Epic 880™

OEM Integration Manual

TRANSACT
Technologies Incorporated

P/N 100-88002
Rev H, Aug 2020

Change History

Rev A	Initial Release	Jan 2009
Rev B	Style and formatting update	Feb 2009
	Added USB Watch dog	
	Added several internal code pages.	
Rev C		May 2009
	Added full 128 character support to Code 93 barcodes	
Rev D	Added frame grounding requirements.	Aug 2009
Rev E	Added additional File status commands	Nov 2011
Rev F	Major Update and added enhanced features	June 2012
	Added ticket clearance requirement.	
	Corrected paper thickness specification; 0.56 MM was 0.76 MM,	
	Added large core spindle sleeve picture and revised paper roll core specifications.	
	Updated pictures to show the recessed connector version of the printer	
	Added paper low and universal spindle adjustment procedures	
	Added Enhanced Barcodes	
	Added Enhanced bitmap file printing	
	Added Enhanced Page Mode	
	Added Enhanced Maintenance mode	
	The ability to store multiple field configurations in the printer has been removed. (You can now use Maintenance mode to deal with field configuration.)	
	Documented the rotated character command.	
	Added English to metric conversions in several places.	
Rev G	Addition of Feed and Config button printer reset.	May 2019
	Various improvements to the manual.	
Rev H	Various improvements to the manual.	August 2020

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

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Chapter 1

Epic 880™ Printer

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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 76.2 to 254 mm. (3.0 -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 & Eastern Region Repair Center
20 Bomax Drive
Ithaca, NY 14850 USA

TransAct Technologies Incorporated
World Gaming Headquarters
& Western Region 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

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Epic 880™ Specifications and Requirements

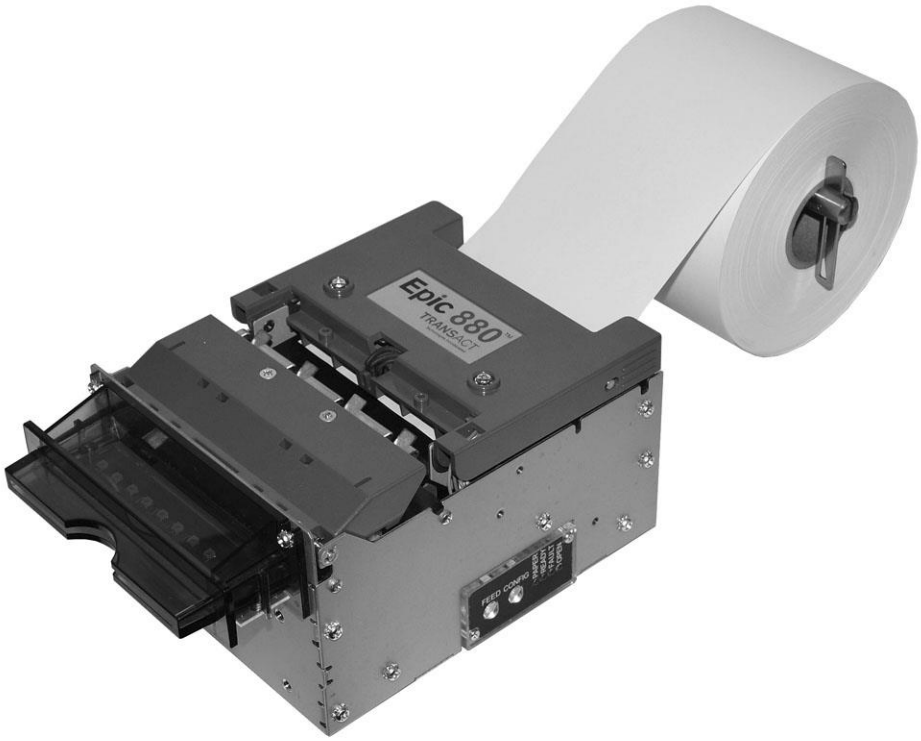


Figure 1. Epic 880™ Printer.

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 76.2 to 254 mm. (3.0 -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[1]
- Serial RS232C and USB interfaces built into main controller PCB
- Selectable baud rates
- Drivers for Windows.

[1] Additional Enhanced barcode support with enhanced firmware.

- 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- ref pg.36, 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, 80.0mm & 82.5mm. wide paper roll
- Compliant with RoHS (Restriction on Hazardous Substances)
- Bezel assembly with LEDs (translucent blue)
- Universal paper spindle (80.0mm & 82.5mm. wide paper roll) ref pg. 36

Optional Features

The following options are available:

- 80mm paper guide
- Lower paper guide below spindle mount; ref page 34
- Additional or custom fonts or character sets.
- Custom emulations (Epson, Custom)
- Universal power supply (100-240 VAC, 47-63 Hz)
- Large core spindle sleeve for use with paper core ID 1.0”-1.25”

Enhanced Firmware

Performance Enhancements

The Enhanced version of the Epic 880 runs the operating firmware from RAM. The RAM is about twice as fast as the flash and as a result the printer will process data about twice as fast as the previous product. This does not allow the printer to actually print any faster; it just starts printing after receiving data faster. To make sure the RAM does not get corrupted, a back ground task continuously compares the RAM data with the flash load image and if they differ, the RAM is repaired.

Firmware Versions that start with PE885X_YYY_ZZZ support additional enhanced features.

Enhanced Barcodes

The Epic 880 printer is available with enhanced barcode generators. This enhanced barcode generator supports GS1 as well as additional 2D barcodes.

Barcodes supported are as follows:

EAN 8
EAN 13
EAN 14
GS1-128 (EAN128)
Codabar
Code 2 of 5
Code-39
Code-39 Extended
Code-93
Code-128(A, B, and C)
UPC A
UPC E
PDF417
MicroPDF417
QR Code
Datamatrix
GS1-Databar-14
GS1-Databar-Truncated
GS1-Databar-Limited
GS1-Databar-Expanded
GS1-Databar-14 Stacked
GS1-Databar-14 Stacked-Omni
GS1-Databar-Expanded Stacked
Aztec
EANX Composite
EAN128 Composite
GS1-Databar-14 Composite
GS1-Databar-Truncated Composite
GS1-Databar-Limited Composite
GS1-Databar-Expanded Composite
UPC A Composite
UPC E Composite
GS1-Databar-14 Stacked Composite
GS1-Databar-14 Omni Composite
GS1-Databar-Expanded Stacked Composite
EAN 2 and EAN 5 Add on barcodes.

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. The enhanced version of firmware has enhanced processing of the top of form mark and allows a wider array of ticket options.

Ticket length and Transport loop Enhancements

The Epic 880 printer has a built in transport. It is capable of buffering a ticket and then presenting it to the user after the ticket is complete and cut. The maximum length of ticket that can be kept or buffered in the printer and not accessible to the user, depends on the length of the bezel. If no bezel is used, a 7inch (178mm) ticket can be kept or buffered in the printer and not allow it to be accessed by the user until it is cut and delivered. With a typical 2 inch (50mm) bezel, about 1.5 inches (38mm) of the ticket can be kept in the bezel. The added space in the bezel allows the printer to buffer an 8.5 inch (216mm) ticket

When a ticket is buffered in the printer, it protrudes above the printer. In some cases, this may interfere with other parts of the system. If this happens, the maximum ticket length may be reduced.

With some tickets it is not desirable to have any transport loop. If the maximum ticket loop is set to zero, the printer will disable the ticket buffering and the transport will be synchronized with the print.

Minimum Ticket length

It is required that the tickets have a minimum size. There are two factors that affect the minimum size. One is the distance between the cutter and the transport drive sensor and the other is the length of the bezel. The smallest ticket that can be printed based on the cutter to transport drive sensor is 3.0 inches (76.2mm). The smallest ticket that can be presented by the transport drive is dependent on the bezel. To allow various bezels to be used the minimum ticket may be set to be from 3.0 to 5 inches (76.2mm – 127mm). The printer will assure that no ticket is printed and cut that is smaller than that length.

Ticket Retract Feature

The Epic 880 has the ability to retract a ticket and place it into a bin below the printer. This feature may be activated by command or disabled. With the enhanced firmware this feature may be completely disabled. This allows the printer to be mounted with the retract exit completely covered.

Enhanced bitmap file processing

The Epic 880 printer now supports direct printing of Monochrome, 4 bit-16 color, 8 bit-256 color and 24 bit True color bitmap files. The image may be directly printed or saved temporarily and scaled at 1 to 1 or 2 to 1. Only Printing in Monochrome is supported however full color bitmaps may be sent to the printer.

Additional Maintenance mode commands

The maintenance mode, present in the previous versions on the Epic 880, has been enhanced. See the Maintenance mode section of this manual.

General Specifications

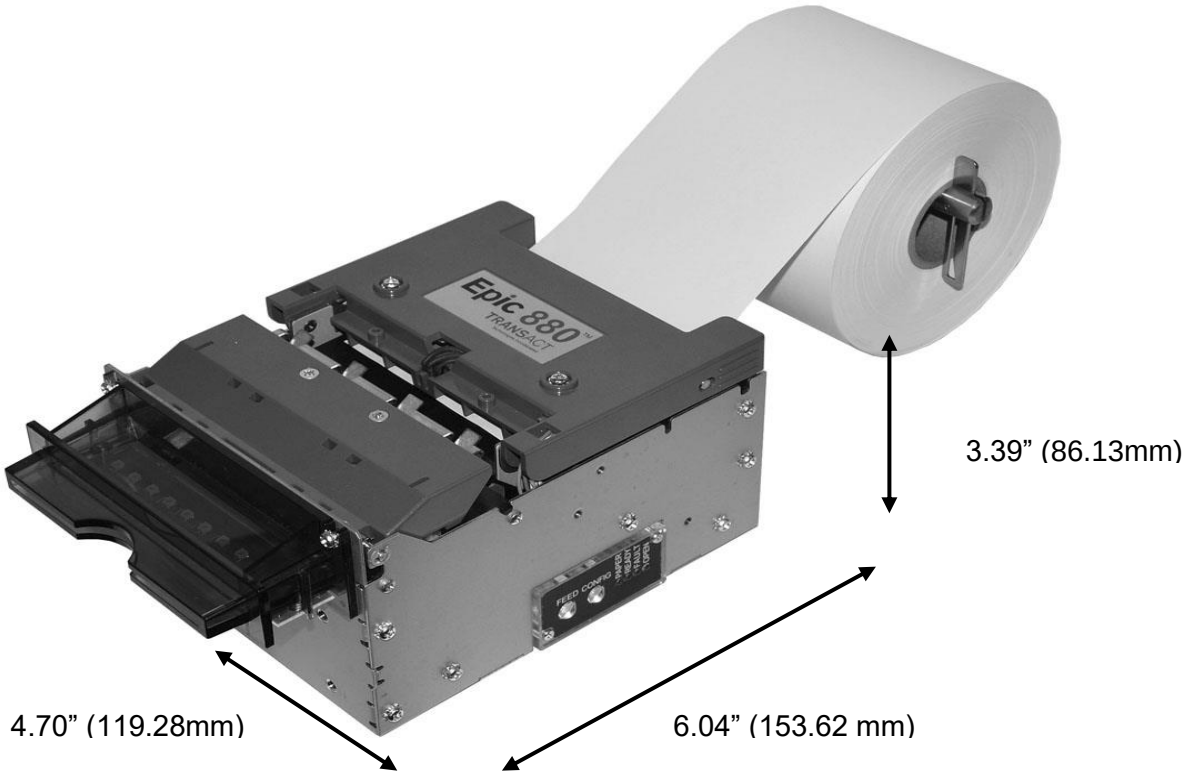


Figure 2. Epic 880™ Dimensions.

Printer Dimensions

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

Fully assembled as single unit

Design Envelope: Ticket Clearance
A minimum paper clearance distance of 2.0” (50.8mm) is required above the printer.
Dimensions of the paper support depend on the specific configuration and are not included here.

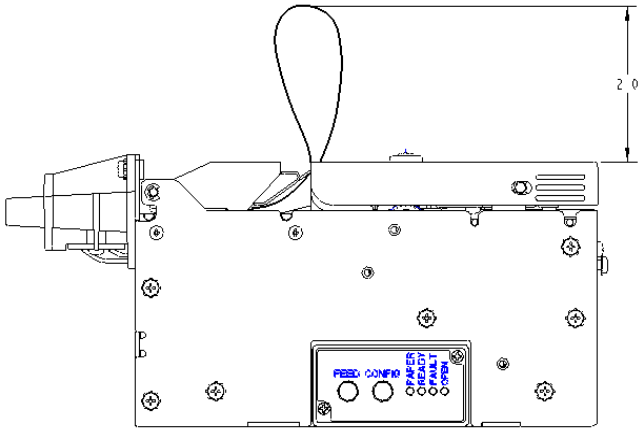


Figure 3 Ticket Clearance

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.

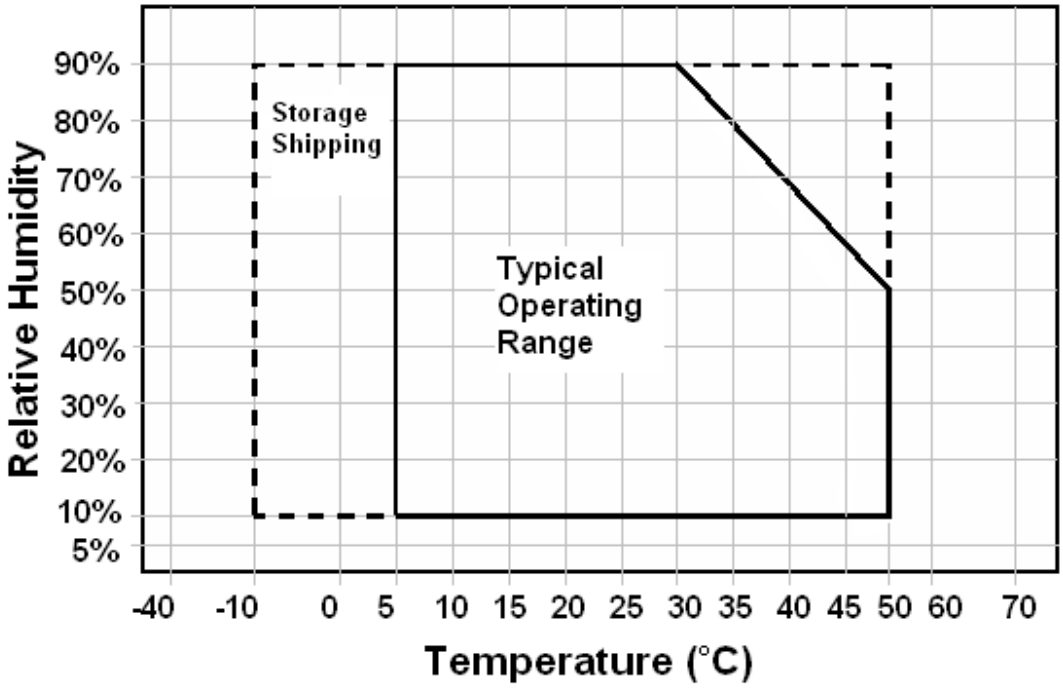


Figure 4. Temperature and Humidity Ranges.

Printer Environmental Conditions

Operating Temperature Range:	5º - 50ºC (41ºF - 122ºF)
Shipping/Storage Temperature Range:	–10º - 50ºC (14ºF - 122ºF)
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 many 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 cased 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.

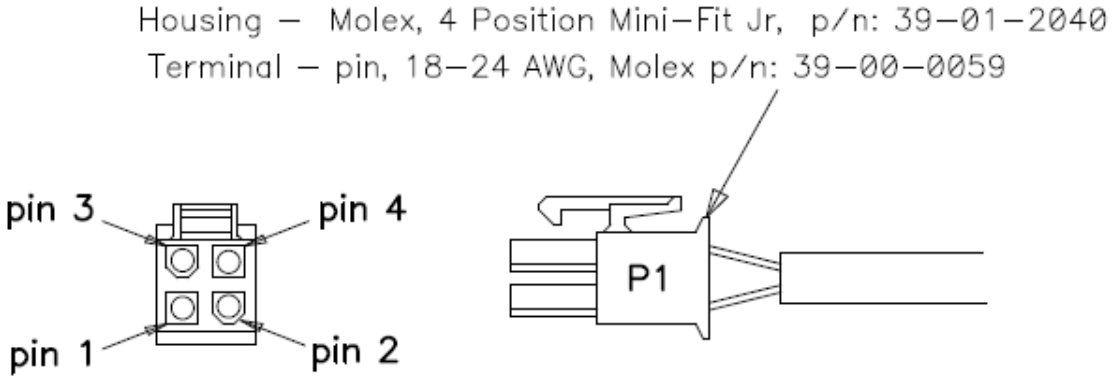
1) It must be able to provide quick response to step loads
2) Current will range widely with peaks at least 4 times the average
3) Load requirements for the power supply are as shown in the table below.
4) Consider a dedicated power supply for the printer.
5) If the printer is expected to print dense 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 ±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



SIGNAL	pin #
+24V	1
24V RTN	2
–	3
FRAME	4

Figure 5. 4 Pin Power Connector

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.

Frame Ground Requirements

An adequate frame ground is required for this product to meet the required ESD immunity standards. It is expected that a typical installation mounts this printer to a metal chassis that is the system “frame” or “safety” ground. This ground must provide adequate conductivity to provide ESD immunity. In cases where the chassis is not connected to the system “frame” or “safety” ground, it is necessary to ensure the printers metal chassis is connected via a separate ground strap with suitably low impedance. It is up to the system integrator to provide adequate frame grounding.

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
Roll Diameter:	152 mm (6.0 in.)
Paper Width:	79.5 +/- .05 mm (3.13 +/- .02 inches) or 82.0 +/- 0.5 mm. (3.23 +/- .02 inches)
Paper Thickness	0.056 mm to 0.09 mm (.0022 to .0035 in.) thick

Paper Grades: POS and Lottery grades

	0022" (POS)	**.0035" (LOTTO)**
Roll Core inside Dia.	**.445" MIN**	**1.00" MIN**
Roll Core outside Dia.	**.635" TYP**	**1.25" MIN**

Table 2 Core Diameter

Roll Core inside Dia. 1.00" (25.4 mm) or larger REQUIRES the SLEEVE SHOWN

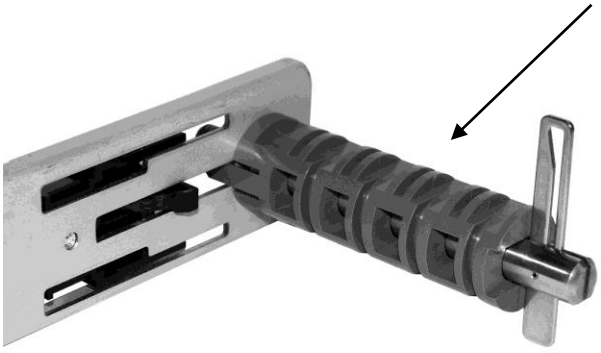


Figure 6. Paper Core Sleeve.

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

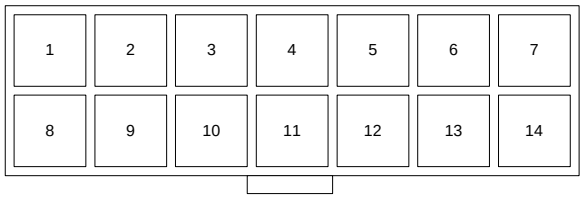
Paper Out

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

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 3 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 dc[2]) (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.

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

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

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.

USB Input Buffer size

The input buffer in the EPIC 880™ is configurable to values that are less than the USB packet size. The printer must be able to accept a full USB packet. If the input buffer is configured to be less than the USB packet size, the printer will dynamically increase the buffer to handle the maximum USB packet size. The USB packet sizes and minimum buffer sizes are listed below.

	Packet Size in bytes	Minimum buffer size in bytes
USB 1.1	64	104
USB 2.0	512	552

Chapter 3

Mounting Requirements

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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)

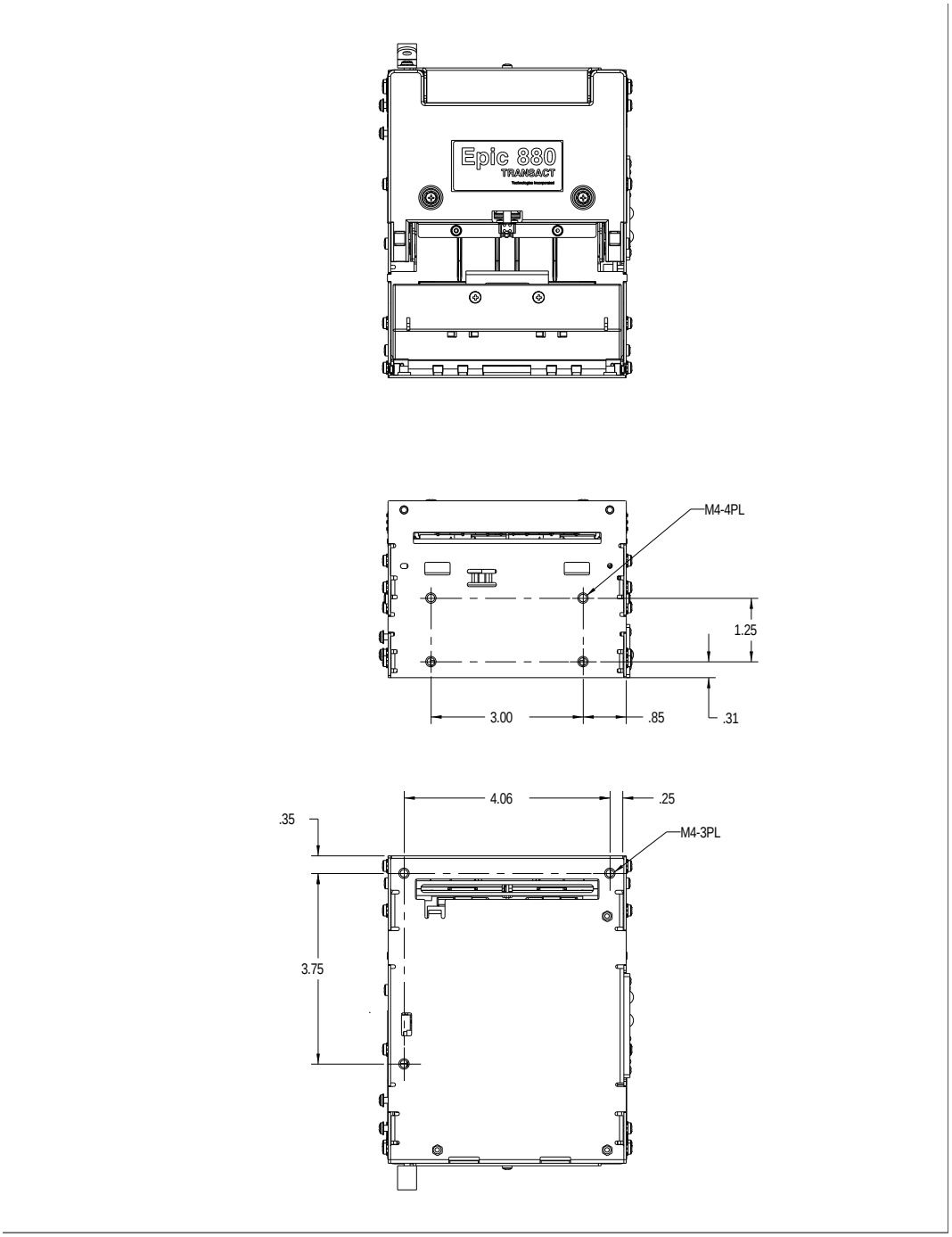

Figure 7. Epic 880™ Mounting Locations

Ticket Loop Clearance

Design Envelope: Ticket Clearance
A minimum paper clearance distance of 2.0” (50.8mm) is required above the printer.

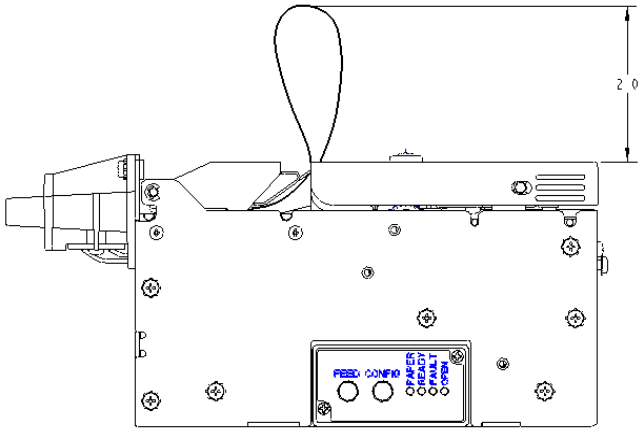

Figure 8 Ticket Clearance

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.

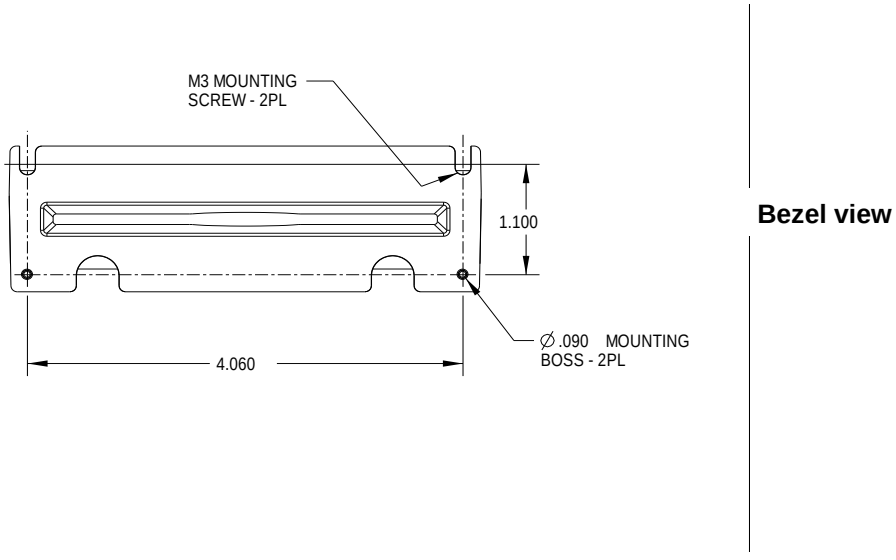

Figure 9. Bezel Mounting and Hardware Requirements

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

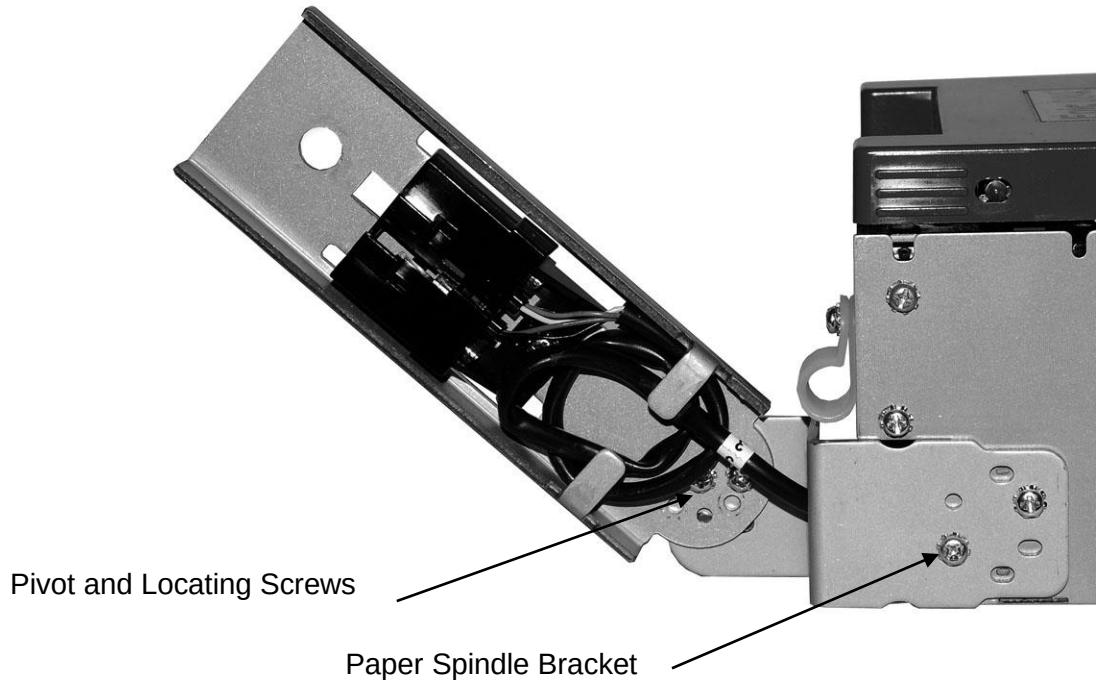

Figure 10. 45˚ Up Spindle Location

Figure 10 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

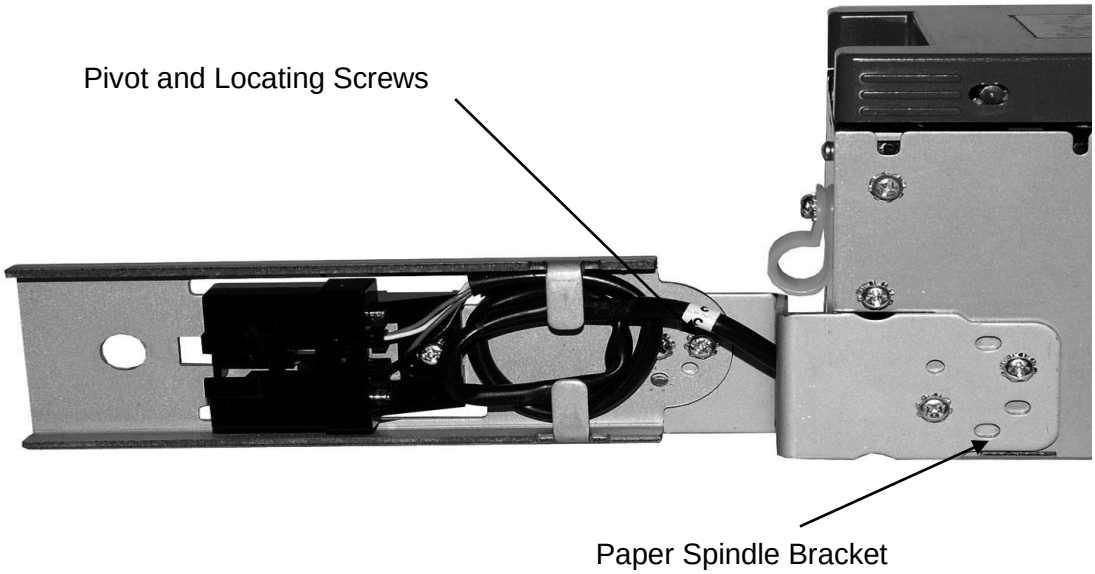

Figure 11. Straight Back Spindle Location

Figure 11 shows the straight back spindle position. Note the location of the pivot and mounting screws.

45˚Down Spindle Mounting

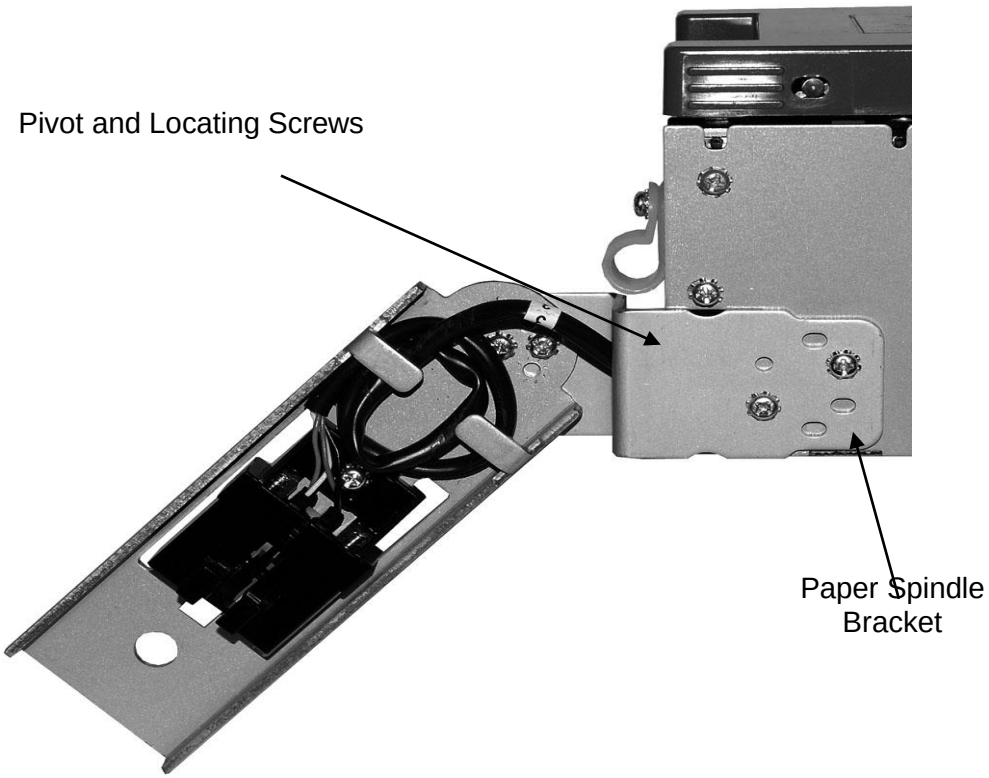

Figure 12. Angle Down Spindle Location

Figure 12 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

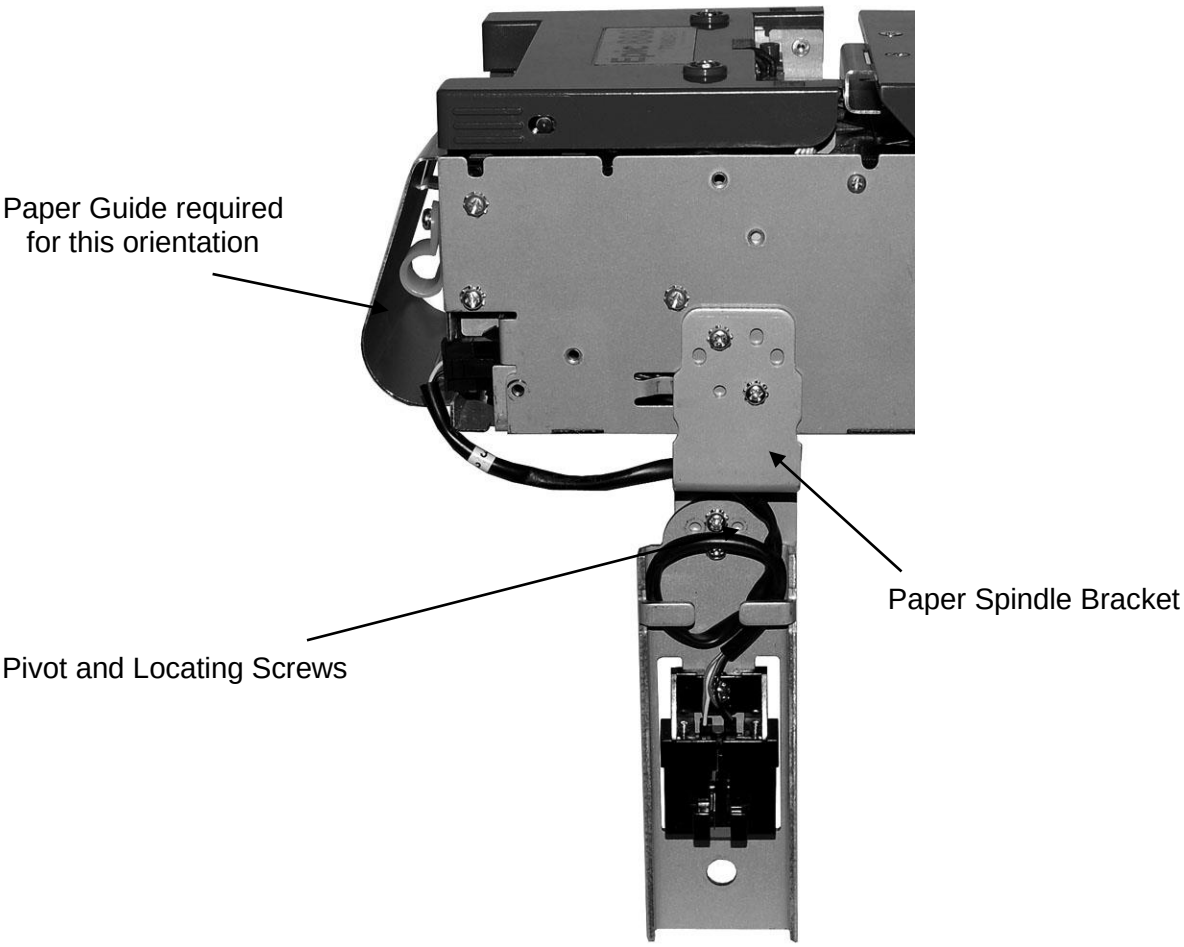

Figure 13. Straight Down Center Spindle Location

Figure 13 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

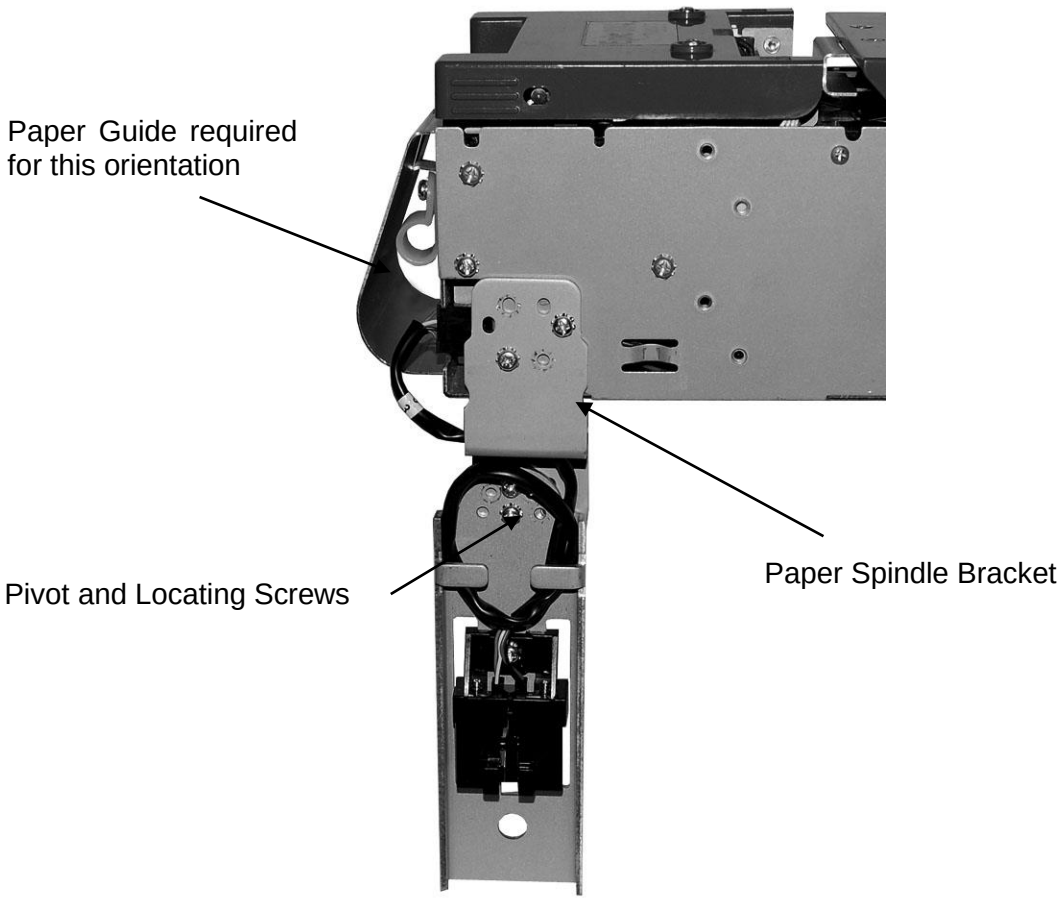

Figure 14. Straight Down Rear Spindle Location

Figure 14 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.

Universal spindle adjustment

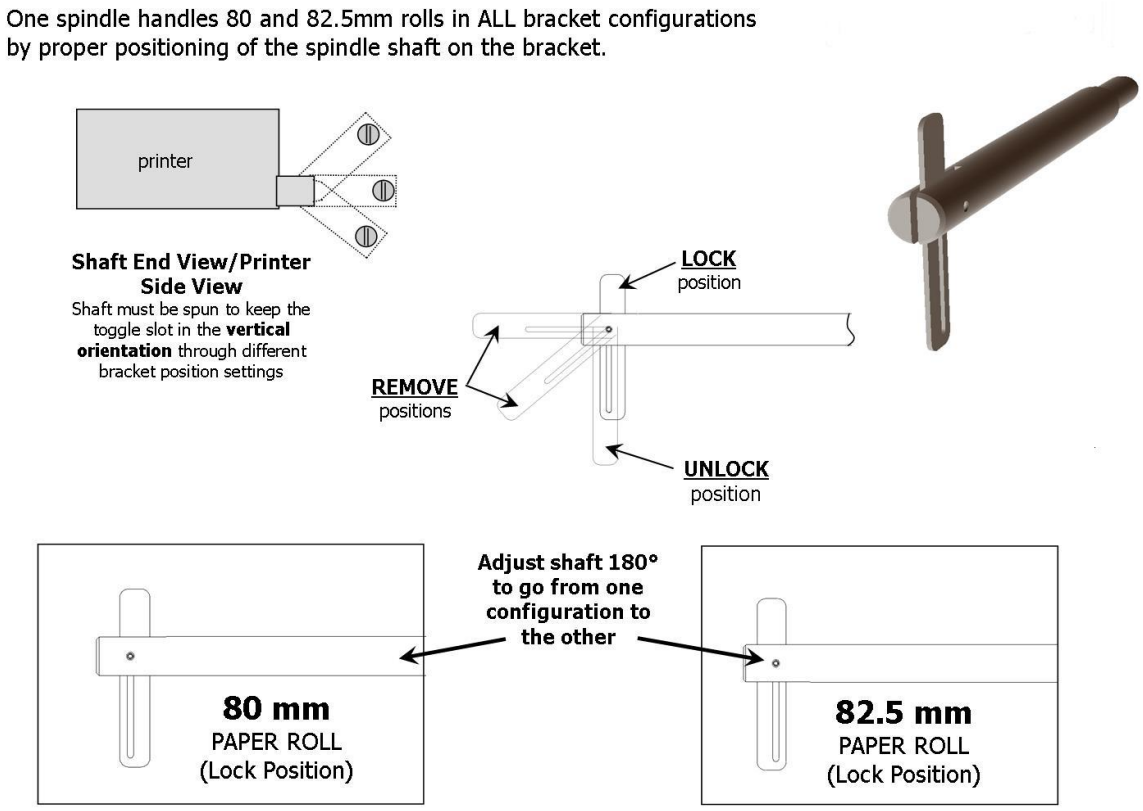

Figure 15. Universal spindle adjustment

Paper low adjustment

To set the paper low switch; loosen the switch screw and slide the switch to the desired position and then tighten the screw

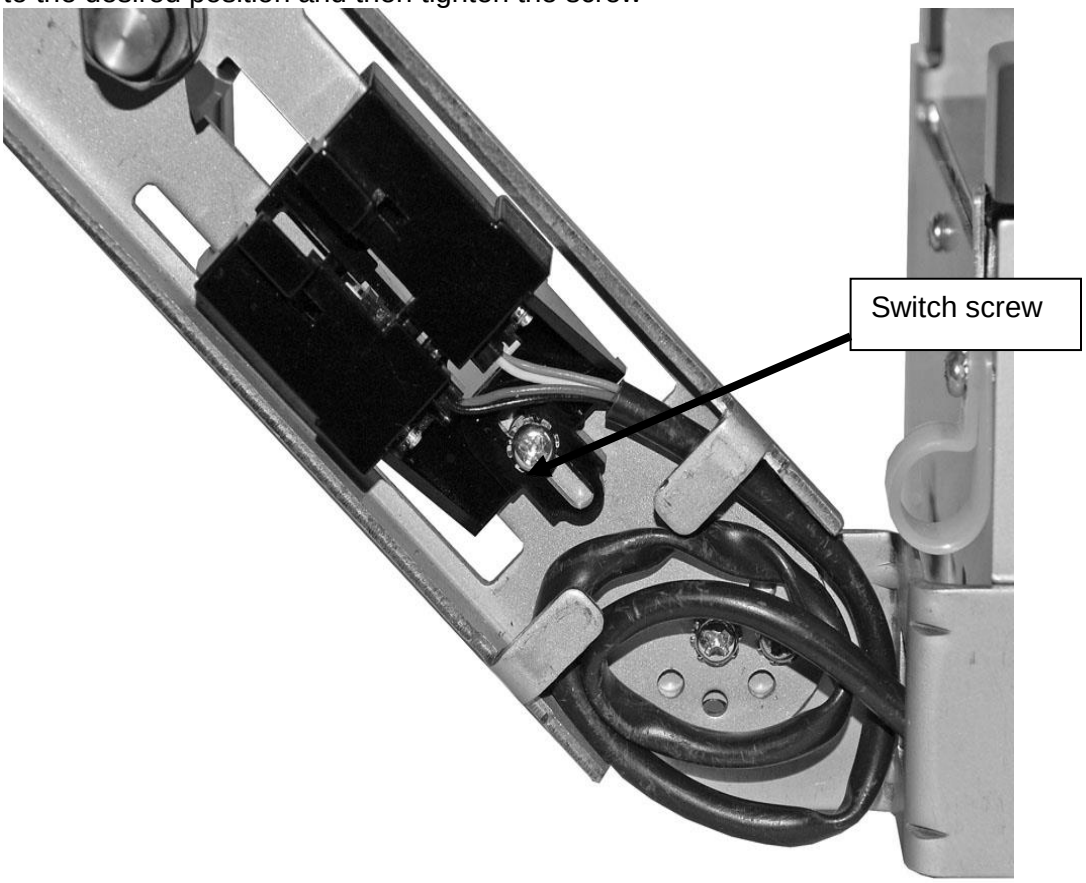

Figure 16. Paper low adjustment

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 13 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.

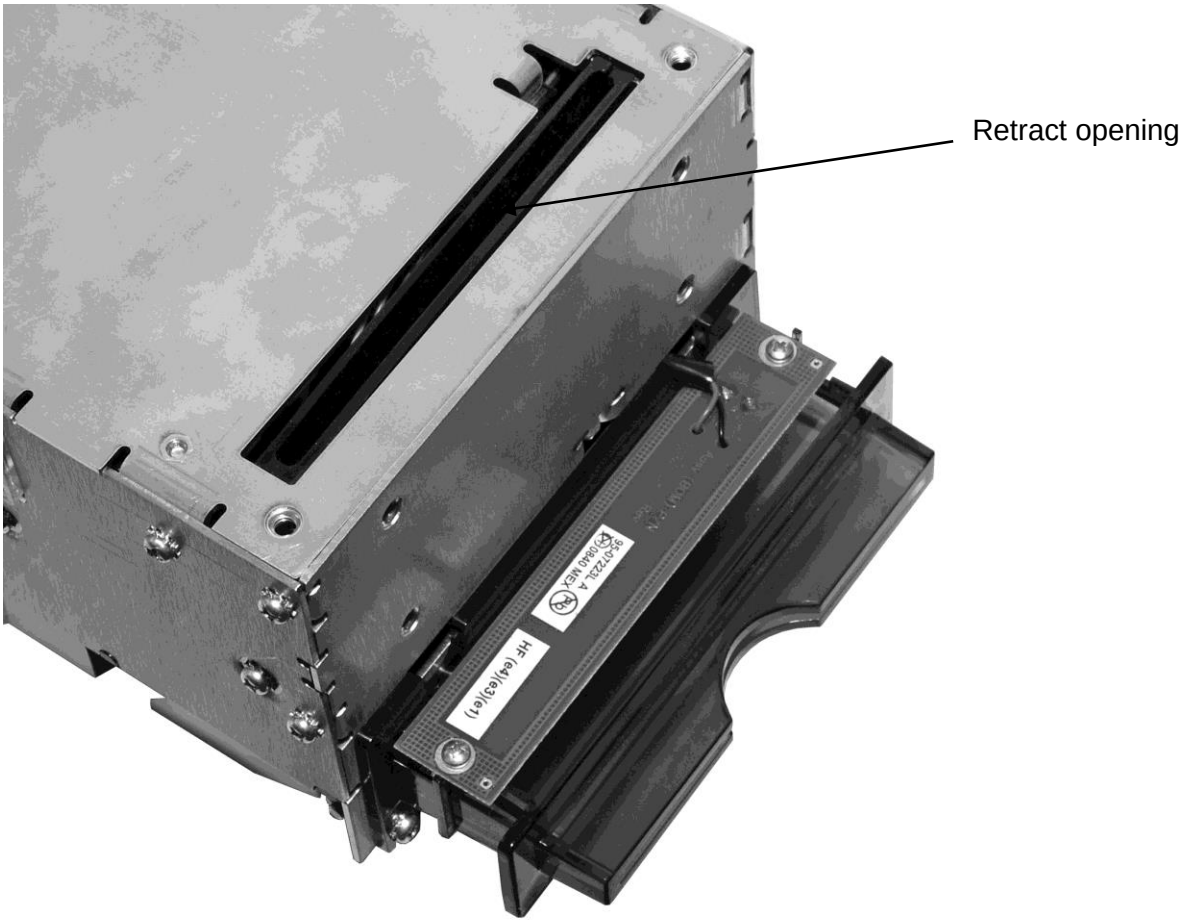

Figure 17. Retract Opening.

The dimensions of this opening are as shown in Figure 18.

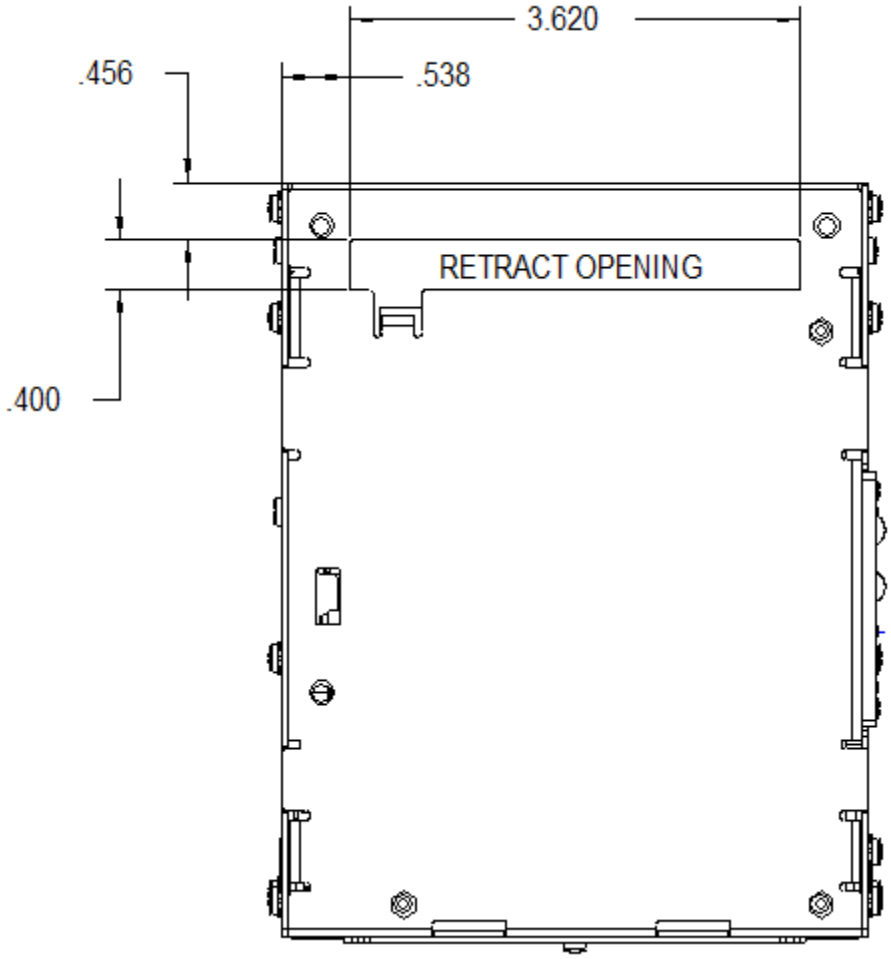

Figure 18. Dimensions for Retract Opening.

Chapter 4

Printer Sensors

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Printer Sensors

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

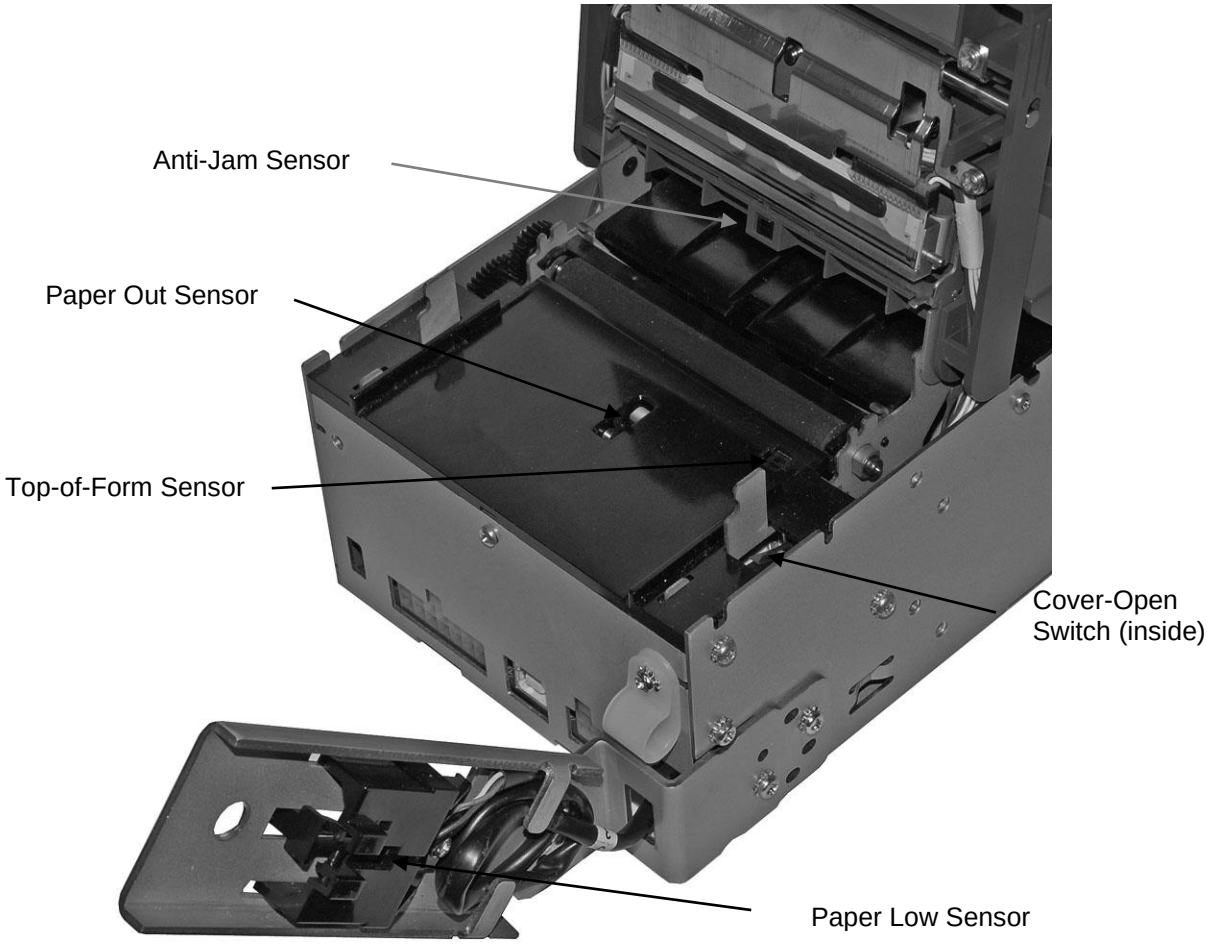

Figure 19. Sensor Breakdown and Locations.

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.

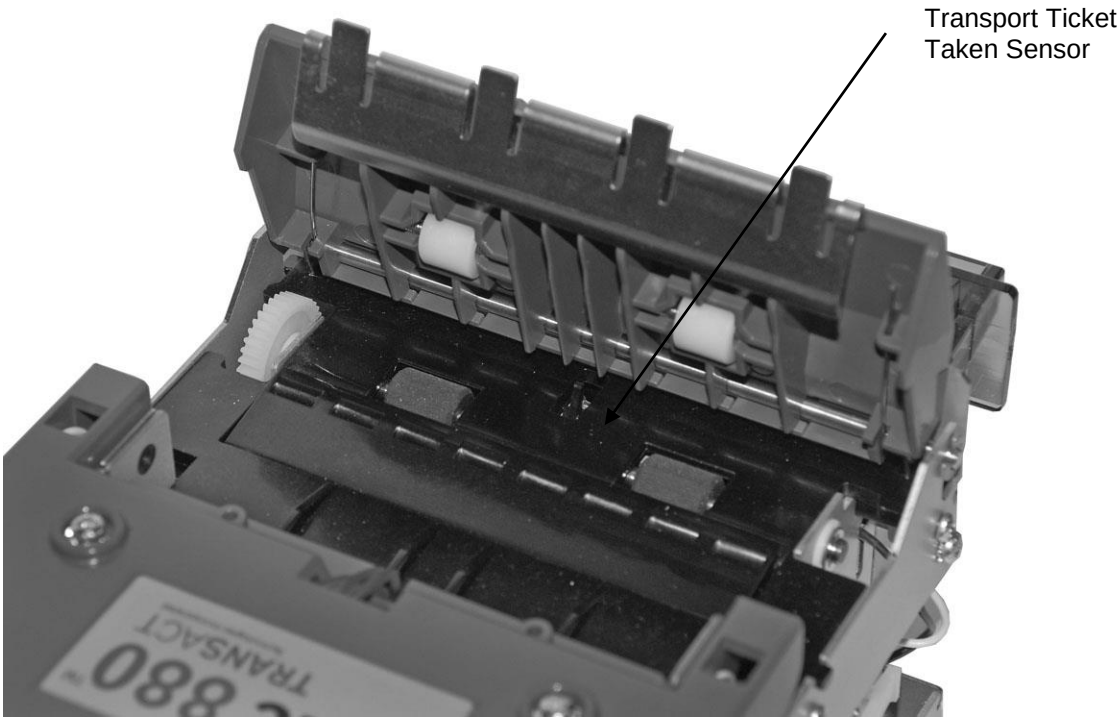

Figure 20. Transport Ticket Taken Sensor.

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.

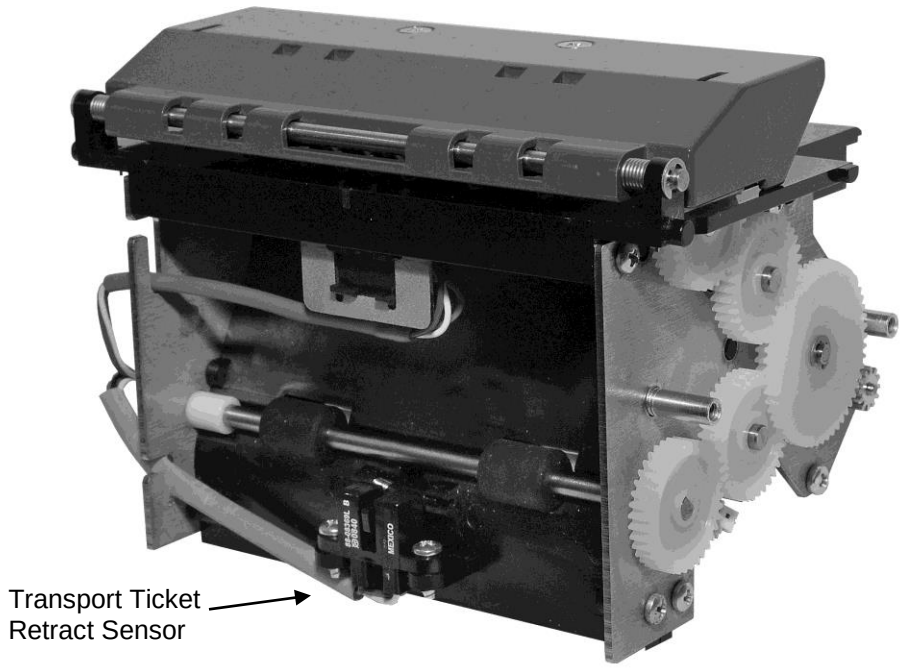

Figure 21. Transport Ticket Retract Sensor.

Chapter 5

Electrical Connections

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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.

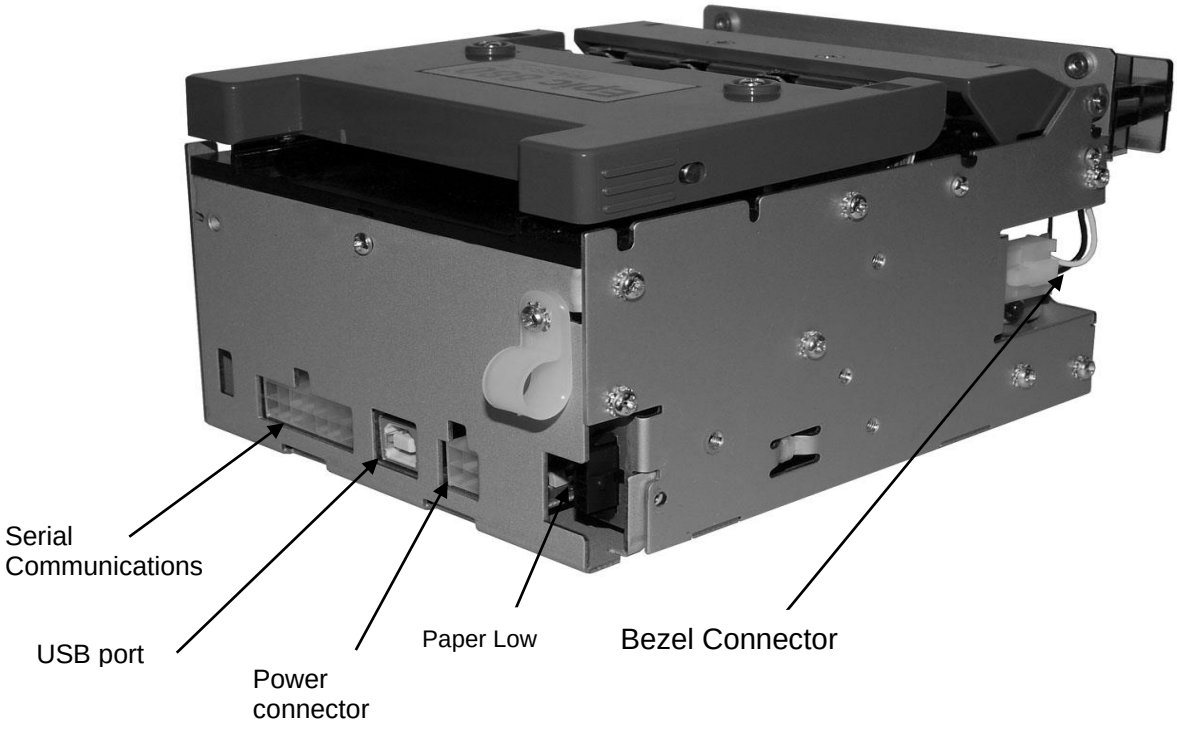

Figure 22. Communication PCB Location and Connector Info.

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

Cable connection locations

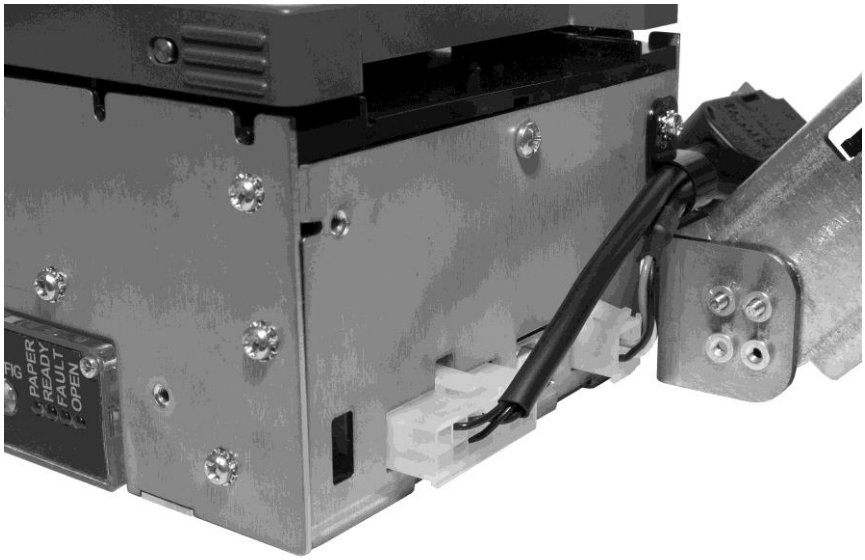

Figure 23 Power and RS232 Left hand Exit

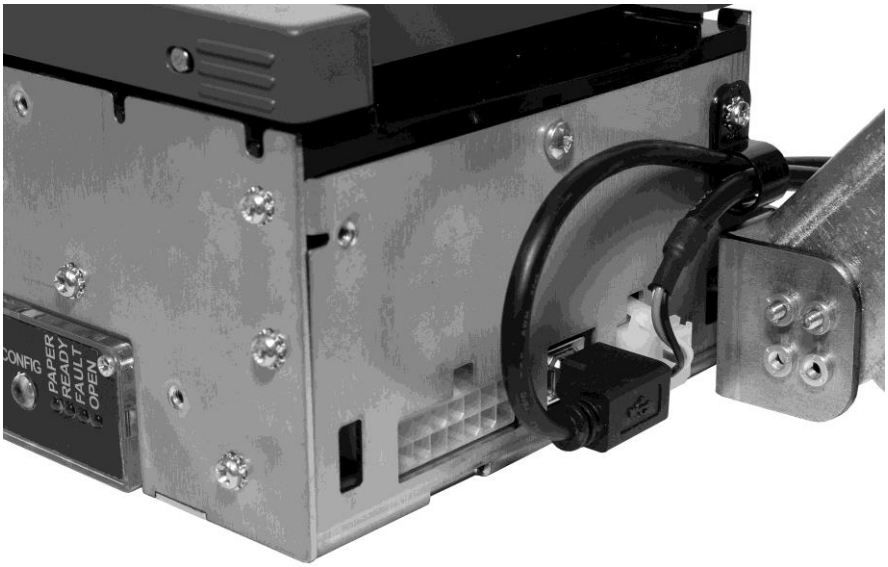

Figure 24 Power and USB Left hand Exit

Note: 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

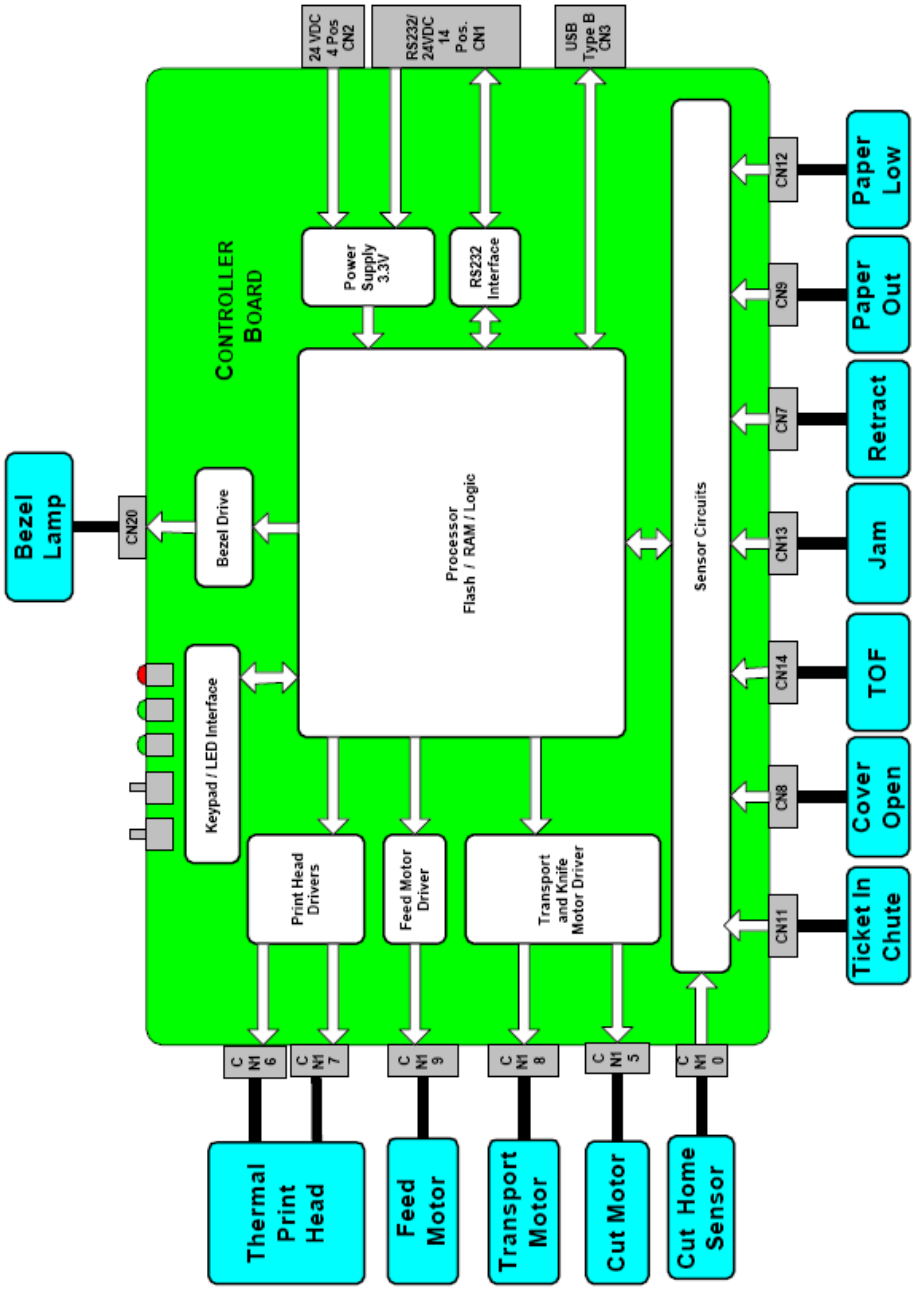

Figure 25. Epic 880™ Block Diagram

Chapter 6

Operational Procedures

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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 26. Control panel

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

Resetting the Printer

Both the standard & enhanced printer firmware have a feature that will reset the printer when both the Feed and Config buttons are held down for 1 second.

Reset Instructions

Hold both Feed and Config buttons for 1 second until the Paper, Ready, Fault and Open lights go out, then release the buttons and the printer will reset.

If the buttons are not pressed correctly then the following scenarios could occur:

1. Pressing the Config button first and not pressing the Feed button puts the printer into diagnostic mode. Allowing the user to perform a pre-defined set of operations. The indicator for this is the Ready light blinking green every 2 seconds. To get out of this state, press and hold the Config button for three seconds or unplug/re-plug the power.
2. If the Config button is pressed and held for 4 seconds, until the Paper light turns yellow, then the printer will go into HEXDUMP mode. To get out of this state, press and hold the Config button for three seconds or unplug/re-plug the power.
3. If the Config button is pressed and held for approximately 6 seconds, until the Paper and Open lights turn yellow, then a complete printer configuration will print if paper is loaded and then it will allow the user to change specific settings on the printer using the feed button. To get out of this state, press and hold the Config button for three seconds or unplug/re-plug the power.
4. If the Config button is pressed and the user waits for the config ticket to pass through, the user then presses the Config button again and then while the Ready light is blink faster, 1 blink per second, the user presses and holds the Config button, this will place the printer in Boot Loader 1 mode. The Ready light will blink on and off (green) while the fault light (red) will stay lit. If the user presses the Config button again it will go into Boot Loader 2 mode. The Ready light and Fault light will alternate blinking. To get out of this state, press the Config button and the printer will go back to normal operation or unplug/re-plug the power.

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.

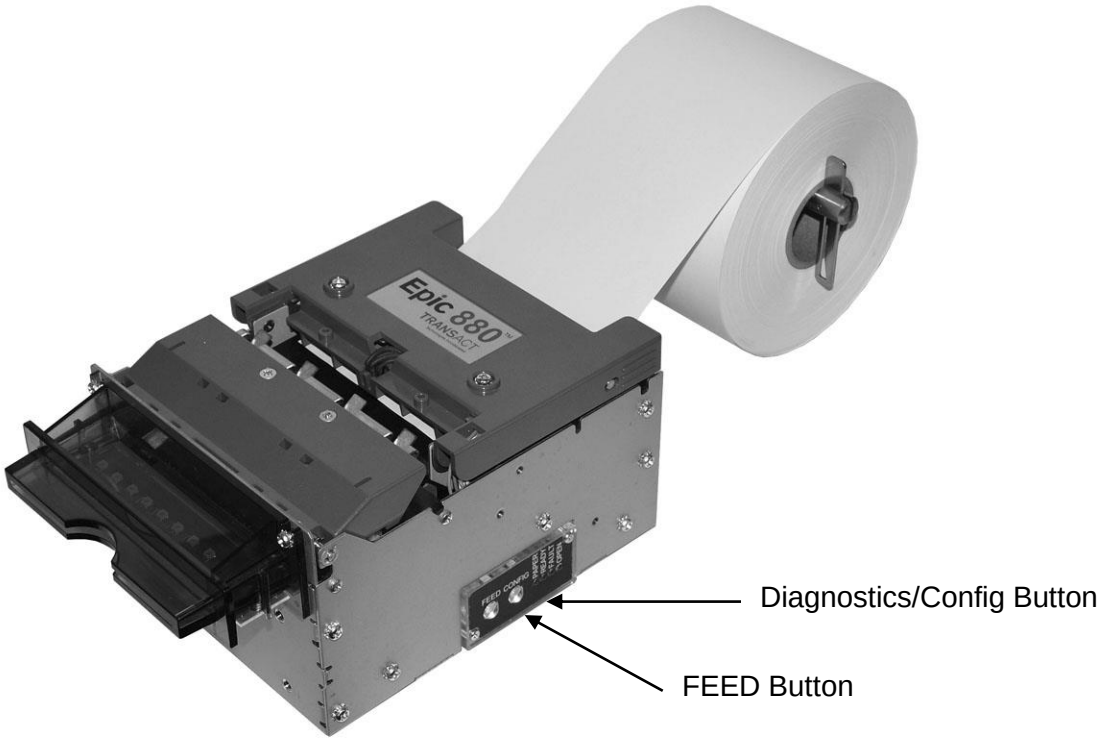

Figure 27. Location of Diagnostics/Config Button.

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 press[3] 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, 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.

[3] 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.

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 Recovery Loader Integrity
5. Maintenance Mode Firmware Integrity (Note: If the firmware is corrupted, the printer will remain in the recovery boot loader)

At this point, Maintenance mode is started

6. The contents of the flash file system is verified
7. Any system configuration or setup programs are run at this point
8. If any faults are detected, the printer remains in Maintenance mode.

At this time, the operating firmware is loaded.

9. The file system has already been verified by maintenance mode and is now opened
10. The Power On Configuration (POR.INI) file is loaded and the firmware starts to configure itself.
11. The USB controller is configured
12. 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.

13. Start USB enumeration (If USB is being used)
14. Cover Closed Check
15. Knife Home
16. Paper Present
17. Clear Paper Path.
18. Place Printer On-line, Start Normal Operation

The first phase of testing consists of steps 1-5 and determines that the boot loader is accurate and the printer firmware is correct. Tests 1 through 4 produce non-recoverable errors and the printer must be returned for service. If the boot loader is intact, but the maintenance firmware is corrupted, the printer will remain in the recovery boot loader.

If errors occur during steps 6-8 the printer will remain in maintenance mode. Maintenance mode allows automated remote recovery of the printer.

If errors occur during steps 9-12 the printer will fault perform a cleanup and restart in Maintenance mode.

Boot Loader and Maintenance Mode

There are two levels of boot loader in the Epic 880. There is a low level recovery boot loader that only supports the serial port and there is a second level loader and maintenance mode, that supports serial and USB operation. Maintenance mode may be entered during normal operation through special commands or manually at power up. The recovery loader may only be entered manually.

Recovery Boot loader

The recovery loader is only available at power on by pressing and holding the Diagnostics button when power is applied. This loader only supports the serial port and is intended primarily

to support the initially programming of the flash. It may also be used to install the firmware in a printer where the PCB has been replaced. It can also be used in the field to update older printers with the new enhanced firmware.

Maintenance Mode Loader

The maintenance mode loader may be entered from the normal operating firmware using special commands or it may be entered manually. When the printer is in maintenance mode, the printer's firmware may be updated, resident fonts may be replaced, the configuration of the printer may be changed and how the printer initially powers up may be altered. It is also possible to recover and reconfigure printer remotely however this requires host system support.

To manually enter maintenance mode, hold the Diagnostics button on 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 recovery boot loader is operational. By pressing and releasing the diagnostics button again, Maintenance mode will be started. When started in this way, maintenance mode will not attempt to run any configuration programs that might be present nor will it attempt to load the operating firmware. Both the Serial and USB ports will be active in maintenance mode.

Note: With the older version of firmware, 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 flash to accept the updated 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 remain in maintenance mode.

Warning: If a printer with enhanced firmware is loaded with older firmware, the printer's configuration will be lost. The printer may also have to be loaded twice as the old firmware formats the flash file system differently than the enhanced version. (See note above)

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:

Recovery Boot Load Mode
In Recovery 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.

Maintenance Mode
In Maintenance mode, the ready LED will blink 3 times then pause in a 6 second repeating cycle.

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 Recovery 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[4]	4 Blinks	
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.

[4] The printer may be configured to beep if the cover is open.

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 60º C, the printer will start to slow down. If the head exceeds 65º C, the printer will stop. The printer will heat the head to maintain a head temperature of 25º C. If the printer cannot maintain a head temperature of 0º 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 880TM Specifications and Requirements*.

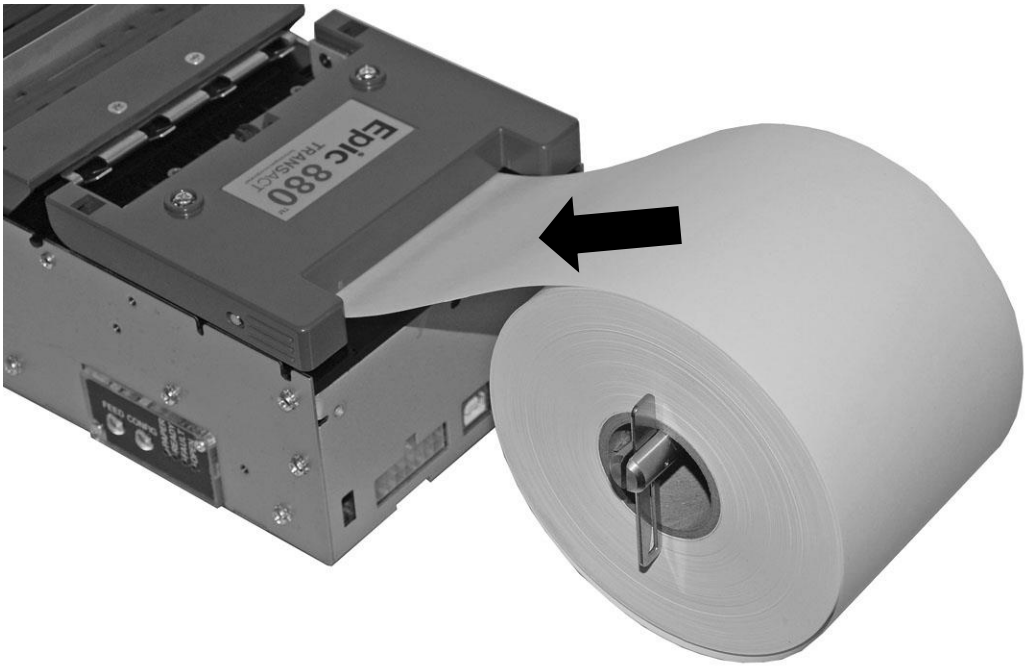

Figure 28. Auto-feeding a Paper Roll.

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. 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 7

Configuring the Epic 880™ Printer

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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 CONFIG[5] 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.

5 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.

Chapter 8

Control Codes

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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.

<n_1> <n_2> Indicates that there are two parameters, <n_1> and <n_2>, where both can have values from zero to 255.

<m_1> <m_2> Is an TransAct® Printer Control Language (IPCL) parameter consisting of two digits where <m_1> and <m_2> are ASCII characters from zero to nine. The parameter is combined to form a value from zero to 99. If <m_3> 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 <m_1> <m_2> 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	83
Carriage return.	[CR]	0DH	&%CR	83
Horizontal Motion				
Back space.	[BS]	08H	&%BS	84
Horizontal tab.	[HT]	09H	&%HT	84
Set horizontal tab stops.	[ESC] D <n_1> <n_2> ... <n_i> <0>	1BH 44H	none	84
Set horizontal position.	[ESC] n <n_1> <n_2>	1BH 6EH	&%HP<m_1> <m_2> <m_3>	86
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}	85
Reset horizontal and vertical tab stops.	[ESC] R	1BH 52H	&%HV	85
Set left/right print margins. n_1 = Left margin, n_2 = Right margin	[ESC] X <n_1><n_2>	1BH 58H	none	229
Select minimum character height and width in points	[ESC] + P<w><h>	1BH 2BH 50H	none	289
Select minimum character height and width in ¼ points	[ESC] + p<w><h>	1BH 2BH 70H	none	290
Vertical Motion				
Perform a fine line feed.	[ESC] J <n>	1BH 4AH	&%FM <m_1> <m_2> <m_3>	87
Set 1/8-inch line spacing.	[ESC] 0	1BH 30H	&%ST	87
Set 7/72-inch line spacing.	[ESC] 1	1BH 31H	&%SG	88
Begin variable line spacing. (Enable [ESC] A <n>).	[ESC] 2	1BH 32H	none	88
Set variable line spacing to n/216 inch.	[ESC] 3 <n>	1BH 33H	&%SV <m_1> <m_2> <m_3>	87
Set variable line spacing to n/72 inch.	[ESC] A <n>	1BH 41H	none	88
Set Line spacing in points	[ESC]+V<n>	1BH 2BH 56H	None	289
Set Line spacing in ¼ points	[ESC]+v<n>	1BH 2BH 76H	None	290
Select minimum character height and width in points	[ESC] + P<w><h>	1BH 2BH 50H	none	289
Select minimum character height and width in ¼ points	[ESC] + p<w><h>	1BH 2BH 70H	none	290
Feed <n> lines at current spacing.	[ESC] d <n>	1BH 64H	&%FL <m_1> <m_2>	90
Set vertical tab stops.	[ESC] B <n_1> <n_2> <n_3>...<n_i> 0	1BH 42H	none	91
Vertical tab.	[VT]	0BH	&%VT	90
Form feed.	[FF]	0CH	&%FF	91

Description	ASCII	Hex	IPCL equivalent code	Page
Feed to black dot	[ESC][VT]	1BH 0BH	None	94
Set top of form.	[ESC] 4	1BH 34H	&%TF	92
Set form length in lines.	[ESC] C <n>	1BH 43H	&%SL <m_1> <m_2>	92
Begin auto line feed. (n=0, end n=1)	[ESC] 5 <n>	1BH 35H	&%CA {n=0} &%MA {n=1}	93
Set form length in inches.	[ESC] C [NUL] <n>	1BH 43H	&%SI <m_1> <m_2>	92
Transport Control				
Set Transport Mode	[ESC]i<f><v>	1BH 69H	None	227
Feed Transport	[ESC]j<n>	1BH 6AH	None	227
Deliver ticket from transport	[ESC]k	1BH 6BH	None	227
Transport ticket retract	[ESC]m	1BH 6DH	None	228
Character Pitch				
Set character spacing in points	[ESC]+I<n>	1BH 2BH 49H	None	287
Set character spacing in ¼ points	[ESC]+i<n>	1BH 2BH 69H	None	287
Set character spacing in points with adjustment	[ESC]+J<n>	1BH 2BH 4AH	None	288
Set character spacing in ¼ points with adjustment	[ESC]+j<n>	1BH 2BH 6AH	None	288
Begin 10 CPI character pitch.	[DC2]	12H	&%F3	98
Begin 12 CPI character pitch.	[ESC] :	1BH 3AH	&%F2	98
Begin 17 CPI character pitch.	[SI]	0FH	&%F1	98
Set character pitch.	[ESC] [P <n>	1BH 5BH 50H	&%F<n>	99
Set inter-character spacing.	[ESC] V <n>	1BH 56H	none	100
Begin 24 CPI character pitch	[ESC][SI]	1BH 0FH	&%F4	98
Select Minimum character Height and Width in points	[ESC] + P<w><h>	1BH 2BH 50H	none	289
Select Minimum character Height and Width in ¼ points	[ESC] + p<w><h>	1BH 2BH 70H	none	290
Character Font				
Select font	[ESC] + 3 <ID>	1BH 2BH 31H	none	279
Select font by name	[ESC] + N Filename<0>	1BH 2BH 4EH	none	279
Define Stacked Font	[ESC] + S <ID_1> <ID_2> …	1BH 2BH 53H	none	279
Set stroke font Brush Size	[ESC] + B <w>	1BH 2BH 42H	none	290
Select Minimum character Height and Width in points	[ESC] + P<w><h>	1BH 2BH 50H	none	289
Select Minimum character Height and Width in ¼ points	[ESC] + p<w><h>	1BH 2BH 70H	none	290
Begin 12 x 12 draft print.	[ESC] # <0>	1BH 23H 00H	&%QT	101
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}	101
Begin rotated font. (See command description).	[ESC] P <n>	1BH 50H	&%RI &%RF &%RN	102

Description	ASCII	Hex	IPCL equivalent code	Page
Select character code page. ASCII Mode only.	[ESC] [T <n_h> <n_l>	1BH 5BH 54H	&%CP <m_1> <m_2> <m_3> <m_4>	107
Select Codepage by name. ASCII Mode only	[ESC] + C	1BH 2BH 43H	None	107
Insert Euro character.	[ESC] [C <n>	1BH 5BH 43H	&%EU	108
Print control character.	[ESC] ^ <n>	1BH 5EH	&%CC <m_1> <m_2> <m_3>	109
Print Unicode character	[ESC] " <n_L><n_H>	1BH 22H	&%PU <m_1> <m_2> <m_3> <m_4> <m_4>	109
Character Attributes				
Select color.	[ESC] c <n>	1BH 63H	&%CL <m_1>	110
Begin one-line double-wide print.	[SO]	0EH	&%MW	110
Cancel one-line double-wide print.	[DC4]	14H	&%MN	110
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}	111
Enable/disable Strike through. n=0 End n=1 Begin	[ESC] _ <n>	1BH 5FH	&%CO {n=0} &%MO {n=1}	111
Begin underline mode. n = 0 End n = 1 Begin	[ESC] - <n>	1BH 2DH	&%CU {n=0} &%MU {n=1}	113
Begin enhanced print.	[ESC] G	1BH 47H	&%ME	113
End enhanced print.	[ESC] H	1BH 48H	&%CE	113
Begin emphasized print.	[ESC] E	1BH 45H	&%MM	114
End emphasized print.	[ESC] F	1BH 46H	&%CM	114
Set print style. (See command description.)	[ESC] [@ ...	1BH 5BH 40H…	&%DH &%SH	112
Select superscript.	[ESC] S <0>	1BH 53H 00H	&%SP	114
Select subscript.	[ESC] S <1>	1BH 53H 01H	&%SB	114
End superscript or subscript.	[ESC] T	1BH 54H	&%SE	115
Begin italics.	[ESC] % G	1BH 25H 47H	&%MI	115
End italics.	[ESC] % H	1BH 25H 48H	&%CI	115
Page Mode				
Select page mode	[ESC] t <n>	1BH 74H	&%PM	127
Set page mode page size	[ESC] u <n_1> …	1BH 75H	&%PS	127
Set page mode page position	[ESC] o <n_1> …	1BH 6FH	none	128
Start Page Mode	[ESC][SUB]t	1BH 1AH 53H	&%PM	118
Set Page Mode Size Enhanced	[ESC][SUB]S	1BH 1AH 53H	none	120
Set Page Mode Printed Area	[ESC][SUB]W	1BH 1AH 57H	none	123
Set Page Position Enhanced	[ESC][SUB]A	1BH 1AH 41H	&%PY	128
Set Page Position Relative	[ESC][SUB]R	1BH 1AH 52H	none	128
Set Page Overlay mode	[ESC][SUB]O	1BH 1AH 4FH	none	125
Set Page Overlay mode	[ESC][SUB]M	1BH 1AH 4DH	none	125
Clear Page Mode Page	[ESC][SUB]C	1BH 1AH 43H	none	125
Set Page Mode Auto Size	[ESC][SUB]Z	1BH 1AH 5AH	none	119

Description	ASCII	Hex	IPCL equivalent code	Page
Exit page mode	[FF]	0CH	&%FF	126
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	130
Print half-speed double-density graphics.	[ESC] L <n_1> <n_2>	1BH 4CH	none	130
Print full-speed double-density graphics.	[ESC] Y <n_1> <n_2>	1BH 59H	none	131
Print quad-density graphics.	[ESC] Z <n_1> <n_2>	1BH 5AH	none	131
Select bidirectional or unidirectional print. n=0 Bidirectional n=1 Unidirectional	[ESC] U <n>	1BH 55H	&%GU {n=1} &%GB {n=0}	132
Print graphics in mode <m>.	[ESC] * <m> <n_1> <n_2>	1BH 2AH	none	131
Reassign graphic mode.	[ESC] ? <m><n>	1BH 3FH	none	132
Horizontal Graphics				
Process horizontal graphics data.	[ESC] h <color> <length> <format> <data>	1BH 68H	none	133
Set horizontal graphic mode.	[ESC] * <m> <0> <0>	1BH 2AH	none	134
Bitmap Graphic File Support				
Print Bitmap File Record	[ESC] [FS]	1BH 1CH	none	261
Print Bitmap graphics from bitmap data	[ESC] [FS] p <BitmapFileData>	1BH 1CH 70H	none	262
Print Bitmap graphics.	[ESC] [FS] P <BitmapFileData>	1BH 1CH 50H	none	262
Print Bitmap graphics from file.	[ESC] [FS] P <s> FileName<0>	1BH 1CH 50H	none	263
Print Bitmap graphics from file.	[ESC] [FS] S FileName<0>	1BH 1CH 53H	none	263
User Store				
Begin named macro record.	[ESC] [US] b <Name..> <0>	1BH 1FH 62H	&%UB <Name..><0>	140
Save macro data in user store.	[ESC] [US] m <Name..> <0>	1BH 1FH 6DH	&%UM <Name..><0>	141
End named macro record.	[ESC] [US] e <Name..> <0>	1BH 1FH 65H	&%UG <Name..><0>	141
Load item from user store.	[ESC] [US] l <Name..> <0>	1BH 1FH 6CH	&%UL <Name..><0>	142
Run macro data from user store.	[ESC] [US] r <Name..> <0>	1BH 1FH 72H	&%UR <Name..><0>	142
Flag item as a start-up macro.	[ESC] [US] s <Name..> <0>	1BH 1FH 6DH	&%US <Name..><0>	143
Delete item from user store.	[ESC] [US] d <Name..> <0>	1BH 1FH 64H	&%UD <Name..><0>	143
Flush information from user store.	[ESC] [US] f ALL <0>	1BH 1FH 66H 00H	&%UF	143

Description	ASCII	Hex	IPCL equivalent code	Page
Report on user store.	[ESC] [US] q <Name..> <0>	1BH 1FH 72H	&%UQ <Name..><0>	144
Return a report on user store	[ESC] [US] ? <Name..> <0>	1BH 1FH 72H	&%UQ <Name..><0>	144
Process user macro.	[ESC] g <0>	1BH 67H 00H	&%GP	145
Start macro record.	[ESC] g <1>	1BH 67H 01H	&%GS	145
Stop macro record.	[ESC] g <2>	1BH 67H 02H	&%GE	145
Stop macro record and save	[ESC] g <3>	1BH 67H 03H	&%GW	146
Barcodes				
Print barcode.	[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}	147
PDF 417 barcode control	[ESC] [EM] E <f> <v>	1BH 19H 45H	none	204
Set barcode 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>	201
Set barcode width	[ESC] [EM] W <n>	1BH 19H 57H	&%BW <m>	201
Set barcode justification, HRI print mode, and print direction.	[ESC] [EM] J <n>	1BH 19H 4AH	&%BJ<m_1> <m_2>	201
Electronic Journal				
Electronic journal: initialize and set password	[ESC][GS]I <Password> <0>	1BH 1DH 49H	%&EI	217
Electronic journal: erase the electronic journal	[ESC][GS]E <Password> <0>	1BH 1DH 45H	&%EC	217
Print the electronic journal	[ESC][GS]P< S_l> <S_h>< L_l> <L_h>	1BH 1DH 50H	&%EP	218
Report the electronic journal	[ESC][GS]R< S_l> < S_h>< L_l> <L_h>	1BH 1DH 52H	&%EQ	218
Electronic journal begin entry	ESC]I <3>	1BH 6CH	%&EB	225
Electronic journal suspend entry	[ESC]I <2>	1BH 6CH	&%ES	226
Electronic journal resume entry	[ESC]I <1>	1BH 6CH	&%ER	226
Electronic journal end entry	[ESC]I <0>	1BH 6CH	&%EE	226
Electronic journal mode begin (journal station)	[ESC]{	1BH 7BH	None	225
Unicode				
Initiate Unicode UTF-16BE encoding	[ESC] + H	1BH 2BH 48H	none	280
Initiate Unicode UTF-16LE encoding	[ESC] + L	1BH 2BH 4CH	none	280
Initiate Unicode UTF-8 encoding (MBCS)	[ESC] + M	1BH 2BH 4DH	none	281
Initiate Unicode UTF-8 Text only encoding (MBCS)	[ESC] + T	1BH 2BH 54H	none	281

Description	ASCII	Hex	IPCL equivalent code	Page
Initiate normal 8-bit ASCII character encoding	[ESC] + A	1BH 2BH 41H	none	282
File System Commands				
Open File	[ESC][RS] O<Mod> FileName<0>	1BH 1EH 4FH	none	295
Return Free Space for Open File	[ESC][RS] S	1BH 1EH 53H	none	296
Return Free Space for Partition	[ESC][RS] s	1BH 1EH 73H	none	296
Return Last File Command Status	[ESC][RS] ?	1BH 1EH 3FH	none	299
Close File	[ESC][RS] C	1BH 1EH 43H	none	297
Close All Files	[ESC][RS] K	1BH 1EH 4BH	none	297
Open File	[ESC][RS] O FileName<0>	1BH 1EH 4FH	none	295
Set/Clear File Attributes	[ESC][RS] A <Atb> FileName<0>	1BH 1EH 41H	none	298
Write File Data	[ESC][RS] W <L_L> <L_H> <data>	1BH 1EH 57H	none	300
Read File Data	[ESC][RS] R <L_L> <L_H>	1BH 1EH 52H	none	300
File Directory File	[ESC][RS] I	1BH 1EH 49H	none	300
Delete all Files in partition	[ESC][RS] E <p>	1BH 1EH 45H	none	301
De-fragment File system	[ESC][RS] F	1BH 1EH 46H	none	301
Verify File System	[ESC][RS] V	1BH 1EH 56H	none	302
Miscellaneous Commands				
Set left/right margins. N_1 = Left margin n_2 = Right margin	[ESC] X <n_1><n_2>	1BH 58H	none	229
Clear print buffer.	[CAN]	18H	&%RP	229
Query marker.	[ESC] q <n>	1BH 71H	none	230
Perform Auto Cut	[ESC] v	1BH 76H	&%FC	230
Initialize printer.	[ESC] @	1BH 40H	none	230
Inquire status. (Refer to command descriptions.)	[ENQ] <n>	05H	none	238
Activate Periodic Status back	[ESC] [EM] P <n>	1BH 19H 50H	none	249
Control Periodic Status back	[ESC] [EM] p <n>	1BH 19H 70H	none	249
User control of Bezel lamp	[ESC]~z	1BH 7EH 7AH	&%BF	232
Extended Diagnostics				
Set control feature commands.	[ESC] y <n>	1BH 79H	&%Y0 – 9 or &%YX<m1> <m2><m3> (for numbers >9)	233
Extended diagnostics.	[ESC] ~ <n>	1BH 7EH	none	234
Return Firmware Checksum	[ESC]~ Z	1BH 7EH 5AH	none	236
Return Firmware ID	[ESC]~ F	1BH 7EH 46H	none	236
Verify File System and Firmware	[ESC][RS] V	1BH 1EH 56H	none	302

Description	ASCII	Hex	IPCL equivalent code	Page
Enter Remote Down load	[ESC] ~ <14> %	1BH 7EH 0EH 25H	none	310

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 <n_1> <n_2> <n_3> ... <n_i> [NUL]
Hexadecimal	1BH 44H <n_1> <n_2> <n_3> ... <n_i> 00H
Decimal	<27> <68> <n_1> <n_2> <n_3> ... <n_i> <0>
IPCL	none
EPOS	[ESC] D <n_1> <n_2> <n_3> ... <n_i> 0

Description The [ESC] D <n_1> <n_2> <n_3> ... <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] [HT]<	Set a horizontal tab stop

ASCII	[ESC] [HT] <T_L> <T_H>
Hexadecimal	1BH 09H <T_L> <T_H>
Decimal	<27> <09> <T_L> <T_H>
IPCL	none
EPOS	none

Description With TrueType fonts, a fixed character width is not always possible because the characters are not always a consistent size. To allow better control over column alignment, this command will set tab stops based on dot columns. Up to 32 tab stops may be defined. If <T_L><T_H> are zero, all tab stops will be removed.

[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. i.e. 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> <n_1> <n_2> command sets the print position to <n_1> + <n_2> * 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 <m_1> <m_2> <m_3>
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	

Description 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	

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

[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 <n_1> <n_2> <n_3> ... <n_i> [NUL]
Hexadecimal	1BH 42H <n_1> <n_2> <n_3> ... <n_i> 00H
Decimal	<27> <66> <n_1> <n_2> <n_3> ... <n_i> <0>
IPCL	none
EPOS	[ESC] B <n_1> <n_2> <n_3> ... <n_i> 0

Description The [ESC] B <n_1> <n_2> <n_3> ... <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 <m_1> <m_2>
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 <m_1> <m_2>
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: The begin and end auto line feed command overrides the configuration setting.
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	Legacy Only

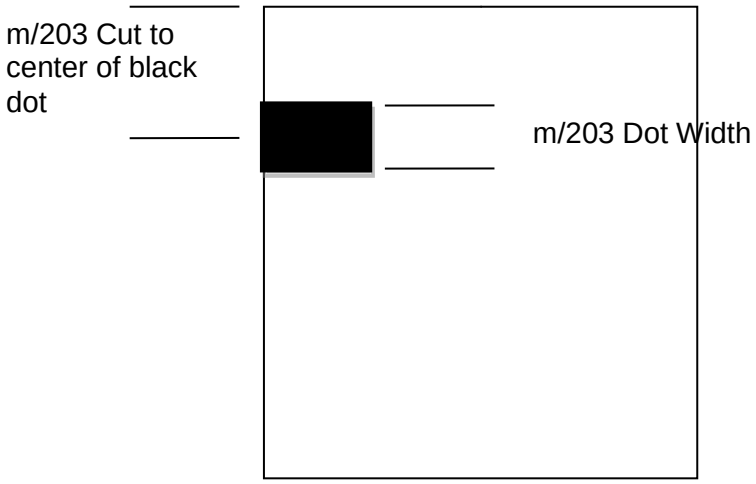
ASCII ESC ~ W <nl> <nh> <m>
Hexadecimal 1BH 7EH 57H <nl> <nh> <m>
Decimal <27> <126> <87> <nl> <nh> <m>

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 <d>	
Decimal	<27> <43> <73> <d>	
Range	d = 0, 4 – 72	

Description 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 <d>	
Decimal	<27> <43> <105> <d>	
Range	d = 0, 16 – 255	

Description 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 <d>	
Decimal	<27> <43> <74> <d>	
Range	d = 0, 4 – 72	

Description 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 characters will overlap. Variable spacing is recommended.

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	

Description The [ESC] + j 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] + 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] [SI] 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

<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	

Shaded selections are not recommended.

Table 4 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 effect 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 5 Inter-character Spacing

Character Font

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

ASCII	[ESC] # [NUL]
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: All characters printed by the Epic 880™ are generated from scalable fonts. All these mode selections configure the font rendering code to generate fonts that are approximately equivalent to the matrix sizes indicated.

[ESC] P	**Begin rotated font**

ASCII	[ESC] P <n>
Hexadecimal	1BH 50H <n>
Decimal	<27> <80> <n>
IPCL	&%RI {n=2}
&%RF {n=1}	
&%RN {n=0}	
EPOS	[ESC] V <n>

Description The [ESC] P <n> command sets the print font to a rotated 90° or 270° font.

Where n	n = 0	Normal
	n = 1	Rotate 90°
	n = 2	Rotate 270°

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.[6]

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

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

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 6 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 <m_1> <m_2> <m_3> <m_4>
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 <n_h> and <n_l>, e.g. (<n_h> * 256) +<n_l>. 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 affected.

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 7 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 <m_1>
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 <n>
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> <4> <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

	----xxxx	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 <n>
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 [NUL]
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.

[ESC] S <1>	Select subscript

ASCII	[ESC] S [SOH]
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.

[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 Enhancements

Page Mode

The Epic 880i supports two operational modes, standard and page mode[7]. 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 or [ESC] [SUB] t <x>command will start page definition and define the initial orientation. An [ESC] t or [ESC] [SUB] t <x> command during page definition will change the orientation and reset the entry location back to the top left corner of that orientation.

[7] Horizontal Color graphics is compatible with Page Mode. The left and right margin should be set to limit the raster length.

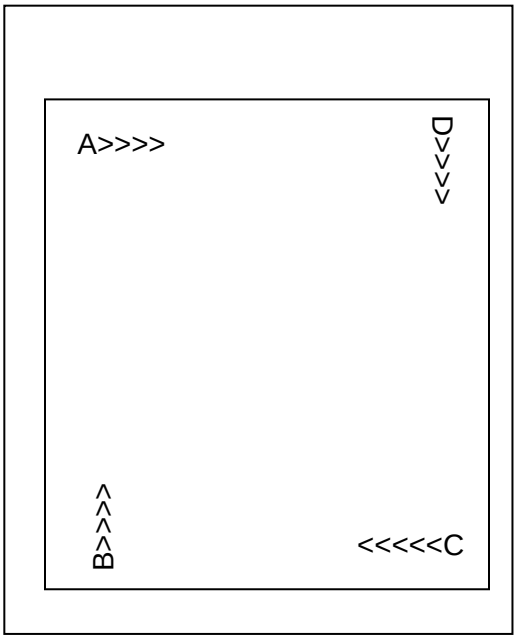


Figure 29 Page Mode Entry Orientations

The [ESC] u command wet the maximum page dimensions. Note that these dimensions are always based on 0 degree rotation.
Enter text and/or graphics as required.

Using Margins to position data
While in page mode the margins may be altered to position text or graphics as required. There are a number of page mode commands that make setting the margins easy in page mode.

Auto-cutter and page mode
You may embed an auto-cutter command within 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.

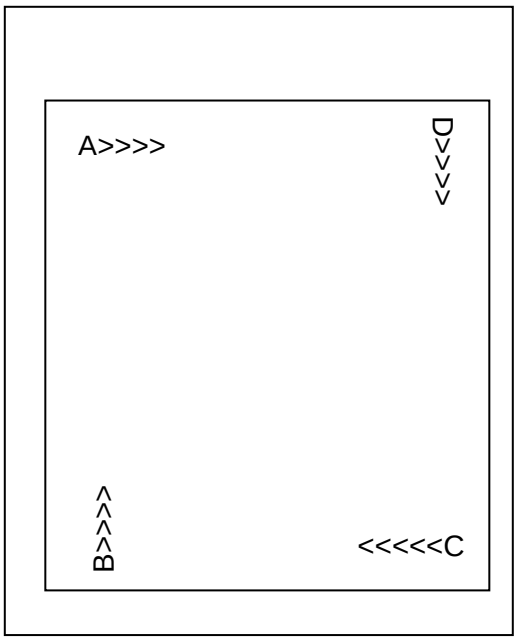
Page mode commands

Function	Select page mode	Enhanced
ASCII	[ESC] [SUB] t <x>	
Hexadecimal	1BH 1AH 74H <x>	
Decimal	<27> <26> <116> <x>	
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 6 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 Auto Size	Enhanced
ASCII	[ESC] [SUB] Z <n>	
Hexadecimal	1BH 1AH 5AH <n>	
Decimal	<27> <26> <90> <n>	
IPCL	**None**	
EPOS	None	

Description This command Sets page auto size mode. This command must be sent to the printer before page mode is started. It modifies the way page mode works only printing the Y direction of the page that is actually used. This allows a large page to be defined but only what is actually used to be printed. This is useful when the page data is dynamically generated and the page length is not known until all the data is generated.

Where: n = 1 to set auto page size and n = 0 to print the page length as defined.

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. This command will use the current state of the auto size feature provided auto size is set before page mode is started.

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.

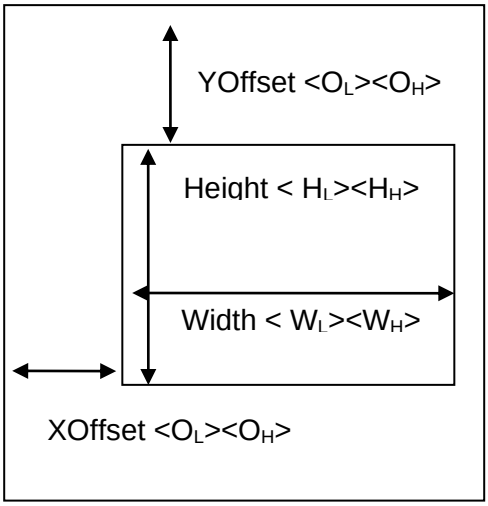


Figure 30 Page mode set printable area

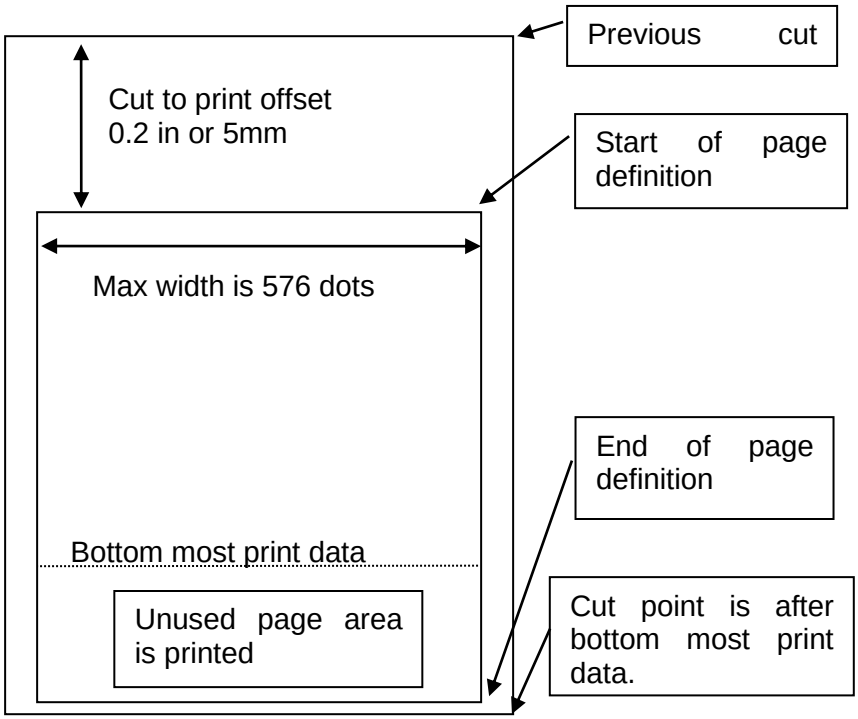


Figure 31 Default Page mode printed area

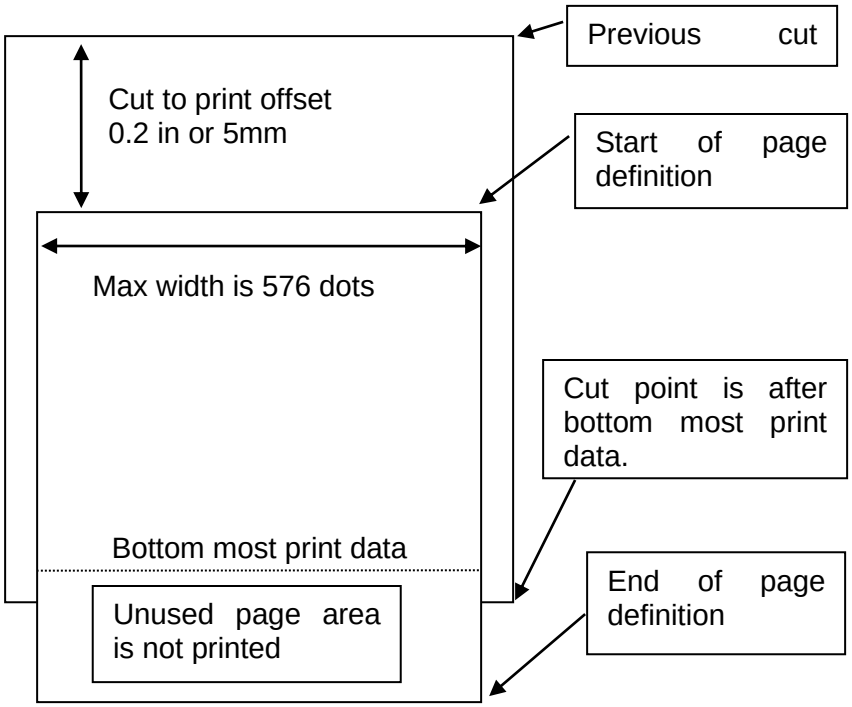


Figure 32 Default Page mode with Auto Size printed area

Function	Set Printed Area in Page Mode	Enhanced
ASCII	[ESC] [SUB] W <XOL><XOH><<YOL><YOH><WL><WH>< HL><HH>	
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 printer rather than only what is used. It will define sub pages however this command 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 the 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 auto sized by automatically resetting the auto size feature. The complete page is printed even if it's not used.

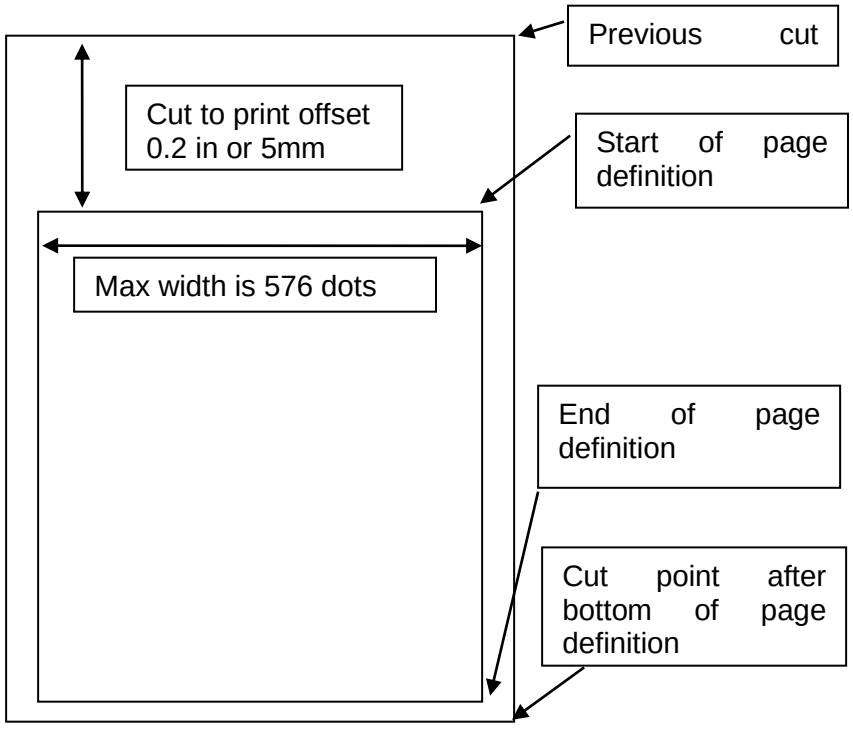


Figure 33 Defined Page mode printed area

Function	Set Page Mode Entry Position	Enhanced
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	Enhanced
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 Text Overlay	Enhanced
ASCII	[ESC] [SUB] O <n>	
Hexadecimal	1BH 1AH 4FH <n>	
Decimal	<27> <26> <79> <n>	
IPCL	None	
EPOS	None	

Description This command sets alters the way information is merged into the page. If Overlay mode is set is inactive new data placed on the page is logically or'ed with the existing data. If Overlay is active new information is exclusive or'ed with the existing data.

Note: This command is only active during page definition and has no effect in normal operation. It may be issued before or after entering page mode.
Note: When you exit page mode, the feature is turned off until reactivated.

Function	Set Page Mode Margins	Enhanced
ASCII	[ESC] [SUB] M <L_L> <L_H> <W_L> <W_H>	
Hexadecimal	1BH 1AH 4DH <L_L> <L_H> <W_L> <W_H>	
Decimal	<27> <26> <77> <L_L> <L_H> <W_L> <W_H>	
IPCL	None	
EPOS	None	

Description This command sets the print margins in dots. <L_L> <L_H> specify the left offset from the currently defined page and <W_L> <W_H> specify the width. Both are in dots. If <W_L> <W_H> is zero, the maximum width allowed by the current page is used.

Note: This command is active during page definition and redefining the page will set the margins to the edges of the page.
Note: This command is also active when not in page mode and will set the left and right margins based on dot columns.

Function	Clear Page Mode Page	Enhanced
ASCII	[ESC] [SUB] C	
Hexadecimal	1BH 1AH 43H	
Decimal	<27> <26> <67>	
IPCL	None	
EPOS	None	

Description This command clears the data in the currently active page area. It allows the complete page or a portion to be erased and allow additional information to be added without the previous information being included

Function	Print Page and Exit Page Mode
ASCII	[ESC][SUB] P
Hexadecimal	1BH 1AH 50H
Decimal	<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 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. The Over lay flag is reset and the Auto Size feature is set to the default. All other format changes are preserved.

Legacy Page mode commands

Function	Select page mode	Legacy Support
ASCII	[ESC] t <x>	
Hexadecimal	1BH 74H <x>	
Decimal	<27> <116> <x>	
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)

Function	Set Print Area in Page Mode	Legacy Support
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 6000)

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 y 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 5999/203 or 29 inches.
Note: The printed page length will only include what actually has print data.

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]
Hexadecimal	0CH
Decimal	<12>
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 <n_1> <n_2> command prints <n_1> + 256 * <n_2> 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 <n_1> <n_2> command prints <n_1> + 256 * <n_2> 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 <n_1> <n_2>
Hexadecimal 1BH 59H <n_1> <n_2>
Decimal <27> <89> <n_1> <n_2>
IPCL none

Description The [ESC] Y <n_1> <n_2> command prints <n_1> + 256 * <n_2> 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 <n_1> <n_2>
Hexadecimal 1BH 5AH <n_1> <n_2>
Decimal <27> <90> <n_1> <n_2>
IPCL none

Description The [ESC] Z <n_1> <n_2> command prints <n_1> + 256 * <n_2> 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> <n_1> <n_2>
Hexadecimal 1BH 2AH <m> <n_1> <n_2>
Decimal <27> <42> <m> <n_1> <n_2>
IPCL none

Description The [ESC] * <m> <n_1> <n_2> 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 [SOH]
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 [NUL]
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 barcode 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 <color> <length> <format> <data>
Decimal	<27> <104> <color> <length> <format> <data>
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> [NUL] [NUL]
Hexadecimal 1BH 2AH <m> 00H 00H
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 thorough 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>*
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…d*n:	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 its 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 16K[8] bytes long. All commands[9] 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.

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.

[8] The actual buffer is smaller because of the overhead.
[9] 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.

Begin/End Macro Without proceeding data

Function	Begin named macro record
ASCII	[ESC] [US] b <Name> [NUL]
Hexadecimal	1BH 1FH 62H <Name> 00H
Decimal	<27> <31> <98> <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 1449.

Function	End name macro record
ASCII	[ESC] [US] e <Name> [NUL]
Hexadecimal	1BH 1FH 65H <Name> 00H
Decimal	<27> <31> <101> <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 1449.

Function	Save macro data
ASCII	[ESC] [US] m <Name> [NUL]
Hexadecimal	1BH 1FH 6DH <Name> 00H
Decimal	<27> <31> <109> <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] l <Name> [NUL]
Hexadecimal	1BH 1FH 4CH <Name> 00H
Decimal	<27> <31> <76> <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 1449.

Function	**Flag as a start-up macro**
ASCII	[ESC] [US] s <Name> [NUL]
Hexadecimal	1BH 1FH 73H <Name> 00H
Decimal	<27> <31> <115> <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 1449.

Function	**Remove item from user store**
ASCII	[ESC] [US] e <Name> [NUL]
Hexadecimal	1BH 1FH 65H <Name> 00H
Decimal	<27> <31> <101> <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 1449.

Function	**Flush information from user store**	
ASCII	[ESC] [US] f ALL [NUL]	for Base User Store
or	[ESC] [US] f EXT [NUL]	for Extended User Store
Hexadecimal	1BH 1FH 66H 41H 4CH 4CH 00H	for Base User Store
or	1BH 1FH 66H 45H 58H 54H 00H	for Extended User Store
Decimal	<27> <31> <102> <65> <76> <76> <0>	for Base User Store
or	<27> <31> <102> <69> <88> <84> <0>	for 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 1449.

Function	Report on user store
ASCII	ESC] [US] q [NUL]
Hexadecimal	1BH 1FH 71H 00H
Decimal	<27> <31> <113> <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 1449.

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> [NUL]
Hexadecimal	1BH 1FH 62H <Name.mac> 00H
Decimal	<27> <31> <98> <Name.mac> <0>
IPCL	&%UB <Name.mac> <0>
EPOS	none

Description The [ESC] [US] b <Name.mac> <0> command erases the current macro, initializes the macro buffer structure, and redirects the following data to the macro buffer. It uses the <Name.mac> 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 1449.

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

Function	End named macro record
ASCII	[ESC] [US] e <Name.mac> [NUL]
Hexadecimal	1BH 1FH 65H <Name.mac> 00H
Decimal	<27> <31> <101> <Name.mac> <0>
IPCL	&%UG <Name.mac> <0>
EPOS	none

Description The [ESC] [US] e <Name.mac> <0> command ends the macro record operation and saves the macro to flash. It uses the <Name.mac> 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.mac> 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 1449.

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

Function	Save macro data in user store
ASCII	[ESC] [US] m <Name.mac> [NUL]
Hexadecimal	1BH 1FH 6DH <Name.mac> 00H
Decimal	<27> <31> <109> <Name.mac> <0>
IPCL	&%UM <Name.mac> <0>
EPOS	[GS] -…<Name.mac> <0> is from one to 15 characters and must be null terminated.

Description The [ESC] [US] m <Name.mac> <0> command saves the current macro buffer structure into the flash user-store area. It uses the <Name.mac> 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 1449.

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

Function	Load item from user store
ASCII	[ESC] [US] l <Name.mac> [NUL]
Hexadecimal	1BH 1FH 6CH <Name.mac> 00H
Decimal	<27> <31> <108> <Name.mac> <0>
IPCL	&%UL <Name.mac> <0>
EPOS	[GS] 0<Name.mac> <0> is from one to 15 characters and must be null terminated.

Description The [ESC] [US] l <Name.mac> <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 1449.

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

Function	Run macro data from user store
ASCII	[ESC] [US] r <Name.mac> [NUL]
Hexadecimal	1BH 1FH 72H <Name.mac> 00H
Decimal	<27> <31> <114> <Name.mac> <0>
IPCL	&%UR <Name.mac> <0>
EPOS	[GS] 0**<**Name.mac> <0> is from one to 15 characters and must be null terminated.

Description The [ESC] [US] r <Name.mac> <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 1449.

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

Function	Flag item as a start-up macro
ASCII	[ESC] [US] s <Name.mac> [NUL]
Hexadecimal	1BH 1FH 73H <Name.mac> 00H
Decimal	<27> <31> <115> <Name.mac> <0>
IPCL	&%US <Name.mac> <0>
EPOS	[GS] 0**<**Name.mac> <0> is from one to 15 characters and must be null terminated.

Description The [ESC] [US] s <Name.mac> <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 page1449

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> [NUL]
Hexadecimal	1BH 1FH 64H <Name.mac> 00H
Decimal	<27> <31> <100> <Name.mac> <0>
IPCL	&%UD <Name.mac> <0>
EPOS	[GS] 1 <Name.mac> <0> is from one to 15 characters and must be null terminated.

Description The [ESC] [US] d <Name.mac> <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 1449.

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

Function	Flush information from user store
ASCII	[ESC] [US] f ALL [NUL]
Hexadecimal	1BH 1FH 66H 41H 4CH 4CH 00H
Decimal	<27> <31> <102> <65> <76> <76> <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 1449.

Function	Report on user store	
ASCII	[ESC] [US] q [NUL]	Print a user store report
or	[ESC] [US] ? [NUL]	Return a formatted user store report
Hexadecimal	1BH 1FH 71H 00H	Print a user store report
or	1BH 1FH 3FH 00H	Return a formatted user store report
Decimal	<27> <31> <113> <0>	Print a user store report
or	<27> <31> <63> <0>	Return a formatted user store report
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 1449.

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 [NUL]
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 [SOH]
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 [STX]
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 [ETX]
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.

Legacy Barcodes

Function	Print barcode
ASCII	[ESC] b <n> {information} [ETX]
Hexadecimal	1BH 62H <n> {information} 03H
Decimal	<27> <98> <n> {information} <3>
IPCL	&%25 ... [CR] Interleaved 2 of 5
&%39 ... [CR]	Code 39
&%12 ... [CR]	Code 128
&%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 barcode. The barcode 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	Three sets of 106 different characters (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 (See description for full 128 character set support)
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.

Function	Set barcode height
ASCII	[ESC] [EM] B <n>
Hexadecimal	1BH 19H 42H <n>
Decimal	<27> <25> <66> <n>
IPCL	&%BH <m>

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

Function	Set barcode width
ASCII	[ESC] [EM] W <n>
Hexadecimal	1BH 19H 57H <n>
Decimal	<27> <25> <87> <n>
IPCL	&%BW <m>

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.

An alternate version of this command is available for Interleaved 2 of 5 barcodes. Interleave 2 of 5 sometimes require that the bar ratios be altered for unconventional barcode readers.

ASCII	[ESC] [EM] W <0> <narrow> <wide>
Hexadecimal	1BH 19H 57H <0> <narrow> <wide>
Decimal	<27> <25> <87> <0> <narrow> <wide>

Description The [ESC] [EM] w <0> <narrow> <wide> only affects the 2 of 5 barcode and sets the narrow bar width to <narrow> dots and the wide bar width to <wide> dots. If this command is used, the scale is set to 1 and the narrow and wide setting provide the scale. No error checking is performed when setting these values and invalid barcodes can be generated.

Function	**Set barcode 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 <m_1> <m_2>
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 barcode 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 barcode
	32	32	--10----	Printed below the barcode
	48	48	--11----	Printed above and below the barcode
			-x------	Vertical print mode. (Page mode may work better)
	0	00	-0------	Barcode printed in horizontal direction (default)
	64	64	-100----	Barcode printed in vertical direction

Note 1: The [ESC] [EM] J <n> command only affects barcode printing.
Note 2: HRI is not available in vertical print mode. You may print normal barcodes in page mode, which will provide for HRI as well as significantly longer barcodes.

Enhanced Barcodes

The Epic 880 printer is available with enhanced barcode generators. This enhanced barcode generator supports GS1 as well as additional 2D barcodes.

The Epic 880 printer offers a number of formats as defined below. The host does not need to form the graphic image for these barcodes. The host need only send the printer the information to be barcoded 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 barcode images, and the images are adjusted for ink bleed. In general, the barcodes generated by sending graphic data to the printer are not as readable as the barcodes the printer generates. Barcodes are printed at the printer's highest possible resolution for maximum readability.

In some products, barcodes may be printed horizontally or vertically. In printers that support page mode, barcodes may be placed in the page along with any other text or graphics.

Function	Print barcode	
ASCII	[ESC] b <n> {information} [NUL]	
Hexadecimal	1BH 62H <n> {information} 00H	
Decimal	<27> <98> <n> {information} <0>	
IPCL	&%25 ... [CR]	Interleaved 2 of 5
&%39 ... [CR]	Code 39	
&%12 ... [CR]	Code 128	
&%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	

Description The [ESC] b <n> {Bar Data} [NUL] command prints information as a barcode. The bar data is terminated with an [ETX], [CR], [LF] or [NUL].

An alternate Format is provided if control characters can be part of the barcode data.
The [ESC] b <n> <L_L> <L_H> {Bar Data} command prints information as a barcode.
The <L_L> <L_H> parameters make up a 16 bit length of bar data as follows:
Length = (L_H * 256) + L_L.

An alternate format is provided that allows only a single character length for some barcodes.
The [ESC] b <n> <L_L> {Bar Data} command prints information as a barcode.
The <L_L> parameters make up a 8 bit length of bar data as follows:
Length = L_L.

If a start code is to be specified, the following format may be required.
The [ESC] b <n> <S> {Bar Data} [NUL] command prints information as a barcode.
<S> indicates the start code and data up to the [NUL] is the bar data.

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)
2	Code 128	Three sets of 106 different characters
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 (16bit length) (See notes below)
10	PDF-417	2D alpha Numeric (NUL term.) (See notes below)
11	EAN-128	GS-1 code 128 Alpha Numeric
12	EAN-14	Numeric (0-9) only 13 digits
13	ITF-14	GS-1 Numeric (0-9) only 13 digits
18	RSS -14	See GS1 Databar barcode definitions below
19	RSS -14 Truncated	“
20	RSS Limited	“
21	RSS Stacked	“ No HRI will be printed
22	RSS Stacked Omni	“ No HRI will be printed
23	RSS Expanded	“
24	RSS Expanded Stacked	“ No HRI will be printed
25	QR Code	2D alpha Numeric (16bit length) (See notes below)
26	QR Code	2D alpha Numeric (NUL term.) (See notes below)
27	Data Matrix	2D alpha Numeric (16bit length) (See notes below)
28	Data Matrix	2D alpha Numeric (NUL term.) (See notes below)
29	Aztec	2D alpha Numeric (16bit length) (See notes below)
30	Aztec	2D alpha Numeric (NUL term.) (See notes below)
33	MicroPDF-417	2D alpha Numeric (16bit length) (See notes below)
34	MicroPDF-417	2D alpha Numeric (NUL term.) (See notes below)
36	Micro QR Code	2D alpha Numeric (16bit length) (See notes below)
37	Micro QR Code	2D alpha Numeric (NUL term.) (See notes below)
38	TruncatedPDF-417	2D alpha Numeric (16bit length) (See notes below)
39	TruncatedPDF-417	2D alpha Numeric (NUL term.) (See notes below)

COMPOSITE Barcodes

		Composite data	
64	Secondary Data	GS-1 Alpha Numeric (NUL term.)	
		Linear Barcode data	
65	UPC A	Numeric (0-9) only; 11 digits	
66	UPC E	Numeric (0-9) only; 11 digits	
67	EAN-8,13,14	Numeric (0-9) only; 7,12, or 13 digits	
68	EAN 128	GS-1 code 128 Alpha Numeric	
69	RSS -14	See GS1 Databar barcode definitions below	
70	RSS -14 Truncated	“	
71	RSS Limited	“	
72	RSS Expanded	“	
73	RSS Stacked	“	No HRI will be printed
74	RSS Stacked Omni	“	No HRI will be printed
75	RSS Expanded Stacked	“	No HRI will be printed

Note1: You may print barcodes in page mode. If you rotate these barcodes 90° or 180° you can get significantly longer barcodes.
Note2: A [CR], [LF] or [NUL] may also be used in place of the [NUL] to end the barcode data field.
Note 3: Only information that is usable in a particular barcode will be printed.

Barcodes and Code Pages

In ASCII mode the barcode data is not translated by the active code page. In general barcode data is numeric (0-9) or alpha numeric (0-9 and A-Z and in some cases a-z). Some barcodes support additional characters and are defined by the barcode specification.

Barcodes and Unicode

In Unicode mode, the printer can accept character values from 0 to 65535. In general barcode data is generally numeric (0-9) or alpha numeric (0-9 and A-Z) and are limited to values from 0-127. Some barcodes support additional characters as defined by the barcode specification, however, only character values from 0 to 255 will be used for barcodes. Any barcode character translations must be done by the host application. Depending on the Unicode mode, values from 128 to 255 may be required to be encoded in UTF before they are sent to the printer.

Note: Any values greater than 255 will be converted into a space (0x20).
Note: In UTF8 or UTF16 modes all data is assumed to be UTF encoded.

Linear Barcodes

Code-39 and Code-39 Extended

Function	Code-39
ASCII	[ESC] b <1> {information} [NUL]
Hexadecimal	1BH 62H 01H {information} 00H
Decimal	<27> <98> <1> {information} <0>

[ESC] b <1> TransAct [NUL]
Note: Case conversion to upper case.

Figure 34 Code 39 Example

Code 39 is an alphanumeric barcode. 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. 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).

Function	Code-39 Extended
ASCII	[ESC] b <1> <L> {information}
Hexadecimal	1BH 62H 01H <L> {information}
Decimal	<27> <98> <1> <L> {information}

[ESC] b <1> <8> TransAct
Note: Extended character support however the barcode is much denser and harder to read.

Figure 35 Code 39 Extended Example

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. i.e. [ESC] b <1> <L>… where L specifies the number of characters to follow and must be less than 32. The characters following the length may be from 0 to 127. Values greater than 127 are converted to printable characters by removing the 8th bit.

Note: In extended mode the printer will automatically convert extended characters to the character pair equivalent. The HRI will print the extended character not the character pair.

Control Codes

The following table specifies the Code 39 character set.

ASCII	Code
NUL	%U
SOH	$A
STX	$B
ETH	$C
EOT	$D
ENQ	$E
ACK	$F
BEL	$G
BS	$H
HT	$I
LF	$J
VT	$K
FF	$L
CR	$M
SO	$N
SI	$O
DLE	$P
DC1	$Q
DC2	$R
DC3	$S
DC4	$T
NAK	$U
SYN	$V
ETB	$W
CAN	$X
EM	$Y
SUB	$Z
ESC	%A
FS	%B
GS	%C
RS	%D
US	%E

ASCII	Code
SP	Space
!	/A
"	/B
#	/C
$	/D
%	/E
&	/F
'	/G
(	/H
)	/I
*	/J
+	/K
,	/L
-	-
.	.
/	/O
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
:	/Z
;	%F
<	%G
=	%H
>	%I
?	%J

ASCII	Code
@	%V
A	A
B	B
C	C
D	D
E	E
F	F
G	G
H	H
I	I
J	J
K	K
L	L
M	M
N	N
O	O
P	P
Q	Q
R	R
S	S
T	T
U	U
V	V
W	W
X	X
Y	Y
Z	Z
[	%K
\	%L
]	%M
^	%N
_	%O

ASCII	Code
`	%W
a	+A
b	+B
c	+C
d	+D
e	+E
f	+F
g	+G
h	+H
i	+I
j	+J
k	+K
l	+L
m	+M
n	+N
o	+O
p	+P
q	+Q
r	+R
s	+S
t	+T
u	+U
v	+V
w	+W
x	+X
y	+Y
z	+Z
{	%P
|	%Q
}	%R
~	%S
DEL	%T

Figure 36 Code 39 full 128 character encoding

Code 128 (Code-128(A, B, and C))

Code 128 is an alphanumeric barcode. 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 Printer 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} [NUL]

Function	Code 128 Manual Encoding
ASCII	[ESC] b <2> <Code> {information} [NUL]
Hexadecimal	1BH 62H 02H <Code> {information} 00H
Decimal	<27> <98> <2> <Code> {information} <0>

If the first character in the data field <Code> is a start code as shown in Figure 40 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 40.

Space is defined as a <0>, which makes programming difficult and causes control character conflicts for the printer. To solve this problem, the Printer subtracts 32 from all characters that are to be included in the barcode. 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 most cases, the Printer will generate the most compact barcode for you. However, if it is desirable to have complete control, the programmer should use manual mode.

[ESC] b <2> <137> <44> <66> <132> Parts [NUL]
Start with Code C, <44> is for character pair 12, <66> is for character pair 34, <132> shifts to Code B, then it’s followed with the characters “Parts” and the ending [NUL].

Figure 37 Code 128 Manual Encoding Example

Code 128 Encoding				Manual	
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
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

Code 128 Encoding				Manual	
Code Stick			Code 128 Value	Decimal Value	Hex Value
Code A	Code B	Code C			
\	\	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 38 Code 128 encoding values

Code 128 Auto Encoding

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

Function	Code 128 Automatic Encoding
ASCII	[ESC] b <2> <Length> {information}
Hexadecimal	1BH 62H 02H <Length> {information}
Decimal	<27> <98> <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. In this mode the exact data sent to the printer is encoded. There is no offset, function code, or shift code requirements.

For example: the following is printed in a mixture of code A and C encoding:

[ESC] b <2> <10> NUM 123456

Figure 39 Automatic Encoding Example

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.

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 possible numeric pairs will be encoded from Code stick C.

FNC1, FNC2, FNC3, and FNC4 may be encoded based on the table below. All other values will result in a barcode data error and the barcode will not be generated.

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

Figure 40 Code 128 FNC encoding

Interleaved 2 of 5 (Code 2 of 5)

Function	Interleaved 2 of 5
ASCII	[ESC] b <0> {information} [NUL]
Hexadecimal	1BH 62H 00H {information} 00H
Decimal	<27> <98> <0> {information} <0>

Interleaved 2 of 5 is a high-density, self-checking, continuous, numeric barcode. 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 Printer, it will be zero padded.

[ESC] b <0> 1234567890 [NUL]

Figure 41 Interleaved 2 of 5 Example

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 barcode 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. UPC A may include an EAN 2 or EAN 5 Addenda.

Function	UPC A
ASCII	[ESC] b <3> {information} [NUL]
Hexadecimal	1BH 62H 03H information} 00H
Decimal	<27> <98> <3> information} <0>

[ESC] b <3> 12345678901 [NUL]

UPC A with an EAN 2 Addenda

[ESC] b <3> 12345678901+12 [NUL]

UPC A with an EAN 5 Addenda

[ESC] b <3> 12345678901+12345 [NUL]

Figure 42 UPC A Examples

UPC E

UPC E is a zero suppression version of UPC. To allow the use of UPC barcodes on smaller packages where a full 12-digit barcode may not fit, a 'zero-compressed' version of UPC was called UPC-E. This barcode differs from UPC-A in that it only a 6-digit code is used, it does not use middle guard bars, and the end bit pattern is altered. UPC E requires that the first digit is zero for number system zero however; the printer does not enforce it. The printer does the compression based on the compression rules for UPC E, prints an UPC barcode based on the 11 digits sent to it, and generates the check digit. If fewer than 11 digits are sent leading zeros are added to form an 11 digit code. If the barcode does not meet the compression rules, invalid zero suppression digits are removed. UPC E may include an EAN 2 or EAN 5 Addenda.

Last digit	UPC-E equivalent is	UPC-A equivalent is
0	XXNNN0	0XX000-00NNN + check
1	XXNNN1	0XX100-00NNN + check
2	XXNNN2	0XX200-00NNN + check
3	XXXNN3	0XXX00-000NN + check
4	XXXXN4	0XXXX0-0000N + check
5	XXXXX5	0XXXXX-00005 + check
6	XXXXX6	0XXXXX-00006 + check
7	XXXXX7	0XXXXX-00007 + check
8	XXXXX8	0XXXXX-00008 + check
9	XXXXX9	0XXXXX-00009 + check

Figure 43 UPC E Zero Suppression Formats

Function	**UPC E**
ASCII	[ESC] b <5> {information} [NUL]
Hexadecimal	1BH 62H 05H {information} 00H
Decimal	<27> <98> <5> {information} <0>

[ESC] b <5> 01210000345 [NUL]

UPC E with an EAN 2 Addenda

[ESC] b <5> 01210000345+12 [NUL]

UPC E with an EAN 5 Addenda

[ESC] b <5> 01210000345+12345 [NUL]

Figure 44 UPC E Examples

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 barcode 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. EAN 13 may include an EAN 2 or EAN 5 Addenda.

Function	EAN-13
ASCII	[ESC] b <5> {information} [NUL]
Hexadecimal	1BH 62H 05H {information} 00H
Decimal	<27> <98> <5> {information} <0>

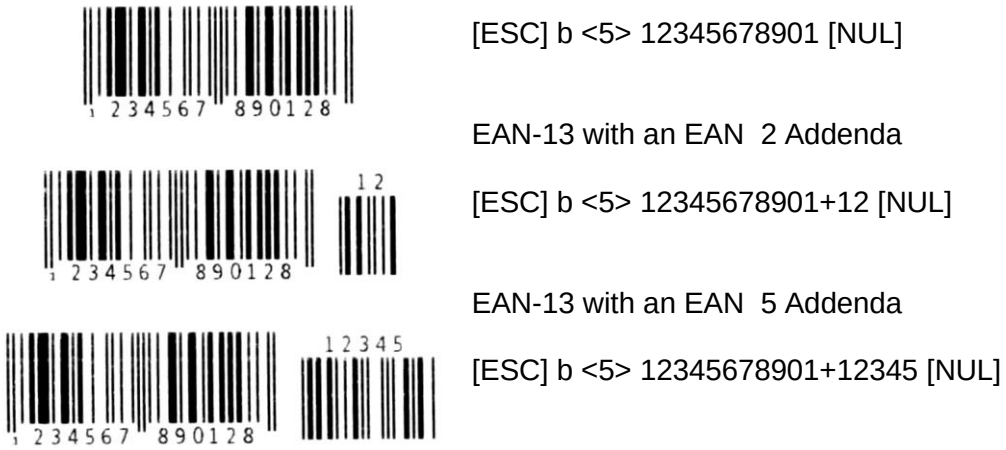


Figure 45 EAN 13 Examples

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 barcode 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. EAN 8 may include an EAN 2 or EAN 5 Addenda.

Function	**EAN-8**
ASCII	[ESC] b <6> {information} [NUL]
Hexadecimal	1BH 62H 06H {information} 00H
Decimal	<27> <98> <6> {information} <0>

[ESC] b <6> 1234567 [NUL]

EAN-8 with an EAN 2 Addenda

[ESC] b <6> 1234567+12 [NUL]

EAN-8 with an EAN 5 Addenda

[ESC] b <6> 1234567+12345 [NUL]

Figure 46 EAN 8 Examples

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.

Function	**EAN-14**
ASCII	[ESC] b <12> {information} [NUL]
Hexadecimal	1BH 62H 0CH {information} 00H
Decimal	<27> <98> <12> {information} <0>

[ESC] b <12> 0500123456789 [NUL]

Figure 47 EAN 14 Example

ITF-14
ITF-14 is the GS1 formatted Interleaved 2 of 5 barcode. It is intended to encode a Global Trade Item Number. The ITF-14 will always encode 13 input digits and adds a 14th check digit.

Function	ITF-14
ASCII	[ESC] b <13> {information} [NUL]
Hexadecimal	1BH 62H 0DH {information} 00H
Decimal	<27> <98> <13> {information} <0>

[ESC] b <13> 0500123456789 [NUL]

Figure 48 ITF-14 Example

NOTE: ITF-14 is generally printed with a surrounding box, however it is not mandatory and the Printer does not add it.

EAN 2 and EAN 5 Addenda barcodes

EAN2 and EAN 5 Addenda barcodes are used to add additional information to several barcodes. The Addenda field is either 2 or 5 characters. The size of the Addenda will automatically be generated based on the size of the data supplied.

Add on data will only be accepted by barcodes that support it. To add Addenda data, append the linear barcode data with a "+" and the numeric Addenda data field. The top image below shows an EAN 2 added to a standard UPC A barcode and the bottom image is an EAN 5 added to the same UPC A barcode.

Figure 49 EAN 2 and EAN 5 Addendas

Code 93

Code 93 is a variable-length, alphanumeric barcode. The complete data field is printed by the printer. Due to space limitations, only 10 or 11 characters can be printed.

Function	Code 93
ASCII	[ESC] b <7> {information} [NUL]
Hexadecimal	1BH 62H 07H {information} 00H
Decimal	<27> <98> <7> {information} <0>

[ESC] b <7> Code-93 [NUL]

Figure 50 Code 93 Example

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. If the first character is 1 to 31 it will be used as the length. Note: If the first and last characters are not a start or stop code, Code A will be added.

Function	Codabar
ASCII	[ESC] b <8> {information} [NUL]
Hexadecimal	1BH 62H 08H {information} 00H
Decimal	<27> <98> <8> {information} <0>

[ESC] b <8> $27.50 [NUL]
As Start and Stop are not specified, start and stop A has been added.

Figure 51 Codabar Example

DataBar (RSS) GS-1 barcodes

The Reduced Space Symbology (RSS) barcodes are intended to encode 14 digit fields and is intended to replace UPC barcodes in the Retail industry. In February 2007 the GS1 organization took over control of the RSS barcodes and renamed them DataBar. RSS barcodes use 6 variable bar and space widths to encode the value. Because of the width encoding, a single scaling factor is used to adjust the barcode. The wide and narrow bar settings are not used. Non-stacked barcodes will use the height setting however, stacked versions have specific height to width ratio requirements and will adjust the ratios to fit in the selected height. The scale factor will also be used but will only affect the width.

All RSS barcodes are encoded with awareness of the GS-1 General specification for AI and AI field requirements. In some cases, not all possible character sequences are allowed in an AI field and many are fixed length. In some cases, AI fields contain check digits and during the encoding process they are removed. When specifying AI fields with check digits the check digit must be passed to the Printer. In some cases, it is used and in others it is removed and replaced by the reader. The Printer will make some attempt to verify the format, however only critical data that would prevent encoding the data is actually checked by the printer. It's up to the application programmer to format the data in accordance with the GS-1 specification.

RSS barcodes may get excessively large. The printer will attempt to generate a barcode that is the requested size but will automatically shrink the barcode scale if it will not fit in the print zone. This may result in elements that are too small to print reliably. If that happens the printer will not fault but will slow the print process and print the barcode anyway. In general barcodes with a single dot wide element are unreadable.

There are several versions or formats of RSS barcodes and each has specific options and requirements.

GS1-Databar-14 (GS1-Databar-Omni-directional)

RSS-14 (GS-1 DataBar Omni-directional) encodes the full 14 digit EAN.UCC[10] item identification in a symbol that can be omni-directionally read. For example:

Figure 52 RSS-14 symbol representing (01)20012345678909

Where the leading (01) is the implied application identifier and is not encoded in the symbol. The last digit, 9, is not directly encoded in the symbol, but is a calculated mod 10 check digit. The (01) and the last digit are not sent as part of the command so the data field would therefore be “2001234567890”

Function	**GS1-Databar 14**
ASCII	[ESC] b <18> {information} [NUL]
Hexadecimal	1BH 62H 12H {information} 00H
Decimal	<27> <98> <18> {information} <0>

[ESC] b <18> 1234567890123 [NUL]

Figure 53 GS1-Databar 14 Example

Note: The data to be encoded does not include the GS1 format [01] as it is implied. You only need to send the 13 digit item number. The check digit will be generated by the printer.

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RSS-14 is capable of encoding $2x10^{13}$ values. These values are expressed as 14 digits. The first digit is a linkage flag, followed by 13 data digits. The 13 data characters plus the check digit form the 14 digit identification number including the leading indicator digit. Values 10,000,000,000,000 and above indicate that the linkage flag is set and therefore a 2D component is present. That is 10,001,234,567,890 encodes as 00012345678905 with a linkage flag of 1.

[10] The 14 digit field is not a simple sequence of digits but must follow EAN.UCC conventions and the GS-1 General specification.

GS1-Databar-Truncated

GS1-Databar truncated is a more compact version of the GS1-Databar and will encode the full 14 digit EAN.UCC item identification but using less vertical height. The specification defines the truncated version to be 13 times the X dimension, however, the height of the barcodes can be set by the configuration commands. The GS1-Databar truncated version printed by the Printer is simply ½ the height of the standard GS-1 DataBar symbol.

Function	GS1-Databar 14 Truncated
ASCII	[ESC] b <19> {information} [NUL]
Hexadecimal	1BH 62H 13H {information} 00H
Decimal	<27> <98> <19> {information} <0>

[ESC] b <19> 1234567890123 [NUL]

Figure 54 GS1-Databar 14 Truncated Example

Note: The data to be encoded does not include the GS1 format [01] as it is implied. You only need to send the 13 digit item number. The check digit will be generated by the printer.

GS1-Databar-14 Stacked and GS1-Databar-14 Stacked-Omni

GS1-Databar-14 Stacked and GS1-Databar-14 Stacked Omni-directional are RSS-14 barcodes printed in a stacked format. The ratios between the top and bottom of this symbol are fixed and are not adjustable. There is also a separator between the barcodes that has a specific relationship to the top and bottom bars. This barcode must be printed within a controlled aspect ratio. GS1-Databar Stacked symbols are typically printed without HRI. To allow HRI to be printed if required the Stacked HRI may be enabled with a special configuration command.

Function	GS1-Databar 14 Stacked
ASCII	[ESC] b <21> {information} [NUL]
Hexadecimal	1BH 62H 15H {information} 00H
Decimal	<27> <98> <21> {information} <0>

[ESC] b <21> 1234567890123 [NUL]

Figure 55 GS1-Databar 14 Stacked Example

GS1-Databar-14 Stacked Omni-directional is specified to be printer with a greater height than the GS1-Databar-14 Stacked by a factor of 3. As the height of the symbol may be specified by command, the GS1-Databar-14 Stacked Omni-directional symbol will be printed 3 times the GS1-Databar-14 Stacked symbol.

Function	GS1-Databar 14 Stacked-Omni
ASCII	[ESC] b <22> {information} [NUL]
Hexadecimal	1BH 62H 16H {information} 00H
Decimal	<27> <98> <22> {information} <0>

[ESC] b <22> 1234567890123 [NUL]

Figure 56 GS1-Databar 14 Stacked Omni Example

Note: The data to be encoded does not include the GS1 format [01] as it is implied. You only need to send the 13 digit item number. The check digit will be generated by the printer.

GS1-Databar-Limited

RSS Limited (GS-1 DataBar Limited) encodes a 14 digit EAN.UCC item identification with an indicator digit of 0 or 1 in a small symbol that is not intended to be scanned. As the indicator can only be 0 or 1, the barcode must start with 0 or 1 or it is invalid.

Function	GS1-Databar Limited
ASCII	[ESC] b <20> {information} [NUL]
Hexadecimal	1BH 62H 14H {information} 00H
Decimal	<27> <98> <20> {information} <0>

[ESC] b <20> 1234567890123 [NUL]

Figure 57 GS1-Databar Limited Example

Note: The data to be encoded does not include the GS1 format [01] as it is implied. You only need to send the 13 digit item number. The check digit will be generated by the printer.

GS1-Databar-Expanded

RSS Expanded (GS-1 DataBar Expanded) encodes the EAN.UCC item identification plus supplementary element strings such as weight and date in a symbol that can be omni-directionally scanned.

Function	GS1-Databar Expanded
ASCII	[ESC] b <23> {information} [NUL]
Hexadecimal	1BH 62H 17H {information} 00H
Decimal	<27> <98> <23> {information} <0>

[ESC] b <23> [01] 12345678901234 [11] 100909 [30] 123456 [NUL]

Figure 58 GS1-Databar Expanded Example

Note: The data for expanded RSS barcodes must be formatted using AI fields as defined by the GS-1 specification and comply with the EAN.UCC format. The GS-1 ISO/IEC 24724 standard specifies these formats.
Note: It is possible to define an RSS Expanded barcode that will not fit in the print zone of the Printer. If this occurs, the printer will attempt to scale the barcode to fit. If the scaling fails, the barcode may be unreadable.

GS1-Databar-Expanded Stacked

RSS Expanded Stacked (GS-1 DataBar Expanded Stacked) encodes the EAN.UCC item identification plus supplementary element strings such as weight and date in a stacked symbol that can be omni-directionally scanned. The ratios between the top and bottom of this symbol are fixed and are not adjustable. There is also a separator between the barcodes that has a specific relationship to the top and bottom bars. This barcode must be printed within a controlled aspect ratio. GS1-Databar Stacked symbols are typically printed without HRI. To allow HRI to be printed if required the Stacked HRI may be enabled with a special configuration command.

Function	GS1-Databar Expanded Stacked
ASCII	[ESC] b <24> {information} [NUL]
Hexadecimal	1BH 62H 18H {information} 00H
Decimal	<27> <98> <24> {information} <0>

[ESC] b <24> [01] 12345678901234 [11] 100909 [30] 123456 [NUL]

Figure 59 GS1-Databar Expanded Stacked Example

EAN-128 (GS1-128)

The GS1-128 BarCode has been designed through joint co-operation between GS1 and Automatic Identification Manufacturers, Inc. (AIM). The GS1-128 barcode is a subset of the more general Code 128 barcode. By agreement between AIM, Inc. and GS1, use of the Function 1 Symbol Character (FNC1) in Code 128 Symbols in the first symbol character position following the Start Character has been reserved exclusively for the GS1 System.

The Printer provides a GS-1 coded input to the barcode and encodes all the EAN-128 requirements into the data.

Function	**GS1-128**
ASCII	[ESC] b <11> {information} [NUL]
Hexadecimal	1BH 62H 0BH {information} 00H
Decimal	<27> <98> <11> {information} <0>

[ESC] b <11> [01] 12345678901234 [11] 100909 [30] 123456 [NUL]

Figure 60 GS1-128 Example

Note: The data for GS1-128 barcodes must be formatted using AI fields as defined by the GS-1 specification and comply with the EAN.UCC format. The GS-1 ISO/IEC 24724 standard specifies these formats.

2D Barcodes

The Printer supports a number of 2D and stacked barcodes. The terms stacked barcode or multi-row barcode code are more accurately applied to those barcodes made up of a series of one-dimensional barcodes. The term Matrix code generally applies to 2-D codes that code the data based on the position of black spots within a matrix. Each black element is the same dimension and it is the position of the element that encodes the data.

Note: When printing 2D barcodes HRI (Human Readable Information) is generally not used. The Printer Supports HRI when printing 2D barcodes but makes no attempt to align the text with the barcode.
Note: Space between the barcode and any HRI if active is controlled by the printer. If HRI is not active, the same white spacing is used. It is up to the user to enforce a quite zone between the barcode and any user data.

PDF 417, Truncated PDF417 and Micro PDF 417

PDF 417, Truncated PDF417 and Micro PDF 417 are 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.

PDF 417

Large amounts of text and data can be encoded when using the PDF417 barcodes. The printed symbol consists of several linear rows of stacked code words. Each codeword represents 1 of 929 possible values from one of three different clusters. A different cluster is chosen for each row, repeating after every three rows. Because the code words in each cluster are unique, the scanner is able to determine what line each cluster is from.

PDF417 uses Reed Solomon error correction instead of check digits. This error correction allows the symbol to endure some damage without causing loss of data. AIM standards recommend a minimum error correction level of 2.

The X dimension is the width of the narrowest bar in a printed codeword. The Y dimension is the height of each row within the PDF417 symbol. The PDF417 barcode is usually printed at an X to Y ratio of 1:2 to 1:5. The Printer defaults to a 1:ratio. By lowering the ratio, a significant amount of space can be saved; however, some scanners cannot read X to Y ratios of less than 1:3.

The form of the command is as follows:

Function	PDF 417
ASCII	[ESC] b <9> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 09H <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <9> <nL> <nH> <d_1> … <d_n>

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

Alternate Command

Function	PDF 417
ASCII	[ESC] b <10> {information} [NUL]
Hexadecimal	1BH 62H 0AH {information} 00H
Decimal	<27> <98> <10> {information} <0>

[ESC] b <10> TransAct Technologies Inc. [NUL]

Figure 61 PDF 417 Example

Truncated PDF 417

Truncated PDF417 is two-dimensional (2D), multi-row barcode, derived from PDF417. A truncated PDF417 symbol uses less area than the normal PDF417 barcode as the right hand side of the symbol is removed or truncated. This option should be used where damage to the barcode is unlikely as it is not as easily read ad normal PDF417.

The form of the command is as follows:

Function	Truncated PDF 417
ASCII	[ESC] b <38> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 26H <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <38> <nL> <nH> <d_1> … <d_n>

Where the data length is (nH * 256) + nL. The length is limited to be from 1 to 150 characters.

Alternate Command

Function	Truncated PDF 417
ASCII	[ESC] b <39> {information} [NUL]
Hexadecimal	1BH 62H 27H {information} 00H
Decimal	<27> <98> <39> {information} <0>

[ESC] b <39> TransAct Technologies Inc. [NUL]

Figure 62 Truncated PDF 417 Example

Note: Micro PDF 417 shares a control table with PDF417 however the right side is removed.

Note: The PDF417 specification does not reference GS-1 formatting; However, GS-1 encoding may be activated for both Standard and Truncated PDF417. There is no indicator in the barcode that indicates that GS1 is active. If GS-1 formatting is used it's up to the user to recognize that GS1 is active and decode the barcode as GS1 data.

Note: The printer has a limited print zone and the amount of data that may be contained in a PDF417 barcode is large. The height of the PDF 417 barcode may be limited by the internal size of the row buffer rather than the PDF417 generator.

Micro PDF 417

MicroPDF417 is two-dimensional (2D), multi-row barcode, derived from PDF417. Micro PFD417 can encode up to 150 bytes. Micro-PDF417 is designed for applications requiring improved area efficiency.

The form of the command is as follows:

Function	Micro PDF 417
ASCII	[ESC] b <33> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 21H <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <33> <nL ><nH> <d_1> … <d_n>

Where the data length is (nH * 256) + nL. The length is limited to be from 1 to 150 characters.

Alternate Command

Function	Micro PDF 417
ASCII	[ESC] b <34> {information} [NUL]
Hexadecimal	1BH 62H 22H {information} 00H
Decimal	<27> <98> <34> {information} <0>

[ESC] b <34> TransAct Technologies Inc. [NUL]

Figure 63 Micro PDF 417 Example

Note: Micro PDF 417 shares a control table with PDF417. PDF417 allows the columns to be set from 1 to 30, however Micro PDF417 only allows 1-4. (0 will auto set the columns) If the columns are set out of range, it will be limited to 4.

Note: The encryption level cannot be changed for Micro PDF 417.

Note: MicroPDF417 is used for composite barcodes which use GS1 formatting. When used for composite barcodes GS1 encoding is active.

Note: The PDF417 and Micro PDF 417 specifications do not reference GS-1 formatting; However, GS-1 encoding may be activated for MicroPDF417. There is no indicator in the barcode that indicates that GS1 is active. If GS-1 formatting is used it's up to the user to recognize that GS1 is active and decode the barcode as GS1 data.

Data Matrix Barcode

This is a 2-D matrix symbology barcode that can encode numeric or alphanumeric data and includes error correction. There are 4 original error correction ECC-000 – ECC-140 as well as the standard Reed-Solomon ECC-200 error correction. Most current scanners only support ECC-200. In theory 3116 numeric and 2335 characters can be encoded in Data Matrix. From a practical point of view the limited print width of the Printer limits the maximum size of the barcode.

The Data Matrix barcode matrix may be square or rectangular and only specific sizes are allowed. You may select a size and you may limit the selection to square only, however, if you limit the size, you must leave enough room for the data or the printer will automatically select a larger matrix. The commands to control 2 dimensional barcode options start on page 207.

Data Matrix Encoding

As referred to above, there are 2 basic encoding schemes defined for Data Matrix barcodes; ECC 000 – 140 and ECC 200. ECC 200 which uses Reed-Solomon error correction and is recommended for all new applications. ECC 000 - 140 is the older system and only supported by a few older scanners. As ECC200 is the recommended encoding, it is the only version supported by the Printer.

Data Matrix ECC200

ECC200 is actually 6 encoding schemes. The data to be encoded is scanned and the optimal encoding scheme or combination of schemes is used to encode the symbol. The resulting encoded data is then processed with the Reed-Solomon error correction algorithm and the resulting information is formatted into a Data Matrix barcode.

Note: The ISO/IEC 16022:2006 specification defines how the ECC200 encoding schemes are to be evoked, however in some cases the resulting size of the compressed data is identical with 2 or more different encoding sequences. The ISO standard is followed by the Printer however it is possible that other generators will generate different barcode patterns that are equivalent.

Encoding scheme	Characters	Bits per data character
ASCII	double digit numerics	4
	ASCII values 0 - 127	8
	Extended ASCII values 128 - 255	16
C40	Upper-case alphanumeric	5,33
	Lower case and special characters	10,66*
Text	Lower-case alphanumeric	5,33
	Upper case and special characters	10,66**
X12	ANSI X12 EDI data set	5,33
EDIFACT	ASCII values 32 - 94	6
Base 256	All byte values 0 - 255	8
* encoded as two C40 values as result of use of a shift character		
** encoded as two Text values as result of use of a shift character		

Table 8 Encoding schemes for ECC 200

Data Matrix barcodes are fixed sizes and depending on how the data compresses, two different strings with the same character count may print different size barcodes. It is possible to select a minimum barcode size and unused data locations will be filled with pad data.

Data Matrix Commands

There are two version of the command, one is null terminated and the other allows a length to be specified (Note that the length is a two byte field as the symbol may contain more than 256 characters.

Function	Data Matrix
ASCII	[ESC] b <28> {information} [NUL]
Hexadecimal	1BH 62H 1CH {information} 00H
Decimal	<27> <98> <28> {information} <0>

Function	Data Matrix
ASCII	[ESC] b <27> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 1BH <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <27> <nL> <nH> <d_1> … <d_n>

Note: The normal Select barcode Width and Select Barcode height commands do not affect Data matrix barcodes. The rules governing how the barcode is printed do not allow variations in the aspect ratios. There are Data Matrix control commands that will allow some control over how the barcode is printed.

[ESC] b <28> TransAct Technologies Inc. 20 Bomax Drive, Ithaca New York [NUL]

Figure 64 Data Matrix Example

Testing Data Matrix barcodes

There is a special reference symbol that is useful for control testing. It is a 16 x 16 ECC 200 symbol and can be printed which encodes the data “30Q324343430794<OQQ”. As shown in the figure below. This reference symbol has a region of parallel bars and spaces which can be linearly scanned and then evaluated for print growth using the edge-measurement methodologies of ISO/IEC 15416.

Figure 65 ECC 200 reference symbol encoding "30Q324343430794<OQQ"

Refer to the ISO/IEC 16022:2006 standard for more information.

QR Code

QR Code is a 2D barcode readable by QR scanners, mobile phones and smart phones with a camera. The code consists of black modules arranged in a square pattern on white background. The information encoded can be most any text data.

Although initially used for tracking parts in vehicle manufacturing, QR Codes are now used in a much broader context, including both commercial tracking applications and convenience-oriented applications aimed at mobile phone users (known as mobile tagging). Denso Wave, Inc. invented the QR Code Barcode. The word “QR Code” is a registered trademark of DENSO WAVE INCORPORATED. This registered trademark applies only for the word “QR Code”, and not for the QR Code pattern or image.

QR Codes storing addresses and URLs may appear in magazines, on signs, buses, business cards, retail receipts, or on just about any object about which users might need information. Users with a camera phone equipped with the correct reader application can scan the image of the QR Code to display text, contact information, connect to a wireless network, or open a web page in the phone's browser. This act of linking from physical world objects is known as a hard link or physical world hyperlinks.

QR Code data Capacity

Numeric only	Max. 7,089 characters
Alphanumeric	Max. 4,296 characters
Binary (8 bits)	Max. 2,953 bytes
Kanji/Kana	Max. 1,817 characters

Note: At this time Kanji and Katakana are not supported by the Printer
QR codes use the Reed–Solomon error correction and the error correction capacity may be adjusted.

Error correction

Level L	7% of code words can be restored.
Level M	15% of code words can be restored.
Level Q	25% of code words can be restored.
Level H	30% of code words can be restored.

If numeric data is used, the barcode generator will optimize the barcode generation for numeric data. In Alpha numeric mode the printer will encode 0-9, A-Z, space, %, *, +, -, .,/ and :.

Figure 66 QR Code Symbol

Encoding: TransAct Technologies Inc. 20 Bomax Drive, Ithaca New York

Figure 67 QR Code Symbol for a URL

Encoding: www.transact-tech.com

QR Code Commands

There are two version of the command, one is null terminated and the other allows a length to be specified (Note that the length is a two byte field as the symbol may contain more than 256 characters.

Function	QR Code
ASCII	[ESC] b <26> {information} [NUL]
Hexadecimal	1BH 62H 1AH {information} 00H
Decimal	<27> <98> <26> {information} <0>

Function	QR Code
ASCII	[ESC] b <25> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 19H <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <25> <nL> <nH> <d_1> … <d_n>

[ESC] b <26> TransAct Technologies Inc. 20 Bomax Drive, Ithaca New York [NUL]

Figure 68 Data QR Code Example

Note: The normal Select barcode Width and Select Barcode height commands do not affect QR Code barcodes. The rules governing how the barcode is printed do not allow variations in the aspect ratios. There are QR Code control commands that will allow some control over how the barcode is printed.

Note: QR Code Model 1 is obsolete, only Model 2 is supported.

Micro QR Code

Micro QR Code is a 2D barcode readable by most QR scanners, mobile phones and smart phones with a camera. The code is similar to QR code although is restricted to 35 characters

Numeric only	Max. 35 characters
Alphanumeric	Max. 21 characters
Binary (8 bits)	Max. 15 bytes
Kanji/Kana	Max. 9 characters

Note: The number of characters is also affected by the error correction. The above assumes the default level L is used.
Note: Lower case alpha is processed as binary data. URL information works best in upper case.
Note: At this time Kanji and Katakana are not supported by the Printer

Micro QR Code is controlled by the same commands as QR code. Error correction level H is not available as the number of correction characters would exceed the input length.

Micro QR Code Commands

There are two version of the command, one is null terminated and the other allows a length to be specified (Note that the length is a two byte field as the symbol may contain more than 256 characters.

Function	Micro QR Code
ASCII	[ESC] b <37> {information} [NUL]
Hexadecimal	1BH 62H 25H {information} 00H
Decimal	<27> <98> <37> {information} <0>

Function	Micro QR Code
ASCII	[ESC] b <36> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 24H <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <36> <nL> <nH> <d_1> … <d_n>

[ESC] b <37> WWW.TRANSACT-TECH.COM [NUL]

Figure 69 Data Micro QR Code Example

Note: The normal Select barcode Width and Select Barcode height commands do not affect Micro QR Code barcodes. The rules governing how the barcode is printed do not allow variations in the aspect ratios. The QR Code control commands that will allow some control over how the barcode is printed.

Aztec
The symbol is built on a square grid with a bulls-eye pattern at its center for locating the code. Data is encoded in concentric square rings around the bulls-eye pattern. The central bulls-eye is 9×9 or 13×13 pixels, and one row of pixels around that encodes basic coding parameters, producing a "core" of 11×11 or 15×15 squares. Data is added in "layers", each one containing 2 rings of pixels, giving total sizes of 15×15, 19×19, 23×23, and so on.

The corners of the core include orientation marks, allowing the code to be read if rotated or reflected. Decoding begins at the corner with three black pixels, and proceeds clockwise to the corners with two, one and zero black pixels. The variable pixels in the central core encode the size, so it is not necessary to mark the boundary of the code with a blank "quiet zone", although some barcode readers require one.

The compact Aztec code core supports symbols from 15×15 (room for 13 digits or 12 letters) through 27×27. There is additionally a special 11×11 "rune" that encodes one byte of information. The full core supports sizes up to 151x151, which can encode 3832 digits, 3067 letters, or 1914 bytes of data.

The level of Reed–Solomon error correction is used for Aztec and the Printer is configurable, to 10%, 23%, 36% or 50% of the data region. The recommended level is 23%.

Aztec Code Standard is ISO/IEC 24778 (published February 2008)
All 8-bit values can be encoded. The default interpretation for values 1[11]–127 is ASCII and for values 128–255, ISO 8859-1

Figure 70 Aztec Symbol

Encoding: TransAct Technologies Inc. 20 Bomax Drive, Ithaca New York

[11] The Aztec Standard allows values from 0 through 255. However, at this time the Printer will not handle a NUL,

Aztec Commands

There are two version of the command, one is null terminated and the other allows a length to be specified (Note that the length is a two byte field as the symbol may contain more than 256 characters.

Function	Aztec
ASCII	[ESC] b <30> {information} [NUL]
Hexadecimal	1BH 62H 1EH {information} 00H
Decimal	<27> <98> <30> {information} <0>

Function	Aztec
ASCII	[ESC] b <29> <nL> <nH> <d_1> … <d_n>
Hexadecimal	1BH 62H 1DH <nL> <nH> <d_1> … <d_n>
Decimal	<27> <98> <29> <nL> <nH> <d_1> … <d_n>

[ESC] b <30> TransAct Technologies Inc. 20 Bomax Drive, Ithaca New York [NUL]

Figure 71 Data Aztec Example

Note: The normal Select barcode Width and Select Barcode height commands do not affect Aztec barcodes. The rules governing how the barcode is printed do not allow variations in the aspect ratios. There are Aztec control commands that will allow some control over how the barcode is printed.

Composite Barcodes

GS1 Composite barcode consists of a linear component, that encodes the item's primary data and an adjacent 2D composite component, that encodes supplementary data.

The linear component will be EAN GS1-128, EAN-8, EAN-13, UPC-A, UPC-E or any barcode in the Databar group.

The supplementary, 2D composite component will be one of the following:
Composite Code A barcode, which is derived from the MicroPDF417 specification, for EAN-8, EAN-13, UPC-A, UPC-E, GS1 DataBar barcodes or
Composite Code C barcode, which is derived from the PDF417 standard GS1-128 (EAN-128) barcodes.

MicroPDF417 barcodes are assigned a specific matrix of row/column combinations. This matrix limits the amount of data that may be encoded in 2D composites. The 2D composites can encode up to 56 numeric characters. Alpha characters and certain punctuation characters may also be encoded in the composite, but the maximum number of characters that can be encoded will be reduced significantly.

The composite component is referred to as the CC component and may be encoded as CC-A, CC-B or CC-C

- CC-A: a variant of MicroPDF417
- CC-B: a MicroPDF417 symbol with new encoding rules
- CC-C: Composite Code C barcodes, is only used as the composite for GS1-128 and is based on PDF417 standards, can encode approximately 800 characters.

The composite portion is saved in the composite buffer. This buffer is loaded using the composite data command and is processed as GA- data as the barcode is processed.

Composite data

Composite data generally follows the GS-1 standard, however, the GS-1 field processing and data compaction may be controlled by the setting the GS-1 options for Composite barcodes.

Function	Composite data
ASCII	[ESC] b @ {information} [NUL]
Hexadecimal	1BH 62H 40H {information} 00H
Decimal	<27> <98> <64> {information} <0>

Note: GS-1 field processing and data compaction occurs when the barcode is generated not when the secondary field is defined.
Note: The secondary field will remain static until it is redefined.

An example would be:
[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
The data field is a valid GS-1 identification string.
“[01]12345678901234[11]100909[30]123456” will be processed as:
“(01)12345678901234(11)100909(30)123456”

UPC A Composite

UPC A Composite uses a standard 11 digit UPC A code with composite data and optional Addenda data.

Function	UPC A Composite
ASCII	[ESC] b A {information} [NUL]
Hexadecimal	1BH 62H 41H {information} 00H
Decimal	<27> <98> <65> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <65> 12345678901 [NUL]

The same as above with an EAN 2 Addenda
[ESC] b <65> 12345678901+12 [NUL]

Figure 72 UPC A Composite Example

UPC E Composite

UPC E Composite uses a standard zero suppressed 11 digit UPC E code with composite data and optional Addenda data.

Function	UPC E Composite
ASCII	[ESC] b B {information} [NUL]
Hexadecimal	1BH 62H 42H {information} 00H
Decimal	<27> <98> <66> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <66> 01210000345 [NUL]

The same as above with an EAN 5 Addenda

[ESC] b <66> 01210000345+56 [NUL]

Figure 73 UPC E Composite Example

EANX Composite

EANX will process EAN 8, EAN 13 or EAN 14 based on the length of the linear data entered.

Function	EANx Composite
ASCII	[ESC] b C {information} [NUL]
Hexadecimal	1BH 62H 43H {information} 00H
Decimal	<27> <98> <67> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <67> 12345678901 [NUL]

The same as above with an EAN 5 Addenda

[ESC] b <67> 12345678901+12345 [NUL]

Figure 74 EAN-13 Composite Example

EAN GS1-128 Composite

GS1-128 will process a GS1-128 barcode with an CC-C composite component.

Function	GS1-128 Composite
ASCII	[ESC] b D {information} [NUL]
Hexadecimal	1BH 62H 44H {information} 00H
Decimal	<27> <98> <68> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <68> [01] 12345678901234 [NUL]

Figure 75 EAN GS1-128 Composite Example

GS1-Databar Composite

GS1-Databar-14 Composite

GS1- Databar 14 composite will process a GS1- Databar 14 barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar 14 Composite
ASCII	[ESC] b E {information} [NUL]
Hexadecimal	1BH 62H 45H {information} [NUL]
Decimal	<27> <98> <69> {information} [NUL]

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <69> 1234567890123 [NUL]

Figure 76 GS1-Databar 14 Composite Example

GS1-Databar-Truncated Composite

GS1- Databar truncated composite will process a GS1- Databar truncated barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar Truncated 14 Composite
ASCII	[ESC] b F {information} [NUL]
Hexadecimal	1BH 62H 46H {information} 00H
Decimal	<27> <98> <70> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <70> 1234567890123 [NUL]

Figure 77 GS1-Databar Truncated 14 Composite Example

GS1-Databar-Limited Composite

GS1- Databar limited composite will process a GS1- Databar limited barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar Limited Composite
ASCII	[ESC] b G {information} [NUL]
Hexadecimal	1BH 62H 47H {information} 00H
Decimal	<27> <98> <71> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <71> 1234567890123 [NUL]

Figure 78 GS1-Databar Limited Composite Example

GS1-Databar-Expanded Composite

GS1- Databar Expanded composite will process a GS1- Databar Expanded barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar Expanded Composite
ASCII	[ESC] b H {information} [NUL]
Hexadecimal	1BH 62H 48H {information} 00H
Decimal	<27> <98> <72> {information} <0>

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <72> [01] 12345678901234 [NUL]

Figure 79 GS1-Databar Expanded Composite Example

GS1-Databar-14 Stacked Composite

GS1- Databar Stacked composite will process a GS1- Databar Stacked barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar Stacked Composite
ASCII	[ESC] b I {information} [NUL]
Hexadecimal	1BH 62H 49H {information} [NUL]
Decimal	<27> <98> <73> {information} [NUL]

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <73> 1234567890123 [NUL]

Figure 80 GS1-Databar Stacked Composite Example

GS1-Databar-Stacked Omni Composite

GS1- Databar Stacked Omni composite will process a GS1- Databar Stacked barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar Stacked Omni Composite
ASCII	[ESC] b J {information} [NUL]
Hexadecimal	1BH 62H 4AH {information} [NUL]
Decimal	<27> <98> <74> {information} [NUL]

[ESC] b @ [01] 12345678901234 [11] 100909 [30] 123456 [NUL]
[ESC] b <74> 1234567890123 [NUL]

Figure 81 GS1-Databar Stacked Omni Composite Example

GS1-Databar-Expanded Stacked Composite

GS1- Databar Expanded Stacked composite will process a GS1- Databar Expanded Stacked barcode with an CC-A, or CC-B composite component.

Function	GS1-Databar Expanded Stacked Composite
ASCII	[ESC] b K {information} [NUL]
Hexadecimal	1BH 62H 4BH {information} 00H
Decimal	<27> <98> <75> {information} <0>

[ESC] b @ [01]12345678901234[11]100909[30]123456 [NUL]
[ESC] b <75> [01]12345678901234[11]100909[30]123456 [NUL]

Figure 82 GS1-Databar Expanded Stacked Composite Example

GS-1 Barcodes

The GS1 General Specification defines a global standard for encoding data about products. The full specification is available from www.gs1uk.org web site. Data is encoded as a series of number pairs where the first number, usually shown in (brackets) is an application identifier (AI) (See Table 10 RSS GS1 AI Codes), and the second is a formatted representation of the data. For example (401)6773 can be read as "Consignment Number 6773" where the AI (401) signifies that the data is a consignment number. Note that for the Printer AI data is entered using [square] brackets[12]. This allows rounded brackets to be included in the data which as allowed by the specification. When the barcode symbol is generated these square brackets are replaced by rounded brackets in HRI if HRI is active.

Note: RSS-14 barcodes are sometimes printed in a composite form. The Epic 880 does not support the composite RSS/EAN13 barcode.

The command to print an RSS expanded symbol representing:

(01)98898765432106(3202)012345(15)991231

Would be:
[ESC]b<23>[01]98898765432106[3202]012345[15]991231<0>
or for stacked version:
[ESC]b<24>[01]98898765432106[3202]012345[15]991231<0>
Where:
(01) indicates that 98898765432106 is the Global Trade Item Number
(3202) Indicates that 012345 Net weight, of 123.45 pounds
(15) indicates 991231 is the Best Before Date (YYMMDD)

[12] It is possible for the Printer to accept () rather than [] to delineate AI fields, however if that is done, the () characters may not be used in the data.

Symbology Name	RSS-14	RSS-14 Truncated	RSS-14 Stacked	RSS-14 Stacked Omni-directional	RSS Limited	RSS Expanded	RSS Expanded Stacked
Omni-Directionally Scan-able	Yes	No	No	Yes	No	Yes	Yes
Transmitted Data	AI plus 14-digits	AI plus 14-digits	AI plus 14-digits	AI plus 14-digits	AI plus 14-digits	Primary Identification & other AI element strings	Primary Identification & other AI element strings
Maximum Data Capacity	16 numeric (fixed)	16 numeric (fixed)	16 numeric (fixed)	16 numeric (fixed)	16 numeric (fixed)	74 numeric 41 alpha	74 numeric 41 alpha
Character Set	0 - 9	0 - 9	0 - 9	0 - 9	0 - 9	ASCII See Note	ASCII See Note
Number of rows	1	1	2	2	1	1	2-11
HRI Available	Yes	Yes	No	No	Yes	Yes	No

Note: The printer will encode the Value and insert latch sequences based on the ASCII Input. Refer to the ISO/IEC 24724 specification for more information.

Table 9 RSS Characteristics Summary

GS-1 AI definitions

Note: This is not a complete list and is not intended to replace the GS1 General Specification.

AI See Notes$_{2,3}$	Data Content	Format See Note$_1$	FNC1 Note$_4$	Data Title
00	SSCC (Serial Shipping Container Code)	n2+n18		SSCC
01	Global Trade Item Number (GTIN)	n2+n14		GTIN
02	GTIN of Contained Trade Items	n2+n14		CONTENT
10	Batch or Lot Number	n2+an..20	(FNC1)	BATCH/LOT
11$_2$	Production Date (YYMMDD)	n2+n6		PROD DATE
12$_2$	Due Date (YYMMDD)	n2+n6		DUE DATE
13$_2$	Packaging Date (YYMMDD)	n2+n6		PACK DATE
15$_2$	Best Before Date (YYMMDD)	n2+n6		BEST BEFORE or SELL BY
17$_2$	Expiration Date (YYMMDD)	n2+n6		USE BY OR EXPIRY
20	Variant Number	n2+n2		VARIANT
21	Serial Number	n2+an..20	(FNC1)	SERIAL
22	Secondary Data Fields	n2+an..29	(FNC1)	QTY /DATE /BATCH
30	Count of Items (Variable Measure Trade Item)	n2+n..8	(FNC1)	VAR. COUNT
37	Count of Trade Items	n2+n..8	(FNC1)	COUNT
90	Information Mutually Agreed Between Trading Partners	n2+an..30	(FNC1)	INTERNAL
91 to 99	Company Internal Information	n2+an..30	(FNC1)	INTERNAL
240	Additional Item Identification	n3+an..30	(FNC1)	ADDITIONAL ID
241	Customer Part Number	n3+an..30	(FNC1)	CUST. PART NO.
242	Made-to-Order Variation Number	n3+n..6	(FNC1)	MTO VARIANT
250	Secondary Serial Number	n3+an..30	(FNC1)	SECONDARY SERIAL
251	Reference to Source Entity	n3+an..30	(FNC1)	REF. TO SOURCE
253	Global Document Type Identifier (GDTI)	n3+n13+n..17	(FNC1)	DOC. ID
254	GLN Extension Component	n3+an..20	(FNC1)	GLN EXTENSION
400	Customer's Purchase Order Number	n3+an..30	(FNC1)	ORDER NUMBER
401	Consignment Number	n3+an..30	(FNC1)	CONSIGNMENT
402	Shipment Identification Number	n3+n17	(FNC1)	SHIPMENT NO.
403	Routing Code	n3+an..30	(FNC1)	ROUTE
410	Ship to - Deliver to Global Location Number	n3+n13		SHIP TO LOC
411	Bill to - Invoice to Global Location Number	n3+n13		BILL TO
412	Purchased from Global Location Number	n3+n13		PURCHASE FROM
413	Ship for - Deliver for - Forward to Global Location Number	n3+n13		SHIP FOR LOC
414	Identification of a Physical Location - Global Location Number	n3+n13		LOC No
415	Global Location Number of the Invoicing Party	n3+n13		PAY TO
420	Ship to - Deliver to Postal Code Within a Single Postal Authority	n3+an..20	(FNC1)	SHIP TO POST
421	Ship to - Deliver to Postal Code with ISO Country Code	n3+n3+an..12	(FNC1)	SHIP TO POST
422	Country of Origin of a Trade Item	n3+n3	(FNC1)	ORIGIN
423	Country of Initial Processing	n3+n3+n..12	(FNC1)	COUNTRY – INITIAL PROCESS.
424	Country of Processing	n3+n3	(FNC1)	COUNTRY - PROCESS.
425	Country of Disassembly	n3+n3	(FNC1)	COUNTRY - DISASSEMBLY
426	Country Covering full Process Chain	n3+n3	(FNC1)	COUNTRY – FULL

				PROCESS
310n3	Net weight, kilograms (Variable Measure Trade Item)	n4+n6		NET WEIGHT (kg)
311n3	Length of first dimension, meters (Variable Measure Trade Item)	n4+n6		LENGTH (m)
312n3	Width, diameter, or second dimension, meters (Variable Measure Trade Item)	n4+n6		WIDTH (m)
313n3	Depth, thickness, height, or third dimension, meters (Variable Measure Trade Item)	n4+n6		HEIGHT (m)
314n3	Area, square meters (Variable Measure Trade Item)	n4+n6		AREA (m2)
315n3	Net volume, liters (Variable Measure Trade Item)	n4+n6		NET VOLUME (l)
316n3	Net volume, cubic meters (Variable Measure Trade Item)	n4+n6		NET VOLUME (m3)
320n3	Net weight, pounds (Variable Measure Trade Item)	n4+n6		WEIGHT (lb)
321n3	Length or first dimension, inches (Variable Measure Trade Item)	n4+n6		LENGTH (i)
322n3	Length or first dimension, feet (Variable Measure Trade Item)	n4+n6		LENGTH (f)
323n3	Length or first dimension, yards (Variable Measure Trade Item)	n4+n6		LENGTH (y)
324n3	Width, diameter, or second dimension, inches (Variable Measure Trade Item)	n4+n6		WIDTH (i)
325n3	Width, diameter, or second dimension, feet (Variable Measure Trade Item)	n4+n6		WIDTH (f)
326n3	Width, diameter, or second dimension, yards (Variable Measure Trade Item	n4+n6		WIDTH (y)
327n3	Depth, thickness, height, or third dimension, inches (Variable Measure Trade Item)	n4+n6		HEIGHT (i)
328n3	Depth, thickness, height, or third dimension, feet (Variable Measure Trade Item)	n4+n6		HEIGHT (f)
329n3	Depth, thickness, height, or third dimension, yards (Variable Measure Trade Item)	n4+n6		HEIGHT (y)
330n3	Logistic weight, kilograms	n4+n6		GROSS WEIGHT (kg)
331n3	Length or first dimension, meters	n4+n6		LENGTH (m), log
332n3	Width, diameter, or second dimension, meters	n4+n6		WIDTH (m), log
333n3	Depth, thickness, height, or third dimension, meters	n4+n6		HEIGHT (m), log
334n3	Area, square meters	n4+n6		AREA (m2), log
335n3	Logistic volume, liters	n4+n6		VOLUME (l), log
336n3	Logistic volume, cubic liters	n4+n6		VOLUME (m3), log
337n3	Kilograms per square meter	n4+n6		KG PER m²
340n3	Logistic weight, pounds	n4+n6		GROSS WEIGHT (lb)
341n3	Length or first dimension, inches	n4+n6		LENGTH (i), log
342n3	Length or first dimension, feet	n4+n6		LENGTH (f), log
343n3	Length or first dimension, yards	n4+n6		LENGTH (y), log
344n3	Width, diameter, or second dimension	n4+n6		WIDTH (i), log
345n3	Width, diameter, or second dimension	n4+n6		WIDTH (f), log
346n3	Width, diameter, or second dimension	n4+n6		WIDTH (y), log
347n3	Depth, thickness, height, or third dimension	n4+n6		HEIGHT (i), log
348n3	Depth, thickness, height, or third dimension	n4+n6		HEIGHT (f), log

349n3	Depth, thickness, height, or third dimension	n4+n6		HEIGHT (y), log
350n3	Area, square inches (Variable Measure Trade Item)	n4+n6		AREA (i^2)
351n3	Area, square feet (Variable Measure Trade Item)	n4+n6		AREA (f^2)
352n3	Area, square yards (Variable Measure Trade Item)	n4+n6		AREA (y^2)
353n3	Area, square inches	n4+n6		AREA (i^2), log
354n3	Area, square feet	n4+n6		AREA (f^2), log
355n3	Area, square yards	n4+n6		AREA (y^2), log
356n3	Net weight, troy ounces (Variable Measure Trade Item)	n4+n6		NET WEIGHT (t)
357n3	Net weight (or volume), ounces (Variable Measure Trade Item)	n4+n6		NET VOLUME (oz)
360n3	Net volume, quarts (Variable Measure Trade Item)	n4+n6		NET VOLUME (q)
361n3	Net volume, gallons U.S. (Variable Measure Trade Item)	n4+n6		NET VOLUME (g)
362n3	Logistic volume, quarts	n4+n6		VOLUME (q), log
363n3	Logistic volume, gallons U.S.	n4+n6		VOLUME (g), log
364n3	Net volume, cubic inches (Variable Measure Trade Item)	n4+n6		VOLUME (i3), log
365n3	Net volume, cubic feet (Variable Measure Trade Item)	n4+n6		VOLUME (f3), log
366n3	Net volume, cubic yards (Variable Measure Trade Item)	n4+n6		VOLUME (y3), log
367n3	Logistic volume, cubic inches	n4+n6		VOLUME (q), log
368n3	Logistic volume, cubic feet	n4+n6		VOLUME (g), log
369n3	Logistic volume, cubic yards	n4+n6		VOLUME (i3), log
390n3	Applicable Amount Payable, local currency	n4+n..15	(FNC1)	AMOUNT
391n3	Applicable Amount Payable with ISO Currency Code	n4+n3+n..15	(FNC1)	AMOUNT
392n3	Applicable Amount Payable, single monetary area (Variable Measure Trade Item)	n4+n..15	(FNC1)	PRICE
393n3	Applicable Amount Payable with ISO Currency Code (Variable Measure Trade Item)	n4+n3+n..15	(FNC1)	PRICE
7001	NATO Stock Number (NSN)	n4+n13	(FNC1)	NSN
7002	UN/ECE Meat Carcasses and Cuts Classification	n4+an..30	(FNC1)	MEAT CUT
7003	Expiration Date and Time	n4+n10	(FNC1)	EXPIRY TIME
703s	Approval Number of Processor with ISO Country Code	n4+n3+an..27	(FNC1)	PROCESSOR # s
8001	Roll Products (Width, Length, Core Diameter, Direction, Splices)	n4+n14	(FNC1)	DIMENSIONS
8002	Cellular Mobile Telephone Identifier	n4+an..20	(FNC1)	CMT No
8003	Global Returnable Asset Identifier (GRAI)	n4+n13+an..16	(FNC1)	GRAI
8004	Global Individual Asset Identifier (GIAI)	n4+an..30	(FNC1)	GIAI
8005	Price Per Unit of Measure	n4+n6	(FNC1)	PRICE PER UNIT
8006	Identification of the Components of a Trade Item	n4+n14+n2+n2	(FNC1)	GCTIN
8007	International Bank Account Number (IBAN)	n4+an..30	(FNC1)	IBAN
8008	Date and Time of Production	n4+n8+n..4	(FNC1)	PROD TIME
8018	Global Service Relation Number (GSRN)	n4+n18	(FNC1)	GSRN
8020	Payment Slip Reference Number	n4+an..25	(FNC1)	REF No

8100	GS1-128 Coupon Extended Code	n4+n6	(FNC1)	-
8101	GS1-128 Coupon Extended Code	n4+n1+n5+n4	(FNC1)	-
8102	GS1-128 Coupon Extended Code	n4+n1+n1	(FNC1)	-
8110	Coupon Code Identification for Use in North America	n4+an..30	(FNC1)	-

Notes: As of GS1 General Specifications Version 10.0 *Issue 1, Jan-2010*

Note$_1$ The first position indicates the length (number of digits) of the GS1 Application Identifier.
The following value refers to the format of the data content. The following conventions applied:
n numeric digit
an any valid character
n3 3 numeric digits, fixed length
n..3 up to 3 numeric digits
an..3 up to 3 valid characters

Note$_2$ If only year and month are available, DD must be filled with two zeroes.

Note$_3$ The fourth digit of this GS1 Application Identifier indicates the implied decimal point position.
Example:
3100 Net weight in kg without a decimal point
3102 Net weight in kg with two decimal points

Note$_4$ **(FNC1):** All GS1 Application Identifiers indicated with (FNC1) are defined as variable length and must be limited by a Function 1 Symbol Character unless this Element String is the last one to be encoded in the symbol. The printer will automatically insert FNC1's when and as required.

Table 10 RSS GS1 AI Codes

Note: It is beyond the scope of this document to define all the AI fields, there meaning, requirements and restrictions. The Printer will do minimal validation of the AI fields to assure that the barcode can be generated. It will not assure that the barcode meets the GS-1 standard. Refer to the GS-1 General specification for additional information.

Mandatory AI Associations

Some AI fields must be associated with other fields. For example, a date field must be associated with some item so cannot be used alone.

AI	Definition	AI	
01 or 02 with N1 = 9	Identification of a Variable Measure Trade Item	30, 3nnn1 or 3nnn2 or 8001	Mandatory association with variable measure information Only GS1-128, ITF-14, and GS1 DataBar Expanded Barcode Symbols can encode a GTIN with N1 = 9.
02	Identification of logistic unit contents	00	Mandatory association with an SSCC (Serial Shipping Container Code)
02	Identification of logistic unit contents	37	Mandatory count of the contained trade items
10	Batch/lot number	01or 02	Mandatory association with a Global Trade Item Number (GTIN) or with the identification of logistic unit contents
11, 13, 15, 17	Dates	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
12	Due date	8020 and 415	Mandatory association with the payment slip reference number (AI (8020)) and the Global Location Number (GLN) of the invoicing party
20	Product variant	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
21	Serial number	01	Mandatory association with a GTIN of a single trade item (a serial number cannot apply to a grouping of trade items)
22	Secondary data health industry	01	Mandatory association with a GTIN
240	Additional product identification	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
241	Customer part number	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
242	Made-to-Order Variation Number	01 or 02 with N1 = 9	Mandatory association with a GTIN-14 with Indicator Digit 9 represents a Custom Industrial Supply Item
250	Secondary serial number	01	Mandatory association with a GTIN (a secondary serial number cannot apply to a grouping of trade items)
251	Reference to source entity	01	Mandatory association with GTIN of the trade item
254	Extension component of a GLN	414	Mandatory association with AI (414). Only GS1-128, GS1 DataBar Expanded symbologies, and EPC RFID tags are valid. This is used with GLN and not GTIN.
30	Variable count	01 or 02	Mandatory association with a variable measure GTIN (e.g., a GTIN-14 starting with the digit 9) or the identification of variable measure content of a logistic unit
$3nnn_1$	Trade measures that cannot be summed	01	Mandatory association with a variable measure GTIN (e.g., a GTIN-14 starting with the digit 9)
$3nnn_2$	Trade measures that can be summed	01 or 02	Mandatory association with a variable measure GTIN (e.g., a GTIN-14 starting with the digit 9) or the identification of variable measure content of a logistic unit
$3nnn_3$	Logistic measures	00 or 01	Mandatory association with an SSCC or a variable measure GTIN (e.g., a GTIN-14 starting with the digit 9)
337n	Kilograms per square	01	Mandatory association with a GTIN

	meter		
37	Count of units contained	02	Mandatory association with the identification of logistic unit contents
390n	Amount payable – single monetary area	8020 and 415	Mandatory association with the payment slip reference number, AI (8020), and the GLN of the invoicing party
391n	Amount payable – with ISO currency code	8020 and 415	Mandatory association with the payment slip reference number, AI (8020), and the GLN of the invoicing party
392n	Amount payable – single monetary unit	01	Mandatory association with variable measure GTIN (e.g., a GTIN-14 starting with the digit 9)
393n	Amount payable – with ISO currency code	01	Mandatory association with variable measure GTIN (e.g., a GTIN-14 starting with the digit 9)
403	Routing code	00	Mandatory association with an SSCC
415	GLN of the invoicing party	8020	Mandatory association with payment slip reference number, AI (8020)
422	Country of origin	01 or 02	Mandatory association with a GTIN
423	Country of initial	01 or 02	Mandatory association with a GTIN or with the processing identification of logistic unit contents
424	Country of processing	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
425	Country of disassembly	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
426	Country of full processing	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
7001	NATO stock number	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
7002	UN/ECE meat carcasses and cuts classification	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
703(s)	Approval number of processor	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
8001	Variables of roll products	01	Mandatory association with a variable measure GTIN (e.g., an GTIN-14 starting with the digit 9)
8005	Price per unit of measure	01 or 02 with N1 = 9	Mandatory association with a variable measure GTIN or the identification of variable measure content of a logistic unit
8007	International Bank Account Number, AI (8007)	8020 and 415	Mandatory association with the payment slip reference number, AI (8020), and the GLN of the invoicing party
8008	Date and time of production	01 or 02	Mandatory association with a GTIN or with the identification of logistic unit contents
8020	Payment slip reference number, AI (8020)	415	Mandatory association with the GLN of the invoicing party

Note 1 Is (3nnn) where the first three digits are 312, 313, 324, 325, 326, 327, 328, and 329

Note 2 Is (3nnn) where the first three digits are 310, 311, 314, 315, 316, 320, 321, 322, 323, 350, 351, 352, 356, 357, 360, 361, 364, 365, and 366

Note 3 Is (3nnn) where the first three digits are 330, 331, 332, 333, 334, 335, 336, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 353, 354, 355, 362, 363, 367, 368, and 369

Table 11 Mandatory AI Code Associations

Note: It is beyond the scope of this document to define all the AI fields, there meaning, requirements and restrictions. The Printer will do minimal validation of the AI fields to assure that the barcode can be generated. It will not assure that the barcode meets the GS-1 standard. Refer to the GS-1 General specification for additional information.

Invalid AI associations

Some AI fields cannot be used with other AI fields.

AI	Definition	AI	Definition	
01	Identification of a trade item	01	Identification of a trade item	Duplicate Global Trade Item Numbers (GTINs) with different values
01	Identification of a trade item	02	Identification of logistic unit contents	AI (02) must not be used for the identification of trade items contained in a trade item.
01	Identification of a trade item	37	Count of units contained	The count of units contained would duplicate the master data of the GTIN. AI (37) may only be used with AI (02).
22	Secondary data for the health industry	30	Count	Duplicate counts with different values
22	Secondary data for the health industry	10	Batch/lot number	Duplicate lot numbers with different values
22	Secondary data for the health industry	17	Expiration date	Duplicate expiration date with different values
22	Secondary data for the health industry	21	Serial number	Duplicate serial numbers with different values
242	Made-to-Order Variation	01 or 02 with N1 not equal to 9	Identification of a Variable Measure Trade Item	Made-to-Order Variation can only be used with a GTIN-14, Indicator digit 9. This represents a Custom Industrial Supply Item
420	Ship to postal code, single postal authority	421	Ship to postal code with ISO country code	Only one ship to postal code may be applied on an item
422	Country of origin of a trade item	426	Country of full processing	Duplication of country of origin of a trade item (covered by country of full processing)
423	Country of initial processing	426	Country of full processing	Duplication of country of initial processing (covered by country of full processing)
424	Country of processing	426	Country of full processing	Duplication of country of processing (covered by country of full processing)
425	Country of disassembly	426	Country of full processing	Duplication of country of disassembly (covered by country of full processing)
390n	Amount payable– single monetary area	391n	Amount payable – with ISO currency code	Only one amount payable Element String may be applied on a payment slip
392n	Amount Payable for a Variable Measure Trade Item – Single Monetary Area	393n	Amount Payable for a Variable Measure Trade Item and ISO Currency Code	Only one amount payable Element String may be applied on a Variable Measure Trade Item.
8006	Component identification	01	Identification of a trade item	Other GTINs cannot be used with AI (8006). The trade item is identified by a GTIN contained in the AI (8006).

Table 12 Invalid AI Code Associations

Note: It is beyond the scope of this document to define all the AI fields, there meaning, requirements and restrictions. The Printer will do minimal validation of the AI fields to assure that the barcode can be generated. It will not assure that the barcode meets the GS-1 standard. Refer to the GS-1General specification for additional information.

GS-1 AI fields with a Check Digit

Refer to the GS-1 General specification for the method used to calculate the check digit. In some cases, the check digit is not encoded into the barcode. However, the check digit is always shown in the human readable interpretation and transmitted by the decoder even though it is not explicitly encoded in RSS-14 and RSS Limited symbols. The printer does not check the check digit and whatever is passed in will be printed in the HRI. The printer however will format the barcode without the check digit and the barcode reader will reinsert it into the resulting data. The result is that if the check digit passed in is not correct, it will be printed in the HRI but may be reported as a different character by the reader.

To make check digit generation easier, the printer will (optionally) automatically generate and insert a check digit in several AI fields. To trigger automatic insertion, the GS-1 AI check digit option should be activated and a "*" character used in the location of the check digit.

AI	Data Content	Format	Check Digit Location	Data Title
00	SSCC (Serial Shipping Container Code)	n2+n18	n18	SSCC
01	Global Trade Item Number (GTIN)	n2+n14	n12, n13, or n14	GTIN
02	GTIN of Contained Trade Items	n2+n14	n14	CONTENT
253	Global Document Type Identifier (GDTI)	n3+n13+n..17	n13	DOC. ID
402	Shipment Identification Number	n3+n17	n17	SHIPMENT NO.
410	Ship to - Deliver to Global Location Number	n3+n13	n13	SHIP TO LOC
411	Bill to - Invoice to Global Location Number	n3+n13	n13	BILL TO
412	Purchased from Global Location Number	n3+n13	n13	PURCHASE FROM
413	Ship for - Deliver for - Forward to Global Location Number	n3+n13	n13	SHIP FOR LOC
414	Identification of a Physical Location - Global Location Number	n3+n13	n13	LOC No
415	Global Location Number of the Invoicing Party	n3+n13	n13	PAY TO
8003	Global Returnable Asset Identifier (GRAI)	n4+n13+an..16	n13	GRAI
8018	Global Service Relation Number (GSRN)	n4+n18	n18	GSRN

Table 13 AI's supported by automatic check digit generation

Note: Automatic Check Character generation for Price/Weight, Four-Digit Price, and Five-Digit Price fields are not supported by automatic check character generation.
Note: If additional AI fields with check characters are added to the GS1 standards they will not be processed by the printer unless the printer's firmware is updated.

Controlling Barcodes

Unified Control Commands

To making control of linear and two dimensional barcode more consistent, all barcode control commands will follow a similar format. The

Function	Control barcode
ASCII	[ESC] [EM] <b> <f> <v>
Hexadecimal	1BH 19H <b> <f> <v>
Decimal	<27> <25> <b> <f> <v>

Where:

<b>	Barcode type
b, 62H, 98D	General Barcodes
d, 64H, 100D	Datamatrix Barcodes
r, 72H, 114D	GS-1 Databar (RSS) Barcodes
a, 61H, 97D	Aztec Barcodes
q, 71Hm 113D	QR Code
E, 45H, 69D	PDF417
c,63H,99D	Composite Barcodes.
<f>	Common Format Parameter to all barcodes
W, 57H, 87D	Minimum bar width or Scale
J, 4AH, 74D	Justification 0 = Left, 1 = Center, 3 = Right
V, 56H, 86D	Vertical Height (value*4) dots at 203 Dots per inch
G, 47H, 71D	GS1 Mode.
P, 50H, 80D	HRI Position 0 – Off, 1 = Top, 2 = Bottom, 3 = Both
F, 46H, 70D	HRI Font
H, 48H, 72D	Space above and below the barcode in dots
C, 43H, 67D	Composite Secondary Mode
	Additional barcode specific controls are available
<v>	Value of the parameter.

Description The [ESC] [EM] <b> <p> <n> command sets general barcode format parameters. In some cases, a specific barcode may set a barcode specific parameter. For example, the general element width value is generally not optimal for 2D barcodes so each 2D barcode will use its own parameter.

General Settings

f = W, 57H, 87D	Minimum bar width or scale
f = J, 4AH, 74D	Justification 0 = Left, 1 = Center, 3 = Right
f = V, 56H, 86D	Vertical Height Height (value*4) dots at 203 Dots per inch
f = G, 47H, 71D	GS1-Mode

The GS1-Mode is configurable as to how closely the GS1 specification is followed. This allows future changes in GS1 compaction to be processed without error. In some cases, this parameter will activate Enhanced features.

The values for GS1-Mode are bit values and are as follows:

0x01	GS1 AI and Compaction Active (If this bit is not set no GS-1 AI processing is performed. The input data is not scanned nor are the AI fields preprocessed or compressed. Not setting this option may produce invalid GS1 barcodes.
0x02	AI field lengths are not strictly enforced.
0x04	No GS1 faults are generated. All AI fields and compaction that can be processed will be but unknown fields or fields in error will not stop the barcode generation. Setting this may produce invalid barcodes.
0x08	AI (01) data field may be passed 12, 13, or 14 bytes. 12 and 13 byte fields will be expanded to 14 with leading zeros.
0x10	The check digit in AI fields (00), (01), (02), (253), (402), (410) trough (415), (8003) and (8018) may be replaced with a '*' and the Printer will replace the '*' with a check digit for that field calculated as defined in the GS1 general specification.
0x20	Use () to delineate AI fields rather than []
Default	The default value for most barcodes is 0x19 which provides variation of the AI (01) length and optional automatic check digit generation. If you require strict compliance with the GS1 general specification, set the GS1-Mode to 0x01.

f = P, 50H, 80D — HRI Position
f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both

f = F, 46H, 70D — HRI Font
f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.

f =f, 66H, 102D — HRI Format
f = 0 UPC and EAN check digits under the barcode. f=1 Outside the barcode.

f = H, 48H, 72D — Space above and below the barcode between the barcode and any HRI if active. This is in dots. Typically, 2 dots is enough, although some 2D barcodes require more.
If HRI is inactive, it is up to the user to enforce the quite zone requirements between the barcode and any user data.

f = C, 43H, 67D — Composite Secondary Mode
f = 0=Auto, 1=CC-A, 2=CC-B, or 3=CC-3

Barcode Control Summary Chart

Barcode Type <b>		Format Parameter <f>															
Barcode	W	J	V	G	P	F	f	H	K	X	Y	C	R	E	Q	S	M
Interleaved 2 of 5	b	b	b		b	b		b									
Code 39	b	b	b		b	b		b									
Code 128	b	b	b		b	b		b									
UPC A	b	b	b		b	b	b	b				b					
UPC E	b	b	b		b	b		b				b					
EAN-13	b	b	b		b	b	b	b				b					
EAN-8	b	b	b		b	b		b				b					
Code 93	b	b	b		b	b		b									
Code 93	b	b	b		b	b		b									
Codabar	b	b	b		b	b		b									
Data Bar	r b	r b	r b	r	r b	r b		r b									
Data Bar Stacked	r b	r b	r b	r	r	r		r b	r			b				r	
EAN-128	b	b	b	b	b	b		b				b					
EAN-14	b	b	b	b	b	b	b	b									
ITF-14	b	b	b		b	b		b									
PDF417				E						E	E	E	E	E			
Datamatrix	d			d	d	d		d						d	d		d
QR Code	q	q b		q	q	q		q				q		q			q
Aztec	a	a b		a	a	a		a						a			A
Composite	c	b		c	*	*		b	c								c

Table 14 Barcode Control Commands

Note: If there are two letters listed, either command may be used. Both will set a common value.

PDF417 Print Options

Function	PDF 417 barcode control
ASCII	[ESC] [EM] E <f> <v>
Hexadecimal	1BH 19H 45H <f> <v>
Decimal	<27> <25> <69> <f> <v>
IPCL	None

Description This command alters the way PDF 417 barcodes are generated and printed.

Where f = Feature to control
v = Value of the feature

f = X, 58H, 88D *Set encoding X aspect.*
2 ≤v ≤6
[Default] v = 3

Note: The X aspect is equivalent to the module width and affects the maximum number of columns that will fit in the print zone.

f = Y, 59H, 89D *Set encoding Y aspect.*
2 ≤v ≤8
[Default] v = 3
f = H, 48H, 72D Blank Space before and after the barcode
0 ≤v ≤255. Default is 8 dots
f = C, 43H, 67D Set encoding columns
0 ≤ v ≤ 30 (Values > 8 generally will not fit in the print zone)
[Default] v = 0 (automatic mode)
If v= 0 then automatic processing is used.
When automatic processing is specified, the number of columns is calculated with the number of code words based on the size of the printable area**.**

f = R, 52H, 82D Set encoding rows
v = 0 or 3 ≤v ≤90
[Default] v = 0
f v = 0 then automatic processing is used.
When automatic processing is specified, the number of rows is calculated with the number of code words or the range of the printable area.

Note: If the number of rows is specified, it will be the minimum number of rows printed. PDF417 requires at least 3 rows so values from 0 to 3 will generate a minimum of three rows.
Note: The number of rows times the number of columns must not exceed 928.

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 are probably too small unless good paper is used. The defaults are 3 by 9, which produce easily readable barcodes.

f = E, 45H, 69D *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.

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 a percent of the encoded data in the barcode where the value v is a percent between 1% and 40%. The correction level is determined by calculating a correction factor based on the formula: Cf = ((v * Encoded Length) + 50)/100 then using Cf in the following table to set the correction level.

Cf	Level	Code Words
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

For example: if the encoded data length is 80 bytes and v = 10% then Cf = ((10 * 80) +50)/100 or Cf = 8. Therefore, Cf is between 4 and 10 so Level 2 correction would be used.

The encoded length is not the same as the input length. The input data is first compressed into Text, Octet and Numeric data and the resulting encoded data length is then used to calculate the correction level.

Note: Setting the Error correction higher will increase the size of the barcode and reduce the available space for data.
Note: The encoding may be set to 0 which will do a 10% error correction, however this is not the same as 1. 0 does not do round off and levels 0 or 8 are never used. (This mode provides compatibility with legacy products.)

f = P, 50H, 80D HRI Position
f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both
f = F, 46H, 70D HRI Font
f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.)

Data Matrix Print Options

Function	Data Matrix barcode control
ASCII	[ESC] [EM] d <f> <v>
Hexadecimal	1BH 19H 64H <f> <v>
Decimal	<27> <25> <100> <f> <v>
IPCL	None

Description This command alters the way Data Matrix barcodes are generated and printed.

Where f = Feature to control
v = Value of the feature

f = H, 48H, 72D Blank Space before and after the barcode
f = M, 4DH, 77 Set minimum matrix size. v = 1-30, 0 sets to auto.

Size(v)	Symbol Size	Size(v)	Symbol Size	Size(v)	Symbol Size
0	Auto	11	36 x 36	21	104 x 104
1	10 x 10	12	40 x 40	22	120 x 120
2	12 x 12	13	44 x 44	23	132 x 132
3	14 x 14	14	48 x 48	24	144 x 144
4	16 x 16	15	52 x 52	25	8 x 18
5	18 x 18	16	64 x 64	26	8 x 32
6	20 x 20	17	72 x 72	27	12 x 26
7	22 x 22	18	80 x 80	28	12 x 36
8	24 x 24	19	88 x 88	29	16 x 36
9	26 x 26	20	96 x 96	30	16 x 48
10	32 x 32				

Figure 83 ECC – 200 Size options

Note: If the data will not fit in the selected size, the printer will revert to auto mode.

f = Q, 52H, 82 if v = 1 Only square matrix sizes will be selected in auto mode y. v = 0-1

f = W 57H, 87D Set the minimum element width and height.
v = 1-10, 6 is the default.
A width of 1 or 2 may be unreadable.
It the barcode will not fit in the print zone, the printer will automatically reduce the width until the barcode will fit. If the barcode will not fit at a width of 1, the printer will not print the barcode.

f = G, 47H, 71D) GS1 Mode. (See General description above)

Note: If in GS1 mode, a FNC1 is added to the beginning of the symbol and that the compression is slightly altered. GS1 data formatting and compaction are active and the input must follow the GS1 rules.

f = P, 50H, 80D	HRI Position f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both
f = F, 46H, 70D	HRI Font f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.)

QR Code Print Options

Function	QR Code barcode control
ASCII	[ESC] [EM] q <f> <v>
Hexadecimal	1BH 19H 71H <f> <v>
Decimal	<27> <25> <113> <f> <v>
IPCL	None

Description This command alters the way QR Code barcodes are generated and printed.

Where f = Feature to control
v = Value of the feature

f = W 57H, 87D Set the minimum element width and height.
v = 1-10, 4 is the default.
A width of 1 may be unreadable.
It the barcode will not fit in the print zone, the printer will automatically reduce the width until the barcode will fit. If the barcode will not fit at a width of 1, the printer will not print the barcode.

f = E, 45H, 69D QR Code Error Correction.
0-4 are accepted.
0 = Auto
1 = L or 7%
2 = M or 15%
3 = Q or 25%
4 = H or 30%

f = H, 48H, 72D Blank Space between the barcode and the following data Default 8

f = M, 4DH, 77D QR Code Matrix Size. 0-40 are accepted. 0 = Auto

f = G, 47H, 71D) GS1 Mode. Default = 0 (See General description above)

Note: If in GS1 mode, a FNC1 is added to the beginning of the symbol. GS1 data formatting and compaction are active and the input must follow the GS1 rules.
Note: QR Code Model 1 is obsolete, only Model 2 is supported

f = P, 50H, 80D HRI Position
f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both

f = F, 46H, 70D HRI Font
f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.)

Aztec Print Options

Function	Aztec barcode control
ASCII	[ESC] [EM] a <f> <v>
Hexadecimal	1BH 19H 61H <f> <v>
Decimal	<27> <25> <97> <f> <v>
IPCL	None

Description This command alters the way Aztec barcodes are generated and printed.

Where f = Feature to control
v = Value of the feature

f = W 57H, 87D	Set the minimum element width. v = 1-10, 6 is the default and height. A width of 1 may be unreadable. It the barcode will not fit in the print zone, the printer will automatically reduce the width until the barcode will fit. If the barcode will not fit at a width of 1, the printer will not print the barcode.
f = M, 4DH, 77D	QR Code Matrix Size. 1-36 are accepted. 0 – Auto Size 1-4 are Compact and 5-36 are normal.
f = E, 45H, 69D	QR Code Error Correction. 1-4 are accepted. 0 = default to level 2
f = H, 48H, 72D	Blank Space between the barcode and the following data Default 8
f = G, 47H, 71D)	GS1 Mode. (See General description above) If in GS1 mode the symbol start with an FNC1 and that the compression is slightly altered. GS1 data formatting and compaction are active and the input must follow the GS1 rules.
f = P, 50H, 80D	HRI Position f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both
f = F, 46H, 70D	HRI Font f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.)

Code One Print Options

Function	Code One barcode control
ASCII	[ESC] [EM] 1 <f> <v>
Hexadecimal	1BH 19H 31H <f> <v>
Decimal	<27> <25> <49> <f> <v>
IPCL	None

Description This command alters the way Code One barcodes are generated and printed.

Where f = Feature to control and v = the value of the feature.

f = W 57H, 87D	Set the minimum element width. v = 1-10, 6 is the default and height. A width of 1 may be unreadable. It the barcode will not fit in the print zone, the printer will automatically reduce the width until the barcode will fit. If the barcode will not fit at a width of 1, the printer will not print the barcode.
f = M, 4DH, 77D	Code One Matrix Size. 1-10 are accepted. 0 – Auto Size 1-8 are 1A – 1H and 9 - 10 allow other shapes.
f = H, 48H, 72D	Blank Space between the barcode and the following data Default 8
f = G, 47H, 71D)	GS1 Mode. (See General description above) If in GS1 mode the symbol start with an FNC1 and that the compression is slightly altered. GS1 data formatting and compaction are active and the input must follow the GS1 rules.
f = P, 50H, 80D	HRI Position f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both
f = F, 46H, 70D	HRI Font f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.)

Databar (RSS) Print Options

Function	Databar Options
ASCII	[ESC] [EM} r <f> <v>
Hexadecimal	1BH 19H 72H <f> <v>
Decimal	<27> <25> <114> <f> <v>
IPCL	None

Description This command alters the way Databar barcodes are generated and printed.

Where f = Feature to control
v = Value of the feature

f = W 57H, 87D	Set the minimum element width. v = 1-10, 3 is the default. A width of 1 may be unreadable. It the barcode will not fit in the print zone, the printer will automatically reduce the width until the barcode will fit. If the barcode will not fit at a width of 1, the printer will not print the barcode.
f = S, 53H, 83D	Expanded Stack character segment width. v = 2-10 Default 3
f = K, 4BH, 75D	Activate Stacked symbol HRI. 0 = off, 1 = on. By convention stacked barcode are not printed with HRI, however if required they may be activated
f = G, 47H, 71D	GS1 Mode. Default = 0x19 (See General description above) By default Databar barcodes use GS1 formatting.
f = P, 50H, 80D	HRI Position f =0 – Off, f = 1 - Top, f =2 - Bottom, f =3 - Both
f = F, 46H, 70D	HRI Font f = 0 Medium, f=1 Larger, f- 2 Smaller (Note: Fonts may be redefined by using the change legacy font command.)

Note: If RSS stacked barcodes don't generally use HRI. The [ESC] [EM] bP and [ESC] [EM] bK will turn on HRI for non stacked RSS barcodes. However, the [ESC] [EM] rP and [ESC] [EM] rK may be used to turn on the stacked barcode HRI.

Composite Barcode Print Options

Function	Composite Barcode control
ASCII	[ESC] [EM] c <f> <v>
Hexadecimal	1BH 19H 63H <f> <v>
Decimal	<27> <25> <99> <f> <v>
IPCL	None

Description This command alters the way Composite barcodes are generated and printed.

Where f = Feature to control
v = Value of the feature.

f = W 57H, 87D	Set the minimum element width. v = 1-3, 2 is the default and height. A width of 1 may be unreadable. It the barcode will not fit in the print zone, the printer will automatically reduce the width until the barcode will fit. If the barcode will not fit at a width of 1, the printer will not print the barcode.
f = M, 4DH, 77D	Composite CC mode. 1-3 are accepted. 0 – Auto 0=Auto, 1=CC-A, 2=CC-B, or 3=CC-C.
f = G, 47H, 71D)	GS1 Mode. (See General description above) If in GS1 mode the symbol start with an FNC1 and that the compression is slightly altered. GS1 data formatting and compaction are active and the input must follow the GS1 rules.
f = K, 4BH, 75D	HRI On and Font. f =0 – Off, F=1 - Medium, f=2 - Larger, f=3 - Smaller (Note: Fonts may be redefined by using the change legacy font command. Note that this command references font offset by 1)

Note: The normal HRI options do not affect Composite barcodes. Composite barcode HRI may be on or off and you may select the font. HRI is only available below barcode.

Function	**Set barcode 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 <m_1> <m_2>
EPOS	none

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

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

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 barcode
	32	32	--10----	Printed below the barcode
	48	48	--11----	Printed above and below the barcode
			-x------	Vertical print mode. (Page mode may work better)
	0	00	-0------	Barcode printed in horizontal direction (default)
	64	64	-100----	Barcode printed in vertical direction

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

Identifying Barcode Processing Errors

Barcodes that are not entered correctly in most cases will not print. It can be difficult at times to identify why. To help identify the problem there is a command that will return the last barcode error in the form of a 16 bit error ID.

ASCII	ENQ <37>
Hexadecimal	05H 25H
Decimal	<5> <37>

Will return: ACK <37> <42> <Error$_{7-0}$> <Error$_{15-8}$>
Or 05H 25H 2AH <Error$_{7-0}$><Error$_{15-8}$>

Where the error codes are as follows:

Error Type	Error ID	Description
Warnings	1	Invalid option, default used
	2	Invalid barcode Command
	3	Unable to process the barcode command
General Errors	10	Too much barcode data.
	11	Not enough barcode data
	12	Too much Addenda data
	13	Invalid barcode data
	14	Invalid check digit
	15	Invalid option
	17	Barcode encoding problem
	18	Barcode won't fit in the print zone.
System Errors[13]	90	This barcode is not active in this code.
	91	HRI Text field pointer is not valid
Not recoverable	98	Unknown Internal ID
	99	Memory allocation error
Aztec	100	Input too long or too many extended ASCII characters
	101	Invalid error correction level - using default instead
	102	Invalid Aztec Code size
	103	Input too large
	104	Not used
	105	Aztec Invalid character (NULL) in input data
Data Matrix	200	Invalid characters in data
	201	Input wrong length
	202	Invalid PZN Data
	203	Value out of range
	300	Data too long to fit in symbol
	301	Data does not fit in selected symbol size
	210	Not Used
	211	Invalid symbol size
	212	Unable to fit data in specified symbol size

[13] System Errors are internal printer errors that should not occur. If error codes between 90 and 99 occur, contact customer support.

Electronic Journal

The Epic 880™ has the capability to store electronic journal[14] 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 about[15] 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 220). 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.

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

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[14] 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.

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> [NUL]
Hexadecimal	1BH 1DH 49H <Password> 00H
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> [NUL]
Hexadecimal	1BH 1DH 45H <Password> 00H
Decimal	<27> <29> <69> <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_l> <S_h> <L_l> <L_h>
Hexadecimal	1BH 1DH 50H <S_l> <S_h> <L_l> <L_h>
Decimal	<27> <29> <80> <S_l> <S_h> <L_l><L_h>
IPCL	&%EP <S> <L> (L and S are 4 digits i.e. 00100020 for 20 records starting at 10)
EPOS	

Description This command prints all or part of the electronic journal. <S_h>*256 + <S_l> specifies the first record to be printed and <L_h>*256 + <L_l> specifies the number of records to print. If <L_h>*256 + <L_l> 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_l> <S_h> <L_l> <L_h>
Hexadecimal	1BH 1DH 52H <S_l> <S_h><L_l> <L_h>
Decimal	<27> <29> <82> <S_l> <S_h><L_l> <L_h>
IPCL	&%EQ <S> <L> (L and S are 4 digits i.e. 00100020 for 20 records starting at 10)
EPOS	

Description This command reports all or part of the electronic journal. <S_h>*256 + <S_l> specifies the first record to be printed and <L_h>*256 + <L_l> specifies the number of records to report. If <L_h>*256 + <L_l> 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> [NUL]
Hexadecimal	1BH 1DH 46H <String %d> 00H
Decimal	<27> <29> <70> <String %d> <0>
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] l	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 an 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 FEED[16] 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.

[16] The FEED button is a multifunction button. By pressing and releasing the FEED button, the printer will feed and cut a short thicket. 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 04H) 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] l <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] l <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] l <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] l <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 effect 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 <n_1> <n_2>
Hexadecimal	1BH 58H <n_1> <n_2>
Decimal	<27> <88> <n_1> <n_2>
IPCL	none
EPOS	[ESC] Q

Description The [ESC] X <n_1> <n_2> command sets left and right print margins in characters from the home position. Where n_1 = left margin and n_2 = 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.

Function	Set Page Mode Margins (By dot column)
ASCII	[ESC] [SUB] M <L_L> <L_H> <W_L> <W_H>
Hexadecimal	1BH 1AH 4DH <L_L> <L_H> <W_L> <W_H>
Decimal	<27> <26> <77> <L_L> <L_H> <W_L> <W_H>
IPCL	None
EPOS	None

Description This command sets the print margins in dots. <L_L><L_H> specify the left offset from the currently defined page and <W_L><W_H> specify the width. Both are in dots. If <W_L><W_H> is zero, the maximum width allowed by the current page is used.

[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
Decimal	<27> <118>
IPCL	&%FC &%PC
EPOS	[ESC] i or [ESC] m

Description The [ESC] v command operated the auto cutter.

[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 ≤ n ≤ 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.

<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 15 Paper Sensor Commands

Note: The Epic 880™ printer does not allow the Paper Out sensor to be disabled. It is always on.

[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 ≤ n ≤ 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 16 Paper Out 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.

Function	**Select Receipt Legacy Command**	**Legacy**
ASCII	[ESC] f	
Hexadecimal	1BH 66H	
Decimal	<27> <102>	
IPCL	None	
EPOS	None	

Description This command is accepted but provides no operational function. It is provided to be compatible with legacy applications written for other TransAct products.

[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>

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.

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

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>

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.

Where n 17 Requests the printer to enter remote OFF.
18 Requests the printer to exit remote OFF

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 modes.

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] ~Z	**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 proceeded with an enabling command. The return is 5 bytes formatted as follows:

~Z<CRC_state><CRC_{msb}><CRC_{lsb}>

Where

~Z	Is the echo of command
<CRC_state>	Status of the returned CRC. 33H when CRC is valid.
<CRCmsb>	Most significant 8 bits of the 16 bit CRC
<CRClsb>	Least significant 8 bits of the 16 bit CRC

[ESC] ~F	**Return Firmware Identification**
ASCII	[ESC] ~ F
Hexadecimal	1BH 7EH 46H
Decimal	<27> <126> <70>
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 proceeded 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, inquires 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) The command was accepted. [NAK] <10> (15H 0AH) The command was rejected.	No response

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> <r_1> <r_2>…

Where:

<15> is the echo of the command ID.

<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).

<r_1>:
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

<r_2>:
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> <r_1> <r_2>…

Where:

<20> is the echo of command ID.

<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).

<r_1>:
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

<r_2>:
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

<r_3>:
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

<r_4>:
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

<r_5>: 0

<r_6>: 0

<r_7>: 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).

<r_1>: 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> <n_1> <n_2> <n_3>

Where
<24> Is the echo of command
<n_1> Secondary Color 0 = Not supported, 1 = Red, 2 = Green, 4 = Blue
<n_2> Primary Color 16 = Black
<n_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

[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

Also see the **[ESC]~Z** 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.

[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 241) on a periodic basis. 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 basis.

Where n = Interval in 100 MS increments. i.e. 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 saved 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.

Chapter 9

Epic 880™ Color Graphics

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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 84 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 their 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 request[17].

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 PJColor[18] 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.

[17] You may be required to sign a nondisclosure agreement with TransAct Technologies to obtain source code.

[18] The PJColor program has been enhanced to provide several ways to create Logos and Coupons and make them available to the Epic 880TM 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-Cutter
IPCL	&%UA <m_1> <m_2> <m_3>

Description This command feeds m/96 inches of paper and cycles the auto cutter.

Where m: $m = m_1 * 100 + m_2 * 10 + m_3$

Bitmap Graphics File Support

The Epic 880 printer supports direct printing of Monochrome, 4 bit-16 color, 8bit-256 color, 24bit True color bitmap files. The image may be directly printed or saved temporarily and scaled at 1 to 1 or 2 to 1. Only Printing in Monochrome is supported however full color bitmaps may be sent to the printer.

Color bitmaps are converted to a grayscale representation of its luminance by adding together 30% of the red value, 60% of the green value, and 10% of the blue value. These weights are predefined in the printer and are close to the industry standard 30%, 59% and 11%. Monochrome print is based on a 50% luminance.

Note: Where as the printer will process and print an 8 bit or 24 bit color image, the actual print will be Monochrome. The printer will translate the color image based on its own rules so the resulting image may not be as you intended. In addition, the amount of data in an 8 or 24 bit color bitmap is extensive. The time required to transfer the image will be much longer than the same monochrome image. You are much better off converting the image to Monochrome or 16 colors within your application.

Note: The data in bitmap files is defined from the bottom up. To print the bitmap correctly, the entire bitmap file must be received by the printer before it can be printed. This can cause a delay in the print.

Note: The printer contains a RAM disk and this memory is used to store the bitmap before it is processed. If the bitmap image is to be saved, it will be copied from RAM to Flash storage. This process can take a period of time. Once in the flash storage, the image can be recreated quickly. It is stored as a bitmap file so the image still must be completely processed before it is printed.

[ESC] [FS]	Print Bitmap File Record
ASCII	[ESC] [FS] <Bitmap file data>
Hexadecimal	1BH 1CH <Bitmap file data>
Decimal	<27> <28> <Bitmap file data>
IPCL	None
EPOS	None

Description The [ESC] [FS] command is actually a group of commands intended to print graphics. All bit map files begin with “BM” so when the bitmap data is sent after the [ESC] [FS], the command is really [ESC] [FS] B. This command accepts Monochrome and 16 color bitmap files and saves it as a temporary RAM file. The image may then be printed with the [ESC] [FS] p command or saved in the file system with and [ESC] [FS] S command.

Note: A Bitmap graphic file may also be written to the Epic 880’s file system using the file system commands. It can then be printed by the [ESC] [FS] P command. In this case, it is not saved in the temporary file so the [ESC] [FS] p does not work.

[ESC] [FS] p	**Print bitmap image buffer.**
ASCII	[ESC] [FS] p <Scale>
Hexadecimal	1BH 1CH 70H <Scale>
Decimal	<27> <28> <112> <Scale>
IPCL	None
EPOS	None

Description The [ESC][FS] p command prints a bitmap image in the temporary buffer.

Where Scale 0 = One to one.
1 = Twice the width
2 = Twice the height
3 = Twice the height and width.

The intent of this command is to allow a bitmap file to be loaded into the Epic 880 and printed scaled up to 2 to 1. Use the [ESC] [FS] <Bitmap file data> command to load the bitmap image and the [ESC] [FS] p to print it.

Note: The temporary buffer is also used for various other commands. If the data in the buffer is not a bitmap graphic, it won't be printed by this command.

[ESC] [FS] P	**Load Bitmap File Image Buffer**
ASCII	[ESC] [FS] P <Bitmap file data>
Hexadecimal	1BH 1CH 50H <Bitmap file data>
Decimal	<27> <28> <80> <Bitmap file data>
IPCL	None
EPOS	None

Description The [ESC] [FS] P command accepts Monochrome, 16 color, 256 color and 24bit color bitmap files and prints them immediately bit for bit with no scaling.

[ESC] [FS] P Print Saved Bitmap File Print

ASCII [ESC] [FS] P <Scale> <File Name> [NUL]
Hexadecimal 1BH 1CH 50H <Scale> <File Name> 00H
Decimal <27> <28> <80> <Scale> <File Name> <0>
IPCL None
EPOS None

Description The [ESC] [FS] P command followed by a value that is not 'B' selects a scale, retrieves a graphic file named in the File Name field and prints it at the selected scale. This graphic file must previously have been defined and saved by the [ESC] [FS] command and the [ESC] [FS] S command or by writing a bitmap file to the file system with file system commands.

Where Scale 0 = One to one.
1 = Twice the width
2 = Twice the height
3 = Twice the height and width.

Note: The [ESC] [FS] P command looks for graphic files defined by the [ESC] [FS] S command first. If the Epic 880 cannot find a .bgp file, it will search for a .bmp file. If there are two files with the same root name, the .bgp file will be processed.

[ESC] [FS] S Save Bitmap File Print

ASCII [ESC] [FS] S <File Name> [NUL]
Hexadecimal 1BH 1CH 53H <File Name> 00H
Decimal <27> <28> <83> <File Name> <0>
IPCL None
EPOS None

Description The [ESC] [FS] S accepts a file name and saves the previously defined bitmap file in the RAM file system to the Flash file system. If the file already exists, the existing file will be erased.

Note: The [ESC] [FS] S command erases the RAM file so the [ESC] [FS] p will no longer print the saved image.
Note: This command followed by a zero length file name will flush the stored graphic image.

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, and then print the Logo.
Logo-Cut-Coupon	Print the Logo, Feed to cut, Cut, and 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

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Fonts

Your TransAct® Epic 880™ printer uses outline and/or stroke based scalable fonts. These fonts provide you wish additional font options as well as improved character appearance, while functioning transparently within legacy applications.

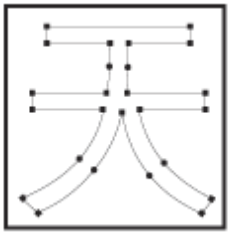
Such fonts represent a substantial improvement to the so-called bitmap fonts that are traditionally used for thermal printers, which are based on a pixel by pixel definition of characters. With a fixed size and fixed character spacing, these bitmap fonts were limited to specific magnification factors 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-like[19] 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.

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

[19] 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.

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 17. 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 18 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 Epic 880™ 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 encoding[20].

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.

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

[20] 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.

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	1st Byte	2nd Byte	3rd Byte
000000000xxxxxxx	0xxxxxxx		
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.

TrueType[21] and Compressed Stroke Fonts[22] are supported by the Epic 880™ Printer. User-defined TrueType fonts many 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]
;EmulationMode = Font,Horizontal,Vertical,Width.
; Where:
```

[21] Some but not all features of Open Type fonts are supported. Open Type fonts are not recommended.
[22] Compressed Stroke fonts are supplied by MonoType Inc.

```
; 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 TrueType 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 33H <ID>	
Decimal	<27> <43> <51> <ID>	

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 $<ID_1>$ $<ID_2>$ $<ID_3>$ … [NUL]	
Hexadecimal	1BH 2BH 53H $<ID_1>$ $<ID_2>$ $<ID_3>$ … 00H	
Decimal	<27> <43> <83> $<ID_1>$ $<ID_2>$ $<ID_3>$ … <0>	

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> [NUL]	
Hexadecimal	1BH 2BH 4EH <FileName> 00H	
Decimal	<27> <43> <78> <FileName> <0>	

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
000000000xxxxxxx	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 their 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 Epic 880™ 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 disables. i.e. 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 <w> <h>	
Decimal	<27> <43> <80> <w> <h>	
Range	w = 0, 4 – 72 h = 4 - 72	

Description 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 <w> <h>	
Decimal	<27> <43> <112> <w> <h>	
Range	w = 0, 16 – 255 h = 16 - 255	

Description 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 <d>	
Decimal	<27> <43> <73> <d>	
Range	d = 0, 4 – 72	

Description 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 <d>	
Decimal	<27> <43> <105> <d>	
Range	d = 0, 16 – 255	

Description 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 <d>	
Decimal	<27> <43> <74> <d>	
Range	d = 0, 4 – 72	

Description 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 <d>	
Decimal	<27> <43> <106> <d>	
Range	d = 0, 16 – 255	

Description The [ESC] + j 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] + 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 minimum Line Spacing in Points	All
ASCII	[ESC] + V <d>	
Hexadecimal	1BH 2BH 56H <d>	
Decimal	<27> <43> <86> <d>	
Range	d = 0, 4 – 72	

Description 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 <d>	
Decimal	<27> <43> <118> <d>	
Range	d = 0, 16 – 255	

Description The [ESC] + v command will set the line spacing in ¼ points, where ¼ point is defined as 1/288th 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 stroke font brush size.	All
ASCII	[ESC] + B <w>	
Hexadecimal	1BH 2BH 42H <w>	
Decimal	<27> <43> <66> <w>	
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 880™ 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 19 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

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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> <32> <Filename> [NUL]	
Hexadecimal	1BH 1EH 4FH <Mode> 20H <Filename> 00H	
Decimal	<27> <30> <79> <Mode> <32> <Filename> <0>	
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 active on Enhanced versions only. It’s not available on all products.

Note: RAM Files are used by the printer to store Bitmap files during processing. If the user application uses RAM files, the available space for Bitmap processing may be limited

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.
.ttf	0	TrueType 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 <B_{7-0}> <B_{15-8}> <B_{23-16}> <B_{31-24}>

Function	**Return Free space for this partition.**	**All**
ASCII	[ESC] [RS] s <n>	
Hexadecimal	1BH 1EH 73H <n>	
Decimal	<27> <30> <115> <n>	
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 <B_{7-0}><B_{15-8}><B_{23-16}><B_{31-24}>

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> [NUL]	
Hexadecimal	1BH 1EH 44H <FileName> 00H	
Decimal	<27> <30> <68> <FileName> <0>	
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> <32> <FileName> [NUL]	
Hexadecimal	1BH 1EH 41H <Attbs> 20H <FileName> 00H	
Decimal	<27> <30> <65> <Attbs> <32> <FileName> <0>	
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.

Note: If the file does not exist a CRC will not be valid and the last file system status will be updated. Enhanced firmware versions will return a 0 CRC.

Function	**Return the last file command status.**	**All**
ASCII	[ESC] [RS] ?	
Hexadecimal	1BH 1EH 3FH	
Decimal	<27> <30> <63>	

Description 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	**Return File CRC command.**	**All**
ASCII	[ESC] [RS] G <FileName> [NUL]	
Hexadecimal	1BH 1EH 47H <FileName> 00H	
Decimal	<27> <30> <71> <FileName> <0>	
FileName	File name from 1 to 30 characters including a three character extension, null terminated.	

Description The [ESC] [RS]G command will return the CRC of the specified file.

Note: If the file does not exist a CRC will not be valid and the last file system status will be updated. Enhanced firmware versions will return a 0 CRC.

Function	Query File Status.	All
ASCII	[ESC] [RS] q	
Hexadecimal	1BH 1EH 71H	
Decimal	<27> <30> <113>	

Description The [ESC] [RS] q command will return the CRC and length of the currently open file.

Return	ACK File open	NAK	File not open
	Length High		0
	Length Low		0
	CRC High		0
	CRC Low		0

Function	Write File command.	All
ASCII	[ESC] [RS] W <L_L> <L_H> <… data ..>	
Hexadecimal	1BH 1EH 57H <L_L> <L_H> <… data ..>	
Decimal	<27> <30> <87> <L_L> <L_H> <… data ..>	

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 <L_L> <L_H>	
Decimal	<27> <30> <82> <L_L> <L_H>	

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 <p>	
Decimal	<27> <30> <88> <p>	
<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 VERIFY.CFG 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

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Extended Control

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 emulation[23].

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 [ESC] y 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.

[23] The Star emulation does not allow the use of [ESC] y commands for extended diagnostics. The [ESC] y commands are not available.

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
10	Power Up Resets
11	Watchdog Resets
12	Base Flash Erases
13	Ext Flash Erases

Values of n	Request:
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 <n>
Decimal:	<27> <126> <106> <n>

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	record number.
------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 proprietary 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 <n>
Decimal <27> <24> <n>

Description 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. The [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>

Description 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™ Maintenance Mode

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Maintenance mode

The enhanced firmware uses a Maintenance mode as the firmware loader & updater. The legacy firmware there is a double level firmware loader.

To allow the printer to be remotely maintained it contains a maintenance mode. When in maintenance mode, the print functions are disabled and only firmware and system maintenance operations are allowed.

Overview

The EPIC 880's normal operating enhanced firmware is loaded from the file system into RAM to run. This provides significantly enhanced performance enhancement as the RAM is about 4 times faster than the flash. The disadvantage is that there must be a firmware loading system (loader) in flash to initially load the RAM. When power is applied, maintenance mode is the loader and will verify and run the operating firmware. After the firmware is started, maintenance mode is no longer required.

The EPIC 880 allows reentry into maintenance mode which allows the firmware and file system to be maintained independent of the operating firmware. This mode will not print and does not require that the printer function.

It is intended for printer setup, maintenance, and failure analysis.

Implementation

EEPROM

Flash has a limited number of read and write cycles so the EPIC 880 contains a 1K EEPROM of information that may require frequent updates (like totals) and for information that is unique to an individual printer like Serial numbers, calibration information, configuration settings and maintenance history. Maintenance mode allows the EEPROM to be read and written independently of normal print operation.

Firmware Loading

Maintenance mode is responsible for loading, verifying and then running firmware. The firmware to be loaded is specified in the PBoot.ini file and specified in one of two ways.
The firmware may be predefined like Runonce.sys, or Main.sys. The firmware may be defined by a root name like "PE8800_" in which case the highest revision of PE8800_ will be found and run. For example, if PE8800_122 and PE8800_123 both exist, PE8800_123 will be loaded and run because it's revision is higher than PE8800_122. This allows firmware roll back.

Note: See the PBoot.ini file description below for more information.

PBOOT.INI File

The boot section of the PBoot.ini file looks like this:

```
;Default Boot Configuration.PB8851-1.12
[boot]
;Boot order, There can be up to 8 Load files
;The defaults are:
Load0 = Runonce.sys
Load1 = UpdPB8801.sys
Load2 = UpdPB8850.sys
Load3 = UpdPB8851.sys
Load4 = UpdPB8853.sys
;If LoadTest is defined, it points to the Test mode root file name
LoadTest = PE8852_
;If LoadHiRev is defined, it points to the root file name
;The highest rev version will be run.
Loadhirev = PE8850_
;If runfrom is defined, the firmware at that address will be run.
runfrom = 0x1104
;If Preloadcfg is defined, the configuration will be preset.
Preloadcfg = 7 1
[usb]
;USB Driver
;Usbclass may be 255, 7, DFU, GSA, 108 ...
;Default is class 7 (Printer device)
Usbclass = 7
;;UsbSpeed may be 0 for Full or 1 for High
;Default Full Speed
Usbspeed = 1
;USB Plug and Play Print driver. 1 = PnP Active.
USB_PnP = 0
```

Note: This file should not be changed unless directed by TransAct.
Note: If no PBoot.INI file is found, the system will generate a default that will allow default operation. It may be modified as required.

USB Interface

The USB interface on this product is integrated into the processor and will support Full and High speed USB 2.00 operation.

The operation of the USB link in maintenance mode is defined by the PBoot.ini file. The device class for the Epic 880 is always a Class 7 or a CDC USB device, however, for future products other class interfaces are allowed.

The USB interface may also be restricted to Full speed operation if required.

USB Enumeration

The USB interface will enumerate as a printer class device. Two devices interfaces will be supported depending on the mode of operation. Maintenance mode has its own USB enumeration PID (Product Identification) and will separate the normal operation from Maintenance mode operation. This implies that when in maintenance mode, the normal print application will not know the printer is present and the maintenance application will not know the printer is connected when in normal operation.

The standard USB printer class interface supports 2 bulk pipes and a control pipe. The control pipe supported by print mode meets the USB printer class specification.

To allow flexibility and allow more than one EPIC 880 printer to be connected to a single host, the way the printer enumerates to the host can also be adjusted. The default is that every printer is identified to host identically. This allows easy interchanging of the printer without requiring any host reconfiguration.

USB Plug and Play as defined by Microsoft is disabled for this product. However, to allow flexibility, the PnP feature may be activated by changing the USB_PNP key in the POR.INI file.

USB and Noise

The USB interface is much more sensitive to noise than the RS232 or RS485 interface. First the levels are much lower and second the data rates are much faster. Noise injected in the USB cable by an outside device (like an air conditioning) will generate false babble on the USB link. The printer will generally ignore this noise but the host, that must accept all data, generally views this as a buffer overrun. This can cause the host to shut down the specific USB link until the cable is disconnected and reconnected.

The printer contains a USB auto recovery feature that (with support from the host) recognizes that the link has been shut down and does an automatic disconnect/reconnect sequence without operator intervention. This makes the USB link considerably more reliable in unattended environments.

Note: Auto recovery is disabled by default in Maintenance mode.

Maintenance Mode Status Commands

[ENQ] <3>	**Inquire receipt paper low status**
ASCII	[ENQ] <3>
Hexadecimal	05H 03H
Decimal	<5> <3>
Function	Receipt paper low
Response	**[**ACK] <3> (06H 03H) Receipt paper is present.

[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

[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

[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	**[**ACK] <10> (06H 0AH) The command was accepted. [NAK] <10> (15H 0AH) The command was rejected.	No response

Description The [ENQ] <10>, has the same effect as resetting the firmware. To prevent data loss, the printer tries to finish printing any 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.

The USB link will not disconnect during this reset. Any data sent to the printer before the reset takes place will be lost.

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] <11> (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

[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> <r_1> <r_2>…

Where **<15>** is the echo of the command ID.
<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).
<r_1>: bit 0 = 1 always
bit 1 = 1
bit 2 = 0

bit 3 = 0
bit 4 = 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
<r_2>: bit 0 - 5 = 0 always
bit 6 = 1 always
bit 7 = 0 always

[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> <r_1> <r_2>…

Where

<20> is the echo of command ID.
<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).
<r_1>: bit 0 = 0 always
bit 1 = 0 always
bit 2 = 0.
bit 3 = 0
bit 4 = 0
bit 5 = 0
bit 6 = 1 always
bit 7 = 0 always
<r_2>: bit 0 = 1 always
bit 1 = 1.
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
<r_3>: bit 0 = 0 always
bit 1 = 1 always (Receipt Station)
bit 2 = 0
bit 3 = 0
bit 4 = Undefined
bit 5 = Printer is offline
bit 6 = 1 always
bit 7 = 0 always
<r_4>: bit 0 = Printer supports receipts.
bit 1 = Printer supports inserted forms.
bit 2 = Printer supports multiple colors

bit 3 = Printer supports cutter.
bit 4 = Printer supports partial cuts.
bit 5 = 0
bit 6 = 1 always
bit 7 = 0 always
<r_5>: 0
<r_6>: 0
<r_7>: 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:Ithaca-Periph.;
CMD:M880CL,IPCL;
CLS:PRINTER;
MDL:880 PcOS;
DES:Ithaca-Peripherals iTherm® 280;
REV:PE8850-01.16
OPTS:$65xy

Where x is a bit field defined as follows:
bit 0 = 1 Red support This printer does not support color
bit 1 = 1 Green support Bits 0-2 are always 0
bit 2 = 1 Blue support
bit 3 = 1 Supports Periodic Status Back
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

Note: This command does not return the operating firmware ID. It only returns the maintenance mode firmware ID.

[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).
<r_1>: Bit status as follows:
bit 0 = 0.
bit 1 = 0
bit 2 = 0.
bit 3 = Not used
bit 4 = 0
bit 5 = 0.
bit 6 = 1 always
bit 7 = An serious error has occurred.

Bit will be set if the Maintenance mode POR.INI file is missing or if the file system is invalid.

[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><n_1><n_2><n_3>
Where <24>	Is the echo of command
<n_1>	Secondary Color 0 = Monochrome, 1 = Red, 2 = Green, 4 = Blue
<n_2>	01H (Primary Black)
<n_3>	40H
Note:	This printer does not support color thermal paper.

[ENQ] <26>	**Inquire current print zone**
ASCII	[ENQ] <26>
Hexadecimal	05H 1AH
Decimal	<5> <26>
Function	The [ENQ] <26> command returns current print zone in dots
Response	[ACK] <26> <n> <r_1> <r_2>…

Where **<26>** is the echo of command ID.
<n> is the number of return bytes + 40
(28H) (to prevent confusion with XON/XOFF).
<r_1>: MSB of the print zone.
<r_2>: LSB of the print zone.

In maintenance mode there are no print functions so this returns 0.

[ENQ] <28>	**Inquire Buffer status**
ASCII	[ENQ] <28>
Hexadecimal	05H 1CH
Decimal	<5> <28>
Function	The [ENQ] <28> command returns current print zone in dots
Response	[ACK] <28> <n> <r_1>

Where **<28>** is the echo of command ID.
<n> is the number of return bytes + 40
(28H) (to prevent confusion with XON/XOFF).
<r_1>: 0-100 Percent of input buffer being used.

[ENQ] <29>	**Inquire Jam detector status**
ASCII	[ENQ] <29>
Hexadecimal	05H 1DH
Decimal	<5> <29>
Function	The [ENQ] <29> command returns current jam detection status
Response	[ACK] <29> <n> <r_1>

Where **<29>** is the echo of command ID.

<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).

<r_1>:
- 0x01 0.
- 0x02 0.
- 0x04 0
- 0x08 0
- 0x10 The Jam detector is sensing paper. (see note below)
- 0x20 1 (Always set)
- 0x40 0
- 0x80 0

Note: The jam detector status bit reflects the real time state of the jam detection sensor. The normal state after a cut and eject is for this bit to be high indicating that there is no jam or no paper at the sensor. During print this sensor will normally see paper as it moves past the sensor and will return a low status. Before the cut operation, it is considered a level 2 jam if there is no paper at this sensor. After the cut and eject, if there is paper at this sensor, it is considered a level 1 jam. At the end of the roll or if the printer is using black dot paper, the jam sensor may detect the black strip or black dot and interpret this condition as no paper present.

[ENQ] <31>	**Inquire Power on status**
ASCII	[ENQ] <31>
Hexadecimal	05H 1FH
Decimal	<5> <31>
Function	The [ENQ] <31> command returns File and POR system status
Response	[ACK] <31> <n> <r_1> <r_2> <r_3>

Where **<31>** is the echo of command ID.

<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).

<r_1>: Power up system status where the bits are defined as follows:
- 0x01 No Font present (never set)
- 0x02 No Files present
- 0x04 File system faulted and has been cleared
- 0x08 POR.INI file was missing and a default has been generated.
- 0x10 Code page file requested Is missing. (never set)
- 0x20 The primary FAT was corrupt and the alternate was used.
- 0x40 The primary and alternate FAT's are corrupt and the file system has been initialized.

<r_2>: Font system status

0x00 Font system closed (There is no font system so it is always closed)
0x01 Font system Ready. (never set)
0x02 Font system Fault. (never set)
All other values are errors that will also set the R3 status byte.

<r_3>: Font imaging system extended status. (never set)
Extended status information being present is a serious error in the printer.

[ENQ] <32>	**Inquire Raw system status**
ASCII	[ENQ] <32>
Hexadecimal	05H 20H
Decimal	<5> <32>
Function	The [ENQ] <32> command returns Raw system status
Response	[ACK] <32> <n> <r_1> <r_2> <r_3><r_4>

Where **<32>** is the echo of command ID.

<n> is the number of return bytes + 40 (28H) (to prevent confusion with XON/XOFF).

<r_1>: Peripheral Status:

PERIPHERAL FAULT	0x80
PERIPHERAL RESET	0x40
DEVICE_BUSY	0x20

<r_2>: Primary Error State: Always 0 or 0x80

GTECH ilg cmd	0x0080

<r_3>: Secondary Error Status

Print Blocked	0x80	Operator recoverable
Protocol Fault	0x80	The protocol is bad
Invalid Command	0x01	The command is not correct
Undef Command	0x01	The command does not exist
Flash Logo Invalid	0x02	A logo is missing (never set)
Invalid Barcode	0x04	The barcode is too large or invalid (never set)
Missed TOF	0x08	The TOF was missed (never set)
Paper Jam Det	0x10	Paper Jam Detected (never set)
Cover Open Det	0x20	Cover Open Status (never set)
Big-time Error	0x80	Printer has faulted for some reason.

<r_4>: Black Dot Sensing Status (never set)

[ENQ] <34>	**Inquire Firmware ID and Rev.**
ASCII	[ENQ] <34>
Hexadecimal	05H 22H
Decimal	<5> <34>
Function	The [ENQ] <34> command returns the Firmware ID and revision.
Response	[ACK] <34> <51> PE885z-X.XX.
Where	
	<34> Is the echo of command
	<51> Length + 40
	Firmware ID PE885z
	Separator - (0x2D or 45D)
	Rev X.XX (Current Revision in ASCII)
Note:	This may or may not match the firmware file name returned by [ENQ]<38>. It is also not updated by loading a firmware update. This is the ID and Rev of the currently running firmware.

[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.

[ENQ] <36>	**Inquire current UTF encoding mode.**
ASCII	[ENQ] <36>
Hexadecimal	05H 24H
Decimal	<5> <36>
Function	The [ENQ] <36> command returns the current UTF encoding mode.
Response	[ACK] <36> <41> <n>
Where	
	<36> Is the echo of command
	<41> Length + 40
	<n> The UTF Mode where:
	0 = ASCII (Maintenance mode is always ASCII 8 bit.)

[ENQ] <37>	**Inquire barcode error code.**
ASCII	[ENQ] <37>
Hexadecimal	05H 25H
Decimal	<5> <37>
Function	The [ENQ] <37> command returns the 16 bit barcode error code that may have been generated by the last barcode operation.
Response	[ACK] <37> <42> <Er_{0-7}><Er_{8-15}>

Where

<37> Is the echo of command
<42> Length + 40
Er Is the Barcode error code.
Barcode Errors are always 0 in Maintenance mode.

[ENQ] <38>	**Inquire Loaded firmware file name.**
ASCII	[ENQ] <38>
Hexadecimal	05H 26H
Decimal	<5> <38>
Function	The [ENQ] <38> command returns the name of the firmware load file. If the firmware has been updated, this will return the updated file name.
Response	[ACK] <38> <4x> “null terminated file name”

Where

<38> Is the echo of command
<4x> Length of the return response + 40

[ENQ] <39> **Inquire Firmware update status.**

ASCII [ENQ] <39>
Hexadecimal 05H 27H
Decimal <5> <39>
Function The [ENQ] <39> command returns the status and current CRC of the update process. The CRC is the current CRC and unless the status indicates that the load is complete the CRC is not complete.
Response [ACK] <39> <43> <Status><CRC_{0-7}><CRC_{8-15}>
Where

<39> Is the echo of command
<43> Length of the return response + 40
CBT Status: 0 Process idle.
3 Receiving Data
4 Writing the data
5 Update complete and verified
8 Update not complete and waiting for more data.
17 Fault. Update cannot be completed.
18 Update complete, verification failed.
21 Update complete, verification attempted but no verify data was found.

CBL Status 0 Process idle.
1 Processing the name
3 Receiving Data
4 Writing the data
5 Update complete
17 Fault. (Can't open the new file)
18 Invalid data (CRC is not correct)

CRC Current CRC calculation for the file being loaded or of the loaded file.

Note: The cbt file must contain a complete flash image for the Update complete status to be set. If after the complete file is transferred the update is not complete, If the update process is waiting for more data, it can safely be restarted. If the process is still in the Receiving data phase when the cbt file ends, pad data must be sent until the waiting for data state is active before the update can be restarted.
Note: During CBT file operations the cbl Status and CRC are not used. During cbl file operations the cbt status is not used

[ENQ] <40>	**Inquire Firmware Code Space CRC.**
ASCII	[ENQ] <40>
Hexadecimal	05H 28H
Decimal	<5> <40>
Function	The [ENQ] <40> command returns the current CRC of the last run firmware file.
Response	[ACK] <40> <42> < CRC_{0-7}><CRC_{8-15}>
Where	
	<40> Is the echo of command
	<42> Length of the return response + 40
	CRC Is the CRC of the last run firmware.

Firmware and system updates

There are two types of system updates. One is the firmware only update. This only updates the firmware file.

Firmware File update

Because the firmware is simply a file that is loaded into memory and run, a firmware update only need update the firmware file.

To allow verification that the update was successful, a unique update start command is provided that will set the firmware file name and specify the CRC of the following image data. When this update start command is received, the file system is checked to see if the firmware file already exists. If it does, a temporary file name is defined that prevents the existing firmware from being erased until the update is received and verified. This process may be used for any file, however, if this is a firmware update, the file name must be consistent with the root file name defined in the PBoot.ini file or it can't be found by the loader. In this case PE8850_ is the root name. As the firmware or file image is received, the printer will maintain a CRC of the image data. Note: The firmware image data is not the actual memory data but is a compressed version of it. The CRC is calculated on the compressed file data not the resulting memory image. When the close command is received, the CRC is compared to the expected value and if they match; the file is committed to the file system and named as defined in the firmware update command.

The Firmware update process may also be used to update any file system file. This includes fonts and logo images. The process is the same only rather than a firmware file name, the file name to be updates may be used.

It is also possible to just use file system commands to perform the same process, however the CRC integrity check will not be functional.

For firmware updates, TransAct will provide a complete update file image including the start, file name, CRC, data and the close command as defined in the automated process below. TransAct will also provide "upon request" the firmware file without the update commands.

Automated Firmware or file update procedure

1. Wait for the printer to be idle and not busy.
2. Issue [ESC] [ETB] C <n> command to clean up all but the last n images (n is typically 1).
3. In POS mode simply send the file data to the printer.
4. It may take time for the printer to completely process all the data. In POS mode you may send [ENQ] 39 commands after all complete file has been sent.
5. In POS mode use the [ENQ] 38 command.
6. Issue a reset command.

Non automated Firmware or file update procedure

1. Wait for the printer to be idle and not busy.
2. Issue [ESC] [ETB] C <n> command to clean up all but the last n images (n is typically 1).
3. Issue the [ESC] [RS] U firmware update command. (You must know the CRC16 of all the file data to be sent to the printer and included as part of this command.
4. Send the complete file image using multiple [ESC] [RS] W commands.
   Note: The data is a compressed image of a binary load file. The binary load file need not

be of contiguous memory. CRC calculations on the embedded data are not useful because there is formatting and verification information present in the file as well as significant gaps in the firmware load locations. The reported CRC is of the compressed image file's CRC.

5. Use the [ENQ] 39 between [ESC] [RS] W commands to track the load.
6. Issue a [ESC] [RS] C close command to save and check the file.
7. It may take time for the printer to completely process all the data, you can use the [ENQ] 39 to track and validate the load.
8. Use the [ENQ] 38 to return the updated firmware ID and Revision.
9. Issue a reset command.

Firmware image file format

The firmware image is composed of numerous firmware load records. These load records are collected into 16K blocks and compressed to make the load faster. All the compressed blocks are collected together and placed into a single firmware image update file.

An individual firmware image record consists of a start flag, length, address and data followed by a check character. To some extent this matches the Motorola S-Record format. There is also a zero length record that contains the entry address as the load address.

A CRC is generated on the compressed file and stored in the file allocation table. For the file to load into memory correctly, the File CRC must be valid, the file must decompress correctly, and the check character on each decompressed record must be correct. Any format error or other error will also stop the load process. Any image that tries to reference memory outside the loadable memory bounds will also stop the load process.

TransAct will provide the compressed update .cbl file with the start, file name, CRC, data and the close commands all included and ready to send to the printer.

System Update Verification

After a firmware update, the file system should be verified to assure that the system is complete and correct. There are two ways to do this. One is by using the host system to track and verify the update. The other is to have the printer verify the update before it is run after a reset.

Optionally a "load verify" file may be added to the update that contains the CRC of all the files in the system partition that must be correct. This file will be checked at every power up and if present will force the system to perform a full file system verification where each file is actually read and the as read CRC is compared to the CRC saved in the File allocation tables. If the CRC does not match, the file is deleted and the verification fails.

Then the CRC of each file in the "load verify" file is compared to the file in the system and if the file is not present or does not match, the verification fails.

If the verification process fails at any point, the printer will not install any pending updates and will remain in maintenance mode. This failure is indicated with a 5 blink Error code. To inform the system of the fault, the response to a poll will indicate a fault, the system status will report printer error and the file system status (see page **Error! Bookmark not defined.**) will indicate a file system fault. The printer will not recover from this error on its own. It will remain in

maintenance mode until the “load verify” file matches the system. At this point the update should be reapplied.

If the verification process does not detect any errors, the “load verify” file is deleted and the update process proceeds.

Note: The verification process takes time. It has to read each file and generate a CRC for it. The communications is not active during this process and the host system should not time out waiting for the printer to come back on line.

In most cases the load verify file will be generated as part of the update, however the file format is documented here.

The file name is Loadvrf.cfg

Format is: File name space CRC in 0xHEX format

For example:

PE8850_105.sy_	0x4048
Chr13x24.bft	0x3110
Chr15x24.bft	0xF467
Ocr16x24.bft	0x7809
Tactwgl_m.ttf	0x6C56
Chr10x24.bft	0xF974

Firmware or File Update Commands

Firmware Update Commands

Define Firmware Image

The [ESC] [ETB] U Identifies and starts a firmware update process. It is equivalent to a file open except flags it as a firmware image. Write mode is implied so no write parameter need be used. In addition, sending this command will prevent any further printing operation until the update operation is completed or stopped. (It may be stopped by issuing a close command at any time.)

ASCII	[ESC] [ETB] U <CRCh> <CRCl> <FirmwareID> [NUL]
Hexadecimal	1BH 17H 55H <CRCh> <CRCl> <FirmwareID> 00H
Decimal	<27> <23> <85> <CRCh> <CRCl> <FirmwareID> <0>

Where: <CRCh><CRCl> is the CRC of the complete firmware image
FirmwareID is the firmware ID (File name).

This command is generally followed by [ESC] [RS] W commands that send all the data to the printer to be stored in the firmware image.

Cleanup Firmware Images
The [ESC] [ETB] C command cleans up old firmware images. It will remove all but the specified number of old firmware images. This command is typically used before a firmware update to clean out old firmware images and make room for new ones.

ASCII	[ESC] [ETB] C <n>
Hexadecimal	1BH 17H 43H <n>
Decimal	<27> <23> <67> <n>

Where: <n> is the number of old images to keep. If n = 0, then all firmware images are removed.

Roll back the Firmware Image
The [ESC] [ETB] B command regresses to a previous firmware image. If there is an older image present, it will remove the latest firmware images. This command is typically used to roll back a firmware update.

ASCII	[ESC] [ETB] B <n>
Hexadecimal	1BH 17H 42H <n>
Decimal	<27> <23> <66> <n>

Where: <n> is the unlock key value of 'Y' (59H or <89>) If n is any other value the command will be ignored.
Note: This command will be ignored if there is no previous version present.

Set Firmware Image root name.
The [ESC] [ETB] N command resets the firmware image root name. This is set by default in the PBoot.ini file but may be redefined by this command.

ASCII	[ESC] [ETB] N <Root_Name> [NUL]
Hexadecimal	1BH 17H 4EH <Root_Name> 00H
Decimal	<27> <23> <78> <Root_Name> <0>

Where: Root_Name is the root of the firmware image. For PE8850_123, PE8850_ would be the root name and 123 is the revision. The system will search for the file with the highest numeric revision to load and run.

Report Firmware Image content.
The [ESC] [ETB] R command either prints or returns a report.

ASCII	[ESC] [ETB] R <n>
Hexadecimal	1BH 17H 52H <n>
Decimal	<27> <23> <82> <n>

Where:
<n> Is where to report
<0> is print it, any other value will return the report.

Write File command.
The [ESC] [RS] W command sends data to the printer to be stored in the file.

ASCII	[ESC] [RS] W <LL> <LH> <… data ..>
Hexadecimal	1BH 1EH 57H <LL> <LH> <… data ..>
Decimal	<27> <30> <87> <LL> <LH> <… data ..>

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.

Close File command.
The [ESC] [RS] C command will close the currently open file.

ASCII	[ESC] [RS] C
Hexadecimal	1BH 1EH 43H
Decimal	<27> <30> <67>

When the file close command is issued, the file will be verified using the initial CRC supplied with the [ESC] [RS] U command. If the image is valid, it will be saved to the file system, if the image CRC does not match, the image will not be saved. If this was a firmware update, a printer reset must be issued to force the system to restart and load the new image.

Maintenance Mode Firmware update

At some point it may become necessary to update the Maintenance mode firmware in flash. This is done by loading a firmware update program into the flash file system that will be run after then next reset that will erase the Maintenance mode flash image and replace it with an updated version. If this process is interrupted, it is possible to make the printer inoperable and unrecoverable in the field. If updating the maintenance mode is required, TransAct will issue a Maintenance mode firmware update file image that may be loaded just like a normal operating firmware update. The difference will be that the time period between the reset and the when the normal firmware is started will be longer.

The process will be as follows:

1) Download the maintenance mode update image.
2) Verify the image is loaded correctly
3) Issue a firmware reset.
4) The printer will do a USB Disconnect.
5) The printer will load the update image into RAM and start it.
6) The update will verify the flash update image.
7) If valid, all interrupts will be disabled and the maintenance mode flash blocks will be erased.
8) The flash update image will be copied to the flash blocks and verified.
9) The flash update program will then erase itself from the file system.
10) The printer will then be reset and normal start up will proceed.

Full system Image update

Maintenance mode may also be used to load a complete flash file system image. This image will include a block by block image of the file system as well as an image of the FAT (File Allocation Tables). This process will completely replace the file system and as a result all the firmware and fonts in the printer.

This process is less reliable than the file by file update method in that no backup is kept. If it fails, it fails and when the file system is reactivated, any corrupt file will be deleted. If the FAT is corrupt, the entire file system will be deleted. To minimize this, the file system verify commands may be used to check the system validity.

Note: The new file system image must match the file system partition definition defined in the EEPROM. If it does not, the new file system will be considered corrupted and erased. The EEPROM definition must be updated before the new file system is opened.

TransAct will provide this image in a file that contains all the information required to replace the entire file system. This image should be sent unaltered to the printer in whatever protocol is currently active. It is extremely important to know that once this process is started, it cannot be stopped without corrupting the file system. It's possible for a partially corrupted file system to actually function (to some extent) after a power cycle. The power up diagnostics will attempt to repair any file system errors. If critical files within the system are valid, the system will boot. The file system integrity should be verified after this type of update.

The file system is automatically shut down when this process starts. When the file image re-write process is complete, the file system can be reopened and the CRC on each file checked. There is an automated process that may be started and monitored by the host application that will verify the integrity of the file system. See the File System Verify commands.

Legacy Double Level Loader

In the legacy code (PE880x firmware) there is a double level firmware loader. The enhanced version (PE8850 firmware) uses an enhanced Maintenance mode.

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 node.

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 invoked. [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. i.e. 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. i.e. 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	02H 58H
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 14

Epic 880™ Programmers Notes

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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?

Legacy Firmware

The Legacy 880 printer supported the TransAct Virtual Serial (TVS) USB Driver that 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.

Enhanced Mode firmware

The enhanced version of firmware supports the TransAct Virtual Serial (TVS) USB Driver as well as the USB standard USB Class Definitions for Communication Devices “CDC class” USB interface. When the printer is in the CDC class mode, it will function as a USB Communications device and appear in the Device manager as a COM port.

http://www.usb.org/developers/devclass_docs/usbcdc11.pdf

Note: If virtual serial port support is required, this mode should be used rather than the TransAct TVS driver.

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?)

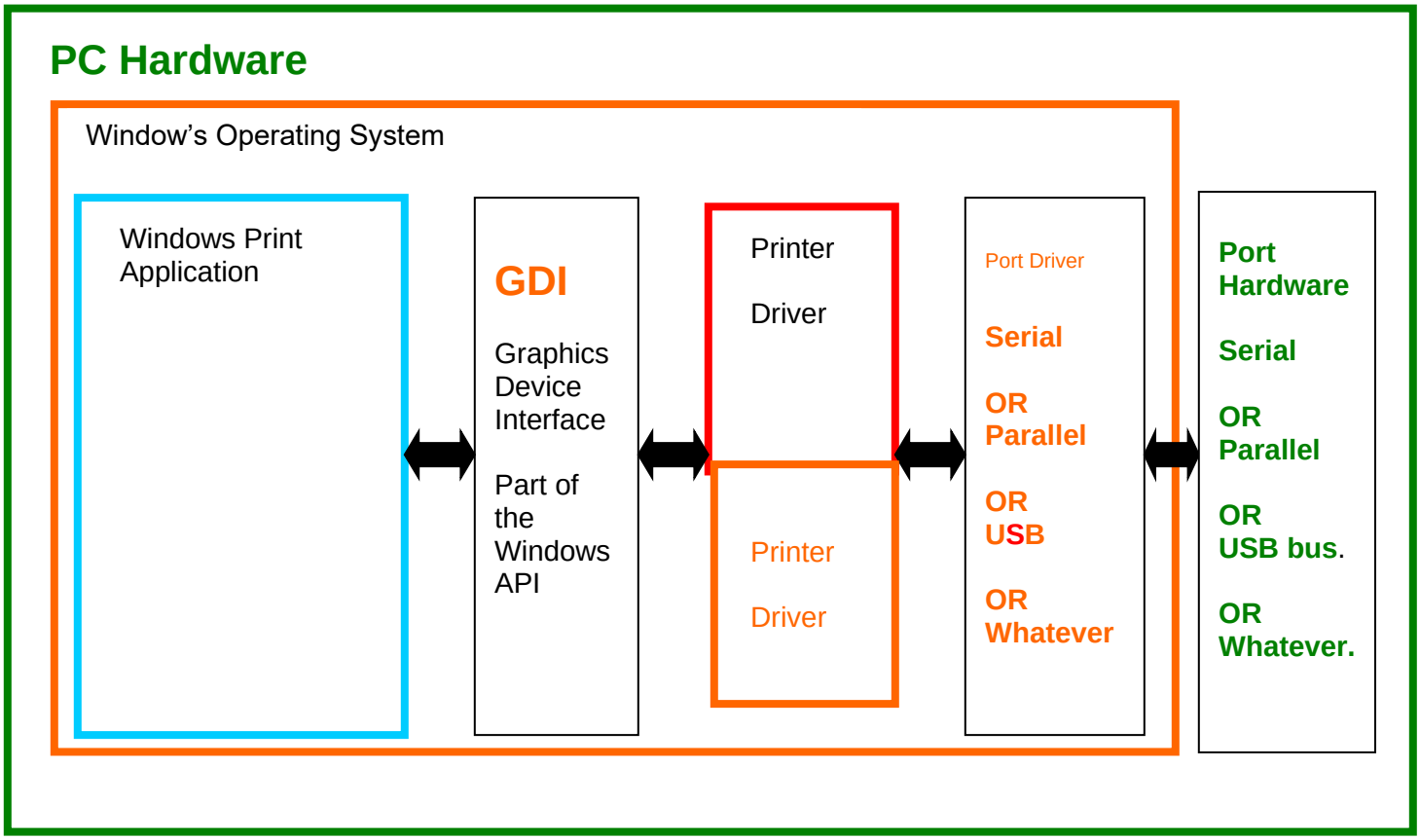

Figure 85 Windows Driver

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.

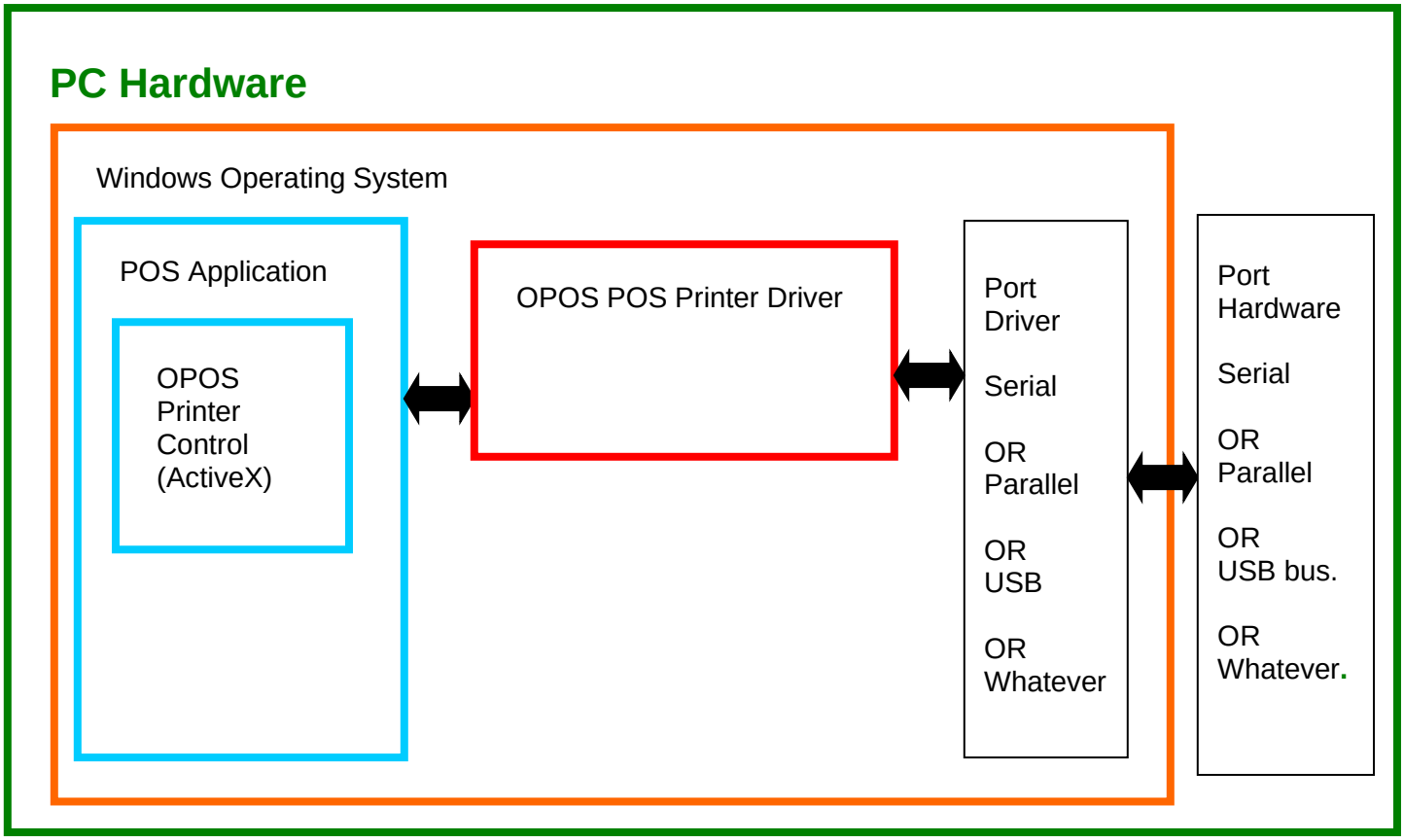

Figure 86 OPOS (UPOS) Driver

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.

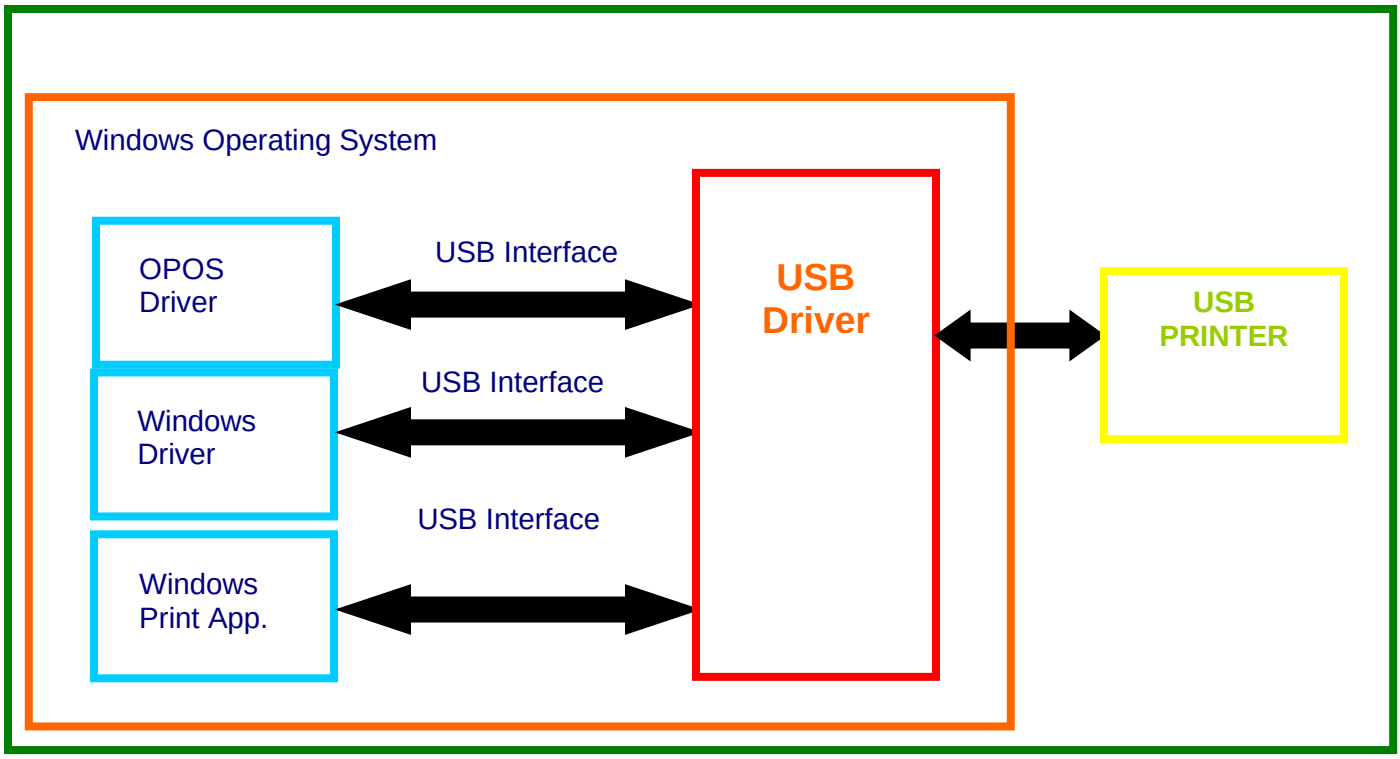

Figure 87 USB Driver

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.

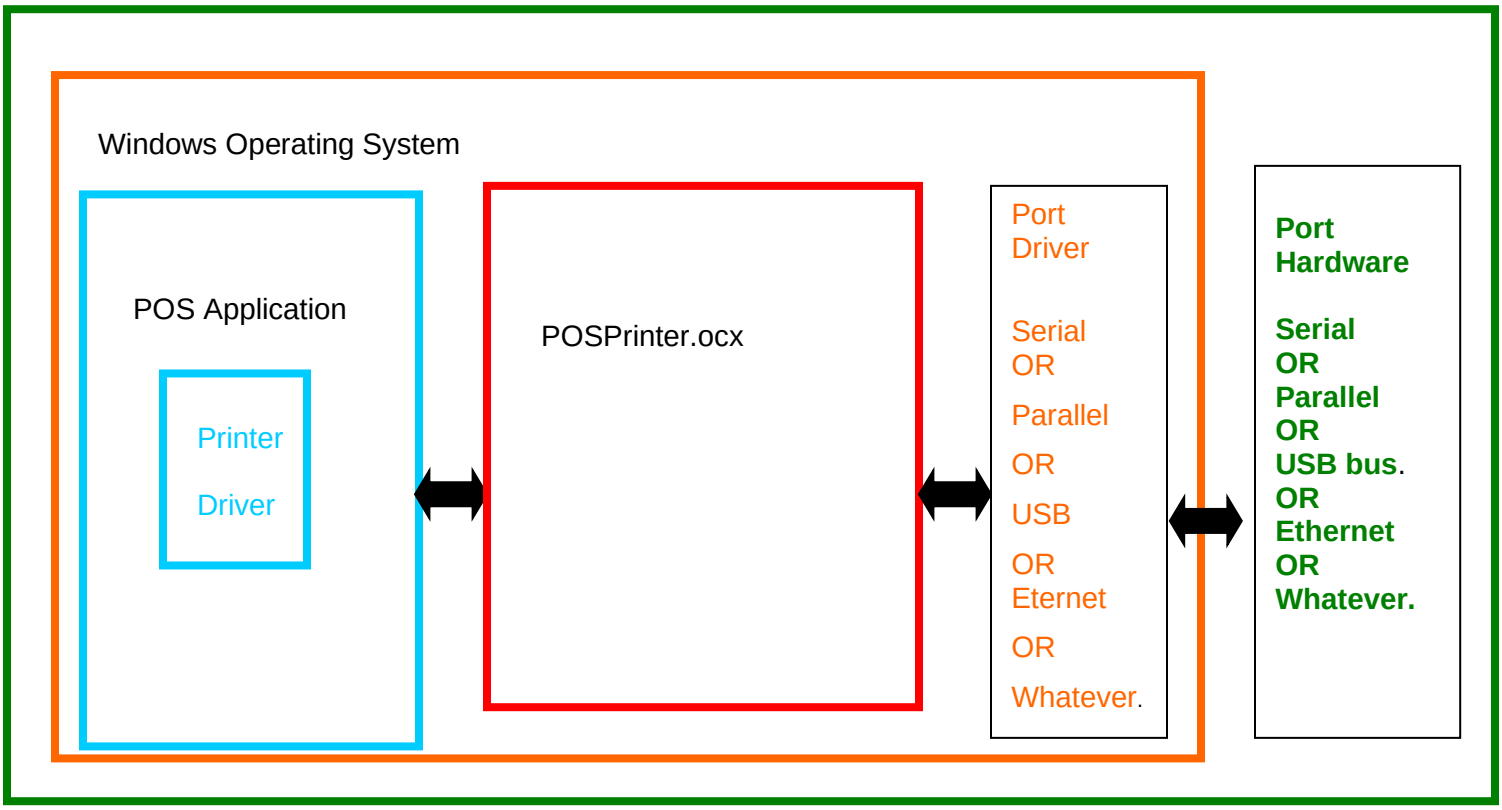

Figure 88 POSPrinter OCX

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	0xFAFF	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
0xFFF0	0xFFFF	Specials
0xFFF0	0xFFFD	Specials
0xFFFE	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	SUPERSCRIPT TWO
00B3	SUPERSCRIPT THREE
00B4	ACUTE ACCENT
00B5	MICRO SIGN
00B6	PARAGRAPH SIGN
00B7	MIDDLE DOT, KANA CONJOCTIVE
00B8	CEDILLA
00B9	SUPERSCRIPT 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 OGENEK
0119	LATIN SMALL LETTER E WITH OGENEK
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 CMALL 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	PARENTHESIZED DIGIT ONE
2475	PARENTHESIZED DIGIT TWO
2476	PARENTHESIZED DIGIT THREE
2477	PARENTHESIZED DIGIT FOUR
2478	PARENTHESIZED DIGIT FIVE
2479	PARENTHESIZED DIGIT SIX
247A	PARENTHESIZED DIGIT SEVEN
247B	PARENTHESIZED DIGIT EIGHT
247C	PARENTHESIZED DIGIT NINE
247D	PARENTHESIZED NUMBER TEN
247E	PARENTHESIZED NUMBER ELEVEN
247F	PARENTHESIZED NUMBER TWELVE
2480	PARENTHESIZED NUMBER THIRTEEN
2481	PARENTHESIZED NUMBER FOURTEEN
2482	PARENTHESIZED NUMBER FIFTEEN
2483	PARENTHESIZED NUMBER SIXTEEN
2484	PARENTHESIZED NUMBER SEVENTEEN
2485	PARENTHESIZED NUMBER EIGHTEEN
2486	PARENTHESIZED NUMBER NINETEEN
2487	PARENTHESIZED 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 DESCRIPTION CHARACTER LEFT TO RIGHT
2FF1	IDEOGRAPHIC DESCRIPTION CHARACTER ABOVE TO BELOW
2FF2	IDEOGRAPHIC DESCRIPTION CHARACTER LEFT TO MIDDLE AND RIGHT
2FF3	IDEOGRAPHIC DESCRIPTION CHARACTER ABOVE TO MIDDLE AND BELOW
2FF4	IDEOGRAPHIC DESCRIPTION CHARACTER FULL SURROUND
2FF5	IDEOGRAPHIC DESCRIPTION CHARACTER SURROUND FROM ABOVE
2FF6	IDEOGRAPHIC DESCRIPTION CHARACTER SURROUND FROM BELOW
2FF7	IDEOGRAPHIC DESCRIPTION CHARACTER SURROUND FROM LEFT
2FF8	IDEOGRAPHIC DESCRIPTION CHARACTER SURROUND FROM UPPER LEFT
2FF9	IDEOGRAPHIC DESCRIPTION CHARACTER SURROUND FROM UPPER RIGHT
2FFA	IDEOGRAPHIC DESCRIPTION CHARACTER SURROUND FROM LOWER LEFT
2FFB	IDEOGRAPHIC DESCRIPTION CHARACTER OVERLAID
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	PARENTHESIZED IDEOGRAPH ONE
3221	PARENTHESIZED IDEOGRAPH TWO
3222	PARENTHESIZED IDEOGRAPH THREE
3223	PARENTHESIZED IDEOGRAPH FOUR
3224	PARENTHESIZED IDEOGRAPH FIVE
3225	PARENTHESIZED IDEOGRAPH SIX
3226	PARENTHESIZED IDEOGRAPH SEVEN
3227	PARENTHESIZED IDEOGRAPH EIGHT
3228	PARENTHESIZED IDEOGRAPH NINE
3229	PARENTHESIZED IDEOGRAPH TEN
3231	PARENTHESIZED 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	SUPERSCRIPT TWO
0xB3	0x00B3	SUPERSCRIPT THREE
0xB4	0x00B4	ACUTE ACCENT
0xB5	0x00B5	MICRO SIGN
0xB6	0x00B6	PILCROW SIGN
0xB7	0x00B7	MIDDLE DOT
0xB8	0x00B8	CEDILLA
0xB9	0x00B9	SUPERSCRIPT 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_l>	Hex <n_h> <n_l>
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	IS08859	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 legacy applications.
They are not recommended for new applications.

Appendix F: ASCII Code Table

Hex	Decimal	ASCII
00	0	NULL
01	1	SOH
02	2	STX
03	3	ETX
04	4	EOT
05	5	ENQ
06	6	ACK
07	7	BEL
08	8	BS
09	9	HT
0A	10	LF
0B	11	VT
0C	12	FF
0D	13	CR
0E	14	SO
0F	15	SI
10	16	DLE
11	17	DC1
12	18	DC2
13	19	DC3
14	20	DC4
15	21	NAK
16	22	SYN
17	23	ETB
18	24	CAN
19	25	EM
1A	26	SUB
1B	27	ESC
1C	28	FS
1D	29	GS
1E	30	RS
1F	31	US

Hex	Decimal	ASCII
20	32	(SP)
21	33	!
22	34	"
23	35	#
24	36	$
25	37	%
26	38	&
27	39	'
28	40	(
29	41	)
2A	42	*
2B	43	+
2C	44	,
2D	45	-
2E	46	.
2F	47	/
30	48	0
31	49	1
32	50	2
33	51	3
34	52	4
35	53	5
36	54	6
37	55	7
38	56	8
39	57	9
3A	58	:
3B	59	;
3C	60	<
3D	61	=
3E	62	>
3F	63	?

Hex	Decimal	ASCII
40	64	@
41	65	A
42	66	B
43	67	C
44	68	D
45	69	E
46	70	F
47	71	G
48	72	H
49	73	I
4A	74	J
4B	75	K
4C	76	L
4D	77	M
4E	78	N
4F	79	O
50	80	P
51	81	Q
52	82	R
53	83	S
54	84	T
55	85	U
56	86	V
57	87	W
58	88	X
59	89	Y
5A	90	Z
5B	91	[
5C	92	\
5D	93	]
5E	94	^
5F	95	_

Hex	Decimal	ASCII
60	96	`
61	97	a
62	98	b
63	99	c
64	100	d
65	101	e
66	102	f
67	103	g
68	104	h
69	105	i
6A	106	j
6B	107	k
6C	108	l
6D	109	m
6E	110	n
6F	111	o
70	112	p
71	113	q
72	114	r
73	115	s
74	116	t
75	117	u
76	118	v
77	119	w
78	120	x
79	121	y
7A	122	z
7B	123	{
7C	124	|
7D	125	}
7E	126	~
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.

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