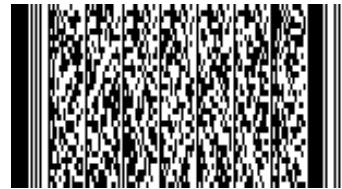


PDF417 Technology Overview

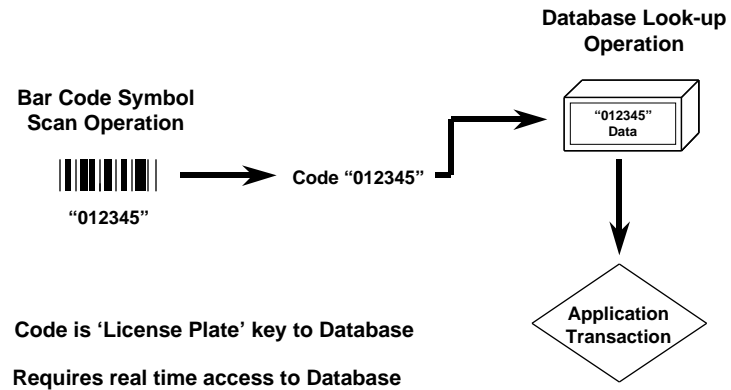


PDF417 - The 2D Portable Data File Standard

Notes

- “Portable Data File 417” is much more than a high capacity bar code. PDF417 provides a means for the very low cost communication of data in a wide variety of applications
- PDF417 opens a highly flexible new dimension to information management. It enables machine readable data to be available where the information is needed without requiring connection to a host database
- PDF417 has been adopted by a number of major industries and standards bodies. It is now the acknowledged standard in Portable Data File technology

One Dimensional Symbology Application Scheme

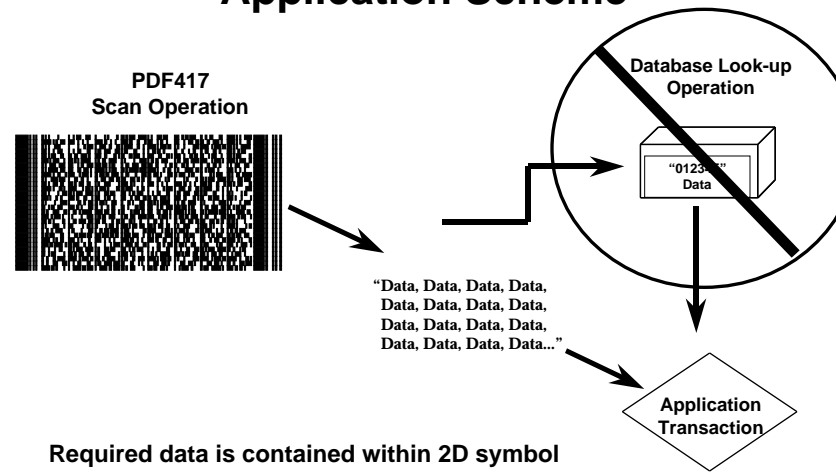


Notes

A one dimensional bar code (Code 128, Code 39, etc.) is generally used as a license plate. The code provides access to data contained within a separate database

- The data required by the user for the Application Transaction is retrieved from the host system

Two Dimensional Symbology Application Scheme



Required data is contained within 2D symbol

Real time access to database not required

Notes

Through the use of PDF417, the information needed by the user is stored in the symbol itself. Direct access to the host system is no longer required

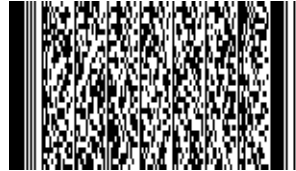
Consider for example the Retail Supply Chain (from manufacturer-to-carrier-to-retailer) and all the nodes where a person handles the carton, package or pallet. Parallel electronic/telecom systems are not necessarily synchronized with the movement of these goods. In contrast PDF417 ensures the data is also with the goods being shipped and can be accessible at all points in the supply chain

Customer Requirements for 2D Symbology

“Must have capacity to communicate a whole file of data”

“Must be Public Domain, Open System Standard”

“Must be readable using right technology for my application”



“Must work with the same printers I use today”

“Must be printed on the same materials I use today”

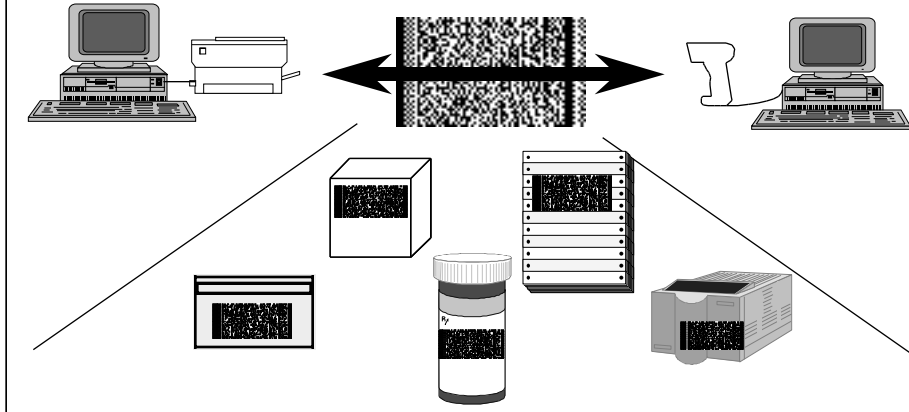
“Must survive damage and read reliably in real-world environments”

Notes

PDF417 was developed specifically to address real customer requirements

Low Cost Communications Medium

- Travels with Document, Person, Package, Object, etc.
- PDF adds no cost to the label, document or card



Notes

Think of PDF417 as “paper based digital communications”

- The key to PDF417 is that it permits you to communicate information for virtually no additional cost. This is because the PDF417 is normally printed on a document, label or card that is already being produced. If you already print a label or a document, it costs nothing to add PDF, in fact it could be less costly if your customer could reduce the size of the label using the higher density PDF417 symbology (replace multiple 1D bar codes).

-The other key attribute of PDF417 is that it is a “digital communications channel synchronized with the item to which it is attached (package, ID card, etc.)”. This means that the data is always available.

PDF417 “Portable Data File”

United Nations Charter



WE THE PEOPLES OF THE UNITED NATIONS DETERMINED to save succeeding generations from the scourge of war, which twice in our life-time has brought untold sorrow to mankind, and to reaffirm faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women and of nations large and small, and to establish conditions under which justice and respect for the obligations arising from treaties and other sources of international law can be maintained, and to promote social progress and better standards of life in larger freedom,

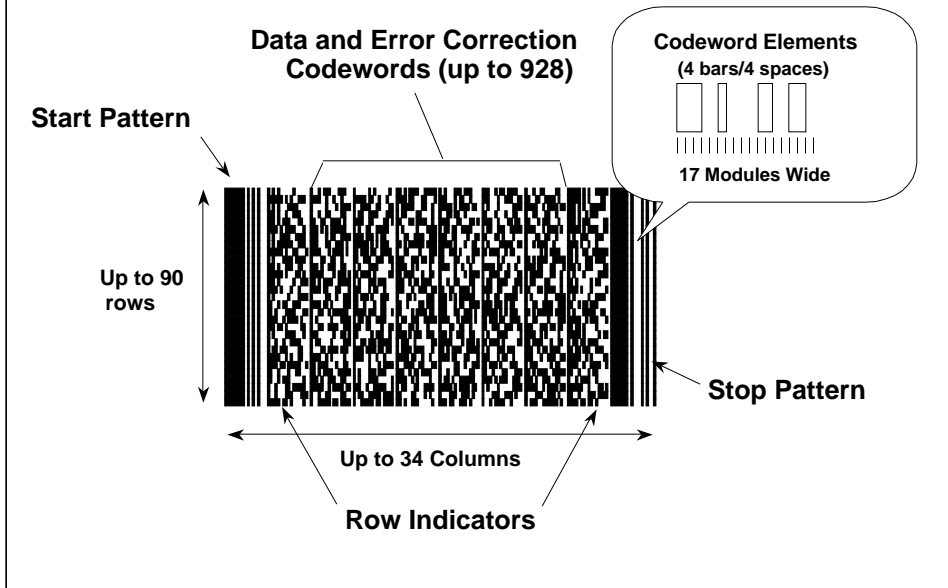
AND FOR THESE ENDS to practice tolerance and live together in peace with one another as good neighbours and to unite our strength to maintain international peace and security, and to ensure, by the acceptance of principles and the institution of methods, that armed force shall not be used, save in the common interest, and to employ international machinery for the promotion of the economic and social advancement of all peoples,

HAVE RESOLVED TO COMBINE OUR EFFORTS TO ACCOMPLISH THESE AIMS Accordingly, our respective Governments, through representatives assembled in the city of San Francisco, who have exhibited their full powers found to be in good and due form, have agreed to the present Charter of the United Nations and do hereby establish an international organisation to be known as the United Nations

Notes

The United Nations Charter contains 1162 characters. Printed at 6.6 mils (0.17 mm) (compatible with any 300 dpi printer) and using Error Correction level 4, this symbol occupies a space measuring 2.2 inches x 1.0 inches

PDF417 - The Structure



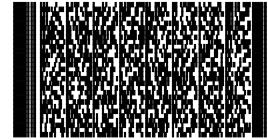
Notes

This chart illustrates the basic structure of the PDF417 symbology

- The symbol may contain up to 34 columns in width or up to 90 rows in height. No more than 928 Data and Error Correction codewords may, however, be contained in one symbol
- Each individual 17 module Codeword is “self clocking” in the horizontal direction. Row Indicators plus a unique “row clustering” scheme provide vertical synchronization. Together, these features permit PDF417 to be read by linear lasers, rastering lasers, linear CCDs or image scanning devices. Matrix codes, in contrast, can only be read with imaging devices.

PDF417 Information Capacity

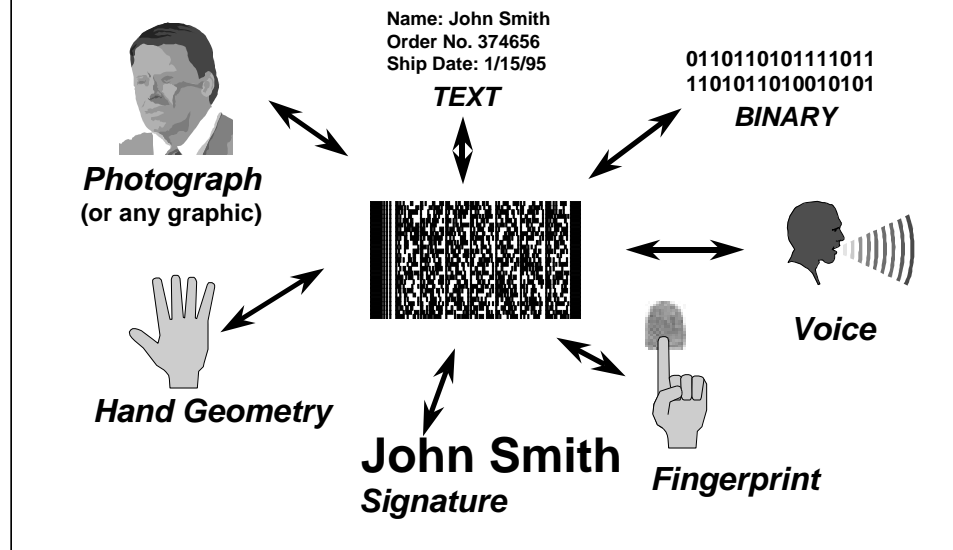
- ❖ Maximum capacity depends on data type:
 - ♦ 1108 Bytes
 - ♦ 1850 ASCII Characters
 - ♦ 2710 Numeric Digits
- ❖ Even higher capacity with other compression techniques
- ❖ “Macro PDF” for concatenation of multiple PDF417 symbols
 - ♦ Up to 899,999 symbols



Notes

- The capacities detailed above are achieved using standard PDF417 compaction modes
- These are the maximum symbol capacities assuming Error Correction level 0. In practical terms, the total capacity will be reduced (by around 15% typically) as error correction is added. The amount of error correction is user selectable depending upon the application.
- Other compression techniques may be applied to the data before it is encoded. Compression efficiency depends on the type of information being encoded and the compression technique employed.
- When a Symbol scanner reads a “Macro PDF” symbol, it will normally concatenate the contents of each symbol within the decoder and then output the complete data set to the host as one contiguous file. Other user-selectable Macro PDF processing options are however available

Encodes all Information Types



Notes

PDF417 can encode all types of data as shown in this graphic (just as a floppy disk can store any type of information)

- The different data types may be mixed within a symbol
- Various compression methods are available for all data types
- Photos may be compressed down to 700 bytes using standard JPEG compression. Other compression techniques achieve even higher levels of compression. Symbol's wavelet compression can encode a color photo in around 400 bytes
- Fingerprint templates can be encoded in less than 300 bytes
- Hand geometry requires 10 to 20 bytes

Error Correction

- ❖ Powerful Error Correction permits 100% data recovery despite physical damage
- ❖ Select from 8 different levels depending on application
- ❖ Symbol size increases in proportion to Error Correction (e.g. 10% damage protection requires 10% larger symbol)

Notes

- Number of codewords required for Error Correction are as follows:

- Level 0:	0
- Level 1:	2
- Level 2:	6
- Level 3:	14
- Level 4:	30
- Level 5:	62
- Level 6:	126
- Level 7:	254
- Level 8:	510
- As Error Correction is increased, data capacity is reduced

Error Correction Levels and Relative Symbol Sizes



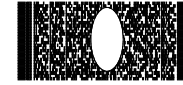
Security Level 3



Security Level 4



Security Level 5



Security Level 6



Security Level 7



Security Level 8

Notes

- These symbols illustrate the amount of damage a PDF417 symbol can sustain while still recovering 100% of the information.
- Symbol size increases as Error Correction is added

Aspect Ratio (Symbol Width:Height)

- ❖ Variable Aspect Ratio enables symbol to be optimized within available space



Notes

PDF417 may be printed with a wide range of symbol aspect ratios (width to height)

- This permits the symbol to be sized to suit different applications such as:
 - ID Cards
 - Documents or forms
 - Parts Labels
 - etc.
- Generally wider symbols are more efficient because there is less area dedicated to “overhead” (Start/Stop Patterns and Row Indicators))

PDF417 Proven Technology

❖ Ohio University, Center for Automatic Identification

- ♦ Total of 32 million characters read without error
- ♦ Theoretical reliability even higher

❖ University of Pittsburgh

- ♦ Demonstrated high speed overhead scanning capability
- ♦ In tests, remained readable despite damage

Notes

- PDF417 has been independently tested for reliability and performance
- No misdecodes were detected. (Data was always correctly decoded)
- PDF417, when subject to printing errors or damage, will either correctly decode the data or not decode at all
- These test reports are available from Symbol upon request

Printing Flexibility

- ❖ “No special printer required” - Compatible with broad range of printing technologies including laser, ink jet, thermal direct, thermal transfer, etc..
- ❖ PDF417 can be Faxed
- ❖ May be printed at various densities and module aspect ratios depending on:
 - ♦ Printing Technology
 - ♦ Reading Technology
 - ♦ Scanning Environment

Notes

PDF417 was specifically designed to be printed using the technology that is employed today for printing 1D codes.

Printing PDF417

- ❖ Wide range of printing options from multiple sources
- ❖ Label printers including:
 - Monarch - Cognitive - Zebra - Datamax
 - Intermec - DH - Kyocera - Eltron
 - Printronix - RJS - Sato - TEC
- ❖ Software packages for DOS/Windows based applications
- ❖ High Speed printing/mainframe based solutions

Notes

- Almost any label printer on the market today has PDF417 capability built in
- The label printers listed is only a partial list
- If using standard desktop laser or inkjet printers, there are several DOS/Windows based labeling software packages available
- There are also printing solutions available for high speed printing environments

Reading PDF417 - “The Universal Technology”

- ❖ Low speed linear CCD
 - ♦ Economical contact/near contact reading
 - ♦ Suitable for less demanding applications
- ❖ High speed 2-D laser raster
 - ♦ Rapid non-contact scanning
 - ♦ Simple “Aim and Shoot” ergonomics
 - ♦ Flexible high performance solution
- ❖ High speed CCD/Imaging
 - ♦ Omnidirectional scanning
 - ♦ Supports demanding fixed automated applications

Notes

- A important feature of PDF417 is that it is based on bar code technology, thus it can be read by any scanning technology.
- Matrix codes, in contrast, can only be read by Imaging technology

PDF417 - Backward Compatible with Installed Bar Code Applications

- ❖ PDF Raster Scanners (and linear CCD readers) also support reading of existing linear symbols such as Code 128, Code 39, EAN, UPC, etc



Notes

- In most applications, PDF417 must coexist with pre-existing 1D barcodes. Symbol's scanning technology maximizes backward compatibility with 1D bar code. Thus the customer doesn't give up any performance when going to PDF417.

PDF417 in the Public Domain

- ❖ PDF417 is a 'public domain' open systems standard
- ❖ PDF417 fully conforms to industry and international standards requirements
- ❖ PDF417 is identical *in all respects* to existing industry standard bar codes (UPC/EAN, Code 39, etc..)

Notes