|  |
| --- |
| **Bar Code Basics** |
| **Excerpts from *A Bar Code Primer*, ©1997-2004 Worth Data**  We recommend you print and save this document for future reference. (The complete publication is available free from [Worth Data](http://www.pcbarcode.com/ukcustreg.html)) You can also download a PDF version of the complete publication. |

|  |  |  |
| --- | --- | --- |
|  | **Contents** | http://www.pcbarcode.com/barcap.gif |
| * [What's in a Bar Code?](http://www.pcbarcode.com/ukprimer.html#WHAT) * [Bar Code Structure](http://www.pcbarcode.com/ukprimer.html#STRUCT) * [Types of Bar Codes](http://www.pcbarcode.com/ukprimer.html#TYPE) * [Bar Code Readers](http://www.pcbarcode.com/ukprimer.html#READERS) * [USB Readers](http://www.pcbarcode.com/ukprimer.html#usb) * [Second Keyboard Wedge Readers](http://www.pcbarcode.com/ukprimer.html#WDP) * [Serial RS-232 Readers](http://www.pcbarcode.com/ukprimer.html#WDR) * [Portable Bar Code Readers](http://www.pcbarcode.com/ukprimer.html#TRI) * [Wireless RF Terminal Readers](http://www.pcbarcode.com/ukprimer.html#RFTERM) * [CCD Scanners](http://www.pcbarcode.com/ukprimer.html#CCD) * [Wand Scanners](http://www.pcbarcode.com/ukprimer.html#WAND) * [Slot Badge Scanners](http://www.pcbarcode.com/ukprimer.html#SLOT) * [Laser Scanners](http://www.pcbarcode.com/ukprimer.html#LASERS) * [Printing Bar Codes](http://www.pcbarcode.com/ukprimer.html#PRINTING) * [Bar Code Fonts](http://www.pcbarcode.com/ukprimer.html#FONTS) * [Bar Code Applications](http://www.pcbarcode.com/ukprimer.html#APPS) * [Labeling Software](http://www.pcbarcode.com/ukprimer.html#SOFTWARE) | | |

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Introduction** | | http://www.pcbarcode.com/barcap.gif |
|  | This booklet is to help you understand bar codes so that you can better plan for your bar coding applications. The use of bar coding has been growing dramatically over the last 15 years. With the adoption of UPC as the standard for retail grocery stores in the late 70's, bar codes have become an everyday experience for most people. Bar codes are a fast, easy, and accurate data entry method. The correct use of bar codes can decrease employee time required and increase an organization's efficiency.  One thing to remember with bar codes: the application software that accepts the bar code data is in 95% control of the success or failure of an application. Bar codes are the sizzle on the software steak. You can eat steak without sizzle, but you can't eat sizzle without steak. Remember that bar codes are just another data input method; what you do with the data is most important. With the introduction of the IBM PC in the early 80's, bar coding applications expanded along with the PC explosion. Worth Data was and is a pioneer in providing bar code hardware and printing software to the PC (and Macintosh) user. Most of this booklet is devoted to bar coding in the microcomputer marketplace.   We hope this booklet proves of benefit to you in understanding bar codes and its associated technology. We wish you well in your undertakings and hope to be able to supply you with equipment and software to meet your needs. | |  |
|  | **What's in a bar code?** | | http://www.pcbarcode.com/barcap.gif |
|  | There is a mystique surrounding bar codes which intimidates many people. Let's eliminate it quickly. First the bar code usually doesn't contain descriptive data, (just like your social security number or car's license plate number doesn't have anything about your name or where you live). The data in a bar code is just a reference number which the computer uses to look up associated computer disk record(s) which contain descriptive data and other pertinent information.   For example, the bar codes found on food items at grocery stores don't contain the price or description of the food item; instead the bar code has a "product number" (12 digits) in it. When read by a bar code reader and transmitted to the computer, the computer finds the disk file item record(s) associated with that item number. In the disk file is the price, vendor name, quantity on-hand, description, etc. The computer does a "price lookup" by reading the bar code, and then it creates a register of the items and adds the price to the subtotal of the groceries purchased. (It also subtracts the quantity from the "on-hand" total.)  Another example of bar code data might be in a quality reporting application, the bar code may have only a single digit in it, but it may be titled "Failed Vibration Test". The computer associates the single digit with the test result.  So, bar codes typically have only ID data in them; the ID data is used by the computer to look up all the pertinent detailed data associated with the ID data. | |  |
|  | **Bar Code Structure** | | http://www.pcbarcode.com/barcap.gif |
|  | A bar code is a series of varying width vertical lines (called bars) and spaces. Bars and spaces together are named "elements". There are different combinations of the bars and spaces which represent different characters.  Bar Code  When a bar code scanner is passed over the bar code, the light source from the scanner is absorbed by the dark bars and not reflected, but it is reflected by the light spaces. A photocell detector in the scanner receives the reflected light and converts the light into an electrical signal.  Bar Code Sine Wave  As the wand is passed over the bar code, the scanner creates a low electrical signal for the spaces (reflected light) and a high electrical signal for the bars (nothing is reflected); the duration of the electrical signal determines wide vs. narrow elements. This signal can be "decoded" by the bar code reader's decoder into the characters that the bar code represents. The decoded data is then passed to the computer in a traditional data format. | |  |
|  | **Types of Bar Codes** | | http://www.pcbarcode.com/barcap.gif |
|  | There are lots of different bar codes. Some bar codes are numeric only, (i.e. UPC, EAN, Interleaved 2 of 5). Some bar codes are fixed length, (i.e. UPC-A is 12 digits, UPC-E is 6 digits, EAN-13 is 13 digits, and EAN-8 is 8 digits). Some bar codes can have numbers and alphabetic characters, (i.e. Code 93, Code 128, and Code 39). One bar code allows you to encode all 128 characters, (Code 128) and other bar codes allow you to encode a lot of data into a small space (PDF417 and MaxiCode).  Many were invented some time ago and have been superseded by newer bar codes. Some industries standardized on older bar codes before the better ones had been invented, thus there is a continuing requirement for their use in particular industries.   |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **Bar Code** | **Variable Length** | **Allowable Characters** | **Industries in use** | |  | **Older Bar Codes** | | | | |  | **Code 11** | Yes | 0-9 | AT&T pre 1990 | |  | **Codabar** | Yes | 0-9,$+.:/ | Blood Banks, Cotton, Transportation | |  | **Plessey** | Yes | 0-9,A-F | Shelf Labels | |  | **MSI** | Yes | 0-9 | Shelf Labels | |  | **2 of 5** | Yes | 0-9 | UPC Shipping Container | |  | **UPC and EAN** | No | 0-9 | Food/Discount Store Items | |  | **Newer Bar Codes** | | | | |  | **Code 39** | Yes | 0-9,A-Z./+-%$Spc (2 character pairings for Full ASCII ) | LOGMARS, HIBCC, AIAG,TCIF | |  | **Code 128** | Yes | Full ASCII | UCC-128, EAN-128 | |  | **Code 93** | Yes | 0-9,A-Z./+-%$Spc (2 character pairings for Full ASCII) | HIBCC Alternative, Canadian Postal Service | |  | **PDF 417** | Yes | Full ASCII | This is a “stacked” code, used mainly by AIAG, LOGMARS and identification card applications. | |  | **MaxiCode** | Yes | Full ASCII | This is a “bulls-eye” type 2-D code created and used primarily by UPS. |   Many readers have to comply with their customer's or industry's bar coding specifications; no choice is possible, just compliance. Look at the following samples of printed bar codes:  Printed Codes  The classic bar code type is Code 39, (also called Code 3 of 9) which has 9 bars and spaces; three are wide, and the other 6 are narrow. In Code 39, 3 of 9 total bars and spaces are wide; hence the name, Code 3 of 9. For example, look at the following character representations with Code 39:  Code 39  Notice there are two widths of bars and two widths of spaces. If you wished to print a bar code of ABCD, you would need to start and end it with a special Start/Stop code character - the \* (asterisk) is used for Code 39. So to print a bar code of ABCD, it would need to be printed as \*ABCD\*. There should be at least 1/4" of white space to the left and right of the code; this helps the reader pick out where a bar code begins and ends.  Code 39 #2  Other bar code types are similarly constructed. UPC and EAN bar codes have four widths of bars and spaces; so does Code 128. | |  |
|  | **Bar Code Selection Recommendations** | | http://www.pcbarcode.com/barcap.gif |
|  | For new bar coding projects that don't have industry or customer standards, **Code 39 is the typical non-food standard**, because almost all bar code equipment reads/prints Code 39. However, Code 39 produces relatively long bar codes; it is not particularly efficient in bar code density, (the maximum density is 9.4 characters per inch including 2 start/stop characters). Where the label width is an issue and there is numeric data or lower case data, Code 128 is the best alternative; Code 128 also has an extra efficient numeric only packing scheme to produce very dense bar codes, and Code 128 has all 128 ASCII characters. Not all readers read Code 128, so before you settle on it as a standard, be sure that your reader is 128 capable. Code 93 has been promoted by only one vendor; it requires two characters to make Full ASCII; and it doesn't have a numeric packing option. For these reasons, Code 128 is preferable over Code 93.  The larger the width of the elements, the more space it takes to print the bar code; therefore, the lower the bar code density. The thinner the bar and spaces, the less space is required and the higher the bar code density. Look at the samples below of different densities:  Bar Code Density Chart  Lower density bar codes are more reliably printed and more consistently read than higher density bar codes, because minor variations (due to printing or damage) are much more serious with high density bar codes - the percentage of distortion is larger. | |  |
|  | **Bar Code Readers** | | http://www.pcbarcode.com/barcap.gif |
|  | There are three basic types of bar code readers: fixed, portable batch, and portable RF. Fixed readers remain attached to their host computer and terminal and transmit one data item at a time as the data is scanned. Portable batch readers are battery operated and store data into memory for later batch transfer to a host computer. Some advanced portable readers can operate in non-portable mode too, often eliminating the need for a separate fixed reader. Portable RF Readers are battery operated and transmit data real-time, on-line. More importantly, the real-time, two-way communication allows the host to instruct the operator what to do next based on what just happened.  A basic bar code reader consists of a decoder and a scanner, (a cable is also required to interface the decoder to the computer or terminal). The basic operation of a scanner is to scan a bar code symbol and provide an electrical output that corresponds to the bars and spaces of a bar code. A decoder is usually a separate box which takes the digitized bar space patterns, decodes them to the correct data, and transmits the data to the computer over wires or wireless, immediately or on a batch basis.  **USB Interface Bar Code Readers**  http://www.pcbarcode.com/li50sm.gifA more recent interface available for bar code reading is the Universal Serial Bus interface. Most new PC’s (with Windows 98, ME, 2000, and XP only – neither Windows 95 nor NT offers USB support) and Macs come with several USB ports available for peripheral attachment. Data transmitted by the bar code reader to the USB port appears much like data coming from a keyboard wedge reader; in fact, USB interface can be used to input data into the same applications that would typically be used with a keyboard wedge reader.  Worth Data now offers integrated USB interface on all our keyboard wedge readers; both integrated scanner models (LI50-WDP, LZ310-WDP and LZ410-WDP) as well as those using a separate decoder (P22 WDP). Worth Data also developed a USB interface adapter that allows an existing keyboard wedge reader to attach to the USB port. The Wedge Saver™ helps the user avoid buying new readers simply for USB interface (some new PC’s don’t have keyboard ports; they only have USB).  http://www.pcbarcode.com/li50-usb.gif  Our TriCoder Portable reader now also features a built-in USB port. Keyboard input as well as lighting-fast USB uploading (40 times faster than through the serial port) is supported.  **Personal Computer Keyboard Wedge Readers**  Wedge ReaderIf the bar code reader is attached through the keyboard interface, the bar code reader sends data in key codes, exactly as though the data had been keyed on the keyboard. Keyboard interface readers are nicknamed "wedge readers", because they physically wedge between the keyboard and the computer (or mainframe terminal) and attach as a 2nd keyboard. The great advantage of "wedge readers" is that bar code reading can be added with **no software changes necessary**; the software thinks that the data received was produced by a fast typist. (Of course the keyboard remains usable too!). With a wedge reader, any program that accepts keyed data will accept bar code data with no change. The following figure shows a keyboard wedge reader attachment.  A keyboard wedge reader which emulates all of the keys including function keys, Ctrl, Alt, Page Up, etc. is preferable. You cannot place a keyboard wedge reader more than 10 feet from the computer.  You cannot place a keyboard wedge reader more than 10 feet from the computer. You can get an extension cable for the scanner, allowing you to range up to 35-100 feet from the computer. For these applications a cordless radio frequency scanner would be better; the scanner has a transmitter and the decoder has a receiver so that the scanner can transmit digitized data to the decoder over RF instead of a cord. RF readers transmit up to 150 feet.  **Serial Bar Code Readers**  Another method of data transmission from the bar code reader to the computer is by RS-232 Serial ASCII format. If you have a multi-user computer, (for example a UNIX system), with serial ASCII terminals for each user, the bar code reader can attach between the terminal and host computer, transmitting ASCII data just like the terminal; in fact the **bar code data looks just like keyed data**. when attached like the following figure:  Single user computers without an external keyboard (most notebooks) must use the serial port for interface of a bar code reader; to get the bar code data to appear as keyed data, a TSR or device driver program is also necessary. Typically requiring only 2K of RAM memory, the program takes data from the COM port and places it into the keyboard data buffer, **so bar code data appears to have been keyed.** If your computer program can read a serial port directly, no additional program is necessary.  . Also, when adding a serial reader to a laptop, notebook or palmtop, it is important to use a reader that does not draw power from the computer itself. Worth Data has designed a serial interface laser scanner that is battery operated, saving all of the laptop or notebooks’ battery power for the operation of the laptop or notebook computer itself.  Serial readers can be placed several hundred feet from the computer, (keyboard wedge readers cannot be placed beyond 10 feet.). Also multiple serial readers can be attached to the same computer, (keyboard wedge readers cannot). The PC runs a program to poll the readers one at a time, thus avoiding the "mish-mash" of data from multiple readers.  http://www.pcbarcode.com/rs-232daisy.gif  **MainFrame Bar Code Readers**  Mainframe computers often have terminals with unique data connectors and data formats, (different from ASCII or PC key codes). The IBM System 36-38, AS/400, 4300, 9000, etc., have such terminals. To use bar codes with these computer systems, you must use a keyboard wedge reader specifically designed for the terminal to be attached to. Vendors such as Compsee, Intermec, and Welch-Allyn specialize in readers which attach to mainframe terminals.  The alternative is to have a PC with a terminal emulation card in it attached to the mainframe; then a less expensive PC bar code reader and laser printer can be used on the PC.  **Portable Readers**  Portable readers are handheld battery operated readers which store the data in memory for later uploading. In addition to a bar code scanner, a portable reader usually has an LCD display to prompt the user what to do; and they usually have a keyboard to enter variable data such as quantities. Ease of programmability is a key issue in selecting a portable, and that depends on your programming abilities; lots of vendors say it's easy, (as long as you can program in C++ or go to their two week school). Other variables to consider are: battery life (at least 20,000 scans), ease of reading the display, size/weight of the unit, who repairs it, and where it is to be repaired in the event of a malfunction.   Worth Data has pioneered and patented voice prompt messages to supplement the display messages in a portable unit, overcoming lighting, language, and message clarity problems; this unit actually announces when you have entered incorrect data and when to change the batteries or upload data, plus you can customize any or all voice prompts for your applications.  Most of you will want a unit that requires no programming for inventory - a unit that has built-in inventory data collection programs - on which you can easily create custom programs.  Tricoder with wand  **Radio Frequency Readers**   RF TerminalRadio frequency readers are the ultimate solution to many applications' needs - especially any computer remote application that can benefit from the computer checking and instructing the operator. Warehousing applications such as picking, put-aways, shipping, and receiving are typically better performed by RF readers because the computer can instruct the operator where to go and what to do, plus the computer files are current as to exact status and location of available inventory.  RF Readers are like on-line terminals, but wireless. The user can roam around his local facility scanning and keying data and getting a response from the computer with each entry. Therefore the computer can very carefully edit the data for errors as well as prompt the user for what to do next considering the data that has just been entered. The classic RF applications and associated advantages are:   * **Picking** - routing of the picker; computer instructed substitutions; real-time status of the order. * **Put-Aways** - inventory is available for sale or for manufacturing immediately. * **Receiving** - purchase order shortages can be immediately determined. Critical parts can be routed to manufacturing immediately. * **Shipping** - eliminating wrong or incomplete shipments by computer checking before loading or even computer led loading.   There are two basic types of RF Readers on the market:   * Readers that emulate terminals or PCs, and * Simpler Readers which talk to a computers serial port. A brief explanation follows:   **RF Readers that Emulate Terminals**  These readers started out as mainframe terminal emulators such as IBM 3270 or 5250 terminal emulation. To emulate an IBM mainframe terminal is no easy task, so the cost was very high, (i.e. $10,000 per control unit, $4000 per terminal).  Today there are several emerging terminals that emulate PC workstations (i.e., Symbol Technologies and Intermec) on NT or Netware Local Area Networks. These machines are 486 computers with lots of memory and download their software from the network server. They are relatively expensive, about $3000-$5000 per terminal, require an operating LAN, mostly require applications to be written to the upper left hand corner of the screen, and usually require a network controller that is $3k-$10k in cost. These terminals almost always require a C++ program to be written on the terminal and the host programs to be modified to just use the upper left hand corner of the screen. Competent network management personnel are also required for each location.  **RF Readers that Talk to a Serial Port**  These readers require programming on the host computer to read and write to a serial port. Such programming is relatively trivial and can be written in almost any language or any platform. Existing application packages can be modified to include these simple RF readers, but programming is required. It could be argued that the amount of effort is considerably less than with terminal emulation, because all programming is on the host computer; the terminal emulation programs require host programming (for the upper left hand corner) and programming on the terminal too.  Readers that communicate to the host by serial port are usually less than 1/2 the price of the more complicated "Terminal Emulators"; they also often have faster response time due to less software overhead. No network is required - even a slow 286 can drive them at maximum speed. They are far simpler - thus less costly, BUT they do require programming to get their full potential. Even though you can run them in "One-Way" mode without programming, that misses the greatest potential of computer-led activities, (often referred to Event Driven Applications).  **Spread Spectrum Terminals vs. Narrow Band Terminals** Narrow band refers to radios that operate within a narrow band of radio frequencies. Spread spectrum refers to radios that jump around on a wide band of frequencies to avoid interference. Narrow band can be licensed at high power and unlicensed at low power. Spread spectrum is almost always unlicensed at high power. Spread spectrum is superior for very large networks of RF terminals - 150 plus terminals in the same building. For terminal networks below that number, unlicensed narrow band is usually less expensive, far less difficult to program and it usually transmits just as far with considerably less power and battery size/weight.  Narrow band radios with a user changeable frequency has the same advantage as spread spectrum in avoiding interference. In fact, it can be argued that 10 plus channels of user selectability are at least as safe as spread spectrum with a fixed pattern. What you really want to avoid is narrow band terminals with a fixed frequency that cannot be changed unless sent back to the manufacturer. More and more devices are going wireless; so, the channel interference is expected to increase substantially in the future.  **Worth Data's R/F Terminal**  R/F TerminalWe offer a narrow band radio that has 16 user selectable frequencies, thus avoiding interference with other devices that might operate in the same band. Because its receiver is so sensitive, the coverage is outstanding- typically 500,000 square feet without relays and up to 3,000,000 square feet with relays. Each base station can handle 300 transactions per minute.  The cost is 1/2 of most Spread Spectrum systems. All programming is on the host computer using any platform and language that can read/write to the host's serial port. Using multiple base stations with split traffic, the number of terminals per site can easily go up to the 50-100 per site. Models are available for the US (911MHz), Europe (434MHz), Australia/New Zealand (921MHz) and Korea (424 MHz).  For complete R/F Terminal programming instructions, [**Click Here.**](http://www.pcbarcode.com/ukprogspec.html) | |  |
|  | **Scanners** | | http://www.pcbarcode.com/barcap.gif |
|  |  |
|  | DeskJet PrinterThere are several methods of getting printed bar codes; these are:   * Buying photocomposed bar codes from a label manufacturer. * Printing your bar codes with inexpensive labeling software on your personal computer's dot matrix, laser, or inkjet printer. * Printing bar codes on a specialized bar code label printer. * For manufacturers who need bar codes printed in their product's packaging, use purchased film masters or use bar code fonts suitable for PostScript® film output.   Whatever printing source you decide upon, there are a few common sense tips to pass on:   * Stay away from colored bar codes (use black) and colored backgrounds (use white). Any other colors lower the contrast between bars and spaces and therefore lower readability. * Do thorough readability testing on any labels before distribution. Be careful. Don't discover a problem after you have distributed 10,000 labels that need to be recalled.   **Pre-printed Labels** If the only bar code application you are doing is an application such as fixed asset inventory tracking and employee badges, pre-printed serialized labels make a lot of sense. Photocomposed labels are usually very high quality and you can buy 5000 for around $300. Libraries typically use pre-printed labels. Why? Because the labels need to last for 25 years and the volume is usually 100,000 per library. High quality, durable, laminated photocomposed labels are usually used. Companies like Data 2 (800-227-2121) supply such labels.  (You can also print high quality durable labels on a thermal transfer printer using XT Polyester label stock or on a laser printer with a poly label stock (call Worth Data for our [Worth Poly™ Polyester Laser Label stock](http://www.pcbarcode.com/ukworthpoly.html)); such stock is more expensive than paper. ).  **Printing on PC Printers**  With the proper PC software, today’s printers are capable of printing excellent quality bar codes. Ink Jet and Dot Matrix printers cannot print high- density bar codes, but laser printers can. Laser printers actually print the best quality bar codes of any commonly available printing technology.  **Laser Printing**  Laser printers can produce outstanding quality bar codes. The quality is consistent even when toner gets low; it is obvious and is not subject to interpretation. (When the toner cartridge is changed, it is important to follow the replacement cleaning instructions, including cleaning the corona wire, especially for high density bar code printing.)  33 Label PageLabels are sectionalized on a 8 1/2" x 11" page in multiple columns and/or rows. For example, mailing labels (1" by 2.8") appear in 3 columns and 11 rows, 33 labels per page. Since laser printers feed one sheet at a time, it is impractical to print one label at a time.   There is an unprintable area 1/4" inch to the left, right, top, and bottom of any form; this makes full labels impossible unless you sacrifice the top row and maybe the bottom row of labels. One trick in laser printing is to use label stock with the laser's unprintable areas cut as a border picture frame around the printable label's area. For example, the previous example of 33 mailing labels per page would be 30 labels per page with the unprintable area isolated as a picture frame border. The top and left margin settings in the program would adjust the labeling program to the picture frame label stock's unprintable borders. 30 Label Page  Laser printers are great for producing batches of labels, but if you need only one label (where there are multiple labels per page) at a time, dot matrix or thermal transfer printers are required. Laser printing is the best quality of all types.  There are several types of label stock available for laser printers. If you need to print durable labels, Worth Data offers a polyester label stock designed especially for laser printers. [Worth Poly ™](http://www.pcbarcode.com/ukworthpoly.html) is made from a special white, matte finish, heat stabilized polyester film designed for laser printers. When printed on a laser printer, the resulting label is heat resistant, water-resistant, light resistant, scuff resistant, smudge resistant, and stain resistant. These labels are ideal for any labels that you want to last through rough handling, repeated usage, outdoor usage, or other harsh environments. The permanent adhesive is designed to keep your label adhered to wood, metal, plastic, or glass for years. You pay a little more, but you get a lot more label for the money.  Windows programs usually give you rich text fonts, more rotations, and excellent image graphics printing. The labeling programs for Windows often support Postscript printers.  **Ink Jet Printers**  These printers are getting better and better. They print pages of labels, so refer to the page label stock discussion below regarding page laser label stock. Also, use label stock specifically meant for inkjet printers – the stock is usually coated to minimize ink bleed. Always test your bar code labels for readability before printing in bulk.  Inkjet printers are almost exclusively supported by Windows programs. If you have problems, check to make sure you are using the latest driver version from the printer manufacturer. Also, be sure to select a printer that has a separate black cartridge in addition to the color cartridge.  If labels you are printing are going to be exposed to water, don't use the inkjet printers – most inkjet ink is water-soluble. Inkjet printers are NOT the best printer to use to print labels that need to withstand the weather or are subjected to constant scanning.  Beware; the inkjet cost per page in color is twice cost of a black and white print.  **Thermal Transfer Printing** Thermal transfer printers are required when you need either to print one label at a time or when you need to print a roll of labels so that labels can be applied by applicators directly to boxes. Volume industrial printing in the 90's is done mostly by thermal transfer printers. They are fast and produce excellent quality bar codes.   Thermal transfer refers to the printhead heating up and melting a ribbon onto the label surface. Most thermal transfer printers can also produce "direct thermal" labels, but paper instead of a soft ribbon wears out the printhead 10 times faster; another disadvantage of thermal printing is that most thermal labels cannot be read with IR light and deteriorate in sunlight to non-readability over time. The media cost is about the same as laser and direct thermal. Therefore thermal transfer printing is far more popular than thermal printing for serious label production.   Beware of the CoStar and Seiko thermal printers for producing serious bar codes. They have two problems:   * The bar codes are just a little off. (The naked eye can often see three sizes of bars when only two are supposed to be possible). * They are thermal printers producing bar code labels that will deteriorate to unreadability in sunlight. * They are inexpensive, so they are very attractive, but beware.   Datamax PrinterMost popular thermal transfer printers can produce labels up to about 4" wide (more expensive models can print at 6" or even 8") and lengths up to 8 inches plus. Smaller widths can of course be accommodated. Popular thermal transfer printers are manufactured by Citizen, Sato, Zebra, and Datamax; these are the major brands.   You can get almost any type of label stock imaginable for thermal transfer printers; high temperature, weather proof, surface laminated, jewelry ring stock, card stock, tag stock, etc.   The basic paper labels with inexpensive ribbons produce bar codes that can be smeared or smudged with hard rubbing by the fingers. Smudge proof labels can be produced with more expensive synthetic label stock and a ribbon with less wax and more resin (hybrid or P2 Ribbon). Scratch- proof laminated labels can be produced with XT Polyester and a high resin ribbon; when heated, the resin and polyester coating fuse to make a very durable label. Worth Data has [a variety of paper, synthetic and polyester labels](http://www.pcbarcode.com/ukthermlbls.html) stocks and ribbons to choose from.  These printers generally print from 2" to 12" per second; at any width up to the maximum, the printers print 2" to 12" lengths per second. Find out if the rated speed quoted for the printer you are considering is to be expected when printing bar codes or graphics - for this, many printers slow down to less than 1/2 their quoted speed.   The print heads wear out on thermal or thermal transfer printers. To maximize the print head life, clean it between every ribbon change with a cleaning card or with a lint-free q-tip soaked in alcohol -a MUST to avoid continually replacing printheads. Unlike most dot matrix and laser printers, the thermal transfer printers discussed have scalable text fonts and bar code fonts resident in the printers firmware. The software necessary to print the bar codes is a series of special command sequences. So you can add printing on a thermal transfer printer to one of your existing programs, providing there is someone semi-skilled at programming.  However, most users want a general purpose design labeling program which requires no programming. It helps to buy the printer from the developer of the labeling software so that you have a single party who has an interest in keeping the software bug-free and matching the printers capabilities that you want.  **Dot Matrix Printing**  Dot matrix printers can produce good quality low volume bar code labels. When printing low-medium (3.7cpi or lower for Code 39), the labels can be excellent quality. The Epson, IBM, and Okidata printers have adequate graphics capability to yield good quality bar codes. You will need a dot matrix printer with a pin feed platen to successfully print the variety of label sizes.  **There's one catch though - you must not wait too long to change the ribbon.** The printer operator must make a judgment call on when to change the ribbon. It's best to tape a bar code of minimum acceptable darkness on the printer, so the operator can't make a judgment error. Programs that can strike the bar codes multiple times can keep the ribbon expense down.  Both 24-pin and 9-pin printers can produce good quality bar codes. The 24- pin printers produce better bar codes than 9-pin printers, especially as the ribbon is getting low on ink. The 24-pins simply put more ink on the paper. | |  |
|  | **Labeling Software** | |  |
|  | Because dot matrix, Inkjet and Laser printers are in such widespread use, labeling software to make these printers capable of printing bar codes has become readily available. There are two general types of bar code printing programs available:   * Menu-driven programs for operators to design and print labels. * Bar code font programs to allow printing of bar codes within other Macintosh or Windows programs; no programming is necessary by the user.   **Stand-Alone Menu-Driven Programs**  These programs allow the user to design different label formats and save them to disk for label runs. Usually there is a WYSIWYG design interface to view the label on screen as it is being designed, especially Windows programs. These programs usually have most of the following features: scalable fonts, graphic image import, all popular bar codes, data file import, easy custom operator interface, popular data base access, and/or built-in label data base. Look for a program that doesn't combine support for laser/dot matrix with thermal transfer. Separate programs for common PC desktop printers vs. thermal transfer printers keep it simple for the user.  Besides the ability to design and print labels, you should look for a program with a simple operator interface. The label designer creates custom prompts for a label format; then the operator answers simple questions that lead him to enter the variable data for the labels to be printed. With a label database, you can select which labels to print. You don't want the operator to have to deal with the more complicated label design screens.  **Font Programs**  In Windows and Macintosh environments, any font based program can select fonts for printing. This makes it possible to use bar code fonts from such programs (i.e. Word, Excel, PageMaker, Quark, etc.). Problems which must be overcome are:   * Scaling - when scaling, Windows and the Mac can make little adjustments that really mess up the bar codes; most programs give you fonts at a certain point size and density that will be very accurate for the point size and printer for which they were designed; however if you change printers or change point sizes, almost anything can happen. Be careful when straying outside the standard point size, printer specific fonts . * When printing UPC, an "0" could be represented by four different bar/space patterns, depending on where it is in the code and the computed parity of the data. Therefore it is necessary to have a translator program which you can switch to, enter the data you wish to print, copy it to the clipboard, and then copy the translated strings into your application. At least one program has a "hot-key" sequence which can copy the bar code into your application without having to first translate and then copy from the clipboard; after setting the bar code type and density from the translator, any highlighted data in the application is translated with the "hot key".   Using fonts, labels can be printed from your favorite word processing program, or you can add bar codes to a form from almost any font-based Windows program, (provided your program can call our DLL).  **Bar Codes on Packaging or Film Masters**  **How to Get a UPC Number**  If you haven't already been assigned your manufacturer's number by the Uniform Code Council or appropriate EAN authority, call (UCC is 937-435-3870) to get registered. You will pay a charge to get a manufacturer's number assigned, (digits 2-6 in the UPC code), plus you will get an information packet. You can create up to 99999 unique UPC numbers for all your products.  For users who wish to have the bar codes printing as an integral part of their packaging (such as sugar bag) there are three ways:   * Create your packaging design with a Windows or Mac based program and use a postscript bar code fonts package to add the bar codes to the whole packaging design. The film for the packaging would include the bar code. * Order separate film masters from organizations that specialize in bar code film masters (such as Symbology Inc. 1-800-328-2612 or www.symbology.com). Have your printer strip in the bar code film to the packaging film so that the whole packaging prints with the bar code included. * A third method that must be done with caution is to print bar codes on paper with a good bar code printing program, photograph the printed bar code, and then use the film as specified above.   After printing, the ink in bars tends to bleed slightly into the spaces. Therefore, bars on film should be slightly narrower, (probably 1/1000 inch narrower), to allow for the spreading or the ink in printing. (Turn down the darkness on the laser printer if printing bar codes on paper to be photographed.)   Whatever method you use, you should have your printer make test print runs. If you don't use a verifier to test the accuracy of the bar codes, at least:   * Test them with a bar code reader for readability. You should get 20 out of 20 reads with reasonable attention in wanding. Don't accept any bar code that has less than 100% readability. AND * Have your printer (the person doing the printing) microscopically inspect the narrowest bar and narrowest space after printing (wait about 30 minutes to 1 hour for any bleeding of the ink to complete). They should be very close to equal. If they vary by more than 10% from each other, then the exposure on the film must be changed; if the bars are too big, expose less; if the spaces are too big, increase the exposure.   Don't forget to leave a 1/4" white space to the left of the leftmost bar and a 1/4" white space to the right of the rightmost bar, (no text or other graphics in these areas). | | http://www.pcbarcode.com/barcap.gif |
|  | **Bar Code Applications** | |  |
|  | Bar Code applications are growing by the day as creative people find ways to enjoy data entry efficiency possible with bar codes. The following is a brief discussion of some major applications: (the key to all of these applications is the software; the software is the steak, the bar code is the sizzle).  **Data Capture Applications**  **Assembly Checking** - usually done with custom assemblies, a terminal leads the operator in what to assemble; as the operator scans each part or subassembly added, the computer can monitor for correct specifications.   **Fixed Asset Inventory Control** - large organizations have multitudes of furniture, PC's, fixtures, etc. The exact location for each item determines cost allocations. Bar codes are placed on all items and bar codes are placed on walls of each location. With a portable bar code reader, the location is wanded and then all items in that location are wanded; the data is then uploaded to the computer for accurate depreciation cost allocation.   **Job Costing and Tracking** - as item(s) are completed, scanning results into a terminal. (Multiple operators use a single terminal).  **Labor Distribution** - again using employee badges, as employees move from department to another, the employee scans in his badge at the new department's terminal. This allows payroll cost allocation to departments..   **Library Automation** - bar codes on ID cards of patrons and bar codes on books. Automatic check out.  **Meter Reading** - similar to a pick list, but downloading to portable terminal the list of addresses to be read, along with the bar code ID of the meter, so that the terminal checks that the operator is indeed reading the right meter.  **Order Books** - catalogs of items with associated bar codes. Used for order taking, estimating car repair costs, route accounting, etc.   **Point of Sale** - at the cash register (or equivalent), scanning the bar code into a computer which looks up the item scanned and displays the description and price plus decreasing the on-hand inventory by the quantity purchased.   **Records Management** - for patient records, case records, loan records, etc., a bar code is placed on the folder. Then as the units are checked out, the folder is scanned and the borrower's ID card is scanned. As the unit is passed from one station to another, the item is scanned so that it can be tracked through the organization.  **Remittance Processing** - printing a bar code on the remittance stub or the invoice stub so that when the customer returns the stub with his payment, it can be wanded to bring up the data or to complete full payments.  **Stock Taking** - the classic portable bar code reader application. The operator scans the codes of the items (perhaps scanning only one of multiple items and then entering the quantity for that item) and then uploading the stored scanned data to the computer later, thereby correcting the computer's files for what is actually on the floor.   **Time and Attendance** - employee badges with bar codes are read at clock-in and clock-out into a computer or terminal to provide attendance data to the computerized payroll program.  **Warehouse Picking** - the computer downloads a table to a portable terminal and the operator is prompted to pick a list of items associated with a specific order. After picking the order, the operator goes back to the terminal to upload the data and receive his next order to pick. As locations are reached or items are picked, the bar codes are scanned and the terminal compares what was scanned to be sure the right location or item is being picked.  **Warehouse Put-Aways** - as the operator stores items in a warehouse, the operator scans the items and the location. This data is the uploaded to the computer so it can keep track of the inventory quantity on hand and locations.  **Warranty and Service Tracking**- as units are received, the bar code on the case of the unit is scanned, bringing up the computer history for that unit. As the unit is repaired, scanning what failures and what new parts are required to repair for costing and failure analysis.  **Work-In-Process Inventory Tracking** - with on-line readers or portable readers, scanning the routing sheets with bar codes on them as parts or subassemblies are completed, often including yield data, so the work-in-process costs and progress can be tracked. (Usually one terminal per operator).  **Event Time Applications**  There is now a variety of hand held bar code terminals which are linked by Radio Frequency (RF) back to a host computer. This makes possible portable interactive applications in the stock room, the warehouse, shipping, receiving, etc.  Whatever the cost of the hardware, the application software investment is intense for most companies. It is really an extension of MRP II software into the portable hand held terminals.  Applications include:  **Rental Car Check in and Billing** - Anyone who has rented a car lately has experienced the convenience and speed of RF Terminal check-in at the curb.  **Massive Table Lookup** - The simplest application is the computer performing validity checks on data entered from its large up-to-date computer files and notifying the operator of any invalid data.   A classic example of this would be grocery price validation. Instead of downloading a 10 MB file into a hand held, the computer does the table lookup and lets the operator know what prices need to be changed on the floor. Any store without prices on the items must have price validation by RF Terminal to be sure the prices on the floor are the same as the price in the computer. Direct Store Delivery by vendors is also a must for RF Terminals, allowing the store to monitor the price being charged by the delivery personnel to the store.  The best example is stock taking. Based on the outage or overage, the computer would instruct the operator in different things to do: count again, see supervisor, etc. The counts could be double checked on the spot, yielding a faster more accurate inventory count.  **Receiving** - As a purchase order is received, the operator scans and keys what has been received, with the computer pointing out shortages that are double checked on the spot rather than after the items have been moved or partially used.  **Shipping** - As items are loaded, they are scanned. Shortages or misloads can be detected immediately.  **Put-Aways** - As items are put away, the computer has them immediately available for picking to satisfy the next order.   **Warehouse Picking** - The computer instructs each picker what to do with up to the second stock status from Put Aways. This would be especially valuable with items in multiple locations and where substitutions are possible. | | http://www.pcbarcode.com/barcap.gif |