



**Homeland
Security**

Science and Technology

U.S. Department of Homeland Security



System Assessment and Validation for Emergency Responders

The U.S. Department of Homeland Security (DHS) established the System Assessment and Validation for Emergency Responders (SAVER) Program to assist emergency responders making procurement decisions.

Located within the Science and Technology Directorate (S&T) of DHS, the SAVER Program conducts objective assessments and validations on commercial equipment and systems and provides those results along with other relevant equipment information to the emergency response community in an operationally useful form. SAVER provides information on equipment that falls within the categories listed in the DHS Authorized Equipment List (AEL).

The SAVER Program is supported by a network of technical agents who perform assessment and validation activities. Further, SAVER focuses primarily on two main questions for the emergency responder community: "What equipment is available?" and "How does it perform?"

For more information on this and other technologies, contact the SAVER Program Support Office.

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TechNote

Bar Code Reading and Printing Equipment

There are four applications that are common to most organizations, including emergency responders: materials management, information management, labor management, and asset management. The use of bar code technology is rapidly increasing in emergency response organizations because it automates the above tasks considerably enhancing the ability of government agencies to prepare for and respond to natural disasters and terrorist attacks. In the United States, federal, state, and local agencies must now comply with the National Incident Management System (NIMS), which mandates accountability of available resources for efficient preparation, response, and recovery from an incident, as well as efficient communications and information access during an incident¹. Bar code systems can facilitate compliance with the NIMS requirements.

Technology Overview

A bar code system typically consists of a bar code, bar code reader, tracking software, and a computer peripheral for printing bar code labels or tags that can be attached to physical objects. A bar code is a pattern of parallel bars and spaces of variable widths arranged in a specific predetermined pattern to represent a corresponding number, letter, or symbol. Information encoded in bar codes is the most popular of the automatic data entry methods because of its accuracy, speed, control, reliability and portability.

Bar Code Symbolologies

Bar code symbolologies (languages) differ both in the way they represent data and in the type of data they can encode. Some encode numbers; others encode numbers, letters, and a few punctuation characters; others offer encoding of the 128 or 256 ASCII character sets. A bar code in its most familiar format consists of a series of varying-width parallel bars and spaces, and is referred to as a linear, or one dimensional (1D) bar code. A bar code scanner analyzes the wide bars, narrow bars, and spaces in between to extract the encoded information. One dimensional bar codes have the drawback of not being space-efficient because they get longer as more data is encoded. Conversely, 2D bar codes, also known as mega density bar code symbolologies, utilize a narrower module width to pack the maximum information.



Figure 1. Bar Code Symbolologies

While 1D bar codes encode data in only one dimension (horizontally), 2D bar codes encode data in two dimensions (horizontally and vertically), enabling

¹ National Response Framework, US Department of Homeland Security, January 2008

them to compress more information into a smaller space. Most 2D symbologies can hold at least 2,000 characters per bar code, while a typical 1D bar code contains about 30 characters. Two dimensional bar codes also come in patterns of squares, dots, hexagons and other geometric patterns. A three dimensional (3D) bar code is another type of linear (1D) bar code that is embossed on a surface. These types of bar codes can be used where printed labels will not adhere, or could be destroyed in an abrasive environment.

Bar Code Readers and Software

A bar code reader is an electronic device for reading printed bar codes, much like a flatbed optical scanner, which consists of a light source, lens, and a light sensor that translates optical impulses into electrical impulses. It is a handheld or stationary input device used to capture and read information contained in a bar code that consists of a scanner, decoder (either built-in or external), and a cable used to connect the reader with a computer. Because a bar code reader merely captures and translates the bar code into numbers and/or letters, the data must be sent to a computer so that a software application can make sense of the data. USB is the most popular method for connecting bar code readers to a computer, but most are available with a number of connection options including PS/2 and serial RS-232. There are bar code readers that can transmit information to a computer wirelessly using Bluetooth or a proprietary radio communication application. Bar code readers used to scan linear bar codes are not typically capable of reading 2D bar codes. Two options are available for scanning 2D codes. The first involves a moving laser beam which scans both horizontally and vertically to capture the entire code image. The second option, a CCD (charge couple device) scanner utilizes a two-dimensional array of photo sensors to capture the entire code image.

Bar Code Printers and Labels

A bar code printer is a computer peripheral for printing bar code labels or tags that can be attached to physical objects. The most common bar code printers employ one of two different printing technologies: direct thermal printers and thermal transfer printers. Direct thermal printers use a print head to generate heat that causes a chemical reaction in specially designed paper that turns the paper black. Thermal transfer printers also use heat that melts a waxy or resin substance on a ribbon that runs over the label or tag material. The heat transfers ink from the ribbon to the paper. Direct thermal printers are generally less expensive, but they produce labels that can become illegible if exposed to

heat, direct sunlight, or chemical vapors. Bar code labels or tags come in a variety of sizes and in different materials: paper, polyester, and synthetic paper, all with either permanent or removable adhesive backings. Most bar code labels are durable; they can survive extreme temperature changes, high-pressure washes, and exposure to sunlight, as well as submersion in oil, alcohol, acid, and other solutions.

Applications

Because of the limited information that can be encoded in a 1D bar code, a 2D code offers the capacity and practicality for use by emergency responders. The assigned numbers on a 1D bar code have no meaning to other organizations that may scan them. For this reason, 1D bar codes remain an intra-organization system. Two dimensional codes, however, can have actual data linked to data stored in a remote database shared with other organizations outside of their own. Use of bar code technology allows a real-time view of all resources so that incident managers can ensure that assets from all responding agencies are deployed as effectively as possible.

During an emergency response incident, with firefighters, police, rescue, Emergency Medical Services and other first responders flooding the scene, keeping track of all assets such as vehicles, rescue gear, etc., no matter where they are located, is a major challenge. Real-time asset visibility, as offered by bar code technology systems, provides the command center with the details needed to evaluate the scene and properly allocate resources.

Bottlenecks can occur as Accountability and Staging Officers work to check-in arriving first responders with paper and pen, and Logistics Officers scramble to locate critical equipment for a high priority incident. With the use of a bar code tracking system, managers can issue site-specific bar code identification badges — complete with site permissions and an expiration date for electronic tracking throughout the incident. As a result, all responders can be tracked and managed throughout the incident regardless of agency affiliation, improving the safety of responders as well as providing visibility of their whereabouts in the event they are required at another incident. Furthermore, with manual systems, critical information often resides on clipboards at the scene and is inaccessible to offsite command centers, evacuation sites, hospitals, and other agencies. Bar code technology can also enable the instant transmission of critical patient data to the hospital and other offsite personnel in real time, allowing healthcare workers to be as prepared as possible for incoming emergencies.