Typical Part Bar Code Specifications
(1-D Single Barcode)

Requirements:
Bar code string will contain the following in this order **Julian Date**, **Rel. Level** and **Operating Division CMI No**. The bar code will be one string of information. The Part #, Rel. Level will also be human readable. Vendors will industry standards for bar code that fits their part. Symbology codes that we recommend are 39, 128 or on smaller parts you should use code 93. All new bar code labels will have to be trailed at the Operating Division Plant prior to production release. Samples can be sent via mail to the Materials Department of the procuring Operating Division.

If a product has a current bar code label that is to industry standards, please contact the Operating Division's Advanced Engineering Team to review current label for visibility within our process.

The Basics:

How does a bar code work?
Actually, a bar code works in much the same way as an ordinary flashlight -by reading the reflected light from a surface. The process begins when a device directs a light beam through a bar code. The device contains a small sensory reading element. This sensor detects the light being reflected back from the bar code, and converts light energy into electrical energy. The result is an electrical signal that can be converted into data.

Bar codes are measured by the width of the narrow bar and are recorded in mils, or 1/1000 inch. A 15 Mill bar code, for instance, has a narrow bar that is 15/1000 inches wide. Further, "quiet zones," or blank spaces to the left and right of bar code symbols, are included to insure the bar code can be read.

Symbologies are systems of encoding data such that a scanner and/or a decoding system may together read and decode the data encoded in the barcode. Aside from the actual technique of encoding the bars and spaces a number of technical specifications or characteristics define and separate one symbology from another.

A **Character Set** refers to what data a given barcode symbology can encode. Generally, there are three types of character sets: Numeric, Alphanumeric, and Full ASCII.

A **Numeric** character set means the symbology can only encode numeric data from 0 through 9. Some additional characters may be encoded which are generally control features of the symbology, such as start/stop characters.

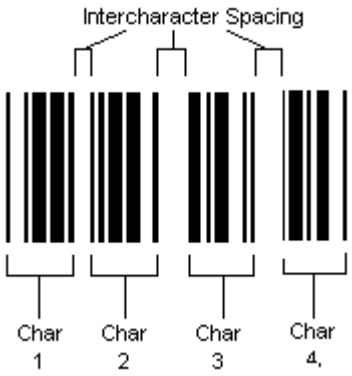
A **Alpha-Numeric** character set means the symbology can encode the digits 0 through 9 as well as alphabetic characters from A through Z. Again, some additional characters may be encoded as start/stop characters.

A **Full ASCII** character set is one that allows the encoding of the full ASCII character set. This implies any ASCII character, value 0 through 127, may be encoded by the symbology.

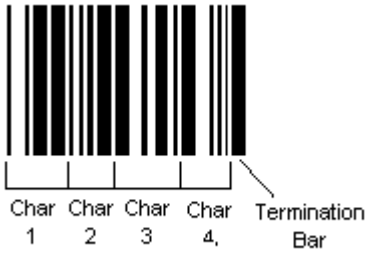
In theory, a numeric character set will produce the smallest barcode whereas a Full ASCII character set will require more physical space to encode the same data. Of course, a Full ASCII symbology gives you more flexibility in encoding more types of information than a numeric symbology.

There are generally two types of barcode symbologies: discrete and continuous.

A **discrete** symbology is one where each and every character encoded in the symbol may be interpreted individually without respect to the rest of the barcode. Such symbologies have characters that both start and end with a bar. Individual characters are separated by some amount of inter-character spacing. The inter character spacing carries no information-the only duty of the inter character spacing is to separate the characters.



A **continuous** symbology is one in which the individual characters of the symbology cannot be interpreted by themselves. This is due to the fact that characters start with a bar and end with a space. The final space is "terminated" by the starting bar of the next character. A character cannot be taken individually since, individually, there is no way to know how wide the last space is without knowing where the next character begins. Continuous symbologies normally implement some kind of special termination bar or termination sequence such that the termination bar terminates the last space of the last data character.



In the above example, each character is consists of four bars and four spaces. The first bar of character 2 terminates the last space of character 1. The first bar of character 3 terminates the last space of character 2. The first bar of character 4 terminates the last space of character 3. The termination bar terminates the last space of character 4.

All else being equal, a discrete symbologies require more space to print the same data as a continuous code since the discrete symbology "wastes" space in the inter character spacing. However, discrete symbology can generally be printed with less quality-this translates to cheaper printers and more tolerance at scan-time.

Other than the amount of space the two types of symbologies require and the types and quality of hardware used to print them, there is no inherent difference in the security afforded by either type. That is to say, it cannot be said that "continuous symbologies are more reliable ore secure than discrete symbologies"-nor can the reverse be said.

Symbologies can also be divided by the number of "widths" encoded in its barcodes.

A **Two-Width** symbology has spaces and bars that are either wide or narrow. This has the benefit of simplicity-once it is determine how wide a "narrow" bar or space is, anything over a certain width can be considered "wide." This allows for a large level of print tolerance in lower-quality printing conditions.

A Multiple-Width symbology is one, which has bars and spaces that may be of 3 or more widths. The narrowest bar or space may be X in width, a medium-width space or bar may be 2X in width, and a wide bar may be 3X in width. Since there are more possible combinations available in a multiple-width symbology, data encoding is often more efficient and results in a tighter barcode. Multiple-width symbologies are usually continuous symbologies and are often scanned using edge-to-similar-edge decoding algorithms.

Symbologies may be either fixed or variable-length.

A **fixed-length** symbology is one, which must, by definition, encode a certain number of characters or digits. For example, a UPC-A barcode always encodes 12 digits of data. An application may not encode less or more than the pre-defined fixed-length of 12 characters. The symbology itself defines the length of data.

A **variable-length** symbology is one, which can carry a message of any length. For example, Code 128 may encode any number of characters that can reasonably fit physically in the printed barcode. The symbology itself does not define how many characters of data must be encoded.

Note that a variable-length symbology can be implemented by an application such that it is, in effect, fixed-length. For example, if you are encoding an identification number that is always 10 digits in length using Code 128 you are implementing Code 128 as if it were fixed-length. However, the fact that you can choose the fixed-length means the symbology itself is variable-length.

A symbology is considered "self-checking" if a single printing or scanning error will not cause one of the component characters to be converted erroneously into another valid character.

Note that "self-checking" does *not* mean self-correcting. It simply means that a single printing defect will cause a scan to fail rather than decoding the erroneous read into data which the application assumes to be correct.

The Basics of the Symbologies Codes:

1D - one dimensional
These are symbologies that only include vertical lines and spaces. There are more symbologies than are listed here, but these are some of the most common.

UPC
UPC is a 12-digit symbology that is used in retail applications.

UPC-A
UPC-A is what you normally would see, for example, on a box of cereal. This numeric-only barcode is basically broken up into 3 parts. The first character is what is referred to as the System Digit and is a way of identifying the industry to which the product might be associated. The next 5 digits identify the manufacturer. The manufacturer must acquire this number from the Uniform Code Council. The next 5 digits are the manufacturer's way of identifying the product. The last digit, known as the "check digit," is the result of a mathematical calculation using the previous 11 digits.

UPC-E
UPC-E, a compressed version of an UPC-A, would be typically seen on a can of soda or pack of gum, where there is not much available space. UPC-E will not have a system digit, and the zeros from the UPC-A will be "suppressed." Therefore, UPC-E can be expanded back into a valid UPC-A code.

Supplemental: Two or five-digit supplemental are commonly found on periodicals or publications. A supplemental is a small barcode that is to the right of the UPC-A or -E barcode.

EAN
The European Article Numbering system is a European version of UPC. Country codes are used to allow the use of one barcode both internationally and domestically. For example, 00, 02, 03, 04, 05, 06, 07, and 09 are assigned to USA and Canada, while 40 - 43 are all used for Germany.

EAN-13
EAN-13 is basically an UPC-A with a leading digit, which is usually representative of a country code. Two and five digit supplemental is supported.

EAN-8
This is a smaller version of the EAN-13. It also has a two-digit country code, followed by data and a check digit.

ISBN (International Standard Book Number):
Also called "Bookland," this symbology is used on books and other publications. Though it is part of the EAN family, there are no country codes used. The ISBN number is simply preceded by "978" or "979." The 5-digit supplemental is simply the price preceded by a "5".

Code 39
A Code 39 barcode will always begin and end with the pattern of "narrow-narrow-wide-wide-narrow" bars. Code 39 is probably the most popular symbology other than UPC. It can encode numbers, uppercase letters, and a dash. The "full ASCII" version of Code 39 will additionally encode $, ?, +, and %.

Code 128
Code 128 is a unique symbology, which includes "subsets" for encoding different characters. Subset "A" will encode uppercase alphanumeric characters, subset "B" will encode lowercase alphanumeric characters, and subset "C" will only encode numbers. A nice feature of this symbology is that it is possible to have all 3 subsets in a single barcode. By combining all 3 subsets, you could actually produce a barcode that is "Code128."

Code 93
Code 93 is an enhanced version of Code 39. Basically, Code 93 will encode every character on a keyboard, including uppercase and lowercase letters, numbers, and other symbols.

Interleaved 2 of 5
"I 2 of 5" is a numeric only symbology that must contain an even number of digits. It is actually possible to get a partial, but valid scan of an I 2 of 5 barcode because the barcode is in pairs. The odd position digits are encoded in the bars and the even position digits are encoded in the spaces. Be sure to program your scanner or decoder for the exact number of characters in your I 2 of 5 barcode.

Standard 2 of 5
The difference between Standard and Interleaved 2 of 5 is that with Standard, the data is only in the bars and not the spaces.

Codabar
Here, the barcode must begin and end with an A, B, C, D, E, N, T, or *, which cannot be used anywhere else within the barcode. Codabar, commonly used in libraries, blood banks, and by overnight delivery services, can only encode numbers and the following characters: $, :, /, ., and +.

The Basics about printing:

Thermal Transfer (TT):
Thermal Transfer printing is when the heat from the print head is applied to the ribbon. The material on the ribbon is then transferred to the label media. As you'll read later, this method is easier on the print head, as the back of the ribbon is very smooth and protects the print head from the friction of the media. Because TT printing uses a ribbon, it also opens up other options regarding the type of ribbon and label media. More information on media is offered later.

Direct Thermal (DT):
Direct Thermal printing is where the print head comes in direct contact with the label media. There's a coating on the label media that turns black as heat is applied to it. Because of this, no ribbon is required.

You might be thinking that this would be a less-expensive method of printing because you don't have to buy ribbons. However, this method will also wear down the print head faster than with thermal transfer. Paper is coarse and will break the print head down over time. Also, the edge of each label strikes the print head, causing further breakdown. You won't have to buy ribbons, but you'll have to buy more print heads, which are expensive. **The bottom line is that there is little-to-no difference in the cost of operation between TT and DT.**

Another downside to DT printing is that the labels will turn yellow over time, and the print will fade to a faint gray. Overnight carriers typically use DT labels because the labels only need to last a day or two. It is reasonable to expect a DT label to last about 6 months.

One last thing to remember - heat is what causes the label to change from white to black. Keep the labels from storefronts, jewelry cases, and lighting centers.

Dots Per Inch (DPI)
The quality of the print is many times directly related to the density of the print head. An image appears on a label due to a single dot or series of dots being turned on. The greater the number of dots, the clearer the image will be.

Print heads come in five different densities: 152 dpi, 203 dpi, 300 dpi, 406 dpi, and 600 dpi. T&W Enterprises will be sure to select the printer that best suits your business' needs. For example, you might specify that you need to print "100% UPC." In this case, you would need a printer with a 152-dpi print head. A barcode is measured in mils, which is 1/1000th of an inch. If you need to print 15 mil barcodes, then the width of the narrowest bar in the barcode would be 15/1000ths of an inch wide.

If you don't care about printing barcodes, but want to print labels with pictures, then you'd want to get a print head with the greatest density. If you are printing barcodes and don't care about the specific mil of the barcode, then 203 dpi would probably be your best bet.

Memory
To print an image, the printer must store a portion, or all, of that label image in its memory before it prints the label. There are different types of memory that serve different purposes.

SRAM / DRAM:
A print head may be the proper density to print a picture on a label, but the printer may not be able to store that entire image up in memory. This is where SRAM or DRAM comes into play. This gives the printer the ability to allow the printer to print a longer label, as well as store that large image in memory. Any data stored in SRAM or DRAM will be lost when the power to the printer is turned off.

Flash:
"Flash is like a floppy." If the printer has to wait for the host to send an entire image down every time it wants to print it, the printing is going to be very slow. Having Flash memory will allow you to store the image on the printer, which will greatly speed up the printing of the label. It's like a floppy diskette because it is permanent storage and does not require power for the data to be maintained. In some cases, it is also portable.

Media Matching
Labels and ribbons come in different varieties. Labels can be paper, polyester, polyolefin, or polypropylene, to name just a few. Ribbons can be wax, a mix of wax and resin, or resin.

Interfaces

Serial:
A printer with a serial port will almost always connect to the serial port of a PC. Serial ports on a PC are always male, and have 9 or 25 pins. Though the pin outs of the serial port on a PC are always the same, the pin outs for the serial port on a printer are not always predictable. Many times, a "null modem" cable is all that's needed, but other solutions may be required.

Parallel:
The parallel port on a PC is always 25-pin female. Again, most printers with a parallel port will have a Centronics interface, but may require other interfaces. T&W Enterprises has the peripherals that plug into the Centronics parallel port on the printer and convert the parallel ports to Ethernet or USB.

Universal Serial Bus (USB):
This is new, but much needed technology. USB is faster than serial or standard parallel communications (ECP/EPP parallel is faster than USB), allows you to connect up to 127 devices to a single PC, and can go as far as 82 feet away from the PC. Serial is limited to about 50 feet and parallel to about 15 feet.

Ethernet:
"10Base-T" and "10Base-2" are terms that you'll hear associated with Ethernet. 10Base-T uses phone jack (RJ) connections, while 10Base-2 uses coaxial (like your cable television cable) connections. Having an Ethernet port on the printer will allow you to connect the printer directly to your network, thus negating the need for a PC to function as a print server.

Twinax:
A Twinax (5250 emulation) interface is required for connecting a printer directly to an IBM AS/400 or IBM 3x System.

Coax:
A coax (3270 emulation) interface is required for connecting a printer directly to an IBM mainframe system.

Software

Regardless of the manufacturer, every thermal printer manufacturer has a proprietary printer language that they use for their printers. In some cases, the manufacturer has some printers that use one language and some printers that use a different language. Programming guides for these printers are generally available.

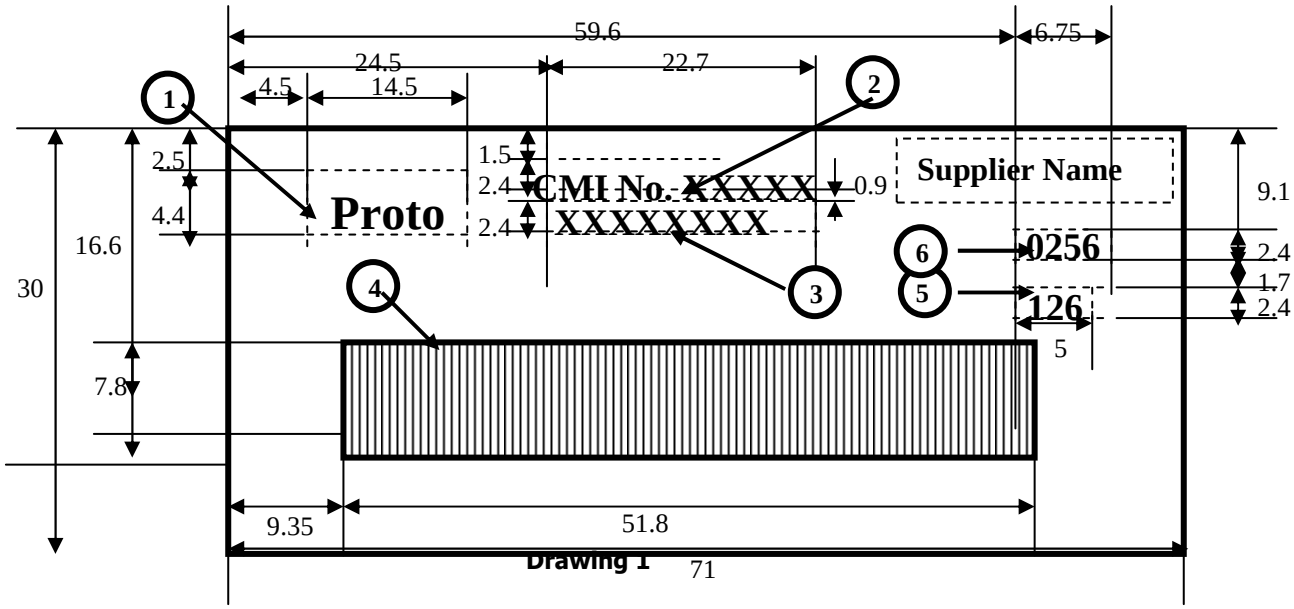
There is software available that will enable you to design and print a label to a long list of printers from different manufacturers using a graphical user interface.

Finally, how many inches of labels a day would you like to print? Printer manufacturers make printers for different applications. Just like you wouldn't take your Honda Civic out to pick up a load of mulch or firewood, we wouldn't recommend a printer designed to create labels for a small boutique when you need a printer for a warehouse that will be printing 20,000 inches of labels every day. This also works hand-in-hand with print speed. If your business needs to print 20,000 inches of labels every day, you are probably going to want a printer that can print faster than 2 inches per second.

Selecting the proper printer ultimately comes down to T&W Enterprises understanding your business application.

A).- A Label Example of code 39 would look like:

*Dim are shown in Millimeters



Drawing 1

1). - ID Code. - Will state the build stage of the parts

2). - Our/N. - This is the current Operating Division CMI Part Number.

3). - Supplier P/N. - This is the Supplier Part Number if different than the Operating Division part number.

4). - CUSTOMER BARCODE. - This Barcode must be **Code 39** and will include: a Start Code, Complete Julian Date (Year+Julian Date), Operating Division CMI P/N, and the Stop Code.

5). - SERIAL NUMBER. - The Serial Number will have 3 Digits in Order to be able to use from 001 ~ 999.

6). - JULIAN DATE. - For Julian Date, we need to use the Last Digit of the Year (1 Digit) and we need to use the Calendar Numbering Date, for example: 365 days per Year, so February 1st is the Julian Date 032.
This Calendar Numbering Date (Julian Date) It will be used from 001 ~ 365 (3 Digit), Then the Quantity of Digits for Julian Date will be 4 (Year + Julian Date = YDDD).

B) Barcode Example of Code 39 String