



Overcoming Printer Control Language Incompatibility for Bar Code Label Printing

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1.800.927.7701

www.dascomedical.com

info@dascomedical.com





Executive Summary

The highly competitive bar code printer industry is an excellent example of how competition creates value for customers. Bar code printer technology is continually evolving and improving to offer users faster print speeds, new connectivity options, support for new bar code symbologies and RFID protocols, and other innovations. However, it is often impractical to change printer vendors to upgrade equipment because of legacy label printing software. Bar code printers traditionally have not been able to process label formats developed for use on competitors' equipment because each manufacturer uses its own proprietary printer control language (PCL). This basic incompatibility proves extremely limiting for organizations that want to add printers to their operations or replace aging units. Introducing printers from new vendors requires the organization to undergo extensive software redevelopment or purchase a separate, third-party conversion solution. The effort and expense these solutions require often offset any performance benefits new hardware may provide, leading users to stick with their legacy printer vendor more out of necessity than out of loyalty.

Zebra Development Services can develop a custom alternative programming language (APL) software solution that enables select Zebra® printers to process legacy label formats developed in popular competitive environments. For the first time, Zebra gives customers the option of replacing the powerful Zebra Programming Language (ZPL®) native to Zebra printers with an alternate programming language (APL) that recognizes and prints label formats developed for other bar code printers. Zebra printers are a leading choice for companies with mission-critical bar code labeling requirements and are in use by more than 90 percent of Fortune 500 companies. Now, other organizations can upgrade to reliable, innovative Zebra printers and preserve their investments in legacy programming.

Zebra's APL solution is not compatible with all bar code printer control languages on the market, or with all features supported in legacy printers, and is only one of several options that organizations have for operating a multi-vendor printing environment. This white paper will explain leading methods for porting legacy file formats to new printers, and describe the scenarios where each method is suitable.

Legacy Limitations

Unlike most printers used in homes and businesses, which have gravitated to a few dominant printer control languages, there is virtually no standardization among bar code label printers, whose manufacturers continue to support their own PCLs. Bar code printing is a precise, specialized application that demands high print quality. Printer vendors have created powerful control languages to take full advantage of the features and capabilities of their specialized equipment. Users benefit because features and applications can be developed to meet many specialized needs for symbology support, special graphics, radio frequency identification (RFID) encoding, etc. Customized applications provide tremendous performance and value, but limit users ability to efficiently modify systems or make apples-to-apples comparisons to alternative products.

Customized systems can be expensive and time-consuming to develop, so organizations understandably want to protect the investment in legacy label formats. Bar code printers continually become faster and more powerful, but incremental improvements typically do not provide a compelling reason for organizations to switch vendors and redevelop their label formats. The integral relationship between printer hardware and software forces organizations into a marriage of convenience that often lasts long after the honeymoon is over. The relationship becomes strained when dependence on legacy software prevents organizations from taking advantage of advances in hardware made by competitive printer manufacturers.

Hardware, software, and custom programming solutions have been developed to enable organizations to interface bar code label files and printers from different manufacturers. These interoperability tools vary widely by their capabilities, ease of integration, and expense. Interoperability solutions fall into five primary categories:

- “Black box” converters that physically connect to the printer to intercept the foreign data stream;
- Character substitution tables, which are loaded onto the printer from PC-based application software;
- Basic translation software, which resides on a PC and acts as middleware;
- Label design software that supports multiple printer control languages; and
- Software solution that recognizes and processes the legacy label file.

All of these options require some programming and have limitations, but each is suitable for specific usage scenarios. The following sections describe each method and explain when they are most effective.

Black Box Solutions

“Black box” converters were among the first solutions developed to translate bar code label formats developed for one printer to work on those that use a different PCL. The box plugs into the back of the printer to intercept the label data stream from the host application. The converter must be programmed to recognize the specific PCL stream; if users need to add new label styles, the box must be reprogrammed to process them. Recognized data streams are processed using software in the box and passed through the normal interface port to the printer for output. To the printer, the incoming data stream appears as if it were developed in its native PCL. The printer cannot provide its top print speed because the additional processing performed by the conversion box may slow throughput.

The black box vendor includes custom programming as part of the solution. The vendor programs the box to recognize data streams and convert them to the PCL of the desired printer. Because files are customized for a specific PCL, the black box cannot be used with other models. If the user desires to use additional printer vendors, additional boxes must be acquired and programmed. The number of formats to be programmed contributes to the cost of the solution.

Black box solutions do not scale well. Users must purchase a conversion box for each new printer added to their operations, which can easily make this approach cost prohibitive. The implementation cost also depends on the nature of the data stream that must be programmed into the box. Because of the hardware expenses, reliance on vendors to modify label formats and program new ones, and the print speed penalty that black boxes may create, there are few situations where the solution is an efficient option.

Usage conditions favorable for this solution

Black boxes are most practical when there are only a few printers to equip, label formats are rarely modified or added, and print speed and throughput are not a concern.

Character Substitution Tables

A character substitution table (CST) is a software solution that works similarly to a black box. A programmer creates a table within a utility software package that maps each element of a label format to a command that the new printer can understand. Tables for specific label formats are then loaded to the printer. When a print job is received, the character substitution table looks up the incoming format, substitutes recognizable data streams, and sends them for printing, which is completed at normal speeds.

There is no printer performance penalty associated with using character substitution tables, but careful, time-consuming programming is required to ensure seamless printing. Substitution code must be created for each element of the label format—individual lines, boxes, graphics, text fields, and bar codes must all be programmed. If the original label format is changed, the character substitution table must be reprogrammed, or else the printer could output labels with missing or erroneous information.

Character substitution tables are larger files than regular label formats, which limits the number that can be stored in printer memory. Many printers offer expandable memory, but this introduces an additional expense to the solution.

As a static, or hard-coded solution, character substitution tables are not a good option for operations where label formats are subject to change, or if new formats are routinely added. Although some enterprises will possess the programming skills to create CSTs on their own, for most the solution will necessitate an ongoing relationship with the print system integrator to provide format changes.

Usage conditions favorable for this solution

Character substitution tables are not a recommended solution to migrate all of an enterprise's label formats from one printer environment to another. They are best used to support a limited number of label formats that aren't likely to change.

Basic Translation Software

Translation packages function somewhat like character substitution tables but are more powerful and flexible. Label formats must still be programmed, but not as rigidly as CSTs because of intelligence in the translation software. Basic translation packages can process conditional statements, so all incoming fields don't have to correspond exactly to preprogrammed formats stored on the printer. For example, software could parse the destination country from a shipping label and produce the appropriate currency symbol in another field: If ship-to = Germany, then currency symbol = €; if ship-to = USA, then currency symbol = \$. There would be no need to create different label formats for each country that the company ships to. Format translation is usually model-specific, which means label formats often have to be reprogrammed for output on different models from the same manufacturer.

Translation applications are typically developed on a PC and downloaded to the printer, although sometimes the application is PC-resident and in effect serves as middleware. Solutions that require a dedicated PC introduce additional expenses and support requirements to the system, and may not scale well for multiple printer environments. Basic translation solutions usually work fine for common label printing. Translation software can be developed by the integrator or the enterprise. However, because the software is proprietary, programmers need to learn the development environment, the original printer control language, and the PCL of the new printer. For these reasons, application development and maintenance is usually done by the integrator.

Usage conditions favorable for this solution

Translation packages are useful when enterprises need some flexibility to add and change label formats, but enterprises may need to rely on their system vendors to create the software routines. Translation packages reliably perform printing applications with no loss of speed, but may not support all the features and capabilities that printers offer.

Label Design Software

Label design software gives users the ability to design and modify their own labels. Packages from independent software vendors (not those offered by printer manufacturers) typically enable label formats to be designed for use on a variety of printers from different manufacturers. Users only need to learn the label design environment—not PCL programming for each desired printer. However, label design software has limited or no ability to convert individual label files for use on printers from different vendors, i.e., individual label files are not interoperable across hardware platforms. To use different brands of printers, users will need to create multiple versions of the same label format.

Label design software provides the benefit of a common design environment. Enterprises may only need to purchase and support one application, and will not need to dedicate resources to learn and support multiple label printer PCLs.

Label design software does not solve the problem of redevelopment time required to convert label formats designed for one PCL to work on another. The freedom users gain by not having to learn multiple PCLs is balanced by the need to purchase, learn, and maintain the design software. There are many label design packages, which vary widely in their features and capabilities. Many provide excellent performance, while others have limitations, such as not supporting all the features that printers offer, or requiring the print system to have a dedicated PC to run the application.

Usage conditions favorable for this solution

Label design software is advantageous when users want the ability to create and modify label formats internally. They are especially useful for enterprises whose labeling needs change frequently.

Printer Software Solution

The remaining option is to utilize a software solution that would reside on the new printer, and that would recognize legacy label formats developed for another printer control language. This approach is akin to transplanting the brain from the legacy printer into the body of a new model from another manufacturer. If supported, label formats do not need to be reprogrammed in this approach, because the printer is driven by the software solution instead of its native printer control language. Software solutions are provided directly from the printer manufacturer, so this approach can be implemented with virtually no user programming or configuration required. Note that the printer still only supports one printer control language. The manufacturer substitutes an adaptation of a competitive PCL for its own.

Native firmware support is highly convenient and cost-effective. In instances where the legacy printer and the new model utilize identical communications ports, the solutions require no additional hardware or software. This adds to their simplicity and cost-effectiveness. Because the printer speaks the same language as label formats, minimal or no changes are needed at the printer level to accommodate modifications made to label files. Plus, because the new printer often is faster and more powerful than the legacy

predecessors, there generally is no loss of print speed or other performance. However, some software solutions were developed to only provide basic translation and do not support every feature and capability the printer has to offer.

The biggest limitation of software solutions is that they are not widely available. Bar code label printer manufacturers offer only limited support for their competitors' products. When solutions are available, they are typically limited to several specific models, and do not cover a manufacturer's entire product line. Customizations made to the legacy printer firmware, for example to add support for a non-standard language, will not likely be compatible with software translation solutions. Customizations don't lend themselves to plug-and-play compatibility out of the box, but software solutions can usually be programmed to match any replications made to the legacy printers.

Software solutions provide a way for enterprises to preserve and leverage their investments in label format development. If the appropriate conditions are met, users can gain the flexibility to add new printers to their operations without incurring the redevelopment penalty associated with changing vendors. Enterprises can maintain a single code base while upgrading to superior printer hardware.

When enterprises have the option of installing new printers that natively support their legacy label formats, they gain the freedom to choose the printer that best meets their application and budget needs without being penalized for introducing a new vendor into their system. Native support creates true competition based on performance, features, and price. Enterprises can choose the printer that best meets their application needs, instead of the one that best matches legacy requirements.

Usage conditions favorable for this solution

The use of a software solution may be the best option for enterprises that want to maintain their legacy files or would like to consolidate with a single code to support label printing. Software may offer the easiest migration path to add printers from a different manufacturer to replace aging legacy units or expand capabilities. It also may be the best alternative to minimize the effort required to update label formats and add new ones.

Zebra's Software Solution: APL

Zebra Development Services can develop a custom APL solution to provide greater compatibility between Zebra printers and label formats developed for use on other popular bar code models. Zebra will install an alternate programming language (APL) in place of its own ZPL printer control language so Zebra printers can be used in other environments with generally no format conversion or additional processing required. The Zebra APL printer appears to the system as another legacy machine, so supported label formats in the legacy environment can be output on the Zebra printer without requiring data streams to be reprocessed. The Zebra APL solution provides code stability without requiring a commitment to a single hardware vendor.

An APL software solution enables users to preserve their supported legacy label formats and implement a state-of-the-art printer that will provide years of reliable service. In some cases, it is easier to upgrade to Zebra APL-enabled printers than to new models from the legacy manufacturer, because new-generation products may use updated firmware that does not provide plug-and-play compatibility with the original version that label formats for which they were developed. The Zebra printer retains much of its own performance capabilities, which often provide productivity and reliability improvements over older, legacy printers.

Zebra offers basic APL versions for its high-performance and midrange printers and print engines, but cannot be used for RFID smart label encoding or Zebra RFID Ready models. The solution is only available for printers

that output 203 dots per inch (dpi) resolution. Zebra APL supports label formats developed for select competitive printer control languages.

Zebra APL does not automatically support all types of label formats developed for a specific printer control language. If the PCL has been customized, for example to add international character support for a nonstandard language, Zebra APL will need to be modified to support the change. And just as is the case with all PCLs, some modification may be necessary to support different models of printers. Zebra APL printers cannot simultaneously support the legacy printer control language and Zebra's ZPL. Therefore, certain ZPL-enabled features associated with Zebra printers, such as remote configuration and 802.11b connectivity through the ZebraNet® Wireless Print Server, are not available for Zebra APL printers. Monitoring through ZebraLink™ maintains limited capability, not dependent upon ZPL. However, the APL is stored in Flash memory, which means it can be replaced with ZPL at any time with no hardware replacement required.

Usage conditions favorable for this solution

In many cases, Zebra APL removes the limitation legacy code places on printer hardware selection. Zebra APL may be an ideal option for organizations that want to preserve their legacy code and maintain a single PCL, and to minimize upgrade and total cost of ownership expenses.

Conclusion

When selecting bar code printers, enterprises often bypass the model that is best suited to do the job in favor of one that best corresponds to what has been done before. The effort and expense required to convert label formats for use by different printer control languages has strongly limited user choice in hardware selection. Many solutions have been developed over the years to overcome the basic lack of interoperability among printer brands. Some solutions are much more efficient and practical than others, but all have their obstacles. In many cases, firmware is the most convenient option, but is the least widely available.

Zebra's Development Services team can develop a custom APL solution that provides enterprises with supported non-Zebra bar code printing systems access to an unprecedented range of products that support their legacy label formats. Enterprises gain a convenient, cost-effective migration path to the brand of printers used by 90 percent of Fortune 500 companies and thousands of other businesses and government agencies. Contact Zebra today to learn about our APL solution and other options for bar code printer integration, or visit www.zebra.com for more information.

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1.800.927.7701

www.dascomedical.com

info@dascomedical.com

Notes

**CORPORATE HEADQUARTERS**

Zebra Technologies Corporation
475 Half Day Road,
Suite 500
Lincolnshire, IL 60069 USA
T: +1 847 634 6700
+1 800 268 1736
F: +1 847 913 8766

www.zebra.com

USA

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

LATIN AMERICA

Zebra Technologies International, LLC
9800 NW 41st Street,
Suite 200
Doral, FL 33178 USA
T: +1 305 558 8470
F: +1 305 558 8485

EMEA

Zebra Technologies Europe Limited
Dukes Meadow
Millboard Road
Bourne End
Buckinghamshire SL8 5XF, UK
T: +44 (0)1628 556000
F: +44 (0)1628 556001

ASIA-PACIFIC

Zebra Technologies Asia Pacific, LLC
120 Robinson Road
#06-01 Parakou Building
Singapore 068913
T: +65 6858 0722
F: +65 6885 0838

OTHER LOCATIONS**USA**

California, Georgia, Rhode Island,
Texas, Wisconsin

EUROPE

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

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