Symbol SE1524ER Scan Engine

Integration Guide

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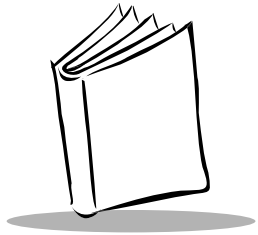
Motorola
One Symbol Plaza
Holtsville, New York 11742-1300
http://www.symbol.com

Revision History

Changes to the original manual are listed below:

Change	Date	Description
72E-66449-01 Rev A	5/2004	Initial release
72E-66449-02 Rev A	10/2004	Updated to correct dimension and weight errors
72E-66449-03 Rev A	10/2006	Updated for RoHS compliance, including flex cables
72E-66449-04 Rev A	3/2007	Updated service information, corrected scan angle specification on page 3-1, updated scan repetition rate specification, changed RSS code type references to GS1 DataBar



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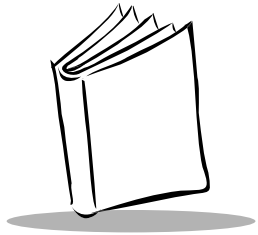


About This Guide

Overview

The *Symbol SE1524ER Scan Engine Integration Guide* provides general instructions for mounting and setting up the Symbol SE1524 Extended Range scan engine.

Chapter Descriptions

Topics covered in this guide are:

- Chapter 1, *Introduction*, provides an overview of the scan engine as well as the theory of operation and electrical interface information.
- Chapter 2, *Installation*, explains how to install the scan engine, including information on mounting, housing design, grounding, ESD, environment, electrical, optical, and location and positioning requirements. Information on accessories is also provided.
- Chapter 3, *Symbol SE1524ER Specifications*, provides technical specifications for the scan engine.
- Chapter 4, *Application Notes*, provides the scan engine's AC electrical characteristics and timing waveforms.
- Chapter 5, *Parameter Menus*, provides programming bar codes for the scan engine.
- Chapter 6, *Simple Serial Interface*, describes the system requirements of the Simple Serial Interface, which provides a communications link between the Symbol SE1524ER and a serial host.
- Appendix A, *Serial Interface Specification*, describes the requirements that two digital systems must meet to exchange asynchronous serial data.
- Appendix B, *Miscellaneous Code Information*, provides information on UCC/EAN-128, AIM Code Identifiers, and setting code lengths, prefixes, and suffixes.
- Glossary provides a listing of common terms used with the scan engine.

Notational Conventions

The following conventions are used in this document:

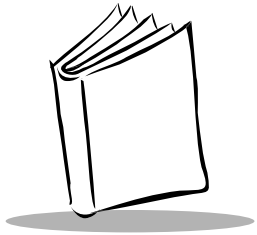
- Italics are used to highlight specific items in the general text, and to identify chapters and sections in this and related documents.
- Bullets (•) indicate:
  - action items
  - lists of alternatives
  - lists of required steps that are not necessarily sequential.
- Sequential lists (e.g., those that describe step-by-step procedures) appear as numbered lists.

Service Information

If you have a problem with your equipment, contact Motorola Enterprise Mobility Support for your region. Contact information is available at: http://www.symbol.com/customersupport. If you purchased your Enterprise Mobility business product from a Motorola business partner, contact that business partner for support.

Before contacting, have the model number and serial number at hand. If your problem cannot be solved by Motorola Enterprise Mobility Support, you may need to return your equipment for servicing and will be given specific directions.

Motorola 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.



Chapter 1
Introduction

Per FDA and IEC standards, the scan engines described in this guide are not given a laser classification. However, the following precautions should be observed:

WARNING

The scan engine, by itself, is an unclassified component. It is intended for use in CDRH/IEC Class II/2 devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards. Do not stare into beam.

Overview

The Symbol SE1524ER is a visible laser-based scan engine with an integrated decoder intended for integration into OEM equipment. The SE1524ER uses a resonant scan motor and an on-board micro-controller to scan bar codes and process the reflected light into a signal. The signal is converted into ASCII data by the decoder and transmitted to the host system.

A zero insertion force connector provides the connection between the Symbol SE1524ER scan engine and the host system. The SE1524ER scan engine communicates using Simple Serial Interface (SSI), the interface used on most of Symbol's scan engines.

Symbol's state-of-the-art laser technology and fuzzy logic capability provide the highest first read rates, an extended reading range, and excellent reliability. Fuzzy logic enhances decoding of poor quality or damaged bar codes not be readable with conventional scan engines, and significantly increases the reading range on good quality codes.

A ribbon cable connector mounted on the Symbol SE1524ER connects the scanner and the decoder/host.

Theory of Operation

A laser diode produces a single beam of coherent light which is deflected off of an oscillating mirror to create the bright laser scan line.

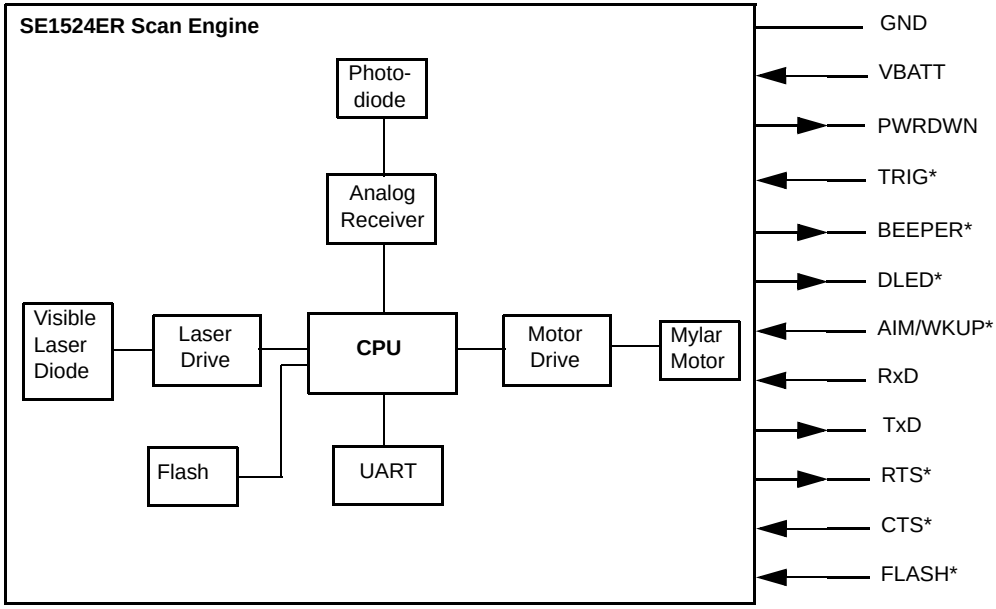
When the light strikes a bar code, the dark bars absorb the light, and the light spaces reflect it. A photo diode senses the reflected laser light and generates a current proportional to the reflected light signal. That current, in turn, produces an analog voltage which is amplified, filtered, and processed into ASCII data.

The Symbol SE1524ER has a low power mode that maintains internal RAM contents but freezes its system oscillator, placing the unit into a dormant state. After power-up initialization, the SE1524ER begins in low power mode. Pulling the TRIG* line low starts a scan and decode session. If a valid bar code is scanned, the micro-controller decodes it and sends the results to the host via the TXD line.

RS-232 drivers are required to communicate with an RS-232 device.

Block Diagram

The Symbol SE1524ER Scan Engine Block Diagram provides the functional relationship of SE1524ER components. A detailed description of each component in the block diagram is also provided.



* = Logic Low

Figure 1-1. Symbol SE1524ER Scan Engine Block Diagram

CPU

The CPU contains a patented multi-bit decoder that enables bar code decoding, host I/O interface protocol, and other decoder functions.

The micro-controller contains a watchdog timer. The enabling/disabling and maintenance of this watchdog are internal to the decoder; the host cannot configure the watchdog.

The CPU's reset circuitry holds the micro-controller in reset after power up to allow sufficient time for hardware initialization. This reset period is 22 msec.

The non-volatile memory stores CPU capability parameters. After each reset, the decoder checks for faults in the memory; if no faults are found, its contents are copied into its internal

RAM. If a fault is found, the decoder copies factory default values into RAM and memory. The CPU does not correct the fault unless requested by the host.

Wake Up Circuitry

The wake up circuitry is contained in the CPU. When the Symbol SE1524ER is awakened, it remains awake for at least 1 second before re-entering Low Power mode. While in Low Power mode, the PWRDWN signal is asserted. This signal is used by the host to remove power from the SE1524ER and is the only indication if the decoder is not transmitting, receiving, decoding, or writing data to non-volatile memory.

Control Circuitry

Interface Control Circuitry is in the Analog Parameters block, and controls operation of the scanner, motor, and laser, depending on the states of the input signals from the host device.

Visible Laser Diode

The Visible Laser Diode (VLD) is a semiconductor device that emits laser light. The laser output is different from conventional light sources in that it is coherent, both spatially and temporally. The VLD output can be focused to allow bar code scanning over long distances.

Laser Driver

The Laser Driver is an electronic feedback circuit that controls laser diode operation. The circuit monitors and controls the VLD, providing a regulated optical output power level.

Mylar Motor

The Mylar Motor and Mirror Assembly is an electromechanical resonant scan element. The oscillating motor/mirror assembly deflects the laser beam across the bar code to be scanned. The resonant design minimizes power consumption, which is especially important in battery operated applications. The scan element is highly rugged and reliable.

Motor Driver

The Motor Driver is an electromagnetic and electronic circuit that provides feedback control of the mylar motor scan element. The circuit regulates the scan amplitude of the motor/mirror assembly. The scan frequency is determined by the resonance characteristics of the mechanical design. The motor fail detector is a laser safety circuit that monitors motor behavior, and turns off the VLD if the motor fails to operate.

Photodiode

The Photodiode is a transducer that converts incident light energy into an electrical current. It is the “eye” of the scan engine. When the laser beam passes over a bar code, the black

bars absorb the light and the white spaces reflect the light. Collection optics focus the received reflected light onto the photodiode. The photodiode produces a photocurrent proportional to the received optical signal.

Analog Receiver

The Analog Receiver is a transimpedance preamplifier which converts the photocurrent into a voltage and provides amplification. Additional amplifier stages provide signal gain and bandpass filtering. The AGC (Automatic Gain Control) circuit is a feedback loop that monitors the received signal voltage level and varies the voltage gain to maintain a constant amplitude at the output. The output analog signal is then input into the decoder.

Flash

In addition to the CPU's internal memory (ROM), flash capability is provided to ease the field upgrade process.

Power Management

The Symbol SE1524ER has two power modes (Continuous Power and Low Power), and two power states (Awake and Sleep).

Power States

WAKEUP and SLEEP commands (see *WAKEUP* on page 6-34 and *SLEEP* on page 6-31), are sent to the scan engine to set the Power state to Awake or Sleep. The Low Power mode has an automatic timer that puts the unit into the Sleep state after a specified period of time.

When the Symbol SE1524ER is in the Sleep power state the PWRDWN signal is asserted. The host uses this signal to remove power from the Symbol SE1524ER. Do not remove power without using this signal since the PWRDWN signal is the only indication if the decoder is not transmitting, receiving, decoding, or writing data to non-volatile memory.

Power Modes

Power modes are controlled by the Power Mode parameter (see *Power Mode* on page 5-12).

- In **Continuous Power** mode, the scan engine remains in the Awake state after each decode attempt. The Continuous Power mode parameter (see *Power Mode* on page 5-12) sets the Symbol SE1524ER to remain in the Awake power state unless it receives a SLEEP command. In this mode, the SE1524ER can switch power states using the SLEEP and Awake commands (see *SLEEP* on page 6-31 and *WAKEUP* on page 6-34); automatic power state switching is not supported.
- In **Low Power** mode, the scan engine enters into a low power consumption Sleep state whenever possible (provided all WAKEUP commands have been released), drawing less current than in Continuous Power mode. This makes the Low Power mode more suitable for battery powered applications. The Low Power mode also allows the Symbol SE1524ER to switch power states using the SLEEP and Awake commands (see *SLEEP* on page 6-31 and *WAKEUP* on page 6-34).

  The Symbol SE1524ER must be awakened from the Sleep power state before performing any functions.

Table 1-1 shows how to place the Symbol SE1524ER into Low Power mode. Table 1-2 shows how to awaken it.

Table 1-1. Putting the Symbol SE1524ER into Low Power Mode

Action	Behavior
Set the Power Mode parameter to Low Power	The SE1524ER enters Low Power mode and automatically switches to the Sleep power state whenever possible.
Send the serial SLEEP command	The SE1524ER enters Sleep power state only once, as soon as possible.
Note: All Wake Up signals (see Table 1-2) must be inactive in order to enter Sleep power state. Once the SE1524ER is awakened, at least 1 second must elapse before it re-enters Low Power mode.	

Table 1-2. Waking Up the Symbol SE1524ER

Signal	State to Wake Up
AIM/WKUP*	Low
TRIG*	Low
CTS*	Low
RXD	Send 0x00
Signal names with the "*" modifier are asserted when at the logic 0 state (active low). Signal names without the "*" modifier are asserted when at the logic 1 state (active high).	

When the Symbol SE1524ER is awakened, it remains awake for at least 1 second before re-entering Low Power mode. The host must perform its first action within the 1 second time period if the power mode parameter is set to Low Power.

Serial I/O

Simple Serial Interface Protocol (SSI) is a half-duplex asynchronous serial interface with two hardware handshaking lines. The four SSI specific interface signals are:

- TXD - Transmitted Data
- RXD - Received Data
- RTS* - Request to Send
- CTS* - Clear to Send

Signal names with the "*" modifier are asserted when at the logic 0 state (active low). Signal names without the "*" modifier are asserted when at the logic 1 state (active high).

Note: *The term "decoder" refers to the scan engine. "Host" refers to the Original Equipment Manufacturer (OEM) host.*

The TXD transmits asynchronous serial data from the decoder to the host. The decoder uses RXD to receive asynchronous serial data from the host. The SSI protocol does not support full-duplex data transfers; data is either transmitted or received by the decoder, but never both simultaneously.

The RTS* and CTS* signals help coordinate data transfers between the decoder and the host.

Beeper and Decode LED

The BPR* and DLED* output lines do not provide enough current drive for the beeper and LED device. Additional buffering is required.

The Symbol SE1524ER's beeper output ranges from 1220 to 3770 kHz (default is 2500). The beeper output is a 50% duty cycle square wave.

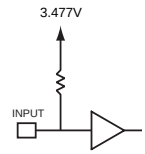
If using a non-inverting driver to buffer the DLED* line, connect the output of the driver to the cathode (-) end of the LED.

Electrical Interface

The Symbol SE1524ER accepts a 3.3V ±10% power input, typically designated as V_{BATT}. The scan engine chassis is GND.

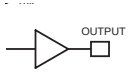
Table 1-3 lists the pin functions of the Symbol SE1524ER interface and illustrates typical input and output circuitry.

Table 1-3. Electrical Interface

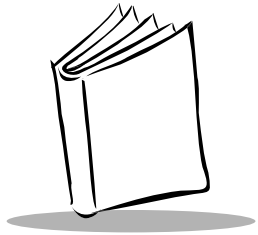
Mnemonic	No.	Type	Name and Function
FLASH	1	I	**Flash Down Load:** Do not drive high. Pull low for download. $I_{SINK} \leq 110$ mA
VBATT	2	I	**Power Supply**: Power supply voltage for the SE1524ER.
GND	3		**Ground:** 0 V reference
AIM/WAKE*	11	I	**Wake Up:** When the SE1524ER is in low power mode, pulsing this pin low for 200 nsec awakens the SE1524ER.
TRIG*	12	I	**Trigger:** Hardware triggering line. Driving this pin low causes the SE1524ER to start a scan and decode session. **AIM:** This pin provides a hard wired trigger line that creates an AIM pattern (a spot). This spot allows positioning the bar code and laser beam alignment to maximize the scan capability of the SE1524ER.
RXD	4	I	**Received Data:** Serial input port
CTS*	6	I	**Clear to Send:** Serial port handshaking line
			Min. / Max. / Pull-Up Current Spec Range V_{IL} — Max. 0.926 V — 20 µA to 165 µA over industrial temperature range V_{IH} — Min. 2.309 V 

Note:
Signal names with the **"*"** modifier are asserted when at the ground level (logic 0, active low).
Signal names without the **"*"** modifier are asserted when at the positive supply voltage level (logic 1, active high).

Table 1-3. Electrical Interface (Continued)

Mnemonic	No.	Type	Name and Function
TXD	5	O	**Transmitted Data:** Serial output port Min. / Max. / Condition V_{OL} — 0.40 — I_{OL} = +2 mA V_{OH} — 2.40 — I_{OH} = -2 mA
RTS*	7	O	**Request to Send:** Serial port handshaking line
PWRDWN	8	O	**Power Down Ready**: When high, the decoder is in low power mode.
BPR*	9	O	**Beeper*:** Low current beeper output
DLED*	10	O	**Decode LED:** Low current decode LED output Min. / Max. / Condition V_{OL} — 0.40 — I_{OL} = +4 mA V_{OH} — 2.40 — I_{OH} = -4 mA 

Note:
Signal names with the **"*"** modifier are asserted when at the ground level (logic 0, active low).
Signal names without the **"*"** modifier are asserted when at the positive supply voltage level (logic 1, active high).



Chapter 2
Installation

Overview

This chapter provides information for mounting and installing the Symbol SE1524ER, including physical and electrical considerations, recommended window properties, and housing designs.

Unpacking

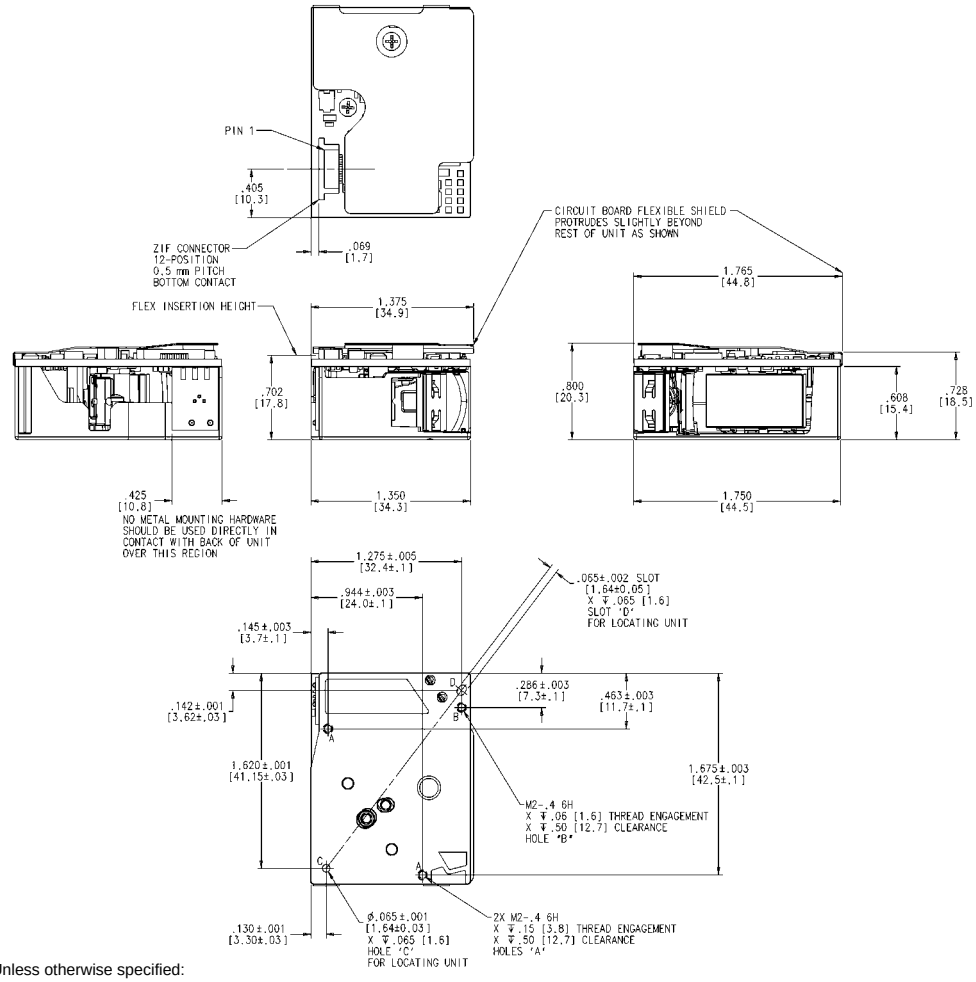
Remove the Symbol SE1524ER from its packing and inspect for physical damage. If the scan engine was damaged in transit, call Motorola Enterprise Mobility Support. See *Service Information* on page xii for contact information.

Keep the packing. It is the approved shipping container and should be used if the equipment needs to be returned for servicing.

Mounting

Mounting holes (M2x0.4-6H) are provided on the bottom of the chassis.
Figure 2-1 on page 2-2 provides an outline drawing of the Symbol SE1524ER scan engine.

The Symbol SE1524ER scan engines may be mounted in any orientation without any degradation in performance.



Notes: Unless otherwise specified:

1. Chassis is electrically connected to GND.
2. Mounting screws and locating pins must be non-magnetic material, e.g., 300-series stainless steel, brass, or plastic. For optimal results, use adhesive on the heads of the mounting screws after fastening.
3. Hole and slot pair “C”, “D” are scan engine location aids. Customer can locate engine with .06 [1.5] max long pins in places marked “C” and “D”.
4. Holes marked “A” and “B” are for mounting the scan engine and have a maximum screw thread engagement as labeled in drawing.
5. This is a reference drawing and is not intended to specify or guarantee all possible integration requirements for this engine.
6. Dimensions are inches [mm].

Figure 2-1. Outline Drawing

Scan Engine Installation

Before installing the Symbol SE1524ER scan engine into the host equipment, consider these two important points:

1. The scan engine chassis is electrically connected to GND*.
2. Use only non-magnetic screws (300-series stainless steel recommended) and locating pins when mounting the scan engine. Magnetic screws, or pins will change the motor/mirror neutral position. Recommended screw torque is 2.5 to 3.5 in. lbs.

*The scan engine chassis is electrically connected to the engine's ground, which may also be connected to the host ground. It is not necessary to electrically insulate the engine chassis from the host ground. It is necessary to insulate the engine chassis from the supply power, and from other source potentials. Ensuring a ground connection through the flex connector is recommended.

When installing metallic, non-magnetic screws, make sure the screwdriver or screw tip is non-magnetic. Magnetic screwdrivers or screw tips change the motor/mirror neutral position.

Housing Design

The scan engine housing design must be such that internal reflections from the outgoing laser beam are not directed back toward the detector. The reflections from the front corners of the scan engine housing near the exit window and from the window itself can often be troublesome. Also, for particular window tilt angles, reflections from the window can bounce off the top or bottom of the housing and reach the detector.

The Exit Window Information tables (see *Exit Window Positioning Characteristics* on page 2-5) provide exit window dimensions and tilt angles for particular scan engine variants. Note that these dimensional requirements can vary for different engine types. Also consider using baffles, matte-finished dark internal housing colors, and anti-reflection coated windows.

Environment

Enclose the scan engine properly to prevent dust particles from gathering on the mirrors, laser lens, and the photodiode. Dust and other external contaminants eventually cause degradation in unit performance. Motorola does not warrant performance of the engine when used in an exposed application. An exit window is required in all housing designs. Refer to *Exit Window* on page 2-4 for positioning the exit window.

Grounding

Caution

> The scan engine chassis is at GND. If the scan engine is being mounted on a grounded host, the chassis does not need to be electrically isolated. It would, however, need to be electrically isolated from electrical potentials other than ground.

If the host chassis has a potential other than ground, insert an insulator between the host chassis and the Symbol SE1524ER chassis, and if using metallic (non-magnetic) screws, use shoulder washers to isolate the screws from the host. Non-metallic screws can also be used if mechanical considerations permit.

ESD

The scan engines are protected from ESD events that can occur in an ESD-controlled environment. Use care when handling the module. Use grounding wrist straps and handle in a properly grounded work area.

Exit Window

The Symbol SE1524ER uses a sophisticated optical system that can provide scanning performance that matches or exceeds the performance of other extended range scanners. However, the performance of the scanner can be affected by an improperly designed enclosure, or improper selection of the window material.

Caution

> This guide provides general instructions for the installation of the scan engine in a customer's device. It is recommended that an opto-mechanical engineer perform an opto-mechanical analysis prior to integration.

Positioning the Exit Window

Position the exit window so that laser light reflected off the inside of the exit window is not reflected back into the scan engine. Allow for manufacturing tolerances when determining the angles and sizes, and maintain the minimum angles specified in *Exit Window Positioning Characteristics* on page 2-5.

Larger angles are generally preferred. If the enclosure design cannot accommodate the recommended window angle, contact Motorola to discuss the requirements. An improperly positioned window can result in significant performance degradation.

Exit Window Positioning Characteristics

Table 2-1 on page 2-5 and Figure 2-3 on page 2-7 provide the minimum exit window dimensions and tilt angles for the Symbol SE1524ER scan engines. Figure 2-2 on page 2-6 provides additional information about the position and angle of the outgoing laser beam and the position and size of the incoming light collection field.

Table 2-1. Exit Window Positioning Information

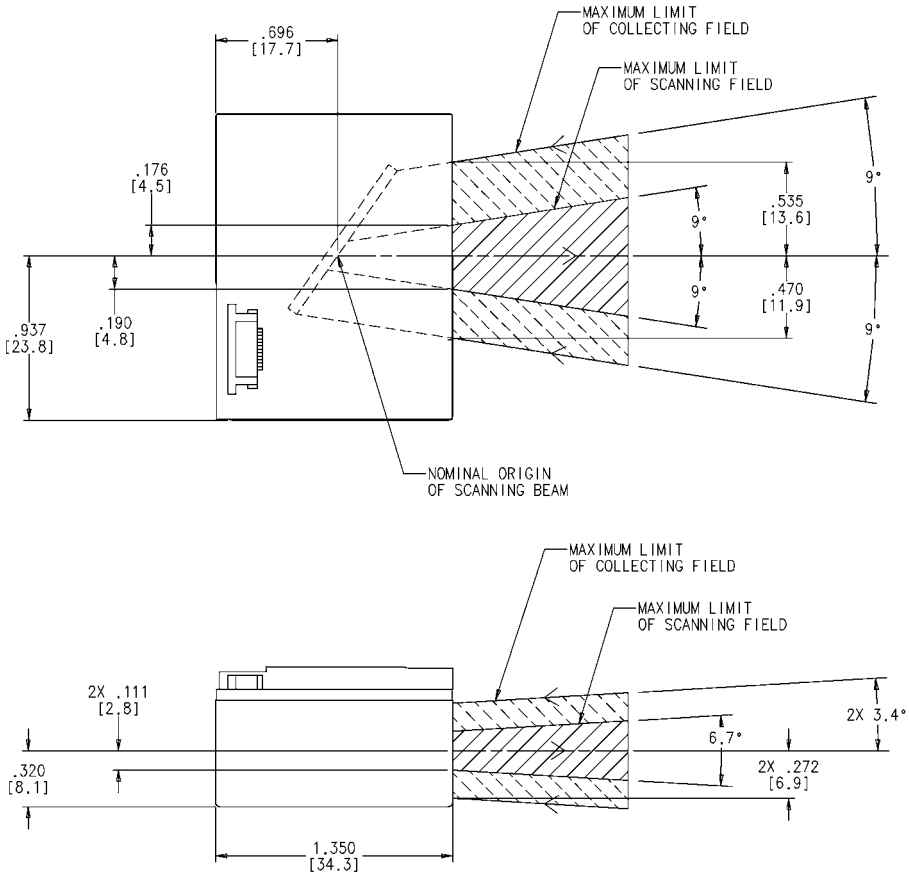
	Exit Window Parameters at Specified Distance in [mm]			
Window Distance*	**0.75 [19.0]**	**1.00 [25.4]**	**1.50 [38.1]**	**2.00 [50.8]**
Minimum Tilt (^{O})	20°	16°	12°	10°
Minimum Width	1.286 [32.7]	1.356 [34.4]	1.505 [38.2]	1.657 [42.1]
Maximum Extra Width**	.152 [3.9]	.584 [14.8]	1.442 [36.6]	2.279 [57.9]
Minimum Height	.685 [17.4]	.704 [17.9]	.753 [19.1]	.807 [20.5]
Minimum Length	.729 [18.5]	.732 [18.6]	.770 [19.6]	.820 [20.8]

*Window distance is defined in Figure 2-3 on page 2-7.

**Maximum Extra Width Requirement: SE1524ER performance is reduced if more width is added to the right side of the window beyond what is shown. There is no limit on extra width on the left side of the window.

Minimum Window Distance Requirement: placing a window closer than the minimum distance of .75 inches [19.0mm] degrades SE1524ER performance.

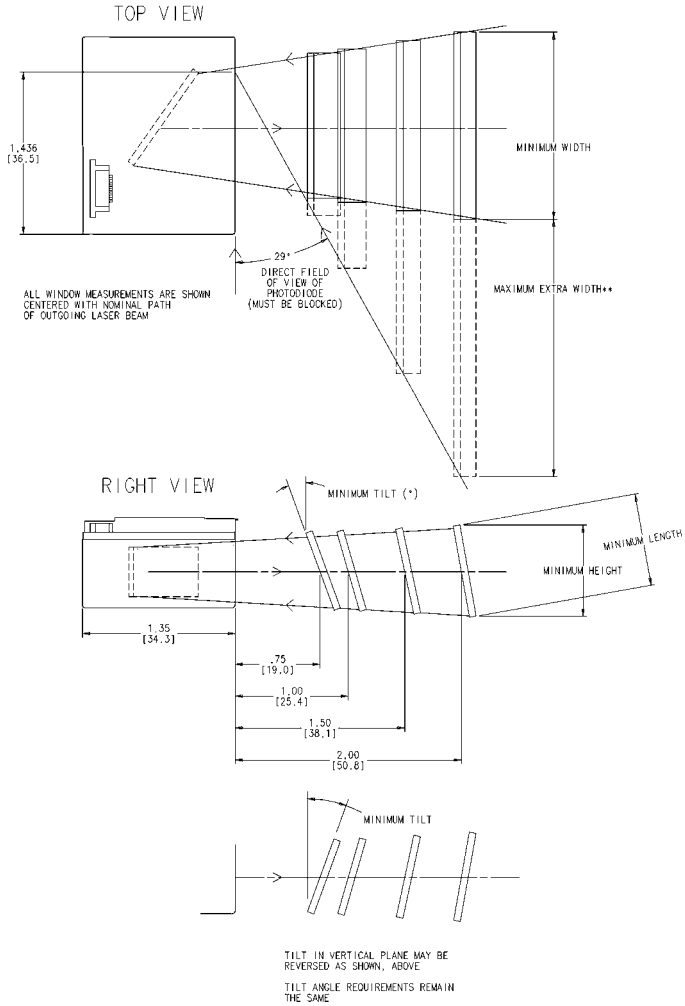
Position opaque material to block light from entering the zone labeled “Direct Field of View of Photodiode”. This requirement determines the maximum width and the minimum distance of the exit window.



Notes: Unless otherwise specified:

1. Chassis is electrically connected to GND.
2. Horizontal deviation of the center of the scan line can be as large as ±2.0°.
3. Vertical deviation of the center of the scan line can be ±3.4°.
4. This reference drawing is not intended to specify or guarantee all possible requirements for the engine. It is recommended that an opto-mechanical engineer perform an opto-mechanical analysis prior to integration.

Figure 2-2. Optical Specifications



Notes: Unless otherwise specified:

1. See Table 2-1 on page 2-5 for Exit Window Specifications.
2. Window may tilt as shown or in opposite direction (top of window furthest from engine).
3. This reference drawing is not intended to specify or guarantee all possible requirements for the engine. It is recommended that an opto-mechanical engineer perform an opto-mechanical analysis prior to integration.

Figure 2-3. Exit Window

Avoiding Scratched Windows

Scratches on the window can greatly reduce scan engine performance. For best results, recess the window into the housing and/or use a scratch resistance coating.

Window Material

Many window materials that look clear can contain stresses and distortions that can reduce scan engine performance. Therefore we recommend using the window material in Table 2-2 on page 2-9.

Caution

Consult an opto-mechanical engineer to recommend an appropriate Window Material and to determine if coatings are appropriate for the specific application.

Note: *Use only optical quality glass windows.*

Anti-Reflection Coatings

Apply an anti-reflection coating to the inside and/or outside of the window. This greatly reduces the amount of light reflected off the window, back into the scan engine. The coating can also improve the range of acceptable window positions and minimize performance degradation due to signal loss as the light passes through the window. For best results, use an anti-reflection coating on the inside of the window; both inside and outside is preferable. See Table 2-2 for recommended coating specifications.

Recommended Window Optical Specifications

Table 2-2 summarizes recommended window optical specifications.

Table 2-2. Recommended Window Properties

Material	Clear float glass or equivalent.
Spectral Transmission	92% minimum along the scan line from 630 to 670 nanometers at the chosen window tilt angle.
AR Coating	Minimum one side (inside) AR coated window. AR coating to provide 0.5% max reflectivity along the scan line from 630 to 670 nanometers at the chosen window tilt angle. Coatings comply with the hardness adherence requirements of MIL-M-13508.
Wavefront Distortion at 633 nm (transmission)	0.15 waves peak-to-valley over any 0.12 in. [3 mm] diameter area within the surface P. 10 waves peak-to-valley over remaining clear aperture.
Surface Quality	60-20 scratch/dig over surface P. 80-50 scratch/dig over remaining clear aperture.
Clear Aperture	Extended to within 0.04 in. [1 mm] of edges all around. Defined by the intersection of the window and the collection field envelope described in Figure 2-2.
Surface P	Defined by the intersection of the window and the scanning field envelope described in Figure 2-2.
Thickness	0.06 ±0.01 in. [1.5 ±0.25 mm]

Table 2-3 on page 2-10 lists some exit window manufacturers and anti-reflection coaters.

Table 2-3. Exit Window Manufacturers and Coaters

Company	Discipline
Evaporated Coatings, Inc. 2365 Maryland Road Willow Grove, PA 19090 (215) 659-3080	Anti-reflection coater
IGS 916 E. California Avenue Sunnyvale, CA 94085 (408) 733-0452 igsglass@aol.com	Window manufacturer and anti-reflection coater
OCLI 2789 Northpoint Parkway Santa Rosa, CA 95407-7397 (707) 525-7441 pbruning@ocli.com	Window manufacturer and anti-reflection coater

Bar Code Location and Positioning

Caution

The general Location and Positioning guidelines provided do not consider unique application characteristics. It is recommended that an opto-mechanical engineer perform an opto-mechanical analysis prior to integration.

Specular Reflection

When laser beams reflect *directly* back into the scanner from the bar code, they can “blind” the scanner and make decoding difficult. This is called specular reflection.

To avoid this, scan the bar code so that the beam does not bounce *directly* back. But don’t scan at too oblique an angle; the scanner needs to collect scattered reflections from the scan to make a successful decode. Practice quickly shows what tolerances to work within.

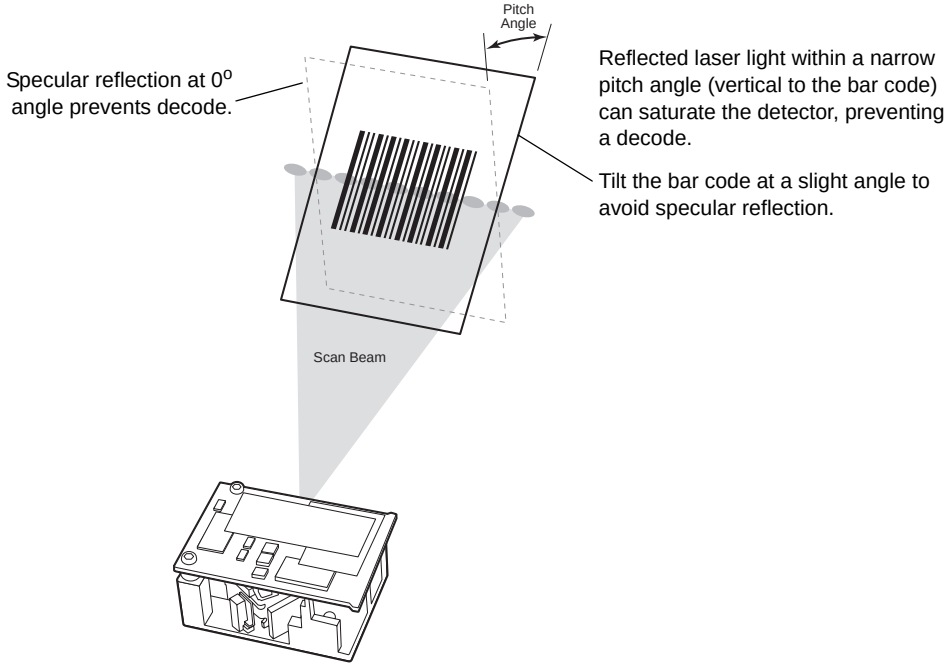


Figure 2-4. Avoiding Specular Reflection

When scanning a 1D bar code, there is only a small specular dead zone to avoid. To determine the specular dead zone, see *Testing The Usable Scan Length Method* on page 2-13, step 6.

Using the Symbol SE1524ER as a Presentation Scanner

Some applications require mounting the Symbol SE1524ER to read symbols that are automatically presented, or that are presented in a pre-determined location. In these applications, SE1524ER positioning with respect to the symbol is critical. Failure to properly position the SE1524ER may lead to degraded or unsatisfactory reading performance.

Two methods of positioning the scanner are provided:

- The *Calculating The Usable Scan Length Method* on page 2-12, can be used with consistently good quality symbols. It provides a mathematical solution to find the usable scan length.

- The *Testing The Usable Scan Length Method* on page 2-13, uses real situation testing to adjust the usable scan length to fit the application conditions.

Calculating The Usable Scan Length Method

Usable scan length is calculated as follows (see Figure 2-5):

L = 1.8 x (D+d) x Tan (A/2)

Where:

D = Distance (in inches) from the front edge of the housing to the bar code.

d = The housing's internal optical path from the edge of the housing to the front of the scanner.

A = Scan Angle in degrees (°) (see Table 3-1 on page 3-2).

Note: *Usable scan length is determined by the formula above, or 90% of scan line at any working distance. This formula is based on good quality symbols in the center of the working range and length of bar code.*

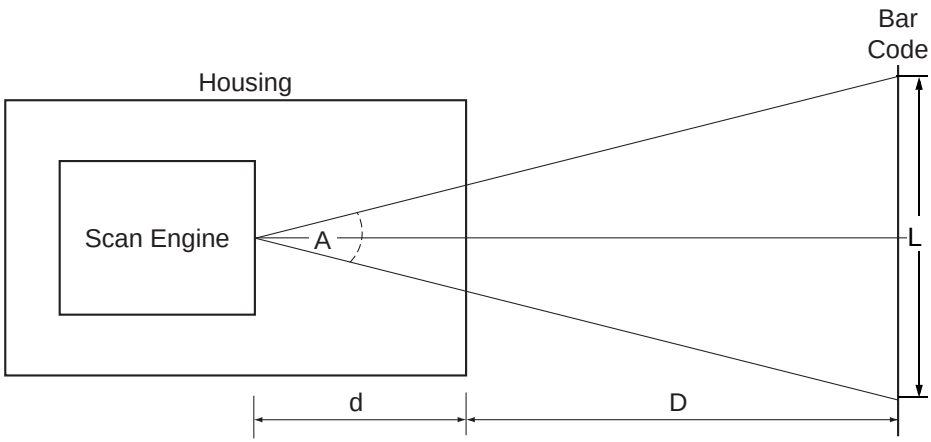


Figure 2-5. Usable Scan Length Diagram

Testing The Usable Scan Length Method

Due to the large variety of symbol sizes, densities, print quality, etc., there is no simple way to calculate the optimum symbol distance. To ensure optimum performance use the *Testing The Usable Scan Length* positioning method to maximize performance.

Determining the optimum distance between the scan engine and the symbol:

1. Measure the maximum and minimum distances at which the symbols can be read.
2. Check the near and far range on several symbols. If they are not reasonably consistent there may be a printing quality problem that can degrade the performance of the system. Motorola can provide advice on how to improve the installation.

Note: *Poor quality symbols (from bad printing, wear, or damage) may not decode well when placed in the center of the depth of field (especially higher density codes). The scan beam has a minimum width in the central area, and when the scanner tries to read all symbol imperfections in this area it may not decode. Therefore, after a preliminary spot is determined using good quality symbols, test several reduced quality symbols and adjust the spot for the best overall symbol position.*

---

3. Locate the scanner so the symbol is near the middle of the near/far range.
4. Center the symbol (left to right) in the scan line whenever possible.
5. Position the symbol so that the scan line is as near as possible to perpendicular to the bars and spaces in the symbol.
6. Avoid specular reflection (glare) off the symbol by tilting the top or bottom of the symbol away from the engine. The exact angle is not critical, but it must be large enough so that if a mirror were inserted in the symbol location, the reflected scan line would miss the front surface of the engine. For the maximum allowable angles refer to the Skew, Pitch and Roll angles listed in each scan engine's *Technical Specifications* Table.
7. If an additional window is to be placed between the scanner and the symbol, determine optimum symbol location by placing a representative window in the desired window position. Review the sections of this chapter concerning window quality, coatings and positioning.
8. Give the scanner time to dwell on the symbol for several scans. When first enabled, the scan engine may take two or three scans before it reaches maximum performance. Enable the scan engine before the symbol is presented, if possible.

Accessories

Table 2-4 lists the available accessories for the scan engine.

Table 2-4. Accessories

Accessory	Part Number
Tapered 12-Pin Flex Strip	15-81378-01
Even Width 12 pin Straight Flex Strip - 10 in. (254 mm)	50-16000-134R
Even Width 12-Pin Straight Flex Strip - 2 in. (53 mm)	50-16000-139R
12-Pin Straight Flex - connectors on opposite sides	50-16000-308R
12-pin Connector	50-12164-012
Universal (Scan Engine) Developer Kit	DKSE-1000-000R

Hardware Accessories

Table 2-5 lists sources for hardware accessories for the scan engine.

Table 2-5. Hardware Accessories

Company	Discipline	Specifics
Tower Fasteners Co., Inc. 1690 North Ocean Ave. Holtsville, New York 11742-1823 (516) 289-8800	Fasteners	Metallic, non-magnetic screws

Flex Cables

A flex strip cable is used to connect the Symbol SE1524ER to your host interface. If desired, the flex strip is available from Motorola (p/n 15-81378-01).

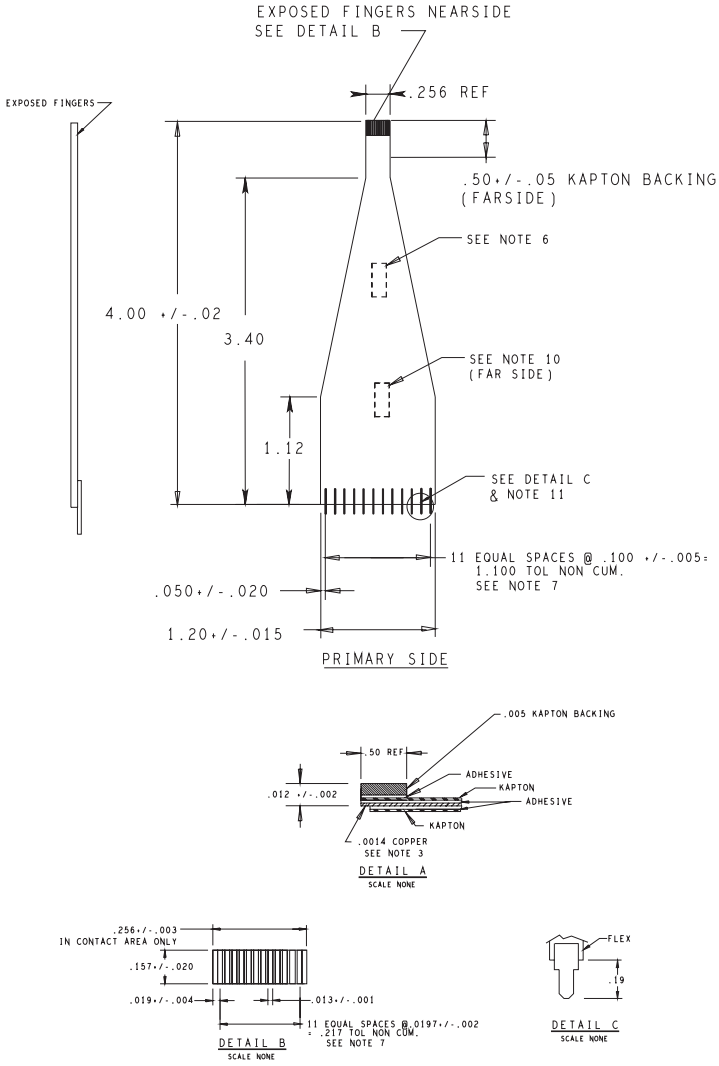
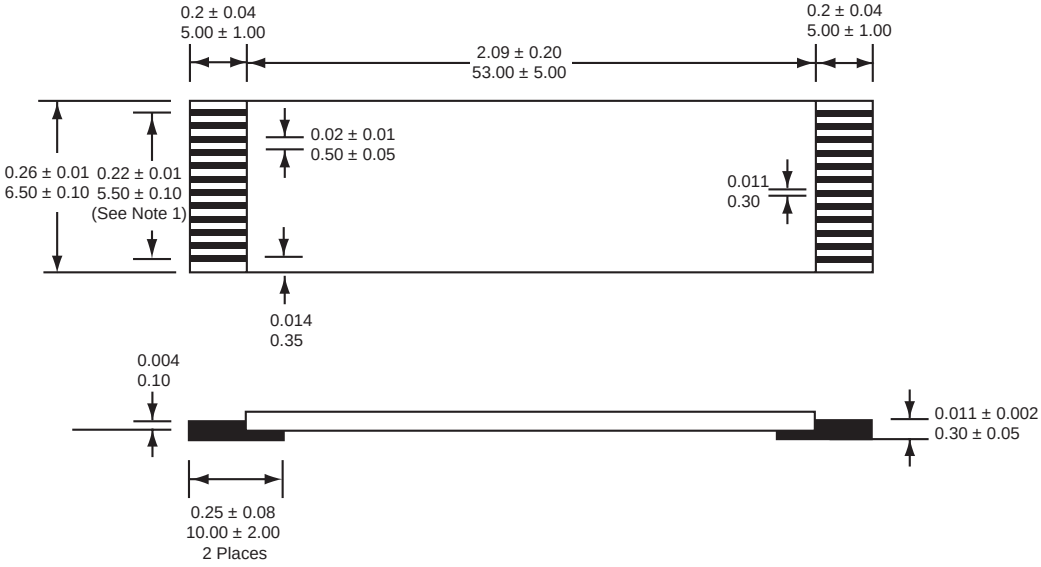


Figure 2-6. Flex Strip (Tapered)



Note:

1. Dimension of conductor is center to center.
2. Dimensions are in: inches
   mm

Figure 2-7. Flex Strip, p/n 50-16000-139R (Even Width, 53 mm)

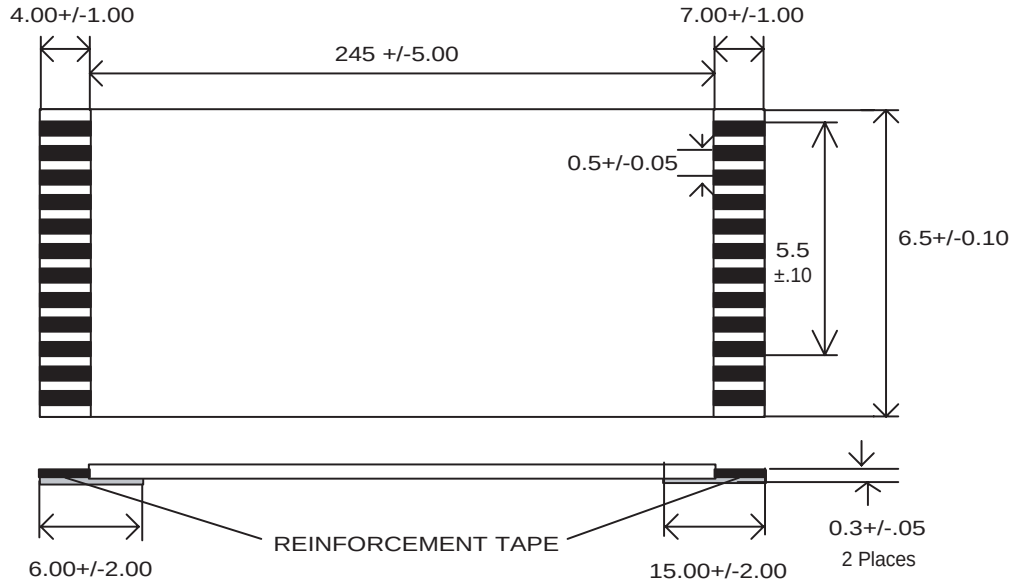


Figure 2-8. Flex Strip, p/n 50-16000-134R (Even Width, 245 mm)

Scan Engine Developer Kit

The Scan Engine Developer Kit (p/n DKSE-1000-000R) enables development of products and systems around the SE1524ER using the Windows 98, 2000, or XP platform. The kit provides the software and hardware tools required to design and test the embedded scan engine application before integration into the host device.

The kit allows you to use Symbol's Simple Serial Interface (SSI) protocol to design bar code scanning applications, and contains an SSI ActiveX component to simplify the scan engine application.

The Scan Engine Developer Kit contains:

- CD, which includes:
  - Simple Serial Interface header files
  - Windows Serial Communication Library and source code
  - Simple Serial Interface Library and source code
  - Dynamic Link Library (DLL) with source code

- ActiveX component
- Windows demo programs and source code
- Simple Serial Interface Developer Guide
- Library documentation

- Developer board for connecting the scan engine to the PC development workstation. Functions of the development board include:
  - Mounting location for scan engine
  - Beeper and LED drivers
  - 9-pin RS232 for connection to PC workstation
  - Aim and trigger buttons
  - Beeper
  - Power, Decode, Low Power Mode LEDs
  - Test points
- Flex strips
- Interface cables for connection between the development board and the PC workstation
- 5V universal power supply.

Note: If using the Cyclone pattern, be sure to mount the scan engine close to the edge of the development board to prevent the pattern from being clipped by any portion of the board.

Note: *The SE1524ER supports 3.3 V ±10% only; do not operate at 5 V.*

Simple Serial Interface

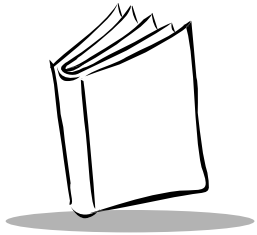
The Simple Serial Interface (SSI) provides a cost effective, highly integrated, flexible protocol for designing bar code scanning applications and Auto-ID markets. The SSI provides a communications link (both hardware handshaking and command protocol) between Symbol's decoded engines and a serial host. The specification for SSI is from the perspective of both the decoder and host.

Features / Layout

The new DK is designed around a larger PCB to accommodate multiple scope probes, debug aids, and provide a larger work area. The board also has several grounds and VCC posts to allow users to easily probe and simulate logic levels on scanner lines.

Quick Troubleshooting

The new development board has LEDs on the four RS-232 lines (RTS*, CTS*, RXD, and TXD) to allow for quick troubleshooting. Simple communication issues that may have required probing with scopes and logic analyzers on older development boards can be diagnosed with the LEDs on the new board.



Chapter 3
Symbol SE1524ER Specifications

Overview

This chapter provides the technical specifications for the Symbol SE1524ER scan engine. The scan engine requires a 3.3 V input, and has a 13.5^{o} scan angle.

Chapter 1, *Introduction* provides the detailed *Theory of Operation,* including a discussion of the functional components and the electrical inputs.

Chapter 2, *Installation* provides detailed *Installation Procedures*, including mounting, positioning, minimum window dimensions and application discussions.

Technical Specifications

Table 3-1 on page 3-2 provides technical specifications for the Symbol SE1524ER.

Electrical Interface

Table 1-3 on page 1-9 lists the pin functions of the Symbol SE1524ER scan engine interface.

Table 3-1. Technical Specifications @ 23°C

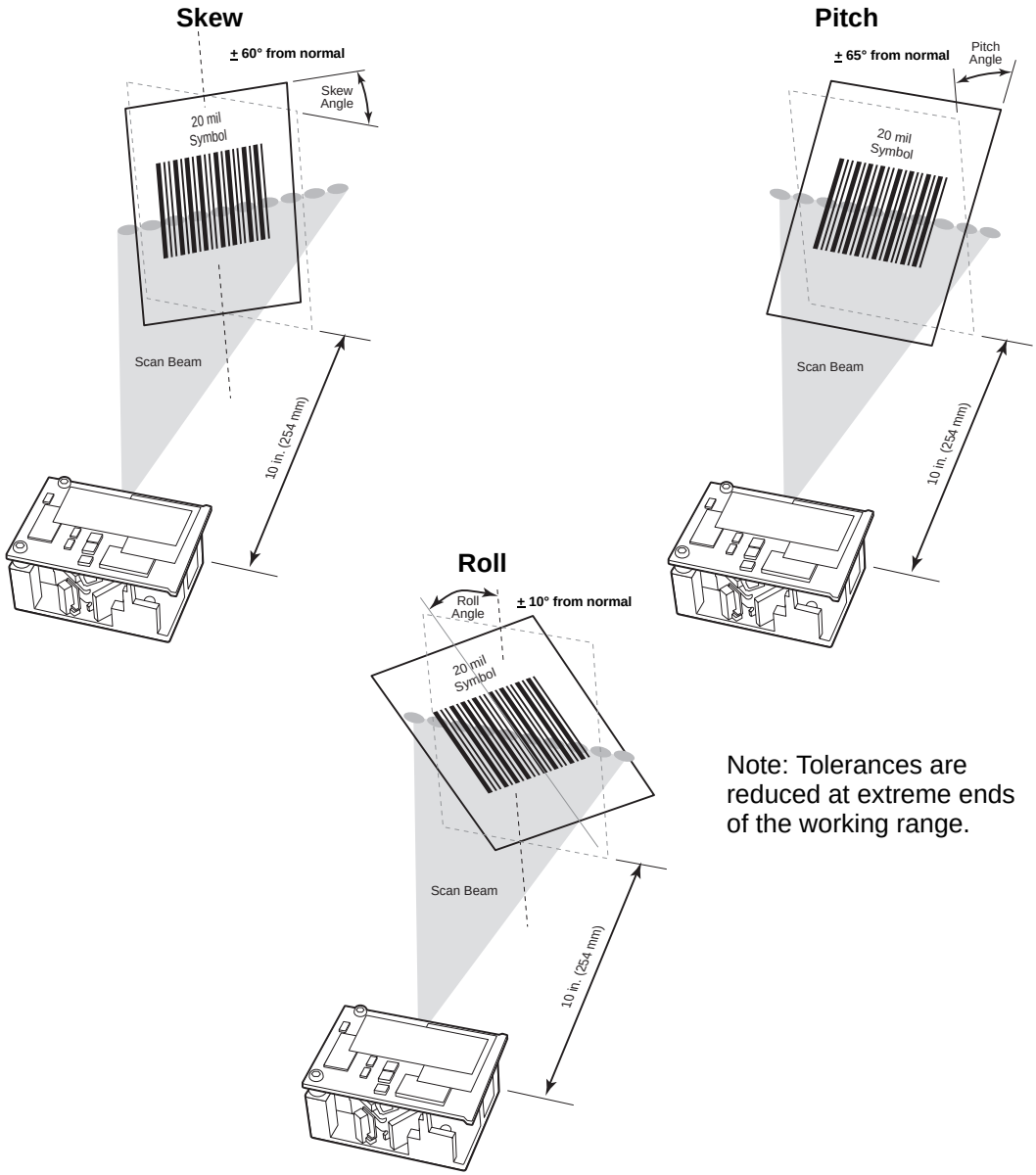
Item	Description
Power Requirements	
Input Voltage	3.3 VDC ±10%
Scanning Current	210 mA typical / 240 mA max
Motor On Current	150 mA typical / 170 mA max
Standby Current	60 µA
Input V_{BATT} Noise Level	100 mV peak-to-peak max.
Surge Current (typical)	**Engine power-up supply current** (170 mA peak) **Time vs. Current*** **Time (ms)** **From** / **To** / **Current (mA)** 0 / 20 / 100 20 / 40 / 125 40 / 60 / 170 60 / 1100 / 150 1100 / / 0.06 *Based on, Soft-Start and 2.6V host supply voltage at time zero. If no interrupt occurs in 1100 mS the engine goes into low power mode.
Note: Environmental and/or tolerance parameters are not cumulative.	

Table 3-1. Technical Specifications @ 23°C (continued)

Item	Description
Surge Current (typical) (continued)	**Engine triggered supply current** (215 mA peak) **Time vs. Current*** **Time (ms)** **From** **To** **Current (mA)** 0 0 0.06 0 10 165 10 24 215 24 3000 210 *Laser time-out is 3 seconds if no decode occurs.
Scan Repetition Rate	35 ±5 scans/sec (bidirectional)
Laser Power	1.23 mW ± 0.07 mW, λ = 650 nm nominal
Print Contrast	minimum 25% absolute dark/light reflectance measured at 650 nm.
Scan Angle	13.5° ± 0.7°
Skew Tolerance	± 60° from normal (see Figure 3-1 on page 3-5)
Pitch Angle	± 65° from normal (see Figure 3-1 on page 3-5)
Roll	± 10° from vertical (see Figure 3-1 on page 3-5)
Decode Depth of Field	See Figure 3-2 on page 3-7
Ambient Light Immunity **Sunlight** **Artificial Light**	 4,000 ft. candles 450 ft. candles (4,844 lux)
Shock	2000 G applied via any mounting surface @ 23°C (for 0.25 msec)
Vibration	Unpowered engine withstands a random vibration along each of the X, Y and Z axes for a period of one hour per axis, defined as follows: 20 to 80 Hz — Ramp up to 0.04 G^2/Hz at the rate of 3dB/octave. 80 to 350 Hz — 0.04 G^2/Hz 350 to 2000 Hz — Ramp down at the rate of 3 dB/octave.
Note: Environmental and/or tolerance parameters are not cumulative.	

Table 3-1. Technical Specifications @ 23°C (continued)

Item	Description
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH/IEC Class II/2 devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
RoHS	Meets RoHS requirements
Operating Temperature	-22° to 140°F (-30° to 60°C), chassis temperature
Storage Temperature	-40° to 158°F (-40° to 70°C)
Humidity	5% to 95% non-condensing
Height	0.80 in. max. (2.03 cm max.)
Width	1.77 in. max. (4.48 cm max.)
Depth	1.375 in. max. (3.49 cm max.)
Weight	1.40 oz. max. (40.0 gm max.)
Note: Environmental and/or tolerance parameters are not cumulative.	

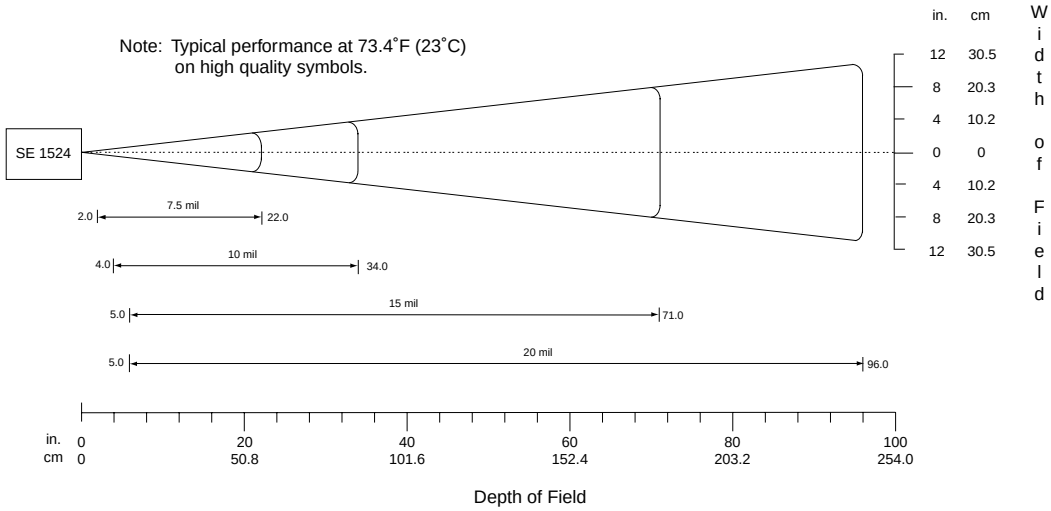


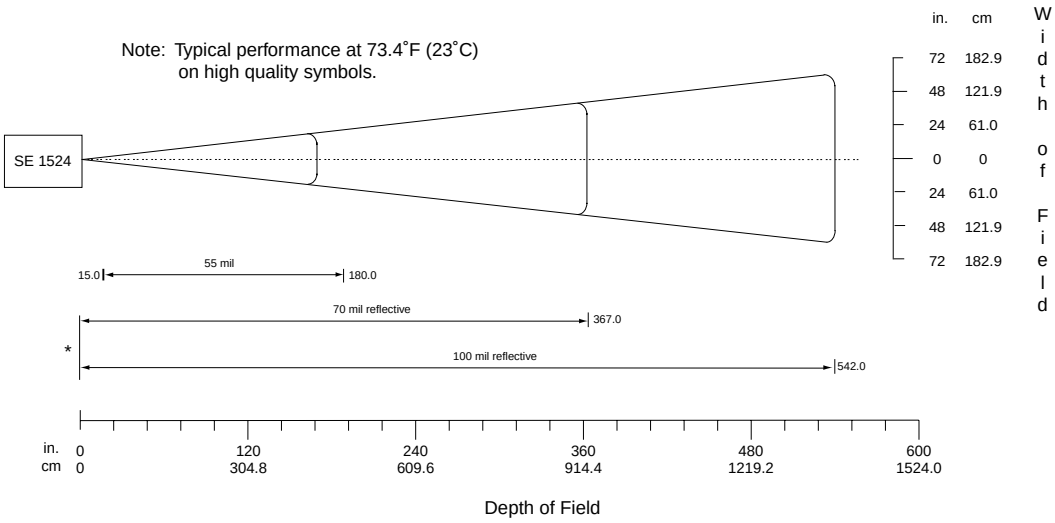
Note: Tolerances are reduced at extreme ends of the working range.

Figure 3-1. Skew, Pitch and Roll

Decode Zones

Typical decode ranges are shown in Figure 3-2. Table 3-2 on page 3-8 lists the typical and guaranteed distances for the Symbol SE1524ER for selected bar code densities. The minimum element width (or “symbol density”) is the width in mils of the narrowest element (bar or space) in the symbol. The maximum usable length of a symbol at any given range is shown. To calculate this distance, see *Calculating The Usable Scan Length Method* on page 2-12.





* Near range determined by degree of reflectivity and width of bar code.

Figure 3-2. Typical Decode Zones

Table 3-2. Decode Distances

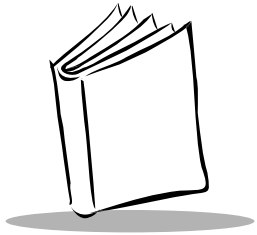
Symbol Density/ p/n / Bar Code Type/ W-N Ratio	Bar Code Content/ Contrast[Note 1]	Typical Working Ranges		Guaranteed Working Ranges	
		Near	Far	Near	Far
7.5 mil 64-17452-01 Code 39; 2.5:1	**ABCDEF** 80% MRD	**2.0 in** 5.08 cm	**22.0 in** 55.88 cm	**6.0 in** 15.24 cm	**15.0 in** 38.10 cm
10 mil 64-17454-01 Code 39; 2.5:1	**ABCDE** 80% MRD	**4.0 in** 10.16 cm	**34.0 in** 86.36 cm	**6.0 in** 15.24 cm	**30.0 in** 76.20 cm
15 mil 64-17417-01 Code 39; 2.5:1	**ABCD** 80% MRD	**5.0 in** 12.70 cm	**71.0 in** 180.34cm	**7.0 in** 17.78 cm	**50.0 in** 127.00 cm
20 mil 64-17456-01 Code 39; 2.2:1	**123** 80% MRD	**5.0 in** 12.70 cm	**96.0 in** 243.84 cm	**7.0 in** 17.78 cm	**70.0 in** 177.80 cm
55 mil 64-17458-01 Code 39; 2.2:1	**CD** 80% MRD	**15.0 in** 38.10 cm	**180.0 in** 457.20 cm	**17.0 in** 43.18 cm	**155.0 in** 393.70 cm
70 mil reflective 64-08780-01 Code 39; 3:1	**123477** Reflective 80% MRD	Note 4	**367.0 in** 932.18 cm	Note 4	**325.0 in** 825.50 cm
100 mil reflective 64-16990-01 Code 39; 3:1	**123456** Reflective 80% MRD	Note 4	**542.0 in** 1376.68 cm	Note 4	**480.0 in** 1219.20 cm

Notes:

1. CONTRAST measured as Mean Reflective Difference (MRD) at 670 nm.
2. Near ranges are largely dependent upon the width of the bar code.
3. Working range specifications at temperature 23 °C.
4. Near range on reflective bar codes determined by degree of reflectivity and width of bar code.

Usable Scan Length

The decode zone is a function of various symbol characteristics including density, print contrast, wide-to-narrow ratio, and edge accuracy. Consider the width of scan line at any given distance when designing a system. *Calculating The Usable Scan Length Method* on page 2-12 describes how to calculate the usable scan length. The scan angle is provided in Table 3-1 on page 3-2.



Chapter 4
Application Notes

Overview

This chapter includes AC electrical characteristics as well as timing information.

AC Electrical Characteristics

AC electrical characteristics appear in Table 4-1. All output lines are measured with 10K pull-up.

Table 4-1. Timing Characteristics

Symbol	Figure	Parameter	Min	Max	Unit
General Characteristics					
t_f	Figure 4-1	High-to-Low fall time, all outputs, C_L = 50 pf		1.0	µsec
t_r	Figure 4-1	Low-to-High rise time, all outputs, C_L = 50 pf		1.0	µsec
Serial I/O Timing, Host Transmit					
t_{rlcl}	Figure 4-2	Request to Send low to Clear to Send low	0	25	msec
t_{clxl}	Figure 4-2	Clear to Send low to first start bit		Note 2	
t_{xlxl}	Figure 4-2	Byte to byte delay, (see Note 1)		990	msec
t_{rhrh}	Figure 4-2	End of the packet to RTS* high		Note 4	msec
Serial I/O Timing, Decoder Transmit, (see Note 3)					
t_{vlvl}	Figure 4-4	Byte to byte delay, (see Note 1)		99	msec
Hardware Trigger Timing					
t_{glwl}	Figure 4-5	Trigger hold time, level and pulse trigger mode, (see Note 6)	6		msec
t_{ghtw}	Figure 4-5	Trigger release time, level and pulse trigger mode (see Note 6)	25		msec
t_{dbt}	Figure 4-3	Trigger debounce time		1	msec

Notes:

1. If byte to byte delay exceeds the maximum specified time, a transmission error is declared. The sender is expected to retransmit the packet in its entirety.
2. The host may hold the Host RTS* low indefinitely, but prevents the SE1524ER from transmitting.
3. The decoder may transmit whenever the Host RTS* is high.
4. The host should release its Host RTS* as soon as possible after transmitting so that the decoder can process the message.
5. The SE1524ER's micro-controller is in full operation whenever the PWRDWN line is driven low.
6. See *Power Management* on page 1-5 if the trigger is not pulled after the maximum specified amount of time.
7. In addition, refer to *Parameter # 0x88* on page 5-10 and *Parameter # 0x8A* on page 5-13.

Table 4-1. Timing Characteristics (Continued)

Symbol	Figure	Parameter	Min	Max	Unit
Beeper Timing					
f_{blht}	Figure 4-6	Beeper frequency	1220	3770	Hz
t_{btw}	Figure 4-6	Beeper duration (decode)	90 (typ)		msec
Power Up Timing					
t_{ehpm}	Figure 4-7	V_{BATT} rise time		10	msec
Wake Up Timing					
t_{aldl}	Figure 4-8	From wake up to full operation, (see Note 5)		5	msec
t_{dlgl}	Figure 4-8	Trigger low after full operation, (see Notes 6 and 7)	0	1	sec
t_{ehdl}	Figure 4-9	Power Enable High to Power Down Logic Low	0	5	msec

Notes:

1. If byte to byte delay exceeds the maximum specified time, a transmission error is declared. The sender is expected to retransmit the packet in its entirety.
2. The host may hold the Host RTS* low indefinitely, but prevents the SE1524ER from transmitting.
3. The decoder may transmit whenever the Host RTS* is high.
4. The host should release its Host RTS* as soon as possible after transmitting so that the decoder can process the message.
5. The SE1524ER's micro-controller is in full operation whenever the PWRDWN line is driven low.
6. See *Power Management* on page 1-5 if the trigger is not pulled after the maximum specified amount of time.
7. In addition, refer to *Parameter # 0x88* on page 5-10 and *Parameter # 0x8A* on page 5-13.

Timing Waveforms

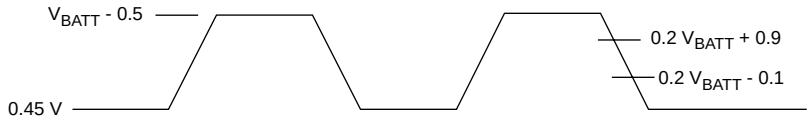
Explanation Of The AC Symbols

Each timing symbol has five characters. The first character is either “t” for time or “f” for frequency. The other characters indicate the name of the signal or the logical status of that signal. Designations are:

a	WKUP*
b	BPR*
c	Host CTS*
d	PWRDWN
f	float, fall time
g	trigger
h	logic level high
l	logic level low
pm	minimum voltage level
r	Host RTS*
tw	time duration
v	Host RXD
w	width
x	Host TXD

* Active Low
Examples:
t_{bltw} = Beeper drive low time
t_{rlcl} = Time for RTS low to CTS low

AC Test Points



Note: *AC inputs during testing are driven at V_{BATT} -0.5 for logic "1" and 0.45 for logic "0." Timing measurements are made at 0.2 V_{BATT} +0.9 and 0.2 V_{BATT} -0.1.*

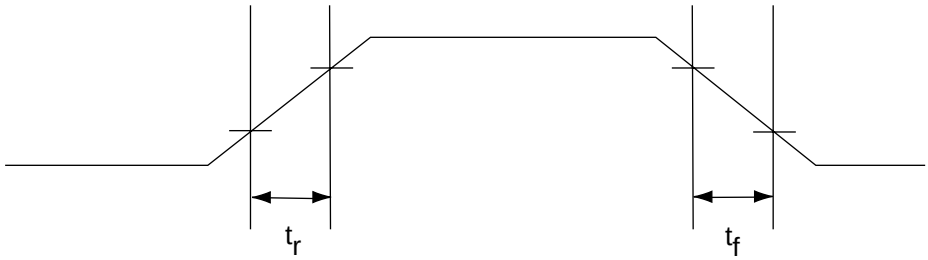


Figure 4-1. General Characteristics

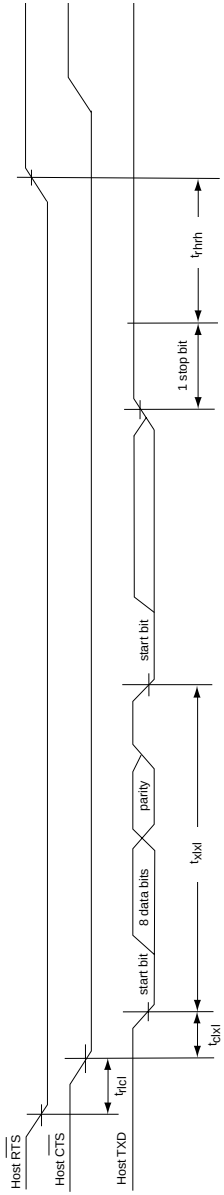


Figure 4-2. Serial I/O Timing, Host Transmit

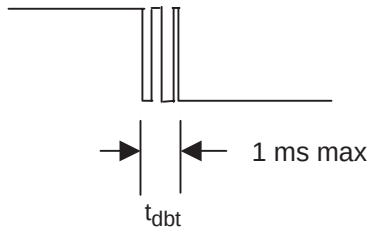


Figure 4-3. Trigger Debounce Timing

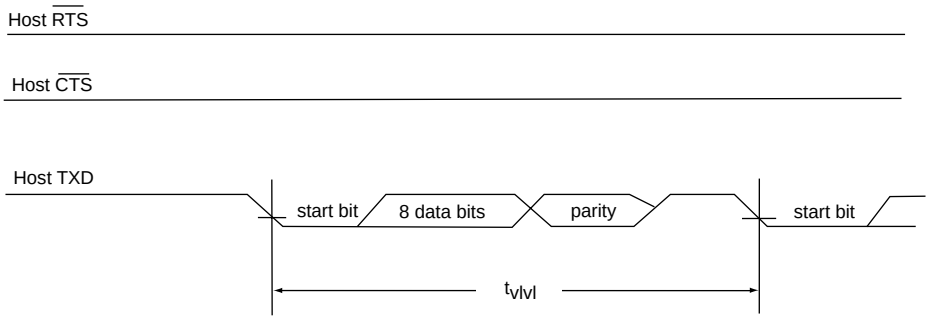


Figure 4-4. Serial I/O Timing, Decoder Transmit

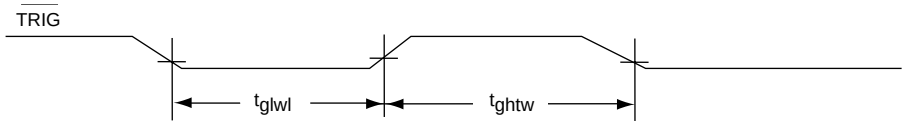


Figure 4-5. Hardware Trigger Timing

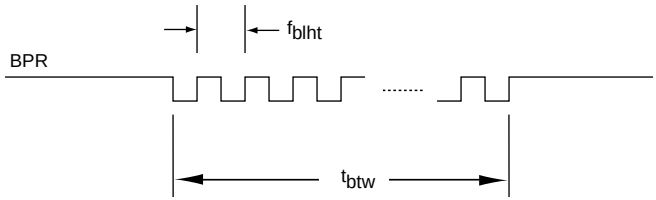


Figure 4-6. Beeper Timing

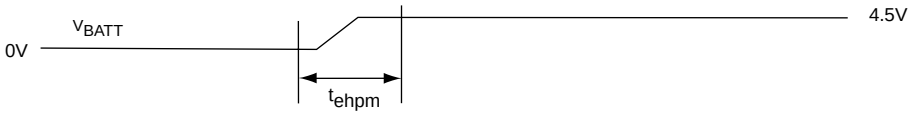


Figure 4-7. V_{BATT} Rise Time

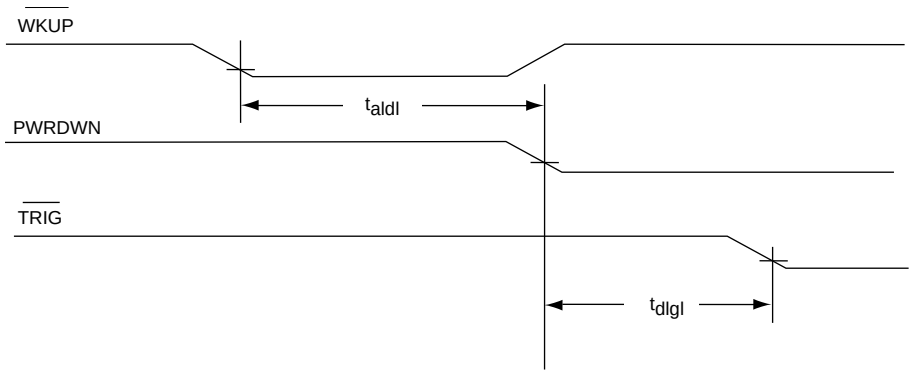


Figure 4-8. Wake Up Timing

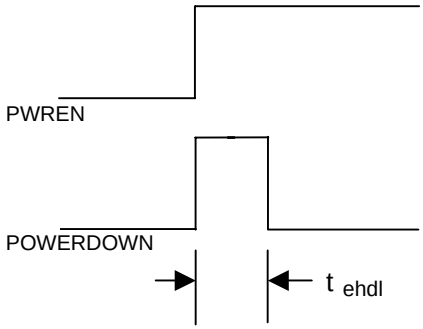
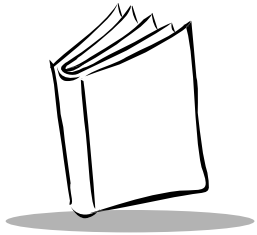


Figure 4-9. Power Enable to Power Down



Chapter 5
Parameter Menus

Overview

This chapter describes the programmable parameters, provides bar codes for programming, and hexadecimal equivalents for host parameter programming through SSI.

Operational Parameters

The Symbol SE1524ER is shipped with the default parameter settings shown in Table 5-1. These default settings are stored in non-volatile memory and are preserved even when the scanner is powered down.

To change the parameter values:

- Scan the appropriate bar codes included in this chapter. The new value replaces the existing memory value. The default parameter values can be recalled by scanning the *Set All Defaults* bar code on *page 5-7*.

or

- Send the parameter through the scan engine's serial port using the SSI command PARAM_SEND. Hexadecimal parameter numbers are shown in this chapter below the parameter title, and options appear in parenthesis beneath the accompanying bar codes. Instructions for changing parameters using this method are found in Chapter 6, *Simple Serial Interface*.

Table 5-1 lists the defaults for all parameters. To change a parameter value(s), scan the appropriate bar code(s).

Table 5-1. Default Table

Parameter	Parameter Number (HEX)	Default	Page Number
Set Default Parameter		All Defaults	5-7
Beeper Tone	0x91	High Frequency	5-8
Beeper Frequency Adjustment	0xF0 0x91	2500 Hz	5-9
Laser On Time	0x88	3.0 sec	5-10
Aim Duration	0xED	0.0 sec	5-11
Power Mode	0x80	Low Power	5-12
Trigger Mode	0x8A	Level	5-13
Time-out Between Same Symbol	0x89	1.0 sec.	5-15
Beep After Good Decode	0x38	Enable	5-16
Transmit “No Read” Message	0x5E	Disable	5-17
Parameter Scanning	0xEC	Enable	5-18
Linear Code Type Security Levels	0x4E	1	5-19
Bi-directional Redundancy	0x43	Disable	5-21
UPC/EAN			
UPC-A	0x01	Enable	5-22
UPC-E	0x02	Enable	5-23
UPC-E1	0x0C	Disable	5-24
EAN-8	0x04	Enable	5-25
EAN-13	0x03	Enable	5-26
Bookland EAN	0x53	Disable	5-27

Table 5-1. Default Table (Continued)

Parameter	Parameter Number (HEX)	Default	Page Number
Decode UPC/EAN Supplementals	0x10	Ignore	5-29
Decode UPC/EAN Supplemental Redundancy	0x50	7	5-30
Transmit UPC-A Check Digit	0x28	Enable	5-31
Transmit UPC-E Check Digit	0x29	Enable	5-32
Transmit UPC-E1 Check Digit	0x2A	Enable	5-33
UPC-A Preamble	0x22	System Character	5-34
UPC-E Preamble	0x23	System Character	5-35
UPC-E1 Preamble	0x24	System Character	5-36
Convert UPC-E to A	0x25	Disable	5-38
Convert UPC-E1 to A	0x26	Disable	5-38
EAN-8 Zero Extend	0x27	Disable	5-39
Convert EAN-8 to EAN-13 Type	0xE0	Type is EAN-13	5-40
UPC/EAN Security Level	0x4D	0	5-40
UPC/EAN Coupon Code	0x55	Disable	5-42
Code 128			
USS-128	0x08	Enable	5-43
UCC/EAN-128	0x0E	Enable	5-44
ISBT 128	0x54	Enable	5-45

Table 5-1. Default Table (Continued)

Parameter	Parameter Number (HEX)	Default	Page Number
Code 39			
Code 39	0x00	Enable	5-46
Trioptic Code 39	0x0D	Disable	5-47
Convert Code 39 to Code 32	0x56	Disable	5-48
Code 32 Prefix	0xE7	Disable	5-49
Set Length(s) for Code 39	0x12 0x13	2-55	5-51
Code 39 Check Digit Verification	0x30	Disable	5-52
Transmit Code 39 Check Digit	0x2B	Disable	5-53
Code 39 Full ASCII Conversion	0x11	Disable	5-54
Code 93			
Code 93	0x09	Disable	5-55
Set Length(s) for Code 93	0x1A 0x1B	4-55	5-56
Interleaved 2 of 5			
Interleaved 2 of 5	0x06	Enable	5-58
Set Length(s) for I 2 of 5	0x16 0x17	14	5-59
I 2 of 5 Check Digit Verification	0x31	Disable	5-61
Transmit I 2 of 5 Check Digit	0x2C	Disable	5-62
Convert I 2 of 5 to EAN 13	0x52	Disable	5-63

Table 5-1. Default Table (Continued)

Parameter	Parameter Number (HEX)	Default	Page Number
Discrete 2 of 5			
Discrete 2 of 5	0x05	Disable	5-64
Set Length(s) for D 2 of 5	0x14 0x15	12	5-65
Codabar			
Codabar	0x07	Disable	5-67
Set Lengths for Codabar	0x18 0x19	5-55	5-69
CLSI Editing	0x36	Disable	5-70
NOTIS Editing	0x37	Disable	5-71
MSI Plessey			
MSI	0x0B	Disable	5-72
Set Length(s) for MSI	0x1E 0x1F	6-55	5-74
MSI Check Digits	0x32	One	5-75
Transmit MSI Check Digit	0x2E	Disable	5-76
MSI Check Digit Algorithm	0x33	Mod 10/Mod 10	5-77
GS1 DataBar			
Enable/Disable GS1 DataBar-14	0XF0 0x52	Disable	5-78
Enable/Disable GS1 DataBar Limited	0XF0 0x53	Disable	5-79
Enable/Disable GS1 DataBar Expanded	0XF0 0x53	Disable	5-80

Table 5-1. Default Table (Continued)

Parameter	Parameter Number (HEX)	Default	Page Number
Data Options			
Transmit Code ID Character	0x2D	None	5-82
Prefix/Suffix Values Prefix Suffix 1 Suffix 2	 0x69 0x68 0x6A	 NULL LF CR	5-83
Scan Data Transmission Format	0xEB	Data as is	5-85
Serial Interface			
Baud Rate	0x9C	9600	5-88
Parity	0x9E	None	5-90
Software Handshaking	0x9F	Enable	5-92
Decode Data Packet Format	0xEE	Unpacketed	5-93
Host Serial Response Time-out	0x9B	2 sec	5-94
Stop Bit Select	0x9D	1	5-95
Intercharacter Delay	0x6E	0	5-96
Host Character Time-out	0xEF	200 msec	5-97
Event Reporting*			
Decode Event	0xF0 0x00	Disable	5-99
Boot Up Event	0xF0 0x02	Disable	5-100
Parameter Event	0xF0 0x03	Disable	5-101
*See Table 6-9 on page 6-25 for formatting of any parameter number greater than FF (256).			

Set Default Parameter

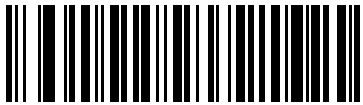
Scan this bar code to return all parameters to the default values listed in Table 5-1. beginning on *page 5-2*.

Set All Defaults

Beeper Tone

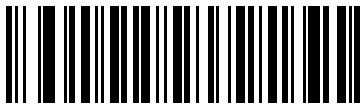
Parameter # 0x91

To select a decode beep frequency (tone), scan the appropriate bar code.



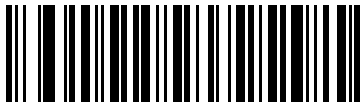
Low Frequency

(0x02)



Medium Frequency*

(0x01)



High Frequency

(0x00)

* Indicates the default value

Beeper Frequency Adjustment

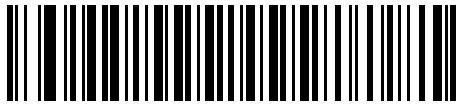
Parameter # 0xF0 0x91

This parameter adjusts the frequency of the high beeper tone from the nominal 2500 Hz to another frequency matching the resonances of the installation. It is programmable in 10 Hz increments from 1220 Hz to 3770 Hz.

To increase the frequency, scan the bar code below, then scan three numeric bar codes beginning on *page 5-102* that correspond to the desired frequency adjustment divided by 10. For example, to set the frequency to 3000 Hz (an increase of 500 Hz), scan numeric bar codes 0, 5, 0, corresponding to 50, or (500/10).

To decrease the frequency, scan the bar code below, then scan three numeric bar codes beginning on *page 5-102* that correspond to the value (256 - desired adjustment/10). For example, to set the frequency to 2000 Hz (a decrease of 500 Hz), scan numeric bar codes 2, 0, 6, corresponding to 206, or (256 - 500/10).

To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



Beeper Frequency Adjustment

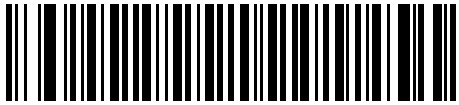
(Default: 2500 Hz)

Laser On Time

Parameter # 0x88

This parameter sets the maximum time decode processing continues during a scan attempt. It is programmable in 0.1 second increments from 0.5 to 9.9 seconds.

To set a Laser On Time, scan the bar code below. Next scan two numeric bar codes beginning on *page 5-102* that correspond to the desired on time. Single digit values must be predefined by a leading zero. For example, to set an on time of 0.5 seconds, scan the bar code below, then scan the “0” and “5” bar codes. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



Laser On Time

Aim Duration

Parameter # 0xED

When a scanner with an aim mode is triggered either by a trigger pull or a *START_DECODE* command, this parameter sets the duration the aiming pattern is seen before a scan attempt begins. It does not apply to the aim signal or the *AIM_ON* command. It is programmable in 0.1 second increments from 0.0 to 9.9 seconds. No aim pattern is visible when the value is 0.0. For more information on this parameter, see the *AIM_ON* command on *page 6-7*.

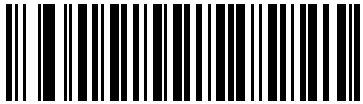
To set an aim duration, scan the bar code below. Next scan two numeric bar codes beginning on *page 5-102* that correspond to the desired aim duration. Single digit values must be predefined by a leading zero. For example, to set an aim duration of 0.5 seconds, scan the bar code below, then scan the “0” and “5” bar codes. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

AIM Duration

Power Mode

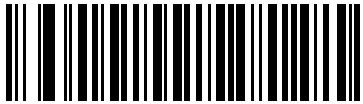
Parameter # 0x80

This parameter determines whether or not the scanner remains in continuous power mode after a decode attempt. In Low Power mode, the scanner enters into a low power consumption mode whenever possible, provided all WAKEUP signals have been released. See *Power Management* on page 1-5. In Continuous On mode, power remains on after each decode attempt.



Continuous On

(0x00)



Low Power

(0x01)

Triggering Modes

Parameter # 0x8A

Choose one of the following options to trigger the scan engine.

- **Level** - A trigger pull activates the laser and decode processing. The laser remains on and decode processing continues until a trigger release, a valid decode, or the Laser On Time-out is reached.
- **Pulse** - A trigger pull activates the laser and decode processing. The laser remains on and decode processing continues until a valid decode or the Laser On Time-out is reached.
- **Continuous** - The laser is always on and decoding.
- **Blinking** - This trigger mode is used for triggerless ScanStand operation. Scanning range is reduced in this mode.
- **Host** - A host command issues the triggering signal. The scan engine interprets an actual trigger pull as a Level triggering option.

Level

(0x00)

Pulse

(0X02)

Triggering Modes (continued)

Continuous

(0x04)

Blinking

(0x07)

Host

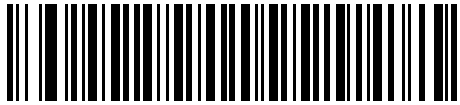
(0X08)

Time-out Between Same Symbol

Parameter # 0x89

When in Continuous triggering mode, this parameter sets the minimum time that must elapse before the scanner decodes a second bar code identical to one just decoded. This reduces the risk of accidently scanning the same symbol twice. It is programmable in 0.1 second increments from 0.0 to 9.9 seconds.

To set a time-out between same symbol, scan the bar code below. Next scan two numeric bar codes beginning on *page 5-102* that correspond to the desired time-out. Single digit values must be predefined by a leading zero. For example, to set a time-out of 0.5 seconds, scan the bar code below, then scan the “0” and “5” bar codes. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

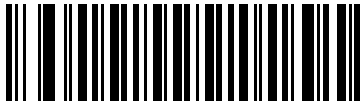


Time-out Between Same Symbol

Beep After Good Decode

Parameter # 0x38

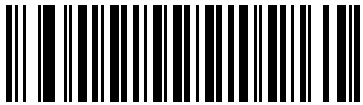
Scan this symbol to set the scanner to beep after a good decode.



Beep After Good Decode

(0x01)

Scan this symbol to set the scanner not to beep after a good decode. The beeper still operates during parameter menu scanning and indicates error conditions.



Do Not Beep After Good Decode

(0x00)

Transmit “No Read” Message

Parameter # 0x5E

Enable this option to transmit “NR” if a 1-D symbol does not decode. Any enabled prefix or suffixes are appended around this message.

Enable No Read

(0x01)

When the parameter is disabled, and a symbol can not be decoded, no message is sent to the host.

Disable No Read

(0x00)

Parameter Scanning

Parameter # 0xEC

To disable decoding of parameter bar codes, scan the bar code below. The Set Defaults parameter bar code can still be decoded. To enable decoding of parameter bar codes, either scan *Enable Parameter Scanning*, *Set All Defaults* or set this parameter to 0x01 via a serial command.

Enable Parameter Scanning

(0x01)

Disable Parameter Scanning

(0x00)

Linear Code Type Security Level

Parameter # 0x4E

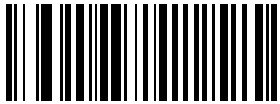
The Symbol SE1524ER offers four levels of decode security for linear code types (e.g. Code 39, Interleaved 2 of 5). Select higher security levels for decreasing levels of bar code quality. As security levels increase, the scanner's aggressiveness decreases.

Select the security level appropriate for your bar code quality.

Linear Security Level 1

The following code types must be successfully read twice before being decoded:

Code Type	Length
Codabar	All
MSI	4 or less
D 2 of 5	8 or less
I 2 of 5	8 or less

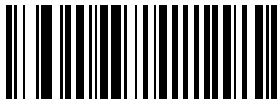


***Linear Security Level 1**

(0x01)

Linear Security Level 2

All code types must be successfully read twice before being decoded.



Linear Security Level 2

(0x02)

Linear Security Level 3

Code types other than the following must be successfully read twice before being decoded. The following codes must be read three times:

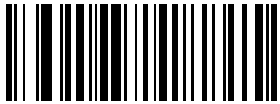
Code Type	Length
MSI	4 or less
D 2 of 5	8 or less
I 2 of 5	8 or less

Linear Security Level 3

(0x03)

Linear Security Level 4

All code types must be successfully read three times before being decoded.



Linear Security Level 4

(0x04)

Bi-directional Redundancy

Parameter # 0x43

This parameter is only valid when a *Linear Code Type Security Level* is enabled (see *page 5-19*). When this parameter is enabled, a bar code must be successfully scanned in both directions (forward and reverse) before being decoded.

Enable Bi-directional Redundancy

(0x01)

Disable Bi-directional Redundancy

(0x00)

UPC/EAN

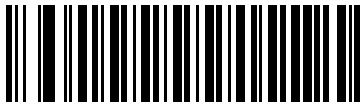
Enable/Disable UPC-A

Parameter # 0x01

To enable or disable UPC-A, scan the appropriate bar code below.

Enable UPC-A

(0x01)



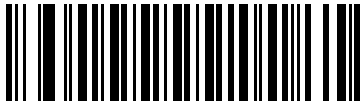
Disable UPC-A

(0x00)

Enable/Disable UPC-E

Parameter # 0x02

To enable or disable UPC-E, scan the appropriate bar code below.



Enable UPC-E

(0x01)

Disable UPC-E

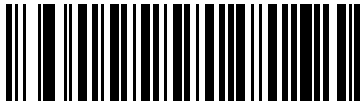
(0x00)

Enable/Disable UPC-E1

Parameter # 0x0C

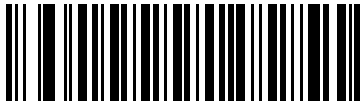
To enable or disable UPC-E1, scan the appropriate bar code below.

Note: *UPC-E1 is not a UCC (Uniform Code Council) approved symbology.*



Enable UPC-E1

(0x01)



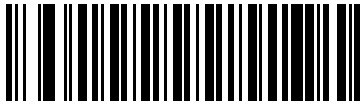
Disable UPC-E1

(0x00)

Enable/Disable EAN-8

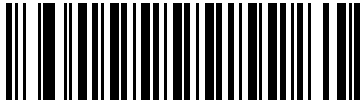
Parameter # 0x04

To enable or disable EAN-8, scan the appropriate bar code below.



Enable EAN-8

(0x01)



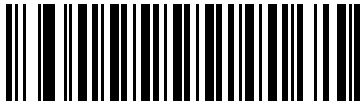
Disable EAN-8

(0x00)

Enable/Disable EAN-13

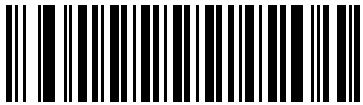
Parameter # 0x03

To enable or disable EAN-13, scan the appropriate bar code below.



Enable EAN-13

(0x01)



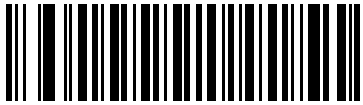
Disable EAN-13

(0x00)

Enable/Disable Bookland EAN

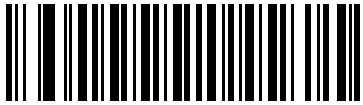
Parameter # 0x53

To enable or disable EAN Bookland, scan the appropriate bar code below.



Enable Bookland EAN

(0x01)



Disable Bookland EAN

(0x00)

Decode UPC/EAN Supplementals

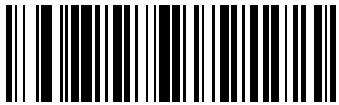
Parameter # 0x10

Supplementals are appended characters (2 or 5) according to specific code format conventions (e.g., UPC A+2, UPC E+2, EAN 8+2). Several options are available:

- If **Decode UPC/EAN with Supplemental** characters is selected, the scanner does not decode UPC/EAN symbols without supplemental characters.
- If **Ignore UPC/EAN with Supplemental** characters is selected, and the SE1524ER is presented with a UPC/EAN symbol with a supplemental, the scanner decodes the UPC/EAN and ignores the supplemental characters.
- If **Autodiscriminate UPC/EAN Supplementals** is selected, scan *Decode UPC/EAN Supplemental Redundancy* on *page 5-30*, then select a value from the numeric bar codes, see *page 5-102*. A value of 5 or more is recommended.
- Select **Enable 378/379 Supplemental Mode** to enable the SE1524ER to identify supplementals for EAN-13 bar codes starting with a '378' or '379' prefix only. All other UPC/EAN bar codes are decoded immediately and the supplemental characters ignored.
- Select **Enable 978 Supplemental Mode** to enable the SE1524ER to identify supplementals for EAN-13 bar codes starting with a '978' prefix only. All other UPC/EAN bar codes are decoded immediately and the supplemental characters ignored.
- Select **Enable Smart Supplemental Mode** to enable the SE1524ER to identify supplementals for EAN-13 bar codes starting with a '378', '379', or '978' prefix only. All other UPC/EAN bar codes are decoded immediately and the supplemental characters ignored.

Note: *To minimize the risk of invalid data transmission, we recommend selecting whether to read or ignore supplemental characters.*

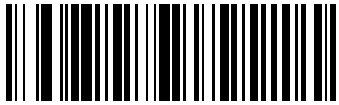
Select the desired option by scanning one of the following bar codes.



Decode UPC/EAN With Supplementals

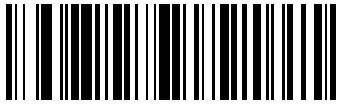
(0x01)

Decode UPC/EAN Supplementals (continued)



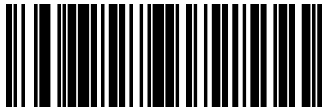
***Ignore UPC/EAN With Supplementals**

(0x00)



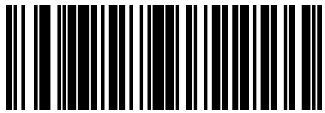
Autodiscriminate UPC/EAN Supplementals

(0x02)



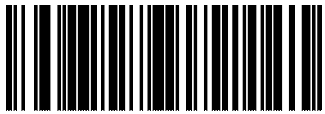
Enable 378/379 Supplemental Mode

(0x04)



Enable 978 Supplemental Mode

(0x05)



Enable Smart Supplemental Mode

(0x03)

Decode UPC/EAN Supplemental Redundancy

Parameter # 0x50

With *Auto discriminate UPC/EAN Supplementals* selected, this option adjusts the number of times a symbol without supplementals will be decoded before transmission. The range is from 2 to 20 times. Five or above is recommended when decoding a mix of UPC/EAN symbols with and without supplementals, and the auto discriminate option is selected.

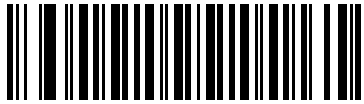
Scan the bar code below to select a decode redundancy value. Next scan two numeric bar codes beginning on *page 5-102*. Single digit values must be predefined by a leading zero. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

Decode UPC/EAN
Supplemental Redundancy

Transmit UPC-A Check Digit

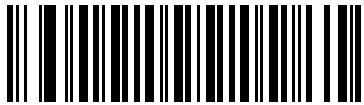
Parameter # 0x28

Scan the appropriate bar code below to transmit the symbol with or without the UPC-A check digit.



Transmit UPC-A Check Digit

(0x01)



Do Not Transmit UPC-A Check Digit

(0x00)

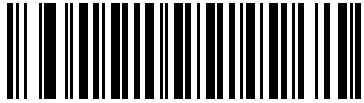
Transmit UPC-E Check Digit

Parameter # 0x29

Scan the appropriate bar code below to transmit the symbol with or without the UPC-E check digit.

Transmit UPC-E Check Digit

(0x01)



Do Not Transmit UPC-E Check Digit

(0x00)

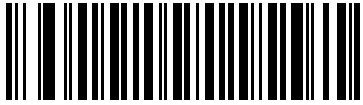
Transmit UPC-E1 Check Digit

Parameter # 0x2A

Scan the appropriate bar code below to transmit the symbol with or without the UPC-E1 check digit.

Transmit Upc-e1 Check Digit

(0x01)



Do Not Transmit UPC-E1 Check Digit

(0x00)

UPC-A Preamble

Parameter # 0x22

Preamble characters (Country Code and System Character) can be transmitted as part of a UPC-A symbol. Select one of the following options for transmitting UPC-A preamble to the host device: transmit system character only, transmit system character and country code (“0” for USA), or transmit no preamble.

No Preamble
(<DATA>)

(0x00)

System Character

(<SYSTEM CHARACTER> <DATA>)

(0x01)

System Character & Country Code

(< COUNTRY CODE> <SYSTEM CHARACTER> <DATA>)

(0x02)

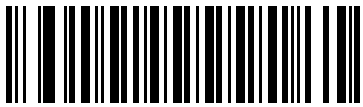
UPC-E Preamble

Parameter # 0x23

Preamble characters (Country Code and System Character) can be transmitted as part of a UPC-E symbol. Select one of the following options for transmitting UPC-E preamble to the host device: transmit system character only, transmit system character and country code (“0” for USA), or transmit no preamble.

No Preamble
(<DATA>)

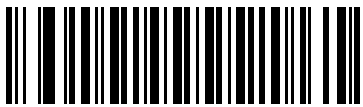
(0x00)



System Character

(<SYSTEM CHARACTER> <DATA>)

(0x01)



System Character & Country Code

(< COUNTRY CODE> <SYSTEM CHARACTER> <DATA>)

(0x02)

UPC-E1 Preamble

Parameter # 0x24

Preamble characters (Country Code and System Character) can be transmitted as part of a UPC-E1 symbol. Select one of the following options for transmitting UPC-E1 preamble to the host device: transmit system character only, transmit system character and country code (“0” for USA), or transmit no preamble.

No Preamble
(<DATA>)

(0x00)

System Character

(<SYSTEM CHARACTER> <DATA>)

(0x01)

System Character & Country Code

(< COUNTRY CODE> <SYSTEM CHARACTER> <DATA>)

(0x02)

Convert UPC-E to UPC-A

Parameter # 0x25

This parameter converts UPC-E (zero suppressed) decoded data to UPC-A format before transmission. After conversion, data follows UPC-A format and is affected by UPC-A programming selections (e.g., Preamble, Check Digit).

Scan **Do Not Convert UPC-E to UPC-A** to transmit UPC-E (zero suppressed) decoded data.

Convert UPC-E to UPC-A
(Enable)

(0x01)

Do Not Convert UPC-E to UPC-A
(Disable)

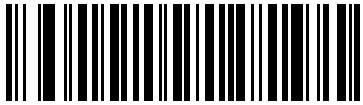
(0x00)

Convert UPC-E1 to UPC-A

Parameter # 0x26

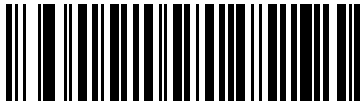
Enable this parameter to convert UPC-E1 (zero suppressed) decoded data to UPC-A format before transmission. After conversion, data follows UPC-A format and is affected by UPC-A programming selections (e.g., preamble, check digit).

Scan **Do Not Convert UPC-E to UPC-A** to transmit UPC-E1 (zero suppressed) decoded data.



Convert UPC-E1 to UPC-A
(Enable)

(0x01)



Do Not Convert UPC-E1 to UPC-A
(Disable)

(0x00)

EAN Zero Extend

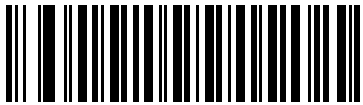
Parameter # 0x27

When enabled, this parameter adds five leading zeros to decoded EAN-8 symbols to make them compatible in format to EAN-13 symbols.

Disable this parameter to transmit EAN-8 symbols as is.

Enable EAN Zero Extend

(0x01)



Disable EAN Zero Extend

(0x00)

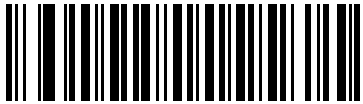
Security Level

Parameter # 0x4D

The Symbol SE1524ER offers four levels of decode security for delta bar codes, which include the Code 128 family, UPC/EAN, and Code 93. Select higher levels of security for decreasing levels of bar code quality. Increasing security decreases the scanner's aggressiveness, so choose only that level of security necessary for the application.

Security Level 0

This default setting allows the scanner to operate in its most aggressive state, while providing sufficient security in decoding most "in-spec" bar codes.

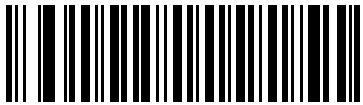


Security Level 0

(0x00)

Security Level 1

Select this option if misdecodes occur. This security level eliminates most misdecodes.



Security Level 1

(0x01)

Security Level 2

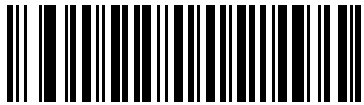
Select this option if Security level 1 fails to eliminate misdecodes.

Security Level 2

(0x02)

Security Level 3

If misdecodes still occur after selecting Security Level 2, select this security level. Be advised, selecting this option is an extreme measure against misdecoding severely out of spec bar codes. Selecting this level of security significantly impairs the decoding ability of the scanner. If this level of security is necessary, try to improve the quality of the bar codes.



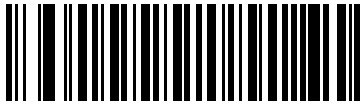
Security Level 3

(0x03)

UPC/EAN Coupon Code

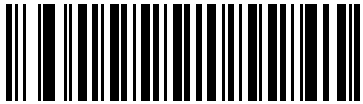
Parameter # 0x55

The UCC Coupon Extended Code is an additional bar code adjacent to a UCC Coupon Code. To enable or disable UCC Coupon Extended Code, scan the appropriate bar code below.



Enable UPC/EAN Coupon Code

(0x01)



Disable UPC/EAN Coupon Code

(0x00)

Code 128

Enable/Disable Code 128

Parameter # 0x08

To enable or disable Code 128, scan the appropriate bar code below.

Enable Code 128

(0x01)

Disable Code 128

(0x00)

Enable/Disable UCC/EAN-128

Parameter # 0x0E

To enable or disable UCC/EAN-128, scan the appropriate bar code below. (See *Appendix B, Miscellaneous Code Information* for details on *UCC/EAN-128*.)

Enable UCC/EAN-128

(0x01)

Disable UCC/EAN-128

(0x00)

Enable/Disable ISBT 128

Parameter # 0x54

To enable or disable ISBT 128, scan the appropriate bar code below.

Enable ISBT 128

(0x01)

Disable ISBT 128

(0x00)

Lengths for Code 128

No length setting is required for Code 128.

Code 39

Enable/Disable Code 39

Parameter # 0x00

To enable or disable Code 39, scan the appropriate bar code below.

Enable Code 39

(0x01)

Disable Code 39

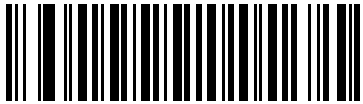
(0x00)

Enable/Disable Trioptic Code 39

Parameter # 0x0D

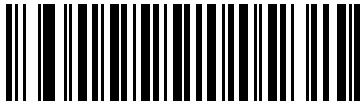
Trioptic Code 39 is a variant of Code 39 used in marking computer tape cartridges. Trioptic Code 39 symbols always contain six characters.

To enable or disable Trioptic Code 39, scan the appropriate bar code below.



Enable Trioptic Code 39

(0x01)



Disable Trioptic Code 39

(0x00)

Convert Code 39 to Code 32

Parameter # 0x56

Code 32 is a variant of Code 39 used by the Italian pharmaceutical industry. Scan the appropriate bar code below to enable or disable converting Code 39 to Code 32.

Note: *Code 39 must be enabled for this parameter to function.*

Convert Code 39 to Code 32

(Enable)

(0x01)

Do Not Convert Code 39 to Code 32

(Disable)

(0x00)

Code 32 Prefix

Parameter # 0xE7

Enable this parameter to add the prefix character “A” to all Code 32 bar codes. *Convert Code 39 to Code 32* must be enabled for this parameter to function.

Enable Code 32 Prefix

(0x01)

Disable Code 32 Prefix

(0x00)

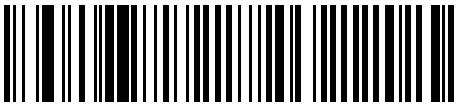
Set Lengths for Code 39

Parameter # L1 = 0x12, L2 = 0x13

The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. Lengths for Code 39 may be set for any length, one or two discrete lengths, or lengths within a specific range. If Code 39 Full ASCII is enabled, **Length Within a Range** or **Any Length** are the preferred options. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands*.

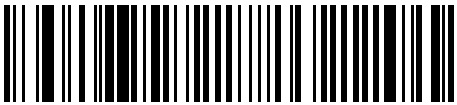
Note: *When setting lengths, single digit numbers must always be preceded by a leading zero.*

One Discrete Length - This option limits decodes to only those Code 39 symbols containing a selected length. Lengths are selected from the numeric bar codes beginning on page 5-102. For example, to decode only Code 39 symbols with 14 characters, scan **Code 39 - One Discrete Length**, then scan **1** followed by **4**. To change the selection or to cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



Code 39 - One Discrete Length

Two Discrete Lengths - This option limits decodes to only those Code 39 symbols containing either of two selected lengths. Lengths are selected from the numeric bar codes beginning on page 5-102. For example, to decode only those Code 39 symbols containing either 2 or 14 characters, select **Code 39 - Two Discrete Lengths**, then scan **0**, **2**, **1**, and then **4**. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



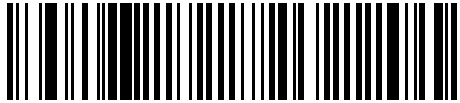
Code 39 - Two Discrete Lengths

Set Lengths for Code 39

Length Within Range - This option limits decodes to only those Code 39 symbols within a specified range. For example, to decode Code 39 symbols containing between 4 and 12 characters, first scan **Code 39 Length Within Range**. Then scan **0**, **4**, **1** and **2** (single digit numbers must always be preceded by a leading zero). Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

Code 39 - Length Within Range

Any Length - Scan this option to decode Code 39 symbols containing any number of characters.

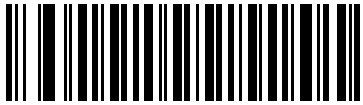


Code 39 - Any Length

Code 39 Check Digit Verification

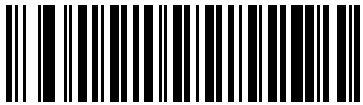
Parameter # 0x30

When this feature is enabled, the scanner checks the integrity of all Code 39 symbols to verify that the data complies with specified check digit algorithm. Only those Code 39 symbols which include a modulo 43 check digit are decoded. Only enable this feature if the Code 39 symbols contain a modulo 43 check digit.



Verify Code 39 Check Digit

(0x01)



Do Not Verify Code 39 Check Digit

(0x00)

Transmit Code 39 Check Digit

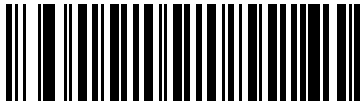
Parameter # 0x2B

Scan this symbol to transmit the check digit with the data.

Transmit Code 39 Check Digit (Enable)

(0x01)

Scan this symbol to transmit data without the check digit.



Do Not Transmit Code 39 Check Digit (Disable)

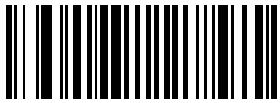
(0x00)

Enable/Disable Code 39 Full ASCII

Parameter # 0x11

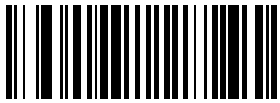
Code 39 Full ASCII is a variant of Code 39 which pairs characters to encode the full ASCII character set. To enable or disable Code 39 Full ASCII, scan the appropriate bar code below.

Refer to Table B-3 on page B-4 for the mapping of Code 39 characters to ASCII values.



Enable Code 39 Full ASCII

(0x00)



***Disable Code 39 Full ASCII**

(0x00)

Note: *Do not enable Trioptic Code 39 and Code 39 Full ASCII simultaneously. If an error beep occurs when enabling Code 39 Full ASCII, disable Trioptic Code 39 and try again.*

Code 93

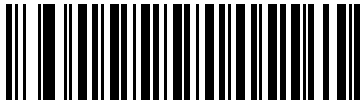
Enable/Disable Code 93

Parameter # 0x09

To enable or disable Code 93, scan the appropriate bar code below.

Enable Code 93

(0x01)



Disable Code 93

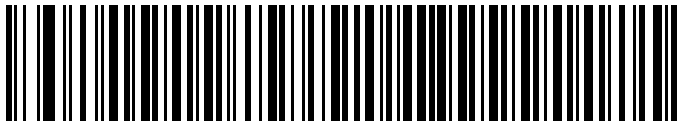
(0x00)

Set Lengths for Code 93

Parameter # L1 = 0x1A, L2 = 0x1B

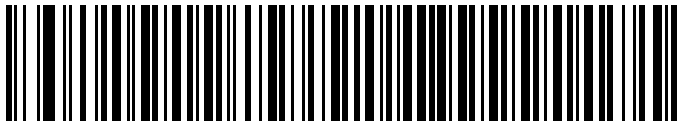
The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. Lengths for Code 93 can be set for any length, one or two discrete lengths, or lengths within a specific range. See Table B-5 on page B-8 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-7.

One Discrete Length - Select this option to decode only those codes containing a selected length. For example, select **Code 93 One Discrete Length**, then scan **1**, **4**, to limit the decoding to only Code 93 symbols containing 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



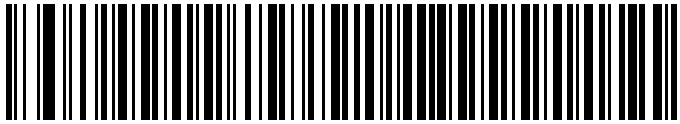
Code 93 - One Discrete Length

Two Discrete Lengths - Select this option to decode only those codes containing two selected lengths. For example, select **Code 93 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, to limit the decoding to only Code 93 symbols containing 2 or 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



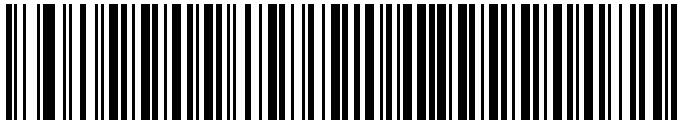
Code 93 - Two Discrete Lengths

Length Within Range - This option sets the unit to decode a code type within a specified range. For example, to decode Code 93 symbols containing between 4 and 12 characters, first scan **Code 93 Length Within Range**, then scan **0**, **4**, **1** and **2** (single digit numbers must always be preceded by a leading zero). Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



Code 93 - Length Within Range

Any Length - Scan this option to decode Code 93 symbols containing any number of characters.



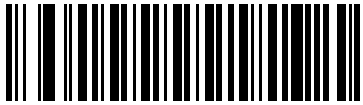
Code 93 - Any Length

Interleaved 2 of 5

Enable/Disable Interleaved 2 of 5

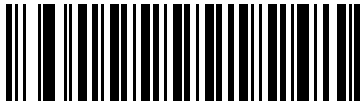
Parameter # 0x06

To enable or disable Interleaved 2 of 5, scan the appropriate bar code below.



Enable Interleaved 2 Of 5

(0x01)



Disable Interleaved 2 Of 5

(0x00)

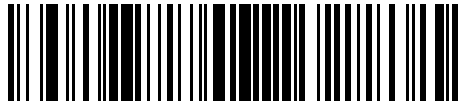
Set Lengths for Interleaved 2 of 5

Parameter # L1 = 0x16, L2 = 0x17

The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. Lengths for I 2 of 5 can be set for any length, one or two discrete lengths, or lengths within a specific range. See Table B-5 on page B-8 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-7

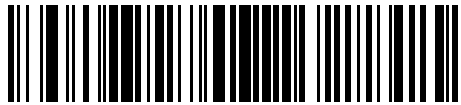
Note: *When setting lengths, single digit numbers must always be preceded by a leading zero.*

One Discrete Length - Select this option to decode only those codes containing a selected length. For example, select **I 2 of 5 One Discrete Length**, then scan **1**, **4**, to decode only I 2 of 5 symbols containing 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



I 2 of 5 - One Discrete Length

Two Discrete Lengths - Select this option to decode only those codes containing two selected lengths. For example, select **I 2 of 5 Two Discrete Lengths**, then scan **0**, **6**, **1**, **4**, to decode only I 2 of 5 symbols containing 6 or 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



I 2 of 5 - Two Discrete Lengths

Set Lengths for Interleaved 2 of 5

Length Within Range - Select this option to decode only codes within a specified range. For example, to decode I 2 of 5 symbols containing between 4 and 12 characters, first scan **I 2 of 5 Length Within Range**, then scan **0**, **4**, **1** and **2** (single digit numbers must always be preceded by a leading zero). Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

I 2 of 5 - Length Within Range

Any Length - Scan this option to decode I 2 of 5 symbols containing any number of characters.

Note: *Selecting this option may lead to misdecodes for I 2 of 5 codes.*

I 2 of 5 - Any Length

I 2 of 5 Check Digit Verification

Parameter # 0x31

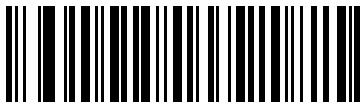
When enabled, this parameter checks the integrity of an I 2 of 5 symbol to ensure it complies with a specified algorithm, either USS (Uniform Symbology Specification), or OPCC (Optical Product Code Council).

Disable

(0x00)

USS Check Digit

(0x01)



OPCC Check Digit

(0x02)

Transmit I 2 of 5 Check Digit

Parameter # 0x2C

Scan this symbol to transmit the check digit with the data.

Transmit I 2 of 5 Check Digit (Enable)

(0x01)

Scan this symbol to transmit data without the check digit.

Do Not Transmit I 2 of 5 Check Digit (Disable)

(0x00)

Convert I 2 of 5 to EAN-13

Parameter # 0x52

This parameter converts a 14 character I 2 of 5 code into EAN-13, and transmits to the host as EAN-13. To accomplish this, I 2 of 5 must be enabled, one length must be set to 14, and the code must have a leading zero and a valid EAN-13 check digit.

Convert I 2 of 5 to EAN-13 (Enable)

(0x01)

Do Not Convert I 2 of 5 to EAN-13 (Disable)

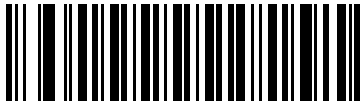
(0x00)

Discrete 2 of 5

Enable/Disable Discrete 2 of 5

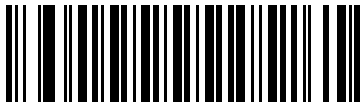
Parameter # 0x05

To enable or disable Discrete 2 of 5, scan the appropriate bar code below.



Enable Discrete 2 of 5

(0x01)



Disable Discrete 2 of 5

(0x00)

Set Lengths for Discrete 2 of 5

Parameter # L1 = 0x14, L2 = 0x15

The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. Lengths for D 2 of 5 can be set for any length, one or two discrete lengths, or lengths within a specific range. See Table B-5 on page B-8 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-7.

One Discrete Length - Select this option to decode only those codes containing a selected length. For example, select **D 2 of 5 One Discrete Length**, then scan **1**, **4**, to decode only D 2 of 5 symbols containing 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

D 2 of 5 - One Discrete Length

Two Discrete Lengths - Select this option to decode only those codes containing two selected lengths. For example, select **D 2 of 5 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, to decode only D 2 of 5 symbols containing 2 or 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

D 2 of 5 - Two Discrete Lengths

Length Within Range - Select this option to decode codes within a specified range. For example, to decode D 2 of 5 symbols containing between 4 and 12 characters, first scan **D 2 of 5 Length Within Range**, then scan **0**, **4**, **1** and **2** (single digit numbers must be preceded by a leading zero). Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

D 2 of 5 - Length Within Range

Any Length - Scan this option to decode D 2 of 5 symbols containing any number of characters.

Note: *Selecting this option may lead to misdecodes of D 2 of 5 codes.*

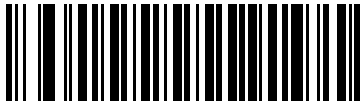
D 2 of 5 - Any Length

Codabar

Enable/Disable Codabar

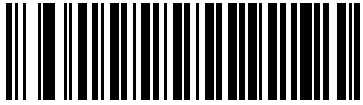
Parameter # 0x07

To enable or disable Codabar, scan the appropriate bar code below.



Enable Codabar

(0x01)



Disable Codabar

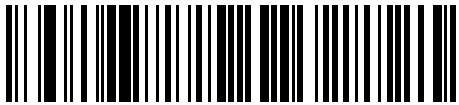
(0x00)

Set Lengths for Codabar

Parameter # L1 = 0x18, L2 = 0x19

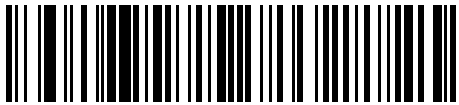
The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. Lengths for Codabar can be set for any length, one or two discrete lengths, or lengths within a specific range. See Table B-5 on page B-8 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-7.

One Discrete Length - Select this option to decode only those codes containing a selected length. For example, select **Codabar One Discrete Length**, then scan **1**, **4**, to decode only Codabar symbols containing 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



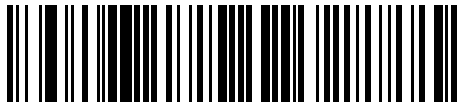
Codabar - One Discrete Length

Two Discrete Lengths - This option sets the unit to decode only those codes containing two selected lengths. For example, select **Codabar Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, to decode only Codabar symbols containing 6 or 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



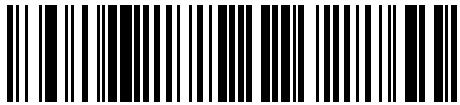
Codabar - Two Discrete Lengths

Length Within Range - Select this option to decode a code within a specified range. For example, to decode Codabar symbols containing between 4 and 12 characters, first scan **Codabar Length Within Range**, then scan **0**, **4**, **1** and **2** (single digit numbers must always be preceded by a leading zero). Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



Codabar - Length Within Range

Any Length - Scan this option to decode Codabar symbols containing any number of characters.



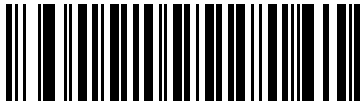
Codabar - Any Length

CLSI Editing

Parameter # 0x36

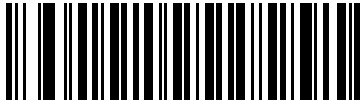
When enabled, this parameter strips the start and stop characters and inserts a space after the first, fifth, and tenth characters of a 14-character Codabar symbol.

Note: *Symbol length does not include start and stop characters.*



Enable CLSI Editing

(0x01)



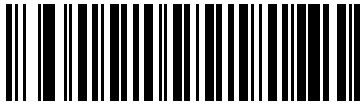
Disable CLSI Editing

(0x00)

NOTIS Editing

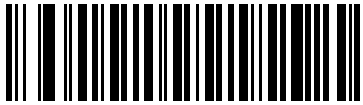
Parameter # 0x37

When enabled, this parameter strips the start and stop characters from decoded Codabar symbol.



Enable NOTIS Editing

(0x01)



Disable NOTIS Editing

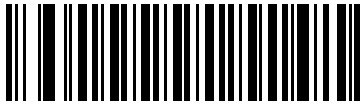
(0x00)

MSI

Enable/Disable MSI

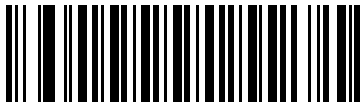
Parameter # 0x0B

To enable or disable MSI, scan the appropriate bar code below.



Enable MSI

(0x01)



Disable MSI

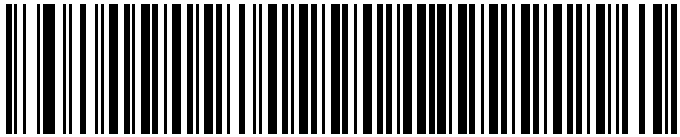
(0x00)

Set Lengths for MSI

Parameter # L1 = 0x1E, L2 = 0x1F

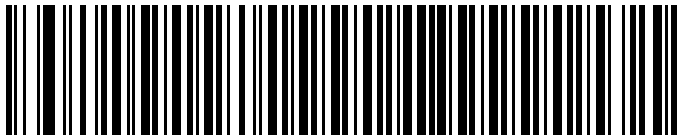
The length of a code refers to the number of characters (i.e., human readable characters) the code contains, and includes check digits. Lengths for MSI can be set for any length, one or two discrete lengths, or lengths within a specific range. See Table B-5 on page B-8 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-7.

One Discrete Length - Select this option to decode only those codes containing a selected length. For example, select **MSI Plessey One Discrete Length**, then scan **1**, **4**, to decode only MSI Plessey symbols containing 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



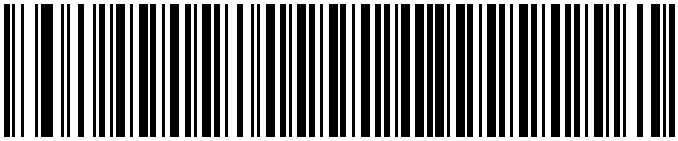
MSI - One Discrete Length

Two Discrete Lengths - Select this option to decode only those codes containing two selected lengths. For example, select **MSI Plessey Two Discrete Lengths**, then scan **0**, **6**, **1**, **4**, to decode only MSI Plessey symbols containing 6 or 14 characters. Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



MSI - Two Discrete Lengths

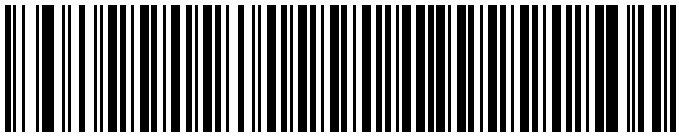
Length Within Range - Select this option to decode codes within a specified range. For example, to decode MSI symbols containing between 4 and 12 characters, first scan **MSI Length Within Range**, then scan **0**, **4**, **1** and **2** (single digit numbers must always be preceded by a leading zero). Numeric bar codes begin on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



MSI - Length Within Range

Any Length - Scan this option to decode MSI Plessey symbols containing any number of characters.

Note: *Selecting this option can cause misdecodes for MSI codes.*



MSI - Any Length

MSI Check Digits

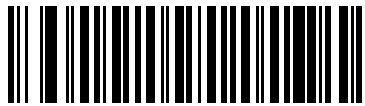
Parameter # 0x32

These check digits at the end of the bar code verify the integrity of the data. At least one check digit is required. Check digits are not automatically transmitted with the data.

One MSI Check Digit

(0x00)

If two check digits is selected, also select an *MSI Check Digit Algorithm*. See *page 5-77*.



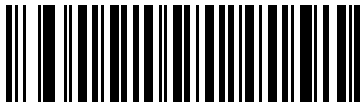
Two MSI Check Digit

(0x01)

Transmit MSI Check Digit

Parameter # 0x2E

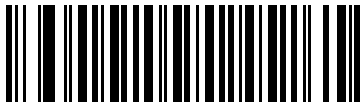
Scan this symbol to transmit the check digit with the data.



Transmit MSI Check Digit (Enable)

(0x01)

Scan this symbol to transmit data without the check digit.



Do Not Transmit MSI Check Digit (Disable)

(0x00)

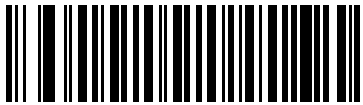
MSI Check Digit Algorithm

Parameter # 0x33

When the Two MSI check digits option is selected, an additional verification is required to ensure integrity. Select one of the following algorithms.

MOD 10/ MOD 11

(0x00)



MOD 10/ MOD 10

(0x01)

GS1 DataBar

Enable/Disable GS1 DataBar-14

Parameter # 0xF0 0x52

To enable or disable GS1 DataBar-14, scan the appropriate bar code below.

Enable GS1 DataBar-14

(0x01)

***Disable GS1 DataBar-14**

(0x00)

Enable/Disable GS1 DataBar Limited

Parameter # 0xF0 0x53

To enable or disable GS1 DataBar Limited, scan the appropriate bar code below.

Enable GS1 DataBar Limited

(0x01)

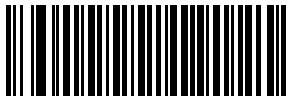
***Disable GS1 DataBar Limited**

(0x00)

Enable/Disable GS1 DataBar Expanded

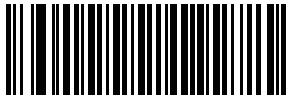
Parameter # 0xF0 0x54

To enable or disable GS1 DataBar Expanded, scan the appropriate bar code below.



Enable GS1 DataBar Expanded

(0x01)



***Disable GS1 DataBar Expanded**

(0x00)

Transmit Code ID Character

Parameter # 0x2D

A code ID character identifies the code type of a scanned bar code. This can be useful when decoding more than one code type. The code ID character is inserted between the prefix character (if selected) and the decoded symbol.

Select no code ID character, a Symbol Code ID character, or an AIM Code ID character. The Symbol Code ID characters are listed below; see Appendix B, *Miscellaneous Code Information* for *AIM Code Identifiers*.

A = UPC-A, UPC-E, UPC-E1, EAN-8, EAN-13

B = Code 39, Code 32

C = Codabar

D = Code 128, ISBT 128

E = Code 93

F = Interleaved 2 of 5

G = Discrete 2 of 5, or Discrete 2 of 5 IATA

J = MSI Plessey

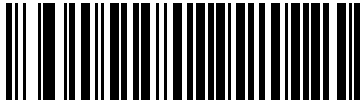
K = UCC/EAN-128

L = Bookland EAN

M = Trioptic Code 39

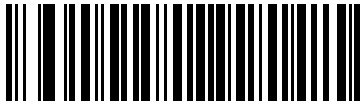
N = Coupon Code

Transmit Code ID Character (continued)



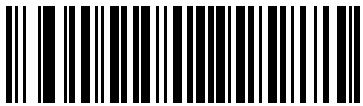
Symbol Code ID Character

(0x02)



AIM Code ID Character

(0x01)



None

(0x00)

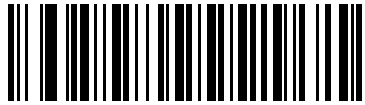
Prefix/Suffix Values

Parameter # P = 0x69, S1 = 0x68, S2 = 0x6A

A prefix and/or one or two suffixes can be appended to scan data for use in data editing. To set these values, scan a four-digit number (i.e. four bar codes) that corresponds to ASCII values. See the *Table B-5 on page B-8*, and *Numeric Bar Codes* beginning on *page 5-102*. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*. To set the Prefix/Suffix values via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-7.

Note: *In order to use Prefix/Suffix values, the Scan Data Transmission Format must be set. See page 5-85.*

Scan Prefix



Scan Suffix 1

Scan Suffix 2

Prefix/Suffix Values (continued)

Data Format Cancel

Scan Data Transmission Format

Parameter # 0xEB

To change the Scan Data Transmission Format, scan one of the following eight bar codes corresponding to the desired format.

Data As Is

(0x00)

<DATA> <SUFFIX 1>

(0x01)

<DATA> <SUFFIX 2>

(0x02)

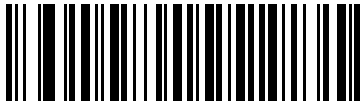
<DATA> <SUFFIX 1> <SUFFIX 2>

(0x03)

Scan Data Transmission Format (continued)

<PREFIX> <DATA >

(0x04)



<PREFIX> <DATA> <SUFFIX 1>

(0x05)

<PREFIX> <DATA> <SUFFIX 2>

(0x06)

<PREFIX> <DATA> <SUFFIX 1> <SUFFIX 2>

(0x07)

Serial Parameters

Baud Rate

Parameter # 0x9C

Baud rate is the number of bits of data transmitted per second. The scanner's baud rate setting should match the data rate setting of the host device. If not, data may not reach the host device or may reach it in distorted form.

Baud Rate 300

(0x01)

Baud Rate 600

(0x02)

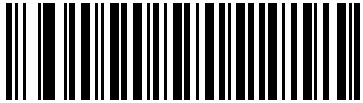
Baud Rate 1200

(0x03)

Baud Rate (continued)

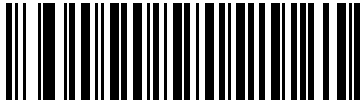
Baud Rate 2400

(0x04)



Baud Rate 4800

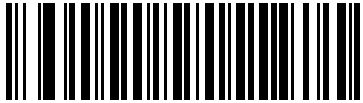
(0x05)



Baud Rate 9600

(0x06)

Baud Rate (continued)



Baud Rate 19,200

(0x07)

Baud Rate 38,400

(0x08)

Parity

Parameter # 0x9E

A parity check bit is the most significant bit of each ASCII coded character. Select the parity type according to host device requirements.

If you select **Odd** parity, the parity bit has a value 0 or 1, based on data, to ensure than an odd number of 1 bits is contained in the coded character.

Odd

(0x00)

If you select **Even** parity, the parity bit has a value 0 or 1, based on data, to ensure than an even number of 1 bits is contained in the coded character.

Even

(0x01)

Parity (continued)

Select **MARK** parity and the parity bit is always 1.

Mark

(0x02)

Select **SPACE** parity and the parity bit is always 0.

Space

(0x03)

If no parity is required, select **NONE**.

None

(0x04)

Software Handshaking

Parameter # 0x9F

This parameter offers control of the data transmission process in addition to that offered by hardware handshaking. Hardware handshaking is always enabled and cannot be disabled by the user.

Disable ACK/NAK Handshaking

When this option is selected, the decoder neither generates nor expects ACK/NAK handshaking packets.

Disable ACK/NAK

(0x00)

Enable ACK/NAK Handshaking

When this option is selected, after transmitting data, the scanner expects either an ACK or NAK response from the host. The scanner also ACKs or NAKs messages from the host.

The scanner waits up to the programmable Host Serial Response Time-out to receive an ACK or NAK. If the scanner does not get a response in this time, it resends its data up to two times before discarding the data and declaring a transmit error.

Enable ACK/NAK

(0x01)

Decode Data Packet Format

Parameter # 0xEE

This parameter selects whether decoded data is transmitted in raw format (unpacketed), or transmitted with the packet format as defined by the serial protocol.

If the raw format is selected, ACK/NAK handshaking is disabled for decode data.

Send Raw Decode Data

(0x00)

Send Packeted Decode Data

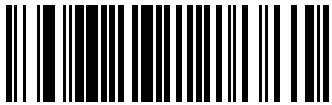
(0x01)

Host Serial Response Time-out

Parameter # 0x9B

This parameter specifies how long the decoder waits for an ACK or NAK before resending. Also, if the decoder wants to send, and the host has already been granted permission to send, the decoder waits for the designated time-out before declaring an error.

The delay period can range from 0.0 to 9.9 seconds in 0.1 second increments. After scanning the bar code below, scan two numeric bar codes beginning on *page 5-102*. Values less than 10 require a leading zero. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

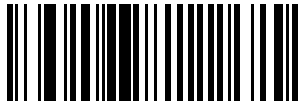


Host Serial Response Time-out

Stop Bit Select

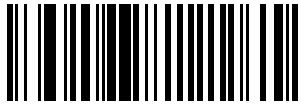
Parameter # 0x9D

The stop bit(s) at the end of each transmitted character marks the end of transmission of one character and prepares the receiving device for the next character in the serial data stream. Set the number of stop bits (one or two) to match host device requirements.



1 Stop Bit

(0x01)



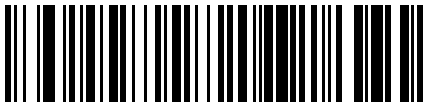
2 Stop Bits

(0x02)

Intercharacter Delay

Parameter # 0x6E

The intercharacter delay gives the host system time to service its receiver and perform other tasks between characters. Select the intercharacter delay option matching host requirements. The delay period can range from no delay to 99 msec in 1 msec increments. After scanning the bar code below, scan two bar codes beginning on *page 5-102* to set the desired time-out. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.

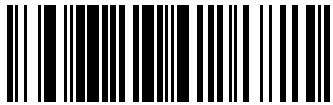


Iintercharacter Delay

Host Character Time-out

Parameter # 0xEF

This parameter determines the maximum time the decoder waits between characters transmitted by the host before discarding the received data and declaring an error. The time-out is set in 0.01 second increments from 0.01 seconds to 0.99 seconds. After scanning the bar code below, scan two bar codes beginning on *page 5-102* to set the desired time-out. To change the selection or cancel an incorrect entry, scan the *Cancel* bar code on *page 5-104*.



Host Character Time-out

Event Reporting

The host can request the decoder to provide certain information (events) relative to the decoder's behavior. Enable or disable the events listed in Table 5-2 by scanning the appropriate bar codes on the following pages. Parameter number format for these parameters follows those shown in Table 6-9 on page 6-25 for parameters numbered 256 or higher.

Table 5-2. Event Codes

Event Class	Event	Code Reported
Decode Event	Non-parameter decode	0x01
Boot Up Event	System power-up	0x03
Parameter Event	Parameter entry error Parameter stored Number expected	0x07 0x08 0x0F

Decode Event

Parameter # 0xF0 0x00

When enabled, the scanner sends a message to the host whenever a bar code is successfully decoded. When disabled, no message is sent.

Enable

(0x01)

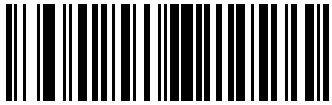
Disable

(0x00)

Boot Up Event

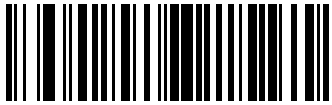
Parameter # 0xF0 0x02

When enabled, the scanner sends a message to the host whenever power is applied. When disabled, no message is sent.



Enable

(0x01)



Disable

(0x00)

Parameter Event

Parameter # 0xF0 0x03

When enabled, the scanner sends a message to the host when one of the events specified in Table 5-2. on *page 5-98* occurs. When disabled, no message is sent.

Enable

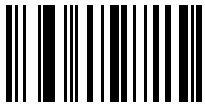
(0x01)

Disable

(0x00)

Numeric Bar Codes

For parameters requiring specific numeric values, scan the appropriately numbered bar code(s).



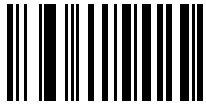
0

1

2

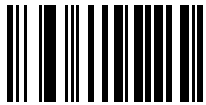
3

Numeric Bar Codes (continued)

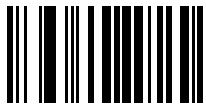


4

5



6



7

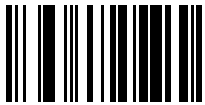
Numeric Bar Codes (continued)

8

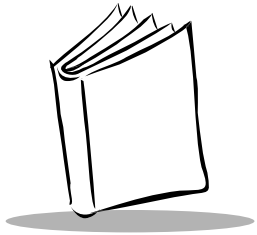
9

Cancel

To change the selection or cancel an incorrect entry, scan the bar code below.



Cancel



Chapter 6
Simple Serial Interface

Overview

This chapter describes the system requirements of the Simple Serial Interface, which provides a communications link between Symbol decoders (e.g., Symbol SE1524ER scan engine, slot scanners, hand-held scanners, two-dimensional scanners, hands free scanners, and RF base stations) and a serial host. SSI allows the host to control the decoder.

Communications

All communications between the decoder and host occur over the hardware interface lines using the SSI protocol. See *Appendix A, Serial Interface Specification*.

The host and the decoder exchange messages in packets. (A packet is a collection of bytes framed by the proper SSI protocol formatting bytes.) The maximum number of bytes per packet allowed by the SSI protocol for any transaction is 257 (255 bytes + 2 byte checksum).

Decode data may be sent as ASCII data (unpacketed), or as part of a larger message (packeted), depending on the decoder configuration.

SSI performs the following functions for the host device:

- Maintains a bi-directional interface with the decoder
- Allows the host to send commands which can control the decoder
- Passes data from the decoder to a host device in the formatted SSI packet format or straight decode message.

The SSI environment consists of a decoder, a serial cable which attaches to the host device, and in some instances, a power supply.

The SSI interface transmits all decode data including special formatting (e.g., AIM ID). The format of this data can be controlled via parameter settings. The decoder may also send parameter information, product identification information or event codes to the host.

All commands sent between the decoder and host must use the format described in *SSI Message Formats* on page 6-5. *SSI Transactions* on page 6-35 describes the required sequence of messages in specific cases.

Table 6-1 lists the SSI opcodes supported by the Symbol SE1524ER. It identifies the SSI partner allowed to send a message of each type. The host transmits type **H** opcodes, the decoder transmits type **D** opcodes, and either partner can transmit Host/Decoder (**H/D**) types.

Table 6-1. SSI Commands

Name	Type	Opcode	Description	Page
AIM_OFF	H	0xC4	Deactivate aim pattern.	6-5
AIM_ON	H	0xC5	Activate aim pattern.	6-7
BEEP	H	0xE6	Sound the beeper.	6-9
CMD_ACK	H/D	0xD0	Positive acknowledgment of received packet.	6-11
CMD_NAK	H/D	0xD1	Negative acknowledgment of received packet.	6-13
DECODE_DATA	D	0xF3	Decode data in SSI packet format.	6-15
EVENT	D	0xF6	Event indicated by associated event code.	6-17
LED_OFF	H	0xE8	De-activate LED output.	6-18
LED_ON	H	0xE7	Activate LED output.	6-19
PARAM_DEFAULTS	H	0xC8	Set parameter default values.	6-20
PARAM_REQUEST	H	0xC7	Request values of certain parameters.	6-21
PARAM_SEND	H/D	0xC6	Send parameter values.	6-24
Note: D = Decoder, H = Host, H/D = Host/Decoder				

Table 6-1. SSI Commands (Continued)

Name	Type	Opcode	Description	Page
REPLY_REVISION	D	0xA4	Reply to REQ_REV contains decoder's software/hardware configuration.	6-26
REQUEST_REVISION	H	0xA3	Request the decoder's configuration.	6-28
SCAN_DISABLE	H	0xEA	Prevent the operator from scanning bar codes.	6-29
SCAN_ENABLE	H	0xE9	Permit bar code scanning.	6-30
SLEEP	H	0xEB	Request to place the decoder into low power.	6-31
START_DECODE	H	0xE4	Tell decoder to attempt to decode a bar code.	6-32
STOP_DECODE	H	0xE5	Tell decoder to abort a decode attempt.	6-33
WAKEUP	H	N/A	Wakeup decoder after it's been powered down.	6-34
Note: D = Decoder, H = Host, H/D = Host/Decoder				

Figure 6-1 shows the general packet format for SSI messages, and Table 6-2 lists the descriptions of fields that occur in all messages. These descriptions are repeated for each opcode in the SSI message formats section. For messages that use the *Data* field, the specific type of data is shown in that field.

Length	Opcode	Message Source	Status	Data	Checksum

Figure 6-1. General Packet Format

Table 6-2. Field Descriptions

Field Name	Format	Sub-Field	Meaning
Length	1 Byte	Length	Length of message not including the check sum bytes. Maximum value is 0xFF.
Opcode	1 Byte	See Table 6-1 for details.	Identifies the type of packet data being sent.
Message Source	1 Byte	0 = Decoder 04 = Host	Identifies where the message is coming from.
Status	Bit 0	Retransmit	0 = First time packet is sent 1 = Subsequent transmission attempts
	Bit 1	Reserved	Always set to zero
	Bit 2	Reserved	Always set to zero
	Bit 3	Change Type (applies to parameters)	0 = Temporary change 1 = Permanent change
	Bits 4 - 7		Unused bits must be set to 0.
Data...	Variable number of bytes	See individual sections for details.	
Checksum	2 Bytes	2's complement sum of message contents excluding checksum.	Checksum of message formatted as HIGH BYTE LOW BYTE
Note: The checksum is a 2 byte checksum and must be sent as HIGH BYTE followed by LOW BYTE.			

SSI Message Formats

The following sections describe each of the SSI messages that can be communicated between the decoder and host. See *SSI Transactions* on page 6-35 for the protocol required to transmit these messages.

AIM_OFF

Description: Turn off aiming pattern

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xC4	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xC4	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

This command applies only to decoders that support an aim pattern .

Decoder Requirements

The decoder turns off the aim pattern, and responds with a CMD_ACK (if ACK/NAK handshaking is enabled).

If the aim pattern is not supported, the decoder responds with NAK_DENIED (if ACK/NAK handshaking is enabled).

AIM_ON

Description: Turn on aiming pattern

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xC5	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xC5	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

This command applies only to decoders which support an aim pattern.

Decoder Requirements

The decoder turns on the aim pattern, and responds with a CMD_ACK (if ACK/NAK handshaking is enabled).

If the aim pattern is not supported, the decoder responds with NAK_DENIED (if ACK/NAK handshaking is enabled).

The Aim Duration parameter controls the amount of time the aiming pattern stays on during a trigger pull. The valid values for this parameter are 0 - 99, which equal 0.1 to 9.9 seconds in 100 msec increments. Table 6-3 lists Aim mode behavior in various situations.

Table 6-3. Aim Mode

Command Sequence	Action performed	Aim duration parameters
AIM_ON	Turn on the aiming pattern indefinitely.	aim duration = 0
AIM_OFF	Turn off the aiming pattern.	aim duration = 0
AIM_ON, START_DECODE	Turn on the aiming pattern, when START_DECODE received turn on scan pattern and begin decoding.	aim duration = 0
AIM_ON,AIM_OFF, START_DECODE	Turn on aiming pattern, turn off aiming pattern, turn on scan pattern and begin decoding.	aim duration = 0
START_DECODE	Turn on aiming pattern for aim duration time, turn on scan pattern and begin decoding.	aim duration > 0

BEEP

Description: Sound the beeper

Packet Format

Length	Opcode	Message Source	Status	Beep Code	Checksum
0x05	0xE6	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xE6	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: unused	1 Byte	Identifies the transmission status. All unused bits must be set to 0.
Beep Code	See Table 6-4.	1 Byte	Number that identifies a beep sequence.
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This opcode instructs the receiver to sound the beep sequence indicated by the Beep Code field.

For Table 6-4, Duration (a relative term) is the length of a sound, Pitch (a relative term) is the pitch of the sound, and Number of Beeps indicates the number of times a beep pitch is repeated at the specified duration.

Table 6-4. Beep Code Definitions

Beep Code	Duration	Pitch	Number of Beeps	Beep Code	Duration	Pitch	Number of Beeps
0x00	Short	High	1	**0x0D**	Long	High	4
0x01	Short	High	2	**0x0E**	Long	High	5
0x02	Short	High	3	**0x0F**	Long	Low	1
0x03	Short	High	4	**0x10**	Long	Low	2
0x04	Short	High	5	**0x11**	Long	Low	3
0x05	Short	Low	1	**0x12**	Long	Low	4
0x06	Short	Low	2	**0x13**	Long	Low	5
0x07	Short	Low	3	**0x14**	Fast Warble	Hi-Lo-Hi-Lo	4
0x08	Short	Low	4	**0x15**	Slow Warble	Hi-Lo-Hi-Lo	4
0x09	Short	Low	5	**0x16**	Mix 1	Hi-Lo	2
0x0A	Long	High	1	**0x17**	Mix 2	Lo-Hi	2
0x0B	Long	High	2	**0x18**	Mix 3	Hi-Lo-Hi	3
0x0C	Long	High	3	**0x19**	Mix 4	Lo-Hi-Lo	3

Host Requirements

The host sends this command to cause the decoder to beep. The host may also send these beep codes as part of the PARAM_SEND directive.

Decoder Requirements

When the decoder receives this command, it beeps the sequence provided in the BEEP directive. If ACK/NAK handshaking is enabled, the decoder ACKs if a valid beep code is requested. Otherwise it sends NAK_DENIED.

CMD_ACK

Description: Positive acknowledgment of received packet

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xD0				

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xD0	1 Byte	Identifies this opcode type.
Message Source	0 = Decoder 4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: unused	1 Byte	Identifies the transmission status. All unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This message is sent to the SSI packet transmitter when the received packet passes the checksum check and no negative acknowledgment conditions apply (see CMD_NAK). If the data is in response to a command (e.g., PARAM_REQUEST, REQUEST_REVISION, etc.), no ACK is sent.

Note: *ACK/NAK handshaking can be disabled, but this is not recommended.*

It is not necessary to respond to a valid ACK or NAK message.

Host Requirements

The decoder must send a CMD_ACK or response data within the programmable Serial Response Time-out to acknowledge receipt of all messages, unless noted otherwise in the message description section. If the host sends data and does not receive a response within the programmable serial response time-out, it resends the message (with the retransmit status bit set) before declaring a failure. The host should limit the number of retries.

Decoder Requirements

The decoder must send a CMD_ACK or response data within the programmable Serial Response Time-out to acknowledge receipt of all messages, unless noted otherwise in the message description section. If the decoder does not receive an ACK within this time period, it sends the previous message again. The decoder retries twice more (with the retransmit status bit set) before declaring a transmit error.

CMD_NAK

Description: Negative acknowledgment of received packet

Packet Format

Length	Opcode	Message Source	Status	Cause	Checksum
0x05	0xD1				

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xD1	1 Byte	Identifies this opcode type.
Message Source	0 = Decoder 4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Cause	Reason code	1 Byte	Identifies the reason the NAK occurred: 0 = Reserved 1 = (RESEND) Checksum failure 2 = (BAD_CONTEXT) Unexpected or Unknown message 3 = Reserved 4 = Reserved 5 = Reserved 6 = (DENIED) Host Directive Denied 7 = Reserved 8 = Reserved 9 = Reserved
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This message is sent when the received packet fails the checksum verification or some error occurred while handling the message.

Note: *ACK/NAK handshaking can be disabled, but this is not recommended.*

It is not necessary to respond to a valid ACK or NAK message.

Table 6-5 describes NAK types supported by the Symbol SE1524ER.

Table 6-5. Decoder-Supported NAK Types

NAK Type	Meaning	Receiver Action
NAK_RESEND	Checksum incorrect.	Ensure checksum is correct. Limit number of resends. Send packet again with resend bit set.
NAK_DENIED	Host is unable to comply with the requested message (e.g., beep code is out of range).	Do not send data with this message again. Developer should check values with specified values. Developer should ensure the proper character is sent, if using wake-up character.
NAK_BAD_CONTEXT	Host does not recognize the command.	

The decoder only resends a message twice. If the message is not sent successfully either time, the decoder declares a transmit error and issues transmit error beeps (LO-LO-LO-LO).

DECODE_DATA

Description: Decode data in SSI packet format

Packet Format

Length	Opcode	Message Source	Status	Bar code Type	Decode Data	Checksum
	0xF3	0x00				

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xF3	1 Byte	Identifies this opcode type.
Message Source	0 = Decoder	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bits 1-7: unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Bar Code Type	See Table 6-6	1 Byte	Identifies the scanned data code type.
Decode Data	<data>	Variable	Data is decoded data including prefix and suffix sent in ASCII format.
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

The decoder uses this opcode when packeted data is selected to send decoded bar code data to the host. The decoded message is contained in the Decode Data field.

Table 6-6 lists all Symbol SE1524ER supported code types. The associated hex value for each code (as required) is entered in the Code Type field.

Table 6-6. Supported Code Types

Not Applicable	0x00	**EAN 8 with 2 Supps.**	0x4A
Code 39	0x01	**EAN 8 with 5 Supps.**	0x8A
Codabar	0x02	**EAN 13**	0x0B
Code 128	0x03	**EAN 13 with 2 Supps.**	0x4B
Discrete 2 of 5	0x04	**EAN 13 with 5 Supps.**	0x8B
Code 32		**MSI Plessey**	0x0E
Interleaved 2 of 5	0x06	**EAN 128**	0x0F
Code 93	0x07	**UPC E1**	0x10
UPC A	0x08	**UPC E1 with 2 Supps.**	0x50
UPC A with 2 Supps.	0x48	**UPC E1 with 5 Supps.**	0x90
UPC A with 5 Supps.	0x88	**Trioptic Code 39**	0x15
UPC E0	0x09	**Bookland EAN**	0x16
UPC E0 with 2 Supps.	0x49	**Coupon Code**	0x17
UPC E0 with 5 Supps.	0x89	**GS1 DataBar Limited**	0x23
ISPT		**GS1 DataBar-14**	0x24
SSI INS		**GS1 DataBar Expanded**	0x25
EAN 8	0x0A		

Host Requirements

If DECODE_EVENT reporting is enabled, the beep event message is received prior to the DECODE_DATA message. If ACK/NAK handshaking is enabled, the host responds to each of these messages.

Decoder Requirements

Decode data is sent in this format if packeted decode data is selected via parameter. The host responds to this message with a CMD_ACK, if ACK/NAK handshaking is enabled.

EVENT

Description: Indicate selected events occurred

Packet Format

Length	Opcode	Message Source	Status	Event Code	Checksum
0x05	0xF6	0x00			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xF6	1 Byte	Identifies this opcode type.
Message Source	0 = Decoder	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Event Code	Type of Event Code.	1 Byte	See Table 5-2 on page 5-98
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

The decoder sends this message when an enabled event occurs. Use Table 5-2 on page 5-98, and parameters 0xF0 0X00 through 0xF0 0X07 to determine which events should be reported.

Host Requirements

The host receives this message when a selected event occurs.

Decoder Requirements

Generate this message when a selected event occurs.

LED_OFF

Description: De-activate LED output

Packet Format

Length	Opcode	Message Source	Status	LED Selection	Checksum
0x05	0xE8	0x04		0x01	

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xE8	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
LED Selection	Bit 0 - 7: LED bit numbers to turn off.	1 Byte	Bit 0 = decode LED All other bits should be set to 0.
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

The host sends this message to turn off the decode LED.

Host Requirements

None.

Decoder Requirements

The decoder turns off the decode LED.

LED_ON

Description: Activate LED output

Packet Format

Length	Opcode	Message Source	Status	LED Selection	Checksum
0x05	0xE7	0x04		0x01	

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xE7	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
LED Selection	Bit 0 - 7: LED bit numbers to turn on.	1 Byte	Bit 0 = decode LED All other bits should be set to 0.
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

The host sends this message to turn on the decode LED.

Host Requirements

None.

Decoder Requirements

The decoder turns on the decode LED.

PARAM_DEFAULTS

Description: Sets the parameters to their factory default values

Packet Format

Length	Opcode	Message Source	Status	Checksum
0x04	0xC8	0x04		

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xC8	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This command returns all parameters to their factory default settings.

Host Requirements

The host sends this command to reset the decoder's parameter settings to the factory default values.

Decoder Requirements

Upon receiving this command, the decoder resets all its parameters to the factory default values. The behavior is the same as scanning a SET DEFAULTS bar code.

PARAM_REQUEST

Description: Request values of selected parameters

Packet Format

Length	Opcode	Message Source	Status	Request Data	Checksum
	0xC7	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xC7	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Request Data	<Param_num><Param_num><Param_num>...	Variable	
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

The host uses this message to request selected parameters from the decoder.

Host Requirements

The host requests the decoder's current values for specific parameters by listing the parameter numbers in the Request_Data field. If the host asks for a parameter value not supported by the decoder, the decoder does not send a value for this unsupported param_num. If none of the requested values is supported, the decoder transmits an empty PARAM_SEND message. If the host requests the value of all the parameters, it sends a special param_num called ALL_PARAMS (0xFE) in the first position of the Request_Data field.

Note: *The decoder's response to this command is PARAM_SEND, not ACK. Depending on the time-out set and the number of parameters requested, this reply can fall outside the programmable Serial Response Time-out. If this occurs, this is not a time-out error. To compensate, increase the time-out.*

Decoder Requirements

When the decoder receives this message, it processes the information by formatting a PARAM_SEND message containing all requested parameters supported and their values. The programmable Serial Response Time-out can be exceeded when processing this message, depending on the time-out set and the number of parameters requested.

Tips for Requesting Parameter Values

Before forming a PARAM_REQUEST, confirm that the decoder supports the requested parameters (Table 6-7). To find out what parameters are supported, send an 0xFE (request all parameters). The response to this is a PARAM_SEND which contains all the supported parameters and their values.

Table 6-7. Example of Supported Parameter Numbers

Supported Parameter Number	Associated Parameter Values
01	00
02	01
9C	07
E6	63

0xFE must be in the first position of the request_data field if used, or it is treated as an unsupported parameter.

Unsupported parameters are not listed in the PARAM_SEND response. Requesting unsupported parameters has no effect, but can cause delays in responding to requests for valid parameters. See Table 6-8 for example requests and responses.

Table 6-8. Example Requests and Replies

PARAM_REQUEST message		Response PARAM_SEND message
#ALL	05 C7 04 00 FE FE 32	0D C6 00 00 FF 01 00 02 01 9C 07 E6 63 FC 3E
#1, 9C	06 C7 04 00 01 9C FE 92	09 C6 00 00 FF 01 00 9C 07 FD 8E
#All, 1, 9C	07 C7 04 00 FE 01 9C FD 93	0D C6 00 00 FF 01 00 02 01 9C 07 E6 63 FC 3E
#1, 9C, ALL	07 C7 04 00 01 9C FE FD 93	09 C6 00 00 FF 01 00 9C 07 FD 8E
#4	05 C7 04 00 04 FF 2C	05 C6 00 00 FF FE 36
#ALL - 3 times	07 C7 04 00 FE FE FE FC 34	0D C6 00 00 FF 01 00 02 01 9C 07 E6 63 FC 3E
#1 -3 times	07 C7 04 00 01 01 01 FF 2B	0B C6 00 00 FF 01 00 01 00 01 00 FE 2D

PARAM_SEND

Description: Respond to a PARAM_REQUEST, change particular parameter values

Packet Format

Length	Opcode	Message Source	Status	Beep Code	Param data	Checksum
	0xC6					

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xC6	1 Byte	Identifies this opcode type.
Message Source	0 = Decoder 4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bits 1, 2: Unused Bit 3: Change Type Bits 4-7: Unused	1 Byte	Bit 0: 1 indicates a retransmit Bit 3: 1 Permanent change 0 Temporary change - lost when power removed. Unused bits must be set to 0.
Beep code	See Table 6-4 on page 6-10.	1 Byte	If no beep is required, set this field to 0xFF.
Param_data	See Table 6-9 on page 6-25.		The parameter numbers and data to be sent to the requester.
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This message is sent by the decoder in response to the PARAM_REQUEST message, or by the host to change the decoder's parameter values.

Parameter numbers 0xF0 (+256), 0xF1 (+512), 0xF2 (+768) are used to access parameters whose numbers are 256 and higher. For example, to access the first parameter in the 256-511 range, use 0xF0 and 0x00.

Table 6-9. Parameter Data Format

Parameter Number	Data Format
0 through 0xEF	<param_num> <value>
0xF0, 0xF1, 0xF2	<extended parameter code> <param_num offset> <value>

Host Requirements

Note: *Due to the processing time of interpreting and storing parameters contained in the message, the decoder may not be able to send an ACK within the programmable Serial Response time-out. This is not an error; to compensate, increase the time-out.*

The host transmits this message to change the decoder's parameters. Be sure the Change Type bit in the Status byte is set as desired. If no beep is required, the beep code must be set to 0xFF, or the decoder beeps as defined in Table 6-4.

Decoder Requirements

When the decoder receives a PARAM_SEND, it interprets and stores the parameters, then ACKs the command (if ACK/NAK handshaking is enabled). These parameters are stored permanently only if the Change Type (bit 3 of the Status byte) is set to 1. If bit 3 is set to 0 the changes are temporary, and are lost when the decoder is powered down.

If the host sends the PARAM_SEND with a valid beep code, the decoder issues the requested beep sequence and changes the requested parameter values.

The decoder issues a PARAM_SEND in response to a PARAM_REQUEST from the host. It responds to the PARAM_REQUEST message by sending all supported parameter values. No value is sent for any unsupported param_num. If none of the requested values is supported, the PARAM_SEND message is transmitted with no parameters. When sending this command, the Change Type bit (bit 3 of Status byte) can be ignored.

REPLY_REVISION

Description: Reply to REQUEST_REVISION command with software revision string

Packet Format

Length	Opcode	Message Source	Status	Revision	Checksum
	0xA4	0x00			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xA4	1 Byte	Identifies this opcode type.
Message Source	0 = Decoder	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Revision	ASCII data	variable	Software revision in ASCII (see format below).
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

None.

Decoder Requirements

The decoder sends its revision string to the host. The revision string is in the following format:

S/W_REVISION <space> BOARD_TYPE <space> SCANNER_ID <space> PGM_CHKSUM

where:

- **S/W_REVISION** is the release name of the software
- **BOARD_TYPE** is *N* for non-flash decoder board, *F* for flash
- **SCANNER_ID** indicates the type of scan engine paired with the decoder
- **PGM_CHKSUM** is the two-byte checksum of the program code.

The scan engine code for the Symbol SE1524ER (Aim/Scanstand) is **0x45.**

REQUEST_REVISION

Description: Request the software revision string from the decoder

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xA3	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xA3	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

The host sends this message to request revision information from the decoder. The decoder responds with REPLY_REVISION.

Decoder Requirements

The decoder sends its revision string to the host. See *REPLY_REVISION* for format.

SCAN_DISABLE

Description: Prevent the decoder from scanning bar codes

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xEA	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xEA	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

All scan attempts are disabled by this command until either a SCAN_ENABLE is sent, or the decoder is reset.

Decoder Requirements

When the decoder receives this command, it ignores all trigger/START_DECODE requests until a SCAN_ENABLE command is received.

SCAN_ENABLE

Description: Permit the decoder to scan bar codes

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xE9	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xE9	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

The host sends the SCAN_ENABLE command to enable scanning in the decoder. Scanning is enabled upon power-up, so this command need only be send if a prior SCAN_DISABLE command was sent.

Decoder Requirements

The decoder allows scanning and decoding upon receipt of this command.

Note: *At initial power-up, the decoder assumes SCAN_ENABLED.*

SLEEP

Description: Request to place the decoder into low power mode

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xEB	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xEB	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

Host Requirements

The host sends this command to place the decoder into low power mode. If the low power mode parameter is enabled, the scanner goes into low power mode automatically, and the SLEEP command is not necessary.

Note: *The decoder may not sleep immediately upon acknowledging the command if it is busy processing data.*

Decoder Requirements

None.

START_DECODE

Description: Tell decoder to attempt to decode a bar code

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xE4	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xE4	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This command tells the decoder to start a scan and decode session. The decode session ends with a successful decode, a scan session time-out, or a STOP_DECODE command.

Host Requirements

If the TRIGGER_MODE parameter is set to HOST, the host can use this command instead of a trigger pull.

Decoder Requirements

None.

STOP_DECODE

Description: Tell decoder to abort a decode attempt

Packet Format

Length	Opcode	Message Source	Status	Data	Checksum
0x04	0xE5	0x04			

Field Descriptions

Field Name	Format	Size	Description
Length	Length of message (not including checksum).	1 Byte	Length Field
Opcode	0xE5	1 Byte	Identifies this opcode type.
Message Source	4 = Host	1 Byte	Identifies where the message is coming from.
Status	Bit 0: Retransmit Bit 1-7: Unused	1 Byte	Identifies the transmission status. Unused bits must be set to 0.
Data			None
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

This command tells the decoder to stop a scan and decode attempt.

Host Requirements

The TRIGGER_MODE parameter must be set to HOST.

Decoder Requirements

None.

WAKEUP

Description: Wakeup decoder after it's been put into low power operation

If the decoder is in low power mode, sending the single character, **NULL** (0x00) wakes up the decoder. This character is only needed when hardware handshaking is not used or is bypassed. (See *Power Management* on page 1-5.)

Host Requirements

Once the WAKEUP character is sent, the host must wait at least 10 msec, but less than 1 second before sending additional data, since the decoder is required to wait 1 second after waking up before going back to sleep (if low power mode is enabled).

Decoder Requirements

The decoder must not return to low power mode for at least 1 second after waking up.

Note: *The mechanism to wake up a decoder in this manner also works if characters other than WAKEUP are sent to the decoder. There is, however, no guarantee that these commands are interpreted correctly upon power-up. Therefore, it is not recommended that characters other than WAKEUP be used to awaken the decoder.*

The WAKEUP character has no effect if sent when the scanner is awake. If the host is unsure of the scanner state, it can send the wakeup character anytime it wants to communicate with the scanner.

SSI Transactions

General Data Transactions

ACK/NAK Handshaking

If ACK/NAK handshaking is enabled, all packeted messages must have a CMD_ACK or CMD_NAK response, unless the command description states otherwise. This parameter is enabled by default. This handshaking should remain enabled to provide feedback to the host. Raw decode data and WAKEUP do not use ACK/NAK handshaking since they are not packeted data.

Following is an example of a problem that can occur when ACK/NAK handshaking is disabled:

- The host sends a PARAM_SEND message to the decoder to change the baud rate from 9600 to 19200.
- The decoder cannot interpret the message.
- The decoder does not implement the changes requested by the host.
- The host assumes that the parameter changes have occurred and acts accordingly.
- Communications are lost because the change did not occur on both sides.

If the ACK/NAK handshaking is enabled, the following occurs:

- The host sends a PARAM_SEND message.
- The decoder cannot interpret the message.
- The decoder CMD_NAKs the message.
- The host resends the message.
- The decoder receives the message successfully, responds with CMD_ACK, and implements parameter changes.

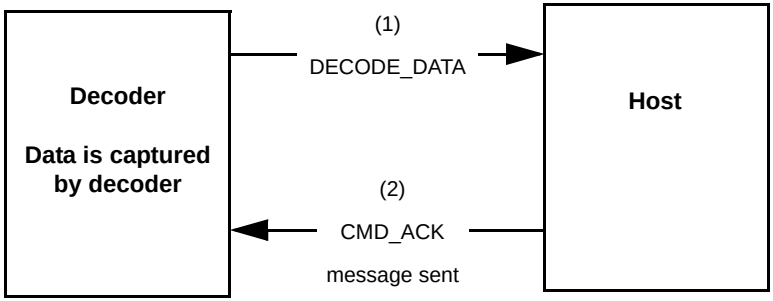
Transfer of Decode Data

The Decode Data Packet Format parameter controls how decode data is sent to the host. When this parameter is set, the data is sent in a DECODE_DATA packet. When the parameter is cleared, the data is transmitted as raw ASCII data.

Note: *When decode data is transmitted as raw ASCII data, ACK/NAK handshaking does not apply regardless of the state of the ACK/NAK handshaking parameter.*

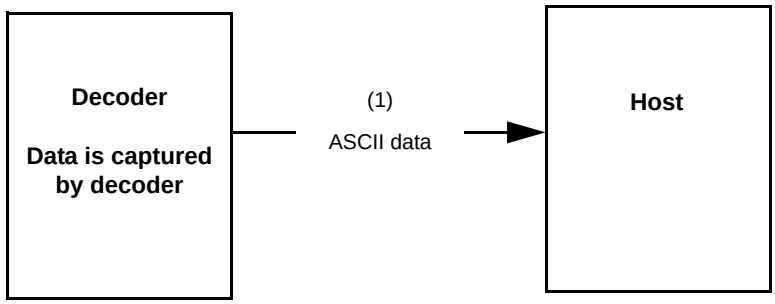
ACK/NAK Enabled and Packeted Data

The decoder sends a DECODE_DATA message after a successful decode. The decoder waits a programmable time-out for a CMD_ACK response. If it does not receive the response, the decoder tries to send twice more before issuing a host transmission error. If the decoder receives a CMD_NAK from the host, it may attempt a retry depending on the cause field of the CMD_NAK message.



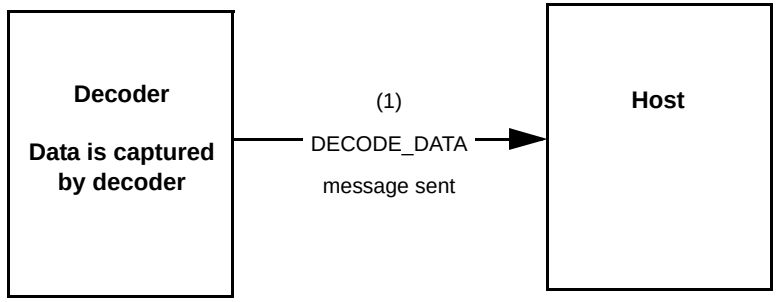
ACK/NAK Enabled and Unpacketed ASCII Data

Even though ACK/NAK handshaking is enabled, no handshaking occurs because the handshaking applies only to packeted data. In this example the packeted_decode parameter is disabled.



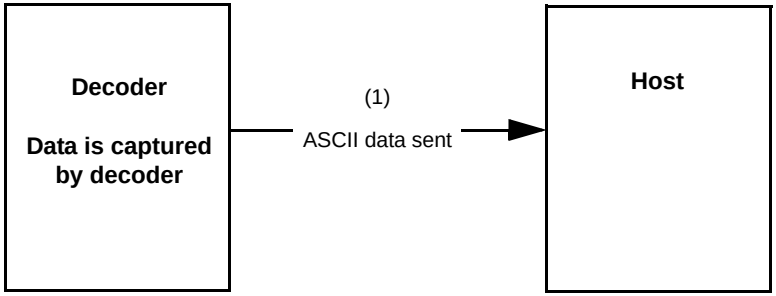
ACK/NAK Disabled and Packeted DECODE_DATA

In this example ACK/NAK does not occur even though packeted_decode is enabled because the ACK/NAK handshaking parameter is disabled.



ACK/NAK Disabled and Unpacketed ASCII Data

Data captured by the decoder is sent to the host.



Communication Summary

RTS/CTS Lines

All communication must use RTS/CTS handshaking as described in *Appendix A, Serial Interface Specification*.

ACK/NAK Option

ACK/NAK handshaking can be enabled or disabled. This handshaking is enabled by default; disabling this is not recommended as it can lead to communication problems, since handshaking is the only indication that a message was received and if it was received correctly. ACK/NAK is not used with unpacketed decode data regardless of whether or not this option is enabled.

Number of Data Bits

All communication with the decoder must use eight bit data.

Serial Response Time-out

The Serial Response Time-out parameter determines how long to wait for a handshaking response before trying again, or aborting any further attempts. Both the host and decoder should use the same value for this parameter.

Note: *A temporary change can be made to the Serial Response Time-out when the host takes longer to process an ACK, or longer data string. Frequent permanent changes are not recommended due to limited write cycles of non-volatile memory.*

Retries

When sending data, the host should resend twice after the initial send if the decoder does not respond with an ACK or NAK (if ACK/NAK handshaking is enabled), or response data (e.g., PARAM_SEND, REPLY_REVISION). If the decoder replies with a NAK RESEND, the host resends the data. All resent messages must have the resend bit set in the Status byte.

The decoder resends data two times after the initial send if the host fails to reply with an ACK or NAK (if ACK/NAK handshaking is enabled).

Baud Rate, Stop Bits, Parity, Response Time-out, ACK/NAK Handshake

If these serial parameters are changed using PARAM_SEND, the ACK response to the PARAM_SEND uses the previous values for these parameters. The new values then take effect for the subsequent transaction.

Errors

The decoder generates a communication error when:

- The CTS line is asserted when the decoder tries to transmit, and is still asserted on each of 2 successive retries
- Failure to receive an ACK or NAK after initial transmit and two resends.

SSI Communication Notes

If hardware handshaking is not used, messages should be spaced sufficiently apart, and the host must not communicate with the Symbol SE1524ER if the SE1524ER is sending.

If hardware handshaking is used, frame each message properly with the handshaking signals. Do not try to send two commands within the same handshaking frame.

There is a permanent/temporary bit in the PARAM_SEND message. Temporary changes are lost when power is removed from the Symbol SE1524ER. Permanent changes are written to non-volatile memory. Frequent changes shorten the life of the non-volatile memory.

Do not scan parameter bar codes and send parameters via SSI simultaneously. All parameters can be accessed via SSI, so parameter bar code scanning is not necessary.

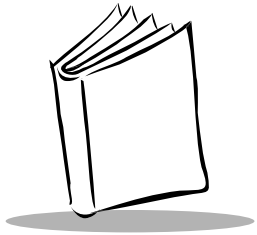
Host Interruption

The host can interrupt decoder transmission by asserting host RTS. The decoder must detect this, halt transmission, and assert decoder RTS (host CTS).

If the host does not transmit at least one byte before de-asserting host RTS the decoder does not detect a transmission (and de-assert to the decoder RTS). The decoder resumes the transmission (from where it left off) with the next byte.

If the host transmits (at least one byte) before deasserting host RTS the decoder detects the transmission and does not resume transmission. When the host deasserts host RTS, the decoder begins re-transmitting the data from the beginning.

If the host transmits a message the decoder processes and responds to the message. The decoder then re-transmits the entire interrupted message from the beginning.



Appendix A
Serial Interface Specification

Purpose

The Serial Interface Specification (SIF) describes the requirements that two digital systems must meet to exchange asynchronous serial data. SIF deals only with the physical flow control and asynchronous serial transmission of data between two digital systems. This specification does not impose any requirements on how the data is packaged and the number of characters exchanged.

SIF data exchange generates errors under certain conditions but does not specify the actions to take to correct the error. This is the responsibility of the software/hardware layer above SIF.

Terms and Definitions

Systems

Unless otherwise noted, the systems described in this specification are digital systems.

Inactive

Each system interprets what physical quantity represents inactive. To communicate, two systems must have the same interpretation of inactive.

The Decoder and the Host

The two systems described in this specification are the decoder and the host. Only one host is allowed to exist at any time.

A Character

This chapter uses the term *character* to generalize a unit piece of information. This unit could be in bit, byte, word, etc.

Data

Data refers to a group of characters.

Tolerances

Unless otherwise noted, all numeric figures stated in this document have a tolerance of ± 5%.

Common Attributes

This section describes requirements common to the decoder and the host.

Note: *SIF is a half-duplex communication protocol. To maintain proper communication, the requirements in this section must be met.*

All SIF systems have four signal lines. Two are for handshaking and two are for transmitting and receiving serial data.

Many communications packages do not properly use the handshaking lines for half duplex communications. If using a PC communications package such as Windows Terminal, disconnect the hardware handshaking lines from the interface.

The software application libraries included with the optional Symbol SE1524ER Developer's Kit provide code to perform proper handshaking.

Table A-1 lists the decoder's signal lines, and Table A-2 lists the host's signal lines.

Table A-1. Decoder Signal Lines

TXD	Serial data transmit output. Drives the serial data receive input of the host.
RXD	Serial data receive input. Driven by the serial data transmit output of the host.
RTS	Request-to-send handshaking line (output). See *The Decoder* on page A-3.
CTS	Clear-to-send handshaking line (input). See *The Decoder* on page A-3.

Table A-2. Host Signal Lines

HOST RXD	Serial data receive input. Driven by the serial data transmit output of the decoder.
HOST TXD	Serial data transmit output. Drives the serial data receive input of the decoder.
HOST CTS	Decoder transmit request (input). See *The Host* on page A-5.
HOST RTS	Decoder transmit request granted (output). See *The Host* on page A-5.

Figure A-1 shows the decoder and host signal relationships.

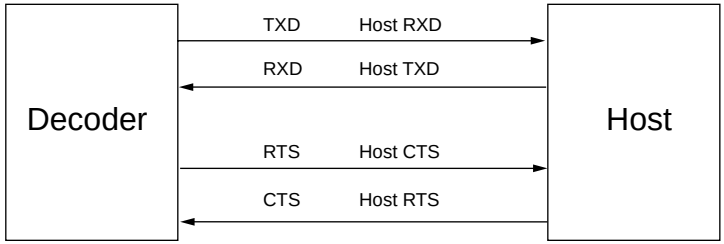


Figure A-1. Decoder and Host Signals

The Decoder

This section describes the requirements that are specific to the decoder.

Transmitting Data

When the decoder needs to send information, it must first check the CTS line to see if the host is trying to transmit.

Once the bus is available, the decoder can transmit. The decoder is responsible for:

- any programmed intercharacter delays
- retrying if the host communicates during decoder transmission

Sample Code for Decoder Transmit Procedure

```
boolean decoder_xmit()
   IF (host is requesting to send) THEN
      enable receiving
```

```
      give host permission to send
      set up serial response time out
      WHILE (host is still requesting to send) DO
         IF (character was received OR timed out) THEN
            RETURN (FALSE)   /* abort transmit */
         END
      END
      disable receiving
      remove host's permission to send
   END
   WHILE (there are characters to send) DO
      IF (host is not requesting to send) THEN
         send next character
      ELSE
         enable receiving
         give host permission to send
         WHILE (host is still requesting to send) DO
            IF (character was received) THEN
               RETURN (FALSE)   /* abort transmit */
            END
         END
         disable receiving
         remove host's permission to send
      END   /* resume transmit */
   END
   RETURN (TRUE)
```

Receiving Data

The decoder can receive data whenever it grants permission to the host to send its data. If the host is transmitting data, the maximum character-to-character delay allowed is determined by the Host Intercharacter Time-out parameter. The decoder may discard any received data if the host exceeds this time limit.

Sample Code for Decoder Receive Procedure

```
void decoder_receive()
   IF (host is requesting to send) THEN
      give host permission to send
      WHILE (no characters received) DO
```

```
            IF (host is no longer requesting to send) THEN
               remove host's permission to send
               RETURN   /* NULL xmit - do not NAK */
            END
         END
         set up host character time out
         WHILE (not timed out AND not the last character) DO
            IF (a character was received) THEN
               reset host character time out
            END
         END
         WHILE (host is requesting to send) DO
            wait   /* for host to end handshake */
         END
         remove host's permission to send
         process received message and prepare response
      END
      RETURN
```

The Host

This section describes the requirements specific to the host.

Transmitting Data

The host only transmits after receiving permission from the decoder. There is no limit to the number of characters per transmit. However, the maximum character-to-character delay cannot exceed the Host Intercharacter Time-out parameter. The HOST RTS signal must return to inactive at the end of transmission (unless the host wants to temporarily prevent the decoder from transmitting).

If the transmit procedure fails, the host must wait for some randomly generated time period before trying again.

Sample Code for Host Transmit Procedure

```
boolean host_transmit()
   request permission to send
   WHILE (the last character has not been sent) DO
      set up serial response time out
      WHILE (permission has not been granted) DO
         IF (serial response time out expired) THEN
```

```
            remove request to send   /* transmit failed */
          RETURN (FALSE)   /* calling function may retry transmit
*/
         END
      END
      transmit a character
   END
   remove request to send
   RETURN (TRUE)   /* transmit successful */
```

Receiving Data

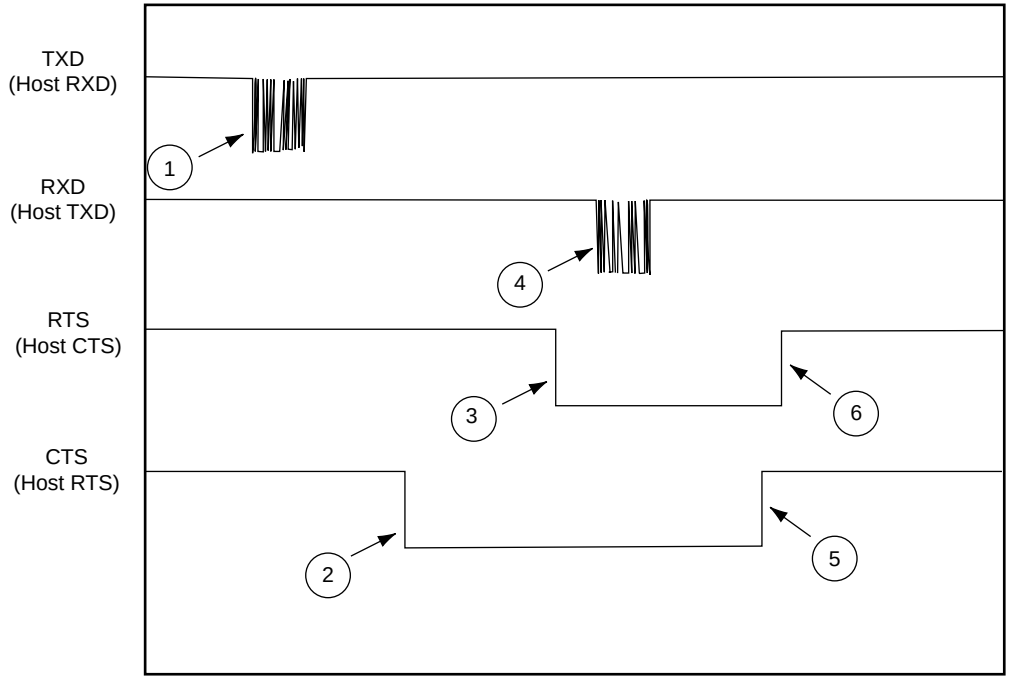
The host must be ready to receive data from the decoder anytime the host is not transmitting. The host can temporarily prevent the decoder from transmitting by using the Host RTS line.

Sample Code for Host Receive Procedure

```
void host_receive()
   IF (a character has been received) THEN
      set up intercharacter time out
      WHILE (not timed out AND not the last character) DO
         IF (host can receive right now) THEN
            deassert host RTS   /* in case host was holding off
decoder */
            IF (a character was received) THEN
               reset intercharacter time out
            END
         ELSE
            IF (host wants to send to decoder) THEN
               RETURN   /* so host can transmit */
            ELSE
               request to send   /* to hold off the decoder */
               set up new intercharacter time-out
            END
         END
      END
      process received message and prepare response
      RETURN
   END
   RETURN
```

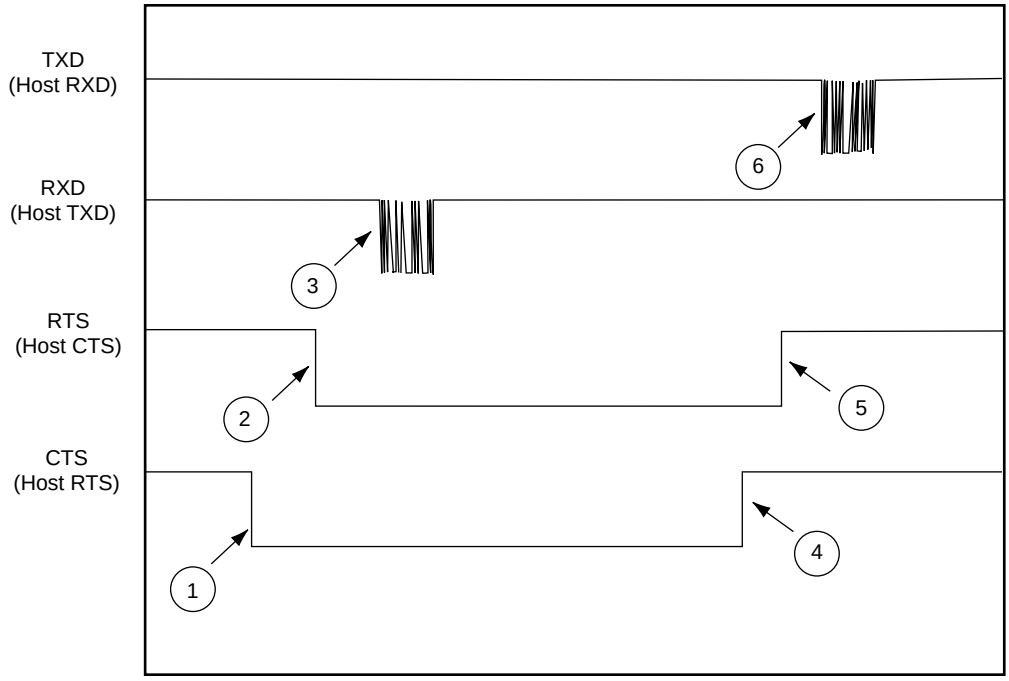
Transaction Examples

Various transaction examples are shown in Figure A-2 through Figure A-9.



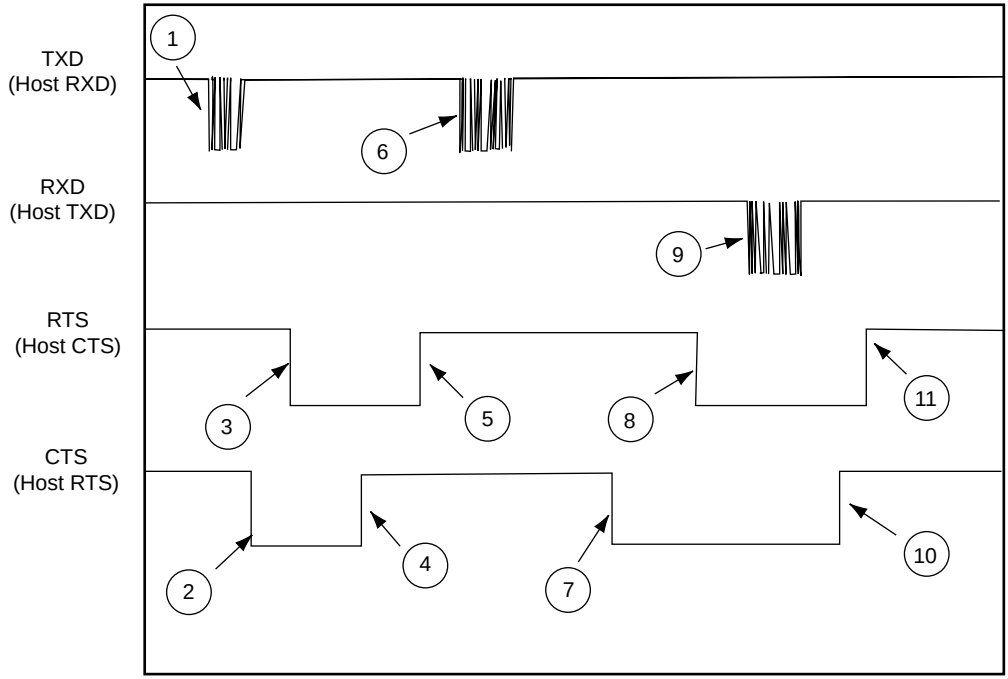
1. Decoder data
2. Host requests to send
3. Decoder grants permission
4. ACK response
5. Host removes request
6. Decoder removes permission

Figure A-2. Basic Decoder Initiated Transaction



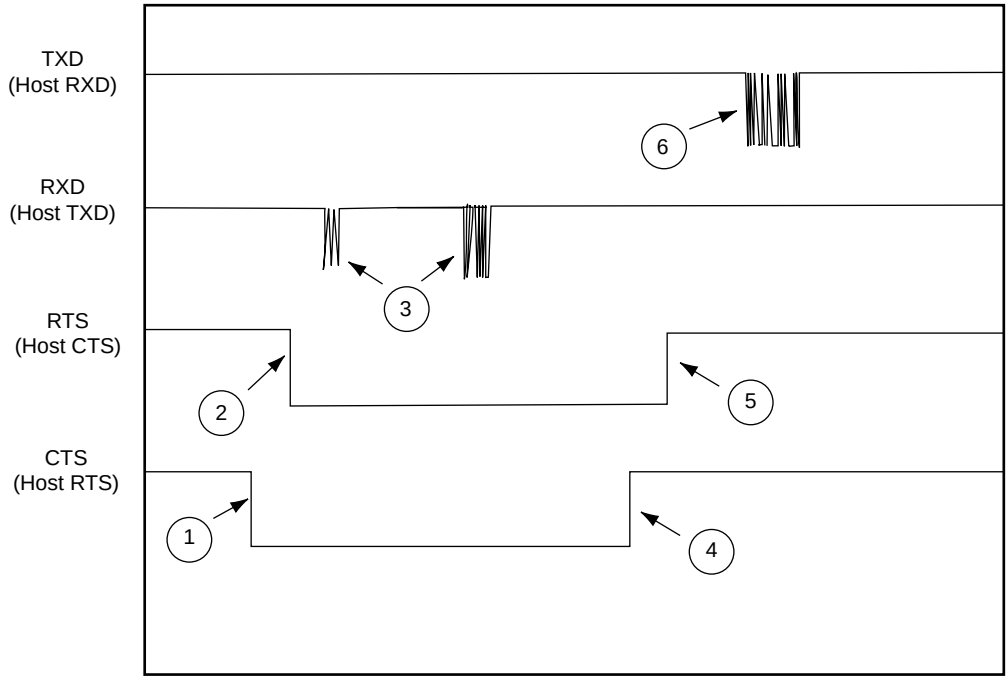
1. Host requests to send
2. Decoder grants permission
3. BEEP command sent
4. Host removes request
5. Decoder removes permission
6. Decoder ACKs

Figure A-3. Basic Host Initiated Transaction



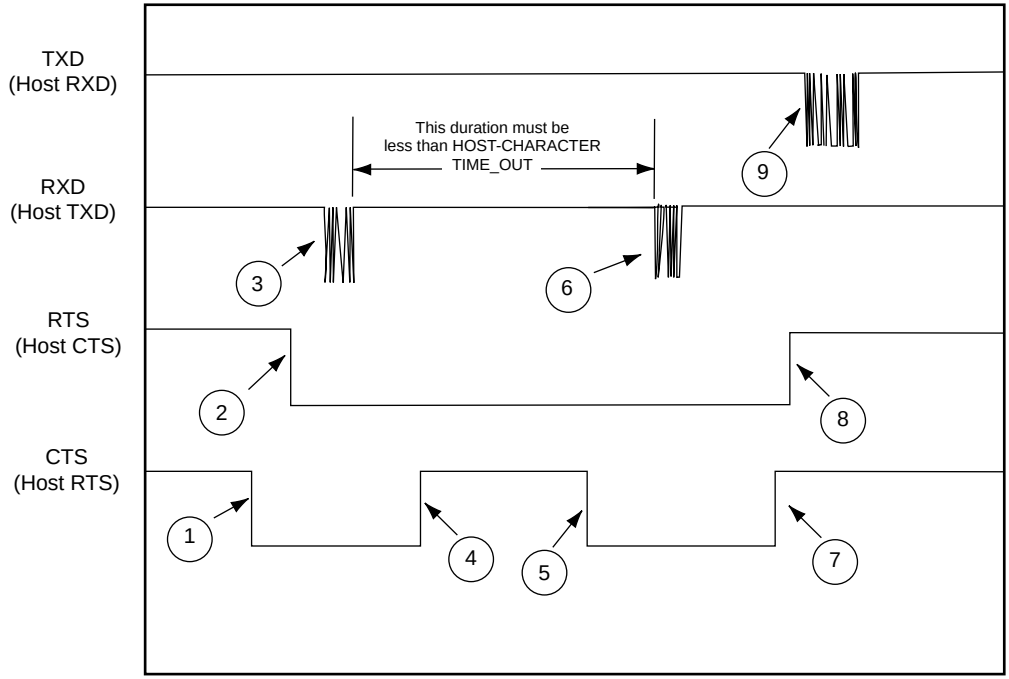
1. Decoder starts to transmit
2. Host asserts RTS causing transmission pause
3. Decoder grants permission for host to send
4. Host removes request without sending
5. Decoder removes permission
6. Decoder resumes transmission
7. Host requests permission to send ACK
8. Decoder grants permission
9. Host sends ACK
10. Host removes request when finished sending
11. Decoder removes permission

Figure A-4. Host Interrupting Decoder's Transmission



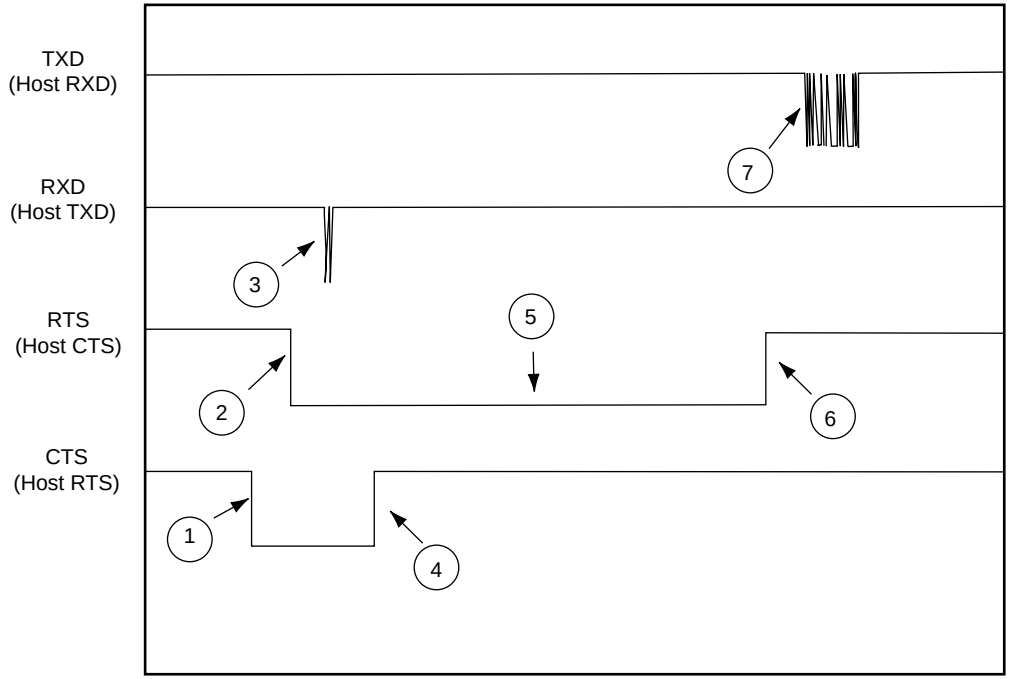
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 3 nulls, then BEEP command
4. Host removes request when finished sending
5. Decoder removes permission
6. Decoder ACKs

Figure A-5. Host Initiated Transmission with Leading Nulls (Decoder in Continuous Power Mode)



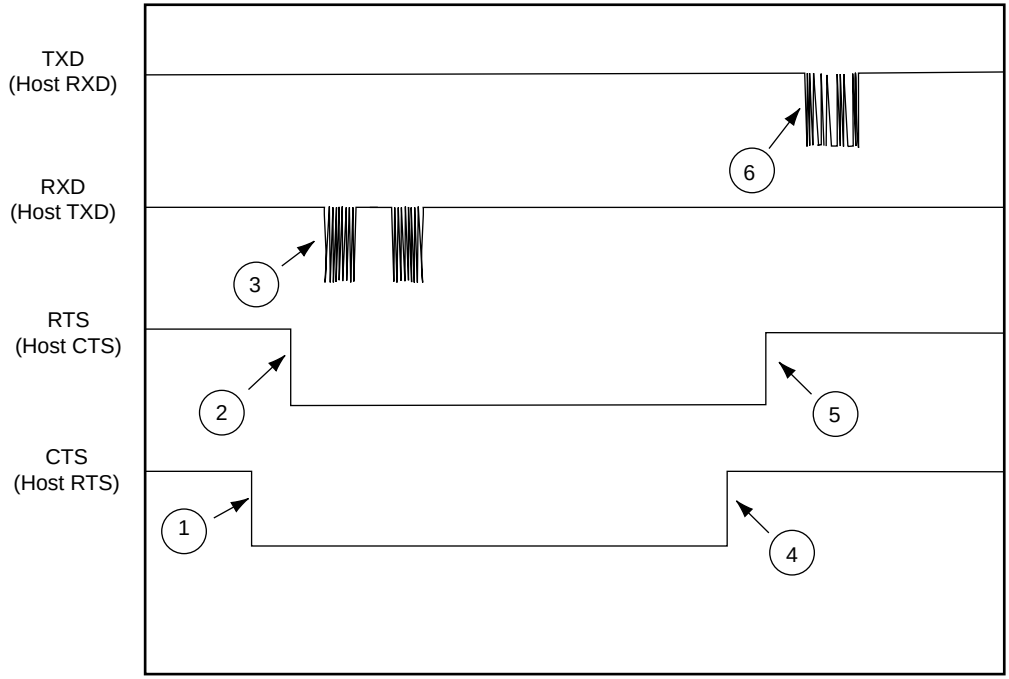
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 1/2 BEEP command
4. Host removes request (ignored by decoder until transmit complete or timed out)
5. Host requests again (ignored by decoder until transmit complete or timed out)
6. Host sends remainder of BEEP command
7. Host removes request
8. Decoder removes permission
9. Decoder ACKs

Figure A-6. Host Initiated Transaction with Host Pausing and Releasing RTS During Transmission



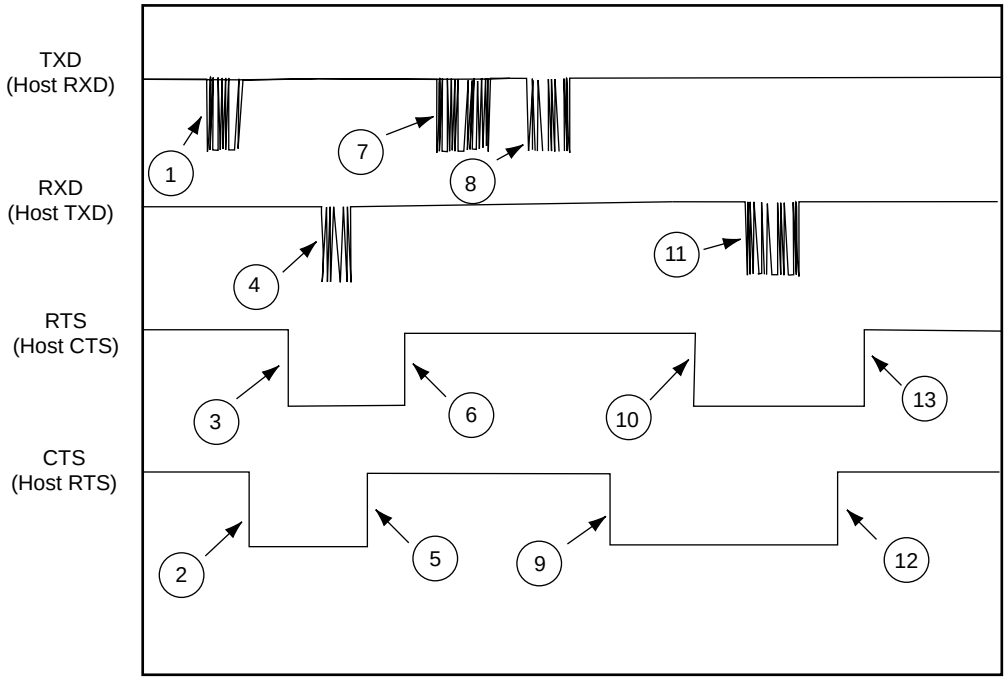
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 2 characters of message
4. Host removes request
5. RTS remains low because decoder is still expecting data
6. Decoder times out waiting for a character and removes permission
7. Decoder sends a NAK resend

Figure A-7. Error Transmission: Host Sends Only First 2 Characters of 6 Character Message



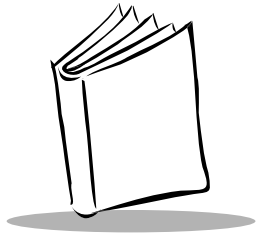
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 2 BEEP commands instead of 1
4. Host removes request
5. Decoder removes permission
6. Decoder ACKs first BEEP command

Figure A-8. Error Condition: Host Sends 2 Valid BEEP Commands Back to Back



1. Decoder starts to transmit
2. Host requests permission
3. Decoder grants permission
4. Host causes abort by sending BEEP
5. Host removes request
6. Decoder removes permission
7. Decoder ACKs
8. Decoder resends data
9. Host requests permission
10. Decoder grants permission
11. Host ACKs
12. Host removes request
13. Decoder removes permission

Figure A-9. Host Causes Decoder to Abort Transmission



Appendix B
Miscellaneous Code Information

This Appendix provides information on the following:

UCC/EAN-128

UCC/EAN-128 is a standard for printing data fields with Code 128 bar code symbols. UCC/EAN-128 symbols are distinguished by a leading FNC 1 character as the first or second character in the symbol. Other FNC 1 characters are used to delineate fields.

When EAN-128 symbols are read, they are transmitted after special formatting strips off the leading FNC 1 character, and replaces other FNC 1 characters with the ASCII 29 GS control character.

When AIM symbology identifiers are transmitted, the modifier character indicates the position of the leading FNC 1 character according to AIM guidelines. For example, **]C1** indicates a UCC/EAN-128 symbol with a leading FNC1 character.

Standard Code 128 bar codes which do not have a leading FNC 1 can still be used, but are not encoded according to the EAN-128 convention. Standard Code 128 and UCC/EAN-128 can be mixed in an application. The Symbol SE1524ER autodiscriminates between these symbols, and can enable or disable one or both code types via bar code menus.

Table B-1 indicates the behavior of the Symbol SE1524ER in each of the four possible parameter settings.

Table B-1. Reading Standard Code 128 & UCC/EAN 128

Standard Code 128	UCC/EAN-128	Effect and Example
Disable	Disable	No Code 128 symbols can be read.
Disable	Enable	Read only symbols with leading FNC 1. Examples: ^{FNC1}ABCD^{FNC1}E are read as ABCD^{29}E A^{FNC1}BCD^{FNC1}E are read as ABCD^{29}E ^{FNC1FNC1}ABCD^{FNC1}E are read as ABCD^{29}E ABCD^{FNC1}E cannot be read ABCDE cannot be read
Enable	Disable	Read only symbols without leading FNC 1. Examples: ^{FNC1}ABCD^{FNC1}E cannot be read A^{FNC1}BCD^{FNC1}E cannot be read ^{FNC1FNC1}ABCD^{FNC1}E cannot be read ABCD^{FNC1}E is read as ABCD^{29}E ABCDE is read as ABCDE
Enable	Enable	Read both types of symbols. Examples: ^{FNC1}ABCD^{FNC1}E are read as ABCD^{29}E A^{FNC1}BCD^{FNC1}E are read as ABCD^{29}E ^{FNC1FNC1}ABCD^{FNC1}E are read as ABCD^{29}E ABCD^{FNC1}E is read as ABCD^{29}E ABCDE is read as ABCDE

AIM Code Identifiers

Each AIM Code Identifier contains the three-character string **]cm** where:

] = Flag Character (ASCII 93)
c = Code Character (see Table B-2)
m = Modifier Character (see Table B-3)

Table B-2. Code Characters

Code Character	Code Type
A	Code 39
C	Code 128
E	UPC/EAN
F	Codabar
G	Code 93
H	Code 11
I	Interleaved 2 of 5
M	MSI
S	D2 of 5, IATA 2 of 5
X	Code 39 Trioptic, Bookland EAN

The modifier character is the sum of the applicable option values based on the following table.

Table B-3. Modifier Characters

Code Type	Option Value	Option
Code 39		
	0	No Check character or Full ASCII processing.
	1	Reader has checked one check character.
	3	Reader has checked and stripped check character.
	4	Reader has performed Full ASCII character conversion.
	5	Reader has performed Full ASCII character conversion and checked one check character.
	7	Reader has performed Full ASCII character conversion and checked and stripped check character.
	Example: A Full ASCII bar code with check character W, **A+I+MI+DW**, is transmitted as **]A7**AimId where 7 = (3+4).	
Trioptic Code 39		
	0	No option specified at this time. Always transmit 0.
	Example: A trioptic bar code 412356 is transmitted as **]X0**412356	
Code 128		
	0	Standard data packet, No Function code 1 in first symbol position.
	1	Function code 1 in first symbol character position.
	2	Function code 1 in second symbol character position.
	Example: A UCCC/EAN 128 bar code is transmitted as **]C1 as** Aim code identifier.	

Table B-3. Modifier Characters (Continued)

Code Type	Option Value	Option
I 2 of 5		
	0	No check digit processing.
	1	Reader has validated check digit.
	3	Reader has validated and stripped check digit.
	Example: An I 2 of 5 bar code without check digit, 4123, is transmitted as **]I0**4123	
Codabar		
	0	No check digit processing.
	Example: A Codabar bar code without check digit, 4123, is transmitted as **]F0**4123	
Code 93		
	0	No options specified at this time. Always transmit 0.
	Example: A Code 93 bar code 012345678905 is transmitted as **]G0**012345678905	
MSI		
	0	Mod 10 check digit checked and transmitted.
	1	Mod 10 check digit checked but not transmitted.
	Example: An MSI bar code 4123, with a Mod 10 check digit checked and transmitted as **]M0**4123	
D 2 of 5		
	0	No options specified at this time. Always transmit 0.
	Example: A D 2 of 5 bar code 4123, is transmitted as **]S0**4123	

Table B-3. Modifier Characters (Continued)

Code Type	Option Value	Option
UPC/EAN		
	0	Standard packet in full EAN country code format, which is 13 digits for UPC-A, UPC-E, and EAN-13 (not including supplemental data).
	1	Two digit supplement data only.
	2	Five digit supplement data only.
	3	Combined data packet comprising 13 digits from a UPC-A, UPC-E, or EAN-13 symbol and 2 or 5 digits from a supplemental symbol.
	4	EAN-8 data packet.
	Example: A UPC-A bar code 012345678905 is transmitted as **]E0**0012345678905	
Bookland EAN		
	0	No options specified at this time. Always transmit 0.
	Example: A Bookland EAN bar code 123456789X is transmitted as **]X0**123456789X	

According to AIM standards, a UPC with supplemental bar code is transmitted in the following format:

]E0 (UPC chars) (terminator) **]E2** (supplemental) (terminator)

In the Symbol SE1524ER, however, the format is changed to:

]E0 (UPC chars) **]E2** (supplemental)

Therefore, a UPC with two supplemental characters, 01234567890510, is transmitted to the host as a 21-character string, **]E0**0012345678905**]E1**10.

Setting Code Lengths Via Serial Commands

There are two lengths (L1 and L2) for each variable length code type. See the individual code types in *Chapter 5, Parameter Menus* for the L1 and L2 parameter numbers.

Depending on the selected option, the scanner will decode:

- One discrete length bar code
- Two discrete length bar codes
- Bar codes within a range of lengths
- Any length of bar codes.

Table B-4 lists the requirements for each option.

Table B-4. Setting Variable Code Lengths

Code length option	L1 value	L2 value
One discrete length will be decoded	Discrete length to decode	0x00
Two discrete lengths will be decoded	Higher length value	Lower length value
Lengths within a range will be decoded	Lower length value	Higher length value
Any length bar code will be decoded	0x00	0x00

Setting Prefixes and Suffixes Via Serial Commands

To append a prefix and suffixes to the decode data:

1. Set the Scan Data Transmission Format (parameter 0xE2) to the desired option.
2. Enter the required value(s) for Prefix (0x68), Suffix1 (0x69) or Suffix2 (0x6A) using the hex values for the desired ASCII value from Table B-5.

Table B-5. Character Equivalents

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
1000	00h	%U	CTRL 2
1001	01h	$A	CTRL A
1002	02h	$B	CTRL B
1003	03h	$C	CTRL C
1004	04h	$D	CTRL D
1005	05h	$E	CTRL E
1006	06h	$F	CTRL F
1007	07h	$G	CTRL G
1008	08h	$H	CTRL H
1009	09h	$I	CTRL I
1010	0Ah	$J	CTRL J
1011	0Bh	$K	CTRL K
1012	0Ch	$L	CTRL L
1013	0Dh	$M	CTRL M
1014	0Eh	$N	CTRL N
1015	0Fh	$O	CTRL O
1016	10h	$P	CTRL P
1017	11h	$Q	CTRL Q

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
1018	12h	$R	CTRL R
1019	13h	$S	CTRL S
1020	14h	$T	CTRL T
1021	15h	$U	CTRL U
1022	16h	$V	CTRL V
1023	17h	$W	CTRL W
1024	18h	$X	CTRL X
1025	19h	$Y	CTRL Y
1026	1Ah	$Z	CTRL Z
1027	1Bh	%A	CTRL [
1028	1Ch	%B	CTRL \
1029	1Dh	%C	CTRL]
1030	1Eh	%D	CTRL 6
1031	1Fh	%E	CTRL -
1032	20h	Space	Space
1033	21h	/A	!
1034	22h	/B	‘
1035	23h	/C	#
1036	24h	/D	$
1037	25h	/E	%
1038	26h	/F	&
1039	27h	/G	‘
1040	28h	/H	(
1041	29h	/I	)
1042	2Ah	/J	*

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
1043	2Bh	/K	+
1044	2Ch	/L	,
1045	2Dh	-	-
1046	2Eh	.	.
1047	2Fh	/	/
1048	30h	0	0
1049	31h	1	1
1050	32h	2	2
1051	33h	3	3
1052	34h	4	4
1053	35h	5	5
1054	36h	6	6
1055	37h	7	7
1056	38h	8	8
1057	39h	9	9
1058	3Ah	/Z	:
1059	3Bh	%F	;
1060	3Ch	%G	<
1061	3Dh	%H	=
1062	3Eh	%I	>
1063	3Fh	%J	?
1064	40h	%V	@
1065	41h	A	A
1066	42h	B	B
1067	43h	C	C

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
1068	44h	D	D
1069	45h	E	E
1070	46h	F	F
1071	47h	G	G
1072	48h	H	H
1073	49h	I	I
1074	4Ah	J	J
1075	4Bh	K	K
1076	4Ch	L	L
1077	4Dh	M	M
1078	4Eh	N	N
1079	4Fh	O	O
1080	50h	P	P
1081	51h	Q	Q
1082	52h	R	R
1083	53h	S	S
1084	54h	T	T
1085	55h	U	U
1086	56h	V	V
1087	57h	W	W
1088	58h	X	X
1089	59h	Y	Y
1090	5Ah	Z	Z
1091	5Bh	%K	[
1092	5Ch	%L	\

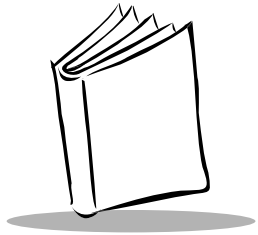
Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
1093	5Dh	%M	]
1094	5Eh	%N	^
1095	5Fh	%O	_
1096	60h	%W	‘
1097	61h	+A	a
1098	62h	+B	b
1099	63h	+C	c
1100	64h	+D	d
1101	65h	+E	e
1102	66h	+F	f
1103	67h	+G	g
1104	68h	+H	h
1105	69h	+I	i
1106	6Ah	+J	j
1107	6Bh	+K	k
1108	6Ch	+L	l
1109	6Dh	+M	m
1110	6Eh	+N	n
1111	6Fh	+O	o
1112	70h	+P	p
1113	71h	+Q	q
1114	72h	+R	r
1115	73h	+S	s
1116	74h	+T	t
1117	75h	+U	u

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
1118	76h	+V	v
1119	77h	+W	w
1120	78h	+X	x
1121	79h	+Y	y
1122	7Ah	+Z	z
1123	7Bh	%P	{
1124	7Ch	%Q	|
1125	7Dh	%R	}
1126	7Eh	%S	~
1127	7Fh		Undefined

Values from 1128 through 1255 (hex values 80h through FFh for SSI) may also be set. Conversion of these characters to printable characters is not standardized, therefore they are not included in the table.



Glossary

Aperture	An opening which limits the amount of light or radiation passing through an optical system.
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.
Autodiscrimination	The ability of an interface controller to determine the code type of a scanned bar code. After this determination is made, the information content can be decoded.
Bar	The dark element in a printed bar code symbol.
Bar Code Density	The number of characters represented per unit of measurement (e.g., characters per inch).
Bar Height	The dimension of a bar measured perpendicular to the bar width.
Bar Width	Thickness of a bar measured from the edge closest to the symbol start character to the trailing edge of the same bar.
Baud Rate	A measure of the data flow or number of signaling events occurring per second. When one bit is the standard "event," this is a measure of bits per second (bps). For example, a baud rate of 50 means transmission of 50 bits of data per second.
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 1	This is the lowest power CDRH laser classification. CDRH Class I devices are safe under reasonably foreseeable conditions of operation. Software and other controls to limit exposure to laser light may be required to achieve CDRH Class I operation. The CDRH time base for Class I devices is 10,000 seconds.
CDRH Class 2	CDRH Class II devices may not emit more than 1 milliwatt average radiant power. For this scan engine, additional software controls are not necessary. Eye protection for CDRH Class II devices is normally afforded by aversion responses, including the blink reflex.
Character	A pattern of bars and spaces which either directly represents data or indicates a control function, such as a number, letter, punctuation mark, or communications control contained in a message.
Character Set	Those characters available for encodation in a particular bar code symbology.
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.
CLSI Editing	An option which inserts a space after the 1st, 5th, and 10th characters of a 14-character Codabar symbol. Length includes start and stop characters.
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.

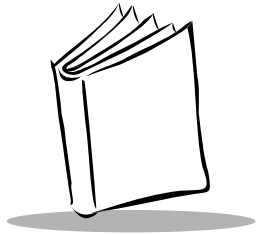
Code 93	An industrial symbology compatible with Code 39 but offering a full character ASCII set and a higher coding density than Code 39.
Code Length	Number of data characters in a bar code between the start and stop characters, not including those characters.
Continuous Code	A bar code or symbol in 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.
CTS	Clear to send.
Dead Zone	An area within a scanner's field of view, in which specular reflection may prevent a successful decode.
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.
Depth of Field	The range between minimum and maximum distances at which a scanner can read a symbol with a certain minimum element width.
Digitized Bar Pattern (DBP)	A digital representation of a decoded bar 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.
Discrete Code	A bar code or symbol in which the spaces between characters (intercharacter gaps) are not part of the code.
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.
Element	Generic term for a bar or space.
Encoded Area	Total linear dimension occupied by all characters of a code pattern, including start/stop characters and data.
GS1 DataBar	Formerly Reduced Space Symbology (RSS): A family of space efficient symbologies developed by UCC.EAN.
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 (825) Class 1	This is the lowest power IEC laser classification. IEC Class I devices are safe under reasonably foreseeable conditions of operation. Software and other controls to limit exposure to laser light may be required to achieve IEC Class 1 operation. The IEC time base for Class 1 devices is 100 seconds if intentional viewing of laser light is not required in the design or function of the device. The IEC time base for Class 1 devices is 30,000 seconds where intentional viewing of laser light is inherent in the design or function of the device.
IEC (825) Class 2	IEC Class 2 devices may not emit more than 1 milliwatt average radiant power. For this scan engine, additional software controls are not necessary. Eye protection for IEC Class 2 devices is normally afforded by aversion responses, including the blink reflex.
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 - **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.
LED Indicator	A semiconductor diode (LED - Light Emitting Diode) used as an indicator, often in digital displays. The semiconductor uses applied voltage to produce light of a certain frequency determined by the semiconductor's particular chemical composition.
MIL	1 mil = 1 thousandth of an inch.

Misread (Misdecode)	A condition which occurs when the data output of a reader or interface controller does not agree with the data encoded within a bar code symbol.
MSI Plessey	A numeric-only bar code type. It can accept a variable number of digits up to 13. MSI consists of four bars and four adjacent spaces. Each bar\space pair consists of one information bit. A zero bit consists of a narrow bar followed by a wide space, while one bit consist of a wide bar followed by a narrow bar. The zero bit is one unit bar followed by a two-unit space and the one bit is a two-unit bar followed by a one unit space. The primary application for the MSI code is marking of retail shelves and subsequent scanning with portable devices for inventory purposes.
Nominal	The exact (or ideal) intended value for a specified parameter. Tolerances are specified as positive and negative deviations from this value.
Nominal Size	Standard size for a bar code symbol. Most UPC/EAN codes can be used over a range of magnifications (e.g., from 0.80 to 2.00 of nominal).
NOTIS Editing	An option that strips the start and stop characters from a decoded Codabar symbol.
Parameter	A variable that can have different values assigned to it.
Percent Decode	The average probability that a single scan of a bar code would result in a successful decode. In a well-designed bar code scanning system, that probability should approach near 100%.
Print Contrast Signal (PCS)	Measurement of the contrast (brightness difference) between the bars and spaces of a symbol. A minimum PCS value is needed for a bar code symbol to be scannable. PCS = $(R_L - R_D) / R_L$, where R_L is the reflectance factor of the background and R_D the reflectance factor of the dark bars.
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.
Random Access Memory (RAM)	Memory devices where any location in memory can be accessed as quickly as any other location.
Reflectance	Amount of light returned from an illuminated surface.
Resolution	The narrowest element dimension which can be distinguished by a particular reading device or printed with a particular device or method.
RTS	Request to send.
RxD	Received data.

Scan Area	Area intended to contain a symbol.
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.
Space	The lighter element of a bar code formed by the background between bars.
Specular Reflection	The mirror-like reflection of light from a surface which can “blind” a scanner.
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.
Substrate	A foundation material on which a substance or image is placed.
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.
Symbol Aspect Ratio	The ratio of symbol height to symbol width.
Symbol Height	The distance between the outside edges of the quiet zones of the first row and the last row.
Symbol Length	Length of symbol measured from the beginning of the quiet zone (margin) adjacent to the start character to the end of the quiet zone (margin) adjacent to a stop character.
Symbology	The structural rules and conventions for representing data within a particular bar code type (e.g. UPC/EAN, Code 39).

Tolerance	Allowable deviation from the nominal bar or space width.
TxD	Transmitted data.
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.



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