SE 923 Scan Engine

Integration Guide

70-37052-01
Rev. A - February 1999

Symbol Technologies, Inc. One Symbol Plaza, Holtsville N.Y. 11742-1300

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symbol®

Symbol Technologies, Inc.
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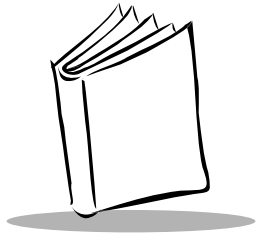
Holtsville, New York 11742-1300
http://www.symbol.com

Patents
This product is covered by one or more of the following U.S. and foreign Patents:
U.S. Patent No.4,360,798; 4,369,361; 4,387,297; 4,460,120; 4,496,831; 4,593,186; 4,603,262; 4,607,156; 4,652,750; 4,673,805; 4,736,095; 4,758,717; 4,816,660; 4,845,350; 4,896,026; 4,897,532; 4,923,281; 4,933,538; 4,992,717; 5,015,833; 5,017,765; 5,021,641; 5,029,183; 5,047,617; 5,103,461; 5,113,445; 5,130,520 5,140,144; 5,142,550; 5,149,950; 5,157,687; 5,168,148; 5,168,149; 5,180,904; 5,229,591; 5,230,088; 5,235,167; 5,243,655; 5,247,162; 5,250,791; 5,250,792; 5,262,627; 5,262,628; 5,266,787; 5,278,398; 5,280,162; 5,280,163; 5,280,164; 5,280,498; 5,304,786; 5,304,788; 5,306,900; 5,321,246; 5,324,924; 5,337,361; 5,367,151; 5,373,148; 5,378,882; 5,396,053; 5,396,055; 5,399,846; 5,408,081; 5,410,139; 5,410,140; 5,412,198; 5,418,812; 5,420,411; 5,436,440; 5,444,231; 5,449,891; 5,449,893; 5,468,949; 5,471,042; 5,478,998; 5,479,000; 5,479,002; 5,479,441; 5,504,322; 5,519,577; 5,528,621; 5,532,469; 5,543,610; 5,545,889; 5,552,592; 5,578,810; 5,581,070; 5,589,679; 5,589,680; 5,608,202; 5,612,531; 5,619,028; 5,664,229; 5,668,803; 5,675,139; 5,693,929; 5,698,835; 5,705,800; 5,714,746; 5,723,851; 5,734,152; 5,734,153; 5,745,794; 5,754,587; 5,762,516; 5,763,863; 5,767,500; 5,789,728; 5,808,287; 5,811,785; 5,811,787; 5,815,811; 5,821,519; 5,821,520; 5,823,812; 5,828,050; 5,850,078; D305,885; D341,584; D344,501; D359,483; D362,453; D363,700; D363,918; D370,478; D383,124; D391,250.
Invention No. 55,358; 62,539; 69,060; 69,187 (Taiwan); No. 1,601,796; 1,907,875; 1,955,269 (Japan).
European Patent 367,299; 414,281; 367,300; 367,298; UK 2,072,832; France 81/03938; Italy 1,138,713.
rev. 1/99



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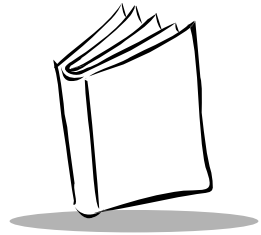

About This Guide

The *SE-923 Scan Engine Integration Guide* provides general instructions for mounting and set up of the SE-923 scan engines.

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 the *Symbol Support Centers*. Before calling, have the model number, serial number, and several of your bar code symbols at hand.

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

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

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

Symbol Support Centers

For service information, warranty information or technical assistance contact or call the Symbol Support Center in:

United States
Symbol Technologies, Inc.
One Symbol Plaza
Holtsville, New York 11742-1300
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If you purchased your Symbol product from a Symbol Business Partner, contact that Business Partner for service.

Warranty

Symbol Technologies, Inc ("Symbol") manufactures its hardware products in accordance with industry-standard practices. Symbol warrants that for a period of twelve (12) months from date of shipment, products will be free from defects in materials and workmanship.

This warranty is provided to the original owner only and is not transferable to any third party. It shall not apply to any product (i) which has been repaired or altered unless done or approved by Symbol, (ii) which has not been maintained in accordance with any operating or handling instructions supplied by Symbol, (iii) which has been subjected to unusual physical or electrical stress, misuse, abuse, power shortage, negligence or accident or (iv) which has been used other than in accordance with the product operating and handling instructions. Preventive maintenance is the responsibility of customer and is not covered under this warranty.

Wear items and accessories having a Symbol serial number, will carry a 90-day limited warranty. Non-serialized items will carry a 30-day limited warranty.

Warranty Coverage and Procedure

During the warranty period, Symbol will repair or replace defective products returned to Symbol's manufacturing plan in the US. For warranty service in North America, call the Symbol Support Center at 1-800-653-5350. International customers should contact the local Symbol office or support center. If warranty service is required, Symbol will issue a Return Material Authorization Number. Products must be shipped in the original or comparable packaging, shipping and insurance charges prepaid. Symbol will ship the repaired or replacement product freight and insurance prepaid in North America. Shipments from the US or other locations will be made F.O.B. Symbol's manufacturing plant.

Symbol will use new or refurbished parts at its discretion and will own all parts removed from repaired products. Customer will pay for the replacement product in case it does not return the replaced product to Symbol within 3 days of receipt of the replacement product. The process for return and customer's charges will be in accordance with Symbol's Exchange Policy in effect at the time of the exchange.

Customer accepts full responsibility for its software and data including the appropriate backup thereof.

Repair or replacement of a product during warranty will not extend the original warranty term.

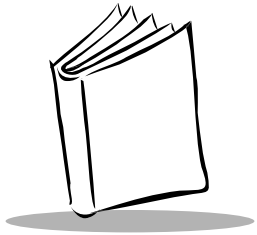
Symbol's Customer Service organization offers an array of service plans, such as on-site, depot, or phone support, that can be implemented to meet customer's special operational requirements and are available at a substantial discount during warranty period.

General

Except for the warranties stated above, Symbol disclaims all warranties, express or implied, on products furnished hereunder, including without limitation implied warranties of merchantability and fitness for a particular purpose. The stated express warranties are in lieu of all obligations or liabilities on part of Symbol for damages, including without limitation, special, indirect, or consequential damages arising out of or in connection with the use or performance of the product.

Seller's liability for damages to buyer or others resulting from the use of any product, shall in no way exceed the purchase price of said product, except in instances of injury to persons or property.

Some states (or jurisdictions) do not allow the exclusion or limitation of incidental or consequential damages, so the proceeding exclusion or limitation may not apply to you.



Chapter 1
Getting Started

Overview

The SE-923-I000A is a miniaturized, high performance 650 nm laser-based, single-line decoded scan engine intended for integration into customer device.

Theory of Operation

The SE-923 contains:

- a miniature laser scan engine and decoder
- a watch dog timer
- a low current beeper line
- a decode LED output line
- two serial I/O lines
- two hardware handshaking lines
- trigger and wake up lines
- non-volatile memory for storing decoder capability parameters.

The SE-923 has a low power mode that maintains the internal RAM contents but freezes its system oscillator, placing the unit into a dormant state.

After power up initialization, the SE-923 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.

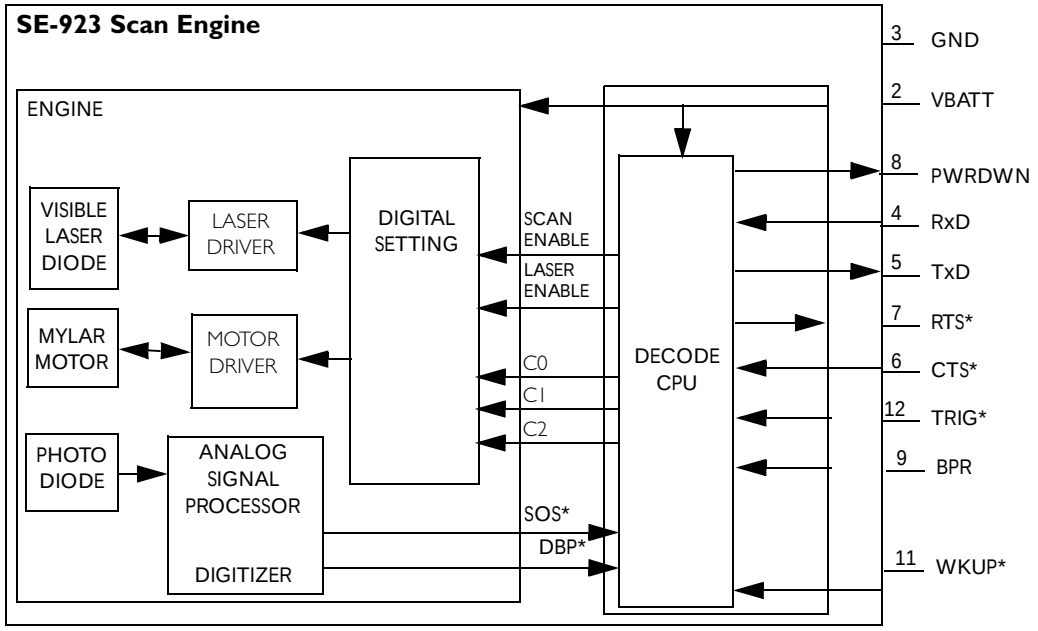
All SE-923 interface signals are TTL compatible. In order to communicate with an RS-232 device, RS-232 drivers are required.

Laser Scan Engine

A laser diode produces a single beam of coherent light which deflects off a mirror, and is emitted from the SE-923. The mirror is attached to a resonant scan motor which oscillates at 19.5 Hz nominally. The total deflection of the single beam is 53° (standard version), and the scan frequency is 39 scans per second.

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 sent to a digitizer. Here the signal is transformed into a digital representation of the bar code called the Digitized Bar Pattern (DBP). The DBP data is then sent to the decoder board for processing into a host-compatible format.

When the SCAN ENABLE and LASER ENABLE lines are brought low, the control circuitry activates the laser and motor driver circuits, turning on both the laser and motor. The laser driver circuit regulates power to the laser. The motor driver circuit controls the mylar "motor" (resonant scan element).



* = Logic Low

Decoder

The heart of the decoder is a micro-controller that provides the necessary intelligence for bar code decoding, host I/O interface protocol, and general decoder maintenance.

The micro-controller contains a watchdog timer. The enabling/disabling and maintenance of this watchdog are totally internal to the decoder; the host has no way of configuring the watchdog.

The decoder's reset circuitry holds the micro-controller in reset after power up to allow sufficient time for hardware initialization. This reset period is 70 msec. nominal at 5 V dc. A reset can occur upon power up, or power supply voltage falling below 2.8 V nominal. A reset time is generated in the CPU from an external resistor, capacitor, voltage detector, and internal pull-up resistor.

The non-volatile memory stores the decoder capability parameters. After every 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 the memory. The decoder does not correct the fault unless requested by the host.

Power Management

The SE-923 has two power modes:

- Continuous Power
- Low Power.

In Continuous Power mode, the SE-923 always waits for a trigger pull or serial communication.

In Low Power mode, the SE-923 draws less current than when in Continuous Power mode, making it more suitable for battery powered applications. The *Power Mode* parameter (page 12) puts the SE-923 into Low Power mode whenever possible. The SE-923 can also be put into Low Power mode by use of the *SLEEP* command (see *SLEEP* on page 6-31).

The SE-923 must be awakened from the Low Power mode before performing any functions.

Whenever the SE-923 is in the Low Power mode, the PWRDWN signal is asserted. This signal is used by the host to remove power from the SE-923. Removing power without using this signal is not recommended since the PWRDWN signal is the only way to know if the decoder is not transmitting, receiving, decoding, or writing data to non-volatile memory. *Table 1-1* shows how to put the SE-923 into Low Power mode. *Table 1-2* shows how to awaken it.

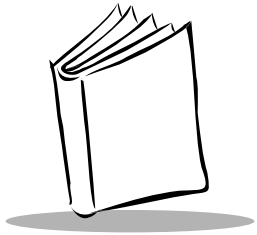
Table 1-1. SE-923 into Low Power Mode

Action	Behavior
Set the Power Mode parameter to Low Power	The SE-923 enters Low Power mode automatically whenever possible.
Send the serial SLEEP command	The SE-923 enters Low Power mode only once, as soon as possible.
Note: All Wake Up signals (see *Table 1-2*) must be inactive in order to enter Low Power mode. Once the SE-923 is awakened, at least 1 second must elapse before it re-enters Low Power mode.	

Table 1-2. Waking Up the SE-923

Signal	State to Wake Up
AIM/WKUP*	Low
TRIG*	Low
CTS*	Low
RXD	Send 0x00

When the SE-923 awakens, it remains awake for at least 1 second before re-entering Low Power mode. Therefore, if the power mode parameter is set to Low Power, the host should perform its first action within the 1 second time period.

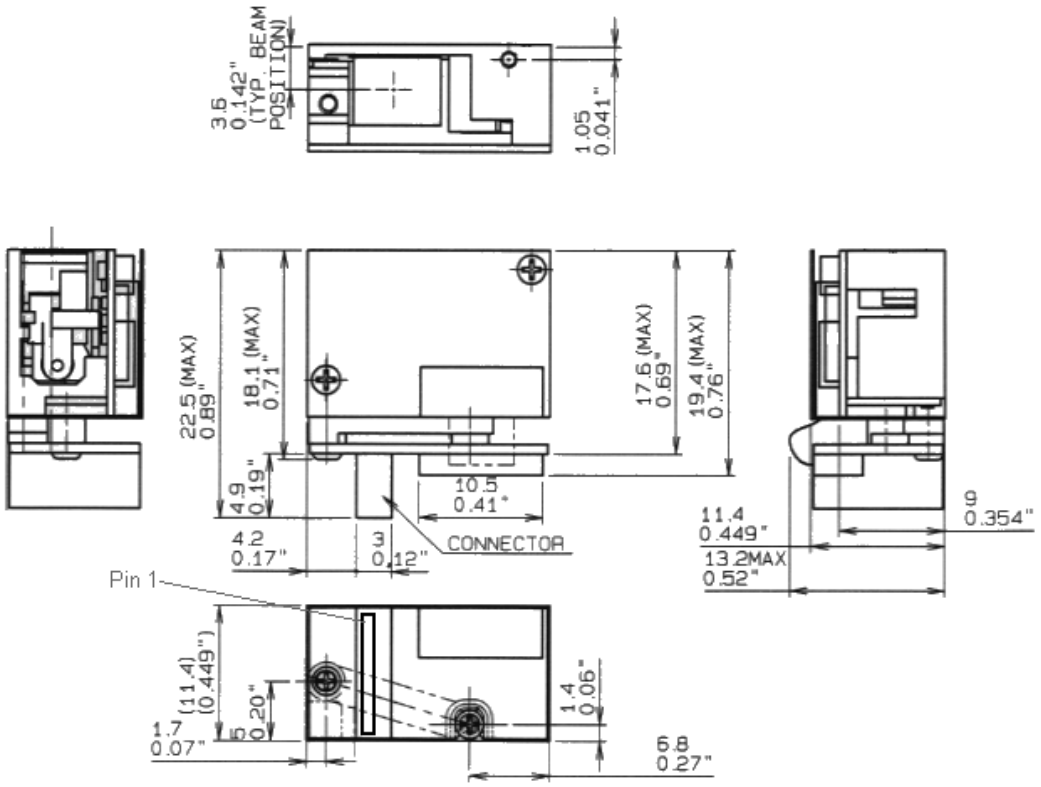


Chapter 2
Installation

This chapter provides information for mounting and installing the SE-923-I000A scan engine. Physical and electrical considerations are presented, together with recommended window properties.

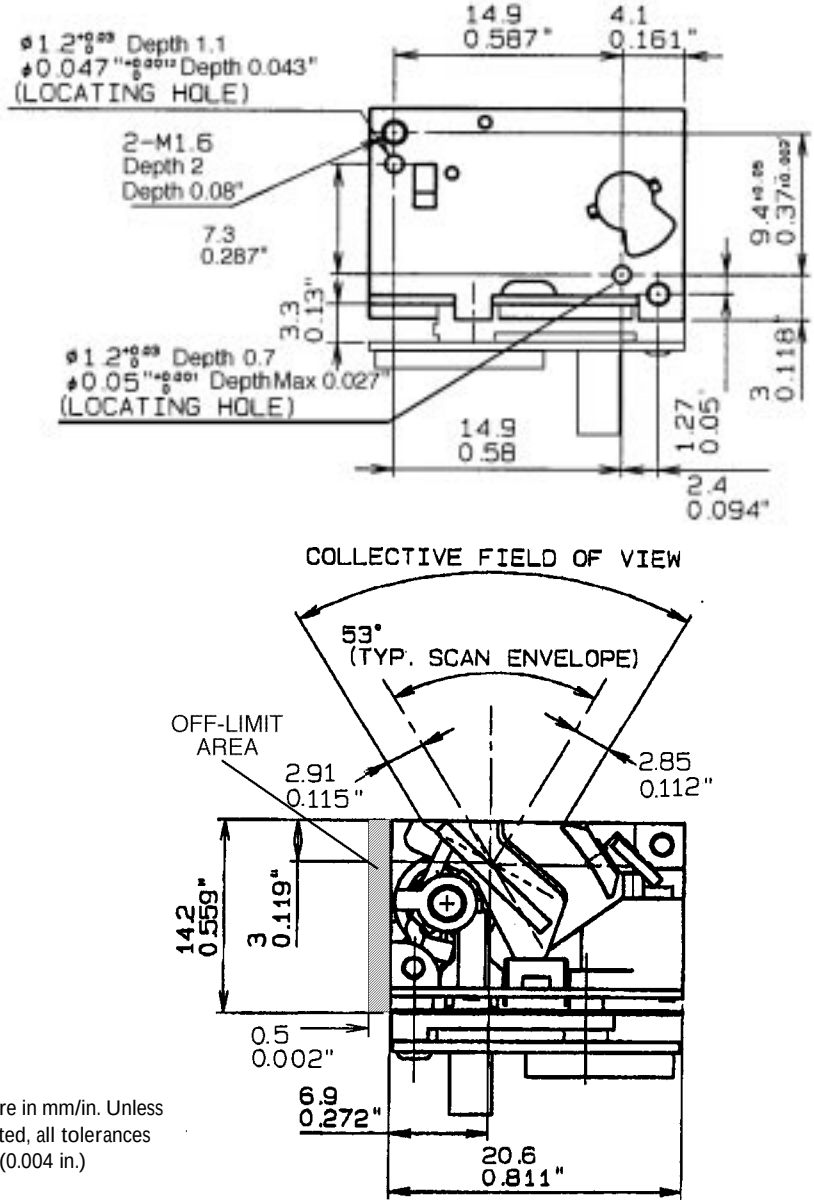
Mounting

There are two mounting holes (M1.6), and two locator holes on the bottom of the chassis (see Figure 2-1). Figure 2-2 illustrates the mechanical outline for the SE-923 decoder board. The SE-923-I000A may be mounted in any orientation without any degradation in performance.



Dimensions are in mm/in. Unless otherwise noted, all tolerances are ± 0.1mm (0.004 in.)

Figure 2-1. SE-923-I000A Mounting Diagram



Dimensions are in mm/in. Unless otherwise noted, all tolerances are ± 0.1mm (0.004 in.)

Figure 2-1. SE-923-I000A Mounting Diagram (Cont'd)

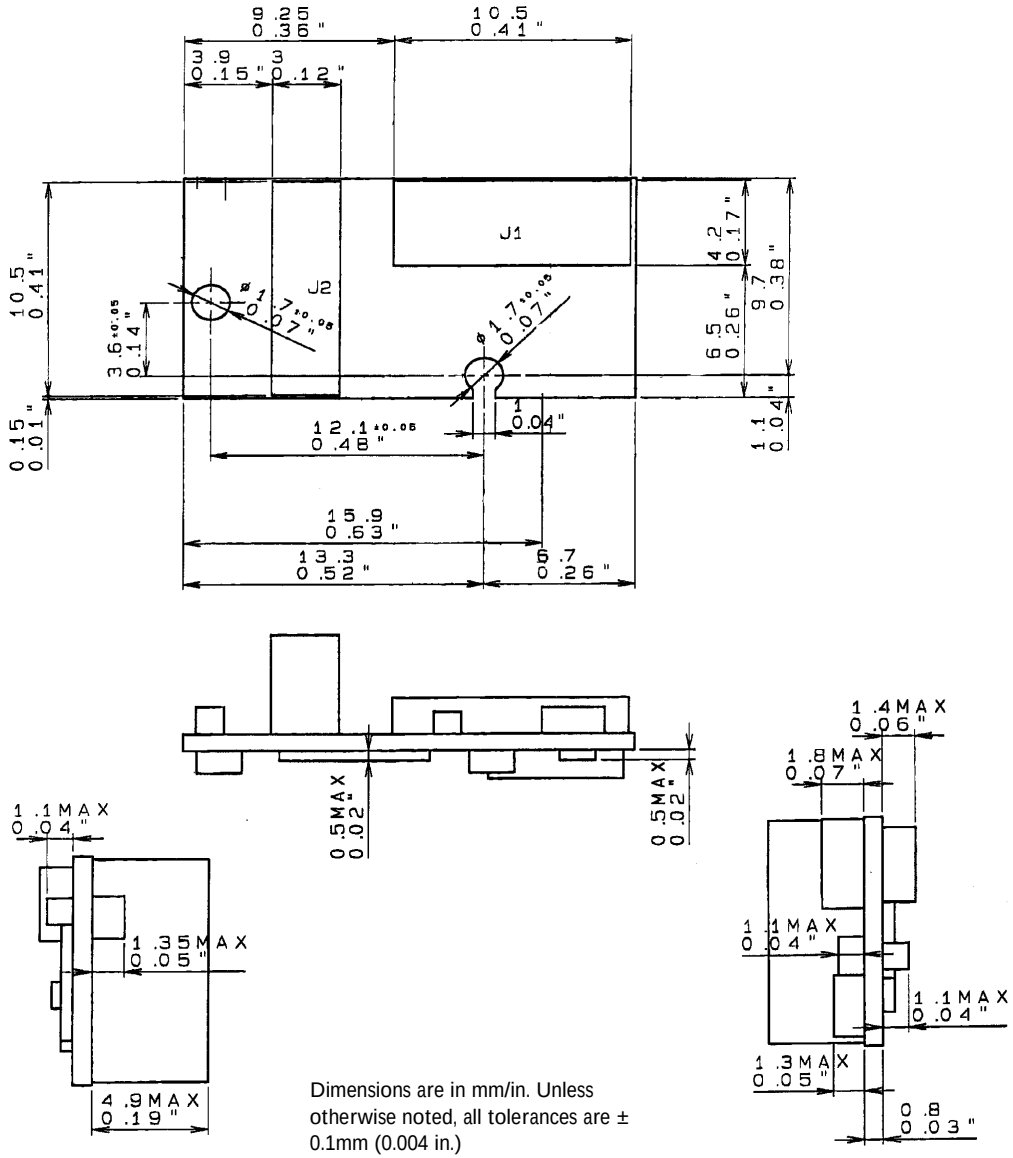


Figure 2-2. SE-923 Decoder Board Mounting Diagram

Installing the SE-923-I000A

Before installing the SE-923-I000A into your host equipment, there are two important points to consider:

- The SE-923-I000A chassis is electrically connected to V_{cc}. It must be isolated from ground.
- Use only non-magnetic screws (i.e. stainless steel 300 Series screws), or locating pins when mounting the SE-923-I000A. Magnetic screws, or pins may cause the motor/mirror neutral position to change. Recommended screw torque is 1.0 kg-cm.
- Do not place any magnetic material (i.e. dynamic speakers, ringers, vibrators, etc.) within 1 inch of the SE-923-I000A chassis.

Considerations

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.

In addition to these minimum dimensional requirements, the designer may want to consider the use of baffles, matte-finished dark internal housing colors, as well as anti-reflection coated windows (if needed). Refer to *Positioning the Window* on page 2-6 for more information on exit window orientation.

Grounding

The SE-923 chassis is at V_{CC}. If you are installing the SE-923 to a grounded host, you must isolate the two. An insulator can be inserted between the two chassis, and if metallic (non-magnetic) screws are used, shoulder washers must be used to isolate the screws from the host. Non-metallic screws may also be used if mechanical considerations permit.

ESD

The SE-923-I000A is protected from ESD events that may occur in an ESD-controlled environment. Always exercise care when handling the module. Use grounding wrist straps and handle in a properly grounded work area.

Environment

The SE-923-I000A must be sufficiently enclosed to prevent dust particles from gathering on the mirrors, laser lens, and the photodiode. Dust and other external contaminants will eventually cause degradation in unit performance. Symbol does not warrant performance of the engine when used in an exposed application.

Optical

The SE-923-I000A uses a sophisticated optical system that is capable of providing scanning performance that can match or exceed the performance of much larger scanners. However, the performance of the scan engine can be affected by an improperly designed enclosure, or improper selection of the window material.

Positioning the Window

The window must be positioned so that laser light reflected off the inside of the window is not reflected back into the collection optics of the scan engine. The window can be positioned more nearly parallel to the face of the scanner if an anti-reflection coating is used. Once again, we stress that the specified angles are minimums and care must be exercised to allow for manufacturing tolerances. Larger angles are generally preferred. If the enclosure you've designed cannot accommodate the recommended window angle, contact Symbol Technologies to discuss your requirements. An improperly positioned window can result in significant performance degradation. Figure 2-3 illustrated the positions of the exit window in reference to the scan engine. Table 2-1 lists the required exit window dimensions and Table 2-2 lists the required exit window tilt angles. The exit window can be tilted away from (case 1) the scan engine or toward (case 2) the scan engine. The exit window size and tilt varies according to the distance from the scan engine.

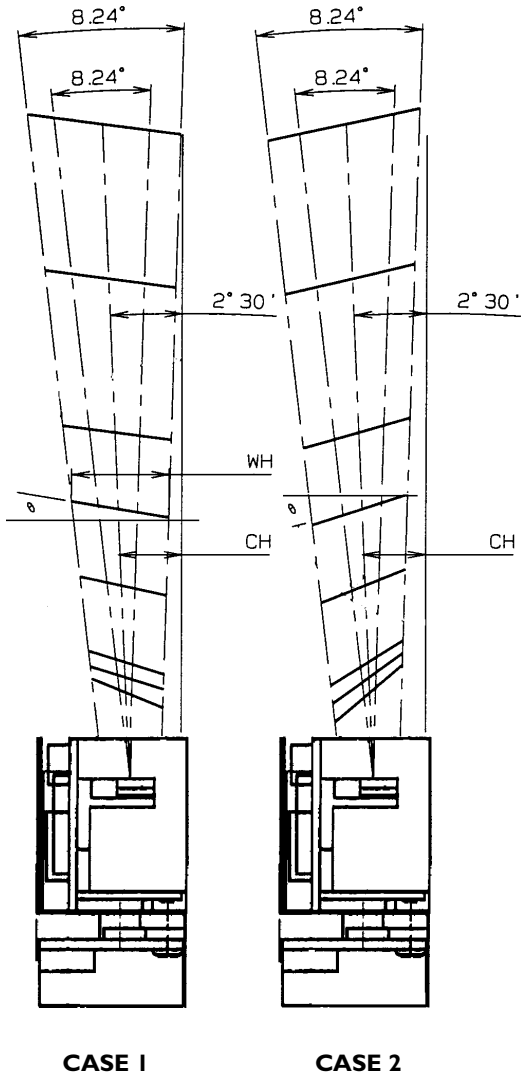


Figure 2-3. Exit Window Positioning

Table 2-1. Exit Window Distance from Scan Engine

Distance from Scan Engine on center line (in.)*	0.15	0.2	0.25	0.5	0.75	1.00	1.50	2.00
Minimum Window Height (WH) (in.)	0.218	0.226	0.234	0.272	0.308	0.345	0.417	0.489
Minimum Window Width (in.)	0.500	0.551	0.568	0.809	1.049	1.290	1.770	2.253
Window Center (CH) (in.)**	0.181	0.183	0.186	0.196	0.207	0.218	0.204	0.262
* Distance from edge of scan engine to inner side of window. ** CH increases with distance due to the 2° 30' beam deviation to the horizontal base of engine.								

Table 2-2. Exit Window Tilt Angle

Distance from Scan Engine on center line (in.)*		0.15	0.2	0.25	0.5	0.75	1.00	1.50	2.00
Case 1	Minimum Window Tilt Uncoated	38.5°	33.5°	29°	20°	15.5°	13°	11°	9.5°
	Minimum Window Tilt One Side A/R Coated	30.2°	26.5°	23.5°	16.7°	13.2°	11.5°	10°	8.7°
	Minimum Window Tilt Two Sides A/R Coated	22°	19.5°	18°	13.5°	11°	10°	9°	8°
Case 2	Minimum Window Tilt Uncoated	40.5°	36°	32°	24°	20°	18°	15.5°	14.5°
	Minimum Window Tilt One Side A/R Coated	33.7°	30.2°	27.5°	21.2°	18.5°	16.5°	14.7°	13.7°
	Minimum Window Tilt Two Sides A/R Coated	27°	24.5°	23°	18.5°	17°	15°	14°	13°
When window is in the vertical position, $\theta = 0°$ All angles are with respect to the vertical plane. A/R - Anti-Reflective Coating. * Distance from edge of scan engine to inner side of window.									

Avoiding Scratched Windows

Scratches on the window can greatly reduce the performance of the scan engine. We suggest you either recess the window into the housing, or apply a scratch resistance coating.

Window Material

Many window materials that look perfectly clear to the eye can contain stresses and distortions that can reduce scan engine performance. For this reason cell-cast acrylic with an anti-reflection coating is highly recommended. Following is a description of acrylic, and CR-39, another popular window material. Table 2-3 outlines the suggested window properties.

Note: *Symbol recommends that polycarbonate NOT be used.*

Acrylic

When fabricated by cell-casting, has very good optical quality and low initial cost, but surface must be protected from the environment due to its susceptibility to attack by chemicals, mechanical stresses, and UV light. Reasonably good impact resistance. Acrylic can be ultrasonically welded.

CR-39

A thermal-setting plastic produced by the cell-casting process. Excellent chemical and environmental resistance. Quite good surface hardness, and therefore does not have to be hard-coated. But may be coated for severe environments. Reasonably good impact resistance. Most plastic eye glasses sold today are uncoated, cell-cast CR-39. This material cannot be ultrasonically welded.

Table 2-3. Suggested Window Properties

Material	Red cell-cast acrylic.
Spectral Transmission	85% minimum from 640 to 690 nanometers.
Thickness	0.059 ± 0.005
Wavefront Distortion (transmission)	0.2 wavelengths peak-to-valley maximum over any 0.08 in. diameter within the clear aperture.
Clear Aperture	To extend to within 0.04 in. of the edges all around.
Surface Quality	60-20 scratch/dig

Table 2-3. Suggested Window Properties

Coating	Both sides to be anti-reflection coated to provide 0.5% max reflectivity (each side) from 640 to 690 nanometers at nominal window tilt angle. Coating shall meet the hardness adherence requirements of MIL-M-13508.

Commercially Available Coatings

Anti-Reflection Coatings

An anti-reflection coating can be applied to the inside and/or outside of the window, which greatly reduces the amount of light reflected off the window, back into the scan engine. This coating can increase the range of acceptable window positions and minimize performance degradation due to signal loss as the light passes through the window.

Polysiloxane Coating

Polysiloxane type coatings are applied to plastic surfaces to improve the surface resistance to both scratch and abrasion. They are generally applied by dipping and then allowed to air dry in an oven with filtered hot air.

A Word About Coatings

If you are using an anti-reflective coating, you don't need a polysiloxane coating. If you decide not to, we recommend CR-39 without a protective coat. In all cases, you must adhere to the minimum tilt angle specified in Table 2-2. As a final note, we recommend that you recess the exit window to minimize scratches and digs.

Table 2-4 lists some exit window manufacturers and anti-reflection coaters.

Table 2-4. Exit Window Manufacturers and Coaters

Company	Discipline	Specifics
Evaporated Coatings, Inc. 2365 Maryland Road Willow Grove, PA 19090 (215) 659-3080	Anti-reflection coater	Acrylic window supplier Anti-reflection coater

Table 2-4. Exit Window Manufacturers and Coaters

Company	Discipline	Specifics
Fosta-Tek Optics, Inc. 320 Hamilton Street Leominster, MA (508) 534-6511	Cell-caster, hard coater, laser cutter	CR39 exit window manufacturer
Glasflex Corporation 4 Sterling Road Sterling, NJ 07980 (908) 647-4100	Cell-caster	Acrylic exit window manufacturer

Location and Positioning

Symbol Position with Respect to a Fixed-Mount Scan Engine

It is sometimes necessary to mount the SE-923-I000A in such a way that it is able to read symbols that are automatically presented to it, or that are always presented in a pre-determined location. In these situations positioning of the SE-923-I000A with respect to the symbol location is critical. Failure to properly position the scan engine and symbol may lead to unsatisfactory reading performance.

Following is a series of steps you should take to ensure satisfactory operation of the SE-923-I000A in your installation:

1. Determine the optimum distance between the scan engine and the symbol. Due to the large variety of symbol sizes, densities, print quality, etc., there is no simple formula to calculate this optimum symbol distance. Try this:
   a. Measure the maximum and minimum distance at which your symbols can be read.
   b. Locate the scan engine so the symbol is near the middle of this range when being scanned.

   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 your system. Symbol Technologies can provide advice on how to improve your installation.
2. Center the symbol (left to right) in the scan line whenever possible.

3. Position the symbol so that the scan line is as near as possible to perpendicular to the bars and spaces in the symbol.
4. 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. See Figure 2-3 on page 2-7 for maximum angles.
5. If a window is to be placed between the engine and the symbol, the determination of optimum symbol location should be made with a representative window in the desired window position. Read the sections of this chapter concerning window quality, coatings and positioning.
6. Give the scan engine time to dwell on the symbol for several scans. Poor quality symbols may not read on the first scan. 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 2-5 lists the available accessories for the scan engine.

Table 2-5. Accessories

Accessory	Symbol Part Number
Flex Strip (tapered)	15-10750-01
Flex Strip (even width)	50-16000-139
12-pin Connector	50-12100-340

Hardware Accessories

Table 2-6 lists sources for hardware accessories for the scan engine.

Table 2-6. 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 can be used to connect the SE-923 scan engine to OEM equipment or to the SE-923 Software Development Board. Figure 2-4 illustrates the 12-pin tapered flex strip cable (p/n 15-10750-01) and Figure 2-5 illustrates the 12-pin even width flex strip cable (p/n 50-16000-139). Both cables are available from Symbol Technologies.

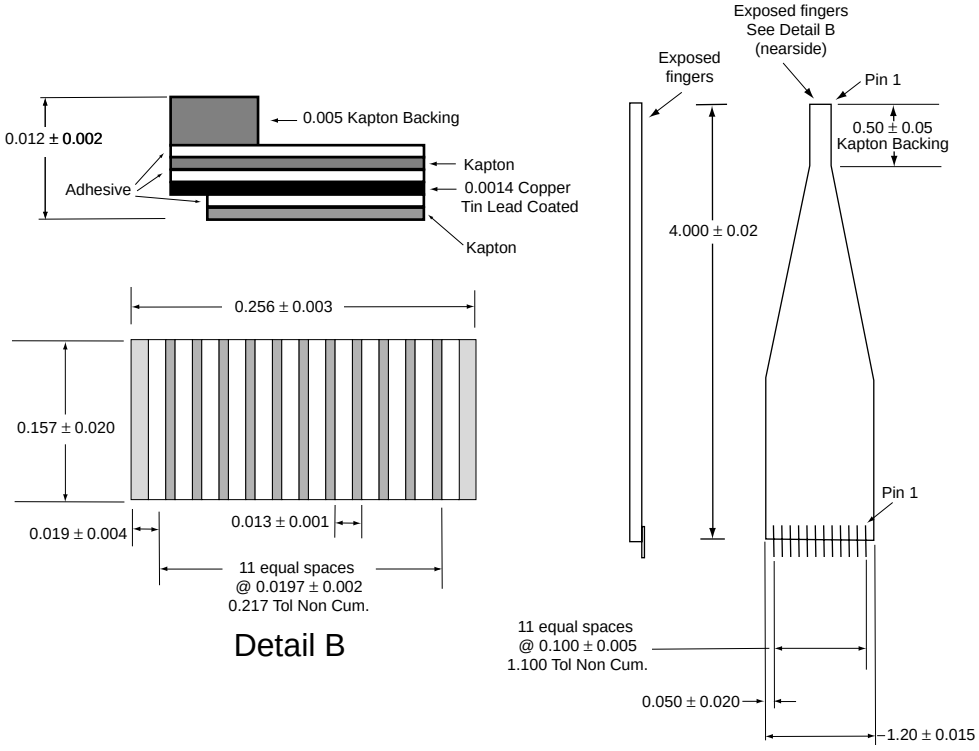
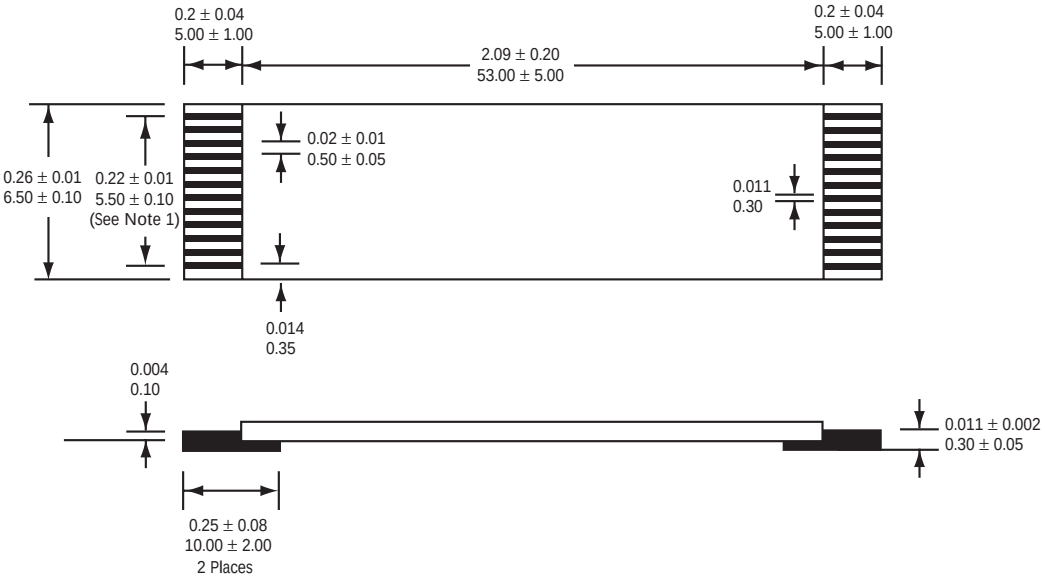


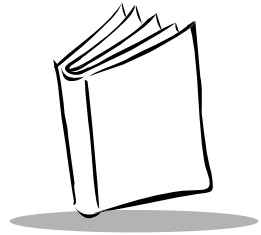
Figure 2-4. Flex Strip, p/n 15-10750-01 (Tapered)



Note:

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

Figure 2-5. Flex Strip, p/n 50-16000-139 (Even Width)



Chapter 3
SE-923-I000A Specifications

This chapter outlines the technical specifications of the SE-923-I00A scan engine. Decode zone, flex cable information, electrical pin-outs, and accessories are also presented.

SE-923 Technical Specifications

Table 3-1. Technical Specifications @ 23°C

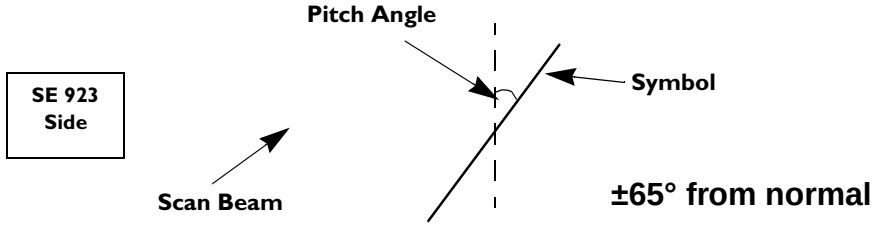
Item	Description
Power Requirements	
Input Voltage	3.3 - 5.0 V DC ±10%
Input Current	68 mA @ 3.3V DC 78 mA @ 5.0V DC
Standby Current	< 35 µA typical; 50 µA max. @ 5VDC
Surge Current	<200 mA typical
V_{cc} Noise Level	100 mV pk - pk (30 Hz - 50 kHz)
Scan Repetition Rate	39 (± 3) scans/sec (bidirectional)
Laser Power	1.2 mW nominal - Scanning Mode 0.8 mW nominal - Aim Mode
Laser Class	Intended use in CDRH/IEC Class 2 devices
Print Contrast	minimum 25% absolute dark/light reflectance measured at 650 nm.
Scan Angle	53° (typical)
Decode Depth of Field	See Figure 3-2 on page 3-4.

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

Item	Description
Pitch Angle	± 65° from normal (see Figure 3-1 on page 3-3)
Skew Tolerance	± 60° from normal (see Figure 3-1 on page 3-3)
Roll	± 10° from vertical (see Figure 3-1 on page 3-3)
Ambient Light Immunity **Sunlight** **Artificial Light**	 10,000 ft. candles (107,640 lux) 450 ft. candles (4,844 lux)
Shock	2,000 G applied via any mounting surface @ -20°, 23°C, and 60°C for a period of 0.7 msec.
Vibration	Withstands a sinusoidal vibration of 4 G along each of the 3 mutually perpendicular axes for a period of 1 hr per axis, over a frequency range of 20 Hz to 1,600 Hz.
Operating Temperature	-4° to 131°F (-20° to 55°C)
Storage Temperature	-40° to 140°F (-40° to 60°C)
Humidity	5% to 95% non-condensing @ 50°C for 168 hours.
Height	0.45 in. (11.4 mm) nominal
Width	0.89 in.(22.6 mm) nominal
Depth	0.56 in.(14.3 mm) nominal
Weight	< 0.21 oz. (6 g)

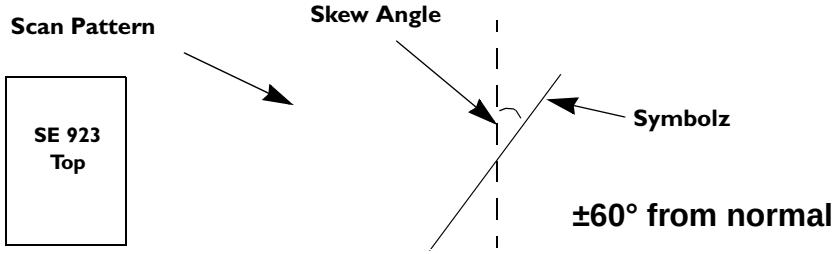
Pitch

Side view of module



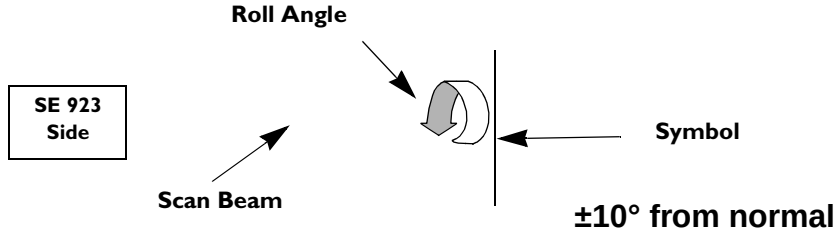
Skew

Top view of module



Roll

Side view of module

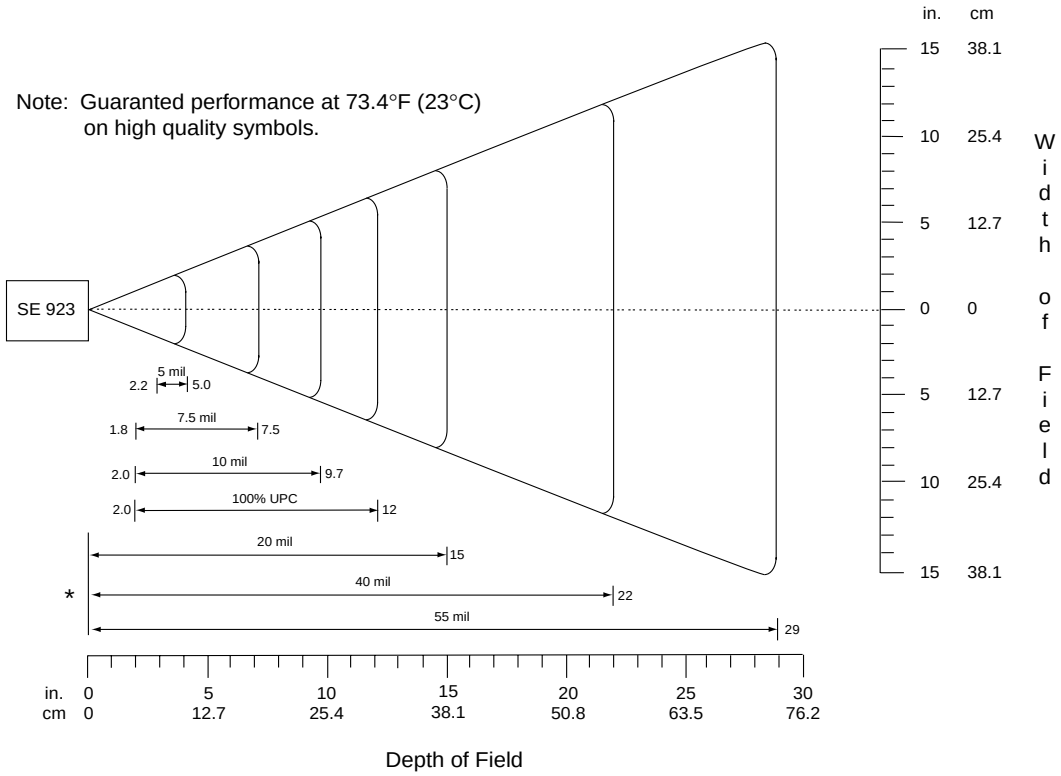


Measured on a 20 mil symbol at a distance of 10 inches. Tolerance is reduced at extreme ends of the working range.
Skew: Measured on a 20 mil symbol at a distance of 7 inches.

Figure 3-1. Pitch, Skew and Roll

Decode Zone

The decode zone for the SE-923-I000A scan engine is shown in *Figure 3-2*. The figures shown are guaranted values. Table 3-2 lists the typical and guaranteed distances 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 below. To calculate this distance, refer to the formula on the following page.



*Minimum distance determined by symbol length and scan angle

Figure 3-2. SE-923-I000A Standard Version Decode Zone

Table 3-2. SE-923-I000A Decode Distances

Symbol Density/ Bar Code Type/ W-N Ratio	Bar Code Content/ Contrast[Note 1]	Typical Working Ranges		Guaranteed Working Ranges	
		Near	Far	Near	Far
5.0 mil Code 39; 1:2.5	**ABCDEFGH** 90% MRD	**2.0 in** 5.1 cm	**5.2 in** 13.2 cm	**2.2 in** 5.6 cm	**5.0 in** 12.7 cm
7.5 mil Code 39; 1:2.5	**ABCDEF** 90% MRD	**1.7 in** 4.3 cm	**8.0 in** 20.3 cm	**1.8 in** 4.6 cm	**7.5 in** 19.1 cm
10 mil Code 39; 1:2.2	**FGH** 90% MRD	**1.8 in** 4.6 cm	**10.0 in** 25.4 cm	**2.0 in** 5.1 cm	**9.7 in** 24.6 cm
13 mil 100% UPC	**12345678905** 90% MRD	**1.9 in** 4.8 cm	**13.0 in** 33.0 cm	**2.0 in** 5.1 cm	**12.0 in** 30.5 cm
20 mil Code 39; 1:2.2	**123** 90% MRD	Note 2	**20.0 in** 50.8 cm	Note 2	**15.0 in** 38.1 cm
40 mil Code 39; 1:2.2	**AB** 90% MRD	Note 2	**25.0 in** 63.5 cm	Note 2	**22.0 in** 55.9 cm
55 mil Code 39; 1:3	**CD** 90% MRD	Note 2	**30.0 in** 76.2 cm	Note 2	**29.0 in** 73.7 cm

Notes:

1. CONTRAST measured as Mean Reflective Difference (MRD) at 650 nm.
2. Near ranges on lower densities (not specified) are largely dependent upon the width of the bar code and the scan angle.
3. Working range specifications at ambient temperature (23 °C)

The decode zone is a function of various symbol characteristics including density, print contrast, wide-to-narrow ratio, and edge acuity. Width of decode zone at any given distance must be considered when designing a system.

Usable scan length is calculated as follows (see Figure 3-3):

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 (53°).

So:

L = 1.8 x (D+d) x Tan 26.5°

Note: *Usable scan length determined by above formula, or 90% of the visible scan line at any working distance.*

The calculation given above is based on good quality symbols in the center of the working range and length of bar code.

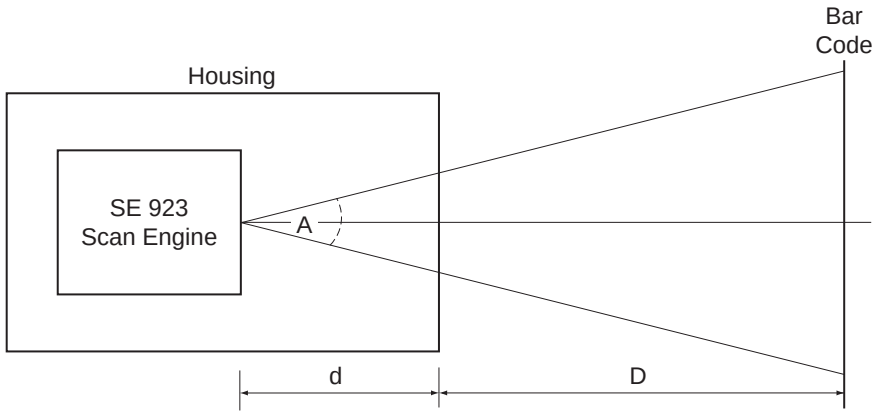
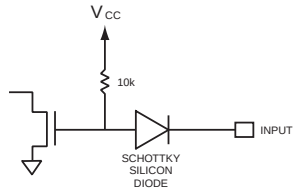


Figure 3-3. Usable Scan Length Diagram

Electrical Interface

Table 3-3 lists the pin functions of the SE-923 interface and illustrates typical input and output circuitry.

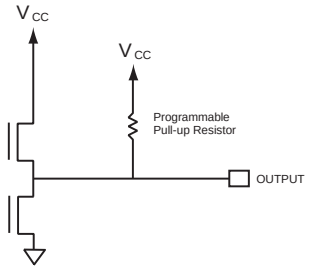
Table 3-3. Electrical Interface

Mnemonic	No.	Type	Name and Function
NC	1		Not connected. Reserved for future versions of the SE-923.
VBATT	2		**Power Supply**: This is the power supply voltage for the SE-923.
GND	3		**Ground:** 0 V reference.
RXD	4	I	**Received Data:** Serial input port
CTS*	6	I	**Clear to Send:** Serial port handshaking line
AIM/WAKE*	11	I	**Wake Up:** When the SE-923 is in the low power mode, pulsing this pin low for 200 nsec awakens the SE-923.
TRIG*	12	I	**Trigger:** This pin is the hardware triggering line. Driving this pin low causes the SE-923 to start a scan and decode session.
			Min. / Max. / Condition V_{IL} -0.3 1.0 V_{CC} = 3.3 V_{IH} 3.85 V_{BATT}+0.3 V_{CC} = 5.5 

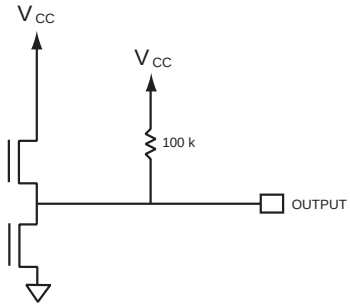
Note: Signal names with the **"*"** modifier are asserted when at the ground level (active low). Signal names without the **"*"** modifier are asserted when at the positive supply voltage level (active high).

Table 3-3. Electrical Interface (Continued)

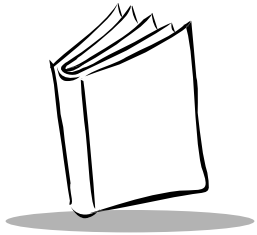
<table>
<tr><th>Mnemonic</th><th>No.</th><th>Type</th><th>Name and Function</th></tr>
<tr><td>TXD</td><td>5</td><td>O</td><td>Transmitted Data: Serial output port.

<table>
<tr><th></th><th>Min.</th><th>Max.</th><th>Condition</th></tr>
<tr><td>V_{OL}</td><td></td><td>0.45</td><td>I_{OL} = 1.6mA</td></tr>
<tr><td>V_{OH}</td><td>2.40</td><td></td><td>I_{OH} = -400µA, V_{CC}=3.3</td></tr>
<tr><td></td><td>4.2</td><td></td><td>I_{OH} = -400µA, V_{CC}=5.5</td></tr>
</table>


</td></tr>
<tr><td>RTS*</td><td>7</td><td>O</td><td>Request to Send: Serial port handshaking line.</td></tr>
<tr><td>PWRDWN</td><td>8</td><td>O</td><td>Power Down Ready: When high, the decoder is in low power mode.</td></tr>
<tr><td>BPR*</td><td>9</td><td>O</td><td>Beeper*: Low current beeper output.</td></tr>
<tr><td>DLED*</td><td>10</td><td>O</td><td>Decode LED: Low current decode LED output.

<table>
<tr><th></th><th>Min.</th><th>Max.</th><th>Condition</th></tr>
<tr><td>V_{OL}</td><td></td><td>0.45</td><td>I_{OL} = 1.6mA</td></tr>
<tr><td>V_{OH}</td><td>2.40</td><td></td><td>I_{OH} = -400µA, V_{CC}=3.3</td></tr>
<tr><td></td><td>4.2</td><td></td><td>I_{OH} = -400µA, V_{CC}=5.5</td></tr>
</table>


</td></tr>
<tr><td colspan="4">Note: Signal names with the “*” modifier are asserted when at the ground level (active low). Signal names without the “*” modifier are asserted when at the positive supply voltage level (active high).</td></tr>
</table>



Chapter 4
Application Notes

AC Electrical Characteristics

For the AC electrical characteristics shown in Table 4-1, T_{amb} = -20°C to 50°C, V_{BATT} = 3.3 V to 5.5 V. 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	

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 it will lock out the SE-923 from transmitting.
3. The decoder may transmit any time 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 SE-923's micro-controller is in full operation whenever the PWRDWN line is driven low.
6. See the *Power Management on page 1-5* if 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
txlxl	Figure 4-2	Byte to byte delay, (see note 1)		990	msec
Serial I/O Timing, Decoder Transmit, (see Note 3)					
tvlvl	Figure 4-4	Byte to byte delay, (see note 1)		99	msec
tvhvh	Figure 4-3	End of the packet to RTS* high		note 4	msec
Hardware Trigger Timing					
tglwl	Figure 4-5	Trigger hold time, level trigger mode, (see note 6)	18		msec
tghtw	Figure 4-5	Trigger release time, level trigger mode (see note 6)	25		msec
tglwl	Figure 4-5	Trigger hold time, pulse trigger mode, (see note 6)	18		msec
tghtw	Figure 4-5	Trigger release time, pulse trigger mode, (see note 6)	25		msec
Beeper Timing					
tblht	Figure 4-6	Beeper frequency	1800	2500	Hz
Power Up Timing					
tehpm	Figure 4-7	V_{BATT} rise time		10	msec
Wake Up Timing					
taldl	Figure 4-8	From wake up to full operation, (see note 5)		11	msec
tdlgl	Figure 4-8	Trigger low after full operation, (see notes 6 and 7)	0	1	sec

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 it will lock out the SE-923 from transmitting.
3. The decoder may transmit any time 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 SE-923's micro-controller is in full operation whenever the PWRDWN line is driven low.
6. See the *Power Management on page 1-5* if 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.

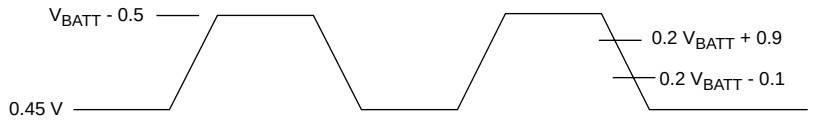
Timing Waveforms

Explanation of the AC Symbols

Each timing symbol has five characters. The first character is always "t." 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
e	PWREN
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
Example: tbltw = Beeper drive low time trlcl = 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.*

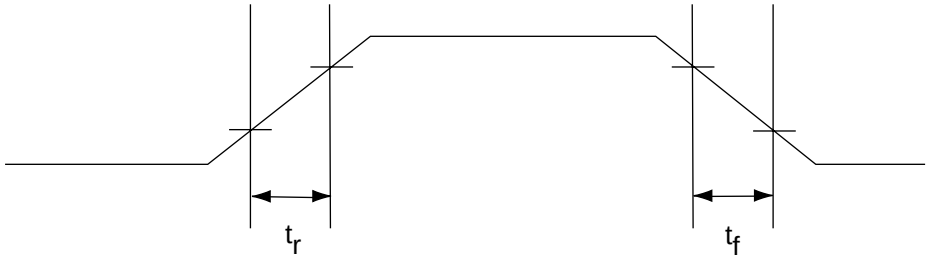


Figure 4-1. General Characteristics

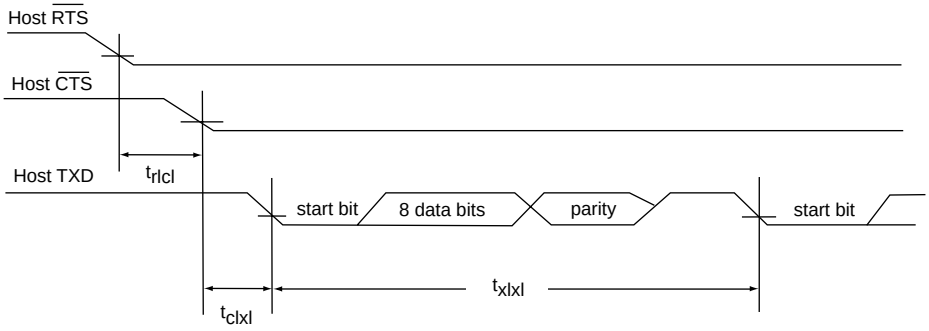


Figure 4-2. Serial I/O Timing, Host Transmit

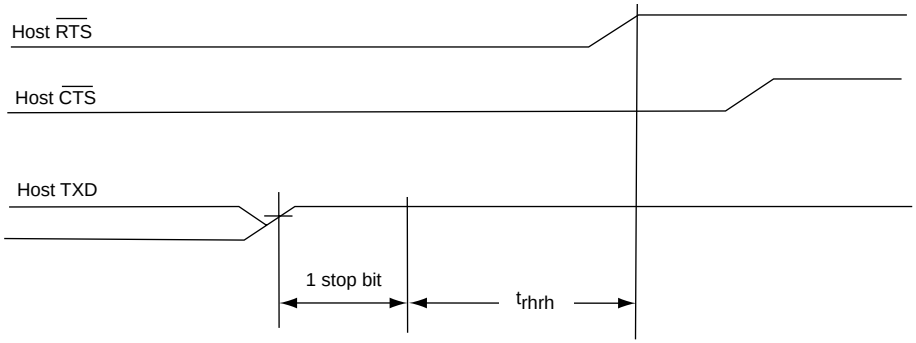


Figure 4-3. Serial I/O Timing, Host Transmit

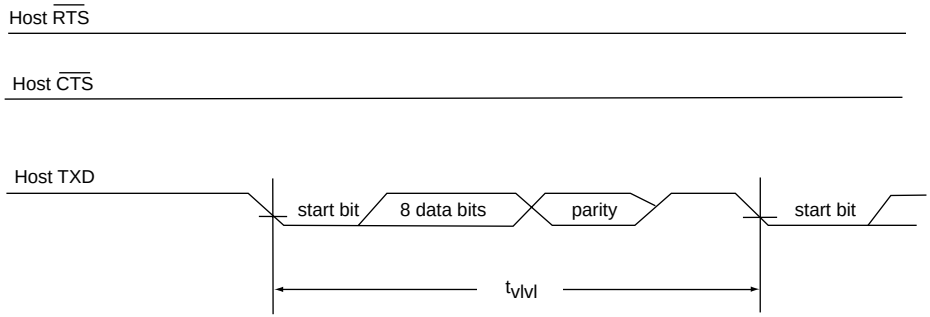


Figure 4-4. Serial I/O Timing, Decoder Transmit

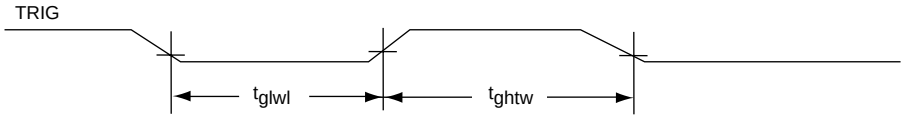


Figure 4-5. Hardware Trigger Timing

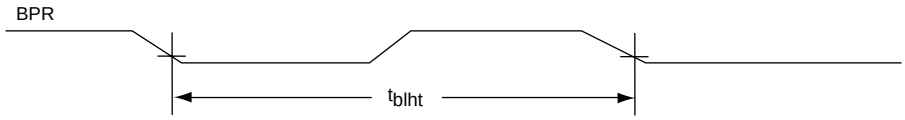


Figure 4-6. Beeper Timing

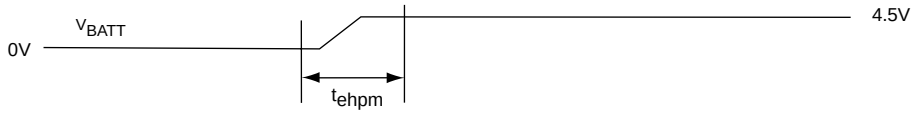


Figure 4-7. V_{BATT} Rise Time

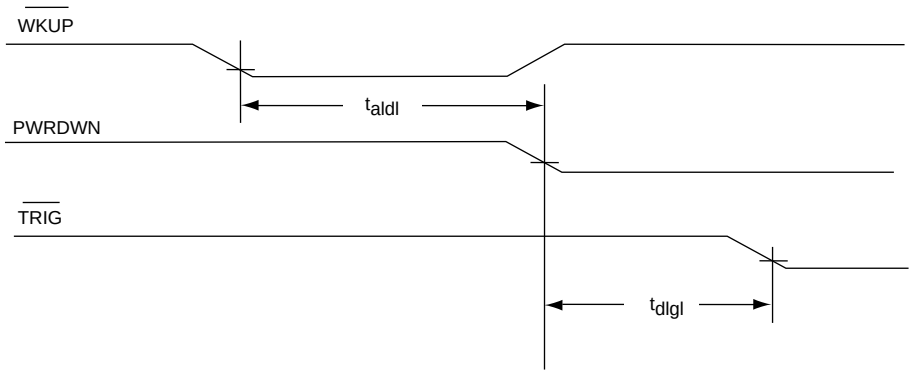
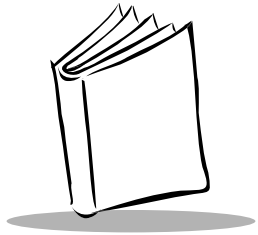


Figure 4-8. Wake Up Timing



Chapter 5 Parameter Menus

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

Operational Parameters

The SE-923 is shipped with the default settings shown in Table 5-1 on page 5-2. These default values are stored in non-volatile memory and are preserved even when the scanner is powered down.

You can change the default values by:

- Scanning the appropriate bar codes included in this chapter. These new values replace the standard default values in memory. The default parameter values can be recalled by scanning the *SET ALL DEFAULTS* bar code on page 5-8.

or

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

Table 5-1 lists the defaults for all parameters. If you wish to change any option, scan the appropriate bar code(s).

Table 5-1. Default Table

Parameter	Parameter Number	Default	Page Number
Set Default Parameter		All Defaults	5-8
Beeper Tone	0x91	Medium Frequency	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	5-22
UPC/EAN			
UPC-A	0x01	Enable	5-23
UPC-E	0x02	Enable	5-24
UPC-E1	0x0C	Disable	5-25
EAN-8	0x04	Enable	5-26
EAN-13	0x03	Enable	5-27
*See Table 6-9 on page 6-25 for formatting of any parameter whose number is 256 or greater.			

Table 5-1. Default Table (Continued)

Parameter	Parameter Number	Default	Page Number
Bookland EAN	0x53	Disable	5-28
Decode UPC/EAN Supplementals	0x10	Ignore	5-30
Decode UPC/EAN Supplemental Redundancy	0x50	7	5-31
Transmit UPC-A Check Digit	0x28	Enable	5-32
Transmit UPC-E Check Digit	0x29	Enable	5-33
Transmit UPC-E1 Check Digit	0x2A	Enable	5-34
UPC-A Preamble	0x22	System Character	5-35
UPC-E Preamble	0x23	System Character	5-36
UPC-E1 Preamble	0x24	System Character	5-37
Convert UPC-E to A	0x25	Disable	5-38
Convert UPC-E1 to A	0x26	Disable	5-39
EAN-8 Zero Extend	0x27	Disable	5-40
Convert EAN-8 to EAN-13 Type	0xE0	Type is EAN-13	5-41
UPC/EAN Security Level	0x4D	0	5-42
UPC/EAN Coupon Code	0x55	Disable	5-44
Code 128			
USS-128	0x08	Enable	5-45
UCC/EAN-128	0x0E	Enable	5-46
ISBT 128	0x54	Enable	5-47
*See Table 6-9 on page 6-25 for formatting of any parameter whose number is 256 or greater.			

Table 5-1. Default Table (Continued)

Parameter	Parameter Number	Default	Page Number
Code 39			
Code 39	0x00	Enable	5-48
Trioptic Code 39	0x0D	Disable	5-49
Convert Code 39 to Code 32	0x56	Disable	5-50
Code 32 Prefix	0xE7	Disable	5-51
Set Length(s) for Code 39	0x12 0x13	2-55	5-53
Code 39 Check Digit Verification	0x30	Disable	5-54
Transmit Code 39 Check Digit	0x2B	Disable	5-55
Code 39 Full ASCII Conversion	0x11	Disable	5-56
Code 93			
Code 93	0x09	Disable	5-57
Set Length(s) for Code 93	0x1A 0x1B	4-55	5-58
Interleaved 2 of 5			
Interleaved 2 of 5	0x06	Enable	5-60
Set Length(s) for I 2 of 5	0x16 0x17	14	5-61
I 2 of 5 Check Digit Verification	0x31	Disable	5-63
Transmit I 2 of 5 Check Digit	0x2C	Disable	5-64
*See Table 6-9 on page 6-25 for formatting of any parameter whose number is 256 or greater.			

Table 5-1. Default Table (Continued)

Parameter	Parameter Number	Default	Page Number
Convert I 2 of 5 to EAN 13	0x52	Disable	5-65
Discrete 2 of 5			
Discrete 2 of 5	0x05	Disable	5-66
Set Length(s) for D 2 of 5	0x14 0x15	12	5-67
Codabar			
Codabar	0x07	Disable	5-69
Set Lengths for Codabar	0x18 0x19	5-55	5-71
CLSI Editing	0x36	Disable	5-72
NOTIS Editing	0x37	Disable	5-73
MSI Plessey			
MSI Plessey	0x0B	Disable	5-74
Set Length(s) for MSI Plessey	0x1E 0x1F	6-55	5-76
MSI Plessey Check Digits	0x32	One	5-77
Transmit MSI Plessey Check Digit	0x2E	Disable	5-78
MSI Plessey Check Digit Algorithm	0x33	Mod 10/Mod 10	5-79
*See Table 6-9 on page 6-25 for formatting of any parameter whose number is 256 or greater.			

Table 5-1. Default Table (Continued)

Parameter	Parameter Number	Default	Page Number
Data Options			
Transmit Code ID Character	0x2D	None	5-81
Prefix/Suffix Values Prefix Suffix 1 Suffix 2	 0x69 0x68 0x6A	 NULL LF CR	5-82
Scan Data Transmission Format	0xEB	Data as is	5-84
Serial Interface			
Baud Rate	0x9C	9600	5-88
Parity	0x9E	None	5-89
Software Handshaking	0x9F	Enable	5-91
Decode Data Packet Format	0xEE	Unpacketed	5-92
Host Serial Response Time-out	0x9B	2 sec	5-93
Stop Bit Select	0x9D	1	5-94
Intercharacter Delay	0x6E	0	5-95
Host Character Time-out	0xEF	200 msec	5-96
Event Reporting*			
Decode Event	0xF0 0x00	Disable	5-98
Boot Up Event	0xF0 0x02	Disable	5-99
Parameter Event	0xF0 0x03	Disable	5-100
*See Table 6-9 on page 6-25 for formatting of any parameter whose number is 256 or greater.			

Table 5-1. Default Table (Continued)

Parameter	Parameter Number	Default	Page Number
Scan Angle			
Scan Angle	0xBF	Normal Width	5-101
*See Table 6-9 on page 6-25 for formatting of any parameter whose number is 256 or greater.			

Set Default Parameter

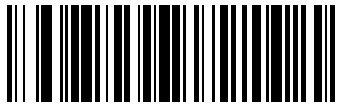
Scanning this bar code returns all parameters to the values listed in Table 5-1 on page 5-2.

SET ALL DEFAULTS

Beeper Tone

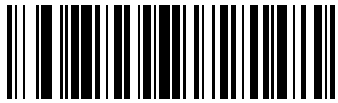
Parameter # 0x91

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



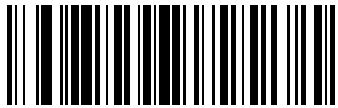
LOW FREQUENCY

(0x02)



MEDIUM FREQUENCY

(0x01)



HIGH FREQUENCY

(0x00)

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. Times less than 1.0 second must have 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on 5-104.

LASER ON TIME

Aim Duration

Parameter # 0xED

When a scanner with an aim mode (see Table 6-10 on page 6-27) is triggered either by a trigger pull, or a *START_DECODE* command, this parameter sets the duration the aiming pattern is seen before a 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 the use of this parameter, see the *AIM_ON* command on 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. Times less that 1.0 second must have 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on 5-104.

AIM DURATION

Power Mode

Parameter # 0x80

This parameter determines whether or not power remains on after a decode attempt. When 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 1-4. When 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 options below to trigger the scan engine. Bar codes and option numbers are on the following page.

- 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. This mode cannot be used with scanners that support an aim mode (see Table 6-10 on page 6-27).
- Host - Triggering signal comes from a host command. Any actual trigger pull will be interpreted by the scan engine as a Level triggering option.

LEVEL

(0X00)

Triggering Modes (cont'd)

PULSE

(0X02)

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 which is identical to one which has just been 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.

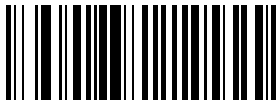
To set a time-out between same symbol, scan the bar code below. Next scan two numeric bar codes beginning on page 5-102 that correspond to the desired time-out. Times less than 1.0 second must have a leading zero. For example, to set a time-out of 0.5 seconds, scan the bar code below, then scan the "0" and "5" bar codes. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on 5-104.

TIME-OUT BETWEEN SAME SYMBOL

Beep After Good Decode

Parameter # 0x38

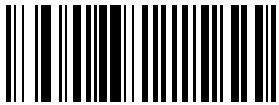
Scan this symbol if you want the unit to beep after a good decode.



BEEP AFTER GOOD DECODE

(0x01)

Scan this symbol if you want the unit 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

When enabled, if a symbol does not decode, "NR" is transmitted. Any prefix or suffixes which have been enabled are appended around this message.

ENABLE NO READ

(0x01)

When disabled, if a symbol does not read, nothing 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. Note that the Set Defaults parameter bar code will 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

Note: *Does not apply to Code 128.*

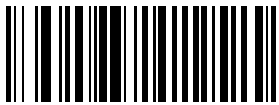
The SE-923 offers four levels of decode security for linear code types (e.g. Code 39, Interleaved 2 of 5). Higher security levels are selected for decreasing levels of bar code quality. As security levels increase, the scanner's aggressiveness decreases.

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 Plessey	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

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

Code Type	Length
All	All

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 Plessey	4 or less
D 2 of 5	8 or less
I 2 of 5	8 or less

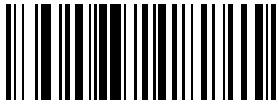
LINEAR SECURITY LEVEL 3

(0x03)

Linear Security Level 4

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

Code Type	Length
All	All



LINEAR SECURITY LEVEL 4

(0x04)

Bi-directional Redundancy

Parameter # 0x43

This parameter is only valid when a *Linear Code Type Security Level* has been 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

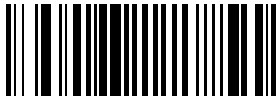
(0x00)

UPC/EAN

Enable/Disable UPC-A

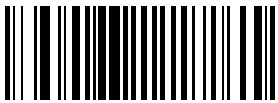
Parameter # 0x01

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



ENABLE UPC-A

(0x01)



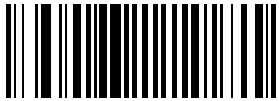
DISABLE UPC-A

(0x00)

Enable/Disable UPC-E

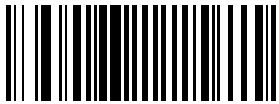
Parameter # 0x02

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.

ENABLE UPC-E1

(0x01)

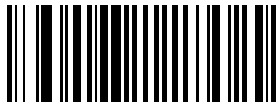
DISABLE UPC-E1

(0x00)

Enable/Disable EAN-8

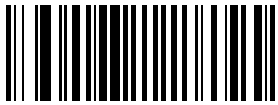
Parameter # 0x04

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



ENABLE EAN-8

(0x01)



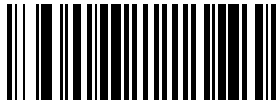
DISABLE EAN-8

(0x00)

Enable/Disable EAN-13

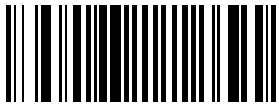
Parameter # 0x03

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

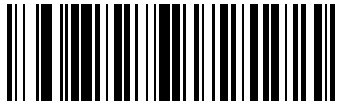
Supplementals are additionally appended characters (2 or 5) according to specific code format conventions (e.g., UPC A+2, UPC E+2, EAN 8+2). Three options are available.

- If UPC/EAN with supplemental characters is selected, UPC/EAN symbols without supplemental characters are not decoded.
- If UPC/EAN without supplemental characters is selected, and the SE-923 is presented with a UPC/EAN plus supplemental symbol, the UPC/EAN is decoded and the supplemental characters ignored.
- An autodiscriminate option is also available. If this option is selected, scan *Decode UPC/EAN Supplemental Redundancy* on page 5-31, then select a value from the numeric bar codes beginning on page 5-102. A value of 5 or more is recommended.

Note: *In order to minimize the risk of invalid data transmission, we recommend that you select whether to read or ignore supplemental characters.*

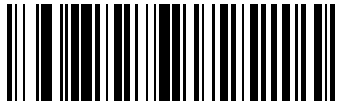
Select the desired option by scanning one of the bar codes on the following page.

Decode UPC/EAN Supplementals (cont'd)



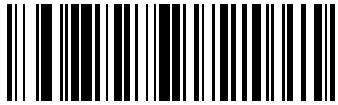
DECODE UPC/EAN WITH SUPPLEMENTALS

(0x01)



IGNORE UPC/EAN WITH SUPPLEMENTALS

(0x00)



AUTODISCRIMINATE UPC/EAN SUPPLEMENTALS

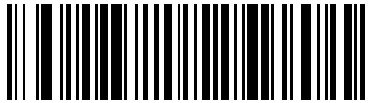
(0x02)

Decode UPC/EAN Supplemental Redundancy

Parameter # 0x50

With *Autodiscriminate 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 autodiscriminate 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 numbers must have a leading zero. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

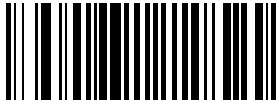


DECODE UPC/EAN SUPPLEMENTAL REDUNDANCY

Transmit UPC-A Check Digit

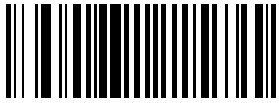
Parameter # 0x28

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



TRANSMIT UPC-A CHECK DIGIT

(0x01)



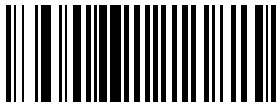
DO NOT TRANSMIT UPC-A CHECK DIGIT

(0x00)

Transmit UPC-E Check Digit

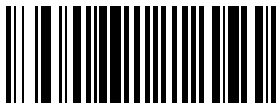
Parameter # 0x29

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)

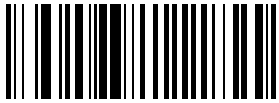
DO NOT TRANSMIT UPC-E1 CHECK DIGIT

(0x00)

UPC-A Preamble

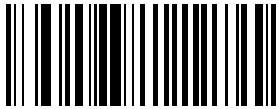
Parameter # 0x22

Three options are given for lead-in characters for UPC-A symbols transmitted to the host device: transmit system character only, transmit system character and country code ("0" for USA), and no preamble transmitted. The lead-in characters are considered part of the symbol.



NO PREAMBLE
(<DATA>)

(0x00)



SYSTEM CHARACTER

(<SYSTEM CHARACTER> <DATA>)

(0x01)

SYSTEM CHARACTER & COUNTRY CODE

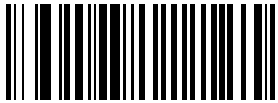
(< COUNTRY CODE> <SYSTEM CHARACTER> <DATA>)

(0x02)

UPC-E Preamble

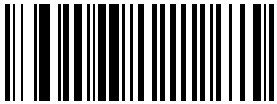
Parameter # 0x23

Three options are given for lead-in characters for UPC-E symbols transmitted to the host device: transmit system character only, transmit system character and country code ("0" for USA), and no preamble transmitted. The lead-in characters are considered part of the symbol.



NO PREAMBLE
(<DATA>)

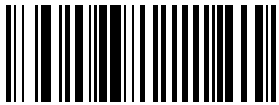
(0x00)



SYSTEM CHARACTER

(<SYSTEM CHARACTER> <DATA>)

(0x01)



SYSTEM CHARACTER & COUNTRY CODE

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

(0x02)

UPC-E1 Preamble

Parameter # 0x24

Three options are given for lead-in characters for UPC-E1 symbols transmitted to the host device: transmit system character only, transmit system character and country code ("0" for USA), and no preamble transmitted. The lead-in characters are considered part of the symbol.

NO PREAMBLE
(<DATA>)

(0x00)

SYSTEM CHARACTER

(<SYSTEM CHARACTER> <DATA>)

(0x01)

SYSTEM CHARACTER & COUNTRY CODE

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

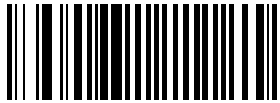
(0x02)

Convert UPC-E to UPC-A

Parameter # 0x25

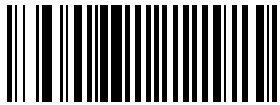
This parameter converts UPC-E (zero suppressed) decoded data to UPC-A format before transmission. After conversion, data follows UPC-A format and is affected by UPC-A programming selections (e.g., Preamble, Check Digit).

Scanning **DO NOT CONVERT UPC-E TO UPC-A** allows you 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

This parameter converts 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).

Scanning **DO NOT CONVERT UPC-E1 TO UPC-A** allows you 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)

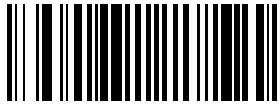
(0x00)

EAN Zero Extend

Parameter # 0x27

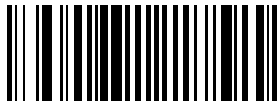
When this parameter is enabled, five leading zeros are added to decoded EAN-8 symbols to make them compatible in format to EAN-13 symbols.

Disabling this parameter returns EAN-8 symbols to their normal format.



ENABLE EAN ZERO EXTEND

(0x01)



DISABLE EAN ZERO EXTEND

(0x00)

Convert EAN-8 to EAN-13 Type

Parameter # 0xE0

When EAN Zero Extend is enabled, this parameter gives you the option of labeling the extended symbol as either an EAN-13 bar code, or an EAN-8 bar code. This affects *Transmit Code ID Character* and *DECODE_DATA* message.

When EAN Zero Extend is disabled, this parameter has no effect on bar code data.

TYPE IS EAN-13

(0x00)

TYPE IS EAN-8

(0x01)

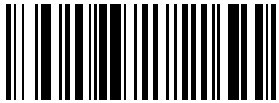
UPC/EAN Security Level

Parameter # 0x4D

The SE-923 offers four levels of decode security for UPC/EAN bar codes. Increasing levels of security are provided for decreasing levels of bar code quality. There is an inverse relationship between security and scanner aggressiveness, so be sure to choose only that level of security necessary for any given application.

UPC/EAN Security Level 0

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

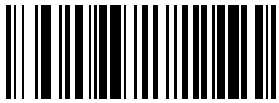


UPC/EAN SECURITY LEVEL 0

(0x00)

UPC/EAN Security Level 1

As bar code quality levels diminish, certain characters become prone to mis-decodes before others (i.e., 1, 2, 7, 8). If you are experiencing mis-decodes of poorly printed bar codes, and the mis-decodes are limited to these characters, select this security level.

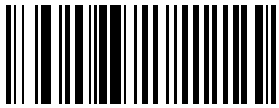


UPC/EAN SECURITY LEVEL 1

(0x01)

UPC/EAN Security Level 2

If you are experiencing mis-decodes of poorly printed bar codes, and the mis-decodes are not limited to characters 1, 2, 7, and 8, select this security level.

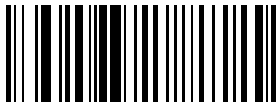


UPC/EAN SECURITY LEVEL 2

(0x02)

UPC/EAN Security Level 3

If you have tried Security Level 2, and are still experiencing misdecodes, select this security level. Be advised, selecting this option is an extreme measure against mis-decoding severely out of spec bar codes. Selection of this level of security significantly impairs the decoding ability of the scanner. If this level of security is necessary, you should try to improve the quality of your bar codes.



UPC/EAN SECURITY LEVEL 3

(0x03)

UPC/EAN Coupon Code

Parameter # 0x55

When enabled, this parameter decodes UPC-A, UPC-A with 2 supplemental characters, UPC-A with 5 supplemental characters, and UPC-A/EAN128 bar codes. Autodiscriminate UPC/EAN Supplementals must be enabled.

ENABLE UPC/EAN COUPON CODE

(0x01)

DISABLE UPC/EAN COUPON CODE

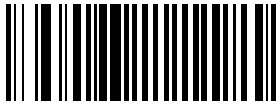
(0x00)

Code 128

Enable/Disable USS-128

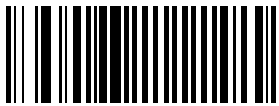
Parameter # 0x08

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



ENABLE USS-128

(0x01)



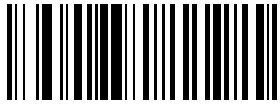
DISABLE USS-128

(0x00)

Enable/Disable UCC/EAN-128

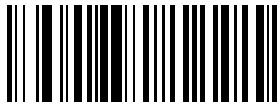
Parameter # 0x0E

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

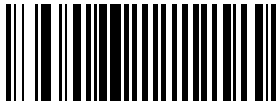
No length setting is required for Code 128. The default setting is Any Length.

Code 39

Enable/Disable Code 39

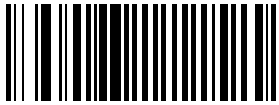
Parameter # 0x00

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 symbols always contain six characters. Trioptic Code 39 and Code 39 Full ASCII should not be enabled simultaneously. 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

Scan this symbol if you want to convert Code 39 to Code 32.

CONVERT CODE 39 TO CODE 32

(ENABLE)

(0x01)

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

Scan this symbol if you do not want to convert Code 39 to Code 32.

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

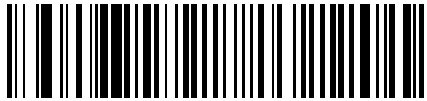
Parameter # L1 = 0x12, L2 = 0x13

Lengths for Code 39 may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. If Code 39 Full ASCII is enabled, **Length Within a Range** or **Any Length** are the preferred options. See Table B-5 on page B-7 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page -6.

One Discrete Length - This option allows you to decode only those codes containing a selected length. For example, if you select **Code 39 One Discrete Length**, then scan **1**, **4**, only Code 39 symbols containing 14 characters are decoded. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODE 39 - ONE DISCRETE LENGTH

Two Discrete Lengths - This option allows you to decode only those codes containing two selected lengths. For example, if you select **Code 39 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, only Code 39 symbols containing 2 or 14 characters are decoded. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.



CODE 39 - TWO DISCRETE LENGTHS

Set Lengths for Code 39

Length Within Range - This option allows you to decode a code type 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODE 39 - LENGTH WITHIN RANGE

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

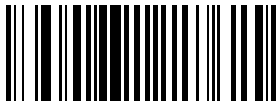
CODE 39 - ANY LENGTH

Code 39 Check Digit Verification

Parameter # 0x30

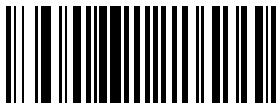
When enabled, this parameter checks the integrity of a Code 39 symbol to ensure it complies with specified algorithms.

Only those Code 39 symbols which include a modulo 43 check digit are decoded when this parameter is enabled.



ENABLE CODE 39 CHECK DIGIT

(0x01)



DISABLE CODE 39 CHECK DIGIT

(0x00)

Transmit Code 39 Check Digit

Parameter # 0x2B

Scan this symbol if you want to transmit the check digit with the data.

TRANSMIT CODE 39 CHECK DIGIT (ENABLE)

(0x01)

Scan this symbol if you want to transmit the data without the check digit.

DO NOT TRANSMIT CODE 39 CHECK DIGIT (DISABLE)

(0x00)

Enable/Disable Code 39 Full ASCII

Parameter # 0x11

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

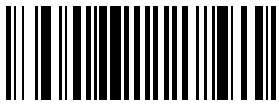
When enabled, the ASCII character set assigns a code to letters, punctuation marks, numerals, and most control keystrokes on the keyboard.

The first 32 codes are non-printable and are assigned to keyboard control characters such as BACKSPACE and RETURN. The other 96 are called printable codes because all but SPACE and DELETE produce visible characters.

Code 39 Full ASCII interprets the bar code special character ($ + % /) preceding a Code 39 character and assigns an ASCII character value to the pair. For example, when Code 39 Full ASCII is enabled and a **+B** is scanned, it is interpreted as **b**, **%J** as **?**, and **$H** emulates the keystroke **BACKSPACE**. Scanning **ABC$M** outputs the keystroke equivalent of **ABC ENTER**. Refer to the Table B-5 on page B-7.

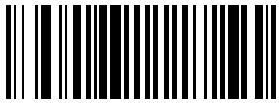
Code 39 Full ASCII and Trioptic Code 39 should not be enabled simultaneously.

The scanner does not autodiscriminate between Code 39 and Code 39 Full ASCII.



ENABLE CODE 39 FULL ASCII

(0x01)



DISABLE CODE 39 FULL ASCII

(0x00)

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

Lengths for Code 93 may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters), including check digit(s) the code contains. See Table B-5 on page B-7 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-6.

One Discrete Length - This option allows you to decode only those codes containing a selected length. For example, if you select **Code 93 One Discrete Length**, then scan **1**, **4**, only Code 93 symbols containing 14 characters are decoded. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODE 93 - ONE DISCRETE LENGTH

Two Discrete Lengths - This option allows you to decode only those codes containing two selected lengths. For example, if you select **Code 93 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, only Code 93 symbols containing 2 or 14 characters are decoded. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODE 93 - TWO DISCRETE LENGTHS

Set Lengths for Code 93

Length Within Range - This option allows you 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODE 93 - LENGTH WITHIN RANGE

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

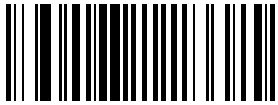
CODE 93 - ANY LENGTH

Interleaved 2 of 5

Enable/Disable Interleaved 2 of 5

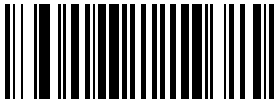
Parameter # 0x06

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

Lengths for I 2 of 5 may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters) the code contains, and includes check digits. See *Table B-5 on page B-7* for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-6.

One Discrete Length - This option allows you to decode only those codes containing a selected length. For example, if you select **I 2 of 5 One Discrete Length**, then scan **1**, **4**, the only I 2 of 5 symbols decoded are those containing 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

I 2 of 5 - ONE DISCRETE LENGTH

Two Discrete Lengths - This option allows you to decode only those codes containing two selected lengths. For example, if you select **I 2 of 5 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, the only I 2 of 5 symbols decoded are those containing 2 or 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, 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 - This option allows you to decode a code type 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

I 2 of 5 - LENGTH WITHIN RANGE

Any Length - Scanning this option allows you 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 if you want to transmit the check digit with the data.

TRANSMIT I 2 of 5 CHECK DIGIT (ENABLE)

(0x01)

Scan this symbol if you want to transmit the 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. In order to accomplish this, the I 2 of 5 code 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

Lengths for D 2 of 5 may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters) the code contains, and includes check digits. See Table B-5 on page B-7 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-6.

One Discrete Length - This option allows you to decode only those codes containing a selected length. For example, if you select **D 2 of 5 One Discrete Length**, then scan **1**, **4**, the only D 2 of 5 symbols decoded are those containing 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

D 2 of 5 - ONE DISCRETE LENGTH

Two Discrete Lengths - This option allows you to decode only those codes containing two selected lengths. For example, if you select **D 2 of 5 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, the only D 2 of 5 symbols decoded are those containing 2 or 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

D 2 of 5 - TWO DISCRETE LENGTHS

Length Within Range - This option allows you to decode a code type 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 always

be preceded by a leading zero). Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

D 2 of 5 - LENGTH WITHIN RANGE

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

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

D 2 of 5 - ANY LENGTH

Codabar

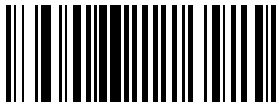
Enable/Disable Codabar

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

Lengths for Codabar may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters) the code contains. It also includes any start or stop characters. See Table B-5 on page B-7 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-6.

One Discrete Length - This option allows you to decode only those codes containing a selected length. For example, if you select **Codabar One Discrete Length**, then scan **1**, **4**, the only Codabar symbols decoded are those containing 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODABAR - ONE DISCRETE LENGTH

Two Discrete Lengths - This option allows you to decode only those codes containing two selected lengths. For example, if you select **Codabar Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, the only Codabar symbols decoded are those containing 2 or 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODABAR - TWO DISCRETE LENGTHS

Length Within Range - This option allows you to decode a code type 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

CODABAR - LENGTH WITHIN RANGE

Any Length - Scanning this option allows you to decode Codabar symbols containing any number of characters.

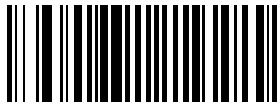
CODABAR - ANY LENGTH

CLSI Editing

Parameter # 0x36

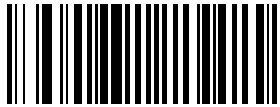
When enabled, this parameter strips the start and stop characters and inserts a space after the first, fifth, and tenth characters of a 14-character Codabar symbol.

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



ENABLE CLSI EDITING

(0x01)



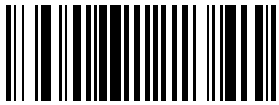
DISABLE CLSI EDITING

(0x00)

NOTIS Editing

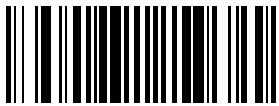
Parameter # 0x37

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



ENABLE NOTIS EDITING

(0x01)



DISABLE NOTIS EDITING

(0x00)

MSI Plessey

Enable/Disable MSI Plessey

Parameter # 0x0B

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

ENABLE MSI PLESSEY

(0x01)

DISABLE MSI PLESSEY

(0x00)

Set Lengths for MSI Plessey

Parameter # L1 = 0x1E, L2 = 0x1F

Lengths for MSI Plessey may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters) the code contains, and includes check digits. See Table B-5 on page B-7 for ASCII equivalents. To set lengths via serial commands, see *Setting Code Lengths Via Serial Commands* on page B-6.

One Discrete Length - This option allows you to decode only those codes containing a selected length. For example, if you select **MSI Plessey One Discrete Length**, then scan **1**, **4**, the only MSI Plessey symbols decoded are those containing 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

MSI Plessey - ONE DISCRETE LENGTH

Two Discrete Lengths - This option allows you to decode only those codes containing two selected lengths. For example, if you select **MSI Plessey Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, the only MSI Plessey symbols decoded are those containing 2 or 14 characters. Numeric bar codes begin on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

MSI Plessey - TWO DISCRETE LENGTHS

Length Within Range - This option allows you to decode a code type within a specified range. For example, to decode MSI Plessey symbols containing between 4 and 12 characters, first scan **MSI Plessey 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

MSI Plessey - LENGTH WITHIN RANGE

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

Note: *Selecting this option may lead to misdecodes for MSI Plessey codes.*

MSI Plessey - ANY LENGTH

MSI Plessey 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 always required. Check digits are not automatically transmitted with the data.

ONE MSI Plessey CHECK DIGIT

(0x00)

If two check digits is selected, an *MSI Plessey Check Digit Algorithm* must also be selected. See page 5-79.

TWO MSI Plessey CHECK DIGIT

(0x01)

Transmit MSI Plessey Check Digit

Parameter # 0x2E

Scan this symbol if you want to transmit the check digit with the data.

TRANSMIT MSI Plessey CHECK DIGIT (ENABLE)

(0x01)

Scan this symbol if you want to transmit the data without the check digit.

DO NOT TRANSMIT MSI Plessey CHECK DIGIT (DISABLE)

(0x00)

MSI Plessey Check Digit Algorithm

Parameter # 0x33

When the Two MSI Plessey check digits option is selected, an additional verification is required to ensure integrity. Either of the two following algorithms may be selected.

MOD 10/ MOD 11

(0x00)

MOD 10/ MOD 10

(0x01)

Transmit Code ID Character

Parameter # 0x2D

A code ID character identifies the code type of a scanned bar code. This may be useful when the scanner is decoding more than one code type. In addition to any single character prefix already selected, the code ID character is inserted between the prefix and the decoded symbol.

The user may 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 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

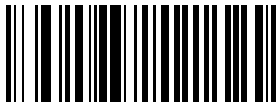
K = UCC/EAN-128

L = Bookland EAN

M = Trioptic Code 39

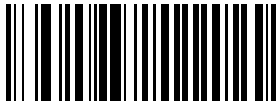
N = Coupon Code

Transmit Code ID Character (cont'd)



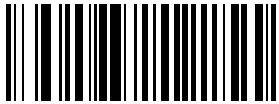
SYMBOL CODE ID CHARACTER

(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 may be appended to scan data for use in data editing. These values are set by scanning a four digit number (i.e. four bar codes) that corresponds to key codes for various terminals. See the *Table B-5 on page B-7*, and *Numeric Bar Codes* on page 5-102. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104. To set the Prefix/Suffix values via serial commands, see *Setting Prefixes and Suffixes 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 5-84.*

SCAN PREFIX

SCAN SUFFIX 1

SCAN SUFFIX 2

Prefix/Suffix Values

DATA FORMAT CANCEL

Scan Data Transmission Format

Parameter # 0xEB

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

DATA AS IS

(0x00)

<DATA> <SUFFIX 1>

(0x01)

<DATA> <SUFFIX 2>

(0x02)

Scan Data Transmission Format

<DATA> <SUFFIX 1> <SUFFIX 2>

(0x03)

<PREFIX> <DATA >

(0x04)

<PREFIX> <DATA> <SUFFIX 1>

(0x05)

<PREFIX> <DATA> <SUFFIX 2>

(0x06)

Scan Data Transmission Format

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

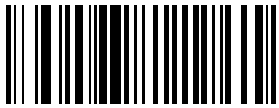
(0x07)

Serial Parameters

Baud Rate

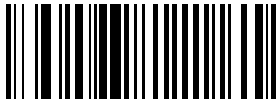
Parameter # 0x9C

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.



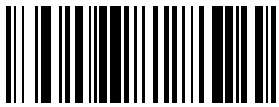
BAUD RATE 300

(0x01)



BAUD RATE 600

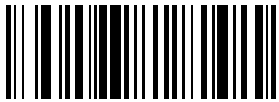
(0x02)



BAUD RATE 1200

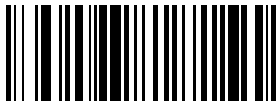
(0x03)

Baud Rate (cont'd)



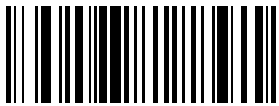
BAUD RATE 2400

(0x04)



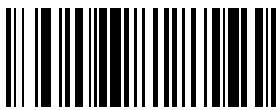
BAUD RATE 4800

(0x05)



BAUD RATE 9600

(0x06)



BAUD RATE 19,200

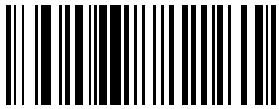
(0x07)

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.

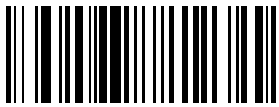
If you select **ODD** parity, the parity bit has a value 0 or 1, based on data, to ensure than an odd number of 1 bits is contained in the coded character.



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.

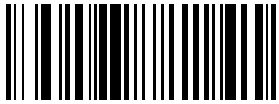


EVEN

(0x01)

Parity (cont'd)

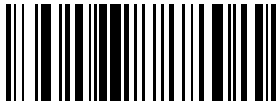
Select **MARK** parity and the parity bit is always 1.



MARK

(0x02)

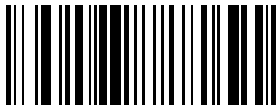
Select **SPACE** parity and the parity bit is always 0.



SPACE

(0x03)

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



NONE

(0x04)

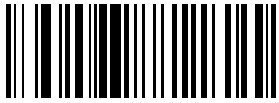
Software Handshaking

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 will neither generate nor expect ACK/NAK handshaking packets.



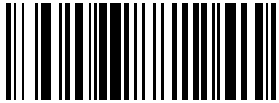
DISABLE ACK/NAK

(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 will also ACK or NAK messages from the host when this option is selected.

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 chosen, ACK/NAK handshaking is automatically 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.

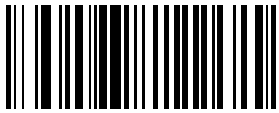
The delay period can range from 0.0 to 9.9 seconds in 0.1 second increments. After scanning the bar code below, scan two numeric bar codes beginning on page 5-102. Time durations of less than 1.0 second require a leading zero. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

HOST SERIAL RESPONSE TIME-OUT

Stop Bit Select

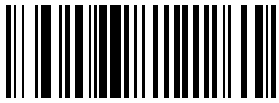
Parameter # 0x9D

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. The number of stop bits selected (one or two) depends on the number the receiving terminal is programmed to accommodate. Set the number of stop bits to match host device requirements.



1 STOP BIT

(0x01)



2 STOP BITS

(0x02)

Intercharacter Delay

Parameter # 0x6E

Select the intercharacter delay option matching host requirements. The intercharacter delay gives the host system time to service its receiver and perform other tasks between characters. 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. If you make an error, or wish to change your selection, 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. If you make an error, or wish to change your selection, scan the *CANCEL* bar code on page 5-104.

HOST CHARACTER TIME-OUT

Event Reporting

The host can request the decoder to furnish certain information (events) relative to the decoder's behavior. The events listed in Table 5-2. and on the following pages can be enabled or disabled by scanning the appropriate bar codes. 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 Defaults set (and parameter event is enabled by default) Number expected	0x07 0x08 0x0A 0x0F

Decode Event

Parameter # 0xF0 0x00

When enabled, the decoder generates a message to the host whenever a bar code is successfully decoded. When disabled, no notification is sent.

ENABLE

(0x01)

DISABLE

(0x00)

Boot Up Event

Parameter # 0xF0 0x02

When enabled, the decoder generates a message to the host whenever power is applied. When disabled, no notification is sent.

ENABLE

(0x01)

DISABLE

(0x00)

Parameter Event

Parameter # 0xF0 0x03

When enabled, the decoder generates a message to the host when one of the events specified in Table 5-2 on page 5-97 occurs. When disabled, no notification is sent.

ENABLE

(0x01)

DISABLE

(0x00)

Scan Angle

Parameter # 0xBF

Choose one of the options belowto adjust the visible scan width in scanners that support laser clipping (see Table 6-10 on page 6-27). The scan width is reduced by software control.

Laser Clipping Selection

No Clipping
(0x64)

Minimum Clipping
(0x4B)

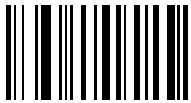
Medium Clipping
(0x3C)

Maximum Clipping
(0x2D)

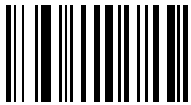
Numeric Bar Codes

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

0



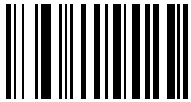
1



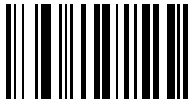
2

3

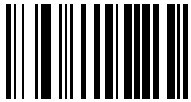
Numeric Bar Codes (cont'd)



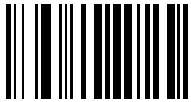
4



5

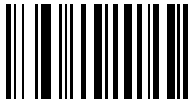


6

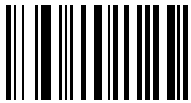


7

Numeric Bar Codes (cont'd)



8

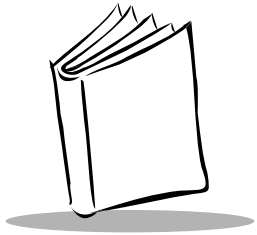


9

Cancel

If you make an error, or wish to change your selection, scan the bar code below.

CANCEL



Chapter 6
Simple Serial Interface

Introduction

This chapter describes the system requirements of the Simple Serial Interface, which provides a communications link between Symbol Technologies decoders (e.g., SE-923 scan engine, slot scanners, hand-held scanners, two-dimensional scanners, hands free scanners, and RF base stations) and a serial host. It provides the means for the host to control the decoder.

Communications

All communications between the decoder and host are done over the hardware interface lines using the Simple Serial Interface (SSI) protocol. The *Serial Interface Specification* (SIF) is described in *Appendix A*.

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.

The Simple Serial Interface performs the following major 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 working environment of the Simple Serial Interface 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 the transmitted 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 the *SSI Message Formats* section. The *SSI Transactions* section describes the required sequence of messages in specific cases.

Table 6-1 lists all the SSI Opcodes supported by the SE-923. It identifies the SSI partner allowed to send a message of each type. The host transmits Opcodes designated type **H**. 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
Note: D = Decoder, H = Host, H/D = Host/Decoder				

Table 6-1. SSI Commands (Continued)

Name	Type	Opcode	Description	Page
PARAM_SEND	H/D	0xC6	Send parameter values.	6-24
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 show 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 utilize 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 6-34 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 (see Table 6-10 on page 6-27).

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 (see Table 6-10 on page 6-27).

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. We recommend, however, it be left enabled.*

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

Host Requirements

A CMD_ACK or response data must be sent by the decoder 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 should resend the message (with the retransmit status bit set) before declaring a failure. The host should limit the number of retries.

Decoder Requirements

A CMD_ACK or response data must be sent by the decoder 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 (retry). 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. We recommend, however, it be left enabled.*

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

NAK types supported by the SE-923 are contained in Table 6-5.

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 has not been sent successfully at that 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.

This Opcode is used by the decoder 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 SE-923 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 with 5 Supps.**	0x8B
Code 128	0x03	**EAN 13**	0x0B
Discrete 2 of 5	0x04	**EAN 13 with 2 Supps.**	0x4B
IATA 2 of 5	0x05	**EAN 13 with 5 Supps.**	0x8B
Interleaved 2 of 5	0x06	**MSI Plessey**	0x0E
Code 93	0x07	**EAN 128**	0x0F
UPC A	0x08	**UPC E1**	0x10
UPC A with 2 Supps.	0x48	**UPC E1 with 2 Supps.**	0x50
UPC A with 5 Supps.	0x88	**UPC E1 with 5 Supps.**	0x90
UPC E0	0x09	**Trioptic Code 39**	0x15
UPC E0 with 2 Supps.	0x49	**Bookland EAN**	0x16
UPC E0 with 5 Supps.	0x89	**Coupon Code**	0x17
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 5-97
Checksum	2's complement sum of message contents excluding checksum.	2 Bytes	Checksum of message.

The message is sent by the decoder when an enabled event occurs. Use Table 5-2 on page 5-97, and parameters 0xF0 0x00 through 0xF0 0x07 to determine which events you would like to 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 decode LED is turned off by the decoder.

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 decode LED is turned on by the decoder.

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 decoders 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, an empty PARAM_SEND message is transmitted. 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 may fall outside the programmable Serial Response Time-out. It should not be considered an error if the time-out is exceeded. 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 that are supported, and their values. The programmable Serial Response Time-out may be exceeded when processing this message, depending on the time-out set, and the number of parameters requested.

Hints for requesting parameter values:

Before forming a PARAM_REQUEST, be sure you are requesting parameters supported by the decoder (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

When using the 0xFE, it must be in the first position of the request_data field, 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

Table 6-8. Example Requests and Replies (Continued)

PARAM_REQUEST message		Response PARAM_SEND message
#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. Param 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, it may not be possible for the decoder to send an ACK within the programmable Serial Response time-out. It should not be considered an error if the time-out is exceeded. 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 PARAM_SEND sent by the host contains 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 sends the values for all the supported parameter values requested in the PARAM_REQUEST message. 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.

Table 6-10 lists the scan engine codes.

Table 6-10. Scan Engine Codes

Engine Code	Engine Description	Aiming Pattern	Blinking Trigger	Laser Clipping	Narrow / Wide
0x00	SE 1200 Standard	No	Yes	No	No
0x01	SE 1200LR (Long Range)	Yes	No	No	No
0x02	SE 1200WA (Wide Angle)	No	Yes	No	No
0x03	SE 1200HV (High Visibility)	Yes	No	No	No
0x04	SE 1200C1 (Class 1)	No	Yes	No	No
0x05	SE 1200VHD (Very High Density)	No	Yes	No	No
0x28	SE 900 Standard	Yes	No	Yes	No
0x29	Reserved	-	-	-	-
0x2C	Reserved	-	-	-	-
0x2D	Reserved	-	-	-	-
0x2A	SE 900C1 IEC Class 1	No	Yes	Yes	No
0x2B	Reserved	-	-	-	-
0x2D	Reserved	-	-	-	-

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 tell the decoder to allow scanning. Scanning is enabled upon power-up, so this command need only be send if a prior SCAN_DISABLE command has been sent.

Decoder Requirements

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

Note: *At initial power-up, the decoder should assume 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, as it may be busy processing data at the time.*

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 being used or has been bypassed. (See *Power Management* on page 1-4.)

Host Requirements

Once the WAKEUP character has been 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 automatically (if low power mode is enabled).

Decoder Requirements

The decoder must not go back into 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 should send the wakeup character anytime it wants to communicate with the scanner.

SSI Transactions

General data transactions

ACK/NAK Handshaking

ACK/NAK handshaking may be enabled or disabled. If this parameter is set, 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.

Example of a problem which may occur when ACK/NAK handshaking is disabled:

- The host sends a PARAM_SEND message to the decoder to change 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

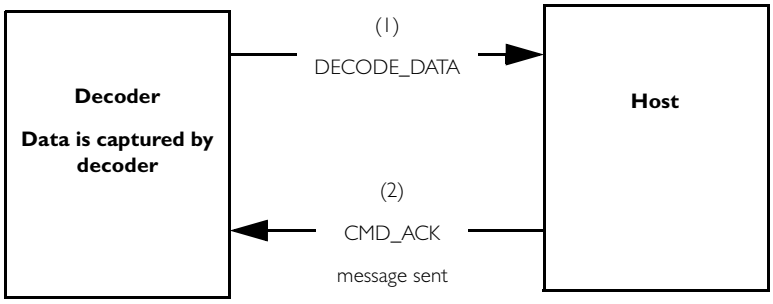
The Decode Data Packet Format parameter controls how decode data is sent to the host. When this parameter is set, the data is sent in a DECODE_DATA packet. When the parameter is cleared, the data is transmitted as raw ASCII data.

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

ACK/NAK Enabled and Packeted Data

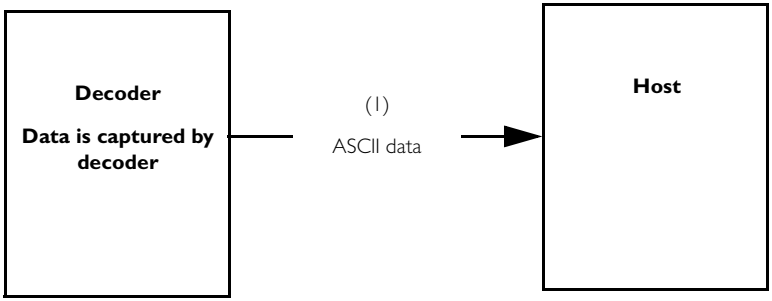
The decoder sends a DECODE_DATA message after a successful decode. The decoder waits for a programmable time-out for a CMD_ACK response. If it does not receive the response, the decoder tries to send twice more before issuing a host transmission error. If the decoder

receives a CMD_NAK from the host, it may attempt a retry depending on the cause field of the CMD_NAK message.



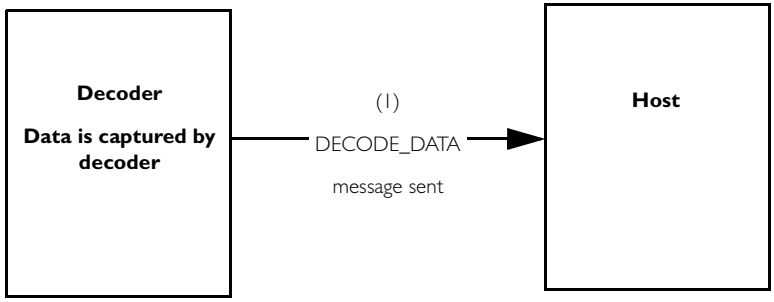
ACK/NAK Enabled and Unpacketed ASCII Data

Even though the 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.



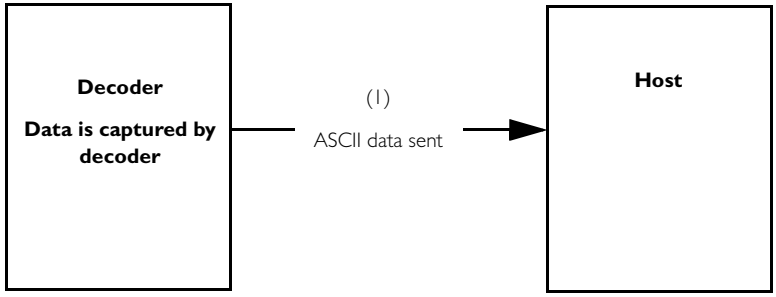
ACK/NAK Disabled and Packeted DECODE_DATA

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 and we suggest the option not be disabled. Disabling this handshaking may lead to communication problems, as handshaking provides the only acknowledgment to the receipt of a message. It tells the sender whether or not the 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 is used to determine 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 may 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 more 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 the serial parameters above are changed using PARAM_SEND, the ACK response to the PARAM_SEND is sent using the previous values for these parameters. The new values then take effect for the next transaction.

Errors

A communication error is generated by the decoder 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.

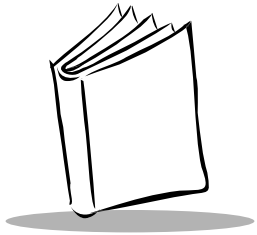
Things to Remember When Using SSI Communication:

If hardware handshaking is not being used, messages should be spaced sufficiently apart, and the host must not communicate with the SE-923 if the SE-923 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 SE-923. 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 should not be necessary.



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. However, SIF does not specify the specific actions to take to correct the error. Instead, this is left to the software/hardware layer above SIF.

Terms and Definitions

The Systems

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

Inactive

The interpretation of what physical quantity represents inactive is up to each system. Two systems must have the same interpretation of inactive in order to communicate.

The Decoder and the Host

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

A Character

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

Data

The word Data is used when referring 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 those requirements that are common to the decoder and the host.

Note: *SIF is a half-duplex communication protocol. In order 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. So, if you are using a PC communications package such as Windows Terminal, you must disconnect the hardware handshaking lines from the interface.

The software application libraries included with the optional SE 1223 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-6.
HOST RTS	Decoder transmit request granted (output). See *The Host* on page A-6.

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

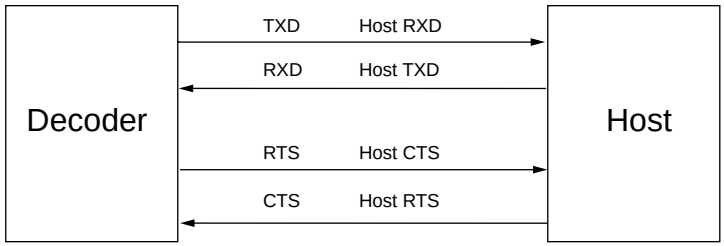


Figure A-1. Decoder and Host Signals

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 may 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.

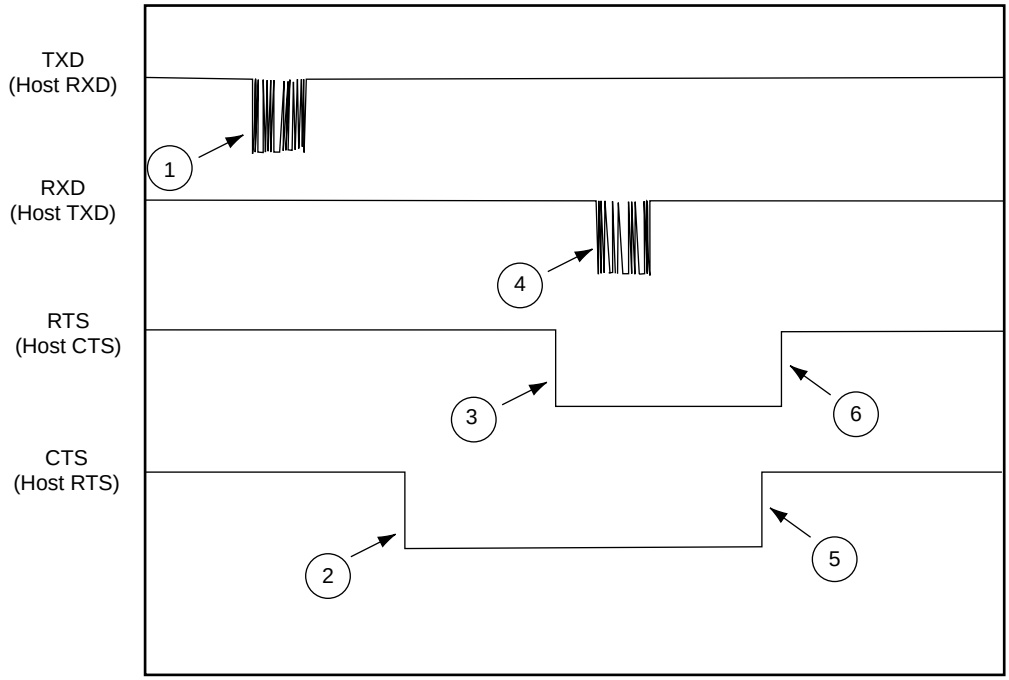
Sample Code for Host Receive Procedure

```
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
```

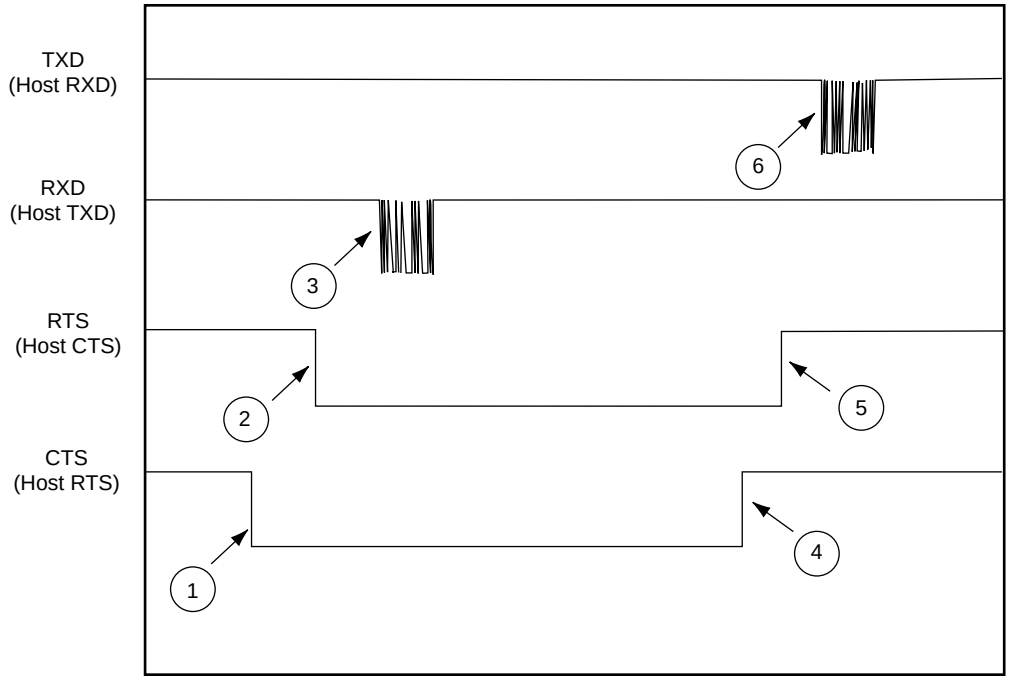
Transaction Examples

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



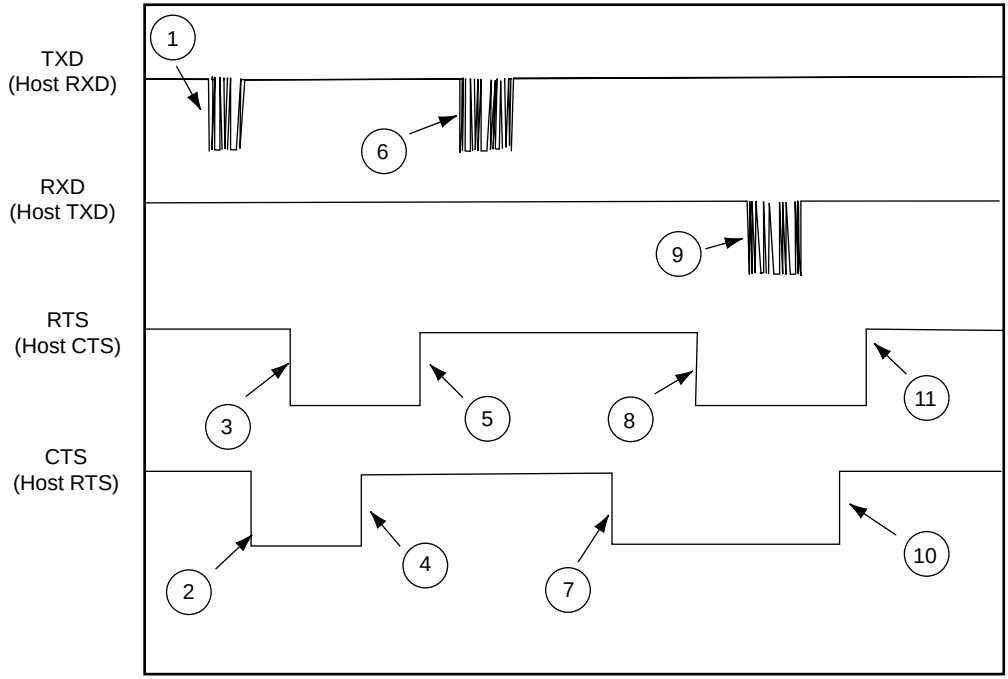
1. Decoder data
2. Host requests to send
3. Decoder grants permission
4. ACK response
5. Host removes request
6. Decoder removes permission

Figure A-2. Basic Decoder Initiated Transaction



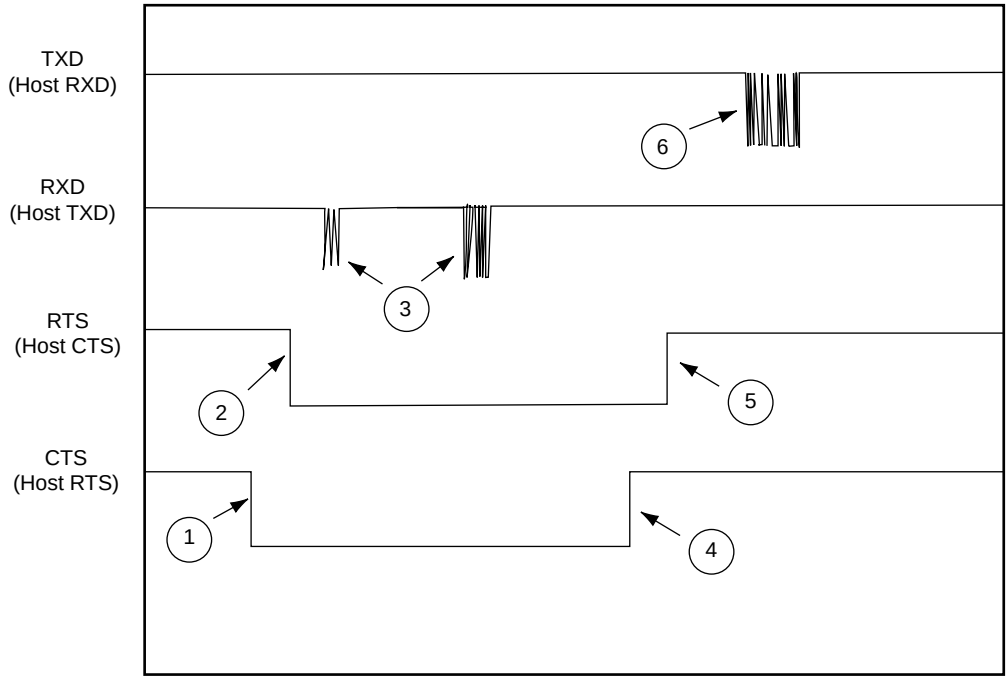
1. Host requests to send
2. Decoder grants permission
3. BEEP command sent
4. Host removes request
5. Decoder removes permission
6. Decoder ACKs

Figure A-3. Basic Host Initiated Transaction



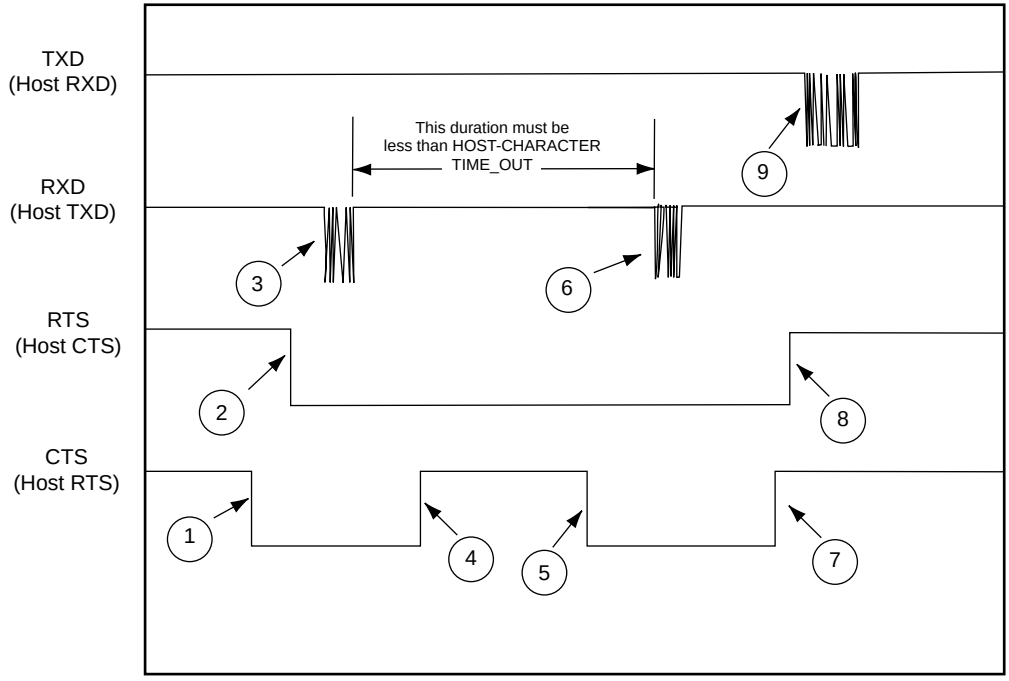
1. Decoder starts to transmit
2. Host asserts RTS causing transmission pause
3. Decoder grants permission for host to send
4. Host removes request without sending
5. Decoder removes permission
6. Decoder resumes transmission
7. Host requests permission to send ACK
8. Decoder grants permission
9. Host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

Figure A-4. Host Interrupting Decoder's Transmission



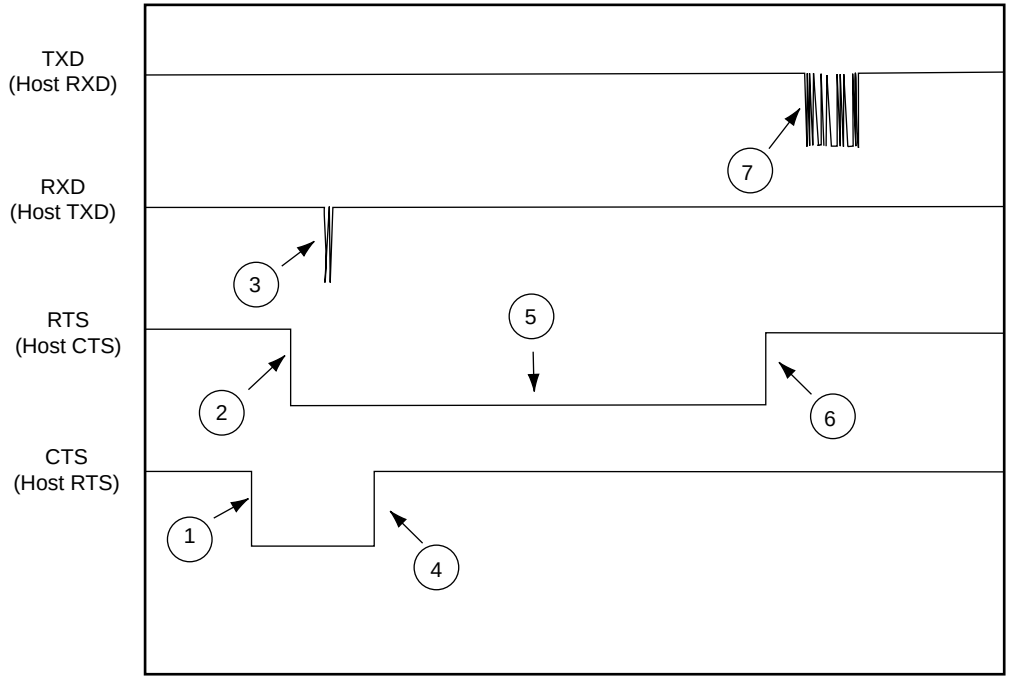
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 3 nulls, then BEEP command
4. Host removes request when finished sending
5. Decoder removes permission
6. Decoder ACKs

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



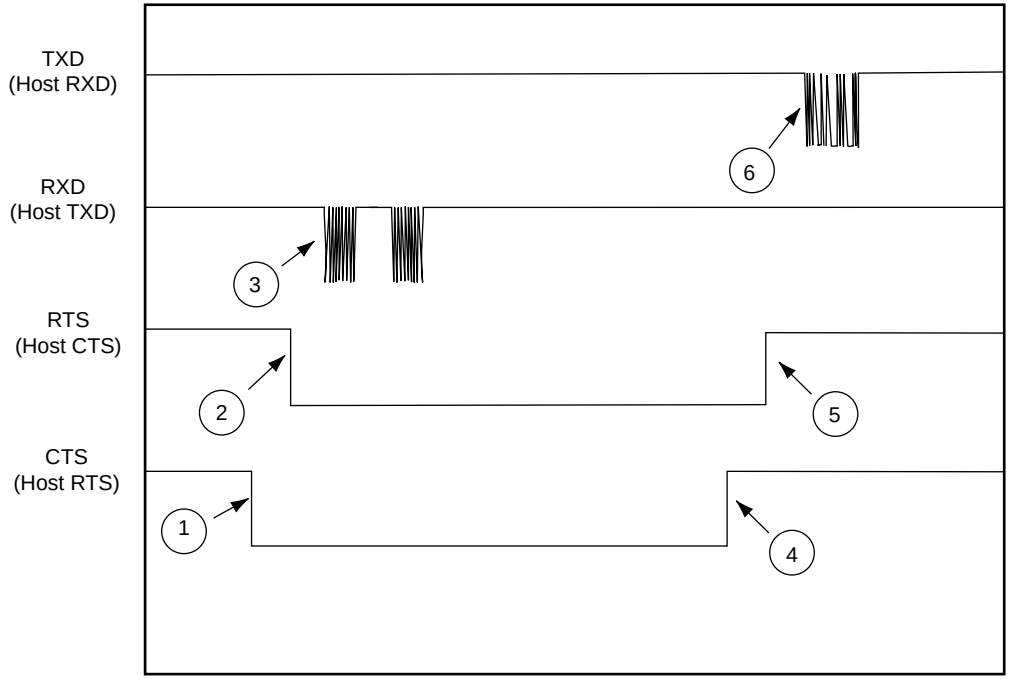
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 1/2 BEEP command
4. Host removes request (ignored by decoder until transmit complete or timed out)
5. Host requests again (ignored by decoder until transmit complete or timed out)
6. Host sends remainder of BEEP command
7.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

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



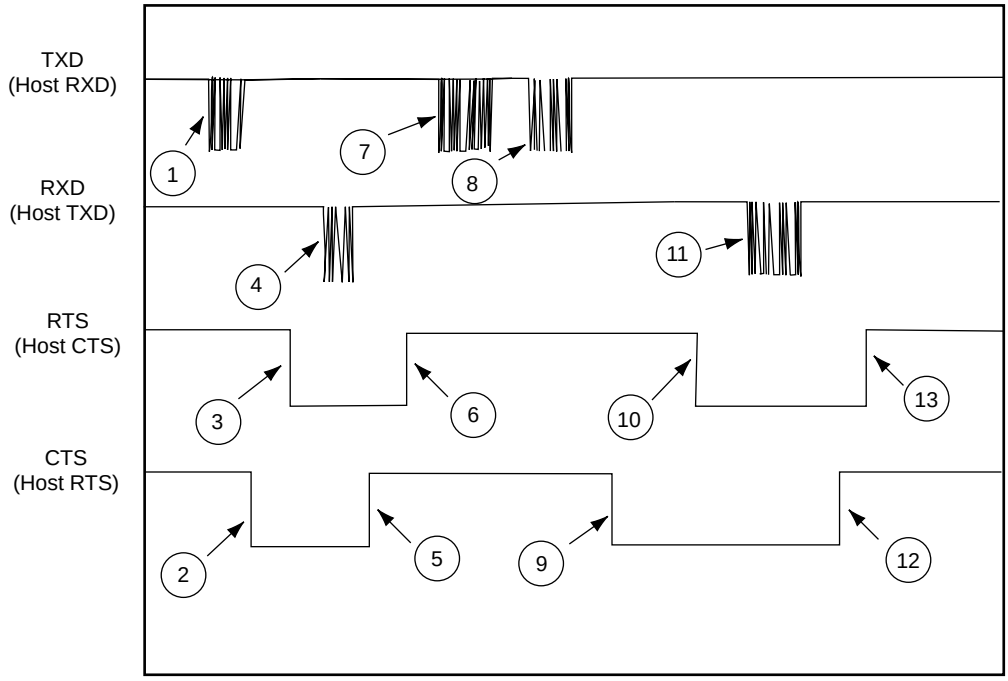
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 2 characters of message
4. Host removes request
5. RTS remains low because decoder is still expecting data
6. Decoder times out waiting for a character and removes permission
7. Decoder sends a NAK resend

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



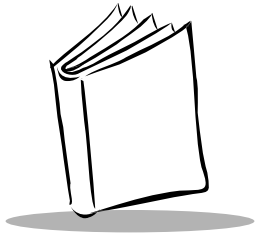
1. Host requests permission to send
2. Decoder grants permission
3. Host sends 2 BEEP commands instead of 1
4. Host removes request
5. Decoder removes permission
6. Decoder ACKs first BEEP command

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*
- *AIM Code Identifiers*
- Setting Code Lengths
- Setting Prefixes and Suffixes Via Serial Commands
- Character Equivalents

UCC/EAN-128

UCC/EAN-128 is a convention for printing data fields with standard 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 may still be used, but are not encoded according to the EAN-128 convention. Standard Code 128 and UCC/EAN-128 may be mixed in an application. The SE-923 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 SE-923 in each of the four possible parameter settings.

Table B-1. Reading Standard Code128 & 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 Plessey
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 Code (EAN) 128 bar code with Function 1 character in the first position, **FNC1** Aim Id is transmitted as]**C1**AimId	

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]I04123	
Codabar		
	0	No check digit processing.
	1	Reader has checked check digit.
	3	Reader has stripped check digit before transmission.
	Example: A Codabar bar code without check digit, 4123, is transmitted as]F04123	
Code 93		
	0	No options specified at this time. Always transmit 0.
	Example: A Code 93 bar code 012345678905 is transmitted as]G0012345678905	
MSI Plessey		
	0	Single check digit checked.
	1	Two check digits checked.
	2	Single check digit verified and stripped before transmission.
	3	Two check digits verified and stripped before transmission.
	Example: An MSI Plessey bar code 4123, with a single check digit checked, is transmitted as]M04123	
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]S04123	

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 and UPC-E (not including supplemental data).
	1	Two digit supplement data only.
	2	Five digit supplement data only.
	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 SE-923, 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* 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 (0x69), Suffix1 (0x68) 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

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
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
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	!

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
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	*
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	:

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
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
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

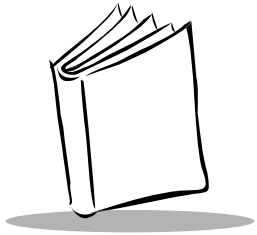
Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
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	\
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

Table B-5. Character Equivalents (Continued)

Scan Value	Hex Value	Full ASCII Code 39 Encode Char.	Keystroke
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
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. But the conversion of those 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 1 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 1 operation. The CDRH time base for Class 1 devices is 10,000 seconds.
CDRH Class 2	CDRH 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 CDRH Class 2 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.

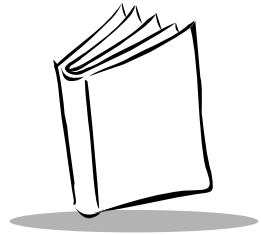
Code 3 of 9 (Code 39)	A versatile and widely used alphanumeric bar code symbology with a set of 43 character types, including all uppercase letters, numerals from 0 to 9, and 7 special characters (- . / + % $ and space). The code name is derived from the fact that 3 of 9 elements representing a character 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.
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 Plessey 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 Plessey 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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W

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Did this manual meet your needs? If not, please explain. _____

What topics need to be added to the index, if applicable? _____

What topics do you feel need to be better discussed? Please be specific. _____

What can we do to further improve our manuals? _____

Thank you for your input—We value your comments.