

3 Tips to Optimize Bar Code Wristband Printing



A ZEBRA BLACK&WHITE PAPER





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Zebra Technologies has worked with hundreds of healthcare organizations to provide on-demand thermal bar code wristband printing solutions to support a variety of identification and patient safety programs. We have learned that the experience and habits organizations have gained from label and document printing often lead to configurations and procedures that are not efficient for producing wristbands. Due to the curved nature of wristbands and the limited space that is typically available for text and the bar code, printers used to produce bar code wristbands need to be configured slightly differently than printers used for other forms of bar code and label printing. Wristband printing will be unnecessarily challenging if these factors are not accounted for in the bar code design and printer configuration.

Based on this leadership and experience, and common questions and challenges resolved through our customer support operations, Zebra provides the following tips to optimize bar code wristband printing.

Manage the Symbol Size


Hospital administrators often find they want to encode more information in a bar code than the wristband space allows. Space can be a constraint even when only a simple patient ID number is encoded. The challenge grows as more types of data, for example date-of-birth, blood type, physician's name, ward, allergies or special instructions are added to the bar code. Applications that require this information on the wristband often necessitate the use of two-dimensional (2-D) bar codes, which are a space-efficient option but can't be processed by all types of bar code readers.

It is more common to encode a 10- to 15-digit patient ID number in a bar code with other data presented in human-readable text. Even these common codes can present a printing and reading challenge. Bar code readers need to scan the entire symbol to read and decode properly. When the ends of the bar code curve around the wrist, it may take several tries before the symbol is recognized. Ideally, the entire symbol fits on a flat portion of the wristband. One option is to print a short code in vertical orientation. However most users desire more data than can fit in a vertical symbol on common 1-inch-wide wristband. So the challenge becomes how to produce a horizontal symbol that doesn't wrap around the edges of the wrist.

The most important step is to choose a dense bar code symbology, such as Code 128 or RSS. These symbologies hold more information in less space than Code 39 or U.P.C., which are popular for many other applications. (See Zebra's white paper "It's All in the Wrist: Improving Patient Safety with Bar Code Wristbands" for a more complete description of symbologies.) If space is still an issue, symbols can be carefully manipulated to reduce their footprint. Before these techniques are explained, a brief overview of how bar codes work is in order.

Information is encoded using a combination of elements that are dark and light, narrow and wide. The reader measures the difference between narrow and wide elements (called the ratio) and dark and light elements (measured as print contrast) and decodes accordingly. Readers can't recognize and decode symbols with insufficient contrast or an improper ratio (each symbology has its own tolerances). Thus there are limits as to how much the symbol size can be manipulated.

It is good bar code print quality practice to produce symbols with the highest ratio that the symbology specification allows. A typical ratio is 3 to 1, which means the wide element is three times as wide as the narrowest element (which is called the X dimension). When the ratio is reduced, the overall symbol size also becomes smaller. Some symbologies, including Code 128, have fixed ratios that can't be adjusted.



Another option for making bar codes smaller is to reduce the X dimension. This approach can be used with variable and fixed-ratio symbologies, because changing the narrow element size does not change the ratio between the narrow and wide elements.

Zebra® printers give customers the ability to adjust both the ratio and X dimension through the ZPL printer command language. For example, the default X dimension on most Zebra printers is two printhead elements, which appears as “^BY2” in ZPL® code. Users can simply change the setting to ^BY1, which would produce an X dimension half as wide (one printhead element compared to two) as the default setting. Symbols should be tested thoroughly any time dimensions or ratios are adjusted, because the media selected for the printer may not work as well at the new settings, or the bar code reader may not recognize an unusually small X dimension. Occasionally a 300 dpi printhead may be required to provide the necessary print quality, but the standard 203 dpi printhead is usually sufficient.

Optimize Scanning Performance and Image Durability


Zebra printers also provide adjustable print contrast, which is an advantage because wristband materials and protective coatings may result in the need for darker printing than typical bar code labels. The adjustable print contrast not only optimizes the scanning performance, but the image durability as well. This is especially important regarding the narrow 5 mil 128 Subset C bar codes that are printed on today's hospital wristbands.

Zebra ZPL-configured printers have user-selectable print darkness settings ranging from 0 (lightest) to 30 (darkest). The default setting is 10. After extensively testing wristbands in Zebra's Supplies R&D laboratory, the Zebra Supplies R&D team recommends a darkness setting of 22 coupled with a print speed setting of 2 inches per second (ips) to optimize the scanning performance and image durability of Zebra's direct thermal wristbands.

Zebra EPL™-configured printers have user-selectable print darkness settings ranging from 1 (lightest) to 15 (darkest). After extensively testing wristbands in Zebra's Supplies R&D laboratory, the Zebra Supplies R&D team recommends a darkness setting of 13 coupled with a print speed setting of 2 inches per second (ips) to optimize scanning performance and image durability of Zebra direct thermal wristbands.

Zebra direct thermal wristband products form a visible image through a chemical reaction of a leuco dye and developer that occurs when the thermal layer is heated to a specific temperature. However, because the image isn't permanent, a reversal of this chemical reaction or exposure to certain conditions can cause it to fade—for example, when water reaches the active thermal layer or the image receives extended exposure to high humidity. Additionally, exposure to oils, plasticizers and other chemicals can affect the optical density of the visible image. Similarly, exposure to alcohol and other solvents can cause the dye and developer to react, creating a darkening of the background on the label.

Zebra's recommended settings will provide optimum scanning performance and image durability. A fully saturated direct thermal image produced at these settings will resist fading significantly better than a less-saturated image printed at a lower darkness setting. This creates a more durable image and one that achieves better scanning performance. This is especially true in regards to the narrow 5 mil 128 Subset C bar codes that are printed on today's hospital wristbands.



Zebra recommends changing the darkness and print speed in the label settings on the healthcare information technology (HIT) software or printer driver, using the following ZPL commands:

- On ZPL printers, the **~SD command** allows you to set the darkness of printing. The format is `~SD##` where `##` is a 2-digit desired darkness setting. The accepted values are 00 to 30. The default value is 10 on all ZPL printers.
- On EPL printers, the **D command** allows you to set the darkness (density) of printing. The format is `D#` where `#` is a desired darkness setting. The accepted values are 0 to 15. The default value is 7 on all EPL printers.
- On ZPL printers, the **^PR command** determines the media speed. The format is `^PR#` where `#` is the parameter for print speed. The accepted values are 2 to 12 depending on the capabilities of the printer. The default value is 2 on all ZPL printers.
- On EPL printers, the **S command** determines the media speed. The format is `S#` where `#` is the parameter for print speed. The accepted values are 1 to 4. The default value is 4 on the EPL printers.

(Please note that, depending on the software, the HIT vendor may need to be contacted for assistance.)

These changes can also be made through ZebraNet™ Bridge Enterprise, Zebra's network management tool.

Calibrate to Avoid Waste

Properly calibrating the printer for wristband media can greatly help efficiency by eliminating waste and saving supply loading time. Wristband and label printers have sensors that help the printer determine where the wristband or label begins so that printing is properly aligned. One type of sensor recognizes a mark on the media, another identifies the gap between the end of one label or wristband and the start of the next. If the sensor setting isn't matched to the media, the printer may need to cycle through several blank wristbands before it can detect the edge and align for proper printing. When this occurs customers often call technical support to report a problem with the printer, although the problem is simply in calibration and is easily remedied.

Zebra wristband materials include a mark to indicate the end point, and therefore require the printer to be set for mark sensing. If the printer is set for gap sensing, which is commonly used for label printing, it may not properly align the wristband material. Often several wristbands will be spooled through the printer and wasted before the media is aligned. Other times, the printer will automatically feed part of the wristband, leaving a portion protruding from the front. This is another indication of an incorrect sensor setting.

There are three simple steps to prevent these problems. The first two are to ensure the wristband media has a sense mark, and that the printer is set to read it. The final step is to configure the printer so that it doesn't automatically reset after the printer has been opened (for example to change media) or after it has been turned off or lost power. Because the default setting is for gap sensing, printers that automatically reset to the default will need to be manually changed to process wristband media.



Additional Resources

By taking the steps outlined in this guide, organizations can prevent unnecessary set-up and configuration time and reduce material waste. Understanding the special characteristics of wristband printing is essential to setting up an efficient system and gaining the required print quality. Zebra offers many free resources about different aspects of bar code wristband printing, applications and supplies, plus printer selection, programming, configuration and management. Visit the Resource Library section of Zebra's Web site, www.zebra.com to learn more. Some useful white papers and guides include:

- The Do's and Don'ts of Selecting Hospital Bar Code Labels and Wristbands
- ZPL II Programming Guide
- It's All in the Wrist: Improving Patient Safety with Bar Code Wristbands
- Evaluating Print Options for Hospital Bar Code Labeling
- Issues and Opportunities for Introducing Bar Code Systems in Hospitals
- Adopting Bar Code Labeling in Hospital Pharmacies
- Quality Assurance Steps for Preventing Label Printing Problems
- ZebraLink Solutions for Extending and Enhancing Zebra Printer Capabilities
- Realize More Value from Your Label Printing Systems with ZebraNet™ Bridge Enterprise

Wristband production is specialized and unlike most other printing applications, so it is advisable to work with a printing solution specialist during system planning and implementation. Zebra is a leading manufacturer of specialty thermal printing solutions including wireless, mobile and high-volume label and wristband printers designed to meet the needs of the healthcare market. Zebra's Z-Band® Direct and Z-Band QuickClip™ patient identification wristbands enable healthcare providers to meet patient safety and privacy standards, such as those set by The Joint Commission (formerly the Joint Commission on Accreditation of Healthcare Organizations) and the Health Insurance Portability and Accountability Act (HIPAA). In addition, Zebra's newly introduced antimicrobial wristband coating further improves the safety and quality of care by reducing the spread of dangerous hospital infections. For more information about Zebra's healthcare solutions, please call +1 800 423 0442 or visit Zebra's Web site at www.zebra.com.



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