SE 1200 Series Scan Engine

Integration Guide

SE 1200 Series Scan Engine Integration Guide

72-58178-01
Revision A
January 2003

symbol®

Symbol Technologies, Inc.
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http://www.symbol.com

Patents

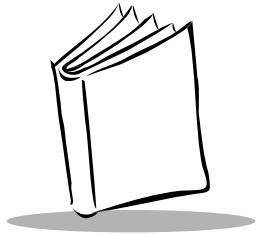
This product is covered by one or more of the following U.S. and foreign Patents:

U.S. Patent No. 4,593,186; 4,603,262; 4,607,156; 4,652,750; 4,673,805; 4,736,095; 4,758,717; 4,760,248; 4,806,742; 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; 5,216,232; 5,229,591; 5,230,088; 5,235,167; 5,243,655; 5,247,162; 5,250,791; 5,250,792; 5,260,553; 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; 5,324,924; 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; 5,557,093; 5,578,810; 5,581,070; 5,589,679; 5,589,680; 5,608,202; 5,612,531; 5,619,028; 5,627,359; 5,637,852; 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; 5,742,043; 5,745,794; 5,754,587; 5,762,516; 5,763,863; 5,767,500; 5,789,728; 5,789,731; 5,808,287; 5,811,785; 5,811,787; 5,815,811; 5,821,519; 5,821,520; 5,823,812; 5,828,050; 5,848,064; 5,850,078; 5,861,615; 5,874,720; 5,875,415; 5,900,617; 5,902,989; 5,907,146; 5,912,450; 5,914,478; 5,917,173; 5,920,059; 5,923,025; 5,929,420; 5,945,658; 5,945,659; 5,946,194; 5,959,285; 6,002,918; 6,021,947; 6,029,894; 6,031,830; 6,036,098; 6,047,892; 6,050,491; 6,053,413; 6,056,200; 6,065,678; 6,067,297; 6,082,621; 6,084,528; 6,088,482; 6,092,725; 6,101,483; 6,102,293; 6,104,620; 6,114,712; 6,115,678; 6,119,944; 6,123,265; 6,131,814; 6,138,180; 6,142,379; 6,172,478; 6,176,428; 6,178,426; 6,186,400; 6,188,681; 6,209,788; 6,209,789; 6,216,951; 6,220,514; 6,243,447; 6,244,513; 6,247,647; 6,308,061; 6,250,551; 6,295,031; 6,308,061; 6,308,892; 6,321,990; 6,328,213; 6,330,244; 6,336,587; 6,340,114; 6,340,115; 6,340,119; 6,348,773; 6,380,949; 6,394,355; D305,885; D341,584; D344,501; D359,483; D362,453; D363,700; D363,918; D370,478; D383,124; D391,250; D405,077; D406,581; D414,171; D414,172; D418,500; D419,548; D423,468; D424,035; D430,158; D430,159; D431,562; D436,104.

Invention No. 55,358; 62,539; 69,060; 69,187, NI-068564 (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. 06/02



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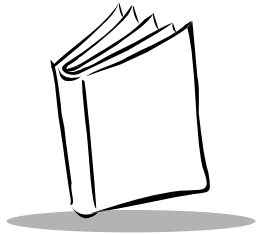

About This Manual

Overview

The *SE 1200 Series Scan Engine Integration Guide* provides general instructions for mounting and set up of the SE 1200 series scan engines.

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

Chapter Descriptions

Topics covered in this guide are as follows:

- Chapter 1, *Introduction*, provides an Overview of the scan engines as well as the Theory of Operation and the Electrical Interface information.
- Chapter 2, *Installation*, explains how to install the scan engines. Provides detailed information on Mounting, Installation, Housing Design, Grounding, ESD, Environmental, Optical, Location and Positioning requirements are provided. Information on accessories is also provided.
- Chapter 3, *SE 1200HP-I10xA Specifications*, provides the SE 1200HP-I10xA scan engine technical specifications.
- Chapter 4, *SE 1200WA-I100A Specifications*, provides the SE 1200WA-I100A scan engine technical specifications.

- Chapter 5, *SE 1200WA-I200A Specifications*, provides the SE 1200WA-I200A scan engine technical specifications.
- Chapter 6, *SE 1200WA-I000A Specifications*, provides the SE 1200WA-I000A scan engine technical specifications.
- Chapter 7, *SE 1200VHD-I000A Specification*, provides the SE 1200VHD-I000A scan engine technical specifications.
- Chapter 8, *SE 1200LR-I001A Specification*, provides the SE 1200LR-I001A scan engine technical specifications.
- Chapter 9, *SE 1200ALR-I000A Specification*, provides the SE 1200ALR-I000A scan engine technical specifications.
- Chapter 10, *Troubleshooting*, provides the scan engines Troubleshooting procedures.
- Glossary, provides a listing of common terms used with the 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 Center* for your region. See page x for contact information. 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.*

Symbol Support Center

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

United States [1]
Symbol Technologies, Inc.
One Symbol Plaza
Holtsville, New York 11742-1300
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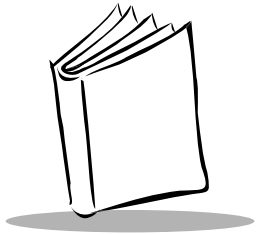
[1]Customer support is available 24 hours a day, 7 days a week.

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

For the latest version of this guide go to: http://www.symbol.com/manuals.

Warranty

(A) Seller's hardware Products are warranted against defects in workmanship and materials for a period of twelve (12) months from the date of shipment, provided the Product remains unmodified and is operated under normal and proper conditions. Warranty provisions and durations on software, integrated installed systems, Product modified or designed to meet specific customer specifications ("Custom Products"), remanufactured products, and reconditioned or upgraded products, shall be as provided in the applicable Product specification in effect at the time of purchase or in the accompanying software license. (B) Products may be serviced or manufactured with parts, components, or subassemblies that originate from returned products and that have been tested as meeting applicable specifications for equivalent new material and Products. The sole obligation of Seller for defective hardware Products is limited to repair or replacement (at Seller's option) on a "return to service depot" basis with prior Seller authorization. Shipment to and from Seller will be at Seller's expense, unless no defect is found. No charge will be made to Buyer for replacement parts for warranty repairs. Seller is not responsible for any damage to or loss of any software programs, data or removable data storage media, or the restoration or reinstallation of any software programs or data other than the software, if any, installed by Seller during manufacture of the Product. The aforementioned provisions do not extend the original warranty period of any Product that had either been repaired or replaced by Seller. (C) The above warranty provisions shall not apply to any Product (i) which has been repaired, tampered with, altered or modified, except by Seller's authorized service personnel; (ii) in which the defects or damage to the Product result from normal wear and tear, misuse, negligence, improper storage, water or other liquids, battery leakage or failure to perform operator handling and scheduled maintenance instructions supplied by Seller; (iii) which has been subjected to unusual physical or electrical stress, abuse, or accident, or forces or exposure beyond normal use within the specified operational and environmental parameters set forth in the applicable Product specification; nor shall the above warranty provisions apply to any expendable or consumable items, such as batteries, supplied with the Product. EXCEPT FOR THE WARRANTY OF TITLE AND THE EXPRESS WARRANTIES STATED ABOVE, SELLER DISCLAIMS ALL WARRANTIES ON PRODUCTS FURNISHED HERUNDER INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABLILTY AND FITNESS FOR A PARTICULAR USE. ANY IMPLIED WARRANTIES THAT MAY BE IMPOSED BY LAW ARE LIMITED IN DURATION TO THE LIMITED WARRANTY PERIOD. SOME STATES OR COUNTRIES DO NOT ALLOW A LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR CONSUMER PRODUCTS. IN SUCH STATES OR COUNTIRES, FOR SUCH PRODUCTS, SOME EXCLUSIONS OR LIMITATIONS OF THIS LIMITED WARRANTY MAY NOT APPLY. The stated express warranties are in lieu of all obligations or liabilities on the part of Seller for damages, including but not limited to, special, indirect or consequential damages arising out of or in connection with the use or performance of the Product or service. Seller's liability for damages to Buyer or others resulting from the use of any Product or service furnished hereunder shall in no way exceed the purchase price of said Product or the fair market value of said service, except in instances of injury to persons or property.



Chapter 1
Introduction

WARNING

Per FDA and IEC standards, the scan engines described in this guide are not given a laser classification. However, the following precautions should be observed.
This laser component emits FDA/IEC Class 2 laser light at the exit port. Do not stare into beam.

Overview

The SE 1200 is a miniaturized, high performance, visible-laser based scan engine intended for integration into OEM equipment.

Symbol's state-of-the-art laser technology provides the highest first read rates, accuracy, a wide decode zone, and excellent reliability.

Available versions include:

- *SE 1200HP-I10xA Specifications* on page 3-1
- *SE 1200WA-I100A Specifications* on page 4-1
- *SE 1200WA-I200A Specifications* on page 5-1
- *SE 1200WA-I000A Specifications* on page 6-1
- *SE 1200VHD-I000A Specification* on page 7-1
- *SE 1200LR-I001A Specification* on page 8-1
- *SE 1200ALR-I000A Specification* on page 9-1

A zif connector mounted on the scan engine provides connection between the scanner and host, or hardware acquisition/decoder element.

Theory of Operation

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

When the laser light strikes a bar code, the dark bars absorb the laser light and the light spaces reflects it. A photo diode senses the reflected light and generates a proportional current. That current is amplified and filtered to produce an analog voltage which is sent to a digitizer. The digitizer transforms the signal into a digital representation of the bar code called the Digitized Bar Pattern (DBP) and the DBP data is sent to the host or decode board for processing.

Block Diagram

The SE 1200 Scan Engine Block Diagram (Figure 1-1) provides the functional relationship of the SE 1200 components. A detailed functional description of each of the components in the block diagram is also provided.

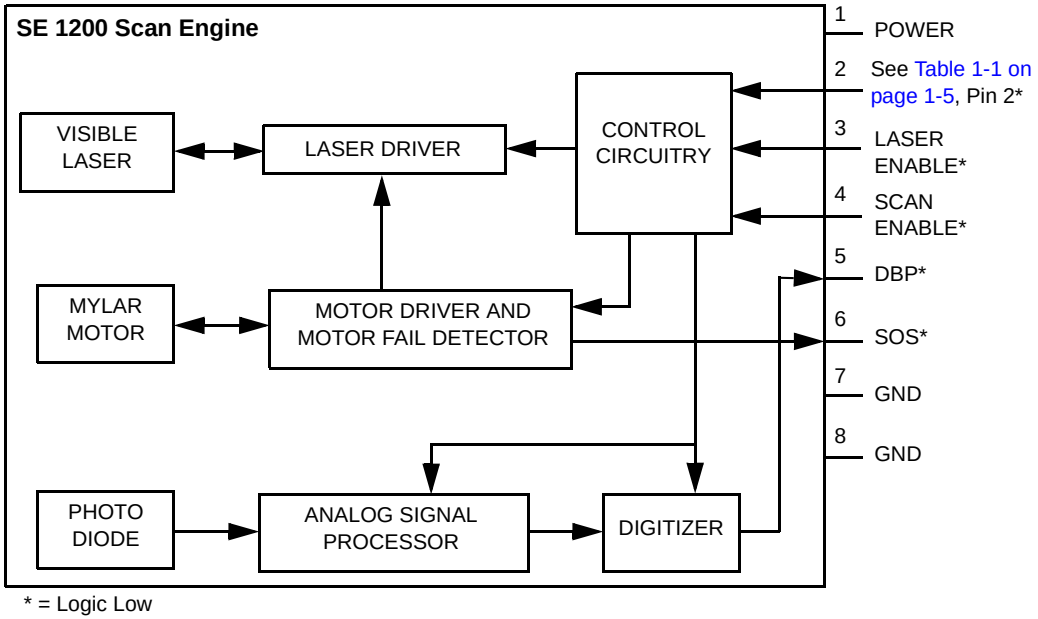


Figure 1-1. SE 1200 Scan Engine Block Diagram

Visible Laser Diode

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

Laser Driver

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

Mylar Motor & Mirror Assembly

The mylar motor is an electromechanical resonant scan element. The oscillating motor/mirror assembly deflects the laser beam across the barcode to be scanned. The resonant design minimizes power consumption, which is especially important in battery operated applications. The scan element has been designed to be highly rugged and reliable.

Motor Driver

The motor driver is an electromagnetic and electronic circuit that provides feedback control of the mylar motor scan element. The circuit regulates the scan amplitude of the motor/mirror assembly. The scan frequency is determined by the resonance characteristics of the mechanical design. The motor fail detector is a laser safety circuit that monitors the motor behavior, and turns off the VLD if the motor fails to operate. The SOS (Start Of Scan) signal transitions from high to low and low to high, corresponding to the edges of the scan line. The signal frames the data received by a complete scan line.

Control Circuitry

Interface circuitry controls operation of the scanner, motor, and laser, depending on the states of the input signals from the host device.

Photodiode

The photodiode is a transducer that converts incident light energy into an electrical current. It is the “eye” of the scan engine. When the laser beam passes over a barcode, the black bars absorb the light and the white spaces reflect the light. Collection optics focus the received reflected light onto the photodiode. The photodiode produces a photocurrent proportional to the received optical signal.

Analog Signal Processor

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

Digitizer

The digitizer is an edge detection circuit that takes the amplified and filtered analog signal and converts it into a digital representation of the scanned barcode. The output of the digitizer is called the DBP (Digitized Bar Pattern). The widths of the DBP elements are proportional to the printed bars and spaces of the barcode. The DBP signal is sent to the decoder board or host computer to decode the data.

Electrical Interface

Table 1-1 lists the pin functions of the SE 1200 interface.

Note: *When the Scan Enable and Laser Enable lines are both low, the control circuitry activates the laser and motor driver circuits, turning on the laser and motor.*

Table 1-1. Electrical Interface

Pin No.	Pin Name	Description
1	Power**	Supplies power to the engine. 5 VDC ± 10%; approx 60 mA
2†	Range Limiter*	When low, scanner range is reduced. When high, or not connected, scanner operates with full performance.
	AIM* SE 1200HP-I100A SE 1200LR-I001A	AIM: Controls the scanner motor when power is supplied to pin 1 and the Scan Enable signal on pin 4 is low. When this pin is high, the scan engine operates in normal scanning mode. When this pin is low, the scan engine operates in aim or pointing mode. When the scan engine is in aim mode and the Aim signal transitions from low to high, the scan engine switches to scanning mode. Creates a stationary spot used to help aim the scan beam on a bar code.
	Scan Stand* SE 1200HP-I102A	Scan Stand: Controls the gain of the receiver, when low, the receiver is in low gain mode, when high, the receiver is in normal gain mode.

* Active Low.

† Minimum impedance between this pin and pin 1 is 1K ohm.

** This pin must always be connected, because power supplied to the engine is switched on and off by the Scan Enable signal.

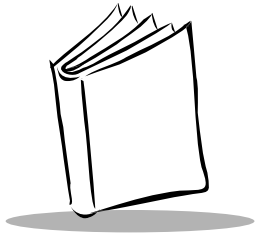
Table 1-1. Electrical Interface (Continued)

Pin No.	Pin Name	Description
3†	Laser Enable*	Turns the laser beam on and off, when power is supplied to pin 1 and the Scan Enable signal on pin 4 is low. When this pin is high, the laser is off. When this pin is low, the laser beam is on.
4†	Scan Enable*	Controls the switching of the power supplied through pin 1 to the rest of the scan engine electronics. When this pin is low, power is supplied to the scan engine electronics. When this pin is high the scan engine is in its power down mode.
5	Digitized Bar Pattern	This output represents the widths of the bars and spaces in the symbol being scanned. An internal 10K ohm pull-up resister is used. Valid DBP data should not be expected for about 55 msec after both Laser Enable and Scan Enable are active. high = bar, low = space
6	Start of Scan	Provides the start of scan signal to the decoding system. This signal toggles each scan line and is a square wave with a frequency of about 18 Hz. Note: This signal is high when the engine is in aim mode.
7, 8	Gnd	Ground

* Active Low.

† Minimum impedance between this pin and pin 1 is 1K ohm.

** This pin must always be connected, because power supplied to the engine is switched on and off by the Scan Enable signal.



Chapter 2
Installation

Overview

This chapter provides the SE 1200 scan engine unpacking, mounting and installing requirements information. Physical and electrical considerations are provided, together with the recommended window properties.

Unpacking

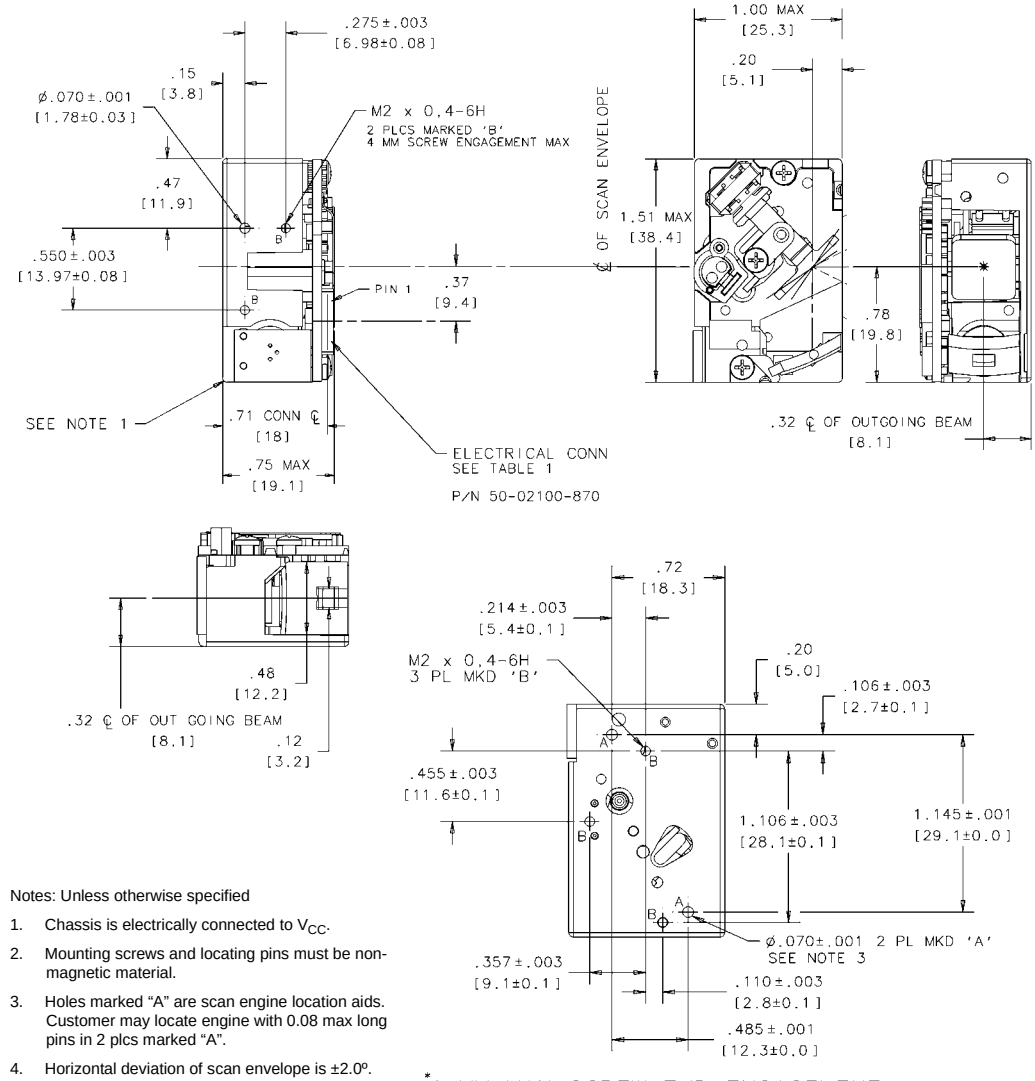
Remove the SE 1200 from its packing and inspect the scanner for evidence of physical damage. If the scanner was damaged in transit, call the *Symbol Support Center* at the telephone number listed on page x.

KEEP THE PACKING. It is the approved shipping container and should be used if the equipment needs to be returned for servicing.

Mounting

Mounting holes (M2x0.4-6H), are provided on the bottom of the chassis. Figure 2-1 on page 2-2 provides an outline drawing of the SE 1200 scan engines.

The SE 1200 scan engines may be mounted in any orientation without any degradation in performance.



Notes: Unless otherwise specified

1. Chassis is electrically connected to V_{CC}.
2. Mounting screws and locating pins must be non-magnetic material.
3. Holes marked "A" are scan engine location aids. Customer may locate engine with 0.08 max long pins in 2 plcs marked "A".
4. Horizontal deviation of scan envelope is ±2.0º.
5. Vertical deviation of the outgoing beam ±3.0º.
6. This is a reference drawing and is not intended to specify or guarantee all possible integration requirements for this engine.

Figure 2-1. Outline Drawing

Installing the Scan Engine

Before installing the SE 1200 scan engine into your host equipment, there are two important points to consider:

1. The scan engine chassis is electrically connected to V_{CC}. It must be isolated from ground.
2. Use only non-magnetic screws, or locating pins when mounting the scan engine. Magnetic screws, or pins will change the motor/mirror neutral position. Recommended screw torque is 2.5 to 3.5 in. lbs.

Housing Design

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

The Exit Window Information tables (see *Exit Window Characteristics* on page 2-5) provide minimum exit window dimensions and tilt angles for particular scan engine variants. One should note that these dimensional requirements can vary for different engine types. 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.

Environment

The scan engine 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. An exit window is required in all housing designs. Refer to *Optical* on page 2-5 for positioning of the exit window.

Grounding

Caution

The scan engine chassis is at V_{CC}. If the scan engine is being mounted on a grounded host, they must be electrically isolated.

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.

Caution

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

ESD

The scan engines are 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.

Optical

The scan engine 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.

Caution

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

Positioning the Exit Window

The exit window must be positioned so that laser light reflected off the inside of the exit window is not reflected back into the collection optics of the scan engine. If an anti-reflection coating is used, the window can be positioned more nearly parallel to the face of the scanner. It is important to allow for manufacturing tolerances when determining the angles, it is essential to maintain the minimum angles specified in *Exit Window Characteristics* on page 2-5.

Larger angles are generally preferred. To maximize your system’s potential, including use with the entire scan engine family (including 2-D scanners), a minimum angle of 24° is recommended. If your enclosure design cannot accommodate the recommended window angle, contact Symbol Technologies to discuss your requirements. An improperly positioned window can result in significant performance degradation.

Exit Window Characteristics

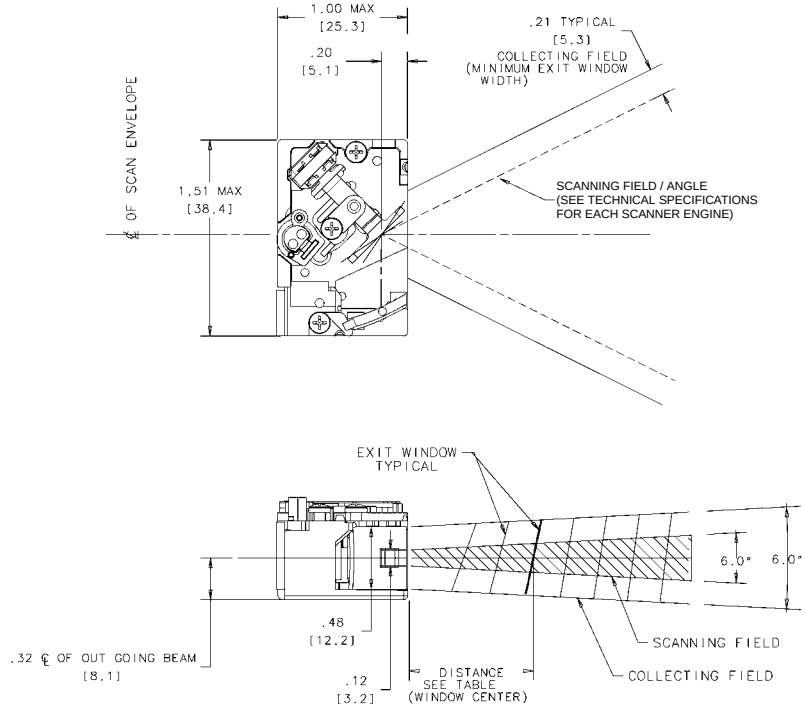
Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.

Table 2-1. Exit Window Information

Values are for all SE 1200 scan engines models (except as specified).	Distance from engine at scan center line (in)						
	0.15	**0.25**	**0.50**	**0.75**	**1.00**	**1.50**	**2.00**
Minimum Window Height (in)*							
All models	0.62	0.59	0.57	0.58	0.60	0.65	0.70
Minimum Window Width, (listed by Scan Engine model number) (in)*							
SE 1200WA-I100A	0.83	0.92	1.15	1.40	1.65	2.15	2.65
SE 1200WA-I200A & SE 1200WA-I000A	0.80	0.90	1.15	1.40	1.65	2.15	2.65
SE 1200HP-I10xA	0.70	0.78	0.97	1.16	1.35	1.75	2.15
SE 1200VHD-I000A	0.70	0.75	0.95	1.10	1.30	1.65	2.00
SE 1200LR-I001A & SE 1200ALR-I000A	0.58	0.63	0.75	0.87	0.99	1.23	1.47
Minimum Window Tilt Uncoated, (listed by Scan Engine model number) **							
All models (except listed below)	25°	20°	15°	12°	10°	10°	10°
SE 1200LR-I001A & SE 1200ALR-I000A	25°	20°	15°	15°	12°	10°	10°
Minimum Window Tilt One Side A/R Coated (listed by Scan Engine model number)**							
All models (except listed below)	15°	12°	10°	10°	10°	10°	10°
SE 1200LR-I001A & SE 1200ALR-I000A	15°	15°	15°	15°	12°	10°	10°
Minimum Window Tilt Two Sides A/R Coated (listed by Scan Engine model number)**							
All models (except listed below)	8°	8°	8°	8°	8°	8°	8°
SE 1200LR-I001A & SE 1200ALR-I000A	12°	12°	10°	10°	10°	8°	8°

* Measured parallel to window surface.

** Window may tilt as shown in Figure 2-2 or in opposite direction (top of window furthest from or closest to engine). Reflectivity of window coating should not exceed 0.5% per side from 640 nm to 690 nm.



Notes: Unless otherwise specified

1. Chassis is electrically connected to V_{CC}.
2. Mounting screws and locating pins must be non-magnetic material.
3. Holes marked “A” are scan engine location aids. Customer may locate engine with 0.08 max long pins in 2 plcs marked “A”.
4. Horizontal deviation of scan envelope is ±2.0°.
5. Vertical deviation of the outgoing beam ±3.0°.
6. Measured parallel to window surface.
7. Window may tilt as shown or in opposite direction (top of window furthest from or closest to engine). Window specifications can vary from different scan engine versions. Consult appropriate interface drawings for other models.
8. Reflectivity of window coating should not exceed 0.5% per side from 640nm to 690 nm.
9. This is a reference drawing and is not intended to specify or guarantee all possible integration requirements for this engine.

CAUTION:

The Exit Window Characteristics provided do not consider unique OEM application characteristics. It is recommended that an opto-mechanical engineer perform an opto-mechanical analysis prior to integration.

Figure 2-2. Exit Window

Avoiding Scratched Windows

Scratches on the window can greatly reduce scan engine performance. A design that recesses the window into the housing and/or the use of a scratch resistance coating is recommended.

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 2-2 outlines the suggested window properties.

Caution

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

Note: *Do not use polycarbinate material for exit windows.*

Acrylic

Easily fabricated by extruding, injection-molding, or by cell-casting. 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, including good surface hardness. Typically it does not require hard-coating, but may be hard coated for severe environments. Reasonably good impact resistance. CR-39 cannot be ultrasonically welded. It is the material most commonly used in plastic eye glasses lenses.

Table 2-2. 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
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. Coatings will comply with the hardness adherence requirements of MIL-M-13508.

Commercially Available Coatings

Exit Window coatings may be used to improve the performance and/or abrasion resistance characteristics. Table 2-3 on page 2-10 lists some exit window manufacturers and anti-reflection coaters.

Anti-Reflection Coatings

An anti-reflection coating should be applied to the inside and/or outside of the window. This greatly reduces the amount of light reflected off the window, back into the scan engine. The coating can also improve the range of acceptable window positions and minimize performance degradation due to signal loss as the light passes through the window. It is highly recommended that anti-reflection coatings be used on both the inside and outside of 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.

Table 2-3. 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
Fosta-Tek Optics, Inc. 320 Hamilton Street Leominster, MA 01453 (978) 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
Optical Polymers Int. (OPI) 110 West Main Street Milford, CT 06460 (203)-882-9093	CR-39 cell-caster, coater, laser cutter	CR39 exit window manufacturer
Polycast 70 Carlisle Place Stamford, CT 06902 800-243-9002	acrylic cell-caster, hard coater, laser cutter	Acrylic exit window manufacturer
TSP 2009 Glen Parkway Batavia, OH 45103 800-277-9778	acrylic cell-caster, coater, laser cutter	Acrylic exit window manufacturer

Location and Positioning

Caution

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

Using the SE 1200 as an Embedded Scanner

Some applications require the SE 1200 be mounted to read symbols that are automatically presented, or that are presented in a pre-determined location. In these applications the SE 1200 positioning (with respect to the symbol) is critical. Failure to properly position the SE 1200 with respect to the symbol may lead to degraded or unsatisfactory reading performance.

Two methods of positioning the scanner have been provided:

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

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

Calculating The Usable Scan Length Method

Usable scan length is calculated as follows (see Figure 2-3 on page 2-12):

$$L = 1.8 \times (D+d) \times \tan(A/2)$$

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 A° (see Technical Specifications table for each scan engine model).

Note: *Usable scan length determined by above formula, or 90% of 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.*

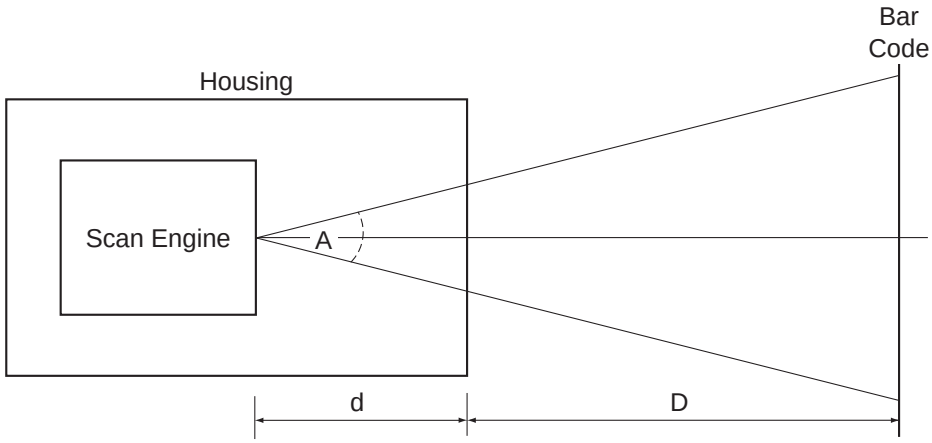


Figure 2-3. Usable Scan Length Diagram

Testing The Usable Scan Length Method

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

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

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

Note: *Poor quality symbols (from bad printing, wear, or damage) may not decode well when placed in the center of the depth of field (especially true of higher density codes). The scan beam has a minimum width in the central area, and when the scanner tries to read all the symbol imperfections in this area it may end up with no decode. Therefore, after a preliminary spot is determined using good quality symbols, several of lessor quality symbols should be tested and the spot adjusted for the best overall symbol position.*

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

Conveyor Applications

Conveyor applications require that the conveyor velocity be set to optimize the scan engines ability to read symbols. The orientation of the symbol with respect to the conveyor direction is another consideration. Figure 2-4 on page 2-14 illustrates the relationship of the conveyor velocity with respect to a symbol positioned perpendicular to the conveyor direction and Figure 2-5 on page 2-15 illustrates the relationship of the conveyor velocity with respect to a symbol positioned parallel to the conveyor direction.

Symbol is Perpendicular to Conveyor Movement

With the symbol perpendicular to the conveyor belt direction (Picket Fence presentation) the relationship is:

V = (R x (F-W) / N

Where: V = Velocity of the Conveyor (inches/second)
R = Scan Rate (35 scans/second)
F = Field Width of Scan Beam
W = Symbol Width (inches)
N = Number of scans over symbol (minimum of 10 scans)

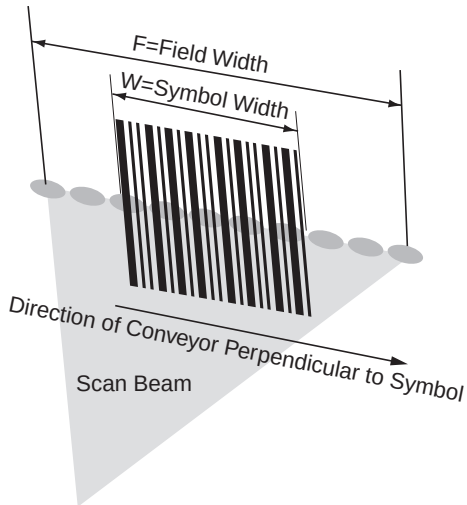


Figure 2-4. Symbol Perpendicular To Conveyor Movement

Symbol is Parallel to Conveyor Movement

With the symbol parallel to the conveyor belt direction (Ladder presentation) the relationship is:

V = (R x H) / N

Where:

V = Velocity of the Conveyor (inches/second)

R = Scan Rate (35 scans/second)

H = Symbol height

N = Number of scans over symbol (minimum of 10 scans)

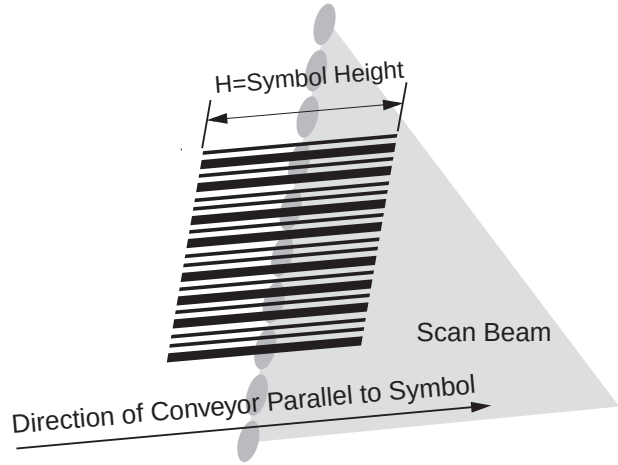


Figure 2-5. Symbol Parallel To Conveyor Movement

Accessories

Table 2-4 lists the available scan engine accessories.

Table 2-4. Accessories

Accessory	Symbol Part Number
Flex Strip, undecoded only (8-pin fanout)	15-08585-01
Flex Strip Variable Length, undecoded only (8-pin fanout)	15-09306-01
Flex Strip, decoded only (12-pin fanout)	15-10750-01
Flex Strip, decoded only (12-pin straight)	50-16000-139
8-pin Connector	50-02100-870
Mounting Kit for SE 1223 Decoder Board Package	KT-0032DK-000

Hardware Accessories

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

Table 2-5. Hardware Accessories

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

Flex Cable

A flex strip cable is used to connect the scan engine to a host interface. Two flex strips are available from Symbol Technologies, an 8-pin tapered flex strip (p/n 15-08585-01, see Figure 2-6) and an 8-pin cut-to-length flex strip (p/n 15-09306-01, see Figure 2-7). These flex strips should be used only for evaluation purposes and not for production units.

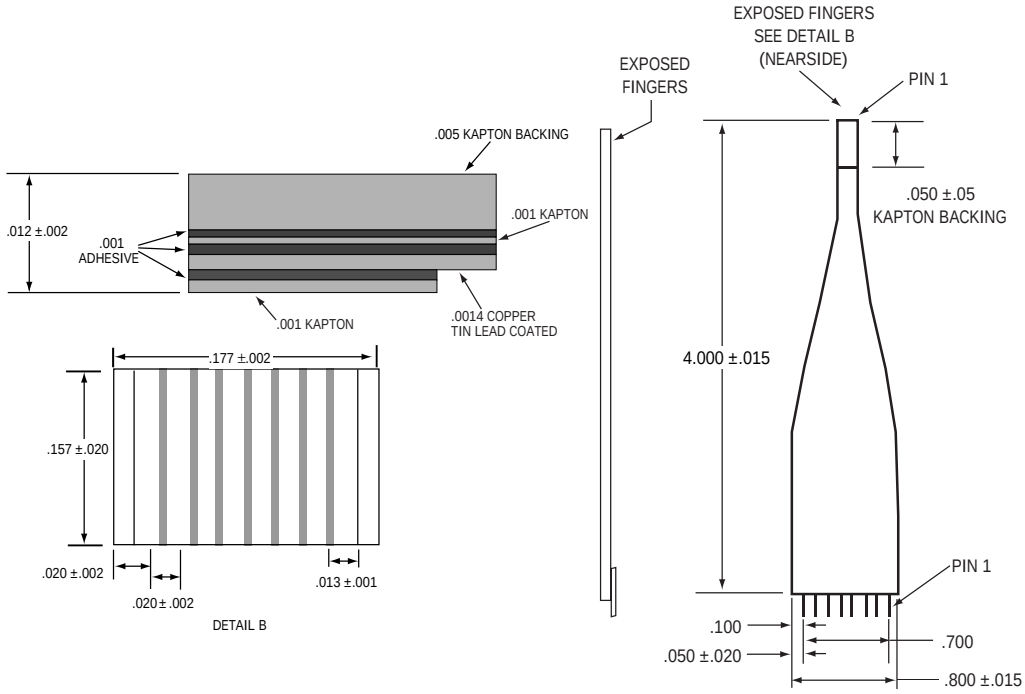
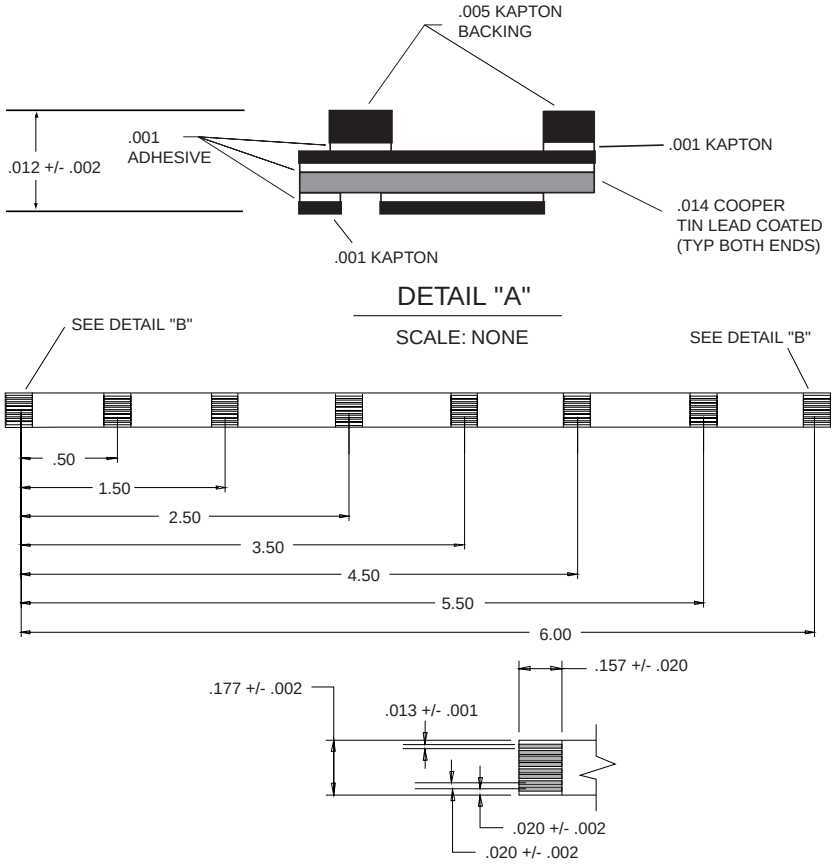


Figure 2-6. 8-Pin Tapered Flex Cable, P/N 15-09306-01



NOTES:

1. MATERIAL:
   ITEM 1 SEE DETAIL A
   ITEM 2 SEE DETAIL A
   ITEM 3 SEE DETAIL A
2. FINISH TO BE BRIGHT TIN LEAD COATING ON EXPOSED AREAS.
3. ITEMS 1, 2 & 3 TO BE LAMINATED TOGETHER PERMANENTLY USING APPROPRIATE ADHESIVES.
4. WORKMANSHIP STANDARDS SHALL BE IN ACCORDANCE WITH IPC-FC-250 FOR CLASS 3 CIRCUITS.
5. MIN. CONDUCTOR WIDTH TO BE .006". MIN. CONDUCTOR TO CONDUCTOR AND CONDUCTOR TO PAD SPACING TO BE .006" MIN.
6. PART TO BE MARKED WITH STI PART NO. AND REV IN PERMANENT CONSTRASTING INK. CHARACTERS TO BE .100" HIGH.
7. PACKAGING SHALL COMPLY WITH STI SPEC. 80-08091-01.
8. LABELING AND SHIPPING SHALL COMPLY WITH STI SPEC 50-04100-013.

Figure 2-7. 8-Pin Cut-To-Length Flex Strip, P/N 15-093601-01

Software Development Kit

The universal SDK (Software Development Kit, part number: SE-DK-I000) provides the software and hardware tools required to integrate and communicate to the SE 1200 scan engines. With over 70 programmable parameters, the SE 1200 can be configured by scanning bar code menus or through the serial interface. Using Symbol Technologies Simple Serial protocol, your product can support every scanning function via the serial port.

Whether your device is Windows®, DOS, or even an embedded system, the SE 1200 SDK will help the user take full advantage of the SE 1200 features and obtain maximum performance.

The SDK contains:

- Media CD
- Development Board
- User Documentation
- Power supply
- Cable.

Media CD

The Media CD provides the software and user documentation:

- Simple Serial Interface Header Files
- DOS Serial Communication Library and Source Code
- Windows Serial Communication Library and Source Code
- Simple Serial Interface Library and Source Code
- DOS and Windows Demo Programs and Source Code
- Library Documentation.

Development Board

The Development Board is useful for connecting the scan engine to your PC development workstation. Functions of the development board include:

- Conversion of the SE 1200 CMOS Serial Output to RS-232
- Mounting location for SE 1200 Scan Engine (any version)
- Beeper and LED drivers
- 9 pin RS-232 for connection to PC workstation
- Aim and Trigger Buttons
- Beeper
- 990Power, Decode, Low Power Mode LEDs
- Test Points.

User Documentation

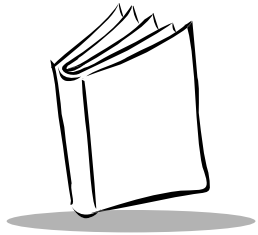
The Integration Guide provides the detailed technical specifications for the scan engine.

Power Supply

Power supplies are available in either 110VAC or 220VAC.

Cable

The cable provides a connection between the development board and your PC workstation.



Chapter 3
SE 1200HP-I10xA Specifications

Overview

This chapter provides the technical specifications for the High Performance, SE 1200HP-I10xA (with Adaptive Logic) scan engine.

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

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

Technical Specifications

Table 3-1 on page 3-2 provides the SE 1200HP-I10xA technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200HP-I10xA.

Table 3-1. SE 1200HP-I10xA Technical Specifications @ 23°C

Item	Description
Power Requirements	
Input Voltage	3.0 - 5.5 VDC
Input Current	65 mA typical; 100 mA maximum
Standby Current	50 µA max.
Surge Current	160 mA max.
V_{cc} Noise Level	200 mV p to p max., 75% of specified working range will be maintained.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	0.8 mW ± 0.05 mW, λ = 650 nm nominal
Print Contrast	minimum 20% absolute dark/light reflectance measured at 650 nm.
Scan Angle	42° ± 2°
Skew Tolerance	± 60° from normal (see Figure 3-1 on page 3-4)
Pitch Angle	± 65° from normal (see Figure 3-1 on page 3-4)
Roll	± 30° from vertical (see Figure 3-1 on page 3-4)
Decode Depth of Field	See Figure 3-2 on page 3-5
Ambient Light Immunity	
Sunlight	10,000 ft. candles (107,640 lux)
Artificial Light	450 ft. candles (4,844 lux)
Shock	2000 G applied via any mounting surface @ 23°C (for 0.25 msec)
Vibration	Unpowered engine withstands a random vibration along each of the X, Y and Z axes for a period of one hour per axis, defined as follows: 20 to 80 Hz — Ramp up to 0.04 G^2/Hz at the rate of 3dB/octave. 80 to 350 Hz — 0.04 G^2/Hz 350 to 2000 Hz — Ramp down at the rate of 3 dB/octave.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 3-1. SE 1200HP-I10xA Technical Specifications @ 23°C (Continued)

Item	Description
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH/IEC Class II/2 devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
Operating Temperature	-22° to 140°F (-30° to 60°C)
Storage Temperature	-40° to 140°F (-40° to 60°C)
Humidity	5% to 95% non-condensing
Height	0.76 in. max. (1.93 cm max.)
Width	1.51 in. max. (3.84 cm max.)
Depth	1.0 in. max. (2.54 cm max.)
Weight	1.19 oz. max. (34.0 gm max.)
Note: Environmental and/or Tolerance Parameters are not cumulative.	

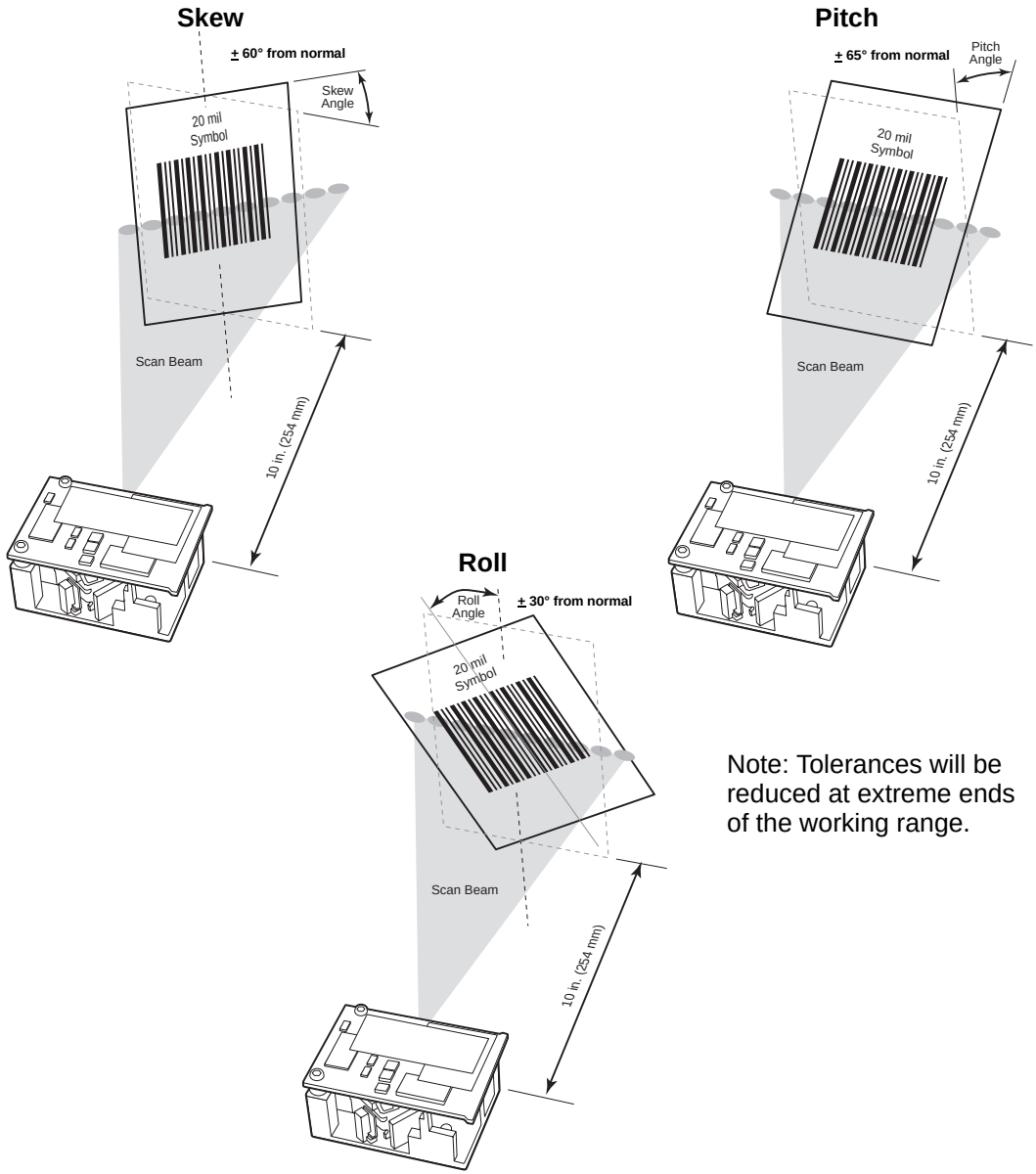
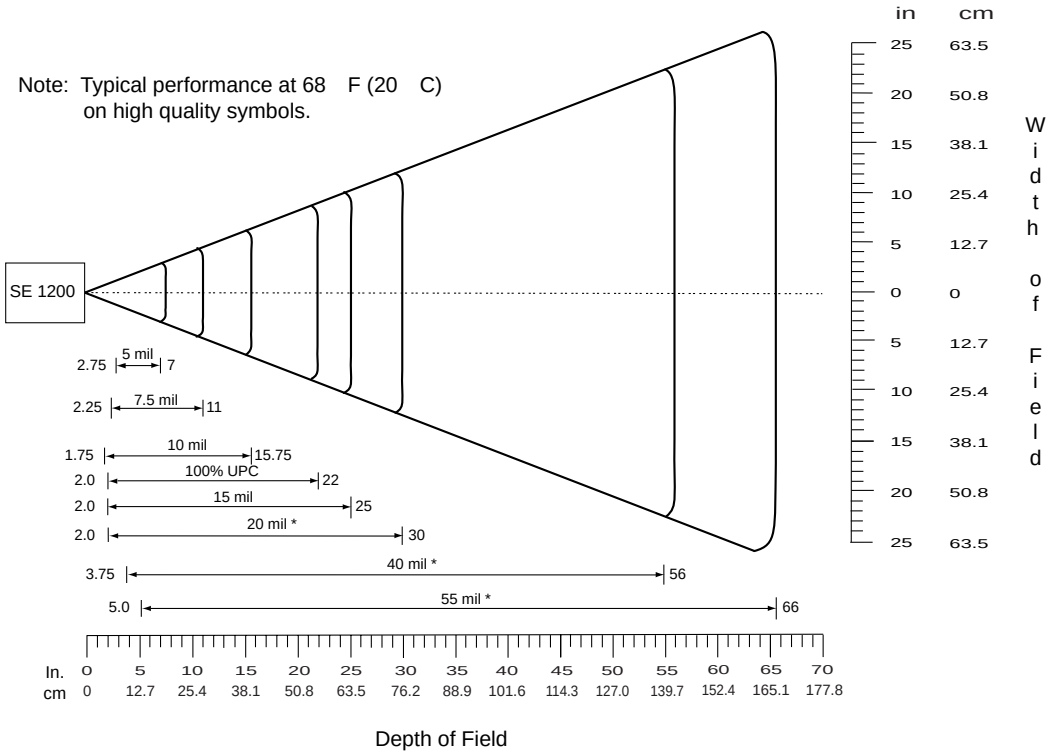


Figure 3-1. SE 1200HP-I10xA Skew, Pitch and Roll

Decode Zone

The scan engine decodes the symbols as shown in Figure 3-2. The figures shown are typical 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, see *Calculating The Usable Scan Length Method* on page 2-12.



*Minimum distance determined by symbol length and scan angle

Figure 3-2. SE 1200HP-I10xA Decode Zone (Typical)

Table 3-2. SE 1200HP-I10xA 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; 2.5:1	**ABCDEFGH** 80% MRD	**2.75 in.** 6.98 cm	**7.0 in.** 17.78 cm	**3.7 in.** 9.40 cm	**5.0 in.** 12.70 cm
7.5 mil Code 39; 2.5:1	**ABCDEF** 80% MRD	**2.25 in.** 5.72 cm	**11.0 in.** 27.94 cm	**2.75 in.** 6.98 cm	**9.0 in.** 22.86 cm
10 mil **Code 39; 2.5:1**	**ABCDE** 80% MRD	**1.75 in.** 4.45 cm	**15.75 in.** 40.00 cm	**2.5 in.** 6.35 cm	**13.0 in.** 33.02 cm
13 mil 100% UPC	**012345678905** 80% MRD	**2.0 in.** 5.08 cm	**22.0 in.** 55.888 cm	**2.5 in.** 6.35 cm	**13.0 in.** 33.02 cm
15 mil Code 39; 2.5:1	**ABCD** 80% MRD	**2.0 in.** 5.08 cm	**25.0 in.** 63.50 cm	**2.5 in.** 6.35 cm	**19.0 in.** 48.26 cm
20 mil Code 39; 2.2:1	**123** 80% MRD	**2.0 in.** 5.08 cm (Note 2)	**30.0 in.** 76.20 cm	**3.0 in.** 7.62 cm (Note 2)	**21.0 in.** 53.34 cm
40 mil Code 39; 2.2:1	**AB** 80% MRD	**3.75 in.** 9.53 cm (Note 2)	**56.0 in.** 142.24 cm	**5.0 in.** 12.70 cm (Note 2)	**30.0 in.** 76.20 cm
55 mil Code 39; 2.2:1	**CD** 80% MRD	**5.0 in.** 12.70 cm (Note 2)	**66.0 in.** 167.64 cm	**6.0 in.** 15.24 cm (Note 2)	**36.0 in.** 91.44 cm

Notes:

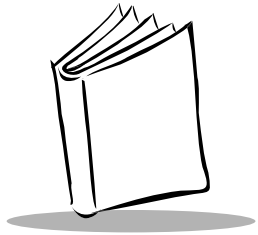
1. CONTRAST measured as Mean Reflective Difference (MRD) at 650 nm.
2. Near ranges on lower densities are largely dependent upon the width of the bar code and the scan angle.
3. Working range specifications: Photographic quality symbols, pitch = 10°, skew = 0°, roll = 0°, ambient light < 150 ft. candles, and temperature = 23 °C.

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 3-1 on page 3-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 4
SE 1200WA-I100A Specifications

Overview

This chapter provides the technical specifications for the SE 1200WA-I100A scan engine.

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

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

Technical Specification

Table 4-1 on page 4-2 provides the SE 1200WA-I100A technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200WA-I100A scan engine.

Table 4-1. SE 1200WA-I100A Technical Specifications @ 23°C

Item	Description
Power Requirements	
Input Voltage	3.0 - 5.5 VDC
Input Current	65 mA typical; 100 mA maximum
Standby Current	50 µA max.
Surge Current	160 mA max.
V_{cc} Noise Level	200 mV p to p max., 75% of specified working range will be maintained.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	0.46 mW ± 10%, λ = 650 nm nominal
Print Contrast	Minimum 20% absolute dark/light reflectance measured at 650 nm.
Scan Angle	53° ± 2°
Skew Tolerance	± 65° from normal (see Figure 4-1 on page 4-4)
Pitch Angle	± 55° from normal (see Figure 4-1 on page 4-4)
Roll	± 20° from vertical (see Figure 4-1 on page 4-4)
Decode Depth of Field	See Figure 4-2 on page 4-5
Ambient Light Immunity	
Sunlight	8,000 ft. candles (86,112 lux)
Artificial Light	450 ft. candles (4,844 lux)
Shock	2000 G applied via any mounting surface @ 23°C (for 0.25 msec)
Vibration	Unpowered engine withstands a random vibration along each of the X, Y and Z axes for a period of one hour per axis, defined as follows: 20 to 80 Hz — Ramp up to 0.04 G^2/Hz at the rate of 3dB/octave. 80 to 350 Hz — 0.04 G^2/Hz 350 to 2000 Hz — Ramp down at the rate of 3 dB/octave.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 4-1. SE 1200WA-I100A Technical Specifications @ 23°C (Continued)

Item	Description
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH Class II (or IEC Class 1 with software to control the laser duty cycle) devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
Operating Temperature	32° to 104°F (0° to 40°C)
Storage Temperature	-40° to 140°F (-40° to 60°C)
Humidity	5% to 95% non-condensing
Height	0.76 in. max. (1.93 cm max.)
Width	1.51 in. max. (3.84 cm max.)
Depth	1.0 in. max. (2.54 cm max.)
Weight	1.19 oz. max. (34 gm max.)
Note: Environmental and/or Tolerance Parameters are not cumulative.	

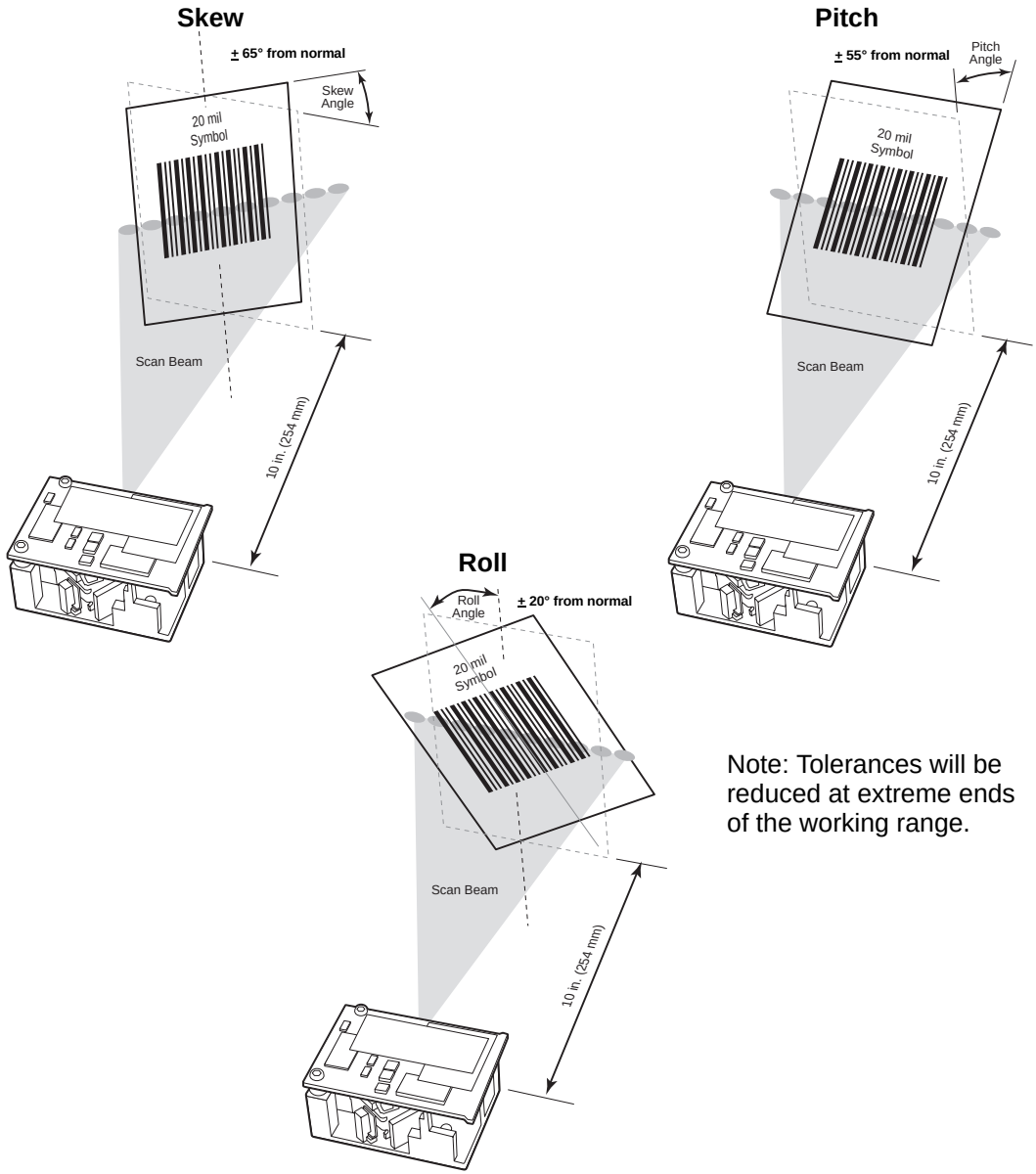
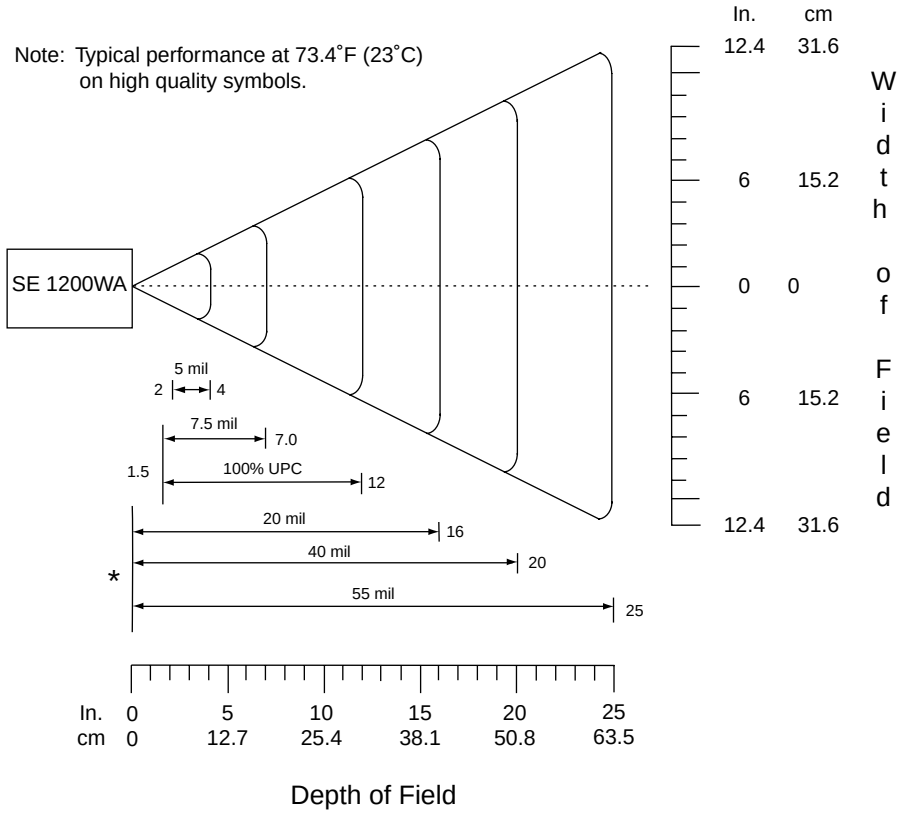


Figure 4-1. SE 1200WA-I100A Skew, Pitch and Roll

Decode Zone

The SE 1200WA-I100A scan engine decodes the symbols as shown in Figure 4-2. The figures shown are typical values. Table 4-2 on page 4-6 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, see *Calculating The Usable Scan Length Method* on page 2-12.



*Minimum distance determined by symbol length and scan angle

Figure 4-2. SE1200WA-I100A Decode Zone (Typical)

Table 4-2. SE 1200WA-I100A Decode Distances

Symbol Density/ Bar Code Type	Bar Code Content/ Contrast[Note 1]	Typical Working Ranges		Guaranteed Working Ranges	
		Near	Far	Near	Far
5.0 mil Code 39	**ABCDEFGH** 80% MRD	**2.0 in** 5.08 cm	**4 in** 10.16 cm	**2 in** 5.08 cm	**4 in** 10.16 cm
7.5 mil Code 39	**ABCDEF** 80% MRD	**1.5 in** 3.81 cm	**7.0 in** 17.78 cm	**1.5 in** 3.81 cm	**7.0 in** 17.78 cm
13 mil 100% UPC	**012345678905** 80% MRD	**1.5 in** 3.81 cm	**12.0 in** 30.48 cm	**1.5 in** 3.81 cm	**10.0 in** 25.40 cm
20 mil Code 39	**123** 80% MRD	Note 2	**16.0 in** 40.64 cm	Note 2	**14.0 in** 35.56 cm
40 mil Code 39	**AB** 80% MRD	Note 2	**20.0 in** 50.80 cm	Note 2	**18.0 in** 45.72 cm
55 mil Code 39	**CD** 80% MRD	Note 2	**25.0 in** 63.50 cm	Note 2	**23.0 in** 58.42 cm

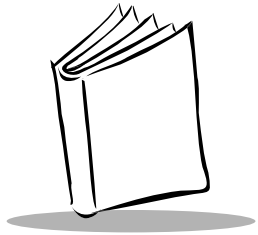
Notes:
1. CONTRAST measured as Mean Reflective Difference (MRD) at 650 nm.
2. Near ranges on lower densities (not specified) are largely dependent upon the width of the bar code and the scan angle.
3. Working range specifications: Photographic quality symbols, pitch = 15°, skew = 0°, roll = 0°, ambient light < 150 ft. candles, and temperature = 23 °C

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 4-1 on page 4-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 5
SE 1200WA-I200A Specifications

Overview

This chapter provides the technical specifications for the SE 1200WA-I200A scan engine.

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

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

Technical Specifications

Table 5-1 on page 5-2 provides the SE 1200WA-I200A technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200WA-I200A scan engine.

Table 5-1. SE 1200WA-I200A Technical Specifications @ 23°C

Item	Description
Power Requirements	
Input Voltage	3.0 - 5.5 VDC
Input Current	65 mA typical; 100 mA maximum
Standby Current	50 µA max.
Surge Current	160 mA max.
V_{cc} Noise Level	200 mV p to p max., 75% of specified working range will be maintained.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	0.51 mW maximum, λ = 650 nm nominal
Print Contrast	minimum 20% absolute dark/light reflectance measured at 650 nm.
Scan Angle	53° ± 2°
Skew Tolerance	± 65° from normal (see Figure 5-1 on page 5-4)
Pitch Angle	± 55° from normal (see Figure 5-1 on page 5-4)
Roll	± 20° from vertical (see Figure 5-1 on page 5-4)
Decode Depth of Field	See Figure 5-2 on page 5-5
Ambient Light Immunity	
Sunlight	8,000 ft. candles (86,112 lux)
Artificial Light	450 ft. candles (4,844 lux)
Shock	2000 G applied via any mounting surface @ 23°C (for 0.25 msec)
Vibration	Unpowered engine withstands a random vibration along each of the X, Y and Z axes for a period of one hour per axis, defined as follows: 20 to 80 Hz — Ramp up to 0.04 G^2/Hz at the rate of 3dB/octave. 80 to 350 Hz — 0.04 G^2/Hz 350 to 2000 Hz — Ramp down at the rate of 3 dB/octave.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 5-1. SE 1200WA-I200A Technical Specifications @ 23°C (Continued)

Item	Description
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH Class II (or IEC Class 1 with software to control the laser duty cycle) devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
Operating Temperature	32° to 104°F (0° to 40°C)
Storage Temperature	-40° to 140°F (-40° to 60°C)
Humidity	5% to 95% non-condensing
Height	0.76 in. max. (1.93 cm max.)
Width	1.51 in. max. (3.84 cm max.)
Depth	1.0 in. max. (2.54 cm max.)
Weight	1.19 oz. max. (34 gm max.)
Note: Environmental and/or Tolerance Parameters are not cumulative.	

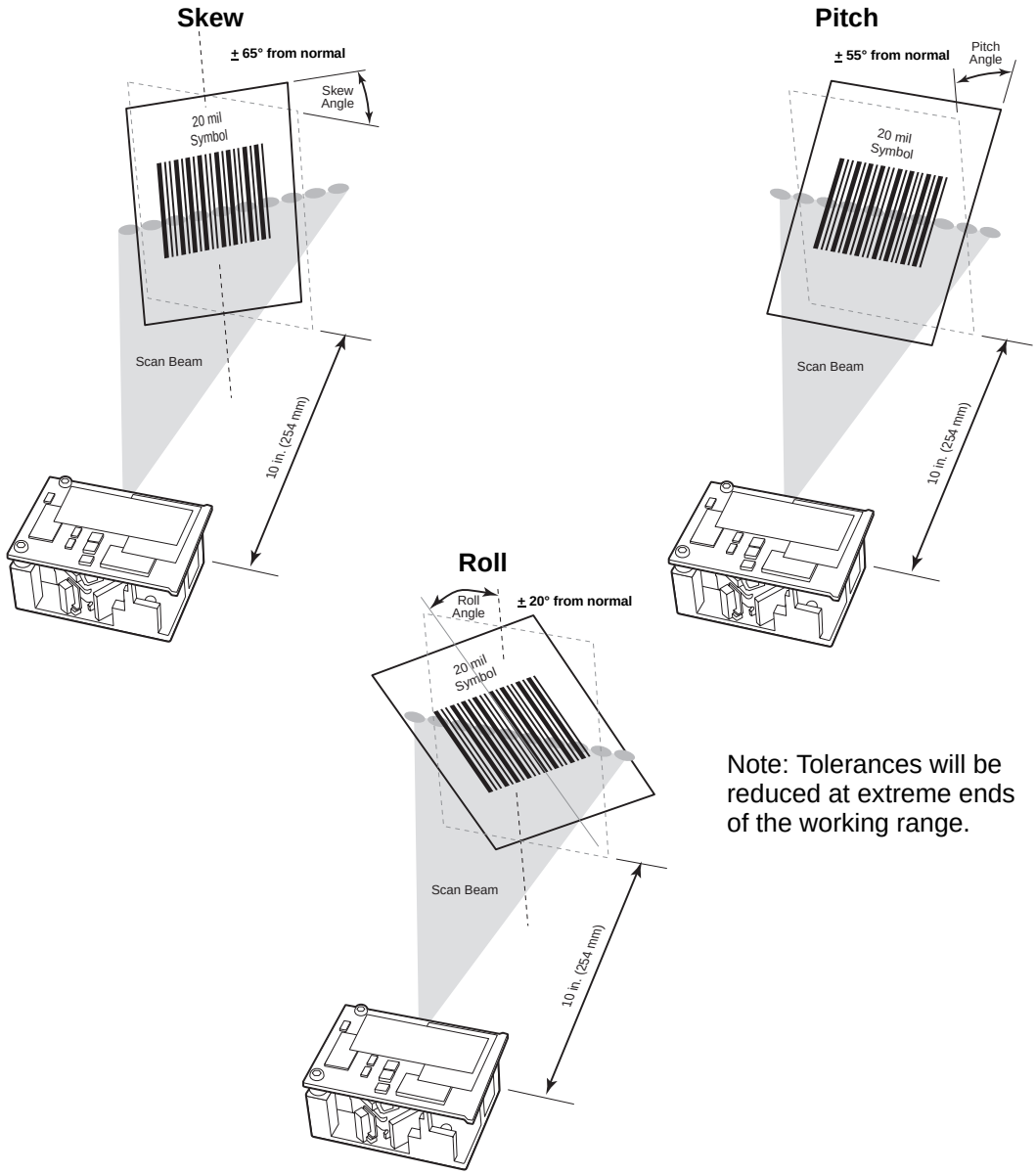
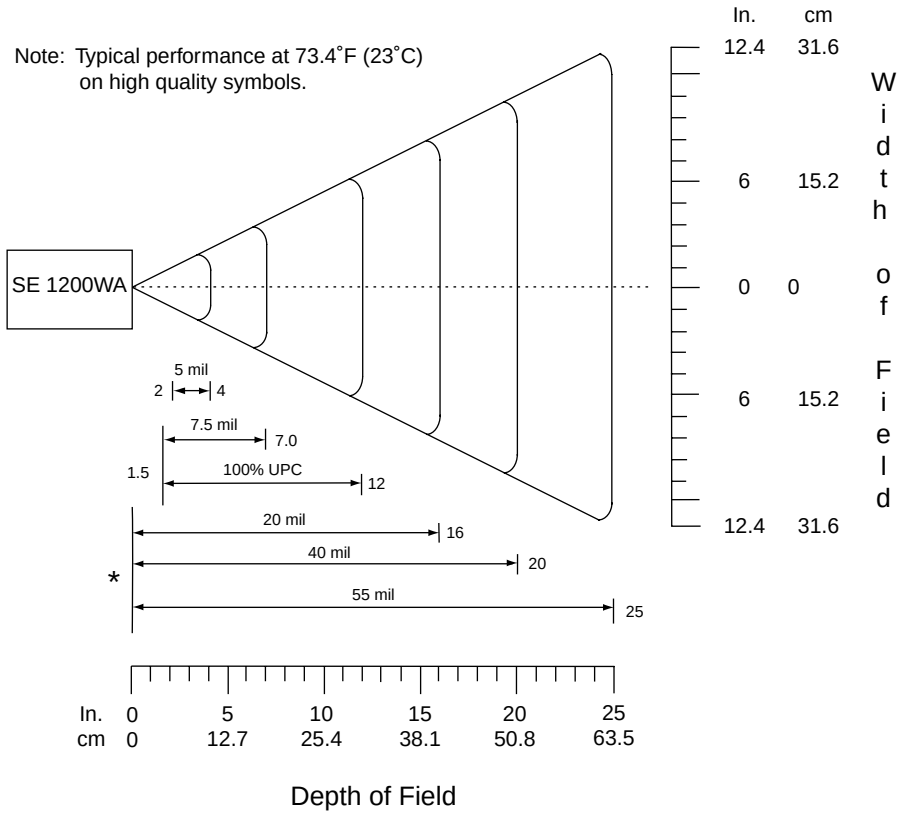


Figure 5-1. SE 1200WA-I200A Skew, Pitch and Roll

Decode Zone

The SE 1200WA-I200A scan engine decodes the symbols as shown in Figure 5-2. The figures shown are typical values. Table 5-2 on page 5-6 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, see *Calculating The Usable Scan Length Method* on page 2-12.



*Minimum distance determined by symbol length and scan angle

Figure 5-2. SE 1200WA-I200A Decode Zone (Typical)

Table 5-2. SE 1200WA-I200A Decode Distances

Symbol Density/ Bar Code Type	Bar Code Content/ Contrast[Note 1]	Typical Working Ranges		Guaranteed Working Ranges	
		Near	Far	Near	Far
5.0 mil Code 39	**ABCDEFGH** 80% MRD	**2.0 in** 5.08 cm	**4 in** 10.16 cm	**2 in** 5.08 cm	**4 in** 10.16 cm
7.5 mil Code 39	**ABCDEF** 80% MRD	**1.5 in** 3.81 cm	**7.0 in** 17.78 cm	**1.5 in** 3.81 cm	**7.0 in** 17.78 cm
13 mil 100% UPC	**012345678905** 80% MRD	**1.5 in** 3.81 cm	**12.0 in** 30.48 cm	**1.5 in** 3.81 cm	**10.0 in** 25.40 cm
20 mil Code 39	**123** 80% MRD	Note 2	**16.0 in** 40.64 cm	Note 2	**14.0 in** 35.56 cm
40 mil Code 39	**AB** 80% MRD	Note 2	**20.0 in** 50.80 cm	Note 2	**18.0 in** 45.72 cm
55 mil Code 39	**CD** 80% MRD	Note 2	**25.0 in** 63.50 cm	Note 2	**23.0 in** 58.42 cm

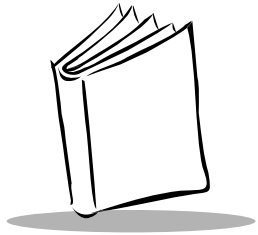
Notes:
1. CONTRAST measured as Mean Reflective Difference (MRD) at 650 nm.
2. Near ranges on lower densities (not specified) are largely dependent upon the width of the bar code and the scan angle.
3. Working range specifications: Photographic quality symbols, pitch = 15°, skew = 0°, roll = 0°, ambient light < 150 ft. candles, and temperature = 23 °C

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 5-1 on page 5-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 6
SE 1200WA-I000A Specifications

Overview

This chapter provides the technical specifications for the SE 1200WA-I000A scan engine.

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

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

SE 1200 Wide Angle Technical Specifications

Table 6-1 on page 6-2 provides the SE 1200WA-I000A technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200WA-I000A scan engine.

Table 6-1. SE 1200WA-I000A Technical Specifications @ 23°C

Item	Description
Power Requirements	
Input Voltage	5.0 VDC ± 10%
Input Current	60 mA typical @ 5V; 85 mA max.
Standby Current	50 µA max.
Surge Current	130 mA max.
V_{cc} Noise Level	50 mV p to p typical, 200 mV p to p max.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	0.54 mW ± 10%, 650 nm
Print Contrast	Minimum 20% absolute dark/light reflectance measured at 650 nm.
Scan Angle	53° ± 2°
Skew Tolerance	± 65° from normal (see Figure 6-1 on page 6-4)
Pitch Angle	± 55° from normal (see Figure 6-1 on page 6-4)
Roll	± 20° from vertical (see Figure 6-1 on page 6-4)
Decode Depth of Field	See Figure 6-2 on page 6-5
Ambient Light Immunity	
Sunlight	8,000 ft. candles 86,112 lux
Artificial Light	450 ft. candles 4,844 lux
Shock	2000 G applied via any mounting surface @ 23°C (for 0.25 msec)
Vibration	Withstands a sinusoidal vibration of 1G along each of the 3 mutually perpendicular axes for a period of 1 hr per axis, over a frequency range of 5 Hz to 2000Hz.
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH Class II (or IEC Class 1 with software to control the laser duty cycle) devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 6-1. SE 1200WA-I000A Technical Specifications @ 23°C (Continued)

Item	Description
Operating Temperature	32° to 104°F 0° to 40°C
Storage Temperature	-40° to 140°F -40° to 60°C
Humidity	5% to 95% non-condensing
Height	0.76 in. max. 1.93 cm max.
Width	1.51 in. max. 3.84 cm max.
Depth	1.0 in. max. 2.54 cm max.
Weight	1.19 oz. max. 34 gm max.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

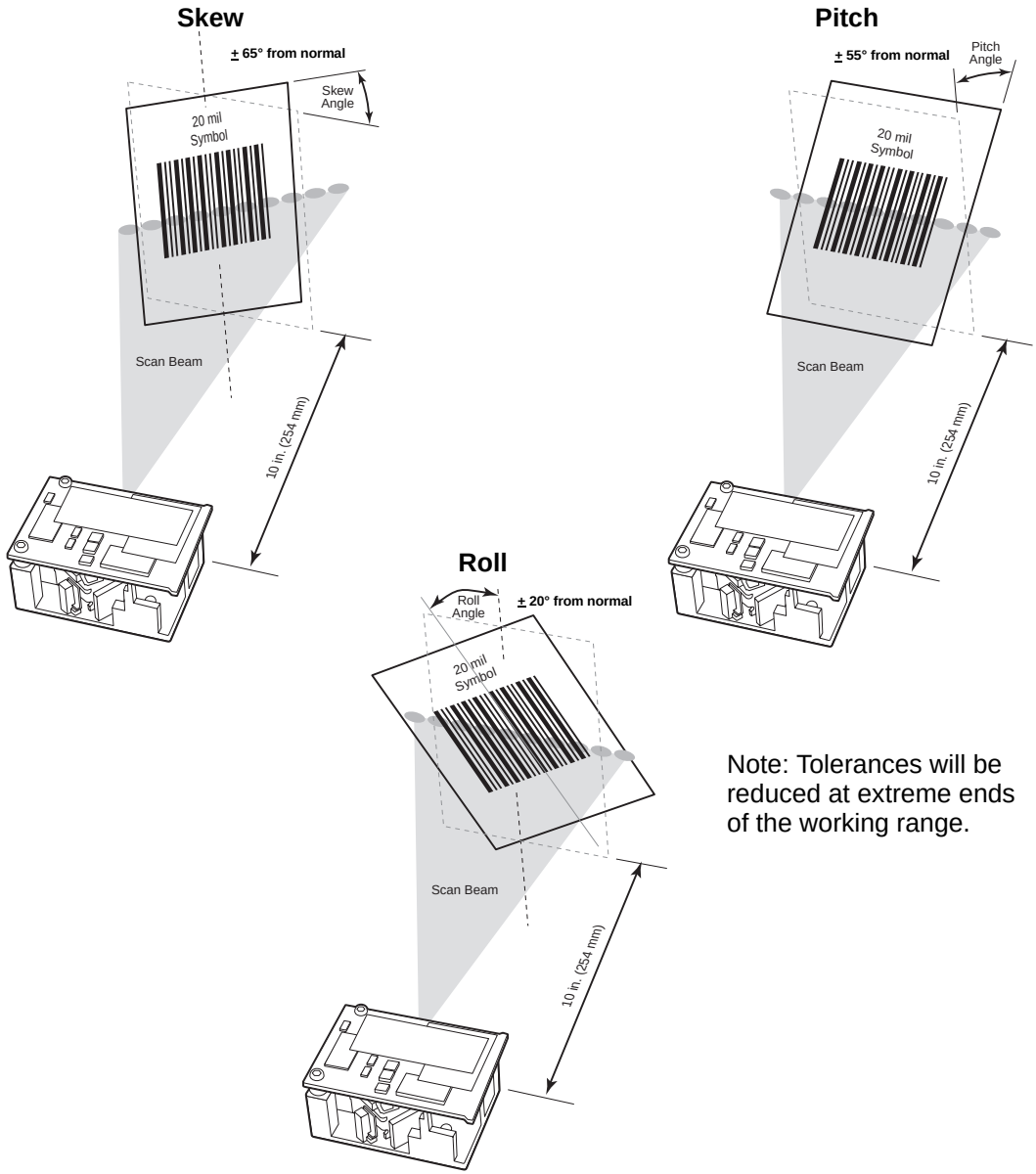
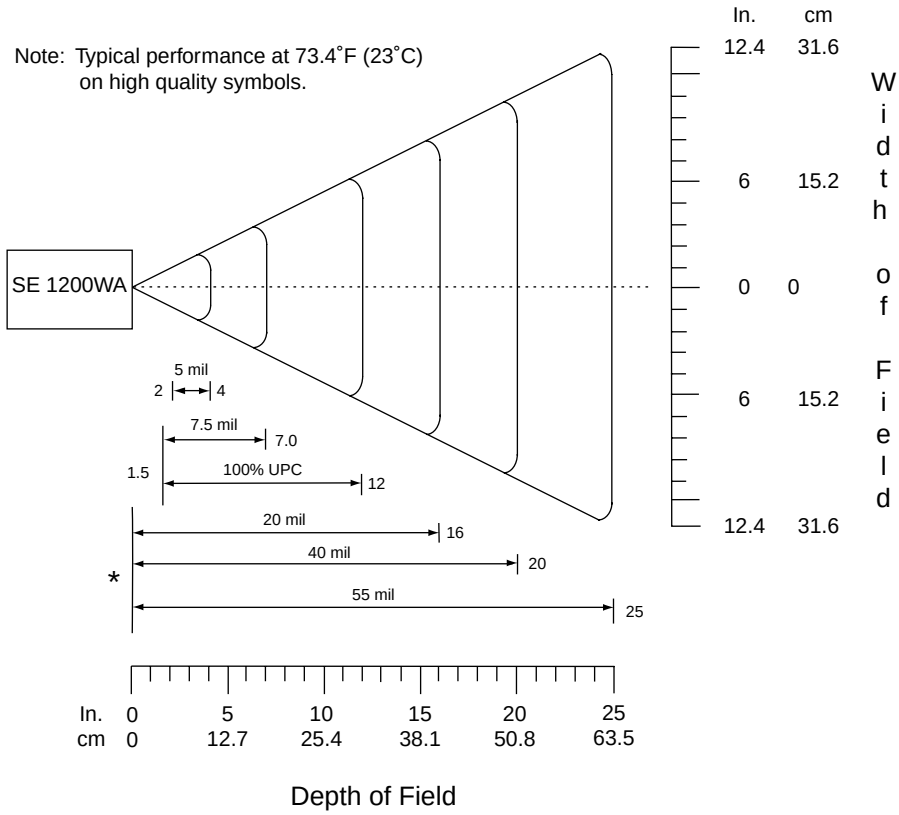


Figure 6-1. SE 1200WA-I000A Skew, Pitch and Roll

SE 1200 Wide Angle Decode Zone (V_{cc} = 5V)

The SE 1200WA-I000A Wide Angle decodes the symbols as shown in Figure 6-2. The figures shown are typical values. Table 6-2 on page 6-6 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, see *Calculating The Usable Scan Length Method* on page 2-12.



*Minimum distance determined by symbol length and scan angle

Figure 6-2. SE 1200WA-I000A Decode Zone (Typical)

Table 6-2. SE 1200WA-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 mil Code 39; 2.5:1	**ABCDEFGH** 80% MRD	**2 in.** 5.08 cm	**4 in.** 10.16 cm	**2 in.** 5.08 cm	**4 in.** 10.16 cm
7.5 mil Code 39; 2.5:1	**ABCDEF** 80% MRD	**1.5 in.** 3.81 cm	**7 in.** 17.78	**1.5 in.** 3.81	**7 in.** 17.78
13 mil 100% UPC	**1234567890** 80% MRD	**1.5 in.** 3.81 cm	**12 in.** 30.48 cm	**1.5 in.** 3.81 cm	**10 in.** 25.40 cm
20 mil Code 39; 2.2:1	**123** 80% MRD	*	**16 in.** 40.64 cm	*	**14 in.** 35.56 cm
40 mil Code 39; 2.2:1	**AB** 80% MRD	*	**20 in.** 50.80 cm	*	**18 in.** 45.72 cm
55 mil Code 39; 2.2:1	**CD** 80% MRD	*	**25 in.** 63.50 cm	*	**23 in.** 58.42 cm

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).
4. Reflective Symbol.

*Minimum distance determined by symbol length and scan angle.

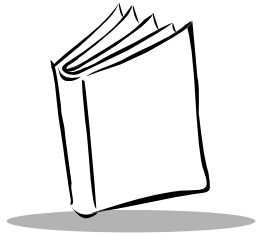
The decode zone is a function of various symbol characteristics including density, print contrast, wide-to-narrow ratio, and edge acuity. Width of decode zone at any given distance must be considered when designing a system.

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 6-1 on page 6-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 7
SE 1200VHD-I000A Specification

Overview

This chapter provides the technical specifications for the SE 1200VHD-I000A (Very High Density) scan engine.

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

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

SE 1200VHD-I000A Technical Specifications

Table 7-1 on page 7-2 provides the SE 1200VHD-I000A technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200VHD-I000A scan engine.

Table 7-1. SE 1200VHD-I000A Technical Specifications @ 23°C

Item	Description
Power Requirements **Input Voltage** **Input Current** **Standby Current** **Surge Current** **V_{cc} Noise Level**	SE 1200VHD-I000A 5.0 VDC ± 10% 60 mA typical @ 5V; 85 mA max. 50 µA max. 130 mA max. 50 mV p to p typical, 200 mV p to p max.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	0.36 mW ± 10%, 650 nm
Print Contrast	Minimum 40% absolute dark/light reflectance measured at 650 nm.
Scan Angle	37° ± 2°
Skew Tolerance	± 60° from normal (see Figure 7-1 on page 7-4)
Pitch Angle	± 65° from normal (see Figure 7-1 on page 7-4)
Roll	± 10° from vertical (see Figure 7-1 on page 7-4)
Decode Depth of Field	See *Usable Scan Length* on page 7-6
Ambient Light Immunity **Sunlight** **Artificial Light**	 8,000 ft. candles 86,112 lux 450 ft. candles 4,844 lux
Shock	2,000 G applied via any mounting surface @ 23°C (for 0.25 msec)
Vibration	Withstands a sinusoidal vibration of 1G along each of the 3 mutually perpendicular axes for a period of 1 hr per axis, over a frequency range of 5 Hz to 2,000Hz.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 7-1. SE 1200VHD-I000A Technical Specifications @ 23°C (Continued)

Item	Description	
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH/IEC Class II/2 devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.	
Operating Temperature	32° to 104°F	0° to 40°C
Storage Temperature	-40° to 140°F	-40° to 60°C
Humidity	5% to 95% non-condensing	
Height	0.76 in. max.	1.93 cm max.
Width	1.51 in. max.	3.84 cm max.
Depth	1.0 in. max.	2.54 cm max.
Weight	1.19 oz. max.	34 gm max.
Note: Environmental and/or Tolerance Parameters are not cumulative.		

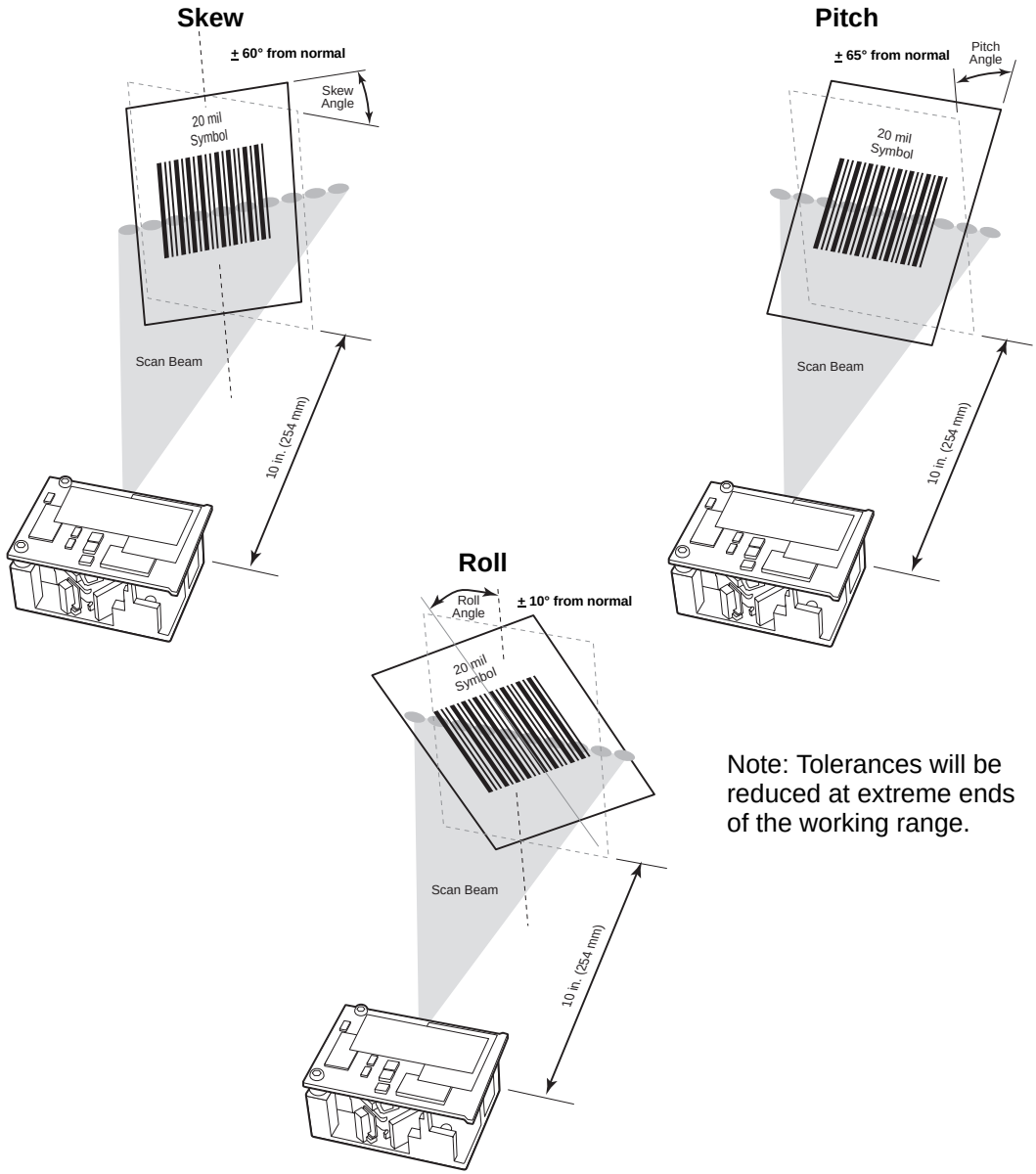


Figure 7-1. SE 1200VHD-I000A Skew, Pitch and Roll

SE 1200VHD-I000A Decode Zone (V_{cc} = 5V)

The SE 1200VHD-I000A decodes the symbols as shown in Figure 7-2. The figures shown are typical values. Table 7-2 on page 7-6 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, see *Calculating The Usable Scan Length Method* on page 2-12.

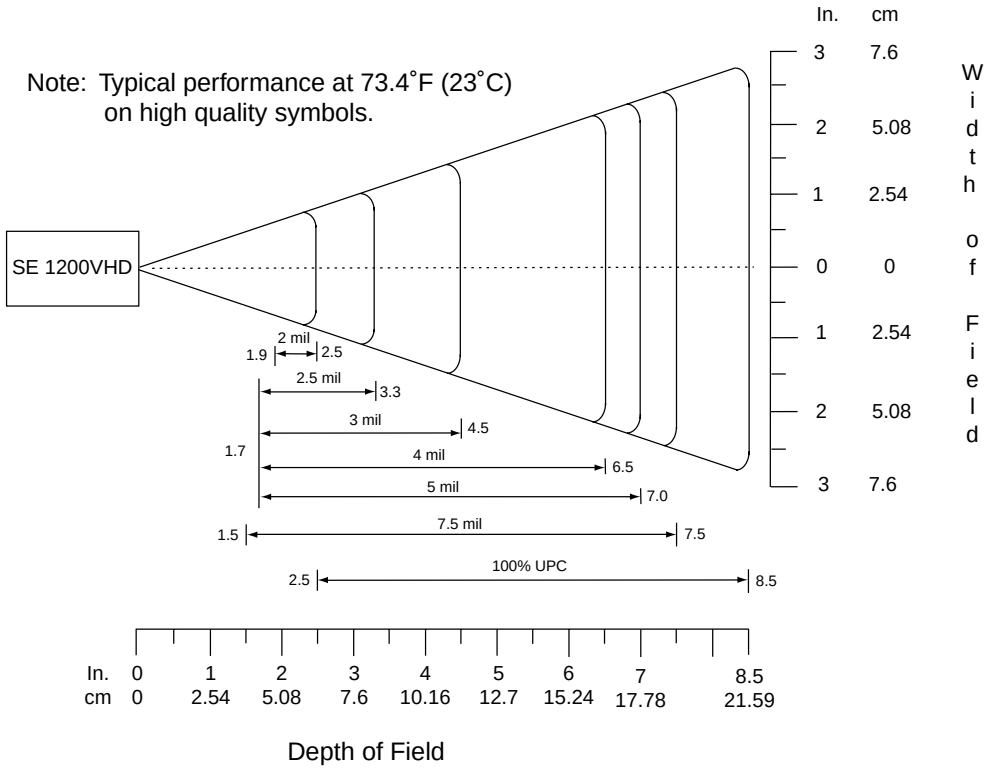


Figure 7-2. SE 1200VHD-I000A Decode Zone (Typical)

Table 7-2. SE 1200VHD-I000A Decode Distances

Symbol Density/ Bar Code Type	Bar Code Content/ Contrast[Note 1]	Typical Working Ranges		Guaranteed Working Ranges	
		Near	Far	Near	Far
2 mil Code 39; 2.5:1	**STI2025** 80% MRD	**1.90 in.** 4.82 cm	**2.5 in.** 6.35 cm	**N/A**	**N/A**
2.5 mil Code 39; 2.5:1	**STI2525** 80% MRD	**1.7 in.** 4.32 cm	**3.3 in.** 8.38 cm	**2.25 in.** 5.71 cm	**2.75 in.** 6.98 cm
3 mil Code 39; 2.5:1	**STI3025** 80% MRD	**1.7 in.** 4.32 cm	**4.5 in.** 11.43 cm	**2.25 in.** 5.71 cm	**3.6 in.** 9.14 cm
4 mil Code 39; 2.5:1	**STI4022** 85% MRD	**1.7 in.** 4.32 cm	**6.5 in.** 16.51 cm	**2.0 in.** 5.08 cm	**5.0 in.** 12.7 cm
5 mil Code 39; 2.5:1	**STI5025** 80% MRD	**1.7 in.** 4.32 cm	**7.0 in.** 17.78 cm	**2.0 in.** 5.08 cm	**5.0 in.** 12.7 cm
7.5 mil Code 39; 2.5:1	**ABCDEF** 80% MRD	**1.5 in.** 3.81 cm	**7.5 in.** 19.05 cm	**2.0 in.** 5.08 cm	**5.6 in.** 14.22 cm
100% UPC 13 mil	**1234567890** 80% MRD	**2.5 in.** 6.35 cm	**8.5 in.** 21.59 cm	**2.75 in.** 6.98 cm	**6.9 in.** 17.53 cm
1. CONTRAST measured as Mean Reflective Difference (MRD) at 650 nm.					

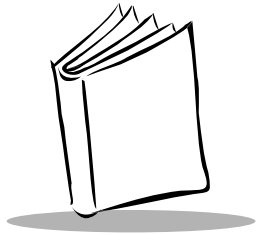
The decode zone is a function of various symbol characteristics including density, print contrast, wide-to-narrow ratio, and edge acuity. Width of decode zone at any given distance must be considered when designing a system.

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 7-1 on page 7-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 8
SE 1200LR-I001A Specification

Overview

This chapter provides the technical specifications for the SE 1200LR-I001A (Long Range) scan engine.

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

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

SE 1200LR-I001A Technical Specifications

Table 8-1 on page 8-2 provides the SE 1200LR-I001A technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200LR-I001A scan engine.

Table 8-1. SE 1200LR-I001A Technical Specifications @ 23°C

Item	Description
Power Requirements **Input Voltage** **Input Current** **Standby Current** **Surge Current** **V_{cc} Noise Level**	SE 1200LR-I001A 5.0 VDC ± 10% 72 mA typical @ 5V; 109 mA max. 50 µA max. 130 mA max. 50 mV p to p typical, 200 mV p to p max.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	Scan Mode: 1.3 mW ± 0.1 mW, 650 nm Aim Mode: < 1.0mW maximum, 650nm
Print Contrast	Minimum 40% absolute dark/light reflectance measured at 650 nm.
Scan Angle	23° ± 2°
Skew Tolerance	± 60° from normal (see Figure 8-1 on page 8-4)
Pitch Angle	± 65° from normal (see Figure 8-1 on page 8-4) (Measured on a 100% UPC symbol at mid working range.)
Roll	± 10° from vertical (see Figure 8-1 on page 8-4)
Decode Depth of Field	See Figure 8-2 on page 8-5
Ambient Light Immunity **Sunlight** **Artificial Light**	 8,000 ft. candles 86,112 lux 450 ft. candles 4,844 lux
Shock	2,000 G applied via any mounting surface @ 25°C (for 0.25 msec)
Vibration	Withstands a sinusoidal vibration of 1G along each of the 3 mutually perpendicular axes for a period of 1 hr per axis, over a frequency range of 5 Hz to 2000Hz.
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH/IEC Class II/2 devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 8-1. SE 1200LR-I001A Technical Specifications @ 23°C (Continued)

Item	Description	
Operating Temperature	-22° to 131°F	-30° to 55°C
Storage Temperature	-40° to 140°F	-40° to 60°C
Humidity	5% to 95% non-condensing	
Height	0.76 in. max.	1.93 cm max.
Width	1.51 in. max.	3.84 cm max.
Depth	1.0 in. max.	2.54 cm max.
Weight	1.19 oz. max.	34 gm max.
Note: Environmental and/or Tolerance Parameters are not cumulative.		

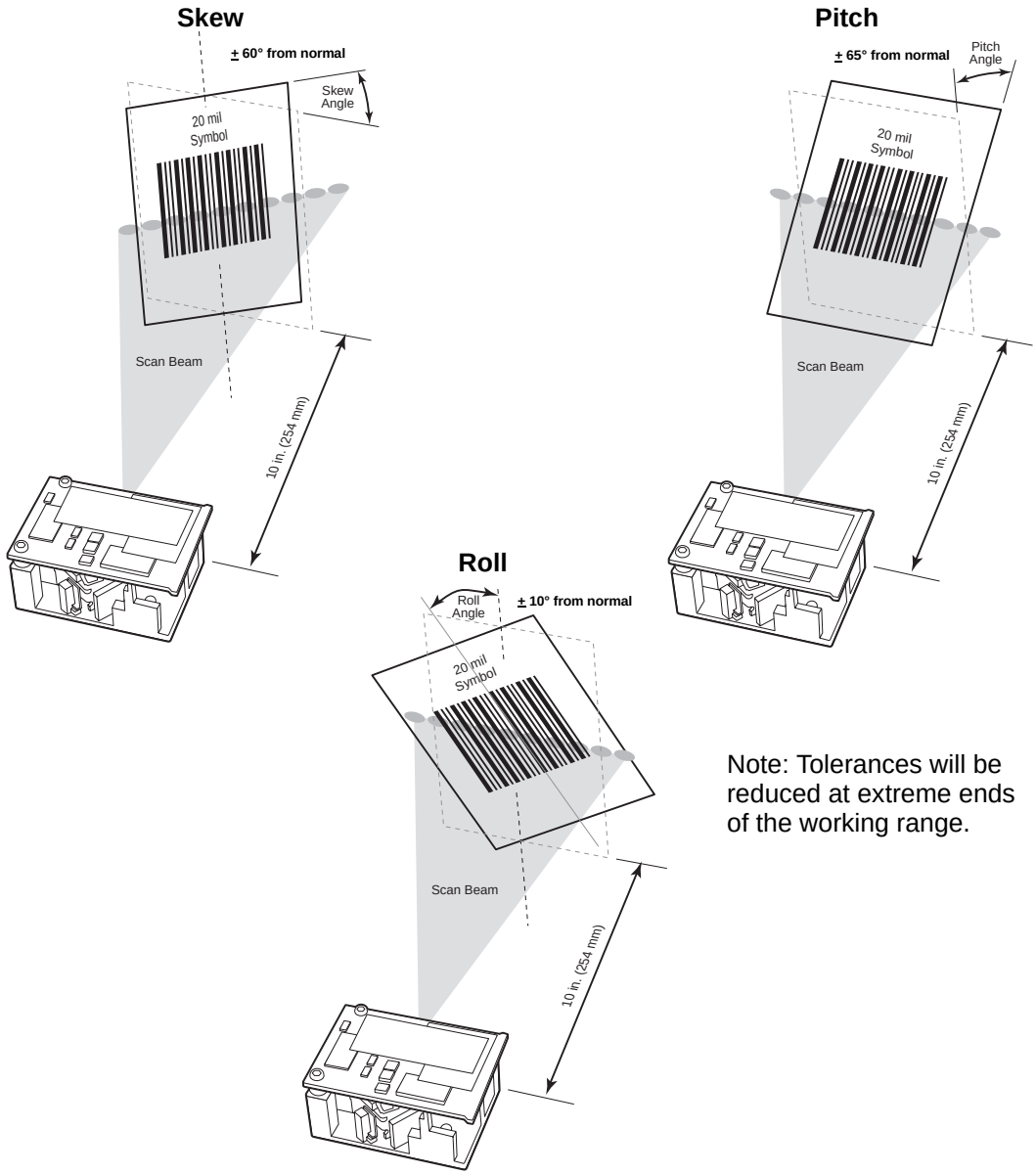


Figure 8-1. SE 1200LR-I001A Skew, Pitch and Roll

SE 1200LR-I001A Decode Zone (V_{cc} = 5V)

The SE 1200LR-I001A decodes the symbols as shown in Figure 8-2. The figures shown are typical values. Table 8-2 on page 8-6 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, see *Calculating The Usable Scan Length Method* on page 2-12.

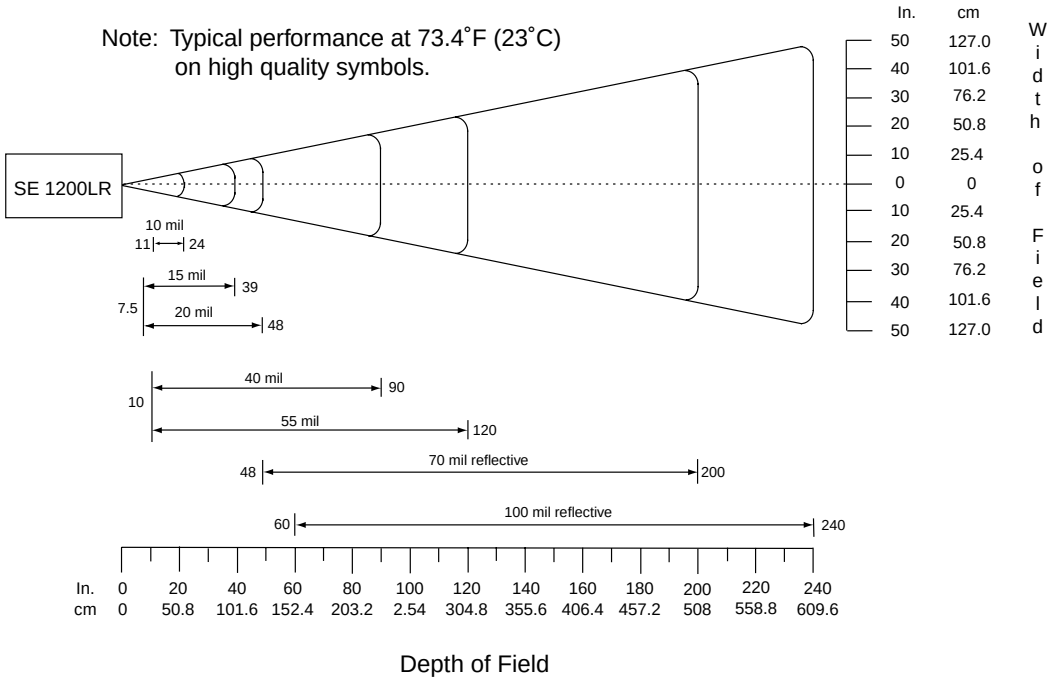


Figure 8-2. SE 1200LR-I001A Decode Zone (Typical)

Table 8-2. SE 1200LR-I001A 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
10 mil Code 39; 2.5:1	**ABCDE** 80% MRD	**11 in.** 27.94 cm	**24 in.** 60.96 cm	**15.5 in.** 39.37 cm	**20 in.** 50.80 cm
15 mil Code 39; 2.8:1	**STI** 80% MRD	**7.5 in.** 19.05 cm	**39 in.** 99.06 cm	**9 in.** 22.86 cm	**34 in.** 86.36 cm
20 mil Code 39; 2.2:1	**123** 80% MRD	**7.5 in.** 19.05 cm	**48 in.** 121.92 cm	**9 in.** 22.86 cm	**39 in.** 99.06 cm
40 mil Code 39; 2.2:1	**AB** 80% MRD	**10 in.** 25.40 cm	**90 in.** 228.60 cm	**10 in.** 25.40 cm	**80 in.** 203.20 cm
55 mil Code 39; 2.2:1	**CD** 80% MRD	**10 in.** 25.40 cm	**120 in.** 304.80 cm	**10 in.** 25.40 cm	**90 in.** 228.60 cm
70 mil[Note 4] Code 39; 3.0:1	**123477** 80% MRD	**48 in.** 121.92 cm	**200 in.** 508.00 cm	**70 in.** 177.80 cm	**162 in.** 411.48 cm
100 mil[Note 4] Code 39; 3.0:1	**1234** 80% MRD	**60 in.** 152.40 cm	**240 in.** 609.60 cm	**84 in.** 213.36 cm	**210 in.** 533.40 cm

Notes:

1. CONTRAST measured as Mean Reflective Difference (MRD) at 670 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).
4. Reflective Symbol.

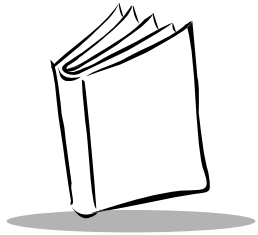
The decode zone is a function of various symbol characteristics including density, print contrast, wide to narrow ratio and edge acuity. Width of decode zone at any given distance must be considered when designing a system.

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 8-1 on page 8-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 9
SE 1200ALR-I000A Specification

Overview

This chapter provides the technical specifications for the SE 1200ALR-I000A (Advanced Long Range) scan engine.

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

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

SE 1200ALR-I000A Technical Specifications

Table 9-1 on page 9-2 provides the SE 1200ALR-I000A technical specifications.

Electrical Interface

Table 1-1 on page 1-5 lists the pin functions of the scan engine interface for the SE 1200ALR-I000A scan engine.

Table 9-1. SE 1200ALR-I000A Technical Specifications @ 23°C

Item	Description
Power Requirements **Input Voltage** **Input Current** **Standby Current** **Surge Current** **V_{cc} Noise Level**	SE 1200ALR-I000A 5.0 VDC ± 10% 72 mA typical @ 5V; 110 mA max. 50 µA max. 130 mA max. 50 mV p to p typical, 200 mV p to p max.
Scan Repetition Rate	35 (± 5) scans/sec (bidirectional)
Laser Power	1.5 mW ± 0.2 mW, 650 nm
Print Contrast	Minimum 40% absolute dark/light reflectance measured at 650 nm.
Scan Angle	13° ± 2°
Skew Tolerance	± 30° from normal (see Figure 9-1 on page 9-4)
Pitch Angle	± 55° from normal (see Figure 9-1 on page 9-4)
Roll	± 10° from vertical (see Figure 9-1 on page 9-4)
Decode Depth of Field	See Figure 9-2 on page 9-5
Ambient Light Immunity **Sunlight** **Artificial Light**	 4,000 ft. candles 43,056 lux 450 ft. candles 4,844 lux
Shock	2,000 G applied via any mounting surface @ 25°C (for 0.25 msec)
Vibration	Withstands a sinusoidal vibration of 1G along each of the 3 mutually perpendicular axes for a period of 1 hr per axis, over a frequency range of 5 Hz to 2000Hz.
Laser Class	The scan engine, by itself, is an unclassified component. It is intended for use in CDRH/IEC Class II/3A devices with proper housing, labeling, and instructions to comply with U.S. Federal and/or international standards.
Operating Temperature	-22° to 131°F -30° to 55°C
Note: Environmental and/or Tolerance Parameters are not cumulative.	

Table 9-1. SE 1200ALR-I000A Technical Specifications @ 23°C (Continued)

Item	Description	
Storage Temperature	-40° to 140°F	-40° to 60°C
Humidity	5% to 95% non-condensing	
Height	0.76 in. max.	1.93 cm max.
Width	1.51 in. max.	3.84 cm max.
Depth	1.0 in. max.	2.54 cm max.
Weight	1.19 oz. max.	34 gm max.
Note: Environmental and/or Tolerance Parameters are not cumulative.		

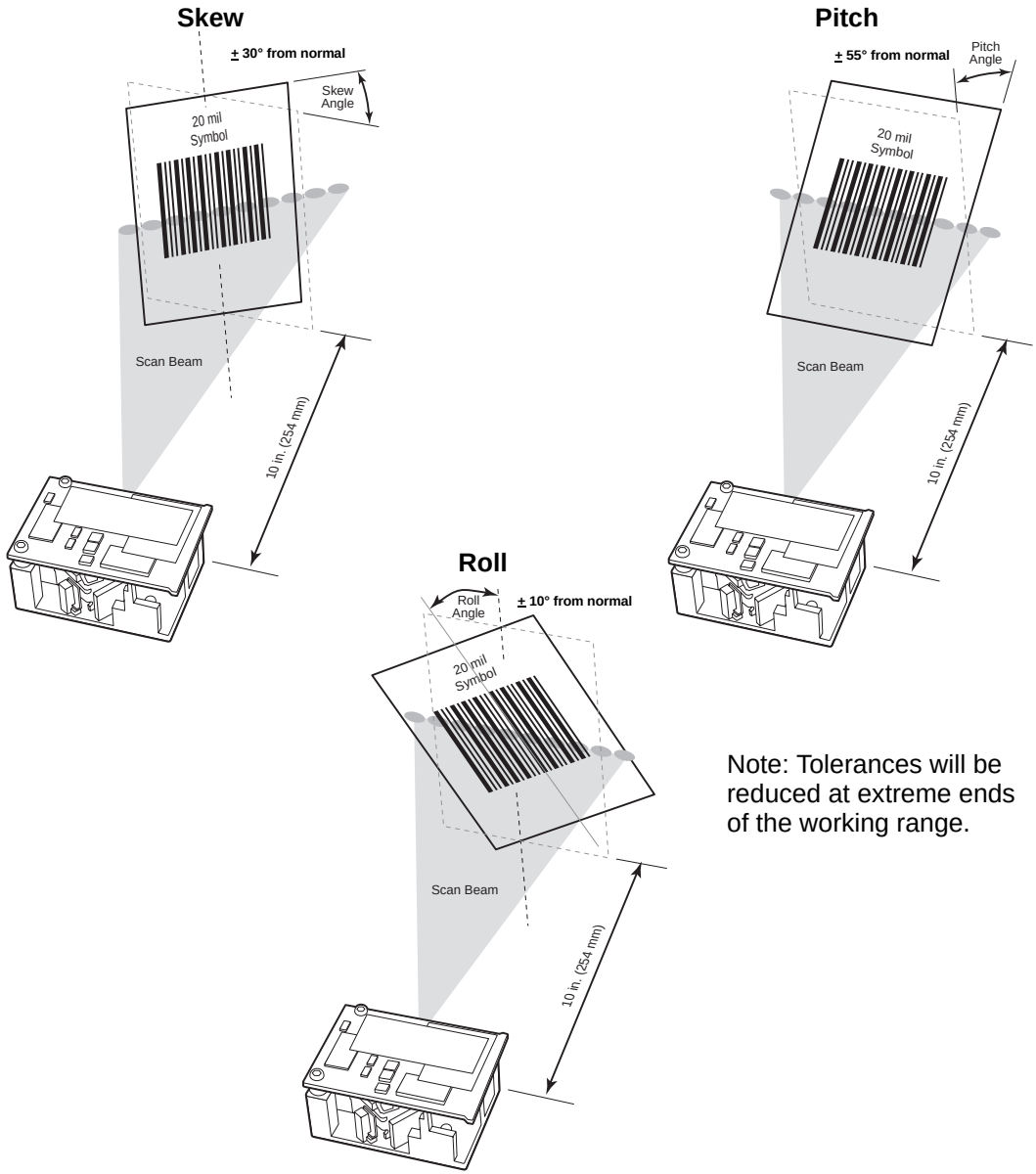


Figure 9-1. SE 1200ALR-I000A Skew, Pitch and Roll

SE 1200ALR-I000A Decode Zone (V_{cc} = 5V)

The SE 1200ALR-I000A decodes the symbols as shown in Figure 9-2. The figures shown are typical values. Table 9-2 on page 9-6 lists the typical and guaranteed distances for selected bar code densities. All specified working ranges are tested with Code 39 and 100% UPC on photographic quality prints with minimum of 90% MRD. 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, see *Calculating The Usable Scan Length Method* on page 2-12.

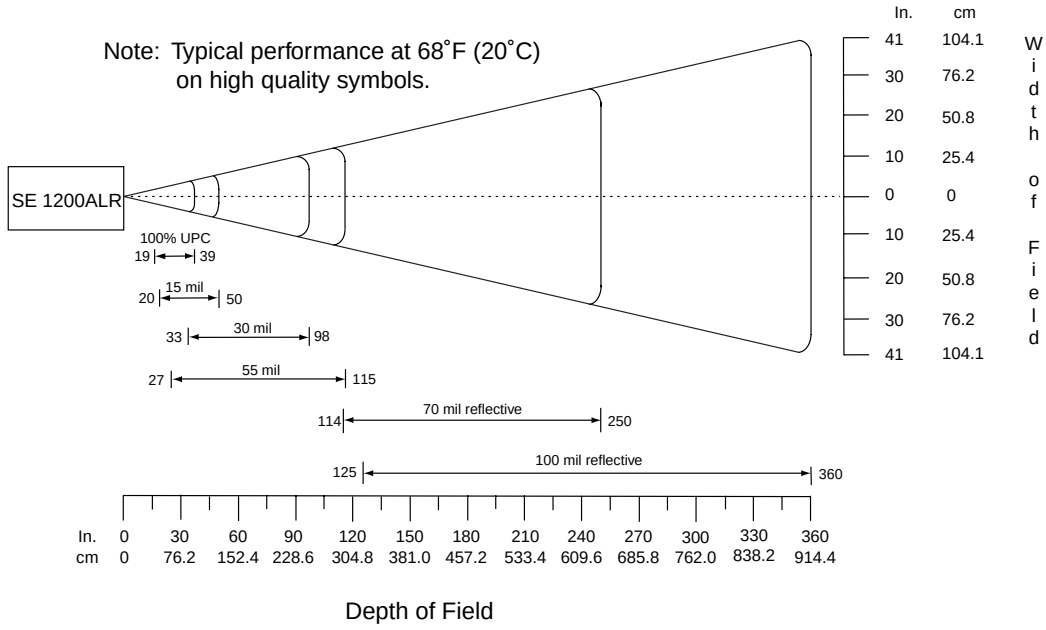


Figure 9-2. SE 1200ALR-I000A Decode Zone (Typical)

Table 9-2. SE 1200ALR-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
13 mil 100% UPC	**1234567890** 90% MRD	**19.0 in** 48.26 cm	**39.0 in** 99.06 cm	**29.0 in** 73.66 cm	- -
15 mil Code 39; 2.8:1	**STI** 90% MRD	**20.0 in** 50.80 cm	**50.0 in** 127.00 cm	**24.0 in** 60.96 cm	**45.0 in** 114.30 cm
30 mil Code 39; 3.0:1	**ABCDEFGHIJ** 90% MRD	**33.0 in** 83.82 cm	**98.0 in** 248.92 cm	**42.0 in** 106.68 cm	**90.0 in** 228.60 cm
55 mil Code 39; 3.0:1	**B** 90% MRD	**27.0 in** 65.58 cm	**115.0 in** 276.86 cm	- -	**101.0 in** 256.54 cm
70 mil[Note4] Code 39; 3.0:1	**123477** 90% MRD	**114.0 in** 289.56 cm	**250.0 in** 635.00 cm	- -	**230.0 in** 584.20 cm
100 mil[Note 4] Code 39; 3.0:1	**1234** 90% MRD	**125.0 in** 317.50 cm	**360.0 in** 914.40 cm	- -	**324.0 in** 822.96 cm

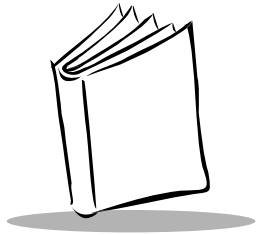
Notes:
1. CONTRAST measured as Mean Reflective Difference (MRD) at 650 nm.
2. Near ranges on lower densities (not specified) are largely dependent upon the width of the bar code and the scan angle.
3. Working range specifications at ambient temperature (23 °C)
4. Reflective Symbol

Usable Scan Length

Calculating The Usable Scan Length Method on page 2-12, provides a detailed description of how to calculate the usable scan length. The scan angle is provided in Table 9-1 on page 9-2.

Exit Window Characteristics

Table 2-1 on page 2-6 and Figure 2-2 on page 2-7 provide the minimum exit window dimensions and tilt angles for the SE 1200 scan engines.



Chapter 10
Troubleshooting

Overview

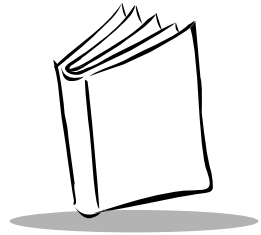
Table 10-1 on page 10-2 provides troubleshooting information.

Note: *If after performing the Troubleshooting checks the symbol still does not scan, contact your distributor or call the Symbol Support Center. See page x for contact information.*

Troubleshooting

Table 10-1. Troubleshooting

Problem	Possible Cause	Possible Solutions
Nothing happens when you attempt to scan.	No power to the scanner.	Check the system power. Confirm that the correct host interface cable is used.
Scanner cannot read the bar code	Interface/power cables are loose.	Check for loose cable connections.
	Scanner is not programmed for the correct bar code type.	Make sure the scanner is programmed to read the type of bar code to be scanned. Try scanning other bar code(s) and other bar code types.
	Incorrect communication parameters.	Check that the communication parameters (baud rate, parity, stop bits, etc.) are set properly.
	Bar code symbol is unreadable.	Check the symbol to make sure it is not defaced. Try scanning similar symbols of the same code type.



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) or equivalently, the minimum element width.
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 I	This is the lowest power CDRH laser classification. CDRH Class I devices are safe under reasonably foreseeable conditions of operation. Software and other controls to limit exposure to laser light may be required to achieve CDRH Class I operation. The CDRH time base for Class I devices is 10,000 seconds.
CDRH Class II	CDRH Class II devices may not emit more than 1 milliwatt average radiant power. For this scan engine, additional software controls are not necessary. Eye protection for CDRH Class II devices is normally afforded by aversion responses, including the blink reflex.
Character	A pattern of bars and spaces which either directly represents data or indicates a control function, such as a number, letter, punctuation mark, or communications control contained in a message.
Character Set	Those characters available for encodation in a particular bar code symbology.
Check Digit	A digit used to verify a correct symbol decode. The scanner inserts the decoded data into an arithmetic formula and checks that the resulting number matches the encoded check digit. Check digits are required for UPC but are optional for other symbologies. Using check digits decreases the chance of substitution errors when a symbol is decoded.
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.

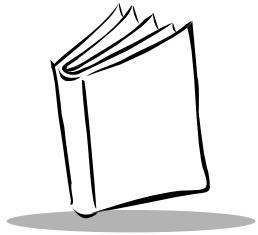
Code Length	Number of data characters in a bar code between the start and stop characters, not including those characters.
Continuous Code	A bar code or symbol in which all spaces within the symbol are parts of characters. There are no intercharacter gaps in a continuous code. The absence of gaps allows 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.
Decoder Asynchronous Serial Interface (DASI)	A half-duplex asynchronous serial interface with two hardware handshaking lines.
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 Code	A bar code or symbol in which the spaces between characters (intercharacter gaps) are not part of the code.
DLED	Decode LED.
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.
EEPROM	Electrically erasable read only memory.
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 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 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 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 electrical current 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.
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).
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.
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 - illuminates a bar code. 2. Photodetector - registers the difference in reflected light (more light reflected from spaces). A transducer that converts received light energy into a proportional electric current. 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 650 to 690 nanometers.



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

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

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What can we do to further improve our manuals?

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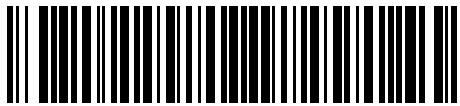
Thank you for your input—We value your comments.

SE 1200 Series Scan Engine Integration Guide



72-58178-01
Revision A - January 2003

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