ExpoTools PDF417 Encoding Guide

Overview

Encoding two-dimensional barcodes such as PDF417 is inherently more complex than traditional one-dimensional (or linear) barcodes. A larger number of things can be altered and adjusted, making it harder to specify how to construct the barcode. This document is intended to serve as a starting point, allowing you to understand the variables that will make a barcode that is compatible with ExpoTools equipment.

The Terms

A PDF417 barcode is not specified simply as a height and width with a dot-size. Typically, it is specified using 4 basic parameters:

- X-element: size of the smallest barcode element (or dot)
- X-to-Y ratio: how many times larger that the x-element is the y element
- Number of columns: how many bands are encoded on a line
- Error correction level: how much redundant information is added to the barcode to allow scratches or defects. Increasing this adds to the size of the barcode

From these, the height, or number of rows, is derived. In addition, a symbol set can be specified as either text, binary or numeric. Although text mode allows more characters to fit inside the same space, it is usually best to use binary mode, since it can be difficult to ensure that the data does not contain any control characters.

Capacity

Although ExpoTools barcode scanners can read up to 480 characters from a badge, such a barcode would prove very difficult for the average user to scan, or at least be overly large for most badge designs. In order to make the badges as easy to scan as possible, you should try to keep the average badge at around 150 characters, with an upper limit of 250 characters. For registration information this is typically more than sufficient.

Size and Shape

Assuming the 250 character information content and an error correction level of 3, the following combinations are typically workable:

Size	X-element	X-to-Y ratio	Columns*	Comments
2.25” by 0.75”	0.012”	2	7	good general purpose design
3.2” by 0.6”	0.015”	2	10	longer but shorter design
3.2” by 0.7”	0.015”	2.5	10	larger, but very easy to scan
2” by 0.45”	0.010”	2.5	10	smaller, requires more training to scan easily

*some barcode printing programs count the error correction column in their number or columns, some do not, therefore the number of columns for these settings may vary slightly from program to program. The definition here is the same as the ID-Automation PDF417 DLL.

These sizes provide a good balance between area and ease of scanning for the user. Other configurations will work, but may prove more difficult for the untrained operator to scan. In general, try to keep the barcode about three times wider than it is tall. Avoid long, skinny barcodes, such as 4 inches by 0.5 inches, as the user must hold the scanner farther back to see the entire code. This is counter-intuitive for most people, as they will typically move the scanner closer in, as opposed to further back, when having trouble scanning.

The 'Sweet-spot'

There is a sweet-spot when designing a badge because of the interaction of all the parameters. One of the more common problems is to set a small X-size (say, 7 thousandths of an inch) and then compensate for that by using a large X-to-Y ratio (such as 4). Instead, it is best to keep the X-size at a larger setting (say, 15 thousandths) and use a smaller X-to-Y ratio. This will lead to a more readable badge, and be more tolerant of printing defects and imperfections. In addition, this will lead to a barcode with more

The Printer

PDF417's require high quality printers due to the small element size. As such, you should plan on using good quality 600 DPI or more laser printers and white badge stock. In general, inkjet and thermal/wax printers do not offer high enough quality output for PDF417 printing, and cost more to operate than typical laser printers.

The Badge Holder

Whatever badge design you arrive at, you must test the resulting barcode with the badge holder that will be used at the show. Two problems arise. The first is that the reflective surface of the badge holder makes the barcodes harder to scan. Holding the scanner at a slight angle helps alleviate this, but a code that scans on plain paper will always prove more difficult to scan once in the badge holder. The second problem is that many shows use badge holders with opaque or coloured stripes. If these overlay the barcode, they can make it impossible to decode.

Placement

Be careful not to place the barcode too close to the edge of the badge, as paper misalignment can cause part of the code to print beyond the perforation. This can make the code unreadable. Also beware of the aforementioned colour stripes.

In addition, you should be careful not to place 1D and 2D barcodes next to each other on the badge. Although it is generally speaking a good idea to have a 1D barcode on any badge, these should be placed far enough from each other to keep them from being confused. Bear in mind that users are far less familiar with barcodes than you might be, and could easily think that they should be scanning the 1D code instead of the 2D one, which could lead to confusion should your back office systems lack the sophistication required to handle this.

A good layout when using 1D and 2D codes on the same badge is to put the 2D code centered at the bottom of the badge (approximately a quarter inch from the bottom) and

the 1D code at the top right hand corner. Although you may be tempted to omit the 1D code, or disable the 1D symbology on the exhibitors' scanners, this is not recommended. A number of printing errors can make 2D barcodes impossible, or at least difficult, to scan. These include creases in the badge stock, lack of toner, low power line voltages and misalignment of the paper. Also, you will find that some exhibitors just can't get the knack of how/where to position the scanners. In all of those cases, the 1D barcode can be used as a backup to the un-scannable 2D code. The missing data can then be pulled out of after the show (or, if using ExpoTools software, it can be automatically added at the moment of download).

Testing

When testing the badge design, be aware that most users will not have the same familiarity with the equipment as you. As such, what is easy for you to scan may prove difficult for a new user, since they have little or no understanding of how to position the scanner. Also note that when testing, make sure you are using a badge with the maximum number of characters that will be encoded. Test badges often contain only small amounts of data, and this makes them easier to scan, but they are not representative. You should also avoid any settings that would automatically change the parameters of the encoding to suit a larger amount of data, as these can lead to barcodes that have been compressed to the point of illegibility.

Other 2D Barcodes

PDF417 is not the only two dimensional symbology that can be used with ExpoTools. Other symbologies, such as micro-PDF, Data-matrix or Aztec offer advantages over standard PDF417, and are compatible with the BC500 scanners. For example, the same information could be encoded as an Aztec barcode only 1.3" x 1.3", and this barcode would be exceptionally easy to scan.

Sample 1D + 2D Layout

The following illustrates a workable layout for a badge when using both 1D and 2D barcodes on the same badge. This sample assumes a 4x4 inch badge holder, but is equally workable with a 3x4 inch version. The red areas indicate where a 1D barcode should not be placed.