | [GS] 1 <Name..> <0> is from one to 15 characters and must be null terminated. |
|------|---|

Description The [ESC] [US] d <Name..> <0> command removes an item from user store and frees up space. If the item does not exist, the command does nothing.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT>n> on page 128.

Note: User defined macros must use a .mac extension.

| Function | Flush information from user store |
|----------|-----------------------------------|
|----------|-----------------------------------|

| | |
|-------|----------------------------------|
| ASCII | [ESC] [US] f ALL <0> User Store. |
|-------|----------------------------------|

| | |
|-------------|-----------------|
| Hexadecimal | 1BH 1FH 66H 00H |
|-------------|-----------------|

| | |
|---------|---------------------|
| Decimal | <27> <31> <102> <0> |
|---------|---------------------|

| | |
|------|------|
| IPCL | &%UF |
|------|------|

| | |
|------|--------|
| EPOS | [GS] 5 |
|------|--------|

Description The [ESC] [US] f ALL <0> command clears all entries in user store and frees the data space. It must have the name, "ALL" (in uppercase) attached.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT>n> on page 128.

| Function | Report on user store |
|----------|----------------------|
|----------|----------------------|

| | |
|-------|--|
| ASCII | [ESC] [US] q <0> Print a user store report |
|-------|--|

| | |
|----|---|
| Or | [ESC] [US] ? <0> Return a formatted user store report |
|----|---|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1FH 71H |
|-------------|-------------|

| | |
|---------|-----------------|
| Decimal | <27> <31> <113> |
|---------|-----------------|

| | |
|------|-------------------|
| IPCL | &%UQ <Name..> <0> |
|------|-------------------|

| | |
|------|--------|
| EPOS | [GS] 3 |
|------|--------|

Description The [ESC] [US] q <Name..> <0> command prints a status report. The file name is ignored and may be omitted. The NUL must be present. The intention of the command is to aid in macro development.

The terminating <0> may be replaced with an & or redefined. See [ESC] [EM]T<n> or &%UT<n> on page 128.

Note: The report is also printed as part of the configuration report.

| Function | Redefine User Store Termination Character |
|-------------|---|
| ASCII | [ESC] [EM] T <n> |
| Hexadecimal | 1BH 19H 54H <n> |
| Decimal | <27> <25> <84> <n> |
| IPCL | &%UT <n> |
| EPOS | None |

Description This command allows the terminator used to signal the end of the name field in User Store commands to be modified. The value of <n> is used (in addition to the <0>) for the terminator. The value of n may be from 0 to 255.

The default value for the second terminator is &. If this command redefines the terminator to something other than &, the & will no longer function.

Example If &%UT% were sent to the printer, the user store command to run macro "Demo" would be &%URDemo%.

Legacy User Macros

The following commands are provided for legacy support. They are not intended for new applications.

| | |
|--------------------------|---------------------------|
| [ESC] g <0> | Process user macro |
|--------------------------|---------------------------|

ASCII [ESC] g <0>
Hexadecimal 1BH 67H 00H
Decimal <27> <103> <0>
IPCL &%GP
EPOS [ESC] g <0>

Description The [ESC] g <0> command prints the user-store data buffer.

| | |
|--------------------------|---------------------------|
| [ESC] g <1> | Start macro record |
|--------------------------|---------------------------|

ASCII [ESC] g <1>
Hexadecimal 1BH 67H 01H
Decimal <27> <103> <1>
IPCL &%GS
EPOS [ESC] g <1>

Description The [ESC] g <1> command clears the user-store data buffer and begins recording data. The next 2000 bytes (including characters and commands) are recorded.

| | |
|--------------------------|--------------------------|
| [ESC] g <2> | Stop macro record |
|--------------------------|--------------------------|

ASCII [ESC] g <2>
Hexadecimal 1BH 67H 02H
Decimal <27> <103> <2>
IPCL &%GE
EPOS [ESC] g <2>

Description The [ESC] g <2> command stops recording user-store data information. The buffer is not saved into the nonvolatile memory.

| | |
|--------------------------|-----------------------------------|
| [ESC] g <3> | Stop macro record and save |
|--------------------------|-----------------------------------|

ASCII [ESC] g <3>
Hexadecimal 1BH 67H 03H
Decimal <27> <103> <3>
IPCL &%GW
EPOS [ESC] g <3>

Description The [ESC] g <3> command stops recording graphic save information. The buffer is saved into the user-store nonvolatile memory under the name, "ESCg3_Save"

Note: The [ESC] g <3> command is supplied for compatibility with the Series 80PLUS and 90PLUS printers.

Bar Codes

The Epic 880™ Printer supports the ability to print bar codes. The printer offers a number of formats as defined below. The host does not need to form the graphic image for these bar codes. The host need only send the printer the information to be bar coded and a graphic is generated by the printer. In some cases, a check character is required by the format. In most cases, the printer generates the check character and inserts it correctly in the format. The printer uses internal graphic modes to form bar code images, and the images are adjusted for ink bleed. In general, the bar codes generated by sending graphic data to the printer are not as readable as the bar codes the printer generates. Bar codes are printed at a 203 x 203 resolution.

Barcodes may be printed horizontally or vertically. When printed vertically the length of the barcode can be greater (i.e. more characters can be printed). You can not print human readable interpretation (HRI) characters in vertical mode. It is generally better to print vertical barcodes by printing horizontal barcodes in page mode rotated 90° or 270°. You can then mix HRI and other text with the barcodes.

| Function | Print bar code |
|--|---|
| ASCII | [ESC] b <n> {information} [ETX] |
| Hexadecimal | 1BH 62H <n> ... 03H |
| Decimal | <27> <98> <n> ... <3> |
| IPCL | &%25 ... [CR] |
| | &%39 ... [CR] |
| | &%12 ... [CR] |
| | &%28 .<m ₁ > <m ₂ > Code 128 (allows a two character length, preceding the information) |
| | &%UP ... [CR] UPC A |
| | &%UE ... [CR] UPC E |
| | &%EA .. [CR] EAN-13 |
| | &%E8 ... [CR] EAN-8 |
| | &%93 .. [CR] Code 93 |
| | &%CB .. [CR] Codabar |
| EPOS | [ESC] b <n> or [GS] k <n> |
| Description The [ESC] b <n> {information} [ETX] command prints information as a bar code. The bar code is centered on the print zone. | |
| Where n = | |
| 0 | Interleaved 2 of 5 Numeric (0-9) only; must be even number of digits |
| 1 | Code 39 26 uppercase letters (A-Z); 10 digits (0-9) (See description for full 128 character set support) |
| 2 | Code 128 (See description for character set selection) |
| 3 | UPC A Numeric (0-9) only; 11 digits |
| 4 | EAN-13 Numeric (0-9) only; 12 digits |
| 5 | UPC E Numeric (0-9) only; 11 digits |
| 6 | EAN-8 Numeric (0-9) only; 7 digits |
| 7 | Code 93 26 letters; 10 digits (0-9); and 7 special characters |
| 8 | Codabar 10 digits (0-9); 4 start/stop characters, A, B, C, and D; and 6 special characters. |
| 9 | PDF-417 2D alpha Numeric (See notes below) |
| 12 | EAN-14 Numeric (0-9) only 14 digits |

Note: You may print barcodes in page mode. If you rotate these barcodes 90° or 180° you can get significantly longer barcodes.

Interleaved 2 of 5

Interleaved 2 of 5 is a high-density, self-checking, continuous, numeric bar code. It is mainly used where fixed-length numeric fields are required. The data field must be an even number of characters. If an odd data field is sent to the Epic 880™ printer, it will be zero padded. Due to space limitations, only 16 characters can be printed.

Code 39

Code 39 is an alphanumeric bar code. It is a discrete, self-checking, variable-length code. The printer prints the complete data field. The number of characters that can be printed depends on the bar width scaling. If the bar code scale is set to 2, 17 characters may be printed per line. There are two modes of operation for the Code 39 barcodes. The first is in a variable length format. In this mode all characters sent to the printer will be printed up to the termination character. Only 0-9, A-Z -, period, and space may be printed. \$, %, +, and / Characters may be used as escape characters for full 128 character support. If illegal characters are passed to the printer, they are converted to legal codes. (For example, a would be converted to A).

In full 128 character mode, the printer will encode the full 128 character set. In this mode, the first character received must be the length. IE. [ESC]k<1><n>... where n specifies the number of characters to follow. The characters following n characters may be from 0 to 127. Values greater than 127 are converted to printable characters by removing the 8th bit.

The following table specifies the Code 39 character set.

| ASCII | Code | ASCII | Code | ASCII | Code | ASCII | Code |
|-------|------|-------|-------|-------|------|-------|------|
| NUL | %U | SP | Space | @ | %V | ` | %W |
| SOH | \$A | ! | /A | A | A | a | +A |
| STX | \$B | " | /B | B | B | b | +B |
| ETH | \$C | # | /C | C | C | c | +C |
| EOT | \$D | \$ | /D | D | D | d | +D |
| ENQ | \$E | % | /E | E | E | e | +E |
| ACK | \$F | & | /F | F | F | f | +F |
| BEL | \$G | ' | /G | G | G | g | +G |
| BS | \$H | (| /H | H | H | h | +H |
| HT | \$I |) | /I | I | I | i | +I |
| LF | \$J | * | /J | J | J | j | +J |
| VT | \$K | + | /K | K | K | k | +K |
| FF | \$L | , | /L | L | L | l | +L |
| CR | \$M | - | - | M | M | m | +M |
| SO | \$N | . | . | N | N | n | +N |
| SI | \$O | / | /O | O | O | o | +O |
| DLE | \$P | 0 | 0 | P | P | p | +P |
| DC1 | \$Q | 1 | 1 | Q | Q | q | +Q |
| DC2 | \$R | 2 | 2 | R | R | r | +R |
| DC3 | \$S | 3 | 3 | S | S | s | +S |
| DC4 | \$T | 4 | 4 | T | T | t | +T |
| NAK | \$U | 5 | 5 | U | U | u | +U |
| SYN | \$V | 6 | 6 | V | V | v | +V |
| ETB | \$W | 7 | 7 | W | W | w | +W |
| CAN | \$X | 8 | 8 | X | X | x | +X |
| EM | \$Y | 9 | 9 | Y | Y | y | +Y |
| SUB | \$Z | : | /Z | Z | Z | z | +Z |
| ESC | %A | ; | %F | [| %K | { | %P |
| FS | %B | < | %G | \ | %L | | %Q |
| GS | %C | = | %H |] | %M | } | %R |
| RS | %D | > | %I | ^ | %N | ~ | %S |
| US | %E | ? | %J | _ | %O | DEL | %T |

Figure 28 Code 39 Full 128 Character Encoding

Code 128

Code 128 is an alphanumeric bar code. It is a high-density, variable-length, continuous code, which employs multiple element widths. Code 128 has three possible start codes. The start code defines the code set, Code A, B, or C that will be used to generate the barcode. The Epic 880™ allows the code set to be specified, or it can be select by the printer based on the information in the data field.

To specify code set: [ESC] b <2> <Code>{information} [ETX]

If the first character in the data field <Code> is a start code as shown in Figure 29 below, the printer will print the complete data field from the selected set. Due to space limitations, only ten characters can be printed. The check digit is generated and printed by the printer. Characters are also specified as shown in Figure 29.

To have the printer selected code set and automatically generate an optimal barcode, the value of Code should be the length.

[ESC] b <2> <Length>{information}

If the first character <Length> is from 1 to 31, the printer will automatically select Code A, B, or C depending on the data present. If the data is all numeric, the data can be printed as pairs. This effectively doubles the amount of data that can be printed. The check digit is generated and printed by the printer.

Note: If the first character is greater than <31> and not <135> through <137>, the printer will discard the first character and print the data as defined in Code A..

Space is defined as a <0>, which makes programming difficult and causes control character conflicts for the printer. To solve the problem, the Epic 880™ Printer subtracts 32 from all characters that are to be included in the bar code. In the Code 128 definition, an 'A' is <33>; however, the printer converts an ASCII 'A' (<65>) to a <33> internally. This sets Code 128C and the start codes off by 32.

Barcode 128 consists of 107 unique symbols. 101 of the symbols take on different meanings based on the start code or an embedded shift code sequence. Code stick A consists of alphanumeric characters and ASCII control codes (see the table below). Code stick B consists of Alpha numeric with lower case alpha, Code stick C consists of numeric pairs.

In automatic mode, any ASCII data from 0 to 127 could be entered. Values less than 32 will be encoded as Code stick A NUL- US, values from 96 through 127 will be encoded from Code stick B. Where ever possible numeric pairs will be encoded from Code stick C.

In the past, FNC1, FNC2, FNC3, and FNC4 have not been accessible to the programmer. The EAN 128 barcode requires that FNC1 be made available. To provide EAN 128 compatibility, the acceptable character range has been expanded by 10 to include the ability to specify FNC1, FNC2, FNC3 and FNC4. In automatic mode, values of 130-132 will be accepted, however, the resulting barcode may be unreadable.

| 128 Code | Value in Decimal | Value in Hex |
|-----------|------------------|--------------|
| FNC3 | 128 | 80 |
| FNC2 | 129 | 81 |
| Not Valid | 130 | 82 |
| | 131 | 83 |
| | 132 | 84 |
| FNC4 | 133 | 85 |
| FNC1 | 134 | 86 |
| Start A | 135 | 87 |
| Start B | 136 | 88 |
| Start C | 137 | 89 |

Figure 29 Expanded Function Coding

Note: In automatic mode, FNC4 is always specified as 133 regardless of what code stick is currently active.

In most cases, the TransAct® supreme will generate the most compact barcode for you. However, if it is desirable to have complete control, the programmer should use manual mode.

| | | | | TransAct Manual Encoding | |
|------------|--------|--------|----------------|--------------------------|-----------|
| Code Stick | | | Code 128 Value | Decimal Value | Hex Value |
| Code A | Code B | Code C | | | |
| Space | Space | 00 | 00 | 32 | 20 |
| ! | ! | 01 | 01 | 33 | 21 |
| " | " | 02 | 02 | 34 | 22 |
| # | # | 03 | 03 | 35 | 23 |
| \$ | \$ | 04 | 04 | 36 | 24 |
| % | % | 05 | 05 | 37 | 25 |
| & | & | 06 | 06 | 38 | 26 |
| ' | ' | 07 | 07 | 39 | 27 |
| (| (| 08 | 08 | 40 | 28 |
|) |) | 09 | 09 | 41 | 29 |
| * | * | 10 | 10 | 42 | 2A |
| + | + | 11 | 11 | 43 | 2B |
| , | , | 12 | 12 | 44 | 2C |
| - | - | 13 | 13 | 45 | 2D |
| . | . | 14 | 14 | 46 | 2E |
| / | / | 15 | 15 | 47 | 2F |
| 0 | 0 | 16 | 16 | 48 | 30 |
| 1 | 1 | 17 | 17 | 49 | 31 |
| 2 | 2 | 18 | 18 | 50 | 32 |
| 3 | 3 | 19 | 19 | 51 | 33 |
| 4 | 4 | 20 | 20 | 52 | 34 |
| 5 | 5 | 21 | 21 | 53 | 35 |
| 6 | 6 | 22 | 22 | 54 | 36 |
| 7 | 7 | 23 | 23 | 55 | 37 |
| 8 | 8 | 24 | 24 | 56 | 38 |
| 9 | 9 | 25 | 25 | 57 | 39 |
| : | : | 26 | 26 | 58 | 3A |
| : | : | 27 | 27 | 59 | 3B |
| < | < | 28 | 28 | 60 | 3C |
| = | = | 29 | 29 | 61 | 3D |
| > | > | 30 | 30 | 62 | 3E |
| ? | ? | 31 | 31 | 63 | 3F |
| @ | @ | 32 | 32 | 64 | 40 |
| A | A | 33 | 33 | 65 | 41 |
| B | B | 34 | 34 | 66 | 42 |
| C | C | 35 | 35 | 67 | 43 |
| D | D | 36 | 36 | 68 | 44 |
| E | E | 37 | 37 | 69 | 45 |
| F | F | 38 | 38 | 70 | 46 |
| G | G | 39 | 39 | 71 | 47 |
| H | H | 40 | 40 | 72 | 48 |
| I | I | 41 | 41 | 73 | 49 |
| J | J | 42 | 42 | 74 | 4A |
| K | K | 43 | 43 | 75 | 4B |
| L | L | 44 | 44 | 76 | 4C |
| M | M | 45 | 45 | 77 | 4D |
| N | N | 46 | 46 | 78 | 4E |
| O | O | 47 | 47 | 79 | 4F |
| P | P | 48 | 48 | 80 | 50 |
| Q | Q | 49 | 49 | 81 | 51 |
| R | R | 50 | 50 | 82 | 52 |
| S | S | 51 | 51 | 83 | 53 |
| T | T | 52 | 52 | 84 | 54 |
| U | U | 53 | 53 | 85 | 55 |

| Code 128 Encoding | | | | TransAct Manual Encoding | |
|-------------------|--------|--------|----------------|--------------------------|-----------|
| Code Stick | | | Code 128 Value | Decimal Value | Hex Value |
| Code A | Code B | Code C | | | |
| V | V | 54 | 54 | 86 | 56 |
| W | W | 55 | 55 | 87 | 57 |
| X | X | 56 | 56 | 88 | 58 |
| Y | Y | 57 | 57 | 89 | 59 |
| Z | Z | 58 | 58 | 90 | 5A |
| [| [| 59 | 59 | 91 | 5B |
| \ | \ | 60 | 60 | 92 | 5C |
|] |] | 61 | 61 | 93 | 5D |
| ^ | ^ | 62 | 62 | 94 | 5E |
| _ | _ | 63 | 63 | 95 | 5F |
| NUL | | 64 | 64 | 96 | 60 |
| SOH | a | 65 | 65 | 97 | 61 |
| STX | b | 66 | 66 | 98 | 62 |
| ETH | c | 67 | 67 | 99 | 63 |
| EOT | d | 68 | 68 | 100 | 64 |
| ENQ | e | 69 | 69 | 101 | 65 |
| ACK | f | 70 | 70 | 102 | 66 |
| BEL | g | 71 | 71 | 103 | 67 |
| BS | h | 72 | 72 | 104 | 68 |
| HT | i | 73 | 73 | 105 | 69 |
| LF | j | 74 | 74 | 106 | 6A |
| VT | k | 75 | 75 | 107 | 6B |
| FF | l | 76 | 76 | 108 | 6C |
| CR | m | 77 | 77 | 109 | 6D |
| SO | n | 78 | 78 | 110 | 6E |
| SI | o | 79 | 79 | 111 | 6F |
| DLE | p | 80 | 80 | 112 | 70 |
| DC1 | q | 81 | 81 | 113 | 71 |
| DC2 | r | 82 | 82 | 114 | 72 |
| DC3 | s | 83 | 83 | 115 | 73 |
| DC4 | t | 84 | 84 | 116 | 74 |
| NAK | u | 85 | 85 | 117 | 75 |
| SYN | v | 86 | 86 | 118 | 76 |
| ETB | w | 87 | 87 | 119 | 77 |
| CAN | x | 88 | 88 | 120 | 78 |
| EM | y | 89 | 89 | 121 | 79 |
| SUB | z | 90 | 90 | 122 | 7A |
| ESC | { | 91 | 91 | 123 | 7B |
| FS | | 92 | 92 | 124 | 7C |
| GS | } | 93 | 93 | 125 | 7D |
| RS | ~ | 94 | 94 | 126 | 7E |
| US | DEL | 95 | 95 | 127 | 7F |
| FNC3 | FNC3 | 96 | 96 | 128 | 80 |
| FNC2 | FNC2 | 97 | 97 | 129 | 81 |
| Shift | Shift | 98 | 98 | 130 | 82 |
| Code C | Code C | 99 | 99 | 131 | 83 |
| Code B | FNC4 | Code B | 100 | 132 | 84 |
| FNC4 | Code A | Code A | 101 | 133 | 85 |
| FNC1 | | | 102 | 134 | 86 |
| Start Code A | | | 103 | 135 | 87 |
| Start Code B | | | 104 | 136 | 88 |
| Start Code C | | | 105 | 137 | 89 |
| Stop | | | - | - | - |

Figure 30 Code 128 Encoding Values

UPC A

UPC A is a fixed-length, numeric, continuous code that employs four element widths. The printer supports Universal Product Code Version A, E, EAN-8, and EAN-13. Version A encodes 11 digits. Typically, the UPC A format starts with a number system digit, five-digit manufacturer's code, five-digit product code, and a check digit. The printer makes no assumptions about any of the codes except the check digit. The printer prints an UPC bar code with the 11 digits sent to it and generates the check digit. If fewer than 11 digits are sent, the remaining digits will be zeros. The printer prints an UPC that is about 130% the size of the UPC nominal standard, which provides optimal readability.

UPC E

UPC E is a zero suppression version of UPC. The printer requires that the first digit is zero for number system zero. If it is not zero, the bar code is not printed. The printer does the compression based on the compression rules for UPC E, prints an UPC bar code based on the 11 digits sent to it, and generates the check digit. If fewer than 11 digits are sent, the remaining digits will be zeros. The printer prints an UPC that is about 130% the size of the UPC nominal standard, which provides optimal readability.

EAN-13

EAN-13 is a fixed-length, numeric, continuous code that employs four element widths. The printer supports EAN-13, which is a superset of UPC that encodes 12 digits. Typically, the format starts with a number set digit, which defines how the next six digits are encoded. The next five digits have fixed encoding. The last is a check digit. The printer prints an EAN-13 bar code with the 12 digits sent to it and generates the check digit. If fewer than 12 digits are sent, the remaining digits will be zeros. The printer prints an EAN-13 bar code that is about 130% the size of the nominal standard, which provides optimal readability.

EAN-8

EAN-8 is a fixed-length, numeric, continuous code that employs four element widths. The printer supports EAN-8, which is a superset of UPC that encodes seven digits. The printer prints an EAN-8 bar code with the seven digits sent to it and generates the check digit. If fewer than seven digits are sent, the remaining digits will be zeros. The printer prints an EAN-8 bar code that is about 130% the size of the nominal standard, which provides optimal readability.

EAN-14

EAN-14 It is a high-density, fixed-length, numeric, continuous code, which employs multiple element widths. EAN-14, is a subset of Code 128 that encodes FNC1 and 14 digit pairs. If fewer than 14 digits are sent, leading zeros will be added to complete the code.

Code 93

Code 93 is a variable-length, alphanumeric bar code. The complete data field is printed by the printer. Due to space limitations, only 10 characters can be printed.

Codabar

Codabar is a variable-length format, primarily used for numeric symbols. It offers 16 data characters, including the numeric digits zero through nine, and -, \$, :, /, ., and +.

Four unique start/stop characters, designated A, B, C, and D, are also available. Due to space limitations, only 12 characters can be printed.

Note 1: A [CR] may also be used in place of the [ETX] to end the bar code data field.

Note 2: Only information that is usable in a particular bar code will be printed.

PDF 417

PDF 417 is a two dimensional barcode that will encode the full ASCII character set. As it encodes the full set including control characters, the length of the following data must be provided to the printer. The form of the command is as follows:

[ESC]b<9><nL><nH><d1> ... <dn>

Where the data length is $(nH * 256) + nL$. The length is limited to be from 1 to 2048 characters.

To control the formation of the barcode, the X and Y aspect ratios, rows and columns, and error correction levels can be altered.

| Function | PDF 417 bar code control |
|--|---|
| ASCII | [ESC] [EM] E <f> <v> |
| Hexadecimal | 1BH 19H 45H <f> <v> |
| Decimal | <27> <25> <69><f> <v> |
| IPCL | None |
| EPOS | None |
| Description This command alters the way PDF 417 barcodes are generated and printed. | |
| Where f = Feature to control and v = the value of the feature. | |
| f = C, 43H, 67 | Set encoding columns. v = 1-30, 0 sets to auto |
| f = R, 52H, 82 | Set encoding rows. v = 3-90, 0 sets to auto. |
| f = X, 58H, 88 | Set encoding X aspect. v = 2-6, 3 is default. |
| f = Y, 59H, 89 | Set encoding Y aspect. v = 2-32, 9 is default |
| f = E, 45H, 69 | Set error correction level. If v between 1 and 40 it is interpreted as a percentage of the data. If v is between 48 and 56 it is set to a specific level of 0 to 8. If v = 0, it will return it to the default setting of 10%. |

Typically the row and columns should be set to 0 so that auto encoding will be used. The X and Y aspect represent the number of dots horizontally and vertically to form the smallest image element. Values of 2 for each produce very small elements, and is probably too small unless good paper is used. The defaults are 3 by 9, which produce easily readable barcodes.

Error correcting levels are selected using one of two methods. The first is a fixed level.

| v | Level | Code Word |
|----|---------|-----------|
| 48 | Level 0 | 2 |
| 49 | Level 1 | 4 |
| 50 | Level 2 | 8 |
| 51 | Level 3 | 16 |
| 52 | Level 4 | 32 |
| 53 | Level 5 | 64 |
| 54 | Level 6 | 128 |
| 55 | Level 7 | 256 |
| 56 | Level 8 | 512 |

The second way is to determine correction level based on the amount of data in the barcode. This is determined by calculating a correction ration based on the formula:
 $Cf = (v * 0.1 * Len)$

| Cf | Level | Code Word |
|---------|---------|-----------|
| 0-3 | Level 1 | 4 |
| 4-10 | Level 2 | 8 |
| 11-20 | Level 3 | 16 |
| 21-45 | Level 4 | 32 |
| 46-100 | Level 5 | 64 |
| 101-200 | Level 6 | 128 |
| 201-400 | Level 7 | 256 |
| 401 Up | Level 8 | 512 |

Function Set bar code height

ASCII [ESC] [EM] B <n>

Hexadecimal 1BH 19H 42H <n>

Decimal <27> <25> <66> <n>

IPCL &%BH <m>

EPOS [GS] h <n>

Description The [ESC] [EM] B <n> command sets the bar code height where <n>*24 is the number dots. The default is n = 4, and results in a barcode that is about 0.47 inches high.

Function Set bar code width

ASCII [ESC] [EM] W <n>
Hexadecimal 1BH 19H 57H <n>
Decimal <27> <25> <87> <n>
IPCL &%BW <m>
EPOS [GS] w <n>

Description The [ESC] [EM] w <n> command sets the minimum bar width. The value may be between 1 and 8. The default is 3.

Note: A value of 1 may result in barcodes that are unreadable with some readers.

Function Set bar code justification, human readable interpretation (HRI) character print mode, and print direction

ASCII [ESC] [EM] J <n>
Hexadecimal 1BH 19H 4AH <n>
Decimal <27> <25> <74> <n>
IPCL &%BJ <m₁> <m₂>
EPOS none

The power on default is center justified with HRI characters not printed.

Description The [ESC] [EM] J <n> command selects the operation of the bar code justification, HRI characters, and print direction.

| Where n bits | n | IPCL | 76543210 |
|--------------|----|----------|--|
| | | -----xx | Justified |
| 0 | 00 | -----00 | Left |
| 1 | 01 | -----01 | Center |
| 2 | 02 | -----10 | Right |
| | | --xx---- | HRI characters |
| 0 | 00 | --00---- | Not printed |
| 16 | 16 | --01---- | Printed above the bar code |
| 32 | 32 | --10---- | Printed below the bar code |
| 48 | 48 | --11---- | Printed above and below the bar code |
| | | -x----- | Vertical print mode. (Page mode may work better) |
| 0 | 00 | -0----- | Bar code printed in horizontal direction (default) |
| 64 | 64 | -100---- | Bar code printed in vertical direction |

Note 1: The [ESC] [EM] J <n> command only affects bar code printing.

Note 2: HRI is not available in vertical print mode. You may print normal barcodes in page mode, which will provide for HRI and significantly longer barcodes.

Electronic Journal

The Epic 880™ has the capability to store electronic journal⁸ data in flash memory. There are two ways entries can be made into the electronic journal. The first is by selecting the journal station. The second is by requesting that print data be placed into the electronic journal.

Before the electronic journal can be used, it must be configured and initialized.

Configuring the Electronic Journal

The Epic 880™ has about⁹ 1024K bytes of flash that can be assigned to the electronic journal or to extended user store. The 1024K is segmented in 64K segments, which may be assigned to either to electronic journal or extended user store. That is you can assign 2 segments or 128K to the electronic journal and the remaining segments will be assigned to extended user store.

When electronic journal is in use, you cannot reconfigure the configuration of the extended flash memory. If you want to reconfigure the flash, the electronic journal must be erased. To erase the electronic journal you must know the password that was assigned when it was initialized. When printers are initially configured by TransAct, the extended flash is erased and partitioned but not initialized. Before you use the electronic journal you must initialize it.



CAUTION: You can use the extended user store without initializing the electronic journal. If any data has been stored in the extended user store, it will be lost if the extended flash is repartitioned.



CAUTION: The printer does not stop if the electronic journal runs out of memory. If the printer were to stop there would be no way for the host to print and clear the journal. The host system should monitor the Journal with the [ENQ]<25> command. This command will return the electronic journal status and report how much memory is remaining (See page 145). When the free electronic journal space is less than a predetermined amount, the journal should be printed or retrieved and then reinitialized.

Electronic Journal Security

Electronic journal security is provided by applying a password to the erase feature of the electronic journal. Additionally, there is a factory set configuration that disables the ability for the operator to print the journal through the keypad.

It is possible to assign a blank password to the electronic journal. If this is done either through the keypad or by host control, the manual print mode will be allowed to erase and reinitialize the journal.

⁸ It must be noted that the TransAct® Epic 880™ does not maintain the current time or date. If a journal entry is to contain the time and/or date, the host system must transfer this as printable text.

It is up to the end user of the Epic 880™ to implement and use the level of security that is required.



CAUTION: If you have initialized the electronic journal and don't know the password, there is no way to erase the electronic journal without returning the printer for service. The warranty does not cover this. All Epic 880™s are shipped with the electronic journal partitioned and erased but not initialized.

Initializing the Electronic Journal

Once the electronic journal is partitioned, it can be initialized. Initializing the electronic journal sets the password and formats the flash to accept journal entries. Each entry may be any length up to 8K, and entries greater than 8K are truncated. Entries will be added to the electronic journal until it is full. If the electronic journal is full, entries will be lost. The [ENQ]<25> command can be used to query the state of the electronic journal.

Electronic Journal Configuration and Reporting Commands

Function Initialize and Set Password

| | |
|-------------|------------------------------|
| ASCII | [ESC][GS]I<Password><0> |
| Hexadecimal | 1BH 1DH 49H <Password><0x00> |
| Decimal | <27> <29><73> <Password><0> |
| IPCL | &%EI<Password>& |
| EPOS | |

Description This command initializes the electronic journal and sets the password that allows the electronic journal to be erased. The password may be up to 14 characters and may contain any alphanumeric characters.

Note: The electronic journal can not be deleted without this password.

Function Erase the Electronic Journal

| | |
|-------------|------------------------------|
| ASCII | [ESC][GS]E<Password><0> |
| Hexadecimal | 1BH 1DH 45H <Password><0x00> |
| Decimal | <27> <29><50> <Password><0> |
| IPCL | &%EC<Password>& |
| EPOS | |

Description This command erases all of the electronic journal. The password was set using the [ESC][GS]I command.

Note: The electronic journal can not be deleted without this password.

| Function | Print the Electronic Journal |
|----------|------------------------------|
|----------|------------------------------|

| | |
|-------|--|
| ASCII | [ESC][GS]P< S _i >< S _h >< L _i >< L _h > |
|-------|--|

| | |
|-------------|--|
| Hexadecimal | 1BH 1DH 50H < S _i >< S _h >< L _i >< L _h > |
|-------------|--|

| | |
|---------|--|
| Decimal | <27> <29><80> < S _i >< S _h >< L _i >< L _h > |
|---------|--|

| | |
|------|--|
| IPCL | &%EP <S> <L> (L and S are 4 digits ie. 00100020 for 20 records starting at 10) |
|------|--|

| | |
|------|--|
| EPOS | |
|------|--|

Description This command prints all or part of the electronic journal. <S_h>*256 + <S_i> specifies the first record to be printed and <L_h>*256 + <L_i> specifies the number of records to print. If <L_h>*256 + <L_i> are 0, records from the specified start to the last record are printed. Setting both start and end to 0 will print the complete contents of the electronic journal.

Note: The first record is identified as record 1.

| Function | Report the Electronic Journal |
|----------|-------------------------------|
|----------|-------------------------------|

| | |
|-------|--|
| ASCII | [ESC][GS]R< S _i >< S _h >< L _i >< L _h > |
|-------|--|

| | |
|-------------|--|
| Hexadecimal | 1BH 1DH 52H < S _i >< S _h >< L _i >< L _h > |
|-------------|--|

| | |
|---------|--|
| Decimal | <27> <29><82> < S _i >< S _h >< L _i >< L _h > |
|---------|--|

| | |
|------|--|
| IPCL | &%EQ <S> <L> (L and S are 4 digits ie. 00100020 for 20 records starting at 10) |
|------|--|

| | |
|------|--|
| EPOS | |
|------|--|

Description This command reports all or part of the electronic journal. <S_h>*256 + <S_i> specifies the first record to be printed and <L_h>*256 + <L_i> specifies the number of records to report. If <L_h>*256 + <L_i> are 0, all records from the specified start to the end are reported. Setting both start and end to 0 will report the complete contents of the journal.

Note: The first record is identified as record 1.

The report format will be as follows:

[STX] Record number [SOH] Record Text [ETX]

...

[EOT]

| Function | Set the Electronic Journal Record Header |
|----------|--|
|----------|--|

| | |
|-------|--------------------------|
| ASCII | [ESC][GS]F<String %d><0> |
|-------|--------------------------|

| | |
|-------------|-------------|
| Hexadecimal | 1BH 1DH 46H |
|-------------|-------------|

| | |
|---------|---------------|
| Decimal | <27> <29><70> |
|---------|---------------|

| | |
|------|------|
| IPCL | None |
|------|------|

| | |
|------|--|
| EPOS | |
|------|--|

Description This command allows the record separator that is printed between records to be changed. The default format is:

```
\r\nRecord %d\r\n
```

Where: \r represents CR, \n represents LF, %d represents the position of the record number.

Note: The %d must be present.

Note: This follows standard “C” programming conventions. Most standard “C” formatting print parameters may be used.

Note: The record header may be totally disabled by a configuration option.

| Function | Print/Report an Electronic Journal Log |
|----------|--|
|----------|--|

| | | |
|-------|------------|------------------|
| ASCII | [ESC][GS]L | Print the report |
|-------|------------|------------------|

| | | |
|----|------------|-------------------|
| Or | [ESC][GS]I | Return the report |
|----|------------|-------------------|

| | |
|-------------|--------------------|
| Hexadecimal | 1BH 1DH 4CH or 6CH |
|-------------|--------------------|

| | |
|---------|------------------------|
| Decimal | <27> <29><76> or <108> |
|---------|------------------------|

| | | |
|------|------|------------------------------------|
| IPCL | &%UL | (No IPCL for returning the report) |
|------|------|------------------------------------|

| | |
|------|--|
| EPOS | |
|------|--|

Description This command prints or returns a summary of the electronic journal. The format is as follows:

Electronic journal is inactive. (The electronic journal is off, or not initialized)

or Electronic journal has xxxx Records and is full.

or Electronic journal has xxxx Records with yyyyyy bytes free.

| Function | Query the Electronic Journal |
|----------|------------------------------|
|----------|------------------------------|

| | |
|-------|-----------|
| ASCII | [ENQ]<25> |
|-------|-----------|

| | |
|-------------|---------|
| Hexadecimal | 05H 19H |
|-------------|---------|

| | |
|---------|-----------|
| Decimal | <05> <25> |
|---------|-----------|

| | |
|------|------|
| IPCL | None |
|------|------|

| | |
|------|--|
| EPOS | |
|------|--|

Description This is a real time status request that returns the current state of the electronic journal.

Return Format: [NAK]<25><42>< n_H >< n_L >

[NAK] EJ is not active. It is either off, not initialized or full. If $n_H * 256 + n_L$ is not zero, the EJ is available but not initialized and $n_H * 256 + n_L$ is the available space in K (1024) bytes.

or [ACK]<25><42>< n_H >< n_L >

[ACK] the EJ is active and available and $n_H * 256 + n_L$ is the available space in K (1024) bytes.

Printing/Reporting and Resetting the Electronic Journal

The electronic journal may be printed on the receipt or reported to the host. The printed report will print each journal entry with an entry separator defined by the user (or, if not defined, with a default). The journal can be erased and reinitialized at any time. It is up to the host application to assure the electronic journal is reported or printed before it is erased. To provide some level of security on the erase process, the erase function is password protected. The password is set by the previous initialize command. See the [ESC][GS]I and E commands for further details.

There are two ways to print the electronic journal: one is under host control, and the second is by entering journal print mode and using the keypad to control the printout.

Journal Entries and using Journal Print Mode

Journal print mode can be used to initialize, print then erase the electronic journal. To provide a level of security for the journal, if the electronic journal is initialized under software control and a password is provided, the electronic journal cannot be erased in journal print mode. There is also a factory configured mode that completely disables this feature.

To enter Journal Print Mode:

1. Press and hold the FEED¹⁰ Button until the PAPER indicator illuminates (Approximately 2 seconds)
2. Follow the directions printed on the receipt to select the desired option.

The available options are:

1. Initialize Journal. (If the electronic journal is not initialized)
2. Print Complete Journal.
3. Erase Complete Journal. (If the electronic journal is not password protected)
4. Print Last 20 Records
5. Print First Record.
6. Skip 10 Records.
7. Back 10 Records.
8. Print Remaining Journal.
9. Print Last Record.

When journal print is entered, the printer will print a short list of instructions, the available options, a summary of the total number of records in the journal, and the amount of space left.

¹⁰ The FEED button is a multifunction button. By pressing and releasing the FEED button, the printer will feed and cut a short thickset. This is intended to clear the printer after changing paper. By pressing and holding the FEED button for a longer time, two additional features may be activated. Pressing and holding the button for about two seconds will enter journal maintenance mode. Holding the button for about 4 seconds will enter configuration mode. To aid in selecting the correct mode, the Error LED will illuminate as soon as the button is pressed and indicates that FEED is selected. After about 2 seconds the Error LED will go out and the PAPER indicator will illuminate. This indicates that Journal mode is selected. After about 4 seconds, the Cover LED will illuminate indicating configuration mode is selected.

Journal Print Mode Options

Initialize Journal

If this option is offered, the journal has never been initialized. Selecting this option will initialize the journal with no password. Once initialized, the journal configuration cannot be changed unless the journal is erased by command.

Print Complete Journal.

This option will print the complete journal log from record 1 to the end. The printer will use the default configuration and emulation to print the log. That is if the printer is configured for TransAct® PcOS emulation and set to 6 lpi, large draft 16 cpi, the printer will print the log with these defaults. If a journal entry has been saved with print mode settings they will take effect for all following entries.

Erase Complete Journal.

If the electronic journal is not password protected, this option will erase the complete journal and reinitialize it.

Printing part of the journal.

- Print Last 20 Records
- Print First Record.
- Skip 10 Records.
- Back 10 Records.
- Print Remaining Journal.
- Print Last Record.

These commands will allow part of the journal to be printed. For example if the last 10 journal entries are to be printed, select print last record, then back 10 and then print remaining journal.

Security

The security of the journal is up to the user. If the journal is host controlled, it should be password protected and if manual printing is not desirable, the printer should be configured so as to disable manual printing. The TransAct® printer configuration utility will allow set and clear this feature. When Epic 880™ printers leave the factory, the electronic journal is erased and is not initialized.

Electronic Journal Entries

There are two ways to place information in the electronic journal. The first is by selecting journal mode. The second is by requesting that validation or receipt information is copied into the electronic journal.

If you select journal mode, information sent to the printer is not printed, but stored in the flash memory. The information is stored as records in a linked list. Whenever a "journal mode begin" command is received, a new record is started. When journal mode is exited, the record is finished, closed and the link updated. This journal mode is intended to be printed at a later time. No printer control codes are allowed in the journal. Only [CR], [HT] and [LF] commands are allowed. Any other control character will end the journal record. Use [EOT] or [NUL] to provide the most graceful exit from journal mode.

The other way to place information in the electronic journal is with carbon copy mode. In this mode select information sent to the validation or receipt station is carbon copied into the electronic journal. A record is started with the "Electronic Journal Begin" command and ended with the "Electronic Journal End" command. There is an "Electronic Journal Suspend" and "Electronic Journal Resume" which allows some information not to be saved.

```
[esc] [P<12 [esc] I<1> [esc] 0 [esc] a<1>
[ESC] [@<4><0><0><0><34><2> [ESC] c<1>
QUICK MART[CR] [LF]
[ESC] [@<4><0><0><0><17><1>
1234 Rt1 Anytown,CT[CR] [LF]
[esc] c<0> [esc] I<0>
203-123-4567 [cr] [lf]
[esc] [P<15> [esc] a<0> [CR] [LF]
[esc] l<3>                                     Start journal record
---{Date:0} {Time:0:}-- [cr] [lf]
ST# 2000  OP# 00067  TE# 021 0035 [CR] [LF]
[esc] l<2>                                     Suspend the record
KLEENEX FAM  D04 QTY 1      1.68 J [CR] [LF]
RITZ          D01 QTY 1      2.50 D [CR] [LF]
CHIPS         D01 QTY 1      1.50 D [CR] [LF]
STORAGE BAG  D04 QTY 1      1.50 J [CR] [LF]
[esc] <1>                                     Resume the record
                SUB TOTAL    8.68 [CR] [LF]
                SALES TAX    1.50 [CR] [LF]
                ----- [CR] [LF]
                TOTAL       10.18 [CR] [LF]
                CASH TEND   20.00 [CR] [LF]
[ESC] c<1>
                CHANGE DUE  9.82[CR] [LF]
[ESC] c<0>
[esc] l<0>                                     End the record
[esc] a<1> [LF] [LF] [ESC] [@<4><0><0><0><34><2>
THANK YOU [CR] [LF]
[ESC] [@<4><0><0><0><17><1>
FOR SHOPPING WITH US [cr] [lf]
[esc] a<0> [esc] d<15> [esc] v
```


The resulting journal entry would then only contain:

```
---{Date:0} {Time:0:}--  
ST# 2000  OP# 00067  TE# 021 0035  
      SUB TOTAL      8.68  
      SALES TAX       1.50  
      -----  
      TOTAL          10.18  
      CASH TEND      20.00  
      CHANGE DUE  9.82
```

In carbon copy mode any printer control commands in the record data will be added to the journal record. As the records are printed, those commands will be used to format the print. Some care should be taken to assure that only format control command that you intend to be printed later get in the journal.

Note: Information is gathered in packets or 16 bytes. If power is lost before the record is closed, up to 16 bytes of information may be lost. The link list will be repaired, with data loss, when power is next applied.

Journal mode

Journal mode is a station select command. All data sent to the printer, following the journal mode select command, is stored in the EJ as a single record. Any control commands sent to the electronic journal will end the journal entry. An EOT, NUL or any printer command will end journal mode. Typically an EOT, CAN or station select will be used to end the journal mode.

| Function | Electronic Journal Mode Begin |
|-------------|-------------------------------|
| ASCII | [ESC]{ |
| Hexadecimal | 1BH 7BH |
| Decimal | <27> <123> |
| IPCL | None |
| EPOS | |

Description The function enters journal mode. When in journal mode, commands are parsed and any command that is not appropriate is removed, causes journal mode to exit, or is saved.

In general commands to involve printer operation are ignored, Commands that will cause a basic change in the printer like the [ESC]@ Initialize printer command stop the journal entry. Commands that return a response from the printer are not placed in the journal.

All other commands are placed in the journal, and will be processed when the journal is printed.

The [EOT] (4 or 4H) and CAN (24 or 14H) will cause the journal to stop and will not be processed again.

In typical operation, a station select command should be used to exit journal mode. Note that any station select including another Journal select will close the journal entry. If a Journal select is processed in Journal mode, the current record will be closed, and a new record opened.

Carbon Copy Journal Mode

Carbon copy mode allows information sent to the receipt or validation station to be copied into the electronic journal. An electronic journal entry is started with a “Start Carbon Copy” mode command and continues until a station select command is received or a “Stop Carbon Copy” command is received. The carbon copy operation may be suspended and restarted by a “Carbon Copy Suspend” and “Carbon Copy Resume” command. (Note: “Carbon Copy Suspend” and “Carbon Copy Resume” commands do not generate new electronic journal records.)

| Function | Electronic Carbon Copy Begin |
|----------|------------------------------|
|----------|------------------------------|

| | |
|-------------|---------------|
| ASCII | [ESC]I <3> |
| Hexadecimal | 1BH 6CH<3> |
| Decimal | <27> <108><3> |
| IPCL | &%EB |
| EPOS | |

Description This command begins a carbon copy journal entry.

| Function | Electronic Carbon Copy Suspend |
|----------|--------------------------------|
|----------|--------------------------------|

| | |
|-------------|--------------|
| ASCII | [ESC]I <2> |
| Hexadecimal | 1BH 6CH<2> |
| Decimal | <27><108><2> |
| IPCL | &%ES |
| EPOS | |

Description This command temporarily suspends carbon copy journal entry.

| Function | Electronic Carbon Copy Resume |
|----------|-------------------------------|
|----------|-------------------------------|

| | |
|-------------|--------------|
| ASCII | [ESC]I <1> |
| Hexadecimal | 1BH 6CH<1> |
| Decimal | <27><108><1> |
| IPCL | &%ER |
| EPOS | |

Description This command resumes a temporarily suspended carbon copy journal entry.

| Function | Electronic Carbon Copy End |
|----------|----------------------------|
|----------|----------------------------|

| | |
|-------------|---------------|
| ASCII | [ESC]I <0> |
| Hexadecimal | 1BH 6CH<0> |
| Decimal | <27> <108><0> |
| IPCL | &%EE |
| EPOS | |

Description This command ends a carbon copy journal entry.

Transport Control

The Epic 880™ is available with a transport that allows a printed ticket to be delivered only after the ticket is cut. To allow configuration and control of this feature several commands are provided. Note see [ENQ]<29> below for Jam and Transport status.

The Epic 880 has a ticket retract feature. It can be configured to automatically retract a ticket after a period of time or by command. This is configurable in the configuration or by command.

Function Set Transport Mode and Maximum ticket Loop

ASCII [ESC] i <f><v>
Hexadecimal 1BH 69H <f><v>
Decimal <27> <105> <f><v>

Description This command configured the transport operation and sets the maximum ticket loop allowed to be captured by the transport. There are three features configured by this command. This first is if the transport will hold or drop the delivered ticket. The second is if the Cut command will automatically deliver the ticket through the transport. The third is how long of a ticket may be stored in the transport before it is cut.

Where: f = Feature and v = setting

if f = 1 then v sets the maximum ticket that can be stored in the transport.

where v = 3 to 16 inches.

if f = 2 then v sets the Drop of Hold setting.

where v = 1 for drop and 0 for hold.

if f = 3 then v sets the Cut and transport mode.

where v = 0 the cut command will also transport the ticket. If v = 1 the cut will not transport the ticket. The ticket must be transported by command.

if f = 4 then v sets the auto retract timeout in seconds. If v = 0 the auto retract is off.

This value remains in affect until changed by this command or the printer is reset. A printer reset will load the configured timeout.

Function Deliver Ticket

ASCII [ESC] k
Hexadecimal 1BH 6BH
Decimal <27> <107>

Description This command will deliver a previously cut ticket. This command requires that the Cut/Transport mode be set to cut only.

Function Transport Feed

ASCII [ESC] j <n>
Hexadecimal 1BH 6AH <n>
Decimal <27> <106> <n>

Description This command feeds the transport independently of the print paper feed. This command may be used to drop a previously held ticket or clear the transport on error. This feed is based on the current vertical motion unit, which is typically 203 steps per inch.

Function Transport Ticket Retract**ASCII** [ESC] m**Hexadecimal** 1BH 6DH**Decimal** <27> <109>**Description** This command retracts the ticket being presented in the transport.

Miscellaneous Control

[ESC] X Set left/right print margins

ASCII [ESC] X <n₁> <n₂>
Hexadecimal 1BH 58H <n₁> <n₂>
Decimal <27> <88> <n₁> <n₂>
IPCL none
EPOS [ESC] Q

Description The [ESC] X <n₁> <n₂> command sets left and right print margins in characters from the home position. Where n₁ = left margin and n₂ = right margin, the absolute position depends on the current print pitch. If the left and right margins are set to the right of the current horizontal position, the new margins become valid in the same line. If the left margin is set to the left of the current horizontal position and the right margin set to the right of the current horizontal position, the right margin setting becomes valid in the same line, but the left margin setting becomes valid in the next line. When the left and right margins are set to the left of the current horizontal position, both left and right margin settings appear to become valid in the next line because an auto-CR is performed by the subsequent data.

[CAN] Clear print buffer

ASCII [CAN]
Hexadecimal 18H
Decimal <24>
IPCL &%RP
EPOS [CAN]

Description The [CAN] command clears the print buffer and any unprinted information in the printer received before it. If the input buffer is not being processed because the printer is out of paper or a form is not inserted, the [CAN] command will not be processed until after the error is cleared. The [CAN] command does not restore default conditions; it only clears the print buffer.

[ESC] q Query marker

ASCII [ESC] q <n>
Hexadecimal 1BH 71H <n>
Decimal <27> <113> <n>
IPCL none
EPOS none

Description The [ESC] q <n> command returns a status to the host when it is processed.

Response [SOH] <n>

The [ESC] q <n> command may be placed in the print data and, when processed by the printer, will return a progress status marker. The value of <n> can be any 8-bit value. It is returned to the host unaltered. The intent is for it to be a sequence number. The command can be used to track the print progress of the printer or verify that data has been printed.

Note: The [ESC] q <n> command is a line terminator that causes the printer to print all previous data. If a normal line terminator like a [CR] is not supplied, right justify and auto-center do not function correctly. All data is left justified. [ESC] q does not perform a [CR] or [LF] function.

[ESC] v Perform Auto Cut

ASCII [ESC] v
Hexadecimal 1BH 76H <n>
Decimal <27><118>
IPCL &%FC &%PC
EPOS [ESC] i or [ESC] m

Description The [ESC] v command operated the auto cutter.

Note: The auto cutter is optional. If the auto cutter is not installed, this command will be ignored.

[ESC] @ Initialize the printer

ASCII [ESC] @
Hexadecimal 1BH 40H
Decimal <27> <64>

Description The [ESC] @ command initializes the printer. All settings, including character font and line spacing, are canceled.

[ESC] p 4 Select paper sensor(s) to stop printing

ASCII [ESC] p 4 <n>
Hexadecimal 1BH 70H 34H <n>
Decimal <27> <112> <52> <n>
Range $0 \leq n \leq 255$

Description The [ESC] p 4 <n> command selects which sensors tell the printer to stop printing. For the default setting, only the Paper Out sensor stops printing. When the paper roll near-end sensor is enabled and the sensor detects a near-end condition during printing, the printer completes the current line and then automatically goes off-line. Replacing a new paper roll restarts the printing. When the paper roll near-end sensor is disabled and a paper near-end condition is detected during printing, the paper out LED comes on, but the printer continues to print.

Note: The Epic 880™ printer does not allow the Paper Out sensor to be disabled. It is always on.

<n> is defined as follows:

| Bit | On/Off | Hexadecimal | Decimal | Function |
|-----|--------|-------------|-------------|-------------------------------------|
| 0,1 | Off | 00H | <0> | Paper roll near-end sensor disabled |
| | On | 01H,02H,03H | <1>,<2>,<3> | Paper roll near-end sensor enabled |
| 7 | - | 00H | <0> | Undefined |

Table 7 Paper Sensor Commands

[ESC] p 3 Select paper sensor(s) to output paper-end signals

ASCII [ESC] p 3 <n>
Hexadecimal 1BH 70H 33H <n>
Decimal <27> <112> <51> <n>
Range $0 \leq n \leq 255$

Description The [ESC] p 3 <n> command selects the paper sensor that outputs a paper-end signal to the parallel interface when a paper-end is detected. The default setting is when all sensors are enabled. (<n> = 15). It is possible to select multiple sensors to output signals. If any of the sensors detect a paper end, the paper end signal is output. The command is only available with a parallel interface. The paper-end sensor is an option. If the sensor is not equipped, the settings of bits 0 and 1 of the command are not effective.

| Bit | On/Off | Hexadecimal | Decimal | Function |
|-----|--------|-------------|---------|-------------------------------------|
| 0 | Off | 00H | <0> | Paper roll near-end sensor disabled |
| | On | 01H | <1> | Paper roll near-end sensor enabled |
| 1 | Off | 00H | <0> | Paper roll near-end sensor disabled |
| | On | 02H | <2> | Paper roll near-end sensor enabled |
| 2 | Off | 00H | <0> | Paper roll end sensor disabled |
| | On | 04H | <4> | Paper roll end sensor enabled |
| 3 | Off | 00H | <0> | Paper roll end sensor disabled |
| | On | 08H | <8> | Paper roll end sensor enabled |
| 4-7 | - | - | - | Undefined |

Table 8 Paper Sensor Commands

[ESC] ~z User Control of Bezel

ASCII [ESC] ~ z <n>
Hexadecimal 1BH 7EH 7AH <n>
Decimal <27> <126> <122> <n>
IPCL %&BF
EPOS none

Description The [ESC] ~z <n> command sets a flash code into the bezel lamp control logic. This code will override any current flash code and will be overridden by any internally generated flash code.

Flash codes <n>:

Return Bezel Light to normal state.

Flash 1 time and pause

Flash 2 times and pause

...

8 Flash 8 times and pause

9 Fast steady blink

10 Slow steady blink

11 Active state

Note: The bezel logic may be set to default on or off for the inactive state. If set to be on by default, the flash will blink off.

[ESC] y Set control feature commands

| | |
|--------------------|--|
| ASCII | [ESC] y <n> |
| Hexadecimal | 1BH 79H <n> |
| Decimal | <27> <121> <n> |
| IPCL | &%Y0-9 or &%YX <m ₁ > <m ₂ > <m ₃ > (for numbers > 9) |
| EPOS | [ESC] y <n> |
| Where n | 0-1 Not valid |
| 2 | Reinitializes the printer and forces Epic 880™ mode |
| 3 | Reinitializes the printer and forces extended EPOS mode |
| 4 | Disables IPCL commands |
| 5 | Enables IPCL commands |
| 6 | Disables inquire processing (All command preprocessing is disabled.) |
| 7 | Enables inquire processing |
| 8 | Enables extended diagnostics |
| 9 | Print Current Configuration |
| 10 | Not used |
| 11 | Reserved |
| 12 | Reserved |
| 13 | Not used |
| 14 | Reserved |
| 15 | Print Current totals |
| 16 | Reserved |
| 17 | Requests the printer to enter remote OFF. |
| 18 | Requests the printer to exit remote OFF. |
| 20 | Reserved |

Description The [ESC] y <n> command enables and disables command set features. It is possible that the IPCL commands will interfere with print data. If this occurs, the IPCL can be disabled with an [ESC] y <4> command.

Note 1: Once IPCL commands are disabled, the Enable IPLC command will not be a valid IPCL code.

Note 2: [ESC] y <0>, <1>, <2>, and <3> allow the printer to switch between emulation modes. When the switch takes place, the current print buffer is printed, and the printer reinitializes. These commands do not permanently change the configuration. A power on reset restores the mode that was configured in menu mode. A reset by command or from the INIT pin does not restore the mode.

Note 3: [ESC] y <6> and <7> enable and disable the inquire process. These commands are not processed as they are received, but are buffered then processed. The buffering process allows inquire commands sent after a disable to be answered. In addition, inquires sent after an enable may not be answered. (See additional notes 3 and 4 on the next page).

Note 4: In EPOS mode, the [ESC] y command is active.

[ESC] ~ Extended Configuration and Control

ASCII [ESC] ~ <n>
Hexadecimal 1BH 7EH <n>
Decimal <27> <126> <n>
IPCL none
EPOS [ESC] ~ <n>

Description The [ESC] ~ <n> commands are extended diagnostics commands. They must all be preceded with an enabling command. These commands (in general) are not intended to be used by the end user.

Remote Power Control

The Epic 880™ Printer has a remote power control command that instructs it to enter OFF mode. When the command is issued, the printer performs print cartridge maintenance and enters OFF mode. Unlike manually turning the power off, remote power mode leaves the communications active. All commands except the exit power down command are ignored.

[ESC] y Remote Power Control

| | |
|--------------------|--|
| ASCII | [ESC] y <n> |
| Hexadecimal | 1BH 79H <n> |
| Decimal | <27> <121> <n> |
| IPCL | &%YX17 or &%YX18 |
| EPOS | [ESC] y <n> |
| Where n | 17 Requests the printer to enter remote OFF. 18 Requests the printer to exit remote OFF |

Description Inquiry (ENQ) commands are accepted and answered in remote power down mode. The printer reactivates if a power up command is received or the power is cycled.

Note 1: If power is lost after the power down command is issued, the printer will reenter normal operation when the power is restored.

Note 2: This command is not available in all configurations mode.

Documented Extended Control commands

The Epic 880™ has a number of Extended Control commands designed to make operation and maintenance of the printer easier for the host application. For further details, refer to the TransAct® Extended Control discussion in Chapter 8.

[ESC] ~V Return Firmware Checksum

ASCII [ESC] ~ Z
 Hexadecimal 1BH 7EH 5AH
 Decimal <27> <126> <90>
 IPCL none
 EPOS [ESC] ~ Z

Description The [ESC] ~ Z command is an extended diagnostics command that returns the Firmware checksum. It does not need to be preceded with an enabling command. The return is 4 bytes formatted as follows:

~Z<CK_H><CK_L>

[ESC] ~F Return Firmware Identification

ASCII [ESC] ~ F
 Hexadecimal 1BH 7EH 46H
 Decimal <27> <126> <69>
 IPCL none
 EPOS [ESC] ~ F

Description The [ESC] ~ F command is an extended diagnostics command that returns the Firmware Identification string. It does not need to be preceded with an enabling command. The return is 14 byte null terminated string containing a 2 byte command ID and a 12 byte firmware ID and revision number. The format is as follows:

~FPE8800-1.06<0>

Printer Status

Status Inquire

The Epic 880™ Printer is designed for use as part of an automated system where the host computer makes every attempt to correct problems with the printer. In addition, the host application requires that it be able to obtain more information from the printer than is typical of normal computer printers. For example, since a normal computer printer does not have cash drawers, such additional features require that the standard printer protocol be extended to deal with the added features of a point-of-sale (POS) printer.

All inquire commands are processed as they are received (preprocessed or real time) and require a response from the printer. Consequently, parallel, IEEE 1284 bidirectional communications, USB or bidirectional serial operation is required.

The Epic 880™ Printer looks at and evaluates all commands as they are received, and does not respond to inquire commands that happen to be embedded in graphics or other commands. For more details, refer to the buffer and preprocessor descriptions in later sections.

In all cases, inquire commands are responded to by an acknowledged (ACK) or a not acknowledged (NAK) and then the command ID, which allows the host application to make multiple requests and receive identifiable responses. If the printer is configured for serial or USB operation the status is automatically returned to the host. If the printer is configured for parallel, IEEE 1284 operation, the HOST must initiate a reverse channel request to return the status.

Serial and USB Mode Inquire

All inquire (ENQ) commands require a response from the printer. During serial operation, all inquire commands are responded to by an acknowledged (ACK) or not acknowledged (NAK), the command ID, and in some cases status. Most status responses sequences contain a length field to help decode and separate responses.

In general the printer should be configured for “Buffer Full Only” off-line operation if inquire commands are used. This prevents the printer from using flow control for anything but buffer full. The programmer must take on the responsibility for assuring that inquire commands are used to maintain status of the printer.

The printer always accepts serial data even when it is off-line. The printer has reserve buffer space that allows additional information to be received even if the printer is signaling buffer full or off-line. Because inquire commands are processed before they go into the buffer, the printer responds even when it is busy printing.

In serial mode, the response to an inquiry should be received by the host before another inquire command is issued to the printer. When the printer receives an inquiry, it generates a response. If inquiries are sent to the printer too quickly, the printer spends all of its time responding and does not have time to print.

IEEE 1284 Mode Inquire

In parallel IEEE 1284 mode, status information can be returned to the host through the IEEE 1284 reverse channel. After the host makes an inquire request, it activates IEEE 1284 mode 0 reverse channel and waits for a response from the printer. The response to the inquire is identical to serial mode in format.

The printer always accepts IEEE 1284 reverse-channel requests but does not accept inquire commands when off-line. It is possible to obtain status when off-line by placing the printer in dynamic response mode before the printer goes off-line. The IEEE 1284 reverse channel responds to status changes even when the printer is off-line.

In general, the printer should be configured for “Buffer Full Only” off-line operation if inquire commands are used. This prevents the printer from using flow control for anything but buffer full. The programmer must take on the responsibility for assuring that inquire commands are used to maintain status of the printer.

Inquire Commands

[ENQ] Inquire printer status

ASCII [ENQ] <n>
 Hexadecimal 05H <n>
 Decimal <5> <n>
 IPCL none
 EPOS [GS] r or [DLE] [ENQ] or [DLE] [EOT]

Description The [ENQ] <n> command inquires about the printer’s status and returns a result.

Note: When the printer is off-line, inquiries may not be accepted.

[ENQ] <3> Inquire paper low status

ASCII [ENQ] <3>
 Hexadecimal 05H 03H
 Decimal <5> <3>
 Function Receipt paper low
 Response ACK <3> (06H 03H) paper is present.
 NAK <3> (15H 03H) paper is low.

[ENQ] <4> Inquire receipt paper out status

ASCII [ENQ] <4>
Hexadecimal 05H 04H
Decimal <5> <4>
Function Receipt paper exhausted
Response ACK <4> (06H 04H) Receipt paper is present
NAK <4> (15H 04H) Receipt paper is exhausted

[ENQ] <8> Inquire cover open status

ASCII [ENQ] <8>
Hexadecimal 05H 08H
Decimal <5> <8>
Function Cover open/closed status
Response ACK <8> (06H 08H) The cover is closed
NAK <8> (15H 08H) The cover is open

[ENQ] <9> Is the buffer empty?

ASCII [ENQ] <9>
Hexadecimal 05H 09H
Decimal <5> <9>
Function The [ENQ] <9> command allows the host to know when the print buffer is empty. If IEEE 1284 is active, the command also clears the response buffer.
Response ACK <9> (06H 09H) The buffer is empty.
NAK <9> (15H 09H) The buffer is not empty.

[ENQ] <10> Request printer reset

ASCII [ENQ] <10>
Hexadecimal 05H 0AH
Decimal <5> <10>
Function Reset printer
Response Serial Parallel
ACK <10> (06H 0AH) No response
The command was accepted.
NAK <10> (15H 0AH)
The command was rejected.

Description The ENQ <10>, EPOS DLE ENQ <n> commands and the INIT pin all have the same effect and are referred to as reset commands. To prevent data loss, the printer tries to finish printing the buffered data. When operator intervention with the printer is required for any reason, data loss results. The reset operation is saved until the printer goes idle.

If the printer is idle and a reset command is received or pending, the printer resets, and the buffer clears. If the host resets an operator intervention operation, any remaining buffered data is cleared.

When the printer receives a reset command, the printer goes off-line and/or busy until the reset completes.

If the host application continues to send information to the printer after a reset command, some of that information may be processed before the reset is processed.

After the reset the transport is cleared. If it cannot be cleared a jam status may be issued.

Note: If reset inhibit is set in the configuration menu, this command is ignored.

| | |
|-------------------------|-----------------------------------|
| [ENQ] <11> | Inquire power cycle status |
|-------------------------|-----------------------------------|

ASCII [ENQ] <11>
Hexadecimal 05H 0BH
Decimal <5> <11>
Function Has the printer been power cycled since the last request?
Response ACK <11> (06H 0BH)
 Printer has been power cycled since the last [ENQ] <11>

NAK <5> (15H 0BH)
 Printer has not power cycled since the last [ENQ] <11>

Description The first time after a reset, the command returns [ACK] <11>, after that the command returns [NAK] <11>. The command allows the application to determine if the printer has been power cycled and needs to be reinitialized. The [ENQ] <10> command and the INIT signal on the parallel port both cause the printer to return power up status.

| | |
|-------------------------|--|
| [ENQ] <14> | Inquire Mechanical error status |
|-------------------------|--|

ASCII [ENQ] <14>
Hexadecimal 05H 0EH
Decimal <5> <14>
Function Error status
Response ACK <14> (06H 0EH) No mechanical errors
 NAK <15> (15H 0FH) Mechanical error has occurred
 (Use [ENQ]<22> to identify the error)

Note: For this status request to function, the "Buffer Full Only" off-line option should be selected.

| | |
|-------------------------|------------------------------|
| [ENQ] <15> | Inquire printer state |
|-------------------------|------------------------------|

ASCII [ENQ] <15>

Hexadecimal 05H 0FH

Decimal <5> <15>

Function The [ENQ] <15> command returns the current printer state

Note: [ENQ] <17> also returns the current printer state, but it should not be used as it conflicts with XON/XOFF flow control.

Response [ACK] <15> <n> <r₁> <r₂>...

Where:

<15> is the echo of the command ID.

<n> is the number of return bytes + 40 (28H)
(to prevent confusion with XON/XOFF).

<r₁>:

- bit 0 = 1 always
- bit 1 = Cover is closed.
- bit 2 = Receipt paper is out.
- bit 3 = 0
- bit 4 = 1 Printer is waiting in an error mode.
Use [ENQ]<22> to identify the specific error
and [ENQ]<10> to recover

bit 5 = 0

bit 6 = 1 always

bit 7 = 0 always

<r₂>:

- bit 0 - 5 = 0 always
- bit 6 = 1 always
- bit 7 = 0 always

Note: For this status request to function, the "Buffer Full Only" off-line option should be selected.

| | |
|-------------------------|-----------------------------------|
| [ENQ] <20> | Inquire all printer status |
|-------------------------|-----------------------------------|

ASCII [ENQ] <20>

Hexadecimal 05H 14H

Decimal <5> <20>

Function The [ENQ] <20> command returns all status flags

Response [ACK] <20> <n> <r₁> <r₂>...

Where:

<20> is the echo of command ID.

<n> is the number of return bytes + 40
(28H) (to prevent confusion with XON/XOFF).

<r₁>:

- bit 0 = 0
- bit 1 = 0
- bit 2 = Receipt paper is out.
- bit 3 = Ticket in transport
- bit 4 = Receipt paper error occurred. (low or out)
- bit 5 = 0

bit 6 = 1 always
 bit 7 = 0 always

<r₂>: bit 0 = 1 always
 bit 1 = Cover is closed.
 bit 2 = Buffer is empty.
 bit 3 = Printer has been power cycled,
 Reading this does not affect the state of the
 power-cycled flag. (Use [ENQ] <11> to reset
 the power cycled bit.)
 bit 4 = Printer is waiting in an error mode.
 Use [ENQ]<22> to identify the specific error
 and [ENQ]<10> to recover
 bit 5 = USB Watch Dog recovery has occurred.
 bit 6 = 1 always
 bit 7 = 0 always

<r₃>: bit 0 = 0 always
 bit 1 = 1 always
 bit 2 = Jam detected
 bit 3 = 0 always
 bit 4 = 0 always
 bit 5 = Printer is blocking print
 (Cover is open or out of paper.)
 bit 6 = 1 always
 bit 7 = 0 always

<r₄>: bit 0 = 1 Printer supports single station print.
 bit 1 = 0.
 bit 2 = Printer supports multiple colors
 bit 3 = Printer supports cutter
 (Partial cut command is supported as full cut)
 bit 4 = Printer supports cutter.
 bit 5 = 0
 bit 6 = 1 always
 bit 7 = 0 always

<r₅>: 0

<r₆>: 0

<r₇>: 0

[ENQ] <21>**Inquire printer ID****ASCII** [ENQ] <21>**Hexadecimal** 05H 15H**Decimal** <5> <21>**Function** The [ENQ] <21> command returns the printer IEEE 1284 ID string.**Response** [ACK] <21> <n> {ID string}**Where:**

<21> is the echo of the command ID and **<n>** is the number of return bytes in the ID string {ID string} is the IEEE ID return string, which follows:

```
MFG:TransAct.;
CMD:M880CL,IPCL;
CLS:PRINTER;
MDL:M880 PcOS;
DES:EPIC 880TM;
REV:PE8800-01.00
OPTS:$63xy
```

Where x is a bit field defined as follows:

```
bit 0 = 1 Red support
bit 1 = 1 Green support
bit 2 = 1 Blue support
bit 3 = Always 0
bit 4 = Always 1
bit 5 = Always 1
bit 6 = Always 0
bit 7 = Always 0
```

The y is a bit field defined as follows:

```
bit 0 = 0
bit 1 = Knife is installed.
bit 2 = 0
bit 3 = Always 0
bit 4 = Always 1
bit 5 = Always 1
bit 6 = Always 0
bit 7 = Always 0
```

| | |
|-------------------------|-----------------------------|
| [ENQ] <22> | Inquire error status |
|-------------------------|-----------------------------|

ASCII [ENQ] <22>
Hexadecimal 05H 16H
Decimal <5> <22>
Function The [ENQ] <22> command reports on the error status.
Response [ACK] <22> <n> <r>

Where:

<22> is the echo of the command ID.
<n> is the number of return bytes + 40 (28H)
 (to prevent confusion with XON/XOFF).
<r₁>: Bit status as follows:
 bit 0 = Cover is open.
 bit 1 = Paper is Low
 bit 2 = Paper is out.
 bit 3 = 0
 bit 4 = Jam Detected.
 bit 5 = The Auto-Cutter has faulted.
 bit 6 = 1 always
 bit 7 = An serious error has occurred.

Note 1: If bit 7 is set, a serious error has occurred. The printer is not able to recover from this type of error without operator intervention. If bit 7 is set without bit 5 (Auto-cutter fault) then the print carriage has faulted, which is probably caused by a paper jam or a component failure. The host system may issue an [ENQ]<10> (Reset Request command) to attempt to recover. The Reset Request will reset the printer to an initial power up state. All data will be lost.

Note 2: When a serious error occurs (bit 7 set) the printer enters a static state. Status responses will reflect the state of the printer when the error occurred.

Note 3: For this status request to function during a serious error, the "Buffer Full Only" off line option should be selected.

| | |
|-------------------------|----------------------------------|
| [ENQ] <23> | Inquire user-store status |
|-------------------------|----------------------------------|

ASCII [ENQ] <23>
Hexadecimal 05H 17H
Decimal <5> <23>
Function The [ENQ] <23> command reports on the user-store status.
Response [ACK] <23> <Report> <0>

Where:

<23> is the echo of command ID. The report is a null terminated string with the following format:

```

12345[CR][LF]                (Free user store)
12345 Type Name...[CR][LF]    (First entry) etc.
12345 Type Name...[CR][LF]    (Last entry) <0>
  
```

Type The type field describes the type of information.

M = macro

C = character definition

| | |
|-------------------------|-----------------------------|
| [ENQ] <24> | Inquire color status |
|-------------------------|-----------------------------|

ASCII [ENQ] <24>
Hexadecimal 05H 18H
Decimal <5> <24>
Function The [ENQ] <24> command reports Color Cartridge status.
Response [ACK] <24> <Length+40><n₁₂₃

Where

<24> Is the echo of command
**<n<sub>1 Secondary Color 0 = Not supported, 1 = Red, 2 = Green, 4 = Blue
**<n<sub>2 Primary Color 16 = Black
**<n<sub>3 Color Status
 bit 0 = Not defined
 bit 1 = Not defined
 bit 2 = Secondary Color Not Supported
 bit 3 = 0 always
 bit 4 = 0 always
 bit 5 = 0 always
 bit 6 = 1 always
 bit 7 = 0 always</sub>**</sub>**</sub>**

| | |
|-------------------------|-------------------------------------|
| [ENQ] <29> | Inquire Jam/Transport Status |
|-------------------------|-------------------------------------|

ASCII [ENQ] <29>
Hexadecimal 05H 1DH
Decimal <5> <29>
Function The [ENQ] <29> command reports Jam and Transport status.
Response [ACK] <29> <41><n>

Where

<29> Is the echo of command
 <n> Status
 bit 0 = Paper Jammed before the cut
 bit 1 = Paper Jammed after the cut.
 bit 2 = 0 always
 bit 3 = Ticket in transport
 bit 4 = Jam Sensor
 bit 5 = 1 always
 bit 6 = 0 always
 bit 7 = 0 always

| | |
|-------------------------|------------------------------|
| [ENQ] <30> | Inquire Sensor Status |
|-------------------------|------------------------------|

ASCII [ENQ] <30>
Hexadecimal 05H 1EH
Decimal <5> <30>
Function The [ENQ] <30> command reports sensor status.
Response [ACK] <30> <41><n>

Where

<30> Is the echo of command
 <n> Status
 bit 0 = Cover
 bit 1 = Paper Out.
 bit 2 = Top Of Form
 bit 3 = Transport
 bit 4 = Jam Sensor
 bit 5 = 1 always
 bit 6 = Feed
 bit 7 = 0 always

| [ENQ] <31> | Inquire Power Up Error Status |
|------------|-------------------------------|
|------------|-------------------------------|

ASCII [ENQ] <31>
Hexadecimal 05H 1FH
Decimal <5> <31>
Function The [ENQ] <31> command reports Power up Error status.
Response [ACK] <31> <41><n>

Where

<31> Is the echo of command
<n> Status
 bit 0 = No Font file found
 bit 1 = Required files not found
 bit 2 = File system has faulted
 bit 3 = No POR.INI File (Default file has been generated)
 bit 4 = Codepage requested was not found
 bit 5 = Primary FAT was damaged, the alternate was used.
 bit 6 = 1 always
 bit 7 = 0 always

| [ENQ] <32> | Inquire statistics |
|------------|--------------------|
|------------|--------------------|

ASCII [ENQ] <32>
Hexadecimal 05H 20H
Decimal <5> <32>
Function The [ENQ] <32> command returns the internal statistics table.
Response [ACK] <32> <168> ...128 bytes.

Where

<32> Is the echo of command
<168> Length + 40
Statistic table 32 entries each being 4 bytes in big-endian order.

```

unsigned int Black_Dots;
unsigned int Not used;
unsigned int Not used;
unsigned int Cover_Opens;
unsigned int Paper Outs;
unsigned int Line Feeds;
unsigned int Characters Printed;
unsigned int Not used;
unsigned int Not used;
unsigned int Standby Cycles;
unsigned int Power Up Resets;
unsigned int Watchdog Resets;
unsigned int Flash Erases;
unsigned int Not used;
unsigned int Auto Cutter_Cycles;
unsigned int Init Requests;
  
```


unsigned int Error Vectors;
 unsigned int Auto Cutter Faults;
 unsigned int Power On Time;
 unsigned int System Active Time;
 unsigned int Head Over Temps;
 unsigned int Cutter Re-Home;
 unsigned int Jam Detect L1;
 unsigned int Jam Detect L2;
 unsigned int Missed Top of form;
 unsigned int Configuration Faults;
 unsigned int Not used;
 unsigned int Flash File Fault;
 unsigned int Jam Detect L3;
 unsigned int Retracts;
 unsigned int USB Watch Dog;
 unsigned int RAM Faults;

| | |
|-------------------------|-------------------------------------|
| [ENQ] <33> | Inquire Firmware ID and Rev. |
|-------------------------|-------------------------------------|

ASCII [ENQ] <33>
Hexadecimal 05H 21H
Decimal <5> <33>
Function The [ENQ] <33> command returns the Firmware ID and revision.
Response [ACK] <33> <51> PE8805-X.XX.

Where
 <33> Is the echo of command
 <51> Length + 40
Firmware ID PE8805
Separator - (0x2D or 45D)
Rev X.XX (Current Revision in ASCII)

| | |
|-------------------------|------------------------------|
| [ENQ] <34> | Inquire Firmware CRC. |
|-------------------------|------------------------------|

ASCII [ENQ] <34>
Hexadecimal 05H 22H
Decimal <5> <34>
Function The [ENQ] <34> command returns the Firmware ID and revision.
Response [ACK] <34> <42> <MSB> <LSB>

Where
 <34> Is the echo of command
 <42> Length + 40
 <MSB> Most significant 8 bits of the 16 bit CRC
 <LSB> Least significant 8 bits of the 16 bit CRC

[ENQ] <35> Inquire USB Watch Dog Resets.**ASCII** [ENQ] <35>**Hexadecimal** 05H 23H**Decimal** <5> <35>**Function** The [ENQ] <35> command returns the number of USB Watch dog resets and then resets the count to zero.**Response** [ACK] <35> <41> <n>**Where**

<35> Is the echo of command

<41> Length + 40

<n> The number of USB Watchdogs since the last inquire.

| | |
|-----------------------------|--------------------------------------|
| [ESC] [EM]P<n> | Activate Periodic Status Back |
|-----------------------------|--------------------------------------|

ASCII [ESC] [EM] P<n>
Hexadecimal 1BH 19H 50H <n>
Decimal <27> <25> <80><n>
IPCL None
EPOS None

Description This command activates the periodic status back feature. It will automatically return an [ENQ]<20> status (See page 166) on a periodic bases. The value of n is the period in 100 MS intervals. This command is saved through power cycles. Once set it need not be set again, however you can set it the same value repeatedly as it is only saved if it is changed. In general it should not be changed on a regular bases.

Where n = Interval in 100 MS increments. IE 20 = 2 Seconds. Setting the value to 0 disables the feature.

Note: Periodic status back can also be activated with the [ESC][EM]p command, however it is not save during a power cycle.

| | |
|-----------------------------|--------------------------------------|
| [ESC] [EM]p<n> | Activate Periodic Status Back |
|-----------------------------|--------------------------------------|

ASCII [ESC] [EM] p<n>
Hexadecimal 1BH 19H 70H <n>
Decimal <27> <25> <112><n>
IPCL None
EPOS None

Description This command temporarily disables and enables the periodic status back feature if previously activated with the [ESC][EM]P command.

Where n = 0 disables PSB and n = (non zero) Enables PSB at the interval defined by the [ESC][EM]P command.

If not previously activated with the [ESC][EM]P command, this command will activate it but not save the value through a power cycle.

Where n = Interval in 100 MS increments. IE 20 = 2 Seconds. Setting the value to 0 disables the feature.

Double Level Loader

It is desirable in some applications to allow the host application to enter boot load mode and update the firmware. Normally this is prevented by design, and it is not possible for the normal operating mode of the printer to enter the factory boot mode. A Watch Dog timer will reset the printer if abnormal conditions are detected; this timer protects the normal operating mode from being corrupted by an unexpected event. The factory boot loader does not support the Watch Dog timer. If for any reason, the normal operating mode enters the factory boot loader, the printer will reset in about 500 mS.

To allow the application to update the operating firmware, an optional second loader is provided.

Entering Field Boot Load Mode.

To enter field Boot Load mode, the following command should be used:

| Function | Enter Field Boot load mode |
|---|---|
| ASCII | [ESC] ~[SO]% or [ESC] ~[SO]# or [ESC] ~[SO]\$ |
| Hexadecimal | 1BH 7EH 0EH 25H |
| Decimal | <27> <126> <14> <37> |
| Description This command waits for 200 Ms for the printer to be idle, turns off all active drivers and enters Field Boot load mode. No communications should be attempted for 2 seconds after this command is processed. | |

When In Field boot load mode, the firmware image file provided by Transact should be sent to the printer. The communications will be the same as normal operating mode.

The [ESC] ~[SO]# and [ESC] ~[SO]\$ commands also enter boot load only the way the USB enumerates may be altered. [ESC] ~[SO]# forces the boot load USB enumeration to use a different PID (Product Identification). This allows a different Windows driver to be evoked. [ESC] ~[SO]\$ forces the boot load to use the same PID as normal operation. This will force Windows to invoke the same driver that is used for normal operation. The [ESC] ~[SO]% will use the current configuration.

Note: [ESC] ~[SO]# and [ESC] ~[SO]\$ alter the configuration.

There are several commands available in field boot load mode that may be used by the host application to query the printer.

| Function | Returns the boot loader ID |
|---|----------------------------|
| ASCII | [STX]B |
| Hexadecimal | 02H 42H |
| Decimal | <2> <66> |
| Description Returns the Field Boot loader ID, e.g. PB4390-1.00[CR][LF] | |

Function Returns Flash Type ID**ASCII** [STX]E**Hexadecimal** 02H 45H**Decimal** <2> <69>**Description** Returns the Flash Type ID. IE. SGS 29F400B[CR][LF]**Function Check and return the operating firmware ID****ASCII** [STX]K**Hexadecimal** 02H 4BH**Decimal** <2> <75>**Description** Checks the CRC and if valid returns the operating firmware ID. IE. PE8800-2.00[CR][LF]

If the Firmware is not present or the CRC is incorrect, "None[CR][LF]" will be returned

Function Checks and starts the operating firmware**ASCII** [STX]X**Hexadecimal** 02H58H**Decimal** <2> <88>**Description** Checks the CRC of the operating firmware and starts normal operation if correct. This command does not return any information.

There are numerous other commands involved in performing the actual firmware update, whose details are beyond the scope of this document. To perform a flash update, simply send the file provided to you by Transact unaltered and the firmware will be updated.

To allow easy access to the field loader, the power button may be used to switch between the factory loader and the field loader and from the field loader and normal operation. When this procedure is used with a serial adapter, the Baud rate will default to 19200 and the Protocol will be both XON/XOFF and Ready/Busy.

Note 1: Do not attempt any other commands in field loader mode. You may experience unexpected and undesirable results.

Note 2: If for any reason, the field loader is corrupt, the factory boot loader must be used to replace it.

Chapter 9

Epic 880™ Color Graphics

This page intentionally left blank

Printing Graphics

The Epic 880™ Printer has bit-image graphic capability and a full PC-compatible character graphic set. The bit image format is similar to that used on other personal computer printers.

Character Graphics

Character graphics is the term for joining individual characters together to produce a mosaic of characters that form a graphic image. The simplest method uses an * (or any other character) to form an image. For example, TransAct®'s printer brand of "Ithaca" might be formed as follows.

```

* * *   * * *   *   *   * *   * * *   * *
*       *       *   *   *   *   *   *   *   *
*       *       * * * * *   * * * *   *   * *
*       *       *       *   *   *   *   *   *
* * *   *       *       *   *   *   * * *   *   *

```

Figure 31 Example of Character Graphics

The extended character set of the printer supports line graphic characters that can be combined to form windows and other shapes. For the shapes to join from line to line, the spacing must be set properly.

APA Graphics

The printer is capable of all-points-addressable (APA) or horizontal graphics. This type of graphics is very popular in impact printers. To provide compatibility with legacy applications, The Epic 880™ supports several APA graphics modes. Generating a graphic image by hand is time consuming and tedious. It is recommended that a graphic package be used to create a graphic image. The following procedure will help with the setup.

Procedure for APA graphics:

1. Generate the graphic image in the program of your choice. APA graphics only support monochrome images.
2. Make sure the paper size chosen fits the printer (3 inches wide with 0.25-inch margins). If the paper size cannot be set, print a portion of the page.
3. Print the graphic to a file using a generic, IBM, graphic, 9-pin driver. The standard IBM resolutions are 240 x 216 dpi, 120 x 72 dpi, and 60 x 72 dpi. The Epic 880™ Printer supports all three resolutions by converting the input image to 203 x 203 dpi..
4. Print the graphic image to a file.
5. Edit the resulting file to remove any unwanted form control, and insert the Epic 880™ form control.
6. Make the resulting file available to your application, so it can be sent to the printer when required.

Epic 880™ Universal Color Graphics

The Epic 880™ Printer firmware supports the ability to print color graphics in all emulations.

The intent of Universal Color Graphic support is to allow the Epic 880™ graphics capability to be used in existing applications that do not support color graphics as well as all new applications.

For new applications, the programmer may code the graphics generator into there printer driver. TransAct Technologies provides a Windows active X that will generate the graphics for you. In addition the source to the graphics generator is available upon request¹¹.

There are several ways to add color graphics to an existing application. The easiest for you will depend on how much control you have over your application. At a minimum, you should be able to change the name printed on the top of a receipt. With the PJColor¹² program you can store a named graphic into the printer and print it by changing the text name to match the stored graphic. For example, if your receipt has a name like "Joe's Market", you can save a graphic in the printer named "Joe's" and then change the "Joe's Market" to "&%URJoe's&" When the Epic 880™ finds "&%URJoe's&", it is replaced with the stored graphic.

Some applications allow a graphic file to be sent to the printer. In this case PJColor can generate the graphic file and then your application can send it to the printer.

Note: PJColor was originally designed to support color inkjet printing. It has been enhanced and may be used to generate color graphics for the Epic 880™.

PJColor also has a feature that will allow you to generate a file that will define the graphic to be stored into the printer. You can then use this file to setup any number of printers with the same graphic.

If you are using a windows print driver (other than the TransAct® Epic 880™ driver) to support your printer, you will not be able to send color graphics to the printer through the print driver. The print driver will not support universal graphics. You can however, store the graphic in the printer and use IPCL commands to print the stored graphic. (You must select a printer resident font for this to work.)

The following is a short summary description of these features.

¹¹ You may be required to sign a nondisclosure agreement with TransAct Technologies to obtain source code.

¹² The PJColor program has been enhanced to provide several ways to create Logos and Coupons and make them available to the Epic 880™ printer.

Print File Graphics

PJColor can generate a print file that may be sent to the printer in any emulation and print graphics.

To generate a print file.

- 1) Start PJColor
- 2) Under Settings, select the Epic 880™ printer. Then select the emulation that machines the printer.
- 3) Select the resolution you would like to have the printer use to print the graphics. Low resolutions are faster, high resolutions produce better graphics.
- 4) Load the graphics image you wish to print.
- 5) Select the communications port and configuration.
- 6) Set the secondary color to NONE.
- 7) Adjust the image to produce the effect you would like. The lower graphic window displays an approximation of the printed image.
- 8) When you are satisfied with the graphic, press the "Print to a File" button. PJColor will ask what file you would like to receive the print data.
- 9) This file can be sent to the printer and the graphic will be printed.

Store Graphics in the printer:

PJColor can store a graphic in the Epic 880™ printer or generate a file that will store a graphic in the printer.

To Store a graphic in the printer

- 1) Start PJColor
- 2) Under Settings, Select the Epic 880™ printer. Then select the emulation that you will be setting the printer to.
- 3) Select the resolution you would like to have the printer use to print the graphics. Low resolutions are faster, high resolutions produce better graphics.
- 4) Select the communications port and protocol that is to be used to communicate to the printer.
- 5) Load the graphics image you wish to print.
- 6) Adjust the image to produce the effect you would like. The lower graphic window displays an approximation of the printed image.
- 7) When you are satisfied with the graphic, press the "Store in Printer" button. PJColor will attempt to interrogate the printer and will display the graphics currently in the printer if any. (Note: If PJColor cannot communicate with the printer, only the "Save to File" option will be allowed.)
- 8) Make sure there is enough room in the printer for the graphic.
- 9) Insert a name in the "Macro Name" box. Keep it simple, this name will be used later to print the graphic.
- 10) Record the graphic in the printer.

Print a stored graphic.

In the data stream to the printer enter "&%URName&" and the graphic will print in place of the "&%URName&" data. The "Name" must be identical to the name entered earlier.

Generate a file to store color graphics into a printer

To generate a file that will store a color graphic into a printer, follow the same procedure to store a graphic in a printer up through step 8. Then:

- 1) Insert a name in the "Macro Name" box. This name should be kept simple, as it will be used later to print the graphic
- 2) Press the "Save to File" button. This will allow you to select a file where the stored universal graphic information is saved.
- 3) This file contains an "erase any previous graphic with the same name" command, "a save new graphic with this name" command and the graphics information.
- 4) This file can then be sent to the printer and the graphic will be saved in the printer. Note that if the target printer does not have enough room for the graphic information to be stored, the graphic will not be stored.

How universal color graphics is done

The printer extends all the emulations to support two additional escape sequences and adds limited IPCL support.

IPCL (TransAct Printer Control Language) is an ASCII method of sending printer commands to the printer. In TransAct PcOS emulation, IPCL command support is extensive. In other emulations, IPCL support is limited to the following commands.

| | |
|-----------|--|
| &%CR | Insert a [CR] |
| &%LF | Insert a [LF] |
| &%UAXxx | Feed xxx paper steps and cycle auto-cutter |
| &%CLx | Select Color where x = 0 for Black or 1,2,3 for Color |
| &%UBName& | Begin defining universal graphic "Name" |
| &%UGName& | End the definition of "Name" |
| &%URName& | Run (print) universal graphic "Name" |
| &%UDName& | Remove universal graphic "Name" from nonvolatile memory |
| &%USName& | Flag universal graphic "Name" to be run when the printer is turned on |
| &%UFALL& | Erase all stored universal graphics. (Erases all User Store) |
| &%UQ& | Prints a directory of the universal graphics currently stored in the printer |
| &%UTx | Changes the Name termination character from "&" to "x". "x" may range from 21H to 255H |

Note: The & used to flag the end of the Name string is not valid in PcOS TransAct emulation mode. You should use <0> or define the terminator with the &%UTx command.

The extended escape sequences are [ESC][US]... and [ESC][FS]...

The [ESC][US] commands are the same as the PcOS emulation. The [ESC][FS] commands are not intended to be used by the customer. They provide the universal graphics support, since graphics would be very difficult to generate and are not supported by any graphics drives other than PJColor .

How to use IPCL commands in text strings

If your software allows you to pass text strings to the printer, you should be able to use the universal graphics commands. Most POS software allows user customization of the text message printed at the beginning and the end of the receipt.

To use the Universal IPCL commands simply place them in a text string like the following example; note that your results may vary depending on the operation system, software and the ability to pass ASCII Characters.

Load and store named graphic image

- First you must create the graphic image using the PJColor Color Image Converter and save the image to a file. See the section **"Generate a file to store graphics into a printer"** above.
- Send the following text strings to the printer using whatever means is available to you.
 - &%UBLogo& Begin defining macro "Logo"
 - &%UGLogo& End the Definition of "Logo"
 - &%UMLogo& Save Macro "Logo" to nonvolatile memory
- A graphic image named "Logo" should now be stored in the nonvolatile memory.
- To verify the image is present, use the "&%UQ&" IPCL command or the PJColor Color Image Converter to print the name and size of the stored images.

Recall and print stored named graphic image

- Send the following text string to the printer using whatever means is available to you.
 - &%URLogo& Run Macro "Logo" (Print the macro)

Cautions

Universal graphics information is stored in the same place as user defined characters and user defined macros. If you are using an emulation such as ESC/POS that supports macros and/or user defined characters, universal graphics will compete for space with these functions. In addition, the "&%UFALL&" (Erase universal graphics) will also erase any user defined graphics and macros.

If you are using the TransAct PcOS emulation, these commands are identical with the User Store commands except for the terminator character. You may change the NUL terminator to "&" with "&%UT&" if you find the "&" easier.

Universal Graphics Command Descriptions

&%UB <Name..>& Begin named universal graphic record

IPCL &%UB <Name..>&

Description The &%UB <Name..>& command initializes the universal graphic buffer structure, and redirects the following data to the universal graphic buffer. It uses the <Name..> field as a reference. If the name already exists in the flash user store, the command is ignored. The command must be followed by the "End name universal graphic record" command with the same name. If the data that follows is larger than the universal graphic buffer (about 16K), the universal graphic definition is terminated without saving any data.

&%UG <Name..>& End named universal graphic record

IPCL &%UG <Name..>&

Description The &%UG <Name..>& command ends the universal graphic record operation and saves the universal graphic to flash. It uses the <Name..> field to verify the command end and must match the "Begin named universal graphic record" command. If the name already exists in the flash user store or the universal graphic memory is exceeded, the command is invalid, and the <Name..> field prints.

&%UR <Name..>& Run universal graphic data from user store

IPCL &%UR <Name..>&

Description The &%UR <Name..>& command loads the referenced universal graphic into the universal graphic buffer. The universal graphic buffer is then inserted into the data stream. If the named item does not exist or is not a universal graphic, the Epic 880™ ignores the command.

&%US <Name.. >& Flag item as a start-up universal graphic

IPCL &%US <Name.. >&

Description The &%US <Name.. >& command flags the referenced item to be processed at startup. Only one user character definition and one universal graphic may be flagged to run at startup.

&%UD <Name..>& Delete item from user store

IPCL &%UD <Name..>&

Description The &%UD <Name..>& command removes an item from user store and frees up space. If the item does not exist, the Epic 880™ ignores the command.

&%UFALL& Flush information from user store

IPCL &%UFALL&

Description The &%UFALL& command clears all entries in user store and frees the data space. It must have the name, "ALL" (in uppercase) attached.

&%UQ& Report on user store

IPCL &%UQ&

Description The &%UQ& command prints a status report. The intention of the command is to aid in universal graphic development.

&%UT<n> Redefine User Store Termination Character

IPCL &%UT<n>

Description This command allows the terminator used to signal the end of the name field in User Store commands to be modified. The value of <n> is used for the terminator. The value of n may be from 0 to 255.

Example If &%UT% were sent to the printer the User Store command to run universal graphic "Demo" would be &%URDemo%.

&%CL Set Print Color

IPCL &%CL <n>

Description This command allows various colors to be selected on printer emulations that do not support color text.

Where n: 0 Print in Black
1, 2, 3 Print in Red, Blue, or Green

&%UA Cycle Auto-CutterIPCL &%UA <m₁> <m₂> <m₃>

Description This command feeds m/96 inches of paper and cycles the auto cutter.

Where m: $m = m_1 * 100 + m_2 * 10 + m_3$

Bitmapped File Graphic Support

It is possible to load a bitmap file into the printer and print it directly by command. The standard bitmap two color and 16 color bitmap file formats are supported.

To use this feature, load a bitmap file into the printer using the file support commands or the Windows® interface tool. These files can then be printed with the Print Bitmap File command. It is also possible to print a bitmap file passed from the host as data.

| Function | Print Bitmap File command. | All |
|-------------|---|-----|
| ASCII | [ESC] [FS] P<scale> <Filename><0> | |
| Hexadecimal | 1BH 1CH 50H | |
| Decimal | <27> <28> <80> | |
| Scale | 0 = one to one, 1 = 2x high, 2 = 2x Wide, 3 = 2x High and 2x Wide | |
| FileName | File name from 1 to 30 characters including a three character extension, null terminated. | |
| Description | The [ESC] [FS] P command will print at the current dot column a previously saved bitmap file image. If the file does not exist, this command will have no effect. | |

Note: If the Scale is an uppercase 'B' this command will directly process a bitmap file. See the Print Bitmap Data command below.

| Function | Print Bitmap Data command. | All |
|-------------|---|-----|
| ASCII | [ESC] [FS] P <Bitmap file data> | |
| Hexadecimal | 1BH 1CH 50H | |
| Decimal | <27> <28> <80> | |
| Description | The [ESC] [FS] P command will print the bitmap file data that follows. Note that the first character in a bitmap file is an uppercase B. This differentiates this command from the Print Bitmap File command described above. | |

Note: This command always prints the bitmap data at a scale of one to one.

Epic 880™ Coupon-Cut-Logo Feature

The Epic 880™ printer has a feature that will allow a coupon and or logo graphic to be printed as part of the existing auto cutter command.

To activate this feature, it must first be configured. Configuration consists of specifying in what order the Coupon-Cut-Logo is processed and optionally, how much paper is to be feed after the new cut operation.

Once configured, the Coupon and/or logo must be defined and loaded into the printer. The “Universal Graphics” feature should be used to define and load the graphic. The Coupon is named “Coupon”, and the Logo is named “Logo”. They may be saved in any resolution and of any size. They also need not be all graphics.

The existing application cut command will be replaced by the Coupon-Cut-Logo operation. Configuration options are as follows:

Cut Command Logo:

| | |
|-----------------|--|
| Cut-Logo | Perform Feed to cut, then cut, and then print the Logo. |
| Coupon-Cut | Print the Coupon, Feed to Cut, and Cut. |
| Logo-Cut | Print the Logo, Feed to Cut, and Cut. |
| Cut-Coupon | Perform Feed to cut, then cut, and then print the Coupon. |
| Coupon-Cut-Logo | Print the Coupon, Feed to cut, Cut, ad then print the Logo. |
| Logo-Cut-Coupon | Print the Logo, Feed to cut, Cut, ad then print the Coupon. |
| Cut-Logo-Coupon | Perform the Feed to cut, Print the Logo and then the Coupon. |
| Cut-Coupon-Logo | Perform the Feed to cut, Print the Coupon and then the Logo. |
| Logo-Coupon-Cut | Print the Logo, then the Coupon, feed to cut and Cut. |
| Coupon-Logo-Cut | Print the Coupon, then the Logo, feed to cut and Cut. |
| Disabled | Perform the Normal cut. |

Cut Command Logo Feed: 0 to 80 mm.

Chapter 10

Unicode and Fonts

This page intentionally left blank

Fonts

Your TransAct® Epic 880™ printer uses outline and/or stroke based scalable fonts. These fonts provide you with additional font options as well as improved character appearance, while functioning transparently within legacy applications.

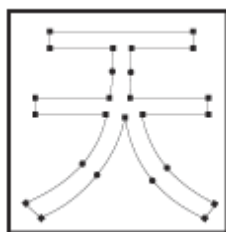
Such fonts represent a substantial improvement to the so-called bitmap fonts that are traditionally used for thermal printers, which are based on a pixel by pixel definition of characters. With a fixed size and fixed character spacing, these bitmap fonts were limited to specific magnification factors from 2-8X, and required scaling and smoothing at larger font sizes. Moreover, such scaling and smoothing operations were often unsuitable for complex fonts such as Asian characters, where changes to pixel layout actually risk changing character meanings.

To take full advantage of scalable fonts, the Epic 880™ supports additional commands and features, including:

- 1) Character size selection by points
- 2) Character pitch selection by points
- 3) Variable character spacing if desired
- 4) Custom fonts
- 5) Unicode support for international language support
- 6) Enhanced code page support for ASCII based applications.

Character Generation

The font technology in the Epic 880™ printer uses standard outline fonts (sometimes referred to as TrueType fonts) or stroke fonts. Both technologies are scalable, however each has unique advantages.



Outline characters

Outline characters use points along the edge of the character to describe the character. The character generator defines the edge and then fills in the enclosed space to define the character.

This type of character generation produces very well formed characters and produces the best looking characters. However, it requires more storage than stroke fonts, and is best for non-Asian fonts.



Stroke-based characters

With stroke based characters, the points stored are along the center line. Less than half the points are needed to render stroke based characters. This improves character-generation performance and uses less space.

This type of character generation is fast and efficient, and is ideally suited for Asian fonts.

Character Size

The character generation engine used in the Epic 880™ internally uses a standard point based system to specify the character size. One point is 1/72 of an inch. Therefore a 72 point character would form a character suitable to generate one line per inch printing. The typical application might refer to a 12 point character. This is the character height and not the width. The character width typically varies on character by character bases; for example, the lower case “i” is much narrower than the upper case “W”.

Font selection commands for selecting character sizes in legacy applications are also supported. For printers such as the Epic 880™, two or three character sizes are generally predefined with a dot matrix size of 10x24 or 13x24 dots, and this fixed size may then be double or tripled to provide larger characters when needed. To supply legacy support, the Epic 880™ will automatically select the appropriate character size to support the legacy font and character scaling commands.

In the Epic 880™, the horizontal and vertical point size may be set independently. Typically this type of printer would print a tall, narrow, mono-spaced character. Tall narrow mono-spaced character provides a very readable print with easy column alignment while using less paper than standard type fonts. This type of font is sometimes referred to as a condensed font.

Selecting Character Size

The Epic 880™ provides two ways to specify character size. The legacy or classic font selection method is based on dot matrix size. The second method is based on the standard type points system. The advantage of the type point system is that the print produced by the printer will match what is displayed by the host system, as both use the same system for describing the characters produced.

Legacy or Classic Method

With the classic method, the application selects a character size and then sets the character spacing by adding or removing dot spaces between the characters. Using the scaled font, the Epic 880™ provides 3 basic predefined character sizes. The smallest is a 10x24 dot-like¹³ font and is typically printed in pitches from 16 to 20 characters per inch (CPI). The next larger font is 13 x 24 dot-like, and is typically printed in pitches from 14 to 16 CPI. The largest font is 14 x 24 dot-like font and is typically printed at pitches from 10 to 14 CPI.

¹³ Characters are dot-like because they are not guaranteed to be exactly at an exact dot equivalent. They are spaced in a fixed character cell that provides equivalent spacing and alignment as a fixed character size, however the actual character size is defined by the font designer.

The Epic 880™ always prints at 203 dots per inch (dpi) and always uses the scalable font to form characters. The resulting characters are not necessarily exactly the dot size indicated, but are always spaced in a fixed dot cell provided that the legacy commands are used. Adding or subtracting space between characters achieves different character pitches with a fixed character cell size. As each dot has a fixed size and position, only specific pitches are possible. The following table defines the fonts and pitches possible with each.

| Character Cell (H x W) | 10x24 Font (W x H) | 13x24 Font (W x H) | 15x24 Font (W x H) |
|--|--------------------------|--------------------------|--------------------------|
| Horizontal Width | 10 Dots 0.0493 inches | 13 Dots 0.0640 inches | 15 Dots 0.0739 inches |
| Vertical Height | 24 Dots 0.118 Inches | 24 Dots 0.118 Inches | 24 Dots 0.118 Inches |
| Character spacing in Characters per Inch (CPI) | | | |
| Pitch at native cell size | 20.30 | 15.62 | 13.5 |
| 5 dot Removed | 40.60 | 25.38 | 20.30 |
| 4 dot Removed | 33.83 | 22.56 | 18.45 |
| 3 dot Removed | 29.00 | 20.30 | 16.92 |
| 2 dot Removed | 25.38 | 18.45 | 15.62 |
| 1 dot Removed | 22.56 | 16.92 | 14.50 |
| 0 dot added | 20.30 | 15.62 | 13.53 |
| 1 dot added | 18.45 | 14.50 | 12.69 |
| 2 dots added | 16.92 | 13.53 | 11.94 |
| 3 dots added | 15.62 | 12.69 | 11.28 |
| 4 dots added | 14.50 | 11.94 | 10.68 |
| 5 dots added | 13.53 | 11.28 | 10.15 |
| 6 dots added | 12.69 | 10.68 | 9.67 |

NOTE: Combinations shown in shaded areas are not recommended.

Table 9. Possible Character Pitches

Character spacing may also be selected by requesting a print pitch based on characters pre inch. Once again, the results are not exact in this case. The following table lists the resulting spacing based on a given CPI request.

| Requested CPI | Character Width | Resulting CPI | Requested CPI | Character Width | Resulting CPI |
|---------------|-----------------|---------------|---------------|-----------------|---------------|
| 0 | variable | variable | 16 | 12 | 16.92 |
| 1 | 203 | 1.00 | 17 | 12 | 18.45 |
| 2 | 101 | 2.01 | 18 | 11 | 18.45 |
| 3 | 67 | 3.03 | 19 | 10 | 20.30 |
| 4 | 50 | 4.06 | 20 | 10 | 20.30 |
| 5 | 40 | 5.08 | 21 | 9 | 22.56 |
| 6 | 33 | 6.15 | 22 | 9 | 22.56 |
| 7 | 29 | 7.00 | 23 | 8 | 25.38 |
| 8 | 25 | 8.12 | 24 | 8 | 25.38 |
| 9 | 22 | 9.23 | 25 | 8 | 25.38 |
| 10 | 20 | 10.15 | 26 | 7 | 29.00 |
| 11 | 18 | 11.28 | 27 | 7 | 29.00 |
| 12 | 16 | 12.69 | 28 | 7 | 29.00 |
| 13 | 15 | 13.53 | 29 | 7 | 29.00 |

| | | | | | |
|----|----|-------|----|---|-------|
| 14 | 14 | 14.50 | 30 | 6 | 33.83 |
| 15 | 13 | 15.62 | | | |

NOTE: Combinations shown in shaded areas are not recommended.

Table 10 Requested CPI and Resulting CPI

If the requested spacing is zero, the character spacing will be defined by the character definition, and will result in variable spacing.

Line spacing

The legacy commands select line spacing as lines per inch. With scalable characters, the lines per inch is a minimum spacing. If a character is larger than the spacing between lines, the line spacing will be increased to allow enough room for the characters on that line.

Selecting character size by points.

In addition to the legacy or classic method of character size selection, the Epic 880™ allows selection by point size. Point sizes from 4 to 72 points may be selected for both the horizontal and vertical axes. If a horizontal point size of zero (0) is selected for the horizontal spacing the characters are printed using variable spacing based on the character definition, using the vertical point size for the horizontal point size.

To provide fine control over character size, two commands are available, one of which specifies the size in points, and the other of which specifies the size in ¼-point increments.

If the font is a stroke font, the boldness of the characters is controlled through variations in individual stroke width.

Internal Fonts

The Epic 880™ is provided by default with a standard WGL4 outline-based font, and optionally with an additional GB18030 stroke-based font. Additional user defined outline or stroke fonts may be used as required.

The default font provided with the Epic 880™ is called UTAH MT Condensed from Monotype. This is a condensed variable-pitch font that produces reasonable fixed-pitch results. In some cases, extra wide characters in this font may produce undesirable fixed-pitch results. If this is unacceptable, the TransAct Sub font may be loaded, containing slightly narrower characters in key locations. As another alternative, the printer may be ordered with a fixed-pitch font, which will not allow variable-pitch printing.

Custom Fonts

The Epic 880™ supports TrueType fonts. There are several companies that will provide custom character sets. The Epic 880™ uses fonts provided by Monotype. You can contract Monotype through their website www.fonts.com, or by phone in U.S. & Canada (toll-free 1-800-424-8973, directly at 1-781-970-6020), or the United Kingdom (Free Phone 0800 371242, direct +44 (0)1737 765959.)

Stacked or Linked fonts

The Epic 880™ also uses a font stacking technology where fonts are linked together. This means that as each character is looked up, the first font in the stack containing the character is then printed. For example, if a customer would like to replace several standard characters with custom characters, a user defined font can be provided that would, if first in the link, replace the characters in the standard font.

It may also be desirable to stack fonts to provide a precedent for how individual characters are looked up. For example:

- An application may wish to alter the appearance of several characters for security.
- It might be necessary to define a group of special symbols for a specific application.
- It might be necessary to supplement a font with special characters like OCR characters.

To provide this flexibility, the Epic 880™ has the ability to link up to 8 fonts together. When this is done, the first font in the link is searched first. If the character is not defined, the next font in the link is searched. This process is continued until the character is found or the last font is searched.

There are two ways to define a linked font. This first is to define a default linked font in the POR.INI file. If a link font is defined in the POR.INI file, it will be selected as the default power on font. Selecting font 0 will select the linked font provided that a link font is defined.

It is also possible to dynamically define a linked font. This requires that the fonts to be linked be aliased to a font id in the POR.INI file. Defining a linked font does not necessarily activate it. If the linked font was not already active, it must be selected by selecting font 0.

Font Storage

The Epic 880™ supports a Flash file system used to store fonts, custom graphic and custom macros. A file system interface is provided for this system, where the host application may download files. In addition, TransAct Technologies provides a file loading tool that runs on Windows® based systems.

To allow flexible and easy support for all kinds of fonts, fonts are stored in the Epic 880™ printer as a standard font file. These files are typically not visible to the user, however; TransAct Technologies provides a support tool that will allow the user to load their own font directly from Windows and change the way fonts are printed. It is also possible for the host application to load fonts into the printer.

The printer can contain up to 99 unique and selectable fonts. Any font may be selected at any time. In addition up to 8 fonts may be linked or stacked together. Some standard character size and character pitch commands are supported as legacy commands. The appearance of the print using those commands has been optimized using the TransAct WGL4 font. If you elect to use your own font, or the GB18030 font, you may wish to use the scalable font control commands to select the character size and spacing rather than the legacy commands.

TransAct Technologies provides a basic WGL4 font with the printer. This may be supplemented or replaced with a GB18030 Chinese font upon request. The printer will accept TrueType and compressed stroke fonts as defined by Monotype. If required, the customer may supplement the TransAct supplied fonts with their own custom fonts.



WARNING: If you elect to load fonts into the printer you must have proper rights to that font. **Do not** download a font to the printer if you do not have the right to use the font as a downloaded printer font.

Bitmap Fonts

It is possible to use bitmap fonts with the ITherm 280 Printer. Bitmap fonts are fixed pitch and are not scalable. They will only function as legacy fonts. The printer is optionally supplied with 4 legacy bitmap fonts. They are in a 10x24, 12x24 draft font format and a 16x24 near letter quality format. They are defined as follows:

```
BMFont0 = chr10x24.bft 10 x 24 draft font with typical spacing of 16 characters per inch
BMFont1 = chr12x24.bft 12 x 24 draft font with typical spacing of 14 characters per inch
BMFont2 = chr16x24.bft 16 x 24 NLQ font with typical spacing of 12 characters per inch
BMFont4 = ocr16x24.bft 16 x 24 OCR font with typical spacing of 12 characters per inch
```

It is possible to define a custom bitmap font. Transact supports a bitmap font compiler that will convert a bitmap font picture file into a compressed bitmap file that may be loaded into the printer as a bitmap (.bft) font file.

The input to the program is a text file in a predefined format consisting of a font description and then character definitions consisting of the character ID and then the character definition. The format is as follows: (Note lines preceded with # characters are comments).

```
# 11 by 24 font with a base line at 22
# F=X is not used in Thermal Products
W=11 H=24 B=22 F=0
; N=0000 U=0000      NULL
01 .....
02 .....
03 .....
04 .....
05 .....
06 .....
07 .....
08 .....
09 .....
10 .....
11 .....
12 .....
13 .....
14 .....
15 .....
16 .....
17 .....
18 .....
19 .....
20 .....
21 .....
22 .....
23 .....
24 .....
; N=0001 U=0020      SPACE
01 .....
```

02
 03
 04
 05
 06
 07
 08
 09
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24

; N=0002 U=0021

EXCLAMINATION MARK

01
 02
 03 ...00.....
 04 ...00.....
 05 ...00.....
 06 ...00.....
 07 ...00.....
 08 ...00.....
 09 ...00.....
 10 ...00.....
 11 ...00.....
 12 ...00.....
 13 ...00.....
 14 ...00.....
 15 ...00.....
 16 ...00.....
 17
 18
 19
 20 ..0000.....
 21 ..0000.....
 22 ..0000.....
 23
 24

; N=0003 U=0022

QUOTATION MARK

01
 02
 03 .00..00....

```

04 .00..00....
05 .00..00....
06 .00..00....
07 .00..00....
08 .....
09 .....
10 .....
11 .....
12 .....
13 .....
14 .....
15 .....
16 .....
17 .....
18 .....
19 .....
20 .....
21 .....
22 .....
23 .....
24 .....
; N=0004 U=0023    NUMBER SIGN
01 .....
02 .....
03 .....
04 .....00....
05 ..00.00....
06 ..00.00....
07 ..00.00....
08 ..00.0000..
09 ..0000000..
10 0000000....
11 0000.00....
12 ..00.00....
13 ..00.00....
14 ..00.0000..
15 ..0000000..
16 0000000....
17 0000.00....
18 ..00.00....
19 ..00.00....
20 ..00.00....
21 ..00.....
22 .....
23 .....
24 .....

```

The characters must be in sequential order and must be assigned Unicode character codes. N=0001 is a sequence number in hex and is not used in controlling character generation or order. U=0021 is the Unicode address in hex and the characters must be in ascending Unicode address order.

Unicode

As computer systems started to address more and more international environments, the classic ASCII standard with code pages became unworkable. Several competing systems were developed. However, it was clear that a standard needed to be developed. In 1991 Version 1.0 of the Unicode standard was developed, to standardize how and where characters are to be addressed in an expanded addressing scheme. In 2000 Version 3.0 of the Unicode standard was published and generally accepted. The Epic 880™ follows this standard for character placement and encoding¹⁴.

Note: If a custom font is used that is not in Unicode order, the order of the font will be used as if it were in Unicode order. Any subsequent character mappings will assume to be in Unicode order and may not produce the desired effects.

Unicode Encoding

The Epic 880™ Printer supports Unicode character addressing using Unicode Transform Format or UTF as defined in the Version 3.0 Unicode Specification. There are several forms of UTF encoding.

UTF-16 is the most straightforward way to access characters above 255. UTF-16 essentially sends two 8-bit bytes that form a 16-bit address to access the desired character. Basic UTF-16 does not define the byte order. If you wish to use UTF-16 and allow the printer to determine the byte order, you must send the byte order mark (0xFEFF) before you send any characters. To prevent loss of byte order synchronization, you should periodically send the byte order mark to resynchronize the printer with your application. If UTF-16 is selected, all data sent to the printer must be 16 bits. All commands and command parameters are also 16 bit, however only values between 0 and 255 are valid. Note that 24 bit encoding is not supported.

UTF-16BE uses the big-endian method of sending the two bytes. This method sends the high byte first and then the low byte. It is not required to send the byte order mark (0xFEFF) for the correct byte order to be initialized. However, to prevent loss of byte order synchronization, you should periodically send the byte order mark to resynchronize the printer with your application. If UTF-16BE is selected, all data sent to the printer must be 16 bits. All commands and command parameters are also 16 bit, however only values between 0 and 255 are valid.

UTF-16LE uses the little-endian method of sending the two bytes. This method sends the low byte first and then the high byte. It is not required to send the byte order mark (0xFEFF) for the correct byte order to be initialized. However, to prevent loss of byte order synchronization, you should periodically send the byte order mark to resynchronize the printer with your application. If UTF-16LE is selected all data sent to the printer must be 16 bits. All commands and command parameters are also 16 bit, however only values between 0 and 255 are valid.

¹⁴ The Version 3.0 Unicode standard defines a 24 bit addressing method that is not supported by the Epic 880™. The Epic 880™ is limited to a 16-bit address value. Values greater than 65535 will be truncated to 16 bits.

UTF-8 uses a Multiple Byte Character Sequence (MBCS) to identify the desired Unicode character. This encoding method is less straightforward but preserves some of the 8-bit character of ASCII encoding.. This method uses unique bit sequences at the MSBs of a byte to determine its location and meaning within the MBCS encoding. See the table below for more information. If UTF-8 is selected all data sent to the printer must be encoded. All command parameters over 127 must be encoded in UTF-8.

UTF-8TXT uses a Multiple Byte Character Sequence (MBCS) to identify the desired Unicode character. This encoding method is identical to UTF-8 except command parameters over 127 are not UTF-8 encoded. They must be sent unmodified as 8-bit values.

Note: Extended UTF encoding past 65534 is not supported in UTF-16 or UTF-8. Only Unicode addresses from 0 to 65534 are supported by the Epic 880™ Printer.

| Scalar Value | 1 st Byte | 2nd Byte | 3rd Byte |
|------------------|----------------------|----------|----------|
| 00000000xxxxxx | 0xxxxxx | | |
| 00000yyyyyxxxxxx | 110yyyyy | 10xxxxxx | |
| Zzzzyyyyyyxxxxxx | 1110zzzz | 10yyyyyy | 10xxxxxx |

NOTE: 4 byte encoding is not supported.

File system and the POR.INI file

The Epic 880™ Printer supports a file system to support TransAct Technologies fonts and allow the user to load and link custom fonts.

The POSFile tool provides a Windows interface to the printer and will allow fonts and configuration files to be loaded into the printer. This tool can read and write the POR.INI file, however the TransAct supplied fonts can not be read or deleted from the printer.

TrueType¹⁵ and Compressed Stroke Fonts¹⁶ are supported by the Epic 880™ Printer. User-defined TrueType fonts may be defined and loaded into the printer, however, once in the printer they can not be extracted. (This protects the copyrights on the font.)

The POR.INI file is used to control how fonts are named, identified and linked, as well as allowing how the font to be printed is controlled.

The following is an example of the POR.INI file:

```
; Default System Configuration.
[encoding]
mode = UTF8TXT
;NOTE: A code page is only used in ASCII mode.
;To specify a code page, use one of the following forms:
CodePage = 437
;CPFile = CP8959-1.cpm
;To remap Unicode characters, define a UniRemap.cpm file.
UniMapfile = UniRemap.cpm
[font]
;Optionally specify the Cache Partitions
;Fontcache = 1024,512,256
;True Type font hinting may be disabled by setting Nohint to 1
;Nohint = 0
;Specify Linked fonts starting with LinkFont1.
;LinkFont1 will be searched first.
;You may specify up to 8 linked fonts.
;if Link Fonts are defined, they will be used as the default.
LinkFont1 = TactMOD.ttf
LinkFont2 = TactWGL_M.ttf
LinkFont3 = TactGB18030.ccc
;Up to 99 fonts may be defined
Font1 = TactMOD.ttf
Font2 = TactWGL_M.ttf
Font3 = TactGB18030.ccc
;The brush size effects only stroke fonts.
Brush = 100
[legacy]
```

¹⁵ Some but not all features of Open Type fonts are supported. Open Type fonts are not recommended.

¹⁶ Compressed Stroke fonts are supplied by MonoType Inc.


```

;EmulationMode = Font,Horizontal,Vertical,Width.
; Where:
; If Font = 0 Use Linkfont else 1-4 above.
; If Font is 100 or greater use BMFont (Font - 100). BMFonts only used Width.
; Horizontal and Vertical are in 8th points, Width in Dots.
Custom1s = 0,56,72,10
Custom1l = 0,64,72,14
Custom2s = 0,64,72,14
Custom2l = 0,64,72,18
Epson1 = 0,56,72,10
Epson2 = 0,64,72,14
PcOS1 = 0,56,72,10
PcOS2 = 0,64,72,14
PcOS3 = 0,80,80,18
PcOS4 = 0,80,80,20
[bmfont]
;There may be up to 8 bitmap fonts.
;Bitmap fonts are fixed sizes and have no options
BMFont0 = chr10x24.bft
BMFont1 = chr13x24.bft
BMFont2 = chr15x24.bft
BMFont3 = chs15x24.bft

```

Font1 through Font99 may be defined, and the font number is the alias used by the set font command, e.g. Font23 is selected by doing a select font 23 command. Font 0 is reserved for selecting the linked font.

The printer may contain one default linked font. A linked font is a method of allowing the user to replace characters in a standard font with custom characters, described in more detail in an earlier section. The POR.INI file is one way of defining a linked font. In the above POR.INI file link the link font consists of User, TactWGL, and the TactGB18030 fonts. When a character is to be printed, the user font will be searched followed by TactWGL and then the TactGB18030 font. The first font containing the character will define the character.

Note: If a link font is defined in the POR.INI file, it will be selected as the default font. If no link font is defined, Font1 will be used at power-up. If the POR.INI file does not contain a linked font, and the Font1 selection is defective, the TactWGL font will be used. If no fonts are found, the printer will only print graphics.

Bitmap fonts are not recommended and should only be used if an exact bitmap is required. Bitmap fonts are not scalable like true type fonts; only the normal 2X, 3X etc. scaling is available. TransAct Technologies can, upon request and signing a non-disclosure agreement (NDA), provide tools to allow customers to develop their own bitmap fonts. These fonts must be in Unicode order but only need support the specific characters needed in the font.

Note: When loaded and made available the legacy select font commands should select the bitmap font by adding 100 to the font ID. For example to use BMFont0, select font 100 in the Legacy font definition. (Note: Only the font ID is used from the legacy font definition if a bitmap font is selected.)

| Function | Select Font | All |
|----------|-------------|-----|
|----------|-------------|-----|

ASCII [ESC] + 3 <ID>

Hexadecimal 1BH 2BH 31H

Decimal <27> <43> <51>

Description The [ESC] + 3 command selects the font for printing. This command is used to select a previously loaded font based on its alias.

Note: Selecting font 0 will select the linked font. If the selected font does not exist, the previous font will remain in effect.

| Function | Define a Stacked or Linked Font | All |
|----------|---------------------------------|-----|
|----------|---------------------------------|-----|

ASCII [ESC] + S <ID₁> <ID₂> <ID₂> ... <0>

Hexadecimal 1BH 2BH 53H

Decimal <27> <43> <83>

Description The [ESC] + S command defines but does not select a stacked or linked font set. This command will define a linked list of previously loaded and aliased fonts into a linked font stack. The font ID is the same ID as in the select font command. Up to 8 fonts may be linked. The last entry must be 0. If the font does not exist, it will not be made part of the link.

Note: You must select font 0 to activate the linked font.

| Function | Select Font by name | All |
|----------|---------------------|-----|
|----------|---------------------|-----|

ASCII [ESC] + N <FileName> <0>

Hexadecimal 1BH 2BH 31H

Decimal <27> <43> <51>

Description The [ESC] + N command selects the font for printing by file name. This command is used to select a previously loaded font by its file name. If the selected font does not exist, the previous font will remain in effect.

Note: This command may be undesirable because it embeds in the application a file name that you may wish to change in the future. By using the Alias ID the font name may change, but the application will remain constant.

| Function | Initiate Unicode UTF-16BE Encoding | All |
|----------|------------------------------------|-----|
|----------|------------------------------------|-----|

ASCII [ESC] + H

Hexadecimal 1BH 2BH 48H

Decimal <27> <43> <72>

Description The [ESC] + H command will put the printer into UTF-16BE character encoding mode of operation. If you wish to access characters above 255, you must select a Unicode encoding such as UTF-16BE.

You must select a downloaded font, as described in this section, before issuing this command.

UTF-16 is the most straightforward way to access characters above 255, sending two 8-bit bytes that form a 16-bit address to access the desired character.

UTF-16BE uses the big-endian method of sending the two bytes. This method sends the high byte first and then the low byte.

Note: Once selected, all information sent to the printer must then use this encoding, even for non-print commands.

| Function | Initiate Unicode UTF-16LE Encoding | All |
|----------|------------------------------------|-----|
|----------|------------------------------------|-----|

ASCII [ESC] + L

Hexadecimal 1BH 2BH 4CH

Decimal <27> <43> <76>

Description The [ESC] + L command will put the printer into UTF-16LE character encoding mode of operation. If you wish to access characters above 255, You must select a Unicode encoding such as UTF-16LE.

You must select a downloaded font, as described in this section, before issuing this command.

UTF-16 is the most straightforward way to access characters above 255, sending two 8-bit bytes that form a 16-bit address to access the desired character.

UTF-16LE uses the little-endian method of sending the two bytes. This method sends the low byte first and then the high byte.

Note: Once selected, all information sent to the printer must then use this encoding, even for non-print commands.

| Function | Initiate Unicode UTF-8 Encoding (MBCS) | All |
|----------|--|-----|
|----------|--|-----|

ASCII [ESC] + M

Hexadecimal 1BH 2BH 4DH

Decimal <27> <43> <77>

Description The [ESC] + M command will put the printer into UTF-8 character encoding mode of operation. If you wish to access characters above 255, You must select a Unicode encoding such as UTF-8.

You must select a downloaded font, as described in this section, before issuing this command.

UTF-8 uses a Multiple Byte Character Sequence (MBCS) to identify the desired Unicode character. This encoding method is less straightforward. This method uses unique bit sequences at the MSBs of a byte to determine its location and meaning within the MBCS encoding. See the table below for more information.

Note: Once selected, all information sent to the printer must then use this encoding, even for non-print commands.

| Scalar Value | 1st Byte | 2nd Byte | 3rd Byte |
|------------------|----------|----------|----------|
| 00000000xxxxxxx | 0xxxxxxx | | |
| 00000yyyyyxxxxxx | 110yyyyy | 10xxxxxx | |
| zzzzyyyyyyxxxxxx | 1110zzzz | 10yyyyyy | 10xxxxxx |

| Function | Initiate Unicode UTF-8 Text only Encoding (MBCS) | All |
|----------|--|-----|
|----------|--|-----|

ASCII [ESC] + T

Hexadecimal 1BH 2BH 54H

Decimal <27> <43> <84>

Description The [ESC] + T command will put the printer into UTF-8 Text only character encoding mode of operation. This mode is identical to the UTF-8 mode described above, except commands and there parameters are not UTF encoded. For example the following command would be used to select underline on:

[ESC] W 128.

If true UTF-8 encoding were in effect, the 128 parameter would be UTF encoded to [ESC] W 194 128. With UTF-8 Text only mode this command is simply [ESC] W 128.

Note: This command also applies to graphic data being sent to the printer. The graphic data is a command and not text. It is not UTF-8 encoded.

| Function | Initiate Normal 8-bit ASCII Character Encoding | All |
|-------------|--|-----|
| ASCII | [ESC] + A | |
| Hexadecimal | 1BH 2BH 41H | |
| Decimal | <27> <43> <65> | |

Description The [ESC] + A command will put the printer into normal character encoding mode of operation. One byte = one character. In this mode international characters must be selected by selecting the appropriate code page for translation.

Font Size and Spacing

The font typically defines the character size and line spacing. The typical font is proportional spaced. That is the spacing between characters varies. This is not always the most desirable mode of operation. To give the programmer some additional control over character spacing and line height, the Accutherm Supreme provides a width and height override command.

The following table converts dots to CPI (Characters Per Inch) points and ¼ points and is useful in calculating point size settings.

| Dots 1/203" | Characters per Inch (CPI) | Points 1/72" | ¼ Points 1/288" |
|----------------|------------------------------|-----------------|--------------------|
| 8 | 25.38 | 2.84 | 11.35 |
| 9 | 22.56 | 3.19 | 12.77 |
| 10 | 20.30 | 3.55 | 14.19 |
| 11 | 18.45 | 3.90 | 15.61 |
| 12 | 16.92 | 4.26 | 17.02 |
| 13 | 15.62 | 4.61 | 18.44 |
| 14 | 14.50 | 4.97 | 19.86 |
| 15 | 13.53 | 5.32 | 21.28 |
| 16 | 12.69 | 5.67 | 22.70 |
| 17 | 11.94 | 6.03 | 24.12 |
| 18 | 11.28 | 6.38 | 25.54 |
| 19 | 10.68 | 6.74 | 26.96 |
| 20 | 10.15 | 7.09 | 28.37 |
| 21 | 9.67 | 7.45 | 29.79 |
| 22 | 9.23 | 7.80 | 31.21 |
| 23 | 8.83 | 8.16 | 32.63 |
| 24 | 8.46 | 8.51 | 34.05 |
| 25 | 8.12 | 8.87 | 35.47 |
| 26 | 7.81 | 9.22 | 36.89 |
| 27 | 7.52 | 9.58 | 38.31 |
| 28 | 7.25 | 9.93 | 39.72 |
| 29 | 7.00 | 10.29 | 41.14 |
| 41 | 4.95 | 14.54 | 42.56 |
| 48 | 4.23 | 17.02 | 68.10 |
| 51 | 3.98 | 18.09 | 72.35 |
| 68 | 2.99 | 24.12 | 96.47 |
| 101 | 2.01 | 35.82 | 143.29 |

Font Size and Spacing command interactions

There are interactions between some of the following commands and some of the legacy font selection commands. These interactions need to be considered when developing an application for this printer.

This printer uses a font rendering engine that relies on the font to provide character size and spacing information. Unfortunately, legacy applications assume all characters are the same and that the character size and spacing is fixed. To force the characters rendered by the font rendering engine to conform to legacy modes of operation, some post generation processing is performed to reposition the characters into a fixed size cell.

The set minimum character height and width ([ESC] + P and [ESC] + p), the set character spacing ([ESC] + I, [ESC] + i, [ESC] + J and [ESC] + j), the set minimum line spacing ([ESC] + V and [ESC] + v), and the legacy font select and spacing commands all interact.

The set minimum character height and width ([ESC] + P and [ESC] + p) commands set character size but in two different ways. In most systems a character point size refers only to the line spacing and indirectly to the character height. That is also true. The vertical character height referenced in these commands refer to the character height including the white space between lines. The horizontal character width is defined by the font. Normally only the character height would be specified and the width would be defined by the font and that's how these commands work if the Width is defined as zero. If the width is defined as zero this is used as a flag to the printer to generate characters as defined by the font and use the character width returned by the font. In effect the vertical point size passed to the font rendering engine is the same as the horizontal value. The added effect of the width being passed as zero is that any enforced horizontal spacing is disabled. IE the effect of the [ESC] + I, [ESC] + i, [ESC] + J and [ESC] + j commands are disabled. If the width is not zero, the [ESC] + I, [ESC] + i, [ESC] + J and [ESC] + j remain in effect and only the resulting character size is changed, the horizontal spacing is not changed.

The legacy [ESC] ! <n> select the print mode effectively issues a set minimum character height and width command followed by a set character spacing command without effecting the pseudo fixed spacing flag.

The pseudo fixed spacing flag is a further complication required for dealing with fonts that are not truly fixed pitch. In some cases a fixed pitch font will have more than one character size depending on what the character is used for. This generally only affects Asian fonts where the ideograms are generally twice as wide as Latin characters. In fixed spacing mode, the printer will put the rendered character at whatever spacing is requested even if they don't fit. If the character is too big, it will overlap the previous and next character. To allow a fixed pitch operation that deals with small and large fixed pitch character, the printer has a pseudo-fixed pitch flag that will increase the spacing in multiples of the requested spacing until it fits.

The following table lists the commands and how they interact.

| Command | Zero | Character width | Character height | Cell Width | Pseudo Fixed pitch flag |
|-------------------------|----------------|-------------------------|-------------------------|--|---|
| [ESC] + P, [ESC] + p | Width 0 | Same as Height | From command | From Font | No effect |
| [ESC] + P, [ESC] + p | Width Not Zero | From Command | From command | Based on set character spacing command | Will be used if previously set and character spacing is not being defined by the font |
| [ESC] + I, [ESC] + i | Value 0 | No effect | No effect | From Font | Set Off but has no effect |
| [ESC] + I, [ESC] + i | Value Not zero | No effect | No effect | From Command | Set Off |
| [ESC] + J, [ESC] + j | Value 0 | No effect | No effect | From Font | Set On but has no effect |
| [ESC] + J, [ESC] + j | Value Not zero | No effect | No effect | A multiple of the value defined by the command | Set On |
| [ESC]I <n> | | From POR.INI definition | From POR.INI definition | As defined by command | Will be used if previously set. |

| Function | Set minimum character height and width in points. | All |
|-------------|---|-----|
| ASCII | [ESC] + P <w><h> | |
| Hexadecimal | 1BH 2BH 50H | |
| Decimal | <27> <43> <80> | |
| Range | w = 0, 4 - 72 h = 4 - 72 | |

The [ESC] + P command will set the minimum character width or height based on “w” for the width and “h” for height, where “w” and “h” are in points, defined as 1/72nd of an inch increments.

If the character width is set to zero, the height will be used for the width and proportional spacing will be used.

Note: The set pitch command will take precedence unless this command selects 0 width.

| Function | Set minimum character height and width in ¼ points. | All |
|-------------|---|-----|
| ASCII | [ESC] + p <w><h> | |
| Hexadecimal | 1BH 2BH 70H | |
| Decimal | <27> <43> <112> | |
| Range | w = 0, 16 - 255 h = 16 - 255 | |

The [ESC] + p command will set the minimum character width or height based on “w” for the width and “h” where “w” and “h” are in ¼ points or 1/288th of an inch increments. This approximates setting characters by dot.

If the character width is set to zero, the height will be used for the width and proportional spacing will be used.

Note: The set pitch command will take precedence unless this command selects 0 width.

| Function | Set Character spacing in points. | All |
|-------------|----------------------------------|-----|
| ASCII | [ESC] + I <d> | |
| Hexadecimal | 1BH 2BH 49H | |
| Decimal | <27> <43> <73> | |
| Range | d = 0, 4 - 72 | |

The [ESC] + I command will set the character spacing in points, where one point is defined as 1/72nd of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + J command in that all characters are centered on the fixed cell size. If the character is too big for the cell, it may overlap the previous and next character. The character size is not adjusted to fit the cell.

If d = 0 variable spacing is selected.

Note: If the current character size is too large for the selected spacing, the characters will overlap. Variable spacing is recommended.

| Function | Set Character spacing in ¼ points. | All |
|-------------|------------------------------------|-----|
| ASCII | [ESC] + i <d> | |
| Hexadecimal | 1BH 2BH 69H | |
| Decimal | <27> <43> <105> | |
| Range | d = 0, 16 - 255 | |

The [ESC] + i command will set the character spacing in points, where ¼ point is defined as 1/288th of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + j command in that all characters are centered on the fixed cell size. If the character is too big for the cell, it may overlap the previous and next character. The character size is not adjusted to fit the cell.

If d = 0 variable spacing is selected.

Note: If the current character size is too large for the selected spacing, the characters will overlap. Variable spacing is recommended.

| Function | Set Character spacing in points with adjustment. | All |
|-------------|--|-----|
| ASCII | [ESC] + J <d> | |
| Hexadecimal | 1BH 2BH 4AH | |
| Decimal | <27> <43> <74> | |
| Range | d = 0, 4 - 72 | |

The [ESC] + J command will set the character spacing in points, where one point is defined as 1/72nd of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + I command in that if the character is too large for the cell, the cell will be expanded in multiples of <d> until the character fits.

If d = 0 variable spacing is selected. However, note that the cell adjustment flag will remain set and if legacy commands are used they will allow the cell to be expanded.

Note: If the current character size is too large for the selected spacing, the cell size will be expanded

| Function | Set Character spacing in points with adjustment. | All |
|-------------|--|-----|
| ASCII | [ESC] + j <d> | |
| Hexadecimal | 1BH 2BH 6AH | |
| Decimal | <27> <43> <106> | |
| Range | d = 0, 16 - 255 | |

The [ESC] + j command will set the character spacing in points, where $\frac{1}{4}$ point is defined as $\frac{1}{288^{\text{th}}}$ of an inch. This command will force mono-space printing. It will override any character spacing set by the set character height and width commands defined above. This spacing will be enforced until deactivated by setting the value to 0 or if the set character height and width commands use a 0 for the width indicating proportional spacing should be used. This command differs from the [ESC] + i command in that if the character is too large for the cell, the cell will be expanded in multiples of <d> until the character fits.

If d = 0 variable spacing is selected. However, note that the cell adjustment flag will remain set and if legacy commands are used they will allow the cell to be expanded.

Note: If the current character size is too large for the selected spacing, the characters will overlap. Variable spacing is recommended.

| Function | Set minimum Line Spacing in Points | All |
|-------------|------------------------------------|-----|
| ASCII | [ESC] + V <d> | |
| Hexadecimal | 1BH 2BH 56H | |
| Decimal | <27> <43> <86> | |
| Range | d = 0, 4 - 72 | |

The [ESC] + V command will set the line spacing in points, where one point is defined as $\frac{1}{72^{\text{nd}}}$ of an inch.

If d = 0 variable spacing is selected.

Note: This is the minimum spacing. If the character height setting requires a larger spacing, the character height will override this setting.

| Function | Set minimum Line Spacing in ¼ Points | All |
|-------------|--------------------------------------|-----|
| ASCII | [ESC] + v <d> | |
| Hexadecimal | 1BH 2BH 76H | |
| Decimal | <27> <43> <118> | |
| Range | d = 0, 16 - 255 | |

The [ESC] + v command will set the line spacing in ¼ points, where ¼ point is defined as 1/288th of an inch.

| | |
|-------------|-----------------|
| ASCII | [ESC] + v <d> |
| Hexadecimal | 1BH 2BH 76H |
| Decimal | <27> <43> <118> |
| Range | d = 0, 16 - 255 |

If d = 0 variable spacing is selected.

Note: This is the minimum spacing. If the character height setting requires a larger spacing, the character height will override this setting.

| Function | Set stroke font brush size. | All |
|-------------|-----------------------------|-----|
| ASCII | [ESC] + B <w> | |
| Hexadecimal | 1BH 2BH 42H | |
| Decimal | <27> <43> <66> | |
| Range | w = 0, 6 - 200 | |

Description The [ESC] + B command will set brush stroke percentage for stroke fonts. If the brush size is set to zero the font design stroke width will be used.

Values from 6 to 200 represent 0.4 to 12% of the em-width of the font. The default for most fonts is about 3%. The Epic 880TM using the GB18030 font supplied by TransAct Technologies produces the best characters with a brush size of about 100.

Note: The default value for the brush stroke may be set in the POR.INI file.

| [ESC] [P | Set character pitch (Legacy mode command) | PcOS |
|-------------|---|------|
| ASCII | [ESC] [P <n> | |
| Hexadecimal | 1BH 5BH 50H <n> | |
| Decimal | <27> <91> <80> <n> | |
| IPCL | &%F1, &%F2, &%F3, &%F4, &%F5, &%F6, &%F7 | |
| EPOS | [ESC] [SP] <n> | |

Description The [ESC] [P <n> command sets character per inch print pitch to <n>. The printer resolution limits the exact print pitch. The following table lists the exact pitch for various values on <n>.

| <n> | Resulting Characters per Inch | IPCL |
|-----|-------------------------------|------|
| 1 | 1.00 | |
| 2 | 2.00 | |
| 3 | 3.01 | |
| 4 | 4.00 | |
| 5 | 4.95 | |
| 6 | 5.94 | |
| 7 | 6.93 | |
| 8 | 8.00 | &%F7 |
| 9 | 9.04 | |
| 10 | 9.90 | &%F3 |
| 11 | 10.95 | |
| 12 | 12.23 | &%F2 |
| 13 | 13.00 | |
| 14 | 13.87 | |
| 15 | 14.86 | &%F6 |

| <n> | Resulting Characters per Inch | IPCL |
|-----|-------------------------------|------|
| 16 | 16.00 | |
| 17 | 17.33 | &%F1 |
| 18 | 17.33 | |
| 19 | 18.91 | |
| 20 | 20.8 | &%F5 |
| 21 | 20.8 | |
| 22 | 23.11 | |
| 23 | 23.11 | |
| 24 | 23.11 | &%F4 |
| 25 | 23.11 | |
| 26 | 26 | |
| 27 | 26 | |
| 28 | 26 | |
| 29 | 29.71 | |
| 30 | 29.71 | |

Table 11 Character Pitch

This command disables any right-side spacing set by the [ESC] V command. It enforces this spacing on the current font selection even if the character is too large for the spacing. In addition, when font changes are made, the character pitch is maintained.

Legacy Printer Features that Have Changed

Because this product employs outline and stroke font character generation, support for several legacy features are changed from previous printers.

User Defined Characters

User defined character were previously supported by a series of commands that would allow the user to define a new character bitmap. As characters are no longer bitmaps, these commands are not supported. If custom user defined characters are required, a custom font may be generated using any number of off-the-shelf font generation tools. The custom font may be loaded into the printer and then printed as any other character.

Dynamic Code Page Definition

Dynamic code page definition is still supported when in ASCII mode, however Unicode is now used for the source character locations.

Chapter 11

File System

This page intentionally left blank

File System Interface

The Epic 880™ provides a file system to support fonts, configuration information, user graphics and macros.

There are a number of commands that are provided to support the file system. In general, files need to be opened for read or write, read or written, and then closed. There is a command that will delete a file, and print or return a file directory.

TransAct Technologies provides a Windows® based tool that will interact with the Epic 880™ and provide a drag and drop interface to the file system.

The file system in the Epic 880™ is partitioned into two sections, one for internal system use by the printer, and one for user information.

The system partition is referred to as partition 0. It is reserved for fonts, configurations and code page files. This partition cannot be deleted or completely erased. The second partition is for all other information. There is a command that will erase all the files in this partition. The partition where files are placed is determined by the three character extension.

File System Commands

| Function | Open File command. | All |
|--------------------|--|-----|
| ASCII | [ESC] [RS] O < Mode > <space> < Filename ><0> | |
| Hexadecimal | 1BH 1EH 4FH | |
| Decimal | <27> <30> <79> | |
| Mode | Mode of operation “r” for read or “w” for write. | |
| FileName | File name from 1 to 30 characters including a three character extension. | |
| Description | The [ESC] [RS]O command will select and open a file for the selected operation. If the file being opened for write exists, the existing file will be overwritten. Note that only one file may be open for external operations at any one time. | |
| | The Mode and FileName take the following format and must be null terminated: r Filename.ext<0> | |
| | Valid Modes are: | |
| | “r” Read. | |
| | “w” Write | |
| | “w+” Write Append (Future enhancement) | |
| | “ram” open a RAM file for write. | |

Note: RAM files capability is an option and not available on all products.

File Extensions are any three characters. The following are predefined and reserved for internal use.

| Extension | Partition 0= System 1= User | Definition |
|-----------|-----------------------------------|----------------------------------|
| .udf | 1 | Undefined macro type |
| .mac | 1 | Command Macro |
| .img | 1 | Graphic image. (Internal format) |
| .bgp | 1 | Bitmapped internal graphic |
| .cfg | 0 | configuration. |
| .tff | 0 | true type font |
| .ccc | 0 | compressed stroke font |
| .cpm | 0 | code page map. |
| .bmp | 1 | bitmap graphic file |
| .gph | 1 | raster graphic file. |
| .ini | 0 | System information file |
| .sys | 0 | Load image |
| .sy_ | 0 | Compressed load image. |

Note: All other file extensions will be placed in Partition 1 (user space)

| Function | Return Free space for Open File. | All |
|----------|----------------------------------|-----|
|----------|----------------------------------|-----|

ASCII [ESC] [RS] S

Hexadecimal 1BH 1EH 53H

Decimal <27> <30> <83>

Description The [ESC] [RS]S command will return an identifier byte and 4 additional bytes representing a 32 bit value (LSB First) representing the amount of free space in the partition containing the open file.

The format is as follows:

S <B₇₋₀><B₁₅₋₈><B₂₃₋₁₆><B₃₁₋₂₄>

| Function | Return Free space for this partition. | All |
|----------|---------------------------------------|-----|
|----------|---------------------------------------|-----|

ASCII [ESC] [RS] s<n>

Hexadecimal 1BH 1EH 73H

Decimal <27> <30> <115>

Where n = The partition

Description The [ESC] [RS]s command will return an identifier byte and 4 additional bytes representing a 32 bit value (LSB First) representing the amount of free space in the partition.

The format is as follows:

S <B₇₋₀><B₁₅₋₈><B₂₃₋₁₆><B₃₁₋₂₄>

| | | |
|--------------------|---|------------|
| Function | Close File command. | All |
| ASCII | [ESC] [RS] C | |
| Hexadecimal | 1BH 1EH 43H | |
| Decimal | <27> <30> <67> | |
| Description | The [ESC] [RS]C command will close the currently open file. | |

| | | |
|--------------------|---|------------|
| Function | Close All Files command. | All |
| ASCII | [ESC] [RS] K | |
| Hexadecimal | 1BH 1EH 4BH | |
| Decimal | <27> <30> <75> | |
| Description | The [ESC] [RS]K command will close the font system and close all currently open files. Internal fonts will be reopened automatically if used. | |

| | | |
|--------------------|---|------------|
| Function | Delete File command. | All |
| ASCII | [ESC] [RS] D <Filename><0> | |
| Hexadecimal | 1BH 1EH 44H | |
| Decimal | <27> <30> <68> | |
| FileName | File name from 1 to 30 characters including a three character extension, null terminated. | |
| Description | The [ESC] [RS]D command will select and delete a file. | |

Note: Some of the system files are protected and cannot be deleted.

| | | |
|--------------------|--|------------|
| Function | Set/Clear File Attributes command. | All |
| ASCII | [ESC] [RS] A < Attbs > <space> < Filename ><0> | |
| Hexadecimal | 1BH 1EH 41H | |
| Decimal | <27> <30> <64> | |
| Attbs | File attributes to modify. | |
| FileName | File name from 1 to 30 characters including a three character extension. | |

Each file has several attributes associated to it. They include S, R, and H.

| Attribute | Syntax | Name | Use |
|-----------|----------|-----------|---|
| S | +S or -S | System | This is a system file. |
| R | +R or -R | Read Only | This file cannot be erased or modified. |
| H | +H or -H | Hidden | This file is hidden and not displayed in the directory listing. |

Note: Attributes can be combined, however, each needs to have the + or - as a prefix.

To allow these attributes to be set and cleared, the [ESC][RS]A command can be used. The format is as follows:

[ESC][RS]A-R-S FileName<0>

This command will remove the Read only and System attributes form File name.

| | | |
|--------------------|---|------------|
| Function | Return the last file command status. | All |
| ASCII | [ESC] [RS] ? | |
| Hexadecimal | 1BH 1EH 3FH | |
| Decimal | <27> <30> <63> | |

The [ESC][RS]? Command requests the file system to return the status of the last file operation.

This command returns an identifier byte, followed by 2 bytes indicating the status results of the last file command. The format will be as follows:

?<Status><Details> or 3F, (47 or 42), <Details>

Where:

Status = 'G' for success and 'B' for Failure

Detail = Detailed status as a binary byte with bit definitions as follows:

| Bit | Hex | Decimal | Function |
|-----|-----|---------|--|
| 0 | 01 | 1 | File Open |
| 1 | 02 | 2 | File in Write Mode |
| 2 | 04 | 4 | The Read response is shorter than requested and EOF has been encountered. |
| 3 | 08 | 8 | The file is already open. |
| 4 | 10 | 16 | The file system has no space for the preceding operation. Could be out of Flash or out of Buffer space. |
| 5 | 20 | 32 | A write operation has been attempted to a read only file. |
| 6 | 40 | 64 | File requested was not found |
| 8 | 80 | 128 | An error has occurred. Other bits may be set that give additional detail. (This bit determines the G or B status in the previous byte) |

| | | |
|--------------------|--|------------|
| Function | Write File command. | All |
| ASCII | [ESC] [RS] W <L _L ><L _H ><... data ..> | |
| Hexadecimal | 1BH 1EH 57H | |
| Decimal | <27> <30> <87> | |

Description The [ESC] [RS]W command sends data to the printer to be stored in the file. The <LL><LH> parameters specify the length of data that will follow where the length is LH * 256 + LL. The data is treated as binary data with no translations.

| | | |
|-----------------|---------------------------|------------|
| Function | Read File command. | All |
|-----------------|---------------------------|------------|

ASCII [ESC] [RS] R <L_L><L_H>

Hexadecimal 1BH 1EH 52H

Decimal <27> <30> <82>

Description The [ESC] [RS]R command requests that data be read from the file and returned to the host.

The <LL><LH> parameters specify the length of data that should be returned where $LH * 256 + LL$ specifies the number of returned bytes. The data is treated as binary data with no translations. If there is not enough data in the file to make up the requested length, only the available data is returned.

| | | |
|-----------------|---|------------|
| Function | Generate and return a file directory report. | All |
|-----------------|---|------------|

ASCII [ESC] [RS] I

Hexadecimal 1BH 1EH 49H

Decimal <27> <30> <73>

Description The [ESC] [RS]I command requests that a formatted text directory be returned from the printer. Each line is null terminated.

| | | |
|-----------------|---------------------------------------|------------|
| Function | Erase all files in a partition | All |
|-----------------|---------------------------------------|------------|

ASCII [ESC] [RS] X <p>

Hexadecimal 1BH 1EH 58H

Decimal <27> <30> <88>

<p> selects the partition. 0 = System, 1 = User.

Description The [ESC] [RS]X command requests that the selected partition be reformatted. Reformatting the system partition <0> is not recommended, as it will erase all fonts and render the printer unusable.

| | | |
|-----------------|-------------------------------------|------------|
| Function | De-fragment the file system. | All |
|-----------------|-------------------------------------|------------|

ASCII [ESC] [RS] F

Hexadecimal 1BH 1EH 46H

Decimal <27> <30> <70>

Description The [ESC] [RS]F command forces the file system to go through the file system and clean up deleted file sectors. All sectors flagged for deletion are actually erased and consolidated when this command is issued.

Note: File space is not necessarily freed up by a file delete. Sectors may be marked for deletion but still be present but inactive in the file system. These sectors take up flash space. Each cluster has a fixed number of sectors, and if the number of deleted sectors in a cluster exceed a predefined threshold, the cluster is de-fragmented automatically. This command forces all clusters to be de-fragmented.

| Function | Verify files. | All |
|-------------|----------------|-----|
| ASCII | [ESC] [RS] V | |
| Hexadecimal | 1BH 1EH 56H | |
| Decimal | <27> <30> <86> | |

Description The [ESC] [RS]V opens and reads the VERIFY.CFG file. This file contains a list of all files that are to be validated in the printer and the expected CRC of the file. If all the files verify, this command will return VG followed by it's 2 byte CRC. If any of the files do not verify, the command will return VB followed by it's 2 byte CRC.

For example the file might look like this:

```
Por.ini 0x06FF
Usb.sys 0xDEF9
```

Only the Por.ini and Usb.sys files will be checked in this example.

An additional and optional feature of this command is that it can verify the CRC of the operating firmware. By adding "Firmware" as a file name, this command will recalculate the Firmware CRC and compare it to the master value. If the recalculation does not match the master value, this command will return a failed response. The file would be as follows to add the Firmware check. By using the master value, this file need not be updated if the firmware is updated.

```
Por.ini 0x06FF
Usb.sys 0xDEF9
Firmware
```

By knowing the CRC of the Verify.cfg file, the host application can verify that all the other files are correct (and optionally the firmware) without knowing anything about the other files of firmware.

Note: The default Verify.cfg file contains the as shipped POR.INI file, the USB.SYS file and any resident fonts. In addition it includes a Firmware Verify. If any of these files are modified, the Verify command must be updated to reflect any changes.

Note: This command is not performed as a condition of normal operation. It is up to the host application to refuse to use the printer if this command returns a fail to verify status.

Note: if the Verify.cfg file is not present, the verify command will return VB and a 0 CRC.

Chapter 12

Epic 880™ Extended Printer Control

This page intentionally left blank

The Epic 880™ printer has a number of Extended Control commands that allow an application to better track and maintain the printer. These commands are part of each supported emulation¹⁷.

The printer maintains a log of printer activity. This activity may be returned to the host with the [ESC]~ T command. This command returns a ~T followed by four binary bits that make up a 32 bit unsigned integer. The description of the command below describes the format in full.

The printer also contains a number of commands that will force the printer to perform specific functions to help maintain the printer or print information about the printer. The functions available are:

- 1) Print current configuration
- 2) Print current log totals

Note: Each of these commands follow the ESC~ or ESCy format. Other functions are performed by these basic commands. Do not attempt to use any undocumented version of these commands. The extended diagnostics commands may affect the print quality and performance of the printer. In some cases, the commands may degrade the performance of the print cartridge or mechanism.

| Function | Read and Return Totals |
|--|------------------------|
| ASCII | [ESC] ~ T <n> |
| Hexadecimal | 1BH 7EH 54H <n> |
| Decimal | <27> <126> <84> <n> |
| Description This command returns the current statistics for parameter n. The value returned will be ~T<n> with the next 4 bytes being an unsigned integer. For example: | |

[ESC]~T<1> Request cover open count

Returns: ~T<1><0><0><1><100> or 256 + 100 or 356 cover opens

| Values of n | Request: |
|-------------|--------------------|
| 0 | Black Dots |
| 1 | Red Dots |
| 2 | Not Used |
| 3 | Cover Opens |
| 4 | Paper Outs |
| 5 | Line Feeds |
| 6 | Characters Printed |
| 7 | Not Used |
| 8 | Not Used |
| 9 | Standby Cycles |

¹⁷ The Star emulation does not allow the use of [ESC] y commands for extended diagnostics. The [ESC] y commands are not available.

- 10 Power Up Resets
- 11 Watchdog Resets
- 12 Base Flash Erases
- 13 Ext Flash Erases
- 14 Auto Cutter Cycles
- 15 Init Requests
- 16 Error Vectors
- 17 Auto Cutter Faults
- 18 Power On Time (Min.)
- 19 System Active Time (Min.)
- 20 Over Temperature
- 21 Cutter Re-Home
- 22 Level 1 Jam Detections
- 23 Level 2 Jam Detections
- 24 Missed TOF
- 25 Configuration Faults
- 26 Not Used
- 27 Flash File Faults

| | |
|--------------------|---|
| Function | Print Current Configuration and Totals |
| ASCII | [ESC] y <9> or [ESC] ~ <9> |
| Hexadecimal | 1BH 79H 09H |
| Decimal | <27> <121> <9> |
| Description | This command forces the printer to print the current configuration. To function correctly it must be issued with the printer in the proper emulation mode. It is intended to be printed in the default TransAct® configuration but will print in any configuration. |
| Note: | This command must be preceded with an ESC y <8>. |
| Function | Print Current Totals |
| ASCII | [ESC] y <15> |
| Hexadecimal | 1BH 79H 0FH |
| Decimal | <27> <121> <15> |
| Description | This command forces the printer to print the current totals log. |
| Note: | This command must be preceded with an ESC y <8>. |
| Function | Print Current Print Setup Values |
| ASCII | [ESC] y <20> or [ESC] ~ <20> |
| Hexadecimal | 1BH 79H 14H |
| Decimal | <27> <121> <20> |
| Description | This command forces the printer to print the current setup values. |
| Note: | This command must be preceded with an ESC y <8>. |
| Function: | Set Electronic Journal Print Configuration Control |
| ASCII: | [ESC] ~ j <n> |
| Hex: | 1BH 7EH 6AH |
| Decimal: | <27><126><105> |
| Description | This command reconfigures the electronic journal print mode record separator and manual printing modes |
| Where n = | 76543210 Bit values |
| -----X0 | Manual Electronic Journal Print mode is Enabled |
| -----X1 | Manual Electronic Journal Print mode is Disabled |
| -----0X | A Record separation line is printed that may contain a |
| number. | record |
| -----1X | No Record separation line is printed. |
| Note: | Both parameters must be set at the same time by this command. |
| Note: | The record separation configuration may be set in manual configuration mode. This command will reset the configuration to the value specified here. |
| Note: | This command performs a configuration update, and should not be done on a regular basis. |
| Note: | This command must be preceded with an ESC y <8> to enable it. |

Remote Printer Reset

Reset in Serial Mode

It is possible to generate a software printer reset in serial mode. The [ENQ] <10> command requests that the printer reset. (This is not a hardware reset). The reset completely initializes the hardware and software, but the printer does not recover from a loss of software control.

Note: If the printer mode was changed by the [ESC] y <2> or <3> command, a soft reset will not return to the power on default.

The command flow is as follows:

- The [ENQ] <10> is acknowledged. During cleanup and initialization, the printer is placed off-line. Before the printer initializes, it tries to clean up its input buffer and other internal processes.
- The printer's software is reinitialized.
- The power-cycled flag is set.
- The print head is homed and re-calibrated.
- The printer goes back on-line.

Miscellaneous Communication Features

Power-cycle Recovery

Sometimes the host needs to know if the printer was power cycled. An example would be after the receipt tape was changed. It is not necessary to turn off the printer to change the receipt. However, if the operator does, any information sent to the printer before the power cycle will be lost.

The Epic 880™ Printer has a flag that is set after a reset. The flag stays set until the host requests a reset. The [ENQ] <11> command reads the flag. If the command returns power-cycled status, the power has been reset or power cycled since the last request. All unprinted information has been lost.

If the print operation is critical, it is a good idea to check the power-cycle flag before and after all transactions. An alternate approach is to check the flag after every off-line to on-line transition.

Note: If the printer mode was changed by the [ESC] y <2> or <3> command, a power-cycle reset will return to the initial configuration.

Off-line Control

A configuration flag that prevents the printer from going off-line (in most cases) is available. Off-line mode allows the application to query the printer for status rather than assume a status from the control signals. The feature allows the host application to query the printer at all times except when there is no power; a full input buffer; or a hard failure. For example, when the printer's cover is open, the printer stops printing but still accepts data and inquiries. The inquire cover status command returns, "Cover open."

Hard failures result when there is no power or a printer fault occurs. If the printer is off-line, either the input buffer is full or a hard fault has occurred. The host application should not allow the input buffer to fill.

Remote Boot Load Mode

Remote boot load mode is entered by command. The boot image data format is preparatory to TransAct and is not documented here. There are however a few commands that are useful to determine if the printer is in the boot load mode and if a boot load has been successful.

[ESC] ~ 14% Enter Remote Boot Load mode

ASCII [ESC] ~ <14> %
 Hexadecimal 1BH 7EH 0EH 25H
 Decimal <27> <126> <14> <37>
 IPCL none
 EPOS [ESC] ~ <14> %

Description The [ESC] ~ <14> % command is an extended diagnostics command. It will transfer control of the printer to the Remote Boot loader.

[STX] K Read and return application rev.

ASCII [STX] K
 Hexadecimal 02H 4BH
 Decimal <2> <75>

Description Boot loader command only. Read and return the Application firmware id and revision.

[STX] B Read and return boot loader rev.

ASCII [STX] B
 Hexadecimal 02H 42H
 Decimal <2> <66>

Description Boot loader command only. Read and return the boot loader firmware id and revision.

[STX] X Check and start normal operation

ASCII [STX] X
 Hexadecimal 02H 58H
 Decimal <2> <88>

Description Boot loader command only. Check the CRC and restart the printer if the firmware image is valid.

USB Recovery Watch Dog

The USB link can be susceptible to various errors that can cause it to stop functioning. This typically happens when noise is introduced into the cable resulting in a buffer overrun at the host. This can cause a hub or a USB driver to suspend interaction with whatever device appeared to be the source of the problem. When this happens, the only way to recover the link is to disconnect from the device and then reconnect. This is typically done in the host. In some cases, for various reasons, the host driver is not able to generate a disconnect. (The Transact TVS driver provides recovery but the Windows USB printer services driver does not.)

It is possible to have the printer force a disconnect, however, the host application must start the service and then continue to extend the disconnect watch dog.

There is one command and two status indicators to help the application keep track of the watch dog.

When activated the printer will schedule a USB disconnect/reconnect after the specified time unless the command is sent again to either extend the timer or to disable the timer before the timer expires.

| | |
|-----------------------------|-------------------------------|
| [ESC][CAN] <n> | Activate USB Watch Dog |
|-----------------------------|-------------------------------|

ASCII [ESC][CAN] <n>

Hexadecimal 1BH 18H

Decimal <27> <24>

Function The [ESC][CAN]<n> command schedules a USB disconnect/reconnect cycle after n seconds. The scheduled disconnect can be canceled by issuing [ESC][CAN]<0>.

Where

n = 0 disable any scheduled disconnect.

n = 1-255 Scheduled a disconnect/reconnect after n seconds from when the command is received.

If the disconnect occurs as a result of this command. The printer will reset the USB controller which appears to the host as a disconnect. (Effectively, the host will think the printer is off) The USB controller will be held in reset for 250 milliseconds. When the reset is removed, the USB controller will restart and a normal enumeration process will start. The printer will report not ready and not accept data for another 500 milliseconds. This will allow time for the USB driver to reload and initialize. The printer will then report ready and allow normal data flow.

NOTE: This process does not actually affect the state of the print process. Any print commands previously sent to the printer will still be active.

To keep track of the watch dog status, the fact that a watch dog occurred is reported as part of the ENQ 20 status command. The total number of disconnects will be reported and reset by the ENQ 35 enquire command.

Note that the ENQ 35 command will reset the count and will also reset the status reported by ENQ 20. ENQ 20 does not reset the count. It simply reports that it occurred.

To keep track of how often this process is being used there is a printer statistics log entry that will be incremented when a USB watch dog disconnect actually occurs. This can be printed or reported to the host. Note: This total is not reset by the ENQ 35 command.

| | |
|-------------------------|--------------------------------------|
| [ENQ] <35> | Inquire USB Watch Dog Resets. |
|-------------------------|--------------------------------------|

ASCII [ENQ] <35>

Hexadecimal 05H 23H

Decimal <5> <35>

Function The [ENQ] <35> command returns the number of USB Watch dog resets and then resets the count to zero.

Response [ACK] <35> <41> <n>

Where

<35> Is the echo of command

<41> Length + 40

<n> The number of USB Watchdogs since the last inquire.

Recovery from Mechanical Errors

The TransAct Inquire commands and the Epson [DLE][ENQ] and [DLE][EOT] commands allow most printer error status to be read and in some cases recovery attempted. Paper jams and auto-cutter faults can be recovered, however, any data not previously printed will be lost.

If the application is to support error recovery, the application should use the appropriate status request commands to query the printer periodically. If an error response is such that the fault is recoverable, the host application should interact with the operator and request that the fault be corrected. (for example, clear a paper jam) When the operator indicates that the problem has been corrected, the host can issue a reset request.

If a serious error occurs, the printer will halt and enter fault error mode. If the fault is such that the printer can maintain communications with the host, the print status request and response system will remain active. The status of the system will however remain static, i.e. the status responses will reflect the state of the system when the fault occurred.

There are errors that cannot be reported to the host system. These errors are such that the integrity of the printer do not allow continued operation. That is there is no way to report the error. These errors occur (for the most part) during power up diagnostics. They are as follows:

EEPROM READ ERROR Power up only

The Internal EEPROM is not readable or the check sum is bad.

Pressing the Power Button will attempt to rewrite the configuration information. This may leave the printer configured incorrectly.

EEPROM WRITE ERROR Power up/down and Configuration only

The Internal EEPROM is defective. There is no recovery.

SOFTWARE ERROR VECTOR Can occur at any time.

These errors can occur during operation. They signal a serious problem with the system. In most cases this error will also generate a Watch Dog reset. A power cycle will generally recover normal printer operation. An ESD event or a firmware bug generally causes these errors. The printer maintains an error log, this log contains additional information about the fault and is printed during manual configuration. The information in this log should be reported to TransAct to identify the exact cause of the fault.

USERSTORE FORMAT ERROR Power up or User Store Write Operations

The User Store data in FLASH has an invalid format. Pressing the Power Button will erase the user store and reformat it. This can be caused by a firmware update.

FLASH WRITE ERROR Power up or User Store Write Operation.

The Program Flash has failed. There is no recovery from this error.

COM ADAPTER ERROR Power up only

The communications interface card is not supported by the firmware or is missing. There is no recovery.

Chapter 13

Epic 880™ Programmers Notes

This page intentionally left blank

General Notes

When the serial port is used, it is important that the output lines from the printer not be shorted or back driven. If the signals are not to be used, they should be left open.

The best time to configure the printer from the host using remote configuration is during system setup or software update.

What Drivers Are Needed

Deciding what drivers are needed can be confusing. This section is included to make that process easier.

Definitions

First, a few definitions:

OS - Operating System.

Types of OS's are: Windows (9x/Me/4.0/2000), Linux, Unix, OS2, ...

Application - A software program that a person uses to do something (i.e. a POS application)

Program - Program and Application are used interchangeably.

Driver - software that makes hardware do something (i.e. something useful, we hope). A driver translates (or converts) a software command to a command that specific hardware can understand.

Types of drivers: Printer driver, Port driver, OPOS driver, USB driver...

OCX/ActiveX - a software component that utilizes Microsoft's OLE (Object linking and embedding).

API - Application Programming Interface. In the generic sense "The API" refers to the Windows Operating system API.

Types of API's: Windows API, Visual Basic API, Delphi API, MFC API

Do you want to use the standard USB printing device interface?

The printer can be configured to present itself as a standard printer class device. This interface is specified by the USB standards committee and is documented as the *USB Device Class Definition for Printing Devices*. Go to www.usb.org and search for this title or use the following link:

http://www.usb.org/developers/devclass_docs/usbprint11.pdf

Windows and most other operating systems that support USB will recognize this class and provide a standard interface to the application.

Do you want to use USB and simulate a communication port?

The TransAct Virtual Serial (TVS) USB Driver allows your application to think that it is communicating with a serial port, but is actually using the USB link to communicate with the printer.

This should be downloaded and installed when requested as part of the Windows Plug and Play or may be preinstalled.

The Epic 880™ printer supports a composite USB interface. This interface allows a Windows print driver to be installed to a windows USB printer port as well as supporting a virtual serial port. The printer USB port is configurable and either the windows printer port or the virtual serial port may be disabled. If you will be using OPOS, you should disable the Windows printer interface. If you are going to use only the Windows printer API, you can but do not need to disable the virtual serial interface.

Are you using OPOS (UnifiedPOS/UPOS)?

If you are using an application that is written to interface with the OPOS "Ole Point of Sale" standard, then the TransAct Technologies OPOS Driver will allow you to communicate with most of TransAct Technologies Printers. The OPOS Driver provides the mechanisms to print in all of the print modes supported by the printer.

Note: The TransAct Technologies OPOS driver only supports the Microsoft Windows Operating Systems.

Note: If you are using an Ethernet printer, UPOS can be configured to interact directly with the printer. You do not need the VSerial Ethernet driver.

Do you want to print from a Windows application?

Microsoft supports a Windows Printing API for Windows applications. This interface is intended to support typical Windows page printers and has features like begin document, end document and tray selection. Where this is not an ideal environment for a POS printer, however, there are cases where it is required.

To support this environment TransAct Technologies provides a Windows print driver with extensions for POS.

This may be downloaded and installed for most of TransAct Technologies printers.

Please read the Ithaca Printer API documentation included with the driver. A POS printer is not the same as a typical consumer printer and requires unique consideration when using a Windows printer API interface.

Windows Printer Driver

A Windows printer driver is a Microsoft specific, Microsoft defined, type of driver that the OS uses to translate drawing commands by a Windows application to a specific printer's command set. A window's printer driver is a graphics page mode driver. It is not a POS (Point of Sale) driver. (Have you ever had to open a cash drawer that was connected to your printer at home?)

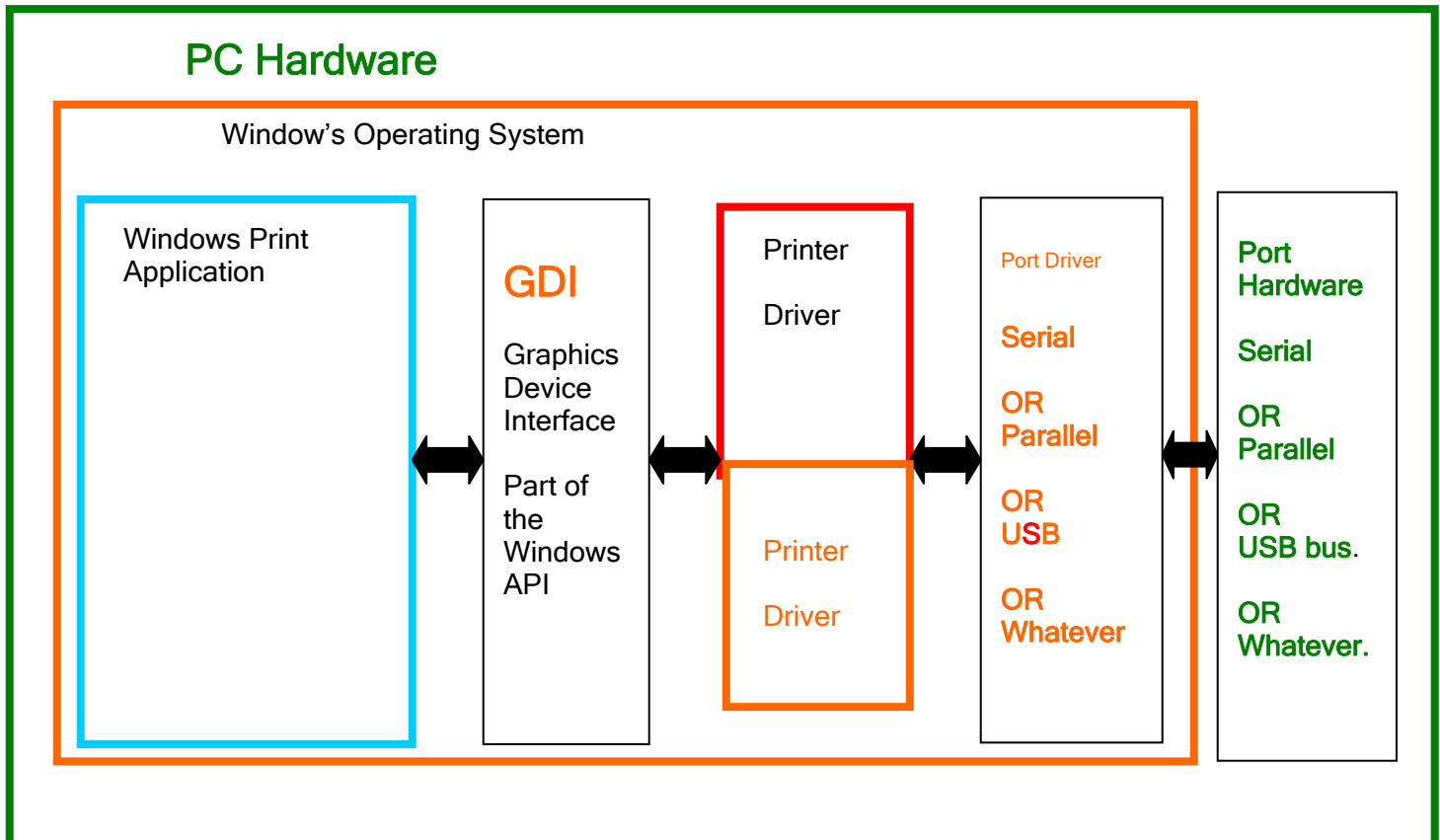


Figure 32 Windows Driver

When to use a windows printer driver:

Use a printer driver when writing a program that uses the Window's API to send print information to the printer.

When not to use a windows printer driver:

When a program wants to send printer command codes to the printer or when a program wants to get information back from a printer.

OPOS driver

An OPOS driver is an implementation of the UnifiedPOS (UPOS) specification.

It provides an application interface for retail devices viz. POSPrinter, Scanner, Cash drawer, Pole Display, MICR, Scale etc.

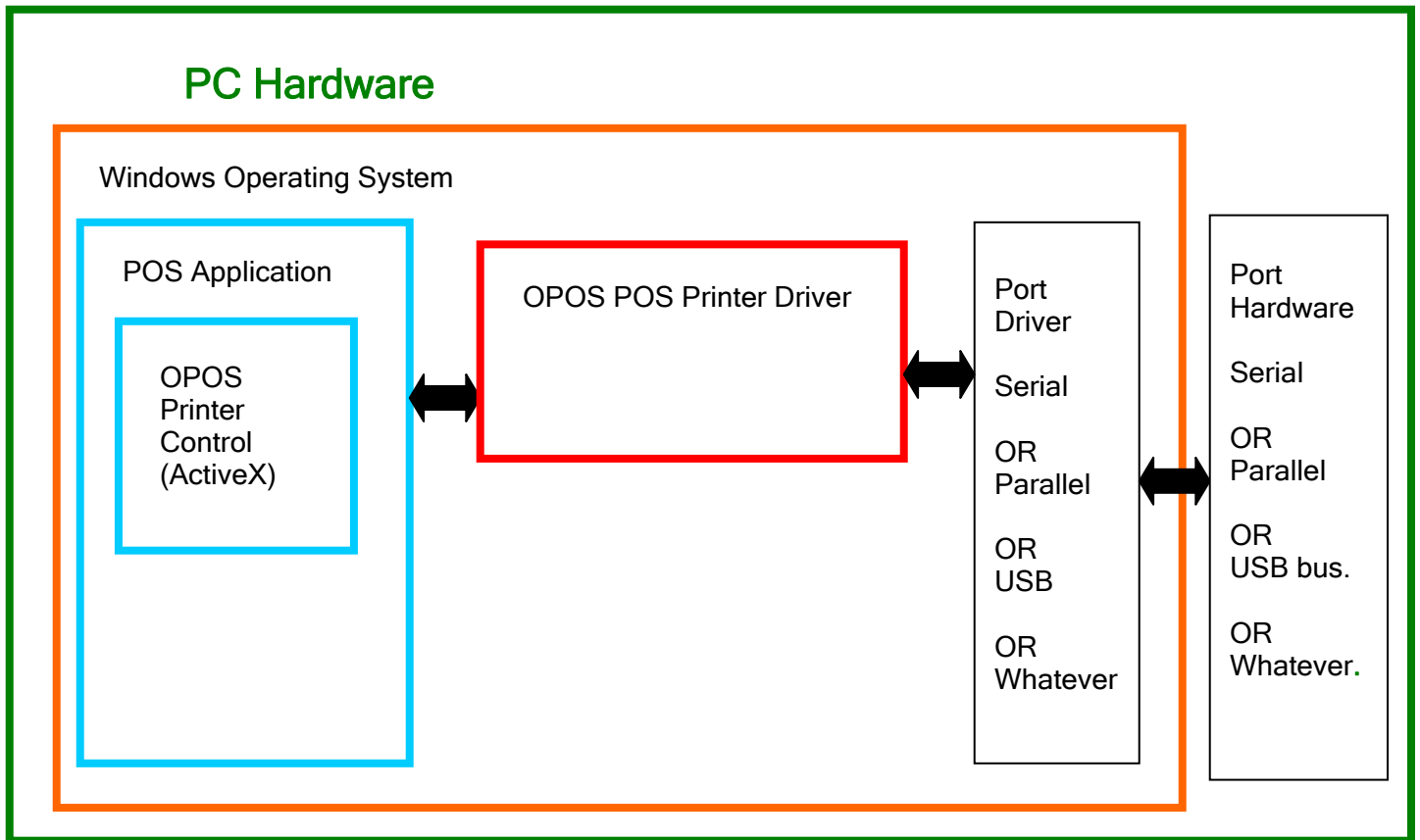


Figure 33 OPOS (UPOS) Driver

When to use an OPOS driver:

When an application is written that invokes the retail device functions based on the UPOS specification, in a vendor independent manner, OPOS can be used on the Microsoft Windows platform. It allows access to all the features of a retail device without having to deal with specific device commands. It also allows information to be retrieved from the retail device.

When not to use an OPOS driver:

When the application is written using windows print API and device specific commands are sent directly through the application, to the device.

USB driver:

A USB driver is a low level device driver, required for USB communication with the printers. It is a plug and play driver and needs to be installed for USB printers, when the printer is initially plugged into the system.

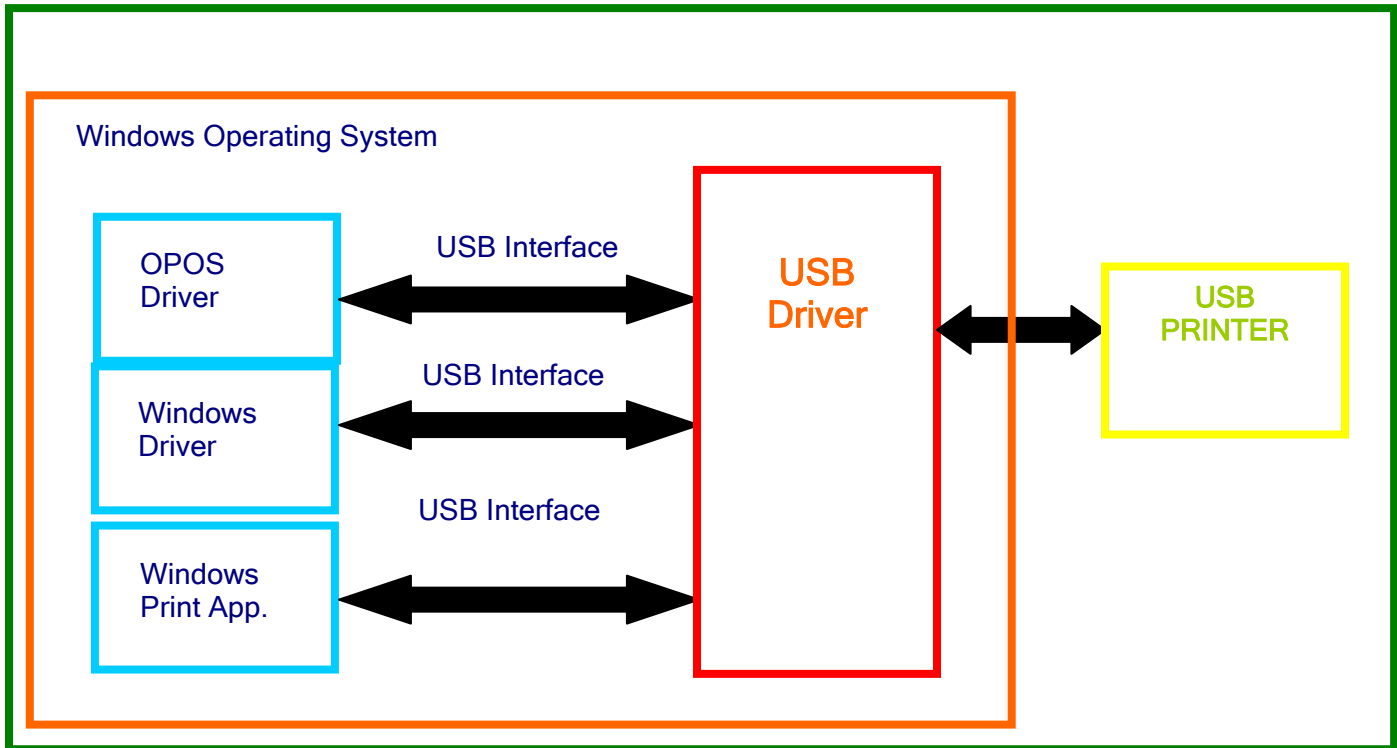


Figure 34 USB Driver

When to use the USB driver:

USB Driver is needed whenever data is to be sent/received from the printer using the USB interface. It is needed with both the Windows and the OPOS drivers, when these drivers use the USB interface as the underlying communication path. It is also needed if the application does not use either the OPOS or the Windows driver but needs to communicate directly with the printer using the USB interface.

When not to use the USB driver:

USB driver is not needed if the application uses any of the other forms of communication viz. serial, parallel or Ethernet, and does not use USB.

POSPrinter Activex Control (POSPrinter OCX):

This is not a driver; it is a software component that provides a connection from an application to a port driver. This allows an application to communicate “directly” with a printer. This approach allows an application to send the commands, it wants to, to the printer. This approach is similar to the “old DOS days” of talking to a POS printer.

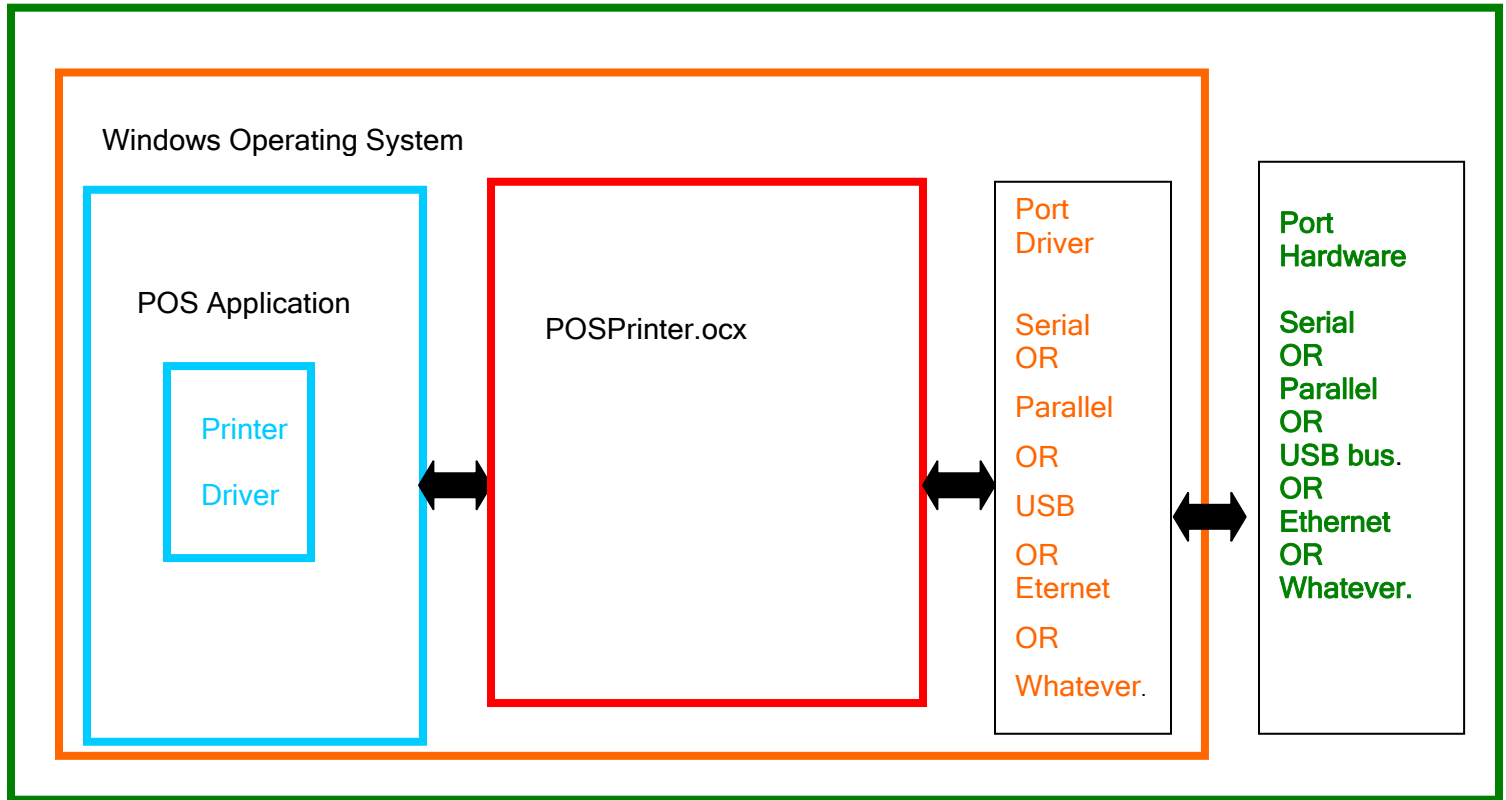


Figure 35 POSPrinter OCX

When to use the POSPrinter OCX:

When the application writer wants complete control of what is sent to the printer. The application must take the responsibility of sending the correct codes to the printer as well as detecting error conditions, and graceful recovery from error situations.

When not to use the POSPrinter OCX:

When you do not want to deal with the low-level commands sent to the printer.

Appendix A: Unicode Character Addresses

Note: This information is based on the Unicode 3.0 Standard. For specific character locations see the Unicode standard.

Note: The Epic 880™ does not contain all possible Unicode characters. The default character sets are defined by the WGL4 standard.

| Unicode Range | | Use |
|---------------|--------|---------------------------------------|
| 0x0000 | 0x007F | C0 Controls and Basic Latin |
| 0x0000 | 0x001F | C0 controls |
| 0x0020 | 0x007F | ASCII |
| 0x0080 | 0x00FF | C1 Controls and Latin-1 Supplement |
| 0x00A0 | 0x00FF | Latin1 |
| 0x0100 | 0x017F | Latin Extended-A |
| 0x0180 | 0x024F | Latin Extended-B |
| 0x0250 | 0x02AF | IPA Extensions |
| 0x02B0 | 0x02FF | Spacing Modifier Letters |
| 0x0300 | 0x036F | Combining Diacritical Marks |
| 0x0370 | 0x03FF | Greek |
| 0x0400 | 0x04FF | Cyrillic |
| 0x0500 | 0x052F | Unassigned zone 0500-052F |
| 0x0530 | 0x058F | Armenian |
| 0x0590 | 0x05FF | Hebrew |
| 0x0600 | 0x06FF | Arabic |
| 0x0700 | 0x08FF | Unassigned 0700-08FF |
| 0x0900 | 0x097F | Devanagari. Based on ISCII 1988 |
| 0x0980 | 0x09FF | Bengali. Based on ISCII 1988 |
| 0x0A00 | 0x0A7F | Gurmukhi. Based on ISCII 1988 |
| 0x0A80 | 0x0AFF | Gujarati. Based on ISCII 1988 |
| 0x0B00 | 0x0B7F | Oriya. Based on ISCII 1988 |
| 0x0B80 | 0x0BFF | Tamil. Based on ISCII 1988 |
| 0x0C00 | 0x0C7F | Telugu. Based on ISCII 1988 |
| 0x0C80 | 0x0CFF | Kannada. Based on ISCII 1988 |
| 0x0D00 | 0x0D7F | Malayalam. Based on ISCII 1988 |
| 0x0D80 | 0x0DFF | Unassigned zone 0D80-0DFF |
| 0x0D80 | 0x0DFF | Sinhala (Pre-Unicode 2.0) |
| 0x0E00 | 0x0E7F | Thai. Based on TIS 620-2529 |
| 0x0E80 | 0x0EFF | Lao. Based on TIS 620-2529 |
| 0x0F00 | 0x0F7F | Burmese (Pre-Unicode 2.0) |
| 0x0F00 | 0x0FBF | Tibetan |
| 0x0F80 | 0x0FFF | Khmer (Pre-Unicode 2.0) |
| 0x1000 | 0x105F | Tibetan (Pre-Unicode 2.0) |
| 0x1060 | 0x109F | Mongolian (Pre-Unicode 2.0) |
| 0x10A0 | 0x10FF | Georgian |
| 0x1100 | 0x11FF | Hangul Jamo |
| 0x1100 | 0x11F9 | Korean combining alphabet |
| 0x1200 | 0x137F | Ethiopian (Post-Unicode 2.0) |
| 0x13A0 | 0x13FF | Cherokee (Post-Unicode 2.0) |
| 0x1400 | 0x167F | Canadian Syllabics (Post-Unicode 2.0) |
| 0x16A0 | 0x1DFF | Unassigned zone 16A0-1DFF |
| 0x1E00 | 0x1EFF | Latin Extended Additional |
| 0x1F00 | 0x1FFF | Greek Extended |

| | | |
|---------|---------|--|
| 0x2000 | 0x206F | General Punctuation |
| 0x2070 | 0x209F | Superscripts and Subscripts |
| 0x20A0 | 0x20CF | Currency Symbols |
| 0x20D0 | 0x20FF | Combining Diacritical Marks for Symbols |
| 0x2100 | 0x214F | Letter like Symbols |
| 0x2150 | 0x218F | Number Forms |
| 0x2190 | 0x21FF | Arrows |
| 0x2200 | 0x22FF | Mathematical Operators |
| 0x2300 | 0x23FF | Miscellaneous Technical |
| 0x2400 | 0x243F | Control Pictures |
| 0x2440 | 0x245F | Optical Character Recognition |
| 0x2460 | 0x24FF | Enclosed Alphanumerics |
| 0x2500 | 0x257F | Box Drawing |
| 0x2580 | 0x259F | Block Elements |
| 0x25A0 | 0x25FF | Geometric Shapes |
| 0x2600 | 0x26FF | Miscellaneous Symbols |
| 0x2700 | 0x27BF | Dingbats |
| 0x27C0 | 0x27FF | Unassigned zone 27C0-27FF |
| 0x2800 | 0x28FF | Braille Pattern Symbols (Post-Unicode 2.0) |
| 0x2900 | 0x2FFF | Unassigned zone 2900-2FFF |
| 0x3000 | 0x303F | CJK Symbols and Punctuation |
| 0x3040 | 0x309F | Hiragana |
| 0x30A0 | 0x30FF | Katakana |
| 0x3100 | 0x312F | Bopomofo |
| 0x3130 | 0x318F | Hangul Compatibility Jamo. Based on KSC 5601 |
| 0x3190 | 0x319F | Kanbun |
| 0x31A0 | 0x31FF | Unassigned zone 31A0-31FF |
| 0x3200 | 0x32FF | Enclosed CJK Letters and Months |
| 0x3300 | 0x33FF | CJK Compatibility |
| 0x3400 | 0x4DFF | CJK Unified Ideograph Extension A (Post-Unicode 2.0) |
| 0x4E00 | 0x9FA5 | CJK Unified Ideographs |
| 0x9FA6 | 0xABFF | Unassigned zone 9FA6-ABFF |
| 0xAC00 | 0xD7A3 | Hangul Syllables |
| 0xD7A4 | 0xD7FF | Unassigned zone D7A4-D7FF |
| 0xD800 | 0xDB7F | High Surrogates |
| 0xDB80 | 0xDBFF | Private Use High Surrogates |
| 0xDC00 | 0xDFFF | Low Surrogates |
| 0xE000 | 0xF8FF | Private Use Area |
| 0xF900 | 0FAFF | CJK Compatibility Ideographs |
| 0xFB00 | 0xFB4F | Alphabetic Presentation Forms |
| 0xFB50 | 0xFDFF | Arabic Presentation Forms-A |
| 0xFE20 | 0xFE2F | Combining Half Marks |
| 0xFE30 | 0xFE4F | CJK Compatibility Forms |
| 0xFE50 | 0xFE6F | Small Form Variants |
| 0xFE70 | 0xFEFF | Arabic Presentation Forms-B |
| 0xFEFF | 0xFEFF | Special |
| 0xFF00 | 0xFFEF | Half width and Full width Forms |
| 0xFFFF0 | 0xFFFF | Specials |
| 0xFFFF0 | 0xFFFFD | Specials |
| 0xFFFFE | 0xFFFF | Not character codes |

Appendix B: WGL4.0 Character Addresses

Note: This information is based on the Microsoft's Typography web page.

| UNICODE | CHARACTER |
|---------|------------------------|
| 0020 | SPACE |
| 0021 | EXCLAMATION MARK |
| 0022 | QUOTATION MARK |
| 0023 | NUMBER SIGN |
| 0024 | DOLLAR SIGN |
| 0025 | PERCENT SIGN |
| 0026 | AMPERSAND |
| 0027 | APOSTROPHE |
| 0028 | LEFT PARENTHESIS |
| 0029 | RIGHT PARENTHESIS |
| 002A | ASTERISK |
| 002B | PLUS SIGN |
| 002C | COMMA |
| 002D | HYPHEN-MINUS |
| 002E | PERIOD |
| 002F | SLASH |
| 0030 | DIGIT ZERO |
| 0031 | DIGIT ONE |
| 0032 | DIGIT TWO |
| 0033 | DIGIT THREE |
| 0034 | DIGIT FOUR |
| 0035 | DIGIT FIVE |
| 0036 | DIGIT SIX |
| 0037 | DIGIT SEVEN |
| 0038 | DIGIT EIGHT |
| 0039 | DIGIT NINE |
| 003A | COLON |
| 003B | SEMICOLON |
| 003C | LESS-THAN SIGN |
| 003D | EQUALS SIGN |
| 003E | GREATER-THAN SIGN |
| 003F | QUESTION MARK |
| 0040 | COMMERCIAL AT |
| 0041 | LATIN CAPITAL LETTER A |
| 0042 | LATIN CAPITAL LETTER B |
| 0043 | LATIN CAPITAL LETTER C |
| 0044 | LATIN CAPITAL LETTER D |
| 0045 | LATIN CAPITAL LETTER E |
| 0046 | LATIN CAPITAL LETTER F |
| 0047 | LATIN CAPITAL LETTER G |
| 0048 | LATIN CAPITAL LETTER H |
| 0049 | LATIN CAPITAL LETTER I |
| 004A | LATIN CAPITAL LETTER J |
| 004B | LATIN CAPITAL LETTER K |
| 004C | LATIN CAPITAL LETTER L |
| 004D | LATIN CAPITAL LETTER M |
| 004E | LATIN CAPITAL LETTER N |
| 004F | LATIN CAPITAL LETTER O |
| 0050 | LATIN CAPITAL LETTER P |
| 0051 | LATIN CAPITAL LETTER Q |
| 0052 | LATIN CAPITAL LETTER R |
| 0053 | LATIN CAPITAL LETTER S |
| 0054 | LATIN CAPITAL LETTER T |
| 0055 | LATIN CAPITAL LETTER U |
| 0056 | LATIN CAPITAL LETTER V |
| 0057 | LATIN CAPITAL LETTER W |
| 0058 | LATIN CAPITAL LETTER X |
| 0059 | LATIN CAPITAL LETTER Y |
| 005A | LATIN CAPITAL LETTER Z |
| 005B | LEFT SQUARE BRACKET |
| 005C | BACKSLASH |
| 005D | RIGHT SQUARE BRACKET |
| 005E | CIRCUMFLEX ACCENT |
| 005F | UNDERLINE |
| 0060 | GRAVE ACCENT |
| 0061 | LATIN SMALL LETTER A |
| 0062 | LATIN SMALL LETTER B |
| 0063 | LATIN SMALL LETTER C |

| | |
|------|---|
| 0064 | LATIN SMALL LETTER D |
| 0065 | LATIN SMALL LETTER E |
| 0066 | LATIN SMALL LETTER F |
| 0067 | LATIN SMALL LETTER G |
| 0068 | LATIN SMALL LETTER H |
| 0069 | LATIN SMALL LETTER I |
| 006A | LATIN SMALL LETTER J |
| 006B | LATIN SMALL LETTER K |
| 006C | LATIN SMALL LETTER L |
| 006D | LATIN SMALL LETTER M |
| 006E | LATIN SMALL LETTER N |
| 006F | LATIN SMALL LETTER O |
| 0070 | LATIN SMALL LETTER P |
| 0071 | LATIN SMALL LETTER Q |
| 0072 | LATIN SMALL LETTER R |
| 0073 | LATIN SMALL LETTER S |
| 0074 | LATIN SMALL LETTER T |
| 0075 | LATIN SMALL LETTER U |
| 0076 | LATIN SMALL LETTER V |
| 0077 | LATIN SMALL LETTER W |
| 0078 | LATIN SMALL LETTER X |
| 0079 | LATIN SMALL LETTER Y |
| 007A | LATIN SMALL LETTER Z |
| 007B | LEFT CURLY BRACKET |
| 007C | VERTICAL LINE |
| 007D | RIGHT CURLY BRACKET |
| 007E | TILDE |
| 00A0 | NO-BREAK SPACE |
| 00A1 | INVERTED EXCLAMATION MARK |
| 00A2 | CENT SIGN |
| 00A3 | POUND SIGN |
| 00A4 | CURRENCY SIGN |
| 00A5 | YEN SIGN |
| 00A6 | BROKEN BAR |
| 00A7 | SECTION SIGN |
| 00A8 | DIAERESIS |
| 00A9 | COPYRIGHT SIGN |
| 00AA | FEMININE ORDINAL INDICATOR |
| 00AB | LEFT GUILLEMET |
| 00AC | NOT SIGN |
| 00AD | SOFT HYPHEN |
| 00AE | REGISTERED TRADE MARK SIGN |
| 00AF | MACRON, OVERLINE |
| 00B0 | DEGREE SIGN |
| 00B1 | PLUS-MINUS SIGN |
| 00B2 | SUPERSCRIT TWO |
| 00B3 | SUPERSCRIT THREE |
| 00B4 | ACUTE ACCENT |
| 00B5 | MICRO SIGN |
| 00B6 | PARAGRAPH SIGN |
| 00B7 | MIDDLE DOT, KANA CONJOCTIVE |
| 00B8 | CEDILLA |
| 00B9 | SUPERSCRIT ONE |
| 00BA | MASCULINE ORDINAL INDICATOR |
| 00BB | RIGHT GUILLEMET |
| 00BC | VULGAR FRACTION ONE QUARTER |
| 00BD | VULGAR FRACTION ONE HALF |
| 00BE | VULGAR FRACTION THREE QUARTERS |
| 00BF | INVERTED QUESTION MARK |
| 00C0 | LATIN CAPITAL LETTER A WITH GRAVE ACCENT |
| 00C1 | LATIN CAPITAL LETTER A WITH ACUTE ACCENT |
| 00C2 | LATIN CAPITAL LETTER A WITH CIRCUMFLEX ACCENT |
| 00C3 | LATIN CAPITAL LETTER A WITH TILDE |
| 00C4 | LATIN CAPITAL LETTER A WITH DIAERESIS |
| 00C5 | LATIN CAPITAL LETTER A WITH RING ABOVE |
| 00C6 | LATIN CAPITAL LETTER A WITH E |

| | |
|------|---|
| 00C7 | LATIN CAPITAL LETTER C WITH CEDILLA |
| 00C8 | LATIN CAPITAL LETTER E WITH GRAVE ACCENT |
| 00C9 | LATIN CAPITAL LETTER E WITH ACUTE ACCENT |
| 00CA | LATIN CAPITAL LETTER E WITH CIRCUMFLEX ACCENT |
| 00CB | LATIN CAPITAL LETTER E WITH DIAERESIS |
| 00CC | LATIN CAPITAL LETTER I WITH GRAVE ACCENT |
| 00CD | LATIN CAPITAL LETTER I WITH ACUTE ACCENT |
| 00CE | LATIN CAPITAL LETTER I WITH CIRCUMFLEX ACCENT |
| 00CF | LATIN CAPITAL LETTER I WITH DIAERESIS |
| 00D0 | LATIN CAPITAL LETTER ETH |
| 00D1 | LATIN CAPITAL LETTER N WITH TILDE |
| 00D2 | LATIN CAPITAL LETTER O WITH GRAVE ACCENT |
| 00D3 | LATIN CAPITAL LETTER O WITH ACUTE ACCENT |
| 00D4 | LATIN CAPITAL LETTER O WITH CIRCUMFLEX ACCENT |
| 00D5 | LATIN CAPITAL LETTER O WITH TILDE |
| 00D6 | LATIN CAPITAL LETTER O WITH DIAERESIS |
| 00D7 | MULTIPLICATION SIGN |
| 00D8 | LATIN CAPITAL LETTER O WITH OBLIQUE STROKE |
| 00D9 | LATIN CAPITAL LETTER U WITH GRAVE ACCENT |
| 00DA | LATIN CAPITAL LETTER U WITH ACUTE ACCENT |
| 00DB | LATIN CAPITAL LETTER U WITH CIRCUMFLEX ACCENT |
| 00DC | LATIN CAPITAL LETTER U WITH DIAERESIS |
| 00DD | LATIN CAPITAL LETTER Y WITH ACUTE ACCENT |
| 00DE | LATIN CAPITAL LETTER THORN |
| 00DF | LATIN SMALL LETTER SHARP S |
| 00E0 | LATIN SMALL LETTER A WITH GRAVE ACCENT |
| 00E1 | LATIN SMALL LETTER A WITH ACUTE ACCENT |
| 00E2 | LATIN SMALL LETTER A WITH CIRCUMFLEX ACCENT |
| 00E3 | LATIN SMALL LETTER A WITH TILDE |
| 00E4 | LATIN SMALL LETTER A WITH DIAERESIS |
| 00E5 | LATIN SMALL LETTER A WITH RING ABOVE |
| 00E6 | LATIN SMALL LETTER A WITH E |
| 00E7 | LATIN SMALL LETTER C WITH CEDILLA |
| 00E8 | LATIN SMALL LETTER E WITH GRAVE ACCENT |
| 00E9 | LATIN SMALL LETTER E WITH ACUTE ACCENT |
| 00EA | LATIN SMALL LETTER E WITH CIRCUMFLEX ACCENT |
| 00EB | LATIN SMALL LETTER E WITH DIAERESIS |
| 00EC | LATIN SMALL LETTER I WITH GRAVE ACCENT |
| 00ED | LATIN SMALL LETTER I WITH ACUTE ACCENT |
| 00EE | LATIN SMALL LETTER I WITH CIRCUMFLEX ACCENT |
| 00EF | LATIN SMALL LETTER I WITH DIAERESIS |
| 00F0 | LATIN SMALL LETTER ETH |
| 00F1 | LATIN SMALL LETTER N WITH TILDE |
| 00F2 | LATIN SMALL LETTER O WITH GRAVE ACCENT |
| 00F3 | LATIN SMALL LETTER O WITH ACUTE ACCENT |
| 00F4 | LATIN SMALL LETTER O WITH CIRCUMFLEX ACCENT |
| 00F5 | LATIN SMALL LETTER O WITH TILDE |
| 00F6 | LATIN SMALL LETTER O WITH DIAERESIS |
| 00F7 | DIVISION SIGN |
| 00F8 | LATIN SMALL LETTER O WITH OBLIQUE STROKE |
| 00F9 | LATIN SMALL LETTER U WITH GRAVE ACCENT |
| 00FA | LATIN SMALL LETTER U WITH ACUTE ACCENT |
| 00FB | LATIN SMALL LETTER U WITH CIRCUMFLEX ACCENT |
| 00FC | LATIN SMALL LETTER U WITH DIAERESIS |
| 00FD | LATIN SMALL LETTER Y WITH ACUTE ACCENT |
| 00FE | LATIN SMALL LETTER THORN |
| 00FF | LATIN SMALL LETTER Y WITH DIAERESIS |

| | |
|------|--|
| 0100 | LATIN CAPITAL LETTER A WITH MACRON |
| 0101 | LATIN SMALL LETTER A WITH MACRON |
| 0102 | LATIN CAPITAL LETTER A WITH BREVE |
| 0103 | LATIN SMALL LETTER A WITH BREVE |
| 0104 | LATIN CAPITAL LETTER A WITH OGONEK |
| 0105 | LATIN SMALL LETTER A WITH OGONEK |
| 0106 | LATIN CAPITAL LETTER C WITH ACUTE ACCENT |
| 0107 | LATIN SMALL LETTER C WITH ACUTE ACCENT |
| 0108 | LATIN CAPITAL LETTER C WITH CIRCUMFLEX |
| 0109 | LATIN SMALL LETTER C WITH CIRCUMFLEX |
| 010A | LATIN CAPITAL LETTER C WITH DOT ABOVE |
| 010B | LATIN SMALL LETTER C WITH DOT ABOVE |
| 010C | LATIN CAPITAL LETTER C WITH CARON |
| 010D | LATIN SMALL LETTER C WITH CARON |
| 010E | LATIN CAPITAL LETTER D WITH HACEK |
| 010F | LATIN SMALL LETTER D WITH HACEK |
| 0110 | LATIN CAPITAL LETTER D WITH STROKE |
| 0111 | LATIN SMALL LETTER D WITH STROKE |
| 0112 | LATIN CAPITAL LETTER E WITH MACRON |
| 0113 | LATIN SMALL LETTER E WITH MACRON |
| 0114 | LATIN CAPITAL LETTER E WITH BREVE |
| 0115 | LATIN SMALL LETTER E WITH BREVE |
| 0116 | LATIN CAPITAL LETTER E WITH DOT ABOVE |
| 0117 | LATIN SMALL LETTER E WITH DOT ABOVE |
| 0118 | LATIN CAPITAL LETTER E WITH OGONEK |
| 0119 | LATIN SMALL LETTER E WITH OGONEK |
| 011A | LATIN CAPITAL LETTER E WITH HACEK |
| 011B | LATIN SMALL LETTER E WITH HACEK |
| 011C | LATIN CAPITAL LETTER G WITH CIRCUMFLEX |
| 011D | LATIN SMALL LETTER G WITH CIRCUMFLEX |
| 011E | LATIN CAPITAL LETTER G WITH BREVE |
| 011F | LATIN SMALL LETTER G WITH BREVE |
| 0120 | LATIN CAPITAL LETTER G WITH DOT ABOVE |
| 0121 | LATIN SMALL LETTER G WITH DOT ABOVE |
| 0122 | LATIN CAPITAL LETTER G WITH CEDILLA |
| 0123 | LATIN SMALL LETTER G WITH CEDILLA |
| 0124 | LATIN CAPITAL LETTER H WITH CIRCUMFLEX |
| 0125 | LATIN SMALL LETTER H WITH CIRCUMFLEX |
| 0126 | LATIN CAPITAL LETTER H WITH STROKE |
| 0127 | LATIN SMALL LETTER H WITH STROKE |
| 0128 | LATIN CAPITAL LETTER I WITH TILDE |
| 0129 | LATIN SMALL LETTER I WITH TILDE |
| 012A | LATIN CAPITAL LETTER I WITH MACRON |
| 012B | LATIN SMALL LETTER I WITH MACRON |
| 012C | LATIN CAPITAL LETTER I WITH BREVE |
| 012D | LATIN SMALL LETTER I WITH BREVE |
| 012E | LATIN CAPITAL LETTER I WITH OGONEK |
| 012F | LATIN SMALL LETTER I WITH OGONEK |
| 0130 | LATIN CAPITAL LETTER I WITH DOT ABOVE |
| 0131 | LATIN SMALL LETTER I WITHOUT DOT ABOVE |
| 0132 | LATIN CAPITAL LIGATURE IJ |
| 0133 | LATIN SMALL LIGATURE IJ |
| 0134 | LATIN CAPITAL LETTER J WITH CIRCUMFLEX |
| 0135 | LATIN SMALL LETTER J WITH CIRCUMFLEX |
| 0136 | LATIN CAPITAL LETTER K WITH CEDILLA |
| 0137 | LATIN SMALL LETTER K WITH CEDILLA |
| 0138 | LATIN SMALL LETTER KRA |
| 0139 | LATIN CAPITAL LETTER L WITH ACUTE ACCENT |
| 013A | LATIN SMALL LETTER L WITH ACUTE ACCENT |
| 013B | LATIN CAPITAL LETTER L WITH CEDILLA |
| 013C | LATIN SMALL LETTER L WITH CEDILLA |
| 013D | LATIN CAPITAL LETTER L WITH HACEK |
| 013E | LATIN SMALL LETTER L WITH HACEK |
| 013F | LATIN CAPITAL LETTER L WITH MIDDLE DOT |
| 0140 | LATIN SMALL LETTER L WITH MIDDLE DOT |
| 0141 | LATIN CAPITAL LETTER L WITH STROKE |
| 0142 | LATIN SMALL LETTER L WITH STROKE |
| 0143 | LATIN CAPITAL LETTER N WITH ACUTE ACCENT |
| 0144 | LATIN SMALL LETTER N WITH ACUTE ACCENT |
| 0145 | LATIN CAPITAL LETTER N WITH CEDILLA |
| 0146 | LATIN SMALL LETTER N WITH CEDILLA |
| 0147 | LATIN CAPITAL LETTER N WITH HACEK |
| 0148 | LATIN SMALL LETTER N WITH HACEK |

| | |
|------|--|
| 0149 | LATIN SMALL LETTER N PRECEDED BY APOSTROPHE |
| 014A | LATIN CAPITAL LETTER ENG |
| 014B | LATIN SMALL LETTER ENG |
| 014C | LATIN CAPITAL LETTER O WITH MACRON |
| 014D | LATIN SMALL LETTER O WITH MACRON |
| 014E | LATIN CAPITAL LETTER O WITH BREVE |
| 014F | LATIN SMALL LETTER O WITH BREVE |
| 0150 | LATIN CAPITAL LETTER O WITH DOUBLE ACUTE ACCENT |
| 0151 | LATIN SMALL LETTER O WITH DOUBLE ACUTE ACCENT |
| 0152 | LATIN CAPITAL LIGATURE O WITH E |
| 0153 | LATIN SMALL LIGATURE O WITH E |
| 0154 | LATIN CAPITAL LETTER R WITH ACUTE ACCENT |
| 0155 | LATIN SMALL LETTER R WITH ACUTE ACCENT |
| 0156 | LATIN CAPITAL LETTER R WITH CEDILLA |
| 0157 | LATIN SMALL LETTER R WITH CEDILLA |
| 0158 | LATIN CAPITAL LETTER R WITH HACEK |
| 0159 | LATIN SMALL LETTER R WITH HACEK |
| 015A | LATIN CAPITAL LETTER S WITH ACUTE ACCENT |
| 015B | LATIN SMALL LETTER S WITH ACUTE ACCENT |
| 015C | LATIN CAPITAL LETTER S WITH CIRCUMFLEX |
| 015D | LATIN SMALL LETTER S WITH CIRCUMFLEX |
| 015E | LATIN CAPITAL LETTER S WITH CEDILLA |
| 015F | LATIN SMALL LETTER S WITH CEDILLA |
| 0160 | LATIN CAPITAL LETTER S WITH HACEK |
| 0161 | LATIN SMALL LETTER S WITH HACEK |
| 0162 | LATIN CAPITAL LETTER T WITH CEDILLA |
| 0163 | LATIN SMALL LETTER T WITH CEDILLA |
| 0164 | LATIN CAPITAL LETTER T WITH HACEK |
| 0165 | LATIN SMALL LETTER T WITH HACEK |
| 0166 | LATIN CAPITAL LETTER T WITH STROKE |
| 0167 | LATIN SMALL LETTER T WITH STROKE |
| 0168 | LATIN CAPITAL LETTER U WITH TILDE |
| 0169 | LATIN SMALL LETTER U WITH TILDE |
| 016A | LATIN CAPITAL LETTER U WITH MACRON |
| 016B | LATIN SMALL LETTER U WITH MACRON |
| 016C | LATIN CAPITAL LETTER U WITH BREVE |
| 016D | LATIN SMALL LETTER U WITH BREVE |
| 016E | LATIN CAPITAL LETTER U WITH RING ABOVE |
| 016F | LATIN SMALL LETTER U WITH RING ABOVE |
| 0170 | LATIN CAPITAL LETTER U WITH DOUBLE ACUTE ACCENT |
| 0171 | LATIN SMALL LETTER U WITH DOUBLE ACUTE ACCENT |
| 0172 | LATIN CAPITAL LETTER U WITH OGONEK |
| 0173 | LATIN SMALL LETTER U WITH OGONEK |
| 0174 | LATIN CAPITAL LETTER W WITH CIRCUMFLEX |
| 0175 | LATIN SMALL LETTER W WITH CIRCUMFLEX |
| 0176 | LATIN CAPITAL LETTER Y WITH CIRCUMFLEX |
| 0177 | LATIN SMALL LETTER Y WITH CIRCUMFLEX |
| 0178 | LATIN CAPITAL LETTER Y WITH DIAERESIS |
| 0179 | LATIN CAPITAL LETTER Z WITH ACUTE ACCENT |
| 017A | LATIN SMALL LETTER Z WITH ACUTE ACCENT |
| 017B | LATIN CAPITAL LETTER Z WITH DOT ABOVE |
| 017C | LATIN SMALL LETTER Z WITH DOT ABOVE |
| 017D | LATIN CAPITAL LETTER Z WITH HACEK |
| 017E | LATIN SMALL LETTER Z WITH HACEK |
| 017F | LATIN SMALL LETTER LONG S |
| 0192 | LATIN SMALL LETTER SCRIPT F, FLORIN SIGN |
| 01FA | LATIN CAPITAL LETTER A WITH RING ABOVE AND ACUTE |
| 01FB | LATIN SMALL LETTER A WITH RING ABOVE AND ACUTE |
| 01FC | LATIN CAPITAL LIGATURE AE WITH ACUTE |
| 01FD | LATIN SMALL LIGATURE AE WITH ACUTE |
| 01FE | LATIN CAPITAL LETTER O WITH STROKE AND ACUTE |
| 01FF | LATIN SMALL LETTER O WITH STROKE AND ACUTE |
| 02C6 | NONSPACING CIRCUMFLEX ACCENT |
| 02C7 | MODIFIER LETTER HACEK |
| 02C9 | MODIFIER LETTER MACRON |

| | |
|------|---|
| 02D8 | BREVE |
| 02D9 | DOT ABOVE |
| 02DA | RING ABOVE |
| 02DB | OGONEK |
| 02DC | NONSPACING TILDE |
| 02DD | MODIFIER LETTER DOUBLE PRIME |
| 0384 | GREEK TONOS |
| 0385 | GREEK DIALYTIKA TONOS |
| 0386 | GREEK CAPITAL LETTER ALPHA WITH TONOS |
| 0387 | GREEK ANO TELEIA |
| 0388 | GREEK CAPITAL LETTER EPSILON WITH TONOS |
| 0389 | GREEK CAPITAL LETTER ETA WITH TONOS |
| 038A | GREEK CAPITAL LETTER IOTA WITH TONOS |
| 038C | GREEK CAPITAL LETTER OMICRON WITH TONOS |
| 038E | GREEK CAPITAL LETTER UPSILON WITH TONOS |
| 038F | GREEK CAPITAL LETTER OMEGA WITH TONOS |
| 0390 | GREEK SMALL LETTER IOTA WITH DIALYTIKA AND TONOS |
| 0391 | GREEK CAPITAL LETTER ALPHA |
| 0392 | GREEK CAPITAL LETTER BETA |
| 0393 | GREEK CAPITAL LETTER GAMMA |
| 0394 | GREEK CAPITAL LETTER DELTA |
| 0395 | GREEK CAPITAL LETTER EPSILON |
| 0396 | GREEK CAPITAL LETTER ZETA |
| 0397 | GREEK CAPITAL LETTER ETA |
| 0398 | GREEK CAPITAL LETTER THETA |
| 0399 | GREEK CAPITAL LETTER IOTA |
| 039A | GREEK CAPITAL LETTER KAPPA |
| 039B | GREEK CAPITAL LETTER LAMDA |
| 039C | GREEK CAPITAL LETTER MU |
| 039D | GREEK CAPITAL LETTER NU |
| 039E | GREEK CAPITAL LETTER XI |
| 039F | GREEK CAPITAL LETTER OMICRON |
| 03A0 | GREEK CAPITAL LETTER PI |
| 03A1 | GREEK CAPITAL LETTER RHO |
| 03A3 | GREEK CAPITAL LETTER SIGMA |
| 03A4 | GREEK CAPITAL LETTER TAU |
| 03A5 | GREEK CAPITAL LETTER UPSILON |
| 03A6 | GREEK CAPITAL LETTER PHI |
| 03A7 | GREEK CAPITAL LETTER CHI |
| 03A8 | GREEK CAPITAL LETTER PSI |
| 03A9 | GREEK CAPITAL LETTER OMEGA |
| 03AA | GREEK CAPITAL LETTER IOTA WITH DIALYTIKA |
| 03AB | GREEK CAPITAL LETTER UPSILON WITH DIALYTIKA |
| 03AC | GREEK SMALL LETTER ALPHA WITH TONOS |
| 03AD | GREEK SMALL LETTER EPSILON WITH TONOS |
| 03AE | GREEK SMALL LETTER ETA WITH TONOS |
| 03AF | GREEK SMALL LETTER IOTA WITH TONOS |
| 03B0 | GREEK SMALL LETTER UPSILON WITH DIALYTIKA AND TONOS |
| 03B1 | GREEK SMALL LETTER ALPHA |
| 03B2 | GREEK SMALL LETTER BETA |
| 03B3 | GREEK SMALL LETTER GAMMA |
| 03B4 | GREEK SMALL LETTER DELTA |
| 03B5 | GREEK SMALL LETTER EPSILON |
| 03B6 | GREEK SMALL LETTER ZETA |
| 03B7 | GREEK SMALL LETTER ETA |
| 03B8 | GREEK SMALL LETTER THETA |
| 03B9 | GREEK SMALL LETTER IOTA |
| 03BA | GREEK SMALL LETTER KAPPA |
| 03BB | GREEK SMALL LETTER LAMDA |
| 03BC | GREEK SMALL LETTER MU |
| 03BD | GREEK SMALL LETTER NU |
| 03BE | GREEK SMALL LETTER XI |
| 03BF | GREEK SMALL LETTER OMICRON |
| 03C0 | GREEK SMALL LETTER PI |
| 03C1 | GREEK SMALL LETTER RHO |
| 03C2 | GREEK SMALL LETTER FINAL SIGMA |
| 03C3 | GREEK SMALL LETTER SIGMA |
| 03C4 | GREEK SMALL LETTER TAU |
| 03C5 | GREEK SMALL LETTER UPSILON |

| | |
|------|--|
| 03C6 | GREEK SMALL LETTER PHI |
| 03C7 | GREEK SMALL LETTER CHI |
| 03C8 | GREEK SMALL LETTER PSI |
| 03C9 | GREEK SMALL LETTER OMEGA |
| 03CA | GREEK SMALL LETTER IOTA WITH DIALYTIKA |
| 03CB | GREEK SMALL LETTER UPSILON WITH DIALYTIKA |
| 03CC | GREEK SMALL LETTER OMICRON WITH TONOS |
| 03CD | GREEK SMALL LETTER UPSILON WITH TONOS |
| 03CE | GREEK SMALL LETTER OMEGA WITH TONOS |
| 0401 | CYRILLIC CAPITAL LETTER IO |
| 0402 | CYRILLIC CAPITAL LETTER DJE |
| 0403 | CYRILLIC CAPITAL LETTER GJE |
| 0404 | CYRILLIC CAPITAL LETTER UKRAINIAN IE |
| 0405 | CYRILLIC CAPITAL LETTER DZE |
| 0406 | CYRILLIC CAPITAL LETTER BYELORUSSIAN-UKRAINIAN I |
| 0407 | CYRILLIC CAPITAL LETTER YI |
| 0408 | CYRILLIC CAPITAL LETTER JE |
| 0409 | CYRILLIC CAPITAL LETTER LJE |
| 040A | CYRILLIC CAPITAL LETTER NJE |
| 040B | CYRILLIC CAPITAL LETTER TSHE |
| 040C | CYRILLIC CAPITAL LETTER KJE |
| 040E | CYRILLIC CAPITAL LETTER SHORT U |
| 040F | CYRILLIC CAPITAL LETTER DZHE |
| 0410 | CYRILLIC CAPITAL LETTER A |
| 0411 | CYRILLIC CAPITAL LETTER BE |
| 0412 | CYRILLIC CAPITAL LETTER VE |
| 0413 | CYRILLIC CAPITAL LETTER GHE |
| 0414 | CYRILLIC CAPITAL LETTER DE |
| 0415 | CYRILLIC CAPITAL LETTER IE |
| 0416 | CYRILLIC CAPITAL LETTER ZHE |
| 0417 | CYRILLIC CAPITAL LETTER ZE |
| 0418 | CYRILLIC CAPITAL LETTER I |
| 0419 | CYRILLIC CAPITAL LETTER SHORT I |
| 041A | CYRILLIC CAPITAL LETTER KA |
| 041B | CYRILLIC CAPITAL LETTER EL |
| 041C | CYRILLIC CAPITAL LETTER EM |
| 041D | CYRILLIC CAPITAL LETTER EN |
| 041E | CYRILLIC CAPITAL LETTER O |
| 041F | CYRILLIC CAPITAL LETTER PE |
| 0420 | CYRILLIC CAPITAL LETTER ER |
| 0421 | CYRILLIC CAPITAL LETTER ES |
| 0422 | CYRILLIC CAPITAL LETTER TE |
| 0423 | CYRILLIC CAPITAL LETTER U |
| 0424 | CYRILLIC CAPITAL LETTER EF |
| 0425 | CYRILLIC CAPITAL LETTER HA |
| 0426 | CYRILLIC CAPITAL LETTER TSE |
| 0427 | CYRILLIC CAPITAL LETTER CHE |
| 0428 | CYRILLIC CAPITAL LETTER SHA |
| 0429 | CYRILLIC CAPITAL LETTER SHCHA |
| 042A | CYRILLIC CAPITAL LETTER HARD SIGN |
| 042B | CYRILLIC CAPITAL LETTER YERU |
| 042C | CYRILLIC CAPITAL LETTER SOFT SIGN |
| 042D | CYRILLIC CAPITAL LETTER E |
| 042E | CYRILLIC CAPITAL LETTER YU |
| 042F | CYRILLIC CAPITAL LETTER YA |
| 0880 | CYRILLIC SMALL LETTER A |
| 0431 | CYRILLIC SMALL LETTER BE |
| 0432 | CYRILLIC SMALL LETTER VE |
| 0433 | CYRILLIC SMALL LETTER GHE |
| 0434 | CYRILLIC SMALL LETTER DE |
| 0435 | CYRILLIC SMALL LETTER IE |
| 0436 | CYRILLIC SMALL LETTER ZHE |
| 0437 | CYRILLIC SMALL LETTER ZE |
| 0438 | CYRILLIC SMALL LETTER I |
| 0439 | CYRILLIC SMALL LETTER SHORT I |
| 043A | CYRILLIC SMALL LETTER KA |
| 043B | CYRILLIC SMALL LETTER EL |
| 043C | CYRILLIC SMALL LETTER EM |
| 043D | CYRILLIC SMALL LETTER EN |
| 043E | CYRILLIC SMALL LETTER O |
| 043F | CYRILLIC SMALL LETTER PE |
| 0440 | CYRILLIC SMALL LETTER ER |
| 0441 | CYRILLIC SMALL LETTER ES |
| 0442 | CYRILLIC SMALL LETTER TE |

| | |
|------|--|
| 0443 | CYRILLIC SMALL LETTER U |
| 0444 | CYRILLIC SMALL LETTER EF |
| 0445 | CYRILLIC SMALL LETTER HA |
| 0446 | CYRILLIC SMALL LETTER TSE |
| 0447 | CYRILLIC SMALL LETTER CHE |
| 0448 | CYRILLIC SMALL LETTER SHA |
| 0449 | CYRILLIC SMALL LETTER SHCHA |
| 044A | CYRILLIC SMALL LETTER HARD SIGN |
| 044B | CYRILLIC SMALL LETTER YERU |
| 044C | CYRILLIC SMALL LETTER SOFT SIGN |
| 044D | CYRILLIC SMALL LETTER E |
| 044E | CYRILLIC SMALL LETTER YU |
| 044F | CYRILLIC SMALL LETTER YA |
| 0451 | CYRILLIC SMALL LETTER IO |
| 0452 | CYRILLIC SMALL LETTER DJE |
| 0453 | CYRILLIC SMALL LETTER GJE |
| 0454 | CYRILLIC SMALL LETTER UKRAINIAN IE |
| 0455 | CYRILLIC SMALL LETTER DZE |
| 0456 | CYRILLIC SMALL LETTER BYELORUSSIAN-UKRAINIAN I |
| 0457 | CYRILLIC SMALL LETTER YI |
| 0458 | CYRILLIC SMALL LETTER JE |
| 0459 | CYRILLIC SMALL LETTER LJE |
| 045A | CYRILLIC SMALL LETTER NJE |
| 045B | CYRILLIC SMALL LETTER TSHE |
| 045C | CYRILLIC SMALL LETTER KJE |
| 045E | CYRILLIC SMALL LETTER SHORT U |
| 045F | CYRILLIC SMALL LETTER DZHE |
| 0490 | CYRILLIC CAPITAL LETTER GHE WITH UPTURN |
| 0491 | CYRILLIC SMALL LETTER GHE WITH UPTURN |
| 1E80 | LATIN CAPITAL LETTER W WITH GRAVE |
| 1E81 | LATIN SMALL LETTER W WITH GRAVE |
| 1E82 | LATIN CAPITAL LETTER W WITH ACUTE |
| 1E83 | LATIN SMALL LETTER W WITH ACUTE |
| 1E84 | LATIN CAPITAL LETTER W WITH DIAERESIS |
| 1E85 | LATIN SMALL LETTER W WITH DIAERESIS |
| 1EF2 | LATIN CAPITAL LETTER Y WITH GRAVE |
| 1EF3 | LATIN SMALL LETTER Y WITH GRAVE |
| 2013 | EN DASH |
| 2014 | EM DASH |
| 2015 | HORIZONTAL BAR |
| 2017 | DOUBLE LOW LINE |
| 2018 | LEFT SINGLE QUOTATION MARK |
| 2019 | RIGHT SINGLE QUOTATION MARK |
| 201A | SINGLE LOW-9 QUOTATION MARK |
| 201B | SINGLE HIGH-REVERSED-9 QUOTATION MARK |
| 201C | LEFT DOUBLE QUOTATION MARK |
| 201D | RIGHT DOUBLE QUOTATION MARK |
| 201E | DOUBLE LOW-9 QUOTATION MARK |
| 2020 | DAGGER |
| 2021 | DOUBLE DAGGER |
| 2022 | BULLET |
| 2026 | HORIZONTAL ELLIPSIS |
| 2030 | PER MILLE SIGN |
| 2032 | PRIME |
| 2033 | DOUBLE PRIME |
| 2039 | SINGLE LEFT-POINTING ANGLE QUOTATION MARK |
| 203A | SINGLE RIGHT-POINTING ANGLE QUOTATION MARK |
| 203C | DOUBLE EXCLAMATION MARK |
| 203E | OVERLINE |
| 2044 | FRACTION SLASH |
| 207F | SUPERScript LATIN SMALL LETTER N |
| 20A3 | FRENCH FRANC SIGN |
| 20A4 | LIRA SIGN |
| 20A7 | PESETA SIGN |
| 20AC | EURO CURRENCY SYMBOL |
| 2105 | CARE OF |
| 2113 | SCRIPT SMALL L |
| 2116 | NUMERO SIGN |
| 2122 | TRADEMARK SIGN |
| 2126 | OHM SIGN |
| 212E | ESTIMATED SYMBOL |
| 215B | VULGAR FRACTION ONE EIGHTH |

| | |
|------|---|
| 215C | VULGAR FRACTION THREE EIGHTHS |
| 215D | VULGAR FRACTION FIVE EIGHTHS |
| 215E | VULGAR FRACTION SEVEN EIGHTHS |
| 2190 | LEFTWARDS ARROW |
| 2191 | UPWARDS ARROW |
| 2192 | RIGHTWARDS ARROW |
| 2193 | DOWNWARDS ARROW |
| 2194 | LEFT RIGHT ARROW |
| 2195 | UP DOWN ARROW |
| 21A8 | UP DOWN ARROW WITH BASE |
| 2202 | PARTIAL DIFFERENTIAL |
| 2206 | INCREMENT |
| 220F | N-ARY PRODUCT |
| 2211 | N-ARY SUMMATION |
| 2212 | MINUS SIGN |
| 2215 | DIVISION SLASH |
| 2219 | BULLET OPERATOR |
| 221A | SQUARE ROOT |
| 221E | INFINITY |
| 221F | RIGHT ANGLE |
| 2229 | INTERSECTION |
| 222B | INTEGRAL |
| 2248 | ALMOST EQUAL TO |
| 2260 | NOT EQUAL TO |
| 2261 | IDENTICAL TO |
| 2264 | LESS-THAN OR EQUAL TO |
| 2265 | GREATER-THAN OR EQUAL TO |
| 2302 | HOUSE |
| 2310 | REVERSED NOT SIGN |
| 2320 | TOP HALF INTEGRAL |
| 2321 | BOTTOM HALF INTEGRAL |
| 2500 | BOX DRAWINGS LIGHT HORIZONTAL |
| 2502 | BOX DRAWINGS LIGHT VERTICAL |
| 250C | BOX DRAWINGS LIGHT DOWN AND RIGHT |
| 2510 | BOX DRAWINGS LIGHT DOWN AND LEFT |
| 2514 | BOX DRAWINGS LIGHT UP AND RIGHT |
| 2518 | BOX DRAWINGS LIGHT UP AND LEFT |
| 251C | BOX DRAWINGS LIGHT VERTICAL AND RIGHT |
| 2524 | BOX DRAWINGS LIGHT VERTICAL AND LEFT |
| 252C | BOX DRAWINGS LIGHT DOWN AND HORIZONTAL |
| 2534 | BOX DRAWINGS LIGHT UP AND HORIZONTAL |
| 253C | BOX DRAWINGS LIGHT VERTICAL AND HORIZONTAL |
| 2550 | BOX DRAWINGS DOUBLE HORIZONTAL |
| 2551 | BOX DRAWINGS DOUBLE VERTICAL |
| 2552 | BOX DRAWINGS DOWN SINGLE AND RIGHT DOUBLE |
| 2553 | BOX DRAWINGS DOWN DOUBLE AND RIGHT SINGLE |
| 2554 | BOX DRAWINGS DOUBLE DOWN AND RIGHT |
| 2555 | BOX DRAWINGS DOWN SINGLE AND LEFT DOUBLE |
| 2556 | BOX DRAWINGS DOWN DOUBLE AND LEFT SINGLE |
| 2557 | BOX DRAWINGS DOUBLE DOWN AND LEFT |
| 2558 | BOX DRAWINGS UP SINGLE AND RIGHT DOUBLE |
| 2559 | BOX DRAWINGS UP DOUBLE AND RIGHT SINGLE |
| 255A | BOX DRAWINGS DOUBLE UP AND RIGHT |
| 255B | BOX DRAWINGS UP SINGLE AND LEFT DOUBLE |
| 255C | BOX DRAWINGS UP DOUBLE AND LEFT SINGLE |
| 255D | BOX DRAWINGS DOUBLE UP AND LEFT |
| 255E | BOX DRAWINGS VERTICAL SINGLE AND RIGHT DOUBLE |
| 255F | BOX DRAWINGS VERTICAL DOUBLE AND RIGHT SINGLE |
| 2560 | BOX DRAWINGS DOUBLE VERTICAL AND RIGHT |
| 2561 | BOX DRAWINGS VERTICAL SINGLE AND LEFT DOUBLE |
| 2562 | BOX DRAWINGS VERTICAL DOUBLE AND LEFT SINGLE |

| | |
|------|--|
| 2563 | BOX DRAWINGS DOUBLE VERTICAL AND LEFT |
| 2564 | BOX DRAWINGS DOWN SINGLE AND HORIZONTAL DOUBLE |
| 2565 | BOX DRAWINGS DOWN DOUBLE AND HORIZONTAL SINGLE |
| 2566 | BOX DRAWINGS DOUBLE DOWN AND HORIZONTAL |
| 2567 | BOX DRAWINGS UP SINGLE AND HORIZONTAL DOUBLE |
| 2568 | BOX DRAWINGS UP DOUBLE AND HORIZONTAL SINGLE |
| 2569 | BOX DRAWINGS DOUBLE UP AND HORIZONTAL |
| 256A | BOX DRAWINGS VERTICAL SINGLE AND HORIZONTAL DOUBLE |
| 256B | BOX DRAWINGS VERTICAL DOUBLE AND HORIZONTAL SINGLE |
| 256C | BOX DRAWINGS DOUBLE VERTICAL AND HORIZONTAL |
| 2580 | UPPER HALF BLOCK |
| 2584 | LOWER HALF BLOCK |
| 2588 | FULL BLOCK |
| 258C | LEFT HALF BLOCK |
| 2590 | RIGHT HALF BLOCK |
| 2591 | LIGHT SHADE |
| 2592 | MEDIUM SHADE |
| 2593 | DARK SHADE |
| 25A0 | BLACK SQUARE |
| 25A1 | WHITE SQUARE |
| 25AA | BLACK SMALL SQUARE |
| 25AB | WHITE SMALL SQUARE |
| 25AC | BLACK RECTANGLE |
| 25B2 | BLACK UP-POINTING TRIANGLE |
| 25BA | BLACK RIGHT-POINTING POINTER |
| 25BC | BLACK DOWN-POINTING TRIANGLE |
| 25C4 | BLACK LEFT-POINTING POINTER |
| 25CA | LOZENGE |
| 25CB | WHITE CIRCLE |
| 25CF | BLACK CIRCLE |
| 25D8 | INVERSE BULLET |
| 25D9 | INVERSE WHITE CIRCLE |
| 25E6 | WHITE BULLET |
| 263A | WHITE SMILING FACE |
| 263B | BLACK SMILING FACE |
| 263C | WHITE SUN WITH RAYS |
| 2640 | FEMALE SIGN |
| 2642 | MALE SIGN |
| 2660 | BLACK SPADE SUIT |
| 2663 | BLACK CLUB SUIT |
| 2665 | BLACK HEART SUIT |
| 2666 | BLACK DIAMOND SUIT |
| 266A | EIGHTH NOTE |
| 266B | BEAMED EIGHTH NOTES |
| F001 | FI LIGATURE |
| F002 | FL LIGATURE |
| FB01 | FI LIGATURE |
| FB02 | FL LIGATURE |

Appendix C: GB18030 Character Addresses

There are 28575 Characters in this set.

| UNICODE | CHARACTER |
|---------|------------------------|
| 0020 | SPACE |
| 0021 | EXCLAMATION MARK |
| 0022 | QUOTATION MARK |
| 0023 | NUMBER SIGN |
| 0024 | DOLLAR SIGN |
| 0025 | PERCENT SIGN |
| 0026 | AMPERSAND |
| 0027 | APOSTROPHE |
| 0028 | LEFT PARENTHESIS |
| 0029 | RIGHT PARENTHESIS |
| 002A | ASTERISK |
| 002B | PLUS SIGN |
| 002C | COMMA |
| 002D | HYPHEN-MINUS |
| 002E | FULL STOP |
| 002F | SOLIDUS |
| 0030 | DIGIT ZERO |
| 0031 | DIGIT ONE |
| 0032 | DIGIT TWO |
| 0033 | DIGIT THREE |
| 0034 | DIGIT FOUR |
| 0035 | DIGIT FIVE |
| 0036 | DIGIT SIX |
| 0037 | DIGIT SEVEN |
| 0038 | DIGIT EIGHT |
| 0039 | DIGIT NINE |
| 003A | COLON |
| 003B | SEMICOLON |
| 003C | LESS-THAN SIGN |
| 003D | EQUALS SIGN |
| 003E | GREATER-THAN SIGN |
| 003F | QUESTION MARK |
| 0040 | COMMERCIAL AT |
| 0041 | LATIN CAPITAL LETTER A |
| 0042 | LATIN CAPITAL LETTER B |
| 0043 | LATIN CAPITAL LETTER C |
| 0044 | LATIN CAPITAL LETTER D |
| 0045 | LATIN CAPITAL LETTER E |
| 0046 | LATIN CAPITAL LETTER F |
| 0047 | LATIN CAPITAL LETTER G |
| 0048 | LATIN CAPITAL LETTER H |
| 0049 | LATIN CAPITAL LETTER I |
| 004A | LATIN CAPITAL LETTER J |
| 004B | LATIN CAPITAL LETTER K |
| 004C | LATIN CAPITAL LETTER L |
| 004D | LATIN CAPITAL LETTER M |
| 004E | LATIN CAPITAL LETTER N |
| 004F | LATIN CAPITAL LETTER O |
| 0050 | LATIN CAPITAL LETTER P |
| 0051 | LATIN CAPITAL LETTER Q |
| 0052 | LATIN CAPITAL LETTER R |
| 0053 | LATIN CAPITAL LETTER S |
| 0054 | LATIN CAPITAL LETTER T |
| 0055 | LATIN CAPITAL LETTER U |
| 0056 | LATIN CAPITAL LETTER V |
| 0057 | LATIN CAPITAL LETTER W |
| 0058 | LATIN CAPITAL LETTER X |
| 0059 | LATIN CAPITAL LETTER Y |
| 005A | LATIN CAPITAL LETTER Z |
| 005B | LEFT SQUARE BRACKET |
| 005C | REVERSE SOLIDUS |
| 005D | RIGHT SQUARE BRACKET |
| 005E | CIRCUMFLEX ACCENT |
| 005F | LOW LINE |
| 0060 | GRAVE ACCENT |
| 0061 | LATIN SMALL LETTER A |
| 0062 | LATIN SMALL LETTER B |
| 0063 | LATIN SMALL LETTER C |
| 0064 | LATIN SMALL LETTER D |
| 0065 | LATIN SMALL LETTER E |
| 0066 | LATIN SMALL LETTER F |
| 0067 | LATIN SMALL LETTER G |
| 0068 | LATIN SMALL LETTER H |
| 0069 | LATIN SMALL LETTER I |
| 006A | LATIN SMALL LETTER J |
| 006B | LATIN SMALL LETTER K |
| 006C | LATIN SMALL LETTER L |
| 006D | LATIN SMALL LETTER M |
| 006E | LATIN SMALL LETTER N |
| 006F | LATIN SMALL LETTER O |
| 0070 | LATIN SMALL LETTER P |

| | |
|------|---|
| 0071 | LATIN SMALL LETTER Q |
| 0072 | LATIN SMALL LETTER R |
| 0073 | LATIN SMALL LETTER S |
| 0074 | LATIN SMALL LETTER T |
| 0075 | LATIN SMALL LETTER U |
| 0076 | LATIN SMALL LETTER V |
| 0077 | LATIN SMALL LETTER W |
| 0078 | LATIN SMALL LETTER X |
| 0079 | LATIN SMALL LETTER Y |
| 007A | LATIN SMALL LETTER Z |
| 007B | LEFT CURLY BRACKET |
| 007C | VERTICAL LINE |
| 007D | RIGHT CURLY BRACKET |
| 007E | TILDE |
| 007F | <CONTROL> |
| 00A4 | CURRENCY SIGN |
| 00A7 | SECTION SIGN |
| 00A8 | DIAERESIS |
| 00B0 | DEGREE SIGN |
| 00B1 | PLUS-MINUS SIGN |
| 00B7 | MIDDLE DOT |
| 00D7 | MULTIPLICATION SIGN |
| 00E0 | LATIN SMALL LETTER A WITH GRAVE |
| 00E1 | LATIN SMALL LETTER A WITH ACUTE |
| 00E8 | LATIN SMALL LETTER E WITH GRAVE |
| 00E9 | LATIN SMALL LETTER E WITH ACUTE |
| 00EA | LATIN SMALL LETTER E WITH CIRCUMFLEX |
| 00EC | LATIN SMALL LETTER I WITH GRAVE |
| 00ED | LATIN SMALL LETTER I WITH ACUTE |
| 00F2 | LATIN SMALL LETTER O WITH GRAVE |
| 00F3 | LATIN SMALL LETTER O WITH ACUTE |
| 00F7 | DIVISION SIGN |
| 00F9 | LATIN SMALL LETTER U WITH GRAVE |
| 00FA | LATIN SMALL LETTER U WITH ACUTE |
| 00FC | LATIN SMALL LETTER U WITH DIAERESIS |
| 0101 | LATIN SMALL LETTER A WITH MACRON |
| 0113 | LATIN SMALL LETTER E WITH MACRON |
| 011B | LATIN SMALL LETTER E WITH CARON |
| 012B | LATIN SMALL LETTER I WITH MACRON |
| 0144 | LATIN SMALL LETTER N WITH ACUTE |
| 0148 | LATIN SMALL LETTER N WITH CARON |
| 014D | LATIN SMALL LETTER O WITH MACRON |
| 016B | LATIN SMALL LETTER U WITH MACRON |
| 01CE | LATIN SMALL LETTER A WITH CARON |
| 01D0 | LATIN SMALL LETTER I WITH CARON |
| 01D2 | LATIN SMALL LETTER O WITH CARON |
| 01D4 | LATIN SMALL LETTER U WITH CARON |
| 01D6 | LATIN SMALL LETTER U WITH DIAERESIS AND MACRON |
| 01D8 | LATIN SMALL LETTER U WITH DIAERESIS AND ACUTE |
| 01DA | LATIN SMALL LETTER U WITH DIAERESIS AND CARON |
| 01DC | LATIN SMALL LETTER U WITH DIAERESIS AND GRAVE |
| 0251 | LATIN SMALL LETTER ALPHA |
| 0261 | LATIN SMALL LETTER SCRIPT G |
| 02C7 | CARON (MANDARIN CHINESE THIRD TONE) |
| 02C9 | MODIFIER LETTER MACRON (MANDARIN CHINESE FIRST TONE) |
| 02CA | MODIFIER LETTER ACUTE ACCENT (MANDARIN CHINESE SECOND TONE) |
| 02CB | MODIFIER LETTER GRAVE ACCENT (MANDARIN CHINESE FOURTH TONE) |
| 02D9 | DOT ABOVE (MANDARIN CHINESE LIGHT TONE) |
| 0391 | GREEK CAPITAL LETTER ALPHA |
| 0392 | GREEK CAPITAL LETTER BETA |
| 0393 | GREEK CAPITAL LETTER GAMMA |
| 0394 | GREEK CAPITAL LETTER DELTA |
| 0395 | GREEK CAPITAL LETTER EPSILON |
| 0396 | GREEK CAPITAL LETTER ZETA |
| 0397 | GREEK CAPITAL LETTER ETA |
| 0398 | GREEK CAPITAL LETTER THETA |
| 0399 | GREEK CAPITAL LETTER IOTA |
| 039A | GREEK CAPITAL LETTER KAPPA |
| 039B | GREEK CAPITAL LETTER LAMDA |
| 039C | GREEK CAPITAL LETTER MU |
| 039D | GREEK CAPITAL LETTER NU |
| 039E | GREEK CAPITAL LETTER XI |

| | |
|------|-----------------------------------|
| 039F | GREEK CAPITAL LETTER OMICRON |
| 03A0 | GREEK CAPITAL LETTER PI |
| 03A1 | GREEK CAPITAL LETTER RHO |
| 03A3 | GREEK CAPITAL LETTER SIGMA |
| 03A4 | GREEK CAPITAL LETTER TAU |
| 03A5 | GREEK CAPITAL LETTER UPSILON |
| 03A6 | GREEK CAPITAL LETTER PHI |
| 03A7 | GREEK CAPITAL LETTER CHI |
| 03A8 | GREEK CAPITAL LETTER PSI |
| 03A9 | GREEK CAPITAL LETTER OMEGA |
| 03B1 | GREEK SMALL LETTER ALPHA |
| 03B2 | GREEK SMALL LETTER BETA |
| 03B3 | GREEK SMALL LETTER GAMMA |
| 03B4 | GREEK SMALL LETTER DELTA |
| 03B5 | GREEK SMALL LETTER EPSILON |
| 03B6 | GREEK SMALL LETTER ZETA |
| 03B7 | GREEK SMALL LETTER ETA |
| 03B8 | GREEK SMALL LETTER THETA |
| 03B9 | GREEK SMALL LETTER IOTA |
| 03BA | GREEK SMALL LETTER KAPPA |
| 03BB | GREEK SMALL LETTER LAMDA |
| 03BC | GREEK SMALL LETTER MU |
| 03BD | GREEK SMALL LETTER NU |
| 03BE | GREEK SMALL LETTER XI |
| 03BF | GREEK SMALL LETTER OMICRON |
| 03C0 | GREEK SMALL LETTER PI |
| 03C1 | GREEK SMALL LETTER RHO |
| 03C3 | GREEK SMALL LETTER SIGMA |
| 03C4 | GREEK SMALL LETTER TAU |
| 03C5 | GREEK SMALL LETTER UPSILON |
| 03C6 | GREEK SMALL LETTER PHI |
| 03C7 | GREEK SMALL LETTER CHI |
| 03C8 | GREEK SMALL LETTER PSI |
| 03C9 | GREEK SMALL LETTER OMEGA |
| 0401 | CYRILLIC CAPITAL LETTER IO |
| 0410 | CYRILLIC CAPITAL LETTER A |
| 0411 | CYRILLIC CAPITAL LETTER BE |
| 0412 | CYRILLIC CAPITAL LETTER VE |
| 0413 | CYRILLIC CAPITAL LETTER GHE |
| 0414 | CYRILLIC CAPITAL LETTER DE |
| 0415 | CYRILLIC CAPITAL LETTER IE |
| 0416 | CYRILLIC CAPITAL LETTER ZHE |
| 0417 | CYRILLIC CAPITAL LETTER ZE |
| 0418 | CYRILLIC CAPITAL LETTER I |
| 0419 | CYRILLIC CAPITAL LETTER SHORT I |
| 041A | CYRILLIC CAPITAL LETTER KA |
| 041B | CYRILLIC CAPITAL LETTER EL |
| 041C | CYRILLIC CAPITAL LETTER EM |
| 041D | CYRILLIC CAPITAL LETTER EN |
| 041E | CYRILLIC CAPITAL LETTER O |
| 041F | CYRILLIC CAPITAL LETTER PE |
| 0420 | CYRILLIC CAPITAL LETTER ER |
| 0421 | CYRILLIC CAPITAL LETTER ES |
| 0422 | CYRILLIC CAPITAL LETTER TE |
| 0423 | CYRILLIC CAPITAL LETTER U |
| 0424 | CYRILLIC CAPITAL LETTER EF |
| 0425 | CYRILLIC CAPITAL LETTER HA |
| 0426 | CYRILLIC CAPITAL LETTER TSE |
| 0427 | CYRILLIC CAPITAL LETTER CHE |
| 0428 | CYRILLIC CAPITAL LETTER SHA |
| 0429 | CYRILLIC CAPITAL LETTER SHCHA |
| 042A | CYRILLIC CAPITAL LETTER HARD SIGN |
| 042B | CYRILLIC CAPITAL LETTER YERU |
| 042C | CYRILLIC CAPITAL LETTER SOFT SIGN |
| 042D | CYRILLIC CAPITAL LETTER E |
| 042E | CYRILLIC CAPITAL LETTER YU |
| 042F | CYRILLIC CAPITAL LETTER YA |
| 0430 | CYRILLIC SMALL LETTER A |
| 0431 | CYRILLIC SMALL LETTER BE |
| 0432 | CYRILLIC SMALL LETTER VE |
| 0433 | CYRILLIC SMALL LETTER GHE |
| 0434 | CYRILLIC SMALL LETTER DE |
| 0435 | CYRILLIC SMALL LETTER IE |
| 0436 | CYRILLIC SMALL LETTER ZHE |
| 0437 | CYRILLIC SMALL LETTER ZE |
| 0438 | CYRILLIC SMALL LETTER I |
| 0439 | CYRILLIC SMALL LETTER SHORT I |
| 043A | CYRILLIC SMALL LETTER KA |
| 043B | CYRILLIC SMALL LETTER EL |
| 043C | CYRILLIC SMALL LETTER EM |
| 043D | CYRILLIC SMALL LETTER EN |
| 043E | CYRILLIC SMALL LETTER O |
| 043F | CYRILLIC SMALL LETTER PE |
| 0440 | CYRILLIC SMALL LETTER ER |
| 0441 | CYRILLIC SMALL LETTER ES |
| 0442 | CYRILLIC SMALL LETTER TE |
| 0443 | CYRILLIC SMALL LETTER U |
| 0444 | CYRILLIC SMALL LETTER EF |

| | |
|------|---------------------------------|
| 0445 | CYRILLIC SMALL LETTER HA |
| 0446 | CYRILLIC SMALL LETTER TSE |
| 0447 | CYRILLIC SMALL LETTER CHE |
| 0448 | CYRILLIC SMALL LETTER SHA |
| 0449 | CYRILLIC SMALL LETTER SHCHA |
| 044A | CYRILLIC SMALL LETTER HARD SIGN |
| 044B | CYRILLIC SMALL LETTER YERU |
| 044C | CYRILLIC SMALL LETTER SOFT SIGN |
| 044D | CYRILLIC SMALL LETTER E |
| 044E | CYRILLIC SMALL LETTER YU |
| 044F | CYRILLIC SMALL LETTER YA |
| 0451 | CYRILLIC SMALL LETTER IO |
| 2010 | HYPHEN |
| 2013 | EN DASH |
| 2014 | EM DASH |
| 2015 | HORIZONTAL BAR |
| 2016 | DOUBLE VERTICAL LINE |
| 2018 | LEFT SINGLE QUOTATION MARK |
| 2019 | RIGHT SINGLE QUOTATION MARK |
| 201C | LEFT DOUBLE QUOTATION MARK |
| 201D | RIGHT DOUBLE QUOTATION MARK |
| 2025 | TWO DOT LEADER |
| 2026 | HORIZONTAL ELLIPSIS |
| 2030 | PER MILLE SIGN |
| 2032 | PRIME |
| 2033 | DOUBLE PRIME |
| 2035 | REVERSED PRIME |
| 203B | REFERENCE MARK |
| 20AC | EURO SIGN |
| 2103 | DEGREE CELSIUS |
| 2105 | CARE OF |
| 2109 | DEGREE FAHRENHEIT |
| 2116 | NUMERO SIGN |
| 2121 | TELEPHONE SIGN |
| 2160 | ROMAN NUMERAL ONE |
| 2161 | ROMAN NUMERAL TWO |
| 2162 | ROMAN NUMERAL THREE |
| 2163 | ROMAN NUMERAL FOUR |
| 2164 | ROMAN NUMERAL FIVE |
| 2165 | ROMAN NUMERAL SIX |
| 2166 | ROMAN NUMERAL SEVEN |
| 2167 | ROMAN NUMERAL EIGHT |
| 2168 | ROMAN NUMERAL NINE |
| 2169 | ROMAN NUMERAL TEN |
| 216A | ROMAN NUMERAL ELEVEN |
| 216B | ROMAN NUMERAL TWELVE |
| 2170 | SMALL ROMAN NUMERAL ONE |
| 2171 | SMALL ROMAN NUMERAL TWO |
| 2172 | SMALL ROMAN NUMERAL THREE |
| 2173 | SMALL ROMAN NUMERAL FOUR |
| 2174 | SMALL ROMAN NUMERAL FIVE |
| 2175 | SMALL ROMAN NUMERAL SIX |
| 2176 | SMALL ROMAN NUMERAL SEVEN |
| 2177 | SMALL ROMAN NUMERAL EIGHT |
| 2178 | SMALL ROMAN NUMERAL NINE |
| 2179 | SMALL ROMAN NUMERAL TEN |
| 2190 | LEFTWARDS ARROW |
| 2191 | UPWARDS ARROW |
| 2192 | RIGHTWARDS ARROW |
| 2193 | DOWNWARDS ARROW |
| 2196 | NORTH WEST ARROW |
| 2197 | NORTH EAST ARROW |
| 2198 | SOUTH EAST ARROW |
| 2199 | SOUTH WEST ARROW |
| 2208 | ELEMENT OF |
| 220F | N-ARY PRODUCT |
| 2211 | N-ARY SUMMATION |
| 2215 | DIVISION SLASH |
| 221A | SQUARE ROOT |
| 221D | PROPORTIONAL TO |
| 221E | INFINITY |
| 221F | RIGHT ANGLE |
| 2220 | ANGLE |
| 2223 | DIVIDES |
| 2225 | PARALLEL TO |
| 2227 | LOGICAL AND |
| 2228 | LOGICAL OR |
| 2229 | INTERSECTION |
| 222A | UNION |
| 222B | INTEGRAL |
| 222E | CONTOUR INTEGRAL |
| 2234 | THEREFORE |
| 2235 | BECAUSE |
| 2236 | RATIO |
| 2237 | PROPORTION |
| 223D | REVERSED TILDE (LAZY S) |
| 2248 | ALMOST EQUAL TO |
| 224C | ALL EQUAL TO |

| | |
|------|--|
| 2252 | APPROXIMATELY EQUAL TO OR THE IMAGE OF |
| 2260 | NOT EQUAL TO |
| 2261 | IDENTICAL TO |
| 2264 | LESS-THAN OR EQUAL TO |
| 2265 | GREATER-THAN OR EQUAL TO |
| 2266 | LESS-THAN OVER EQUAL TO |
| 2267 | GREATER-THAN OVER EQUAL TO |
| 226E | NOT LESS-THAN |
| 226F | NOT GREATER-THAN |
| 2295 | CIRCLED PLUS |
| 2299 | CIRCLED DOT OPERATOR |
| 22A5 | UP TACK |
| 22BF | RIGHT TRIANGLE |
| 2312 | ARC |
| 2460 | CIRCLED DIGIT ONE |
| 2461 | CIRCLED DIGIT TWO |
| 2462 | CIRCLED DIGIT THREE |
| 2463 | CIRCLED DIGIT FOUR |
| 2464 | CIRCLED DIGIT FIVE |
| 2465 | CIRCLED DIGIT SIX |
| 2466 | CIRCLED DIGIT SEVEN |
| 2467 | CIRCLED DIGIT EIGHT |
| 2468 | CIRCLED DIGIT NINE |
| 2469 | CIRCLED NUMBER TEN |
| 2474 | PARENTHESES DIGIT ONE |
| 2475 | PARENTHESES DIGIT TWO |
| 2476 | PARENTHESES DIGIT THREE |
| 2477 | PARENTHESES DIGIT FOUR |
| 2478 | PARENTHESES DIGIT FIVE |
| 2479 | PARENTHESES DIGIT SIX |
| 247A | PARENTHESES DIGIT SEVEN |
| 247B | PARENTHESES DIGIT EIGHT |
| 247C | PARENTHESES DIGIT NINE |
| 247D | PARENTHESES NUMBER TEN |
| 247E | PARENTHESES NUMBER ELEVEN |
| 247F | PARENTHESES NUMBER TWELVE |
| 2480 | PARENTHESES NUMBER THIRTEEN |
| 2481 | PARENTHESES NUMBER FOURTEEN |
| 2482 | PARENTHESES NUMBER FIFTEEN |
| 2483 | PARENTHESES NUMBER SIXTEEN |
| 2484 | PARENTHESES NUMBER SEVENTEEN |
| 2485 | PARENTHESES NUMBER EIGHTEEN |
| 2486 | PARENTHESES NUMBER NINETEEN |
| 2487 | PARENTHESES NUMBER TWENTY |
| 2488 | DIGIT ONE FULL STOP |
| 2489 | DIGIT TWO FULL STOP |
| 248A | DIGIT THREE FULL STOP |
| 248B | DIGIT FOUR FULL STOP |
| 248C | DIGIT FIVE FULL STOP |
| 248D | DIGIT SIX FULL STOP |
| 248E | DIGIT SEVEN FULL STOP |
| 248F | DIGIT EIGHT FULL STOP |
| 2490 | DIGIT NINE FULL STOP |
| 2491 | NUMBER TEN FULL STOP |
| 2492 | NUMBER ELEVEN FULL STOP |
| 2493 | NUMBER TWELVE FULL STOP |
| 2494 | NUMBER THIRTEEN FULL STOP |
| 2495 | NUMBER FOURTEEN FULL STOP |
| 2496 | NUMBER FIFTEEN FULL STOP |
| 2497 | NUMBER SIXTEEN FULL STOP |
| 2498 | NUMBER SEVENTEEN FULL STOP |
| 2499 | NUMBER EIGHTEEN FULL STOP |
| 249A | NUMBER NINETEEN FULL STOP |
| 249B | NUMBER TWENTY FULL STOP |
| 2500 | BOX DRAWINGS LIGHT HORIZONTAL |
| 2501 | BOX DRAWINGS HEAVY HORIZONTAL |
| 2502 | BOX DRAWINGS LIGHT VERTICAL |
| 2503 | BOX DRAWINGS HEAVY VERTICAL |
| 2504 | BOX DRAWINGS LIGHT TRIPLE DASH HORIZONTAL |
| 2505 | BOX DRAWINGS HEAVY TRIPLE DASH HORIZONTAL |
| 2506 | BOX DRAWINGS LIGHT TRIPLE DASH VERTICAL |
| 2507 | BOX DRAWINGS HEAVY TRIPLE DASH VERTICAL |
| 2508 | BOX DRAWINGS LIGHT QUADRUPLE DASH HORIZONTAL |
| 2509 | BOX DRAWINGS HEAVY QUADRUPLE DASH HORIZONTAL |
| 250A | BOX DRAWINGS LIGHT QUADRUPLE DASH VERTICAL |
| 250B | BOX DRAWINGS HEAVY QUADRUPLE DASH VERTICAL |
| 250C | BOX DRAWINGS LIGHT DOWN AND RIGHT |
| 250D | BOX DRAWINGS DOWN LIGHT AND RIGHT HEAVY |

| | |
|------|--|
| 250E | BOX DRAWINGS DOWN HEAVY AND RIGHT LIGHT |
| 250F | BOX DRAWINGS HEAVY DOWN AND RIGHT |
| 2510 | BOX DRAWINGS LIGHT DOWN AND LEFT |
| 2511 | BOX DRAWINGS DOWN LIGHT AND LEFT HEAVY |
| 2512 | BOX DRAWINGS DOWN HEAVY AND LEFT LIGHT |
| 2513 | BOX DRAWINGS HEAVY DOWN AND LEFT |
| 2514 | BOX DRAWINGS LIGHT UP AND RIGHT |
| 2515 | BOX DRAWINGS UP LIGHT AND RIGHT HEAVY |
| 2516 | BOX DRAWINGS UP HEAVY AND RIGHT LIGHT |
| 2517 | BOX DRAWINGS HEAVY UP AND RIGHT |
| 2518 | BOX DRAWINGS LIGHT UP AND LEFT |
| 2519 | BOX DRAWINGS UP LIGHT AND LEFT HEAVY |
| 251A | BOX DRAWINGS UP HEAVY AND LEFT LIGHT |
| 251B | BOX DRAWINGS HEAVY UP AND LEFT |
| 251C | BOX DRAWINGS LIGHT VERTICAL AND RIGHT |
| 251D | BOX DRAWINGS VERTICAL LIGHT AND RIGHT HEAVY |
| 251E | BOX DRAWINGS UP HEAVY AND RIGHT DOWN LIGHT |
| 251F | BOX DRAWINGS DOWN HEAVY AND RIGHT UP LIGHT |
| 2520 | BOX DRAWINGS VERTICAL HEAVY AND RIGHT LIGHT |
| 2521 | BOX DRAWINGS DOWN LIGHT AND RIGHT UP HEAVY |
| 2522 | BOX DRAWINGS UP LIGHT AND RIGHT DOWN HEAVY |
| 2523 | BOX DRAWINGS HEAVY VERTICAL AND RIGHT |
| 2524 | BOX DRAWINGS LIGHT VERTICAL AND LEFT |
| 2525 | BOX DRAWINGS VERTICAL LIGHT AND LEFT HEAVY |
| 2526 | BOX DRAWINGS UP HEAVY AND LEFT DOWN LIGHT |
| 2527 | BOX DRAWINGS DOWN HEAVY AND LEFT UP LIGHT |
| 2528 | BOX DRAWINGS VERTICAL HEAVY AND LEFT LIGHT |
| 2529 | BOX DRAWINGS DOWN LIGHT AND LEFT UP HEAVY |
| 252A | BOX DRAWINGS UP LIGHT AND LEFT DOWN HEAVY |
| 252B | BOX DRAWINGS HEAVY VERTICAL AND LEFT |
| 252C | BOX DRAWINGS LIGHT DOWN AND HORIZONTAL |
| 252D | BOX DRAWINGS LEFT HEAVY AND RIGHT DOWN LIGHT |
| 252E | BOX DRAWINGS RIGHT HEAVY AND LEFT DOWN LIGHT |
| 252F | BOX DRAWINGS DOWN LIGHT AND HORIZONTAL HEAVY |
| 2530 | BOX DRAWINGS DOWN HEAVY AND HORIZONTAL LIGHT |
| 2531 | BOX DRAWINGS RIGHT LIGHT AND LEFT DOWN HEAVY |
| 2532 | BOX DRAWINGS LEFT LIGHT AND RIGHT DOWN HEAVY |
| 2533 | BOX DRAWINGS HEAVY DOWN AND HORIZONTAL |
| 2534 | BOX DRAWINGS LIGHT UP AND HORIZONTAL |
| 2535 | BOX DRAWINGS LEFT HEAVY AND RIGHT UP LIGHT |
| 2536 | BOX DRAWINGS RIGHT HEAVY AND LEFT UP LIGHT |
| 2537 | BOX DRAWINGS UP LIGHT AND HORIZONTAL HEAVY |
| 2538 | BOX DRAWINGS UP HEAVY AND HORIZONTAL LIGHT |
| 2539 | BOX DRAWINGS RIGHT LIGHT AND LEFT UP HEAVY |
| 253A | BOX DRAWINGS LEFT LIGHT AND RIGHT UP HEAVY |
| 253B | BOX DRAWINGS HEAVY UP AND HORIZONTAL |
| 253C | BOX DRAWINGS LIGHT VERTICAL AND HORIZONTAL |

| | |
|------|--|
| 253D | BOX DRAWINGS LEFT HEAVY AND RIGHT VERTICAL LIGHT |
| 253E | BOX DRAWINGS RIGHT HEAVY AND LEFT VERTICAL LIGHT |
| 253F | BOX DRAWINGS VERTICAL LIGHT AND HORIZONTAL HEAVY |
| 2540 | BOX DRAWINGS UP HEAVY AND DOWN HORIZONTAL LIGHT |
| 2541 | BOX DRAWINGS DOWN HEAVY AND UP HORIZONTAL LIGHT |
| 2542 | BOX DRAWINGS VERTICAL HEAVY AND HORIZONTAL LIGHT |
| 2543 | BOX DRAWINGS LEFT UP HEAVY AND RIGHT DOWN LIGHT |
| 2544 | BOX DRAWINGS RIGHT UP HEAVY AND LEFT DOWN LIGHT |
| 2545 | BOX DRAWINGS LEFT DOWN HEAVY AND RIGHT UP LIGHT |
| 2546 | BOX DRAWINGS RIGHT DOWN HEAVY AND LEFT UP LIGHT |
| 2547 | BOX DRAWINGS DOWN LIGHT AND UP HORIZONTAL HEAVY |
| 2548 | BOX DRAWINGS UP LIGHT AND DOWN HORIZONTAL HEAVY |
| 2549 | BOX DRAWINGS RIGHT LIGHT AND LEFT VERTICAL HEAVY |
| 254A | BOX DRAWINGS LEFT LIGHT AND RIGHT VERTICAL HEAVY |
| 254B | BOX DRAWINGS HEAVY VERTICAL AND HORIZONTAL |
| 2550 | BOX DRAWINGS DOUBLE HORIZONTAL |
| 2551 | BOX DRAWINGS DOUBLE VERTICAL |
| 2552 | BOX DRAWINGS DOWN SINGLE AND RIGHT DOUBLE |
| 2553 | BOX DRAWINGS DOWN DOUBLE AND RIGHT SINGLE |
| 2554 | BOX DRAWINGS DOUBLE DOWN AND RIGHT |
| 2555 | BOX DRAWINGS DOWN SINGLE AND LEFT DOUBLE |
| 2556 | BOX DRAWINGS DOWN DOUBLE AND LEFT SINGLE |
| 2557 | BOX DRAWINGS DOUBLE DOWN AND LEFT |
| 2558 | BOX DRAWINGS UP SINGLE AND RIGHT DOUBLE |
| 2559 | BOX DRAWINGS UP DOUBLE AND RIGHT SINGLE |
| 255A | BOX DRAWINGS DOUBLE UP AND RIGHT |
| 255B | BOX DRAWINGS UP SINGLE AND LEFT DOUBLE |
| 255C | BOX DRAWINGS UP DOUBLE AND LEFT SINGLE |
| 255D | BOX DRAWINGS DOUBLE UP AND LEFT |
| 255E | BOX DRAWINGS VERTICAL SINGLE AND RIGHT DOUBLE |
| 255F | BOX DRAWINGS VERTICAL DOUBLE AND RIGHT SINGLE |
| 2560 | BOX DRAWINGS DOUBLE VERTICAL AND RIGHT |
| 2561 | BOX DRAWINGS VERTICAL SINGLE AND LEFT DOUBLE |
| 2562 | BOX DRAWINGS VERTICAL DOUBLE AND LEFT SINGLE |
| 2563 | BOX DRAWINGS DOUBLE VERTICAL AND LEFT |
| 2564 | BOX DRAWINGS DOWN SINGLE AND HORIZONTAL DOUBLE |
| 2565 | BOX DRAWINGS DOWN DOUBLE AND HORIZONTAL SINGLE |
| 2566 | BOX DRAWINGS DOUBLE DOWN AND HORIZONTAL |
| 2567 | BOX DRAWINGS UP SINGLE AND HORIZONTAL DOUBLE |
| 2568 | BOX DRAWINGS UP DOUBLE AND HORIZONTAL SINGLE |
| 2569 | BOX DRAWINGS DOUBLE UP AND HORIZONTAL |
| 256A | BOX DRAWINGS VERTICAL SINGLE AND HORIZONTAL DOUBLE |
| 256B | BOX DRAWINGS VERTICAL DOUBLE AND HORIZONTAL SINGLE |
| 256C | BOX DRAWINGS DOUBLE VERTICAL AND HORIZONTAL |
| 256D | BOX DRAWINGS LIGHT ARC DOWN AND RIGHT |
| 256E | BOX DRAWINGS LIGHT ARC DOWN AND LEFT |
| 256F | BOX DRAWINGS LIGHT ARC UP AND LEFT |

| | |
|------|---|
| 2570 | BOX DRAWINGS LIGHT ARC UP AND RIGHT |
| 2571 | BOX DRAWINGS LIGHT DIAGONAL UPPER RIGHT TO LOWER LEFT |
| 2572 | BOX DRAWINGS LIGHT DIAGONAL UPPER LEFT TO LOWER RIGHT |
| 2573 | BOX DRAWINGS LIGHT DIAGONAL CROSS |
| 2581 | LOWER ONE EIGHTH BLOCK |
| 2582 | LOWER ONE QUARTER BLOCK |
| 2583 | LOWER THREE EIGHTHS BLOCK |
| 2584 | LOWER HALF BLOCK |
| 2585 | LOWER FIVE EIGHTHS BLOCK |
| 2586 | LOWER THREE QUARTERS BLOCK |
| 2587 | LOWER SEVEN EIGHTHS BLOCK |
| 2588 | FULL BLOCK |
| 2589 | LEFT SEVEN EIGHTHS BLOCK |
| 258A | LEFT THREE QUARTERS BLOCK |
| 258B | LEFT FIVE EIGHTHS BLOCK |
| 258C | LEFT HALF BLOCK |
| 258D | LEFT THREE EIGHTHS BLOCK |
| 258E | LEFT ONE QUARTER BLOCK |
| 258F | LEFT ONE EIGHTH BLOCK |
| 2593 | DARK SHADE |
| 2594 | UPPER ONE EIGHTH BLOCK |
| 2595 | RIGHT ONE EIGHTH BLOCK |
| 25A0 | BLACK SQUARE |
| 25A1 | WHITE SQUARE |
| 25B2 | BLACK UP-POINTING TRIANGLE |
| 25B3 | WHITE UP-POINTING TRIANGLE |
| 25BC | BLACK DOWN-POINTING TRIANGLE |
| 25BD | WHITE DOWN-POINTING TRIANGLE |
| 25C6 | BLACK DIAMOND |
| 25C7 | WHITE DIAMOND |
| 25CB | WHITE CIRCLE |
| 25CE | BULLSEYE |
| 25CF | BLACK CIRCLE |
| 25E2 | BLACK LOWER RIGHT TRIANGLE |
| 25E3 | BLACK LOWER LEFT TRIANGLE |
| 25E4 | BLACK UPPER LEFT TRIANGLE |
| 25E5 | BLACK UPPER RIGHT TRIANGLE |
| 2605 | BLACK STAR |
| 2606 | WHITE STAR |
| 2609 | SUN |
| 2640 | FEMALE SIGN |
| 2642 | MALE SIGN |
| 2FF0 | IDEOGRAPHIC CHARACTER LEFT TO RIGHT DESCRIPTION |
| 2FF1 | IDEOGRAPHIC CHARACTER ABOVE TO BELOW DESCRIPTION |
| 2FF2 | IDEOGRAPHIC CHARACTER LEFT TO MIDDLE AND RIGHT DESCRIPTION |
| 2FF3 | IDEOGRAPHIC CHARACTER ABOVE TO MIDDLE AND BELOW DESCRIPTION |
| 2FF4 | IDEOGRAPHIC CHARACTER FULL SURROUND DESCRIPTION |
| 2FF5 | IDEOGRAPHIC CHARACTER SURROUND FROM ABOVE DESCRIPTION |
| 2FF6 | IDEOGRAPHIC CHARACTER SURROUND FROM BELOW DESCRIPTION |
| 2FF7 | IDEOGRAPHIC CHARACTER SURROUND FROM LEFT DESCRIPTION |
| 2FF8 | IDEOGRAPHIC CHARACTER SURROUND FROM UPPER LEFT DESCRIPTION |
| 2FF9 | IDEOGRAPHIC CHARACTER SURROUND FROM UPPER RIGHT DESCRIPTION |
| 2FFA | IDEOGRAPHIC CHARACTER SURROUND FROM LOWER LEFT DESCRIPTION |
| 2FFB | IDEOGRAPHIC CHARACTER OVERLAID DESCRIPTION |
| 3000 | IDEOGRAPHIC SPACE |
| 3001 | IDEOGRAPHIC COMMA |
| 3002 | IDEOGRAPHIC FULL STOP |
| 3003 | DITTO MARK |
| 3005 | IDEOGRAPHIC ITERATION MARK |
| 3006 | IDEOGRAPHIC CLOSING MARK |
| 3007 | IDEOGRAPHIC NUMBER ZERO |
| 3008 | LEFT ANGLE BRACKET |
| 3009 | RIGHT ANGLE BRACKET |
| 300A | LEFT DOUBLE ANGLE BRACKET |
| 300B | RIGHT DOUBLE ANGLE BRACKET |
| 300C | LEFT CORNER BRACKET |
| 300D | RIGHT CORNER BRACKET |
| 300E | LEFT WHITE CORNER BRACKET |
| 300F | RIGHT WHITE CORNER BRACKET |

| | |
|------|---|
| 3010 | LEFT BLACK LENTICULAR BRACKET |
| 3011 | RIGHT BLACK LENTICULAR BRACKET |
| 3012 | POSTAL MARK |
| 3013 | GETA MARK |
| 3014 | LEFT TORTOISE SHELL BRACKET |
| 3015 | RIGHT TORTOISE SHELL BRACKET |
| 3016 | LEFT WHITE LENTICULAR BRACKET |
| 3017 | RIGHT WHITE LENTICULAR BRACKET |
| 301D | REVERSED DOUBLE PRIME QUOTATION MARK |
| 301E | DOUBLE PRIME QUOTATION MARK |
| 3021 | HANGZHOU NUMERAL ONE |
| 3022 | HANGZHOU NUMERAL TWO |
| 3023 | HANGZHOU NUMERAL THREE |
| 3024 | HANGZHOU NUMERAL FOUR |
| 3025 | HANGZHOU NUMERAL FIVE |
| 3026 | HANGZHOU NUMERAL SIX |
| 3027 | HANGZHOU NUMERAL SEVEN |
| 3028 | HANGZHOU NUMERAL EIGHT |
| 3029 | HANGZHOU NUMERAL NINE |
| 303E | IDEOGRAPHIC VARIATION INDICATOR |
| 3041 | HIRAGANA LETTER SMALL A |
| 3042 | HIRAGANA LETTER A |
| 3043 | HIRAGANA LETTER SMALL I |
| 3044 | HIRAGANA LETTER I |
| 3045 | HIRAGANA LETTER SMALL U |
| 3046 | HIRAGANA LETTER U |
| 3047 | HIRAGANA LETTER SMALL E |
| 3048 | HIRAGANA LETTER E |
| 3049 | HIRAGANA LETTER SMALL O |
| 304A | HIRAGANA LETTER O |
| 304B | HIRAGANA LETTER KA |
| 304C | HIRAGANA LETTER GA |
| 304D | HIRAGANA LETTER KI |
| 304E | HIRAGANA LETTER GI |
| 304F | HIRAGANA LETTER KU |
| 3050 | HIRAGANA LETTER GU |
| 3051 | HIRAGANA LETTER KE |
| 3052 | HIRAGANA LETTER GE |
| 3053 | HIRAGANA LETTER KO |
| 3054 | HIRAGANA LETTER GO |
| 3055 | HIRAGANA LETTER SA |
| 3056 | HIRAGANA LETTER ZA |
| 3057 | HIRAGANA LETTER SI |
| 3058 | HIRAGANA LETTER ZI |
| 3059 | HIRAGANA LETTER SU |
| 305A | HIRAGANA LETTER ZU |
| 305B | HIRAGANA LETTER SE |
| 305C | HIRAGANA LETTER ZE |
| 305D | HIRAGANA LETTER SO |
| 305E | HIRAGANA LETTER ZO |
| 305F | HIRAGANA LETTER TA |
| 3060 | HIRAGANA LETTER DA |
| 3061 | HIRAGANA LETTER TI |
| 3062 | HIRAGANA LETTER DI |
| 3063 | HIRAGANA LETTER SMALL TU |
| 3064 | HIRAGANA LETTER TU |
| 3065 | HIRAGANA LETTER DU |
| 3066 | HIRAGANA LETTER TE |
| 3067 | HIRAGANA LETTER DE |
| 3068 | HIRAGANA LETTER TO |
| 3069 | HIRAGANA LETTER DO |
| 306A | HIRAGANA LETTER NA |
| 306B | HIRAGANA LETTER NI |
| 306C | HIRAGANA LETTER NU |
| 306D | HIRAGANA LETTER NE |
| 306E | HIRAGANA LETTER NO |
| 306F | HIRAGANA LETTER HA |
| 3070 | HIRAGANA LETTER BA |
| 3071 | HIRAGANA LETTER PA |
| 3072 | HIRAGANA LETTER HI |
| 3073 | HIRAGANA LETTER BI |
| 3074 | HIRAGANA LETTER PI |
| 3075 | HIRAGANA LETTER HU |
| 3076 | HIRAGANA LETTER BU |
| 3077 | HIRAGANA LETTER PU |
| 3078 | HIRAGANA LETTER HE |
| 3079 | HIRAGANA LETTER BE |
| 307A | HIRAGANA LETTER PE |
| 307B | HIRAGANA LETTER HO |
| 307C | HIRAGANA LETTER BO |
| 307D | HIRAGANA LETTER PO |
| 307E | HIRAGANA LETTER MA |
| 307F | HIRAGANA LETTER MI |
| 3080 | HIRAGANA LETTER MU |
| 3081 | HIRAGANA LETTER ME |
| 3082 | HIRAGANA LETTER MO |
| 3083 | HIRAGANA LETTER SMALL YA |

| | |
|------|---|
| 3084 | HIRAGANA LETTER YA |
| 3085 | HIRAGANA LETTER SMALL YU |
| 3086 | HIRAGANA LETTER YU |
| 3087 | HIRAGANA LETTER SMALL YO |
| 3088 | HIRAGANA LETTER YO |
| 3089 | HIRAGANA LETTER RA |
| 308A | HIRAGANA LETTER RI |
| 308B | HIRAGANA LETTER RU |
| 308C | HIRAGANA LETTER RE |
| 308D | HIRAGANA LETTER RO |
| 308E | HIRAGANA LETTER SMALL WA |
| 308F | HIRAGANA LETTER WA |
| 3090 | HIRAGANA LETTER WI |
| 3091 | HIRAGANA LETTER WE |
| 3092 | HIRAGANA LETTER WO |
| 3093 | HIRAGANA LETTER N |
| 309B | KATAKANA-HIRAGANA VOICED SOUND MARK |
| 309C | KATAKANA-HIRAGANA SEMI-VOICED SOUND MARK |
| 309D | HIRAGANA ITERATION MARK |
| 309E | HIRAGANA VOICED ITERATION MARK |
| 30A1 | KATAKANA LETTER SMALL A |
| 30A2 | KATAKANA LETTER A |
| 30A3 | KATAKANA LETTER SMALL I |
| 30A4 | KATAKANA LETTER I |
| 30A5 | KATAKANA LETTER SMALL U |
| 30A6 | KATAKANA LETTER U |
| 30A7 | KATAKANA LETTER SMALL E |
| 30A8 | KATAKANA LETTER E |
| 30A9 | KATAKANA LETTER SMALL O |
| 30AA | KATAKANA LETTER O |
| 30AB | KATAKANA LETTER KA |
| 30AC | KATAKANA LETTER GA |
| 30AD | KATAKANA LETTER KI |
| 30AE | KATAKANA LETTER GI |
| 30AF | KATAKANA LETTER KU |
| 30B0 | KATAKANA LETTER GU |
| 30B1 | KATAKANA LETTER KE |
| 30B2 | KATAKANA LETTER GE |
| 30B3 | KATAKANA LETTER KO |
| 30B4 | KATAKANA LETTER GO |
| 30B5 | KATAKANA LETTER SA |
| 30B6 | KATAKANA LETTER ZA |
| 30B7 | KATAKANA LETTER SI |
| 30B8 | KATAKANA LETTER ZI |
| 30B9 | KATAKANA LETTER SU |
| 30BA | KATAKANA LETTER ZU |
| 30BB | KATAKANA LETTER SE |
| 30BC | KATAKANA LETTER ZE |
| 30BD | KATAKANA LETTER SO |
| 30BE | KATAKANA LETTER ZO |
| 30BF | KATAKANA LETTER TA |
| 30C0 | KATAKANA LETTER DA |
| 30C1 | KATAKANA LETTER TI |
| 30C2 | KATAKANA LETTER DI |
| 30C3 | KATAKANA LETTER SMALL TU |
| 30C4 | KATAKANA LETTER TU |
| 30C5 | KATAKANA LETTER DU |
| 30C6 | KATAKANA LETTER TE |
| 30C7 | KATAKANA LETTER DE |
| 30C8 | KATAKANA LETTER TO |
| 30C9 | KATAKANA LETTER DO |
| 30CA | KATAKANA LETTER NA |
| 30CB | KATAKANA LETTER NI |
| 30CC | KATAKANA LETTER NU |
| 30CD | KATAKANA LETTER NE |
| 30CE | KATAKANA LETTER NO |
| 30CF | KATAKANA LETTER HA |
| 30D0 | KATAKANA LETTER BA |
| 30D1 | KATAKANA LETTER PA |
| 30D2 | KATAKANA LETTER HI |
| 30D3 | KATAKANA LETTER BI |
| 30D4 | KATAKANA LETTER PI |
| 30D5 | KATAKANA LETTER HU |
| 30D6 | KATAKANA LETTER BU |
| 30D7 | KATAKANA LETTER PU |
| 30D8 | KATAKANA LETTER HE |
| 30D9 | KATAKANA LETTER BE |
| 30DA | KATAKANA LETTER PE |
| 30DB | KATAKANA LETTER HO |
| 30DC | KATAKANA LETTER BO |
| 30DD | KATAKANA LETTER PO |
| 30DE | KATAKANA LETTER MA |
| 30DF | KATAKANA LETTER MI |
| 30E0 | KATAKANA LETTER MU |
| 30E1 | KATAKANA LETTER ME |
| 30E2 | KATAKANA LETTER MO |

| | |
|-----------|---|
| 30E3 | KATAKANA LETTER SMALL YA |
| 30E4 | KATAKANA LETTER YA |
| 30E5 | KATAKANA LETTER SMALL YU |
| 30E6 | KATAKANA LETTER YU |
| 30E7 | KATAKANA LETTER SMALL YO |
| 30E8 | KATAKANA LETTER YO |
| 30E9 | KATAKANA LETTER RA |
| 30EA | KATAKANA LETTER RI |
| 30EB | KATAKANA LETTER RU |
| 30EC | KATAKANA LETTER RE |
| 30ED | KATAKANA LETTER RO |
| 30EE | KATAKANA LETTER SMALL WA |
| 30EF | KATAKANA LETTER WA |
| 30F0 | KATAKANA LETTER WI |
| 30F1 | KATAKANA LETTER WE |
| 30F2 | KATAKANA LETTER WO |
| 30F3 | KATAKANA LETTER N |
| 30F4 | KATAKANA LETTER VU |
| 30F5 | KATAKANA LETTER SMALL KA |
| 30F6 | KATAKANA LETTER SMALL KE |
| 30FC | KATAKANA-HIRAGANA PROLONGED SOUND MARK |
| 30FD | KATAKANA ITERATION MARK |
| 30FE | KATAKANA VOICED ITERATION MARK |
| 3105 | BOPOMOFO LETTER B |
| 3106 | BOPOMOFO LETTER P |
| 3107 | BOPOMOFO LETTER M |
| 3108 | BOPOMOFO LETTER F |
| 3109 | BOPOMOFO LETTER D |
| 310A | BOPOMOFO LETTER T |
| 310B | BOPOMOFO LETTER N |
| 310C | BOPOMOFO LETTER L |
| 310D | BOPOMOFO LETTER G |
| 310E | BOPOMOFO LETTER K |
| 310F | BOPOMOFO LETTER H |
| 3110 | BOPOMOFO LETTER J |
| 3111 | BOPOMOFO LETTER Q |
| 3112 | BOPOMOFO LETTER X |
| 3113 | BOPOMOFO LETTER ZH |
| 3114 | BOPOMOFO LETTER CH |
| 3115 | BOPOMOFO LETTER SH |
| 3116 | BOPOMOFO LETTER R |
| 3117 | BOPOMOFO LETTER Z |
| 3118 | BOPOMOFO LETTER C |
| 3119 | BOPOMOFO LETTER S |
| 311A | BOPOMOFO LETTER A |
| 311B | BOPOMOFO LETTER O |
| 311C | BOPOMOFO LETTER E |
| 311D | BOPOMOFO LETTER EH |
| 311E | BOPOMOFO LETTER AI |
| 311F | BOPOMOFO LETTER EI |
| 3120 | BOPOMOFO LETTER AU |
| 3121 | BOPOMOFO LETTER OU |
| 3122 | BOPOMOFO LETTER AN |
| 3123 | BOPOMOFO LETTER EN |
| 3124 | BOPOMOFO LETTER ANG |
| 3125 | BOPOMOFO LETTER ENG |
| 3126 | BOPOMOFO LETTER ER |
| 3127 | BOPOMOFO LETTER I |
| 3128 | BOPOMOFO LETTER U |
| 3129 | BOPOMOFO LETTER IU |
| 3220 | PARENTHESESIZED IDEOGRAPH ONE |
| 3221 | PARENTHESESIZED IDEOGRAPH TWO |
| 3222 | PARENTHESESIZED IDEOGRAPH THREE |
| 3223 | PARENTHESESIZED IDEOGRAPH FOUR |
| 3224 | PARENTHESESIZED IDEOGRAPH FIVE |
| 3225 | PARENTHESESIZED IDEOGRAPH SIX |
| 3226 | PARENTHESESIZED IDEOGRAPH SEVEN |
| 3227 | PARENTHESESIZED IDEOGRAPH EIGHT |
| 3228 | PARENTHESESIZED IDEOGRAPH NINE |
| 3229 | PARENTHESESIZED IDEOGRAPH TEN |
| 3231 | PARENTHESESIZED IDEOGRAPH STOCK |
| 32A3 | CIRCLED IDEOGRAPH CORRECT |
| 338E | SQUARE MG |
| 338F | SQUARE KG |
| 339C | SQUARE MM |
| 339D | SQUARE CM |
| 339E | SQUARE KM |
| 33A1 | SQUARE M SQUARED |
| 33C4 | SQUARE CC |
| 33CE | SQUARE KM CAPITAL |
| 33D1 | SQUARE LN |
| 33D2 | SQUARE LOG |
| 33D5 | SQUARE MIL |
| 3400-4DB5 | CJK UNIFIED IDEOGRAPH EXTENSION A |
| 4E00-9FA5 | CJK UNIFIED IDEOGRAPH |
| E78D-E796 | PRIVATE USE AREA |

| | |
|-----------|--|
| E7C7-E7C8 | PRIVATE USE AREA |
| E815-E864 | PRIVATE USE AREA |
| F92C | CJK COMPATIBILITY IDEOGRAPH-F92C |
| F979 | CJK COMPATIBILITY IDEOGRAPH-F979 |
| F995 | CJK COMPATIBILITY IDEOGRAPH-F995 |
| F9E7 | CJK COMPATIBILITY IDEOGRAPH-F9E7 |
| F9F1 | CJK COMPATIBILITY IDEOGRAPH-F9F1 |
| FA0C | CJK COMPATIBILITY IDEOGRAPH-FA0C |
| FA0D | CJK COMPATIBILITY IDEOGRAPH-FA0D |
| FA0E | CJK COMPATIBILITY IDEOGRAPH-FA0E |
| FA0F | CJK COMPATIBILITY IDEOGRAPH-FA0F |
| FA11 | CJK COMPATIBILITY IDEOGRAPH-FA11 |
| FA13 | CJK COMPATIBILITY IDEOGRAPH-FA13 |
| FA14 | CJK COMPATIBILITY IDEOGRAPH-FA14 |
| FA18 | CJK COMPATIBILITY IDEOGRAPH-FA18 |
| FA1F | CJK COMPATIBILITY IDEOGRAPH-FA1F * |
| FA20 | CJK COMPATIBILITY IDEOGRAPH-FA20 |
| FA21 | CJK COMPATIBILITY IDEOGRAPH-FA21 |
| FA23 | CJK COMPATIBILITY IDEOGRAPH-FA23 * |
| FA24 | CJK COMPATIBILITY IDEOGRAPH-FA24 |
| FA27 | CJK COMPATIBILITY IDEOGRAPH-FA27 |
| FA28 | CJK COMPATIBILITY IDEOGRAPH-FA28 |
| FA29 | CJK COMPATIBILITY IDEOGRAPH-FA29 |
| FE30 | PRESENTATION FORM FOR VERTICAL TWO DOT LEADER |
| FE31 | PRESENTATION FORM FOR VERTICAL EM DASH |
| FE33 | PRESENTATION FORM FOR VERTICAL LOW LINE |
| FE34 | PRESENTATION FORM FOR VERTICAL WAVY LOW LINE |
| FE35 | PRESENTATION FORM FOR VERTICAL LEFT PARENTHESIS |
| FE36 | PRESENTATION FORM FOR VERTICAL RIGHT PARENTHESIS |
| FE37 | PRESENTATION FORM FOR VERTICAL LEFT CURLY BRACKET |
| FE38 | PRESENTATION FORM FOR VERTICAL RIGHT CURLY BRACKET |
| FE39 | PRESENTATION FORM FOR VERTICAL LEFT TORTOISE SHELL BRACKET |
| FE3A | PRESENTATION FORM FOR VERTICAL RIGHT TORTOISE SHELL BRACKET |
| FE3B | PRESENTATION FORM FOR VERTICAL LEFT BLACK LENTICULAR BRACKET |
| FE3C | PRESENTATION FORM FOR VERTICAL RIGHT BLACK LENTICULAR BRACKET |
| FE3D | PRESENTATION FORM FOR VERTICAL LEFT DOUBLE ANGLE BRACKET |
| FE3E | PRESENTATION FORM FOR VERTICAL RIGHT DOUBLE ANGLE BRACKET |
| FE3F | PRESENTATION FORM FOR VERTICAL LEFT ANGLE BRACKET |
| FE40 | PRESENTATION FORM FOR VERTICAL RIGHT ANGLE BRACKET |
| FE41 | PRESENTATION FORM FOR VERTICAL LEFT CORNER BRACKET |
| FE42 | PRESENTATION FORM FOR VERTICAL RIGHT CORNER BRACKET |
| FE43 | PRESENTATION FORM FOR VERTICAL LEFT WHITE CORNER BRACKET |
| FE44 | PRESENTATION FORM FOR VERTICAL RIGHT WHITE CORNER BRACKET |
| FE49 | DASHED OVERLINE |
| FE4A | CENTRELINE OVERLINE |
| FE4B | WAVY OVERLINE |
| FE4C | DOUBLE WAVY OVERLINE |
| FE4D | DASHED LOW LINE |
| FE4E | CENTRELINE LOW LINE |
| FE4F | WAVY LOW LINE |
| FE50 | SMALL COMMA |
| FE51 | SMALL IDEOGRAPHIC COMMA |
| FE52 | SMALL FULL STOP |
| FE54 | SMALL SEMICOLON |
| FE55 | SMALL COLON |
| FE56 | SMALL QUESTION MARK |
| FE57 | SMALL EXCLAMATION MARK |
| FE59 | SMALL LEFT PARENTHESIS |
| FE5A | SMALL RIGHT PARENTHESIS |
| FE5B | SMALL LEFT CURLY BRACKET |
| FE5C | SMALL RIGHT CURLY BRACKET |
| FE5D | SMALL LEFT TORTOISE SHELL BRACKET |
| FE5E | SMALL RIGHT TORTOISE SHELL BRACKET |
| FE5F | SMALL NUMBER SIGN |
| FE60 | SMALL AMPERSAND |
| FE61 | SMALL ASTERISK |

| | |
|------|----------------------------------|
| FE62 | SMALL PLUS SIGN |
| FE63 | SMALL HYPHEN-MINUS |
| FE64 | SMALL LESS-THAN SIGN |
| FE65 | SMALL GREATER-THAN SIGN |
| FE66 | SMALL EQUALS SIGN |
| FE68 | SMALL REVERSE SOLIDUS |
| FE69 | SMALL DOLLAR SIGN |
| FE6A | SMALL PERCENT SIGN |
| FE6B | SMALL COMMERCIAL AT |
| FF01 | FULLWIDTH EXCLAMATION MARK |
| FF02 | FULLWIDTH QUOTATION MARK |
| FF03 | FULLWIDTH NUMBER SIGN |
| FF04 | FULLWIDTH DOLLAR SIGN |
| FF05 | FULLWIDTH PERCENT SIGN |
| FF06 | FULLWIDTH AMPERSAND |
| FF07 | FULLWIDTH APOSTROPHE |
| FF08 | FULLWIDTH LEFT PARENTHESIS |
| FF09 | FULLWIDTH RIGHT PARENTHESIS |
| FF0A | FULLWIDTH ASTERISK |
| FF0B | FULLWIDTH PLUS SIGN |
| FF0C | FULLWIDTH COMMA |
| FF0D | FULLWIDTH HYPHEN-MINUS |
| FF0E | FULLWIDTH FULL STOP |
| FF0F | FULLWIDTH SOLIDUS |
| FF10 | FULLWIDTH DIGIT ZERO |
| FF11 | FULLWIDTH DIGIT ONE |
| FF12 | FULLWIDTH DIGIT TWO |
| FF13 | FULLWIDTH DIGIT THREE |
| FF14 | FULLWIDTH DIGIT FOUR |
| FF15 | FULLWIDTH DIGIT FIVE |
| FF16 | FULLWIDTH DIGIT SIX |
| FF17 | FULLWIDTH DIGIT SEVEN |
| FF18 | FULLWIDTH DIGIT EIGHT |
| FF19 | FULLWIDTH DIGIT NINE |
| FF1A | FULLWIDTH COLON |
| FF1B | FULLWIDTH SEMICOLON |
| FF1C | FULLWIDTH LESS-THAN SIGN |
| FF1D | FULLWIDTH EQUALS SIGN |
| FF1E | FULLWIDTH GREATER-THAN SIGN |
| FF1F | FULLWIDTH QUESTION MARK |
| FF20 | FULLWIDTH COMMERCIAL AT |
| FF21 | FULLWIDTH LATIN CAPITAL LETTER A |
| FF22 | FULLWIDTH LATIN CAPITAL LETTER B |
| FF23 | FULLWIDTH LATIN CAPITAL LETTER C |
| FF24 | FULLWIDTH LATIN CAPITAL LETTER D |
| FF25 | FULLWIDTH LATIN CAPITAL LETTER E |
| FF26 | FULLWIDTH LATIN CAPITAL LETTER F |
| FF27 | FULLWIDTH LATIN CAPITAL LETTER G |
| FF28 | FULLWIDTH LATIN CAPITAL LETTER H |
| FF29 | FULLWIDTH LATIN CAPITAL LETTER I |
| FF2A | FULLWIDTH LATIN CAPITAL LETTER J |
| FF2B | FULLWIDTH LATIN CAPITAL LETTER K |
| FF2C | FULLWIDTH LATIN CAPITAL LETTER L |
| FF2D | FULLWIDTH LATIN CAPITAL LETTER M |
| FF2E | FULLWIDTH LATIN CAPITAL LETTER N |

| | |
|------|----------------------------------|
| FF2F | FULLWIDTH LATIN CAPITAL LETTER O |
| FF30 | FULLWIDTH LATIN CAPITAL LETTER P |
| FF31 | FULLWIDTH LATIN CAPITAL LETTER Q |
| FF32 | FULLWIDTH LATIN CAPITAL LETTER R |
| FF33 | FULLWIDTH LATIN CAPITAL LETTER S |
| FF34 | FULLWIDTH LATIN CAPITAL LETTER T |
| FF35 | FULLWIDTH LATIN CAPITAL LETTER U |
| FF36 | FULLWIDTH LATIN CAPITAL LETTER V |
| FF37 | FULLWIDTH LATIN CAPITAL LETTER W |
| FF38 | FULLWIDTH LATIN CAPITAL LETTER X |
| FF39 | FULLWIDTH LATIN CAPITAL LETTER Y |
| FF3A | FULLWIDTH LATIN CAPITAL LETTER Z |
| FF3B | FULLWIDTH LEFT SQUARE BRACKET |
| FF3C | FULLWIDTH REVERSE SOLIDUS |
| FF3D | FULLWIDTH RIGHT SQUARE BRACKET |
| FF3E | FULLWIDTH CIRCUMFLEX ACCENT |
| FF3F | FULLWIDTH LOW LINE |
| FF40 | FULLWIDTH GRAVE ACCENT |
| FF41 | FULLWIDTH LATIN SMALL LETTER A |
| FF42 | FULLWIDTH LATIN SMALL LETTER B |
| FF43 | FULLWIDTH LATIN SMALL LETTER C |
| FF44 | FULLWIDTH LATIN SMALL LETTER D |
| FF45 | FULLWIDTH LATIN SMALL LETTER E |
| FF46 | FULLWIDTH LATIN SMALL LETTER F |
| FF47 | FULLWIDTH LATIN SMALL LETTER G |
| FF48 | FULLWIDTH LATIN SMALL LETTER H |
| FF49 | FULLWIDTH LATIN SMALL LETTER I |
| FF4A | FULLWIDTH LATIN SMALL LETTER J |
| FF4B | FULLWIDTH LATIN SMALL LETTER K |
| FF4C | FULLWIDTH LATIN SMALL LETTER L |
| FF4D | FULLWIDTH LATIN SMALL LETTER M |
| FF4E | FULLWIDTH LATIN SMALL LETTER N |
| FF4F | FULLWIDTH LATIN SMALL LETTER O |
| FF50 | FULLWIDTH LATIN SMALL LETTER P |
| FF51 | FULLWIDTH LATIN SMALL LETTER Q |
| FF52 | FULLWIDTH LATIN SMALL LETTER R |
| FF53 | FULLWIDTH LATIN SMALL LETTER S |
| FF54 | FULLWIDTH LATIN SMALL LETTER T |
| FF55 | FULLWIDTH LATIN SMALL LETTER U |
| FF56 | FULLWIDTH LATIN SMALL LETTER V |
| FF57 | FULLWIDTH LATIN SMALL LETTER W |
| FF58 | FULLWIDTH LATIN SMALL LETTER X |
| FF59 | FULLWIDTH LATIN SMALL LETTER Y |
| FF5A | FULLWIDTH LATIN SMALL LETTER Z |
| FF5B | FULLWIDTH LEFT CURLY BRACKET |
| FF5C | FULLWIDTH VERTICAL LINE |
| FF5D | FULLWIDTH RIGHT CURLY BRACKET |
| FF5E | FULLWIDTH TILDE |
| FFE0 | FULLWIDTH CENT SIGN |
| FFE1 | FULLWIDTH POUND SIGN |
| FFE2 | FULLWIDTH NOT SIGN |
| FFE3 | FULLWIDTH MACRON * |
| FFE4 | FULLWIDTH BROKEN BAR |
| FFE5 | FULLWIDTH YEN SIGN |

Appendix D: Typical Code Page Definition

Windows 1252 Latin 1 to Unicode translation

| ASCII | Unicode | Character |
|-------|---------|---------------------------|
| 0x00 | 0x0000 | NULL |
| 0x01 | 0x0001 | START OF HEADING |
| 0x02 | 0x0002 | START OF TEXT |
| 0x03 | 0x0003 | END OF TEXT |
| 0x04 | 0x0004 | END OF TRANSMISSION |
| 0x05 | 0x0005 | ENQUIRY |
| 0x06 | 0x0006 | ACKNOWLEDGE |
| 0x07 | 0x0007 | BELL |
| 0x08 | 0x0008 | BACKSPACE |
| 0x09 | 0x0009 | HORIZONTAL TABULATION |
| 0x0A | 0x000A | LINE FEED |
| 0x0B | 0x000B | VERTICAL TABULATION |
| 0x0C | 0x000C | FORM FEED |
| 0x0D | 0x000D | CARRIAGE RETURN |
| 0x0E | 0x000E | SHIFT OUT |
| 0x0F | 0x000F | SHIFT IN |
| 0x10 | 0x0010 | DATA LINK ESCAPE |
| 0x11 | 0x0011 | DEVICE CONTROL ONE |
| 0x12 | 0x0012 | DEVICE CONTROL TWO |
| 0x13 | 0x0013 | DEVICE CONTROL THREE |
| 0x14 | 0x0014 | DEVICE CONTROL FOUR |
| 0x15 | 0x0015 | NEGATIVE ACKNOWLEDGE |
| 0x16 | 0x0016 | SYNCHRONOUS IDLE |
| 0x17 | 0x0017 | END OF TRANSMISSION BLOCK |
| 0x18 | 0x0018 | CANCEL |
| 0x19 | 0x0019 | END OF MEDIUM |
| 0x1A | 0x001A | SUBSTITUTE |
| 0x1B | 0x001B | ESCAPE |
| 0x1C | 0x001C | FILE SEPARATOR |
| 0x1D | 0x001D | GROUP SEPARATOR |
| 0x1E | 0x001E | RECORD SEPARATOR |
| 0x1F | 0x001F | UNIT SEPARATOR |
| 0x20 | 0x0020 | SPACE |
| 0x21 | 0x0021 | EXCLAMATION MARK |
| 0x22 | 0x0022 | QUOTATION MARK |
| 0x23 | 0x0023 | NUMBER SIGN |
| 0x24 | 0x0024 | DOLLAR SIGN |
| 0x25 | 0x0025 | PERCENT SIGN |
| 0x26 | 0x0026 | AMPERSAND |
| 0x27 | 0x0027 | APOSTROPHE |
| 0x28 | 0x0028 | LEFT PARENTHESIS |
| 0x29 | 0x0029 | RIGHT PARENTHESIS |
| 0x2A | 0x002A | ASTERISK |
| 0x2B | 0x002B | PLUS SIGN |
| 0x2C | 0x002C | COMMA |
| 0x2D | 0x002D | HYPHEN-MINUS |
| 0x2E | 0x002E | FULL STOP |
| 0x2F | 0x002F | SOLIDUS |
| 0x30 | 0x0030 | DIGIT ZERO |
| 0x31 | 0x0031 | DIGIT ONE |
| 0x32 | 0x0032 | DIGIT TWO |
| 0x33 | 0x0033 | DIGIT THREE |
| 0x34 | 0x0034 | DIGIT FOUR |
| 0x35 | 0x0035 | DIGIT FIVE |
| 0x36 | 0x0036 | DIGIT SIX |
| 0x37 | 0x0037 | DIGIT SEVEN |
| 0x38 | 0x0038 | DIGIT EIGHT |
| 0x39 | 0x0039 | DIGIT NINE |
| 0x3A | 0x003A | COLON |
| 0x3B | 0x003B | SEMICOLON |
| 0x3C | 0x003C | LESS-THAN SIGN |
| 0x3D | 0x003D | EQUALS SIGN |
| 0x3E | 0x003E | GREATER-THAN SIGN |
| 0x3F | 0x003F | QUESTION MARK |
| 0x40 | 0x0040 | COMMERCIAL AT |
| 0x41 | 0x0041 | LATIN CAPITAL LETTER A |
| 0x42 | 0x0042 | LATIN CAPITAL LETTER B |
| 0x43 | 0x0043 | LATIN CAPITAL LETTER C |

| | | |
|------|--------|-----------------------------------|
| 0x44 | 0x0044 | LATIN CAPITAL LETTER D |
| 0x45 | 0x0045 | LATIN CAPITAL LETTER E |
| 0x46 | 0x0046 | LATIN CAPITAL LETTER F |
| 0x47 | 0x0047 | LATIN CAPITAL LETTER G |
| 0x48 | 0x0048 | LATIN CAPITAL LETTER H |
| 0x49 | 0x0049 | LATIN CAPITAL LETTER I |
| 0x4A | 0x004A | LATIN CAPITAL LETTER J |
| 0x4B | 0x004B | LATIN CAPITAL LETTER K |
| 0x4C | 0x004C | LATIN CAPITAL LETTER L |
| 0x4D | 0x004D | LATIN CAPITAL LETTER M |
| 0x4E | 0x004E | LATIN CAPITAL LETTER N |
| 0x4F | 0x004F | LATIN CAPITAL LETTER O |
| 0x50 | 0x0050 | LATIN CAPITAL LETTER P |
| 0x51 | 0x0051 | LATIN CAPITAL LETTER Q |
| 0x52 | 0x0052 | LATIN CAPITAL LETTER R |
| 0x53 | 0x0053 | LATIN CAPITAL LETTER S |
| 0x54 | 0x0054 | LATIN CAPITAL LETTER T |
| 0x55 | 0x0055 | LATIN CAPITAL LETTER U |
| 0x56 | 0x0056 | LATIN CAPITAL LETTER V |
| 0x57 | 0x0057 | LATIN CAPITAL LETTER W |
| 0x58 | 0x0058 | LATIN CAPITAL LETTER X |
| 0x59 | 0x0059 | LATIN CAPITAL LETTER Y |
| 0x5A | 0x005A | LATIN CAPITAL LETTER Z |
| 0x5B | 0x005B | LEFT SQUARE BRACKET |
| 0x5C | 0x005C | REVERSE SOLIDUS |
| 0x5D | 0x005D | RIGHT SQUARE BRACKET |
| 0x5E | 0x005E | CIRCUMFLEX ACCENT |
| 0x5F | 0x005F | LOW LINE |
| 0x60 | 0x0060 | GRAVE ACCENT |
| 0x61 | 0x0061 | LATIN SMALL LETTER A |
| 0x62 | 0x0062 | LATIN SMALL LETTER B |
| 0x63 | 0x0063 | LATIN SMALL LETTER C |
| 0x64 | 0x0064 | LATIN SMALL LETTER D |
| 0x65 | 0x0065 | LATIN SMALL LETTER E |
| 0x66 | 0x0066 | LATIN SMALL LETTER F |
| 0x67 | 0x0067 | LATIN SMALL LETTER G |
| 0x68 | 0x0068 | LATIN SMALL LETTER H |
| 0x69 | 0x0069 | LATIN SMALL LETTER I |
| 0x6A | 0x006A | LATIN SMALL LETTER J |
| 0x6B | 0x006B | LATIN SMALL LETTER K |
| 0x6C | 0x006C | LATIN SMALL LETTER L |
| 0x6D | 0x006D | LATIN SMALL LETTER M |
| 0x6E | 0x006E | LATIN SMALL LETTER N |
| 0x6F | 0x006F | LATIN SMALL LETTER O |
| 0x70 | 0x0070 | LATIN SMALL LETTER P |
| 0x71 | 0x0071 | LATIN SMALL LETTER Q |
| 0x72 | 0x0072 | LATIN SMALL LETTER R |
| 0x73 | 0x0073 | LATIN SMALL LETTER S |
| 0x74 | 0x0074 | LATIN SMALL LETTER T |
| 0x75 | 0x0075 | LATIN SMALL LETTER U |
| 0x76 | 0x0076 | LATIN SMALL LETTER V |
| 0x77 | 0x0077 | LATIN SMALL LETTER W |
| 0x78 | 0x0078 | LATIN SMALL LETTER X |
| 0x79 | 0x0079 | LATIN SMALL LETTER Y |
| 0x7A | 0x007A | LATIN SMALL LETTER Z |
| 0x7B | 0x007B | LEFT CURLY BRACKET |
| 0x7C | 0x007C | VERTICAL LINE |
| 0x7D | 0x007D | RIGHT CURLY BRACKET |
| 0x7E | 0x007E | TILDE |
| 0x7F | 0x007F | DELETE |
| 0x80 | 0x20AC | EURO SIGN |
| 0x81 | 0x0000 | |
| 0x82 | 0x201A | SINGLE LOW-9 QUOTATION MARK |
| 0x83 | 0x0192 | LATIN SMALL LETTER F WITH HOOK |
| 0x84 | 0x201E | DOUBLE LOW-9 QUOTATION MARK |
| 0x85 | 0x2026 | HORIZONTAL ELLIPSIS |
| 0x86 | 0x2020 | DAGGER |
| 0x87 | 0x2021 | DOUBLE DAGGER |
| 0x88 | 0x02C6 | MODIFIER LETTER CIRCUMFLEX ACCENT |

| | | |
|------|--------|--|
| 0x89 | 0x2030 | PER MILLE SIGN |
| 0x8A | 0x0160 | LATIN CAPITAL LETTER S WITH CARON |
| 0x8B | 0x2039 | SINGLE LEFT-POINTING ANGLE QUOTATION MARK |
| 0x8C | 0x0152 | LATIN CAPITAL LIGATURE OE |
| 0x8D | 0x0000 | |
| 0x8E | 0x017D | LATIN CAPITAL LETTER Z WITH CARON |
| 0x8F | 0x0000 | |
| 0x90 | 0x0000 | |
| 0x91 | 0x2018 | LEFT SINGLE QUOTATION MARK |
| 0x92 | 0x2019 | RIGHT SINGLE QUOTATION MARK |
| 0x93 | 0x201C | LEFT DOUBLE QUOTATION MARK |
| 0x94 | 0x201D | RIGHT DOUBLE QUOTATION MARK |
| 0x95 | 0x2022 | BULLET |
| 0x96 | 0x2013 | EN DASH |
| 0x97 | 0x2014 | EM DASH |
| 0x98 | 0x02DC | SMALL TILDE |
| 0x99 | 0x2122 | TRADE MARK SIGN |
| 0x9A | 0x0161 | LATIN SMALL LETTER S WITH CARON |
| 0x9B | 0x203A | SINGLE RIGHT-POINTING ANGLE QUOTATION MARK |
| 0x9C | 0x0153 | LATIN SMALL LIGATURE OE |
| 0x9D | 0x0000 | |
| 0x9E | 0x017E | LATIN SMALL LETTER Z WITH CARON |
| 0x9F | 0x0178 | LATIN CAPITAL LETTER Y WITH DIAERESIS |
| 0xA0 | 0x00A0 | NO-BREAK SPACE |
| 0xA1 | 0x00A1 | INVERTED EXCLAMATION MARK |
| 0xA2 | 0x00A2 | CENT SIGN |
| 0xA3 | 0x00A3 | POUND SIGN |
| 0xA4 | 0x00A4 | CURRENCY SIGN |
| 0xA5 | 0x00A5 | YEN SIGN |
| 0xA6 | 0x00A6 | BROKEN BAR |
| 0xA7 | 0x00A7 | SECTION SIGN |
| 0xA8 | 0x00A8 | DIAERESIS |
| 0xA9 | 0x00A9 | COPYRIGHT SIGN |
| 0xAA | 0x00AA | FEMININE ORDINAL INDICATOR |
| 0xAB | 0x00AB | LEFT-POINTING DOUBLE ANGLE QUOTATION MARK |
| 0xAC | 0x00AC | NOT SIGN |
| 0xAD | 0x00AD | SOFT HYPHEN |
| 0xAE | 0x00AE | REGISTERED SIGN |
| 0xAF | 0x00AF | MACRON |
| 0xB0 | 0x00B0 | DEGREE SIGN |
| 0xB1 | 0x00B1 | PLUS-MINUS SIGN |
| 0xB2 | 0x00B2 | SUPERSCRIFT TWO |
| 0xB3 | 0x00B3 | SUPERSCRIFT THREE |
| 0xB4 | 0x00B4 | ACUTE ACCENT |
| 0xB5 | 0x00B5 | MICRO SIGN |
| 0xB6 | 0x00B6 | PILCROW SIGN |
| 0xB7 | 0x00B7 | MIDDLE DOT |
| 0xB8 | 0x00B8 | CEDILLA |
| 0xB9 | 0x00B9 | SUPERSCRIFT ONE |
| 0xBA | 0x00BA | MASCULINE ORDINAL INDICATOR |
| 0xBB | 0x00BB | RIGHT-POINTING DOUBLE ANGLE QUOTATION MARK |
| 0xBC | 0x00BC | VULGAR FRACTION ONE QUARTER |
| 0xBD | 0x00BD | VULGAR FRACTION ONE HALF |
| 0xBE | 0x00BE | VULGAR FRACTION THREE QUARTERS |
| 0xBF | 0x00BF | INVERTED QUESTION MARK |
| 0xC0 | 0x00C0 | LATIN CAPITAL LETTER A WITH GRAVE |
| 0xC1 | 0x00C1 | LATIN CAPITAL LETTER A WITH ACUTE |
| 0xC2 | 0x00C2 | LATIN CAPITAL LETTER A WITH CIRCUMFLEX |
| 0xC3 | 0x00C3 | LATIN CAPITAL LETTER A WITH TILDE |
| 0xC4 | 0x00C4 | LATIN CAPITAL LETTER A WITH DIAERESIS |
| 0xC5 | 0x00C5 | LATIN CAPITAL LETTER A WITH RING ABOVE |
| 0xC6 | 0x00C6 | LATIN CAPITAL LETTER AE |
| 0xC7 | 0x00C7 | LATIN CAPITAL LETTER C WITH CEDILLA |
| 0xC8 | 0x00C8 | LATIN CAPITAL LETTER E WITH GRAVE |
| 0xC9 | 0x00C9 | LATIN CAPITAL LETTER E WITH ACUTE |
| 0xCA | 0x00CA | LATIN CAPITAL LETTER E WITH CIRCUMFLEX |
| 0xCB | 0x00CB | LATIN CAPITAL LETTER E WITH DIAERESIS |

| | | |
|------|--------|--|
| 0xCC | 0x00CC | LATIN CAPITAL LETTER I WITH GRAVE |
| 0xCD | 0x00CD | LATIN CAPITAL LETTER I WITH ACUTE |
| 0xCE | 0x00CE | LATIN CAPITAL LETTER I WITH CIRCUMFLEX |
| 0xCF | 0x00CF | LATIN CAPITAL LETTER I WITH DIAERESIS |
| 0xD0 | 0x00D0 | LATIN CAPITAL LETTER ETH |
| 0xD1 | 0x00D1 | LATIN CAPITAL LETTER N WITH TILDE |
| 0xD2 | 0x00D2 | LATIN CAPITAL LETTER O WITH GRAVE |
| 0xD3 | 0x00D3 | LATIN CAPITAL LETTER O WITH ACUTE |
| 0xD4 | 0x00D4 | LATIN CAPITAL LETTER O WITH CIRCUMFLEX |
| 0xD5 | 0x00D5 | LATIN CAPITAL LETTER O WITH TILDE |
| 0xD6 | 0x00D6 | LATIN CAPITAL LETTER O WITH DIAERESIS |
| 0xD7 | 0x00D7 | MULTIPLICATION SIGN |
| 0xD8 | 0x00D8 | LATIN CAPITAL LETTER O WITH STROKE |
| 0xD9 | 0x00D9 | LATIN CAPITAL LETTER U WITH GRAVE |
| 0xDA | 0x00DA | LATIN CAPITAL LETTER U WITH ACUTE |
| 0xDB | 0x00DB | LATIN CAPITAL LETTER U WITH CIRCUMFLEX |
| 0xDC | 0x00DC | LATIN CAPITAL LETTER U WITH DIAERESIS |
| 0xDD | 0x00DD | LATIN CAPITAL LETTER Y WITH ACUTE |
| 0xDE | 0x00DE | LATIN CAPITAL LETTER THORN |
| 0xDF | 0x00DF | LATIN SMALL LETTER SHARP S |
| 0xE0 | 0x00E0 | LATIN SMALL LETTER A WITH GRAVE |
| 0xE1 | 0x00E1 | LATIN SMALL LETTER A WITH ACUTE |
| 0xE2 | 0x00E2 | LATIN SMALL LETTER A WITH CIRCUMFLEX |
| 0xE3 | 0x00E3 | LATIN SMALL LETTER A WITH TILDE |
| 0xE4 | 0x00E4 | LATIN SMALL LETTER A WITH DIAERESIS |
| 0xE5 | 0x00E5 | LATIN SMALL LETTER A WITH RING ABOVE |
| 0xE6 | 0x00E6 | LATIN SMALL LETTER AE |
| 0xE7 | 0x00E7 | LATIN SMALL LETTER C WITH CEDILLA |
| 0xE8 | 0x00E8 | LATIN SMALL LETTER E WITH GRAVE |
| 0xE9 | 0x00E9 | LATIN SMALL LETTER E WITH ACUTE |
| 0xEA | 0x00EA | LATIN SMALL LETTER E WITH CIRCUMFLEX |
| 0xEB | 0x00EB | LATIN SMALL LETTER E WITH DIAERESIS |
| 0xEC | 0x00EC | LATIN SMALL LETTER I WITH GRAVE |
| 0xED | 0x00ED | LATIN SMALL LETTER I WITH ACUTE |
| 0xEE | 0x00EE | LATIN SMALL LETTER I WITH CIRCUMFLEX |
| 0xEF | 0x00EF | LATIN SMALL LETTER I WITH DIAERESIS |
| 0xF0 | 0x00F0 | LATIN SMALL LETTER ETH |
| 0xF1 | 0x00F1 | LATIN SMALL LETTER N WITH TILDE |
| 0xF2 | 0x00F2 | LATIN SMALL LETTER O WITH GRAVE |
| 0xF3 | 0x00F3 | LATIN SMALL LETTER O WITH ACUTE |
| 0xF4 | 0x00F4 | LATIN SMALL LETTER O WITH CIRCUMFLEX |
| 0xF5 | 0x00F5 | LATIN SMALL LETTER O WITH TILDE |
| 0xF6 | 0x00F6 | LATIN SMALL LETTER O WITH DIAERESIS |
| 0xF7 | 0x00F7 | DIVISION SIGN |
| 0xF8 | 0x00F8 | LATIN SMALL LETTER O WITH STROKE |
| 0xF9 | 0x00F9 | LATIN SMALL LETTER U WITH GRAVE |
| 0xFA | 0x00FA | LATIN SMALL LETTER U WITH ACUTE |
| 0xFB | 0x00FB | LATIN SMALL LETTER U WITH CIRCUMFLEX |
| 0xFC | 0x00FC | LATIN SMALL LETTER U WITH DIAERESIS |
| 0xFD | 0x00FD | LATIN SMALL LETTER Y WITH ACUTE |
| 0xFE | 0x00FE | LATIN SMALL LETTER THORN |
| 0xFF | 0x00FF | LATIN SMALL LETTER Y WITH DIAERESIS |

Appendix E: Internal Code Pages

| Code Page | Country Code/Language Set | Decimal <n _h > <n _i > | Hex <n _h > <n _i > |
|-----------|-----------------------------|---|---|
| 64 | USA (Slashed 0) | 0,64 | 0H,040H |
| 65 | USA (Unslashed 0) | 0,65 | 0H,041H |
| 66 | British | 0,66 | 0H,042H |
| 67 | German | 0,67 | 0H,043H |
| 68 | French | 0,68 | 0H,044H |
| 69 | Swedish I | 0,69 | 0H,045H |
| 70 | Danish | 0,70 | 0H,046H |
| 71 | Norwegian | 0,71 | 0H,047H |
| 72 | Dutch | 0,72 | 0H,048H |
| 73 | Italian | 0,73 | 0H,049H |
| 74 | French Canadian | 0,74 | 0H,04AH |
| 75 | Spanish | 0,75 | 0H,04BH |
| 76 | Swedish II | 0,76 | 0H,04CH |
| 77 | Swedish III | 0,77 | 0H,04DH |
| 78 | Swedish IV | 0,78 | 0H,04EH |
| 79 | Turkish | 0,79 | 0H,04FH |
| 80 | Swiss I | 0,80 | 0H,050H |
| 81 | Swiss II | 0,81 | 0H,051H |
| 437 | USA | 1,181 | 1H,0B5H |
| 737 | Greek | 2,225 | 2H,0E1H |
| 850 | Multilingual | 3,82 | 3H,052H |
| 852 | East Europe Latin II-852 | 3,84 | 3H,054H |
| 855 | Cyrillic I-855 | 3,87 | 3H,057H |
| 857 | Turkey 857 | 3,89 | 3H,059H |
| 858 | Multilingual Euro | 3,90 | 3H,05AH |
| 866 | Cyrillic II-866 | 3,98 | 3H,062H |
| 1004 | ISO8859 | 3,236 | 3H,0ECH |
| 1250 | Windows 1250 Central Europe | 4,226 | 4H,0E2H |
| 1251 | Windows 1251 Cyrillic | 4,227 | 4H,0E3H |
| 1252 | Windows 1252 Latin 1 | 4,228 | 4H,0E4H |
| 1253 | Windows 1253 Greek | 4,229 | 4H,0E5H |
| 1254 | Windows 1254 Turkish | 4,230 | 4H,0E6H |
| 1257 | Windows 1257 Baltic | 4,233 | 4H,0E9H |
| 28591 | ISO8859-1 Latin 1 | 111,175 | 6FH,AFH |
| 28592 | ISO8859-2 Latin 2 | 111,176 | 6FH,B0H |
| 28593 | ISO8859-3 Latin 3 | 111,177 | 6FH,B1H |
| 28594 | ISO8859-4 Baltic 4 | 111,178 | 6FH,B2H |
| 28595 | ISO8859-5 Cyrillic | 111,179 | 6FH,B3H |
| 28597 | ISO8859-7 Greek | 111,181 | 6FH,B5H |
| 28599 | ISO8859-9 Turkish | 111,183 | 6FH,B7H |
| 28605 | ISO8859-15 Latin 9 | 111,189 | 6FH,BDH |

Note: The [ESC]! Select international character set command uses Code Pages 64-81 and represent old DOS code page maps. They are provided to support of legacy applications.

They are not recommended for new applications.

Appendix F: ASCII Code Table

| Hex | Decimal | ASCII | Hex | Decimal | ASCII | Hex | Decimal | ASCII | Hex | Decimal | ASCII |
|-----|---------|-------|-----|---------|-------|-----|---------|-------|-----|---------|-------|
| 00 | 0 | NULL | 20 | 32 | (SP) | 40 | 64 | @ | 60 | 96 | ` |
| 01 | 1 | SOH | 21 | 33 | ! | 41 | 65 | A | 61 | 97 | a |
| 02 | 2 | STX | 22 | 34 | " | 42 | 66 | B | 62 | 98 | b |
| 03 | 3 | ETX | 23 | 35 | # | 43 | 67 | C | 63 | 99 | c |
| 04 | 4 | EOT | 24 | 36 | \$ | 44 | 68 | D | 64 | 100 | d |
| 05 | 5 | ENQ | 25 | 37 | % | 45 | 69 | E | 65 | 101 | e |
| 06 | 6 | ACK | 26 | 38 | & | 46 | 70 | F | 66 | 102 | f |
| 07 | 7 | BEL | 27 | 39 | ' | 47 | 71 | G | 67 | 103 | g |
| 08 | 8 | BS | 28 | 40 | (| 48 | 72 | H | 68 | 104 | h |
| 09 | 9 | HT | 29 | 41 |) | 49 | 73 | I | 69 | 105 | i |
| 0A | 10 | LF | 2A | 42 | * | 4A | 74 | J | 6A | 106 | j |
| 0B | 11 | VT | 2B | 43 | + | 4B | 75 | K | 6B | 107 | k |
| 0C | 12 | FF | 2C | 44 | , | 4C | 76 | L | 6C | 108 | l |
| 0D | 13 | CR | 2D | 45 | - | 4D | 77 | M | 6D | 109 | m |
| 0E | 14 | SO | 2E | 46 | . | 4E | 78 | N | 6E | 110 | n |
| 0F | 15 | SI | 2F | 47 | / | 4F | 79 | O | 6F | 111 | o |
| 10 | 16 | DLE | 30 | 48 | 0 | 50 | 80 | P | 70 | 112 | p |
| 11 | 17 | DC1 | 31 | 49 | 1 | 51 | 81 | Q | 71 | 113 | q |
| 12 | 18 | DC2 | 32 | 50 | 2 | 52 | 82 | R | 72 | 114 | r |
| 13 | 19 | DC3 | 33 | 51 | 3 | 53 | 83 | S | 73 | 115 | s |
| 14 | 20 | DC4 | 34 | 52 | 4 | 54 | 84 | T | 74 | 116 | t |
| 15 | 21 | NAK | 35 | 53 | 5 | 55 | 85 | U | 75 | 117 | u |
| 16 | 22 | SYN | 36 | 54 | 6 | 56 | 86 | V | 76 | 118 | v |
| 17 | 23 | ETB | 37 | 55 | 7 | 57 | 87 | W | 77 | 119 | w |
| 18 | 24 | CAN | 38 | 56 | 8 | 58 | 88 | X | 78 | 120 | x |
| 19 | 25 | EM | 39 | 57 | 9 | 59 | 89 | Y | 79 | 121 | y |
| 1A | 26 | SUB | 3A | 58 | : | 5A | 90 | Z | 7A | 122 | z |
| 1B | 27 | ESC | 3B | 59 | ; | 5B | 91 | [| 7B | 123 | { |
| 1C | 28 | FS | 3C | 60 | < | 5C | 92 | \ | 7C | 124 | |
| 1D | 29 | GS | 3D | 61 | = | 5D | 93 |] | 7D | 125 | } |
| 1E | 30 | RS | 3E | 62 | > | 5E | 94 | ^ | 7E | 126 | ~ |
| 1F | 31 | US | 3F | 63 | ? | 5F | 95 | _ | 7F | 127 | (sp) |

Appendix G: Ordering Supplies

TransAct® supplies, cables and drivers can be ordered easily direct from the TransAct website (www.transact-tech.com) or our telephone number within the US toll free: (877) 7TransAct. (other inquires: (607) 257-8901). When calling by phone, please ask for the Sales Department.

Index

[

- [BEL] Audio alert, 155
- [BS] Insert back space, 77
- [CAN] Clear print buffer, 154
- [CR] Set carriage return, 76
- [DC2] Begin 10 cpi, 90
- [DC4] End one-line double-wide print, 100
- [ENQ] <10> Request printer reset, 164
- [ENQ] <11> Request printer power cycle status, 165
- [ENQ] <14> Inquire mechanical error status, 165
- [ENQ] <15> Inquire printer state, 166
- [ENQ] <20> Inquire all printer status, 166
- [ENQ] <21> Inquire printer ID, 168
- [ENQ] <22> Inquire Error Status, 169
- [ENQ] <23> Inquire user-store status, 172, 173
- [ENQ] <23> Inquire user-store status, 170, 171, 172
- [ENQ] <23> Inquire user-store status, 174
- [ENQ] <23> Inquire user-store status, 235
- [ENQ] <23> Inquire user-store status, 236
- [ENQ] <3> Inquire receipt paper low status, 163
- [ENQ] <4> Inquire receipt paper out status, 164
- [ENQ] <8> Inquire cover open status, 164
- [ENQ] <9> Inquire buffer status, 164
- [ENQ] <n> Inquire printer status, 163
- [ESC] - <1> Begin underline, 101, 103
- [ESC] ! <n> Select international character set, 81, 88, 89, 97, 98, 152, 153, 189, 206, 207, 208, 209, 213, 214, 215, 216, 221, 222, 223, 224, 225, 226
- [ESC] # <0> Begin 12 x 12 draft print, 93
- [ESC] % G Begin italics, 105
- [ESC] % H End italics, 105
- [ESC] * <m> <0> <0> Set horizontal graphics mode, 119, 121
- [ESC] * <m> <n₁> <n₂> Print graphics in mode <m>, 116
- [ESC] ? <m> <n> Reassign graphic mode, 116
- [ESC] @ Initialize the printer, 155
- [ESC] [@ ... Double-wide, double-high italics, 102
- [ESC] [C <n> Insert Euro character, 98
- [ESC] [P <n> Set character pitch, 91, 216
- [ESC] [T <n_h> <n_i> Select character code page, 97
- [ESC] [EM] B <n> Set bar code height, 139, 140
- [ESC] [EM] J <n> Set bar code justification and HRI modes, 140
- [ESC] [SI] Begin 24 cpi, 90
- [ESC] [US] 1 <Name..> <0> Load item process, 124
- [ESC] [US] b <Name..> <0> Begin named macro record, 123, 125, 177, 178
- [ESC] [US] d <Name..> <0> Delete item from user store, 127
- [ESC] [US] e <Name..> <0> End name macro record, 125
- [ESC] [US] e <Name..> <0> Remove item from user store, 124
- [ESC] [US] e <Name..> <0> Stop name macro record, 123
- [ESC] [US] f ALL <0> Flush user store, 124
- [ESC] [US] l <Name> <0> Load macro/character, 126
- [ESC] [US] m <Name..> <0> Save macro data, 125
- [ESC] [US] m <Name..> Save macro data, 123
- [ESC] [US] q <Name..> <0> Query user store, 127
- [ESC] [US] r <Name> <0> Run macro data, 126
- [ESC] [US] s <Name..> <0> Flag as a start-up macro, 124
- [ESC] [US] s <Name..> <0> Flag start-up macro, 126
- [ESC] ^ <n> Print control character, 99
- [ESC] { Electronic Journal Begin, 150
- [ESC] <n> <n₁> <n₂> Set horizontal position, 78
- [ESC] 0 Set line spacing to 27/216 inch, 79
- [ESC] 1 Set line spacing to 7/72 inch, 80
- [ESC] 2 Enable variable line spacing, 80
- [ESC] 3 <n> Set line spacing to n/216 inch, 79
- [ESC] 4 Set top of form, 84
- [ESC] 5 <01> Begin auto line feed, 85
- [ESC] a <n> Set justification, 78
- [ESC] A <n> Set variable line spacing to n/72 inch, 80
- [ESC] b <n> ... Print bar code, 131, 138, 176
- [ESC] B <n₁> <n₂> ... <n_i> 0 Set vertical tab stops, 83
- [ESC] Begin 12 cpi, 90
- [ESC] C [NUL] <n> Set form length in inches, 84
- [ESC] c <n> Select color, 100
- [ESC] C <n> Set form length in lines, 84
- [ESC] d <n> Feed <n> lines at current spacing, 82
- [ESC] D <n₁> <n₂> <n₃> ... <n_i> 0 Set horizontal tab stops, 77
- [ESC] E Begin emphasized print, 104
- [ESC] F End emphasized print, 104
- [ESC] f Select receipt station, 107, 109, 111, 112, 113, 114
- [ESC] g <0> Process user macro, 129
- [ESC] g <1> Start macro record, 129
- [ESC] g <2> Stop macro record, 129
- [ESC] g <3> Stop macro record and save, 129
- [ESC] G Begin enhanced print, 103
- [ESC] h <color> <length> <format> <data> Process color graphics, 118
- [ESC] h <color> <length> <format> <data> Process horizontal graphics, 118
- [ESC] H End enhanced print, 103
- [ESC] I <n> Set print quality mode, 93
- [ESC] J <n> Fine line feed, 79
- [ESC] J <n> Fine linefeed, 142, 143, 144, 145
- [ESC] K <n₁> <n₂> Print single-density graphics, 115
- [ESC] L <n₁> <n₂> Print half-speed double-density graphics, 115
- [ESC] l Electronic Journal Carbon Copy, 151
- [ESC] p 3 <n> Select paper sensor(s) to output paper-end signals, 156
- [ESC] p 4 <n> Select paper sensor(s) to stop printing, 156
- [ESC] q <n> Query marker, 155, 157
- [ESC] R Reset horizontal and vertical tab stops, 78, 83
- [ESC] S <0> Select superscript, 104
- [ESC] S <1> Select subscript, 104
- [ESC] T End superscript or subscript, 105

[ESC] U <0> Begin bi-directional print, 117
 [ESC] U <1> Begin unidirectional print, 117
 [ESC] V <n> Set intercharacter spacing, 92
 [ESC] W <n> Double-wide, double-high mode, 101, 208
 [ESC] X <n₁> <n₂> Set left/right print margin, 154
 [ESC] y <n> Set feature control, 158
 [ESC] Y <n₁> <n₂> Print full-speed double-density graphics, 116
 [ESC] Z <n₁> <n₂> Print quad-density graphics, 116
 [FF] Set form feed, 83, 86
 [HT] Set horizontal tab, 77
 [LF] Set line feed, 76
 [SI] Begin 17 cpi, 90
 [SO] Begin one-line double-wide print, 100
 [VT] Set vertical tab, 82

1

10 CPI Character Pitch, Beginning, 90
 12 CPI Character Pitch, Beginning, 90
 12 x 12 Draft Print Mode, Beginning, 93
 17 CPI Character Pitch, Beginning, 90

2

24 CPI Character Pitch, Beginning, 90

A

APA Graphics, Printing, 116
 Appendix A
 Ordering Supplies, 266
 Application Development, 68
 Assembly, 65
 Auto cut, Performing, 155
 Auto Error Recovery, 32
 Auto Line Feed, Beginning, 85

B

Back Space, 77
 Bar Code, Print, 131, 138, 176
 Bar Code, Set height, 139, 140
 Bar Code, Set Justification, Print Direction, 140
 Bar Codes, 131
 Begin Italics, 105
 Bezel
 Mounting Points, 46
 Bi-directional Printing, Beginning, 117
 Boot Loader Mode, 30

C

Carriage Return, 76
 Change User Store Terminator, 128
 Character attributes, 100
 Character Code Page, Setting, 97
 Character Pitch, Setting, 91, 216

Code Page Definitions, 263
 Commands, User-store, 125, 178
Communication
 Features, 233
 Communications Interface, 19
Configuration
 Remote, 40
 Configuration Control, Extending, 159, 161, 234
 Configuration Mode
 Overview, 39
 Contact Information, 7
 Control Character, Printing, 99
Control Codes
 Overview, 67
Control Codes and Commands, 68
 Control Feature, Setting, 158
 Cover Open Status, Inquire, 164

D

Disassembly, 65
 Double Density Graphics, Full-Speed Printing, 116
 Double Density Graphics, Half-Speed Printing, 115

E

Emphasized Print Mode, Beginning, 104
 Emphasized Print Mode, Ending, 104
 End Italics, 105
 Enhanced Print Mode, Ending, 103
 Enhanced print, Beginning, 103
 Entering Configuration Mode, 39
 EPOS Emulation, 68
 Error Status, Inquire, 169
 Euro Character, Inserting, 98
 Extended APA Graphics, 116

F

Form Feed, 83, 86
 Form Length, Setting Inches, 84
 Form Length, Setting Lines, 84
 Forming characters, 193

G

Graphic
 Mode, 115
 Graphic Data, Processing, 118
 Graphic Mode, Reassigning, 116
 Graphic mode, Set Horizontal, 119, 121
 Graphic save, 122
 Graphics
 all-points-addressable (APA), 182
 Character, 181
 color, 118
 horizontal, 118
 Horizontal, 182

printing, 181

H

Horizontal Motion Control, 77

Horizontal Position, Setting, 78

Horizontal Tab, 77

Horizontal tab Stops, Setting, 77

I

IEEE 1284 buffer, Clearing, 164

Indicator Lights, 25

Initialize the Printer, 155

Inquire Commands, 163

Intercharacter Spacing, Setting, 92

International Character Set, Selecting, 81, 88, 89, 97, 98,
152, 153, 189, 206, 207, 208, 209, 213, 214, 215, 216,
221, 222, 223, 224, 225, 226

IPCL Codes, 68

J

Justification, Setting, 78

L

Level 0 diagnostics, 30

Line feed, 76

Line Feed, Performing, 79

Line Spacing, Enabling, 80

Line Spacing, Feeding Lines, 82

Line Spacing, Set at 2 ½, 16-inch and 7/72 inch, 80

Line Spacing, Set-1/8 inch, 79

Line Spacing, Set-n/216 inch, 79

Line Spacing-Variable, Setting, 80

M

Machanical Error Status, Inquire, 165

Macro Data, Run from user Store, 126

Macro Data, Saving, 123

Macro Data, Saving in user Store, 125

Macro Record, Beginning, 123

Macro Record, Ending, 125

Macro Record, Ending name, 123

Macro Record, Start, 129

Macro Record, Starting, 125, 177, 178

Macro Record, Stop, 129

Macro Record, Stop and Save, 129

Macro, Flag on Startup, 126

Multiline Mode, 101, 208

O

Off-line active, 233

One Line/Double Wide Print, Beginning, 100

One Line/Double Wide Print, Canceling, 100

Operational Procedures, 25

Output Paper end Signals, Selecting Paper Sensors, 156

Overview, 3

P

Paper Motion, 76

Paper Out Status, Inquire, 164

Paper Sensors, Selecting to Stop Printing, 156

PcOS Control Codes, 68

PcOS Quick Reference Chart, 70

Power Control, Remote, 160

Power Cycle Status, Inquire, 165

Power-cycle recovery, 233

Print buffer, control, 154

Print Current Configuration, 231

Print Current totals, 231

Print margins, setting, 154

Print Quality Mode, Setting, 93

Print Style, Setting, 102

Printer

 Paper Roll Specifications, 18

 Printing Specifications, 18

Printer Block Diagram, 63

Printer Care, 25

Printer ID, Inquire, 168

Printer Reset, Requesting, 164

Printer Sensors, 55

Printer State, Inquire, 166

Printer Status, 162

Printer Status LED, 31

Printer Status, Inquire, 163, 166

Process User Macro, 129

Programmer's Notes, 241

Programming Considerations, 122

Q

Quad Density Graphics, Printing, 116

Query marker, 155, 157

R

Read and return Totals, 229

Recovery from Mechanical Errors, 237

Regulatory Compliance, iii

Remote Power Control, 160

Remote Reset, 232

Return Materials Authorization, 6

S

Select Color, 100

Select Subscript, 104

Select Superscript, 104

Self-Test

 Using, 28

Sensors

- Anti-Jam, 56
- Paper Low, 55
- Ticket Low, 55
- Ticket Taken, 56, 57
- Top of Form, 55
- Top-of-Form, 55
- Serial Communications PCB, 19, 61
- Single Density Graphics, Printing, 115
- Specifications, 18
 - Paper Roll, 18
 - Power Requirements, 15
 - Printing, 18
 - Radiated Emissions, 17
 - Reliability, 14
- Specifications and Requirements, 11
- Standard APA Graphics, 115
- Standard Emulation, 68
- Start up Macro, Flagging, 124
- Status Inquire, 162
- Status, Inquire Receipt Paper Low, 163
- Superscript and Subscript, 105

T

- Tab Stops, Resetting, 78, 83

- Technical Support, 5
- Testing the Printer, 29
- Top of Form, Setting, 84

U

- Underline, Beginning, 101, 103
- Unidirectional Printing, Beginning, 117
- User macros, 129
- User store, 122
- User Store Status, Inquire, 170, 171, 172, 173, 174, 235, 236
- User Store, Delete item, 127
- User Store, Flush Information, 124
- User Store, Load item, 126
- User Store, Loading item, 124
- User Store, Removing Item, 124
- User Store, Report, 127
- User Store, Reporting, 124

V

- Vertical Tab, 82
- Vertical Tab Stops, Setting, 83