



CodeFacts

AIDC (Automated Identification and Data Collection) Technical & Informational Documents
Written for Everyone

Bar Code Readers

The Many Ways to Scan Bar Code Symbols

Bar code symbols can be scanned many ways by many different devices. A bar code reading system is typically made up of two components: an interface box, commonly referred to as a *decoder*, and what is unexcitingly referred to as the *input device*. The decoder is where all the magic happens. The input device does the “grunt” work, the decoder does the sophisticated stuff. Almost always, these days, these two devices are one and are *integrated* into one package. That is, the decoding is done within the input device and not in a separate device. There are, essentially, three ways these devices are put together to scan bar codes. They are known as *on-line systems*, *off-line systems* and *wireless* (formerly referred to folks in our industry as RF—radio frequency systems. You may also have heard of *cordless systems*. Even though you may think this is just another name for wireless, you’re wrong. Read on for all of the dirt on bar code scanning.

On-Line Systems

These systems are semi-permanently attached to a computer, terminal, cash register or other “intelligent” device. Their main job is to scan a bar code symbol, interpret (decode) the bar code, and immediately transmit it. On-line systems generally take three forms; wedge, serial and USB, depending on the computer system and the preference of the user. Wedge systems are usually found being used on IBM and Apple PCs and compatibles, as well as IBM mainframe terminals. They “wedge” between the computer keyboard and PC or terminal. Serial systems are most often used with RS-232 dumb terminals (Wyse, Amdek, etc.) but are also interfaced with PCs and cash registers that accept serial data through their RS-232 port. USB interface scanners can be used with desktop and laptop PCs, as well as Imacs and some other computers.

It is worth noting here that on-line bar code readers are also available with interfaces such as PCMCIA and other add-on cards, often found in palmtop computers. Other interfaces allow bar code readers to be added to Handspring Visors, Palm computers, and Compaq Ipaqs.

All on-line decoders work the same way; changing the analog signal sent to them by the scanner, converting that signal, and making the computer accept the scanned data as if in-keyed. Therefore, all on-line systems are, essentially a second keyboard to the computer - *no software or device drivers are required as this is a "hardware" interface, only.*

On-line systems are programmable, usually by scanning bar coded programming commands into the system from a special programming menu included with the system. All program commands are held in a non-volatile memory area of the decoder. They can only be changed by scanning in new program commands and overwriting the previous program. *Why would you want to program a bar code reader?* Well, you may wish to have the "enter" character automatically transmitted after every scan, or you may need to set the decoder up to transmit keyboard codes from an XT-class PC, as opposed to an AT-class. Other programming techniques can actually edit, parse or not accept a bar code symbol before it is transmitted to the computer system.

Recently, *cordless* on-line bar code readers have been developed. They all use wireless RF technology to transmit (up to 100 feet or more) the bar code data from the scanner to the computer, but *they are not wireless bar code reader terminals!* A cordless bar code reader functions just like the tethered readers described above, except that the tether is wireless. So, like the channel changer on your TV set (which is typically infrared, not RF—but who's getting fussy?) the transmission is *one way only*. That means that, apart from getting an acknowledgement beep back from the base system attached to the PC or terminal, you have no assurance that the bar code data you've just scanned has gone into the appropriate screen field. Cordless scanners, therefore, are probably most practically used up to a few steps away from the computer, or for very simplistic (i.e., scan, scan, scan,...) data input.

Off-line Systems

While an on-line system tethers the operator to within a few feet of the terminal, off-line systems open up a whole new realm of applications. Such systems are simply a hand-held computer outfitted with a bar code reader and may also be called *PDTs* (Portable Data-Entry Terminals), *hand-helds* or *portables*. They are powered by batteries, which are usually rechargeable and typically weigh less than two pounds.

Portables can be thought of in two different ways: they can be simply used as data collection devices, or they can be used as an extension of the host computer system and do more than just store collected data. Originally, due to less-developed programming tools, obtuse operating systems and lack of RAM, portables could only function as storage for inventory counts or surveys. Now, with megabytes of

RAM, familiar operating systems (like DOS) and powerful programming languages, hand-helds are virtually as powerful as a desktop computer.

Hand-helds are typically pre-programmed for a particular data-gathering task. The standard program “boots” when the unit is turned on, insulating the operator from the operating system. Programming is done by generating a program on a PC and downloading the program to the hand-held, or by utilizing a standard data collection program already residing in the unit. Communications to and from the portable are RS-232, or sometimes these days, USB. A PC is almost always used as the communicating device to hand-helds as they are cheap, relatively easy to program and serve as an excellent “way station” for files travelling between the portable(s) and host system.

AURORA carries portables in numerous configurations to fit a multitude of applications and application environments. Some hand-helds are as small as a credit card! Most all of the portable systems these days are integrated: combining both the bar code scanning device and the hand-held computer. Some can even operate underwater or at -40 degrees! Still, the majority of these devices utilize a text-based interface, displaying 2, 4, 8 or 16 lines on their integrated LCD. These can run a proprietary operating system, or often, MS-DOS. Newer systems use graphical user interface operating systems such as Palm, Windows CE/Pocket PC, Symbian, or EPOCH.

Wireless RF (Radio Frequency) Systems

These systems are essentially hand-helds with a radio frequency transmitter and receiver integrated within the system. They provide the best of all worlds as they are constantly on-line to the host system, yet portable enough to be used far away from the host computer. Some are based on LAN technology, some are WAN—using public wireless networks to communicate to and from the device anywhere in a metropolitan area.

With the advent of the IEEE 802.11x series of wireless standards, virtually all of the wireless bar code reader terminals we provide function within this universal standard for wireless LANs. Other devices such as desktop and laptop PCs, palmtops, telephones (using VoIP—voice over IP technology) or even local area pagers can utilize the same wireless network used by the mobile bar code readers.

Bar Code Input Devices

The bar code scanners one sees at the grocery store are very sophisticated. Most applications do not call for such a method of scanning and are usually limited to

scanners held in the hand of the operator. The proper scanner must be matched to the application and type of bar code being used in order to achieve reliability, accuracy, speed, and operator acceptance. This is one area where economy is not always best.

Simply speaking, most any input device can be attached to any system (on-line, off-line or wireless).

Wand (or Pen) Scanners used to be the most popular of all the bar code input devices, but the nominal cost difference between them and the lower end gun-type scanners has made them less fashionable. To use one properly, the operator must put the tip of the wand in the white zone preceding or trailing the bar code and slide the wand across the bar code at a consistent speed. The angle of the wand must be maintained throughout the scan. Scanning with a wand is an acquired "knack" and can only be practically used if the bar code is on a hard, flat, preferably horizontal surface.

Slot/Badge (or Swipe) Readers are basically wand scanners mounted within a box. Scanning is achieved when a card or document with the bar code printed near its edge is slipped through the reader. First-time read rates are higher with this kind of reader than a wand, but the bar code must be aligned properly and be near the edge of the card.

CCD Scanners use a Charge Coupled Device, like those found in digital or video cameras, to accomplish scanning. Use of a CCD Scanner involves placing the reading head on top of the bar code to be scanned. The code is "flashed" with LED light from the CCD and the resulting reflection is measured in the CCD's photosensors. CCD Scanners typically require virtually contacting the bar code (although some will function from a distance of a few inches), yet there is no scanning movement, nor degradation of the image due to scratching the media surface as with wands.

Imaging Scanners are the latest and greatest versions of CCD scanners. With a CMOS chip at their heart, doing both the scanning and the decode processing, these scanners are very efficient. Most are capable of scanning both 1D and 2D bar code symbologies. One nifty potential feature with an imaging scanner is that it can not only scan a bar code, but also take a digital picture! Therefore, the signature of the person receiving a package (or a picture of their face!), the damage on some freight or a returned rental car, or the placement of boxes in the back of a transport truck, can all be captured by the same scanner that scanned the bar code.

Hand-Held Moving Beam Laser Gun Scanners utilize light emitted from a laser diode source. An oscillating or rotating mirror in the scanner moves the beam back

and forth across the bar code, requiring no movement on the part of the operator. The scanner is usually anywhere from 3 to 10 inches from the bar code symbol, although special laser scanners are now available which will read bar codes from 20 feet away, or more!

Fixed-Mount Moving Beam Laser Scanners are essentially the scanner noted above, mounted in a stand. The scanner head faces towards the bar code symbol (usually down) and is activated when the item to be scanned is put beneath it or crosses a sensor beam. These scanners are often used in libraries as they free the operator's hands to move the book through the scanner. ((Imaging scanners can also perform this trick.) Another place where fixed-mount moving beam laser scanners are used in factory and warehouse automation systems. The scanner is usually mounted above a conveyor belt where it scans objects as they move past.

Slot (Flat-Top or Projection) Laser Scanners are usually seen at checkouts of large grocery stores. They are only used when the items to be scanned can be moved past the scanning window by hand and where the "throughput" required is very great. The cost of these scanners is considerably less than it was a number of years ago, comparing favourably with hand-held laser scanners.