

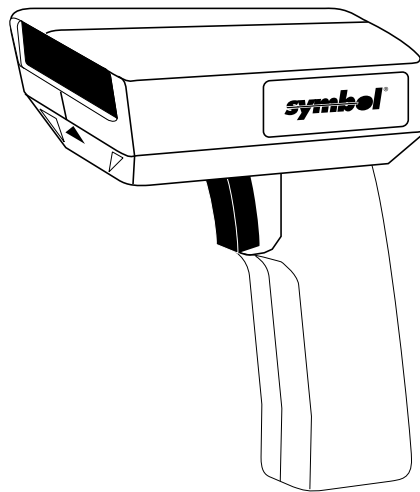
## Chapter 1 User's Guide

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### Scanning Made Easy

The LS 2040MX is Symbol's new retail-specific hand-held scanner. It is based on Symbol's unique "MX" advanced mylar™ technology scan engine. This state-of-the-art technology gives the scanner a wide decode zone, greater depth of field, and excellent reliability. This scanner reads color bar codes and symbols printed on all substrates. These scanners may also be used in light industrial and commercial applications.

The LS 2040MX scans automatically at the rate of 36 scans per second. For decode capability, see *Technical Specifications*.



The LS 2040MX scanner weighs 7.5 oz. (213 gm) without the cable, and is made from a durable plastic. The ergonomic design ensures comfortable use over extended time periods.

# Set Up

## Unpacking

Remove the scanner from its packing and inspect it for damage. If the scanner was damaged in transit, call the **Symbol Support Center** at the telephone number listed on page 1-11. **KEEP THE PACKING**. It is the approved shipping container and should be used if you ever need to return your equipment for servicing.

## Connecting Your LS 2040MX

**Note** **Typical System Configuration** on page 1-4

Switch off all devices to be connected to the scanner.

- Plug the Multi-Port Coupler (MPC) into the appropriate port on an RS-232C device. Secure the 25-pin, D-type connector to the receiving device by tightening the thumb screws. Connect the other end to the mating receptacle at the bottom of the scanner.
- Plug the end of the Secondary Device Cable (SEC) terminated with a modular plug into the mating receptacle in the Multi-Port Coupler; plug the other end to the mating 25-pin D-connector on the second RS-232C device.
- Use the power input jack on the multi-port coupler to connect the power supply.
- Connect the power supply to a receptacle supplying AC power of the proper voltage level.

Power up the device attached to the Multi-Port Coupler; if applicable, power up the second RS-232C device.

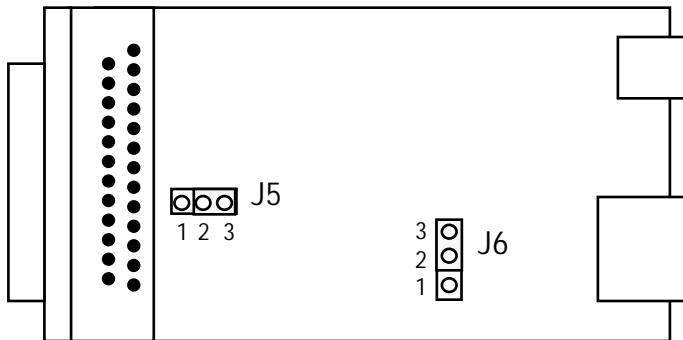
## Hardware Requirements

Both ports on the LS 2040MX maintain the Data Terminal Ready (DTR) line active. Some RS-232C devices interpret this signal as enabling hardware handshaking. If hardware handshaking is disabled on the LS 2040MX, the DTR lines can be set inactive, if needed, by the following procedure:

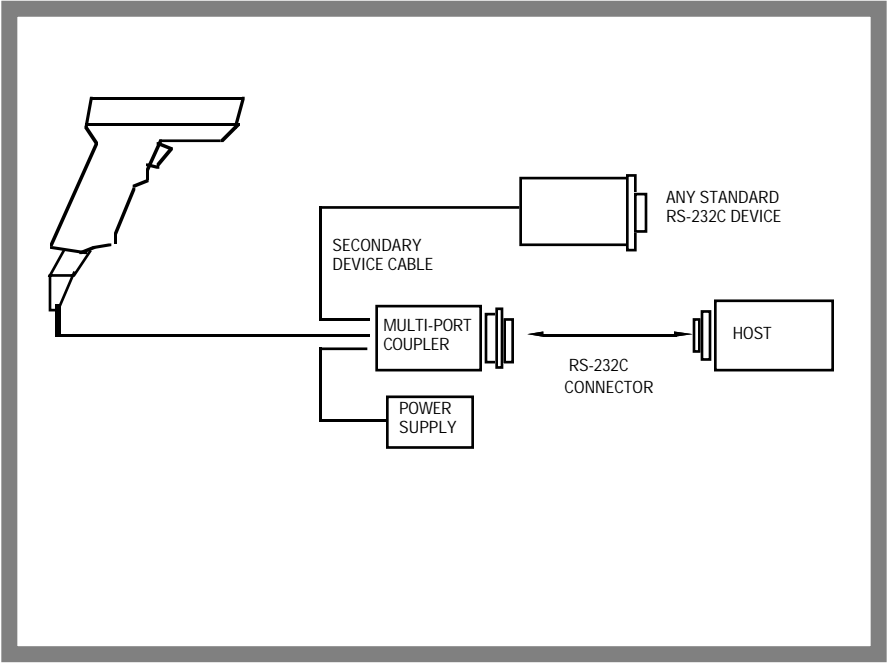
- Use a small screwdriver to open the MPC cable accessory.

**Be sure to observe industry standard procedures with regard to the handling of electrostatically sensitive electronic components and assemblies.**

- To set the DTR of the Host port inactive, change the setting of J5 to positions 1 & 2.
- Similarly, to set the DTR of the Secondary port inactive, change the setting of J6 to positions 1 & 2.



# Typical System Configuration



# Ready, Test, Scan

## 1. Ready

Make sure the scanner is connected to the controller before you turn on the system.

## 2. Test

Aim the scanner away from you and press the trigger. When you press the trigger, the scanning beam is energized for approximately 3.5 seconds.

## 3. Scan

Make sure the symbol you want to scan is within the LS 2040MX scanning range. (See *LS 2040MX Decode Zone* on page 1-8.)

Aim and press the trigger.

- The scan beam (and red LED at the back of the scanner) lights for 3.5 seconds, or until a successful decode.
- The scanner has read the symbol when:
  - You hear a beep.
  - The green DECODE LED lights.

The LED stays green until the next trigger pull, or until power is removed from the scanner.

# Aiming

## Hold at an Angle

Do not hold the scanner directly over the bar code. In this position, light can bounce back into the scanner's exit window and prevent a successful decode.

## Scan the Entire Symbol

**Your scan beam must cross every bar and space on the symbol.**

- The larger the symbol, the farther away you should hold the scanner.
- Hold the scanner closer for symbols with bars that are close together.
- A short high-tone beep indicates a good decode.



# Problems

See *What If...* on page 1-7.

## Beeper Definitions

The beeper in the unit provides a variety of messages. See *Beeper Definitions* in the *Programmer's Guide*.

# Programming the System

An LS 2040MX is programmed by scanning sequences of bar codes; consult the *Programmer's Guide*.

## What If...

### Nothing happens when you follow the operating instructions

- Check the system power.
- Make sure the scanner is programmed to read the type of bar code you are scanning.
- Check for loose cable connections.
- Check the symbol to make sure it is not defaced.
- Try scanning test symbols of the same code type.

### Keystrokes from your terminal do not appear on the CRT

- Check the system power.
- Check for loose cable connections.
- Ensure that the LS 2040MX configuration selected is compatible with your system (i.e., RS-232C Transmit and Receive are paired correctly). Refer to [page 1-15 to 1-18](#).
- Make sure the DTR line from the LS 2040MX did not initiate hardware handshaking (see [page 1-3](#)).

### Your terminal is operative but scanned data is not displayed

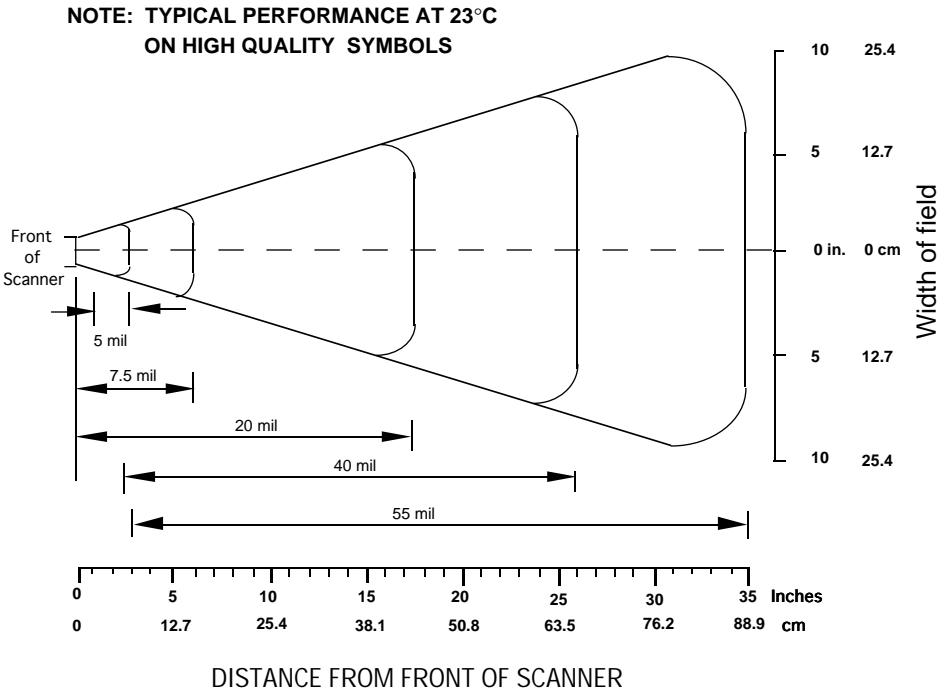
- Check that the transmission direction parameter has been programmed correctly. See the [Programmer's Guide](#).

### Scanned data improperly displayed on the screen

- Check that the following parameters have been programmed correctly:  
>Baud Rate                      >Stop Bits                      >Parity

**Note:** If after performing these checks the symbol still does not scan, contact your distributor or call the [Symbol Support Center](#). See page 1-11 for the telephone number.

# LS 2040MX Decode Zone





## **Maintenance**

Cleaning the exit window is the only maintenance required. A dirty window may affect scanning accuracy.

- Do not allow any abrasive material to touch the window.
- Remove any dirt particles with a damp cloth.
- Wipe the window using a damp cloth, and if necessary, a non-ammonia based detergent.
- Do not spray water or other cleaning liquids directly into the window.

## Factory Service

If you have a problem, contact the *Symbol Support Center* at the telephone number on page 1-11.

Before calling, have the model number and several of your bar code symbols at hand.

Call the Support Center from a phone near the scanning equipment so that the service person can try to talk you through your problem. If the equipment is found to be working properly and the problem is symbol readability, Support will request samples of your bar codes for analysis at our plant.

If your problem cannot be solved over the phone, you may need to return your equipment for servicing. If that is necessary, you will be given specific directions.

**Note:** Symbol Technologies is not responsible for any damages incurred during shipment if the approved shipping container is not used. Shipping the units improperly can possibly void the warranty. If the original shipping container was not kept, contact Symbol to have another sent to you.

# Symbol Support Center

In the U.S.A., for service information, warranty information or technical assistance call:

## **SYMBOL SUPPORT CENTER**

**1-800-653-5350**

If you purchased your Symbol product from a Symbol Business Partner, contact that Business Partner for service.

## **Canada**

Mississauga, Ontario  
Canadian Headquarters  
(905) 629-7226

## **Europe**

Wokingham, England  
European Headquarters  
01734-771-222 (Inside UK)  
+44-1734-771222 (Outside UK)

## **Asia**

Singapore  
Symbol Technologies Asia, Inc.  
337-6588 (Inside Singapore)  
+65 337-6588 (Outside Singapore)

# Accessories

## Required Accessories

LS 2040MX scanners are sent as a package with required accessories, listed in the *Product Ordering Guide*. Optional accessories are available at extra cost.

## Optional Accessories

Optional accessories, listed in the *Product Ordering Guide*, include various stands and holders, which are supplied at extra cost. Additional units of required accessories may also be purchased at extra cost.

# Technical Specifications

Item	Description
<b>Power Requirements</b>	8 V (+ 5%); 225 mA @ 5 VDC Typical.
<b>Decode Capability</b>	LS 2040MX scanners can be programmed to decode the following code types: UPC/EAN, Code 39, Code 39 Full ASCII, Codabar, Interleaved 2 of 5, Code 128, Discrete 2 of 5, and Code 93. Set code length(s) for any 2 of 5 code type. There is no autodiscrimination between Code 39 and Code 39 Full ASCII. See <i>Programmer's Guide</i> .
<b>Beeper Operation</b>	User-selectable: Enable, Disable.
<b>Scan Repetition Rate</b>	36 ( $\pm$ 3) scans/sec. (bidirectional)
<b>Decode Depth of Field</b>	Maximum typical working distance is 35 in. (89 cm); minimum element width resolution is 5.0 mils (7.5 mils at contact).
<b>Skew Tolerance</b>	$\pm$ 65° from normal
<b>Pitch Angle</b>	$\pm$ 55° L/R of normal
<b>Print Contrast Minimum</b>	25% absolute dark/light reflectance differential, measured at 675 nm.
<b>Ambient Light Immunity</b>	Immune to direct exposure from office-level lighting and direct exposure from sunlight.
<b>Durability</b>	4-ft. drop to concrete
<b>Operating Temperature</b>	32° to 104° F                      0° to 40° C
<b>Storage Temperature</b>	-40° to 140° F                      -40° to 60° C

Item	Description	
Coil Cable Length	8 ft.	244 cm
Weight	7.5 oz.	213 gm (without cable)
Height	5.8 in.	14.7 cm
Length	4.9 in.	12.4 cm
Width	2.6 in.	6.5 cm

# Interface Cable Pin-outs

## 25-Pin, Male, D-Type Connector

(p/n 21-03191-12)		
Pin	Signal Name	Function
2	RxD	Serial data receive input. It will be driven by the serial data transmit output on the device communicating with the scanner.
3	TxD	Serial data transmit output. It will drive the serial data receive input on the device communicating with the scanner.
4	CTS	Clear-to-send handshaking input line. It may be optionally used by another device to signal the scanner that it may commence transmitting data. It can be used only in conjunction with the RTS line
5	RTS	Request-to-send handshaking output line. It may be optionally used by the scanner to signal another device that data is available to send. It can only be utilized in conjunction with the CTS line.
6	DTR	Data Terminal Ready. This signal establishes communications between the scanner's UART and the MPC device and is jumpered active.
7	GROUND	Power supply input ground pin and reference for both output signals. It must be capable of sinking all return current.

# Interface Cable Pin-outs

## 25-Pin, Male, D-Type Connector

(p/n 21-03191-13)		
Pin	Signal Name	Function
2	<b>TxD</b>	Serial data transmit output. It will drive the serial data receive input on the device communicating with the scanner.
3	<b>RxD</b>	Serial data receive input. It will be driven by the serial data transmit output on the device communicating with the scanner.
4	<b>RTS</b>	Request-to-send handshaking output line. It may be optionally used by the scanner to signal another device that data is available to send. It can only be utilized in conjunction with the CTS line.
5	<b>CTS</b>	Clear-to-send handshaking input line. It may be optionally used by another device to signal the scanner that it may commence transmitting data. It can be used only in conjunction with the RTS line.
7	<b>GROUND</b>	Power supply input ground pin and reference for both output signals. It must be capable of sinking all return current.
20	<b>DTR</b>	Data Terminal Ready. This signal control establishes communications between the scanner's UART and the MPC device and is jumpered active.



# Interface Cable Pin-outs

## 25-Pin, Female, D-Type Connector

(p/n 20-03369-01)		
Pin	Signal Name	Function
2	RxD	Serial data receive input. It will be driven by the serial data transmit output on the device communicating with the scanner.
3	TxD	Serial data transmit output. It will drive the serial data receive input on the device communicating with the scanner.
4	CTS	Clear-to-send handshaking input line. It may be optionally used by another device to signal the scanner that it may commence transmitting data. It can be used only in conjunction with the RTS line.
5	RTS	Request-to-send handshaking output line. It may be optionally used by the scanner to signal another device that data is available to send. It can only be utilized in conjunction with the CTS line.
6	DTR	Data Terminal Ready. This signal control establishes communications between the scanner's UART and the SEC device and is jumpered active.
7	GROUND	Power supply input ground pin and reference for both output signals. It must be capable of sinking all return current.

# Interface Cable Pin-outs

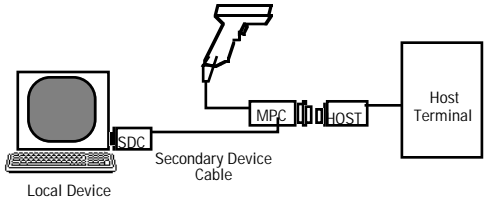
## 25-Pin, Female, D-Type Connector

(p/n 20-03369-02)		
Pin	Signal Name	Function
2	<b>TxD</b>	Serial data transmit output. It will drive the serial data receive input on the device communicating with the scanner.
3	<b>RxD</b>	Serial data receive input. It will be driven by the serial data transmit output on the device communicating with the scanner.
4	<b>RTS</b>	Request-to-send handshaking output line. It may be optionally used by the scanner to signal another device that data is available to send. It can only be utilized in conjunction with the CTS line.
5	<b>CTS</b>	Clear-to-send handshaking input line. It may be optionally used by another device to signal the scanner that it may commence transmitting data. It can be used only in conjunction with the RTS line.
7	<b>GROUND</b>	Power supply input ground pin and reference for both output signals. It must be capable of sinking all return current.
20	<b>DTR</b>	Data Terminal Ready. This signal control establishes communications between the scanner's UART and the SEC device and is jumpered active.

To install the LS 2040MX for Connection at the Local Device Site:

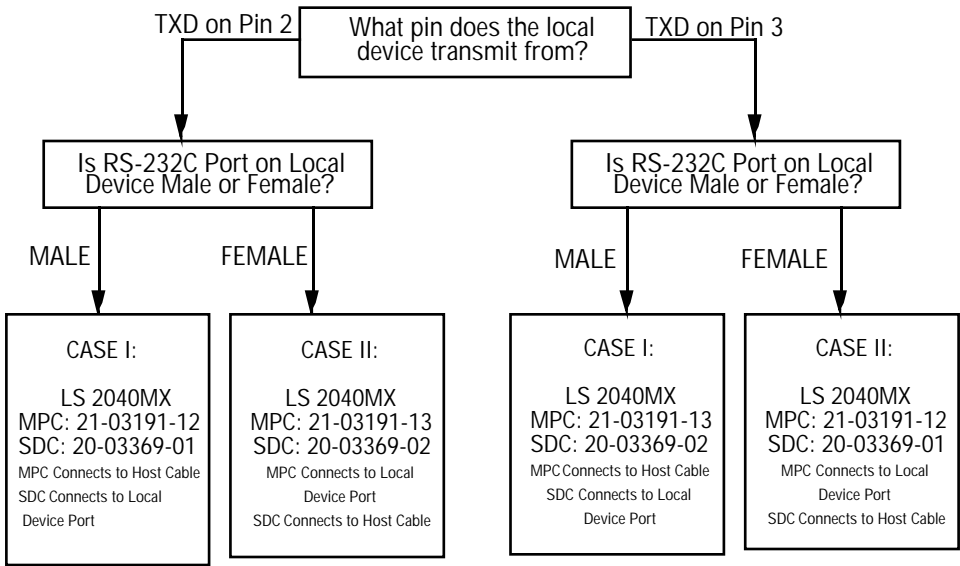
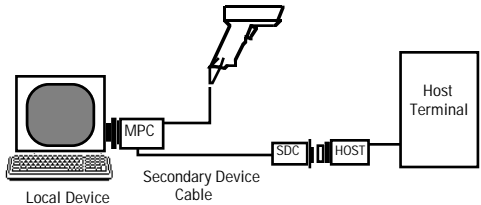
CASE I TYPICAL CONFIGURATION:

MPC ATTACHES TO HOST CABLE;  
SDC ATTACHES TO LOCAL PORT



CASE II TYPICAL CONFIGURATION:

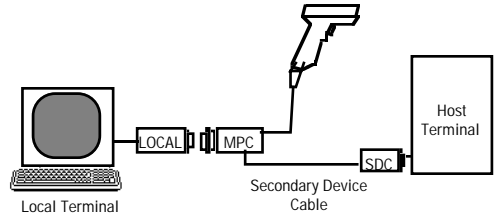
MPC ATTACHES TO LOCAL PORT;  
SDC ATTACHES TO HOST CABLE



To install the LS 2040MX for Connection at the Host Terminal:

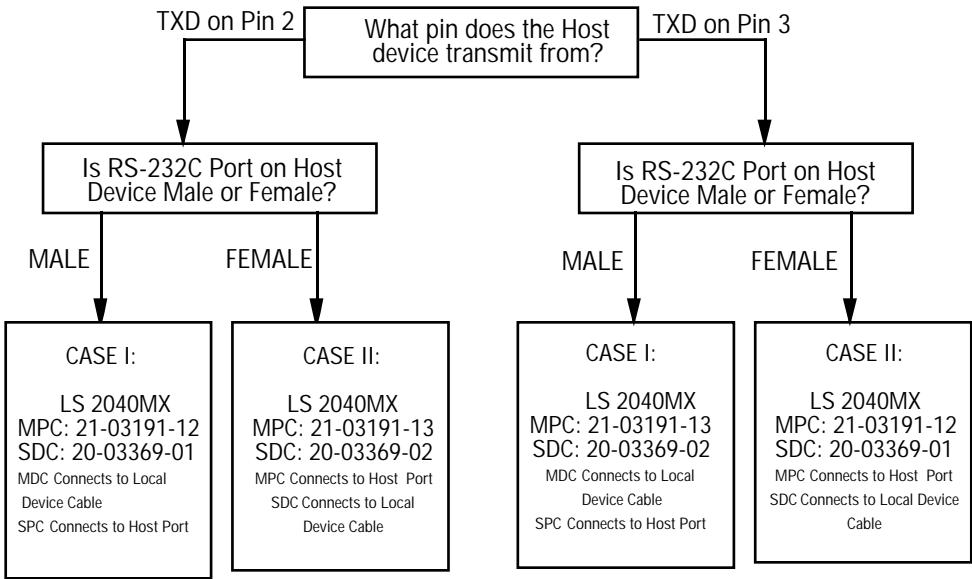
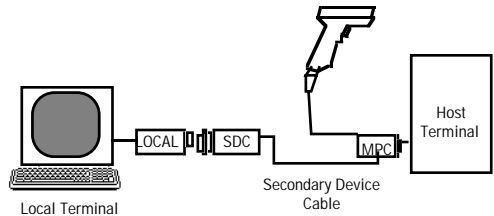
CASE I TYPICAL CONFIGURATION:

MPC ATTACHES TO LOCAL CABLE;  
SDC ATTACHES TO HOST PORT



CASE II TYPICAL CONFIGURATION:

MPC ATTACHES TO HOST PORT;  
SDC ATTACHES TO LOCAL CABLE



## Glossary

**ASCII** - American Standard Code for Information Interchange. A 7 bit-plus-parity code representing 128 letters, numerals, punctuation marks, and control characters. It is a standard data transmission code in the U.S.

**BIT** - Binary digit. One bit is the basic unit of binary information. Generally, eight consecutive bits compose one byte of data. The pattern of 0 and 1 values within the byte determines its meaning.

**BYTE** - On an addressable boundary, eight adjacent binary digits (0 and 1) combined in a pattern to represent a specific character or numeric value. Bits are numbered from the right, 0 through 7, with bit 0 the low-order bit. One byte in memory can be used to store one ASCII character.

**CDRH** - Center for Devices and Radiological Health. A federal agency responsible for regulating laser product safety. This agency specifies various laser operation classes based on power output during operation.

**CDRH CLASS I** - This is the lowest power laser class. Class 1 lasers are safe when used in accordance with the user instructions. They are inherently safe (so that the maximum permissible exposure level cannot be exceeded under any condition), or are safe by virtue of their engineering design.

**CDRH CLASS II** - No additional software mechanisms are needed to conform to this limit. Laser operation in this class poses no danger for unintentional direct human exposure.

**CHECK DIGIT** - A digit used to verify a correct symbol decode. The scanner inserts the decoded data into an arithmetic formula and checks that the resulting number matches the encoded check digit. Check digits are required for UPC but are optional for other symbologies. Using check digits decreases the chance of substitution errors when a symbol is decoded.

**CODABAR** - A discrete self-checking code with a character set consisting of digits 0 to 9 and six additional characters: (- \$ : / , +).

**CODE 128** - A high density symbology which allows the controller to encode all 128 ASCII characters without adding extra symbol elements.

**CODE 3 OF 9 (CODE 39)** - A versatile and widely used alphanumeric bar code symbology with a set of 43 character types, including all uppercase letters, numerals from 0 to 9, and 7 special characters (- . / + % \$ and space). The code name is derived from the fact that 3 of 9 elements representing a character are wide, while the remaining 6 are narrow.

**CODE 93** - An industrial symbology compatible with Code 39 but offering a full character ASCII set and a higher coding density than Code 39.

**CONTINUOUS CODE** - A bar code or symbol in which all spaces within the symbol are parts of characters. There are no intercharacter gaps in a continuous code. The absence of gaps allows for greater information density.

**DECODE** - To recognize a bar code symbology (e.g., UPC/EAN) and then analyze the content of the specific bar code scanned.

**DECODE ALGORITHM** - A decoding scheme that converts pulse widths into data representation of the letters or numbers encoded within a bar code symbol.

**DISCRETE CODE** - A bar code or symbol in which the spaces between characters (intercharacter gaps) are not part of the code.

**DISCRETE 2 OF 5** - A binary bar code symbology representing each character by a group of five bars, two of which are wide. The location of wide bars in the group determines which character is encoded; spaces are insignificant. Only numeric characters (0 to 9) and START/STOP characters may be encoded.

**EAN** - European Article Number. This European/International version of the UPC provides its own coding format and symbology standards. Element dimensions are specified metrically. EAN is used primarily in retail.

**HOST COMPUTER** - A computer that serves other terminals in a network, providing such services as computation, database access, supervisory programs, and network control.

**IEC** - International Electrotechnical Commission. This international agency regulates laser safety by specifying various laser operation classes based on power output during operation.

**IEC CLASS I (IEC 825 Class I)** - This is the lowest power IEC laser classification. Conformity is ensured through a software restriction of 120 seconds of laser operation within any 1000 second window and an automatic laser shutdown if the scanner's oscillating mirror fails.

**INTERCHARACTER GAP** - The space between two adjacent bar code characters in a discrete code.

**INTERLEAVED BAR CODE** - A bar code in which characters are paired together, using bars to represent the first character and the intervening spaces to represent the second.

**INTERLEAVED 2 OF 5** - A binary bar code symbology representing character pairs in groups of five bars and five interleaved spaces. Interleaving provides for greater information density. The location of wide elements (bar/spaces) within each group determines which characters are encoded. This continuous code type uses no intercharacter spaces. Only numeric (0 to 9) and START/STOP characters may be encoded.

**LASER** - An acronym for Light Amplification by Stimulated Emission of Radiation. The laser is an intense light source. Light from a laser is all the same frequency, unlike the output of an incandescent bulb. Laser light is typically coherent and has a high energy density.

**LASER DIODE** - A gallium-arsenide semiconductor type of laser connected to a power source to generate a laser beam. This laser type is a compact source of coherent light.

**PARAMETER** - A variable that can have different values assigned to it.

**PROGRAMMING MODE** - The state in which a scanner is configured for parameter values. See SCANNING MODE.

**QUIET ZONE** - A clear space, containing no dark marks, which precedes the start character of a bar code symbol and follows the stop character.

**SCANNER** - An electronic device used to scan bar code symbols and produce a digitized pattern that corresponds to the bars and spaces of the symbol. Its three main components are:

1. Light source (laser or photoelectric cell) - illuminates a bar code.
2. Photodetector - registers the difference in reflected light (more light reflected from spaces).
3. Signal conditioning circuit - transforms optical detector output into a digitized bar pattern.

**SCANNING MODE** - The scanner is energized, programmed, and ready to read a bar code.

**SCANNING SEQUENCE** - A method of programming or configuring parameters for a bar code reading system by scanning bar code menus.

**SELF-CHECKING CODE** - A symbology that uses a checking algorithm to detect encoding errors within the characters of a bar code symbol.

**START/STOP CHARACTER** - A pattern of bars and spaces that provides the scanner with start and stop reading instructions and scanning direction. The start and stop characters are normally to the left and right margins of a horizontal code.

**SYMBOL** - A scannable unit that encodes data within the conventions of a certain symbology, usually including start/stop characters, quiet zones, data characters, and check characters.

**SYMBOLOGY** - The structural rules and conventions for representing data within a particular bar code type (e.g. UPC/EAN, Code 39).

**UPC** - Universal Product Code. A relatively complex numeric symbology. Each character consists of two bars and two spaces, each of which can be any of four widths. The standard symbology for retail food packages in the United States.

**VISIBLE LASER DIODE (VLD)** - A solid state device which produces visible laser light. Laser light emitted from the diode has a wavelength of 670 to 680 nanometers.