

Successfully Integrating Bar Code Printers in the IBM Midrange Environment



A ZEBRA BLACK & WHITE PAPER





Copyrights

©2006 ZIH Corp. EPL, ZebraLink, and all product names and numbers are trademarks of, and Zebra, the Zebra head graphic, ZPL, and ZebraNet are registered trademarks of, ZIH Corp. All rights reserved. Print Services Facility is a trademark of, and IBM, AS/400, iSeries, and Intelligent Printer Data Stream are registered trademarks of, International Business Machines Corporation. Windows and Windows NT are either registered trademarks or trademarks of Microsoft Corporation in the United States and/or other countries. Unicode is a trademark of Unicode, Inc. Marknet is a registered trademark of Lexmark International, Inc. UNIX is a registered trademark of The Open Group. All other trademarks are the property of their respective owners.

Unauthorized reproduction of this document or the software in the label printer may result in imprisonment of up to one year and fines of up to \$10,000 (17 U.S.C.506). Copyright violators may be subject to civil liability.



Executive Summary

Organizations with IBM® AS/400® and iSeries® computers face three major challenges to printing bar code and radio frequency identification (RFID) smart labels from their host environment. First, bar code printing is often required at dock doors, shop floors, and other locations far from the computer room. A bigger challenge is that printer management features within the IBM midrange environment are not optimized for thermal label printers, which has traditionally limited administrators' ability to remotely monitor, manage, and troubleshoot label printers. The biggest challenge is that IBM midrange computers do not support the printer control languages (PCLs) that thermal label printers use to optimize bar code and RFID output, so print commands from the IBM host must be converted to a format the printer can recognize.

Software and integration approaches that solve some of these challenges do not necessarily solve all of them. Printers with features friendly to the IBM midrange environment can greatly simplify the label printing challenge and provide organizations superior total cost of ownership. With optimized IBM solutions, enterprises can print bar codes without having to add and support dedicated PCs or Windows® drivers, and without making costly and time-consuming revisions to application software. IBM connectivity lets information from AS/400 and iSeries computers be output in a variety of bar code printers, including mobile, wireless, and RFID smart label printers. This white paper will explain options for bar code and RFID printing in the IBM midrange environment by:

- Explaining software connectivity options, including ZebraDesigner™ label design software, embedding label printer support within midrange applications, and middleware;
- Providing an overview of supported protocols and how to use them, including SNMP, ASCII, Intelligent Printer Data Stream™ (IPDS), Ethernet, and twinax/coax;
- Illustrating the advantages of controlling Zebra® printers through IBM's favored IBMSNMPDRV driver;
- Describing how Zebra printers can be included in IBM networks through Ethernet, wireless, and other connectivity options;
- Presenting the device management and remote print queue options for printer management.

With effective printer networking and output management, it isn't necessary to dedicate network administrators and support personnel to keep the bar code printing system running. The selection of the proper printers, networking options, software integration tools, and IBM business partners are critical to creating and managing an efficient bar code printing operation.

Generating Bar Code Output from the IBM Midrange

Zebra and other thermal printers are basically ASCII printers that respond to a proprietary printer page description language such as Zebra Programming Language (ZPL®), Eltron Programming Language (EPL™) or Comtec Printer Control Language (CPCL). Thermal printers typically do not support the page description languages commonly used by document printers in IBM environments. Therefore, the IBM output must be converted to a format that the thermal printer can recognize. Conversion can occur through middleware, a print server, embedding the thermal PCL code within the IBM application, or bar code labeling software.



There are several ways to integrate Zebra's page description languages (ZPL, EPL, and CPCL) with existing business applications for printing from the IBM midrange platform, so organizations can choose a method that best matches their architecture and software environment. Business applications can be integrated with Zebra printers by:

- Embedding or calling ZPL code within the host application;
- External print servers that can convert IPDS commands to ZPL;
- Third-party middleware or labeling software.

Integrating ZPL into Applications

Sending ZPL directly from software applications residing on the IBM midrange host allows printing to any ZPL-enabled printer without printer drivers, middleware, or any further modification. This approach essentially does a search and replace for pre-defined variables. This method works for all page description languages and does not require that you understand the syntax.

This embedded ZPL approach enables Zebra customers to take full advantage of Zebra printer features and functions with no software licensing. Implementations can be relatively fast because there are minimal installation, configuration, support, and operator training requirements.

Some application software companies have embedded ZPL into their applications to offer plug-and-play bar code printing capability. ZPL also is commonly directly sent from legacy applications and systems. Legacy applications can send ZPL by either embedding the commands within the application itself, or by calling an external file that contains the commands along with pre-defined variable names, which allows the application to do a search and replace.

Zebra customers, resellers, and partners can integrate ZPL code into a variety of legacy applications. This white paper is intended as a general guide to Zebra bar code printing options for the IBM midrange platform, not as a programming manual. Visit Zebra's Web site, www.zebra.com, for more literature about ZPL programming.

Zebra Special Feature: Native International Character Printing Directly from the IBM Platform

Companies working across borders must consider what language support they need from their label printer. Most Western European languages are not a problem for label printers, but special consideration must be given to Eastern European, Middle Eastern and African (EMEA) languages, as these will prove to be very costly to implement for bar code label printers without Unicode™ support. Zebra eliminates these concerns by including native Unicode support in its printers shipped to the EMEA region and offering it as a free option in the rest of the world.

Zebra printers ship with out-of-the box support for most EMEA languages, with a convenient option to add fonts for Asian languages. With Zebra's Unicode solutions, users can implement the same printer model, label formats, and iSeries applications in all headquarters and regional locations without customization or additional font and codepage licensing. Enterprises avoid the need for many derivatives of custom applications and printer configurations, and gain superior return on investment from their print system.



ZebraDesigner Label Design Software

ZebraDesigner is a graphical design tool to create label formats on a Windows PC. After labels are designed, this easy-to-use software generates optimized ZPL that is then uploaded, normally via FTP, to the IBM midrange for printing directly from RGP II, COBOL, or other programming languages. All the programmer needs to do is merge the variable data file with the previously defined “variable names.” This type of printing is very fast and similar to mail merge. Alternatively, the label file could be embedded within a legacy application to support bar code output.

ZebraDesigner doesn't require the user to implement separate middleware, but does require applications to be modified to merge the variable data. Zebra has written detailed documentation to help connect and integrate Zebra printers with IBM midrange servers. It explains how to FTP (upload) the ZebraDesigner-created print file and how to set up devices, queues, and writers on the IBM iSeries. This technical documentation is titled “A Guide to Bar Code Label Printing for IBM Midrange Servers” and is available for download at www.zebra.com/ibm.

Third-party labeling software is also available for bar code printing for the IBM platform. Visit www.zebra.com/ibm to learn about labeling software and other solutions available from Zebra and its partners for IBM midrange servers.

Print Servers

Print servers are peripherals that reside between the printer and the IBM host to convert data streams and manage printing operations. Print servers can be used in homogenous and multi-vendor printer environments. They also can convert data from bar code scanners, scales and other peripherals, and software environments for bar code output. The role of print servers will be discussed further in the Printer Management Options section.

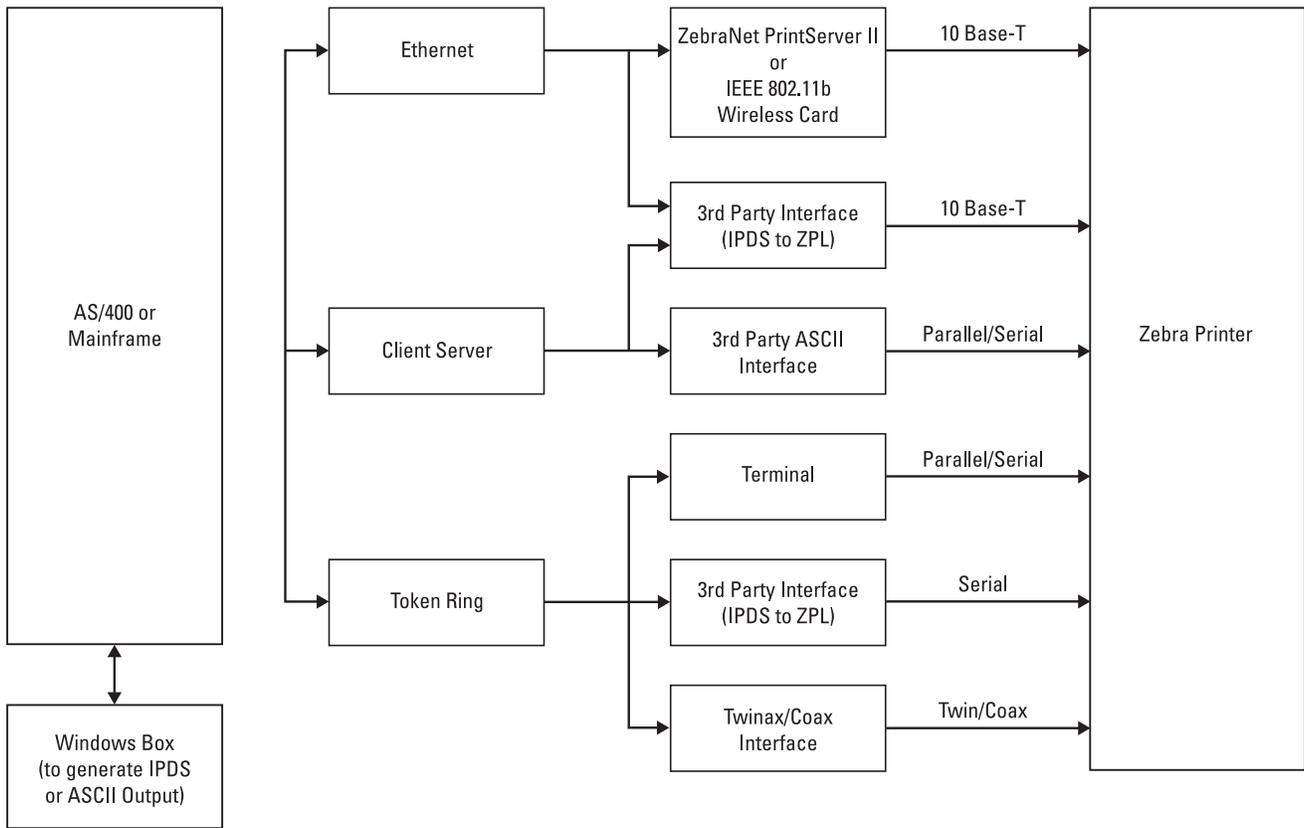
Middleware

Third-party middleware is also available to format IBM output for Zebra printers. Like print servers, middleware resides between the printer and the IBM host application to receive and reformat incoming data. Middleware is available that runs natively on the AS/400 or as a Windows NT® service. There is generally no need to alter IBM host files or legacy applications when middleware is used for bar code printing. Middleware adds a layer of complexity to the system, but this can be an acceptable tradeoff when legacy applications are difficult to change.

Networking

The challenge of networking label printers to IBM AS/400 and iSeries systems is easily solved if the printer provides the right support. Every day, thousands of printers in shipping docks, warehouse aisles, production lines, and other remote, industrial environments receive millions of print commands through IBM midrange networks. From venerable twinax/coax to wireless control of mobile printers, Zebra offers numerous options for networking bar code printers in the IBM midrange environment. Printers can be connected to the IBM host through Ethernet, wireless Ethernet, twinax/coax, parallel, serial, and Token Ring, either directly or through print servers, PCs, controllers, or other peripherals. Zebra also supports IBM's IPDS through third-party interfaces. The range of supported network connections and protocols lets enterprises add bar coding to virtually any operation. The following sections describe various methods for including Zebra printers in IBM midrange networks.

Fig. 1: IBM Midrange to Zebra Printer Network Connectivity Solutions



Ethernet (10/100 Base-T)

Zebra printers can be used in a number of wired Ethernet environments using internal or external ZebraNet® print servers or available third-party external interfaces. Zebra offers Ethernet users the flexibility to set up their print queue per IBM's recommended method for ASCII printers, SNMP device type IBMSNMPDRV. Remote Output Queues continue to be supported, as does IPDS. The physical connection is made through the ZebraNet 10/100 Print Server option, which can be an external device that plugs into the printer's parallel port or, more commonly, integrated internally within the printer. The print server is the physical means of connecting a



printer to the Ethernet network in order to receive data from the AS/400 or iSeries and to report its status for printer management purposes. Although Zebra printers can be connected via other print servers, such as HP's Jetdirect, they do not give users the ability to monitor all the Zebra-specific printer conditions, only the general ones that apply to any kind of printer. More details will follow in the "Printer Management Options" section.

Wireless Ethernet Connectivity

Zebra printers—both stationary and mobile models—also can operate in IEEE 802.11 wireless Ethernet networks using Zebra's wireless card slot. Wireless networking extends the capabilities of distributed printing to areas of the enterprise where cables and host computers can't reach. By doing so, wireless printing provides many benefits, including reduced cabling expenses, new flexibility in facility layout and printer placement, and elimination of data latency through real-time, two-way communication.

The ZebraNet Wireless Print Server lets select Zebra printers connect to IEEE 802.11-standard wireless networks using radio cards from Cisco Systems or Symbol Technologies. Select Zebra mobile printers can also connect to 802.11 networks through internal radio cards. Printers with 802.11 connectivity receive a network IP address and communicate just as though they were physically connected to the network through an Ethernet cable.

Mobile and wireless printing represent the ultimate in distributed printing. The most common benefits organizations realize after implementing wireless printing are increased productivity, because workers no longer need to make repeated trips to a central printing location to get labels, and improved labeling accuracy, because labels are produced and applied at or close to the exact time and place where they are needed. See Zebra's white papers "The Benefits of Wireless Printing," "Understanding Mobile Printing Technology and Capabilities," and "Productivity Through Portability: Mobile Printing Delivers ROI in the Warehouse" on www.zebra.com for more information about wireless printing.

Twinax

The Zebra twinax interface permits the Zebra 105SL™ and XiIIIPlus™ printers and PAX™ print engines to communicate with an IBM System 34/36/38, AS/400, iSeries, or associated controller. It can be configured on the IBM host as either an IBM 5256, 5224, 5225, or 4214 printers.

Coax

The Zebra coax interface permits the Zebra 105SL and XiIIIPlus printers and PAX print engines to communicate with an IBM 3270 mainframe or associated controller. It provides IBM 3287, Model 2, printer compatibility including LU1 (SCS) and LU3 (3270 data stream) modes.

Parallel/Serial

All Zebra ASCII printers can be connected to PCs using their standard parallel and serial ports. PC5250 sessions are used to print AS/400 and iSeries spooled files on the PC. Alternatively, IBM's Network Printing function allows the PC user to identify the attached Zebra printer as their network printer.

Token Ring

Zebra printers can be attached to the network via Token Ring. The two-way communication between the IBM midrange system and the Zebra printer enables the same general level of print functionality, print management, and error recovery for LAN/WAN-attached printers as is found in twinax-attached printers. Zebra ASCII printers can also be attached to the network using Token Ring connections with either Marknet® XLs, INA cards, or HP's Jetdirect.



Other Connection Options

Zebra printers support any IBM midrange network configuration in which an ASCII or IPDS printer can be attached to the AS/400 or iSeries system. Zebra ASCII printers can be locally attached to an AS/400 or iSeries system through IBM Info Window displays 3477, 3486, 3487, 3488, and 3489. Zebra printers can be attached directly to AS/400 workstation controllers (WSC) by twinax cable. Printers can also be attached to an IBM 5x94 remote control unit through twinax cable.

Print Services Direct is provided by Print Services Facility/2™ (PSF/2) and Print Services Facility/6000 (PSF/6000). When PSF Direct is attached to printers, the AS/400 or iSeries computer maintains printer control and all available IPDS messages are directed to the computer.

The PSF Distributed Print Function (DPF) is provided by Print Services Facility/2 (PSF/2). With PSF/2 attached printers, the PSF/2 controls the printers and the AS/400 system is not notified of any printer messages.

Printer Management Options

With Ethernet emerging as the dominant networking protocol, twinax/coax backbones are waning and many consider them obsolete. The combination of Ethernet's dominance and the growing need for distributed printing is causing many enterprises to evaluate their printer management architecture. However, twinax and coax offer many powerful printer management capabilities that many thermal printers can't match when they connect through Ethernet. IBM midrange administrators configure and manage printers on their Ethernet networks either by remote print queues or local devices. Twinax/coax connectivity lets AS/400 and iSeries users set up their printers by either method. While each has its benefits, configuring printers as devices emerged as the preferred method and is the recommended approach for managing bar code printers, whose differences from standard page printers are better served by local device configuration.

Remote Print Queue

This is generally the simplest and quickest method of connecting any Ethernet printer to an AS/400 or iSeries host. Many printer vendors tout remote print queues because they do not have the technology to enable device configuration. A remote print queue is a simple method of sending data to a printer that is regarded as remote. It provides limited control functions that may not be sufficient for mission-critical bar code and smart label printing. Remote print queue normally would be used for directing output to printers connected to other LANs, such as Windows or UNIX® networks.

A remote print queue can also be set up for a print server, which can be treated as a remote device. The benefits of remote queues is that they are easy to set up and do not require any device or system drivers. The disadvantages of remote print queues are they provide no printer management or status monitoring capability, and are perceived as giving slower printing throughput. Remote print queues do not support "Printer Error Reporting" and "Page Range Printing."

Device Management

A device is a locally configured software driver that is used to interface directly with a printer. On an AS/400 or iSeries system, a device is also referred to as a system driver. AS/400 and iSeries device/system drivers are not like Windows drivers, because they do not carry out any page description formatting. They simply monitor the status of the printer. Devices are preferred in the IBM midrange environment because they are the fastest



printing method and are more easily managed and monitored than printers connected as remote print queues. IBM's Redbook on printing recommends connecting ASCII printers via the IBMSNMPDRV (SNMP) device type. This device type provides real-time status monitoring and error recovery via a separate TCP/IP port, and therefore is not affected by a port being busy printing or the print buffer being full.

Connecting via SNMP enables advanced, real-time printer monitoring features that are essential for mission-critical label printing. With SNMP, IT administrators can get real-time notification if label media or ribbon have run out and other error messages. SNMP uses a separate port to communicate these messages in real time, rather than putting them into a buffer that could become full and block the message.

Zebra printers can be configured as devices with SNMP connectivity on Ethernet-based AS/400 and iSeries networks by using ZebraLink™ Solutions, a suite of networking, software, and firmware products that includes the ZebraNet 10/100 Print Server and highly advanced monitoring and reporting features. Connecting Zebra printers to other print servers (e.g., HP's Jetdirect) does not give administrators all the useful management reports that are available through ZebraNet. For more information about the ZebraNet 10/100 Print Server and associated ZebraLink capabilities, see the Zebra white paper "ZebraLink Solutions for Extending and Enhancing Zebra Printer Capabilities" on www.zebra.com.

There are currently only three ASCII drivers available for configuring a printer as a device. Two of the drivers require that the printer/device supports HP's Printer Job Language (PJL), and the third requires that the printer/device supports a specific level of SNMP functionality. PJL or SNMP are necessary for the IBM host to be able to monitor status and manage the printer for online/offline, paper out, and other conditions.

The ZebraNet 10/100 Print Server supports the IBM SNMP device type, which means that a Zebra printer can connect to an AS/400 system driver as a direct device rather than having to be connected as a remote print queue. Zebra Technologies is currently the only bar code printer maker that can support the IBMSNMPDRV driver, so Zebra printers can be configured as an SNMP device on Ethernet-based AS/400 or iSeries networks. Note that this approach is not suitable for IPDS output. Connecting through IBMSNMPDRV is very valuable because it helps organizations eliminate downtime and keep their systems running at maximum efficiency.

Zebra supports IPDS connectivity through third-party products from its partners. Visit www.zebra.com/ibm for more information.

Fig. 2: Summary of Zebra Connectivity Options for IBM Midrange Servers

	Remote Output Queue	PJL Device	SNMP Device	IPDS
ZPL	Yes	No	Yes	203 dpi only (3rd party product)
EPL	Yes	No	No	203 dpi only (3rd party product)
CPCL/ZPL emulation	Yes	No	No	No



Conclusion

Intelligent printers and flexible connectivity options help enterprises leverage their investments in IBM infrastructure and prepare the midrange platform for continued service in an era of new applications and distributed printing. Because of the many options available, enterprises should conduct bar code printing from their IBM host in a way that is compatible with their architecture, expertise, and support goals. Users should be wary of proposals for inflexible new printing systems that may impose unnecessary complexity and support costs. The time and effort required for implementation, ongoing support needs, and total cost of ownership must be considered when evaluating bar code printing options.

Zebra Technologies has extensive experience integrating thermal printers into IBM midrange environments, offers multiple printing options, and is the only vendor that offers printer device management on AS/400 and iSeries networks using IBM's recommended SNMP driver. Zebra has its own AS/400 purely for research and development and customer technical support purposes, and continues to develop IBM connectivity solutions. These differentiators provide system performance and management advantages to enterprises that use IBM computers with Ethernet networks. Zebra's continuing innovations, such as its ZebraLink Solutions and wireless printing offerings, help ensure customers will be able to take advantage of the latest productivity-improving developments in network and printing technologies. Visit Zebra's Web site, www.zebra.com, to browse our connectivity, software, and partner information, or contact us at +1 800 423 0422 or +1 847 634 6700 for additional assistance.



Notes



GLOBAL/AMERICAS

HEADQUARTERS

Zebra Technologies Corporation
333 Corporate Woods Parkway
Vernon Hills, IL 60061-3109 U.S.A.

T: +1 847 793 2600 or
+1 800 423 0442
F: +1 847 913 8766

EMEA HEADQUARTERS

Zebra Technologies Europe, Limited
Zebra House, Unit 14, The Valley
Centre
Gordon Road, High Wycombe
Buckinghamshire HP13 6EQ, UK

T: +44 (0) 494 472872
F: +44 (0) 494 450103

ASIA-PACIFIC HEADQUARTERS

Zebra Technologies Asia Pacific, LLC
16 New Industrial Road
#05-03 Hudson TechnoCentre
Singapore 536204

T: +65 6858 0722
F: +65 6858 0838

OTHER LOCATIONS

USA

California, Rhode Island, Wisconsin

EUROPE

France, Germany, Italy, Netherlands,
Poland, Spain, Sweden, United
Kingdom

ASIA-PACIFIC

Australia, China, Japan, South Korea

LATIN AMERICA

Florida (USA), Mexico

AFRICA/MIDDLE EAST

South Africa, United Arab Emirates

GSA#: GS-35F-0268N

©2006 ZIH Corp.

#11440L Rev. 4 (9/06)

Web: www.zebra.com