VS 4000 Series Imager

Product Reference Guide

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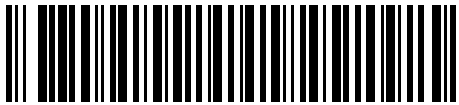

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Symbol Technologies, Inc. One Symbol Plaza, Holtsville N.Y. 11742-1300

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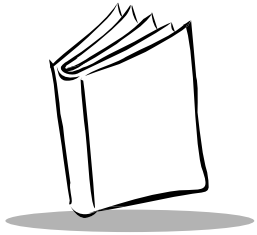

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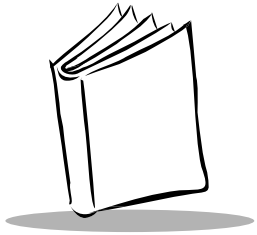

About This Guide

Introduction

This manual provides general instructions for setting up, operating, troubleshooting, maintaining, and programming your VS 4000 Series Imager. The target audience is a system administrator or other personnel responsible for getting the imager up and running in its intended environment.

Chapter Descriptions

The manual includes the following chapters.

- *Chapter 1, Getting Started*, provides a product overview and information on connecting the imager to the host. It also provides scanning instructions and beeper definitions.
- *Chapter 2, Programming the VS 4000*, provides all the bar codes necessary to program your imager.
- Chapter 3, *Advanced Data Formatting (ADF)*, describes how to customize scanned data in your imager before transmitting it to the host.
- *Chapter 4, Maintenance and Troubleshooting* , includes tips on maintaining and troubleshooting your imager.
- *Appendix A, Programming Reference*, provides information on AIM identifiers and prefix/suffix values.
- *Appendix B, VS 4000 Imager Specifications*, lists the imager's technical specifications and provides decode ranges.

Notational Conventions

The following conventions are used in this document:

- "You" refers to the administrator who is using this manual as a reference aid to install, configure, operate, maintain, and troubleshoot the VS 4000 Series Imager.
- **Bold** type is used to highlight specific items in the general text.
- *Italics* are used 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.

Related Publications

- *VS 4000 Series Quick Reference Guide* p/n 72-38485-xx
  This document provides general information to help the user get started with the imager, and includes basic operation instructions.

Service Information

If you have a problem with your equipment, contact the *Symbol Support Center* for your region. Refer to page xi for 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 the problem. In order to help troubleshoot a scanning problem, the Support Center may request to capture a picture of test patterns or bar codes with your imager and E-Mail to our plant for analysis. If the equipment is found to be working properly and the problem is symbol readability, the Support Center may also request samples of your bar codes for further analysis.

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

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

Symbol Support Centers

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

United States

Symbol Technologies, Inc.
One Symbol Plaza
Holtsville, New York 11742-1300
1-800-653-5350

Canada

Symbol Technologies Canada, Inc.
2540 Matheson Boulevard East
Mississauga, Ontario, Canada L4W 4Z2
905-629-7226

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

Warranty

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

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

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

Warranty Coverage and Procedure

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

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

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

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

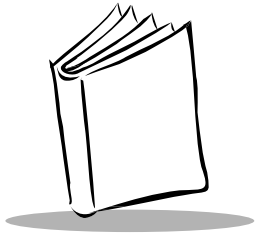
Symbol's Customer Service organization offers an array of service plans, such as on-site, depot, or phone support, that can be implemented to meet customer's special operational requirements and are available at a substantial discount during warranty period.

General

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

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

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



Chapter 1
Getting Started

Introduction

The VS 4000 Series hand-held imager is a high-performance, durable solution for a wide variety of data collection applications using the latest digital camera technology. This system features:

- omnidirectional reading of a variety of bar code symbologies, including the most popular linear, postal, PDF417, and 2D matrix code types.
- the ability to capture and download images to a host for a variety of imaging applications.
- advanced intuitive laser aiming for easy point-and-shoot operation.
- a tough, ergonomic thermoplastic housing for comfort and durability.

The VS 4000 supports the following interfaces:

- Standard RS-232 interface for serial connection to a host. The imager communicates with the host through scanned bar codes.
- Keyboard wedge via Symbol's Synapse cables, where scanned data is interpreted by the host as keystrokes.

This chapter describes how to set up the imager with your host system, how to operate the imager, and defines beeper indications.

Unpacking

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

Setting Up the Imager

This section provides instructions first on connecting the interface cable to the imager, then to each supported interface.

Connecting the Interface Cable to the VS 4000

To attach the supplied interface cable to your imager:

1. Pull the boot up over the cable until just the connector is protruding.

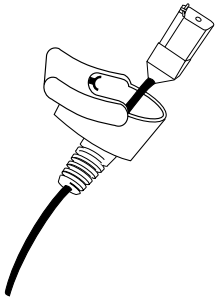


Figure 1-1. Connector on Cable

2. Plug the modular connector on the cable into the receptacle in the bottom of the VS 4000 handle. Listen for a click.

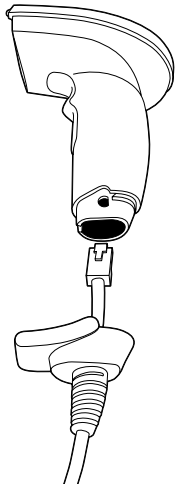


Figure 1-2. Plugging Connector into Imager

3. Gently tug the cable to ensure the connector is properly secured.
4. Slide the boot up in its proper orientation, ensuring the semi-circular key on the boot slides inside the handle assembly, until it is securely in place.

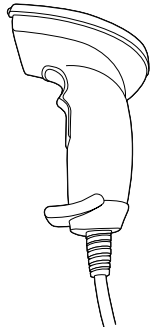


Figure 1-3. Sliding Boot up on Cable

5. Gently pull the boot to be sure it is properly seated.

Switching Cables

Different cables may be required for different hosts. To change the imager's cable:

1. Slide the boot down over the cable.
2. Unplug the modular connector by depressing the connector clip (through the access hole), and remove the existing cable.

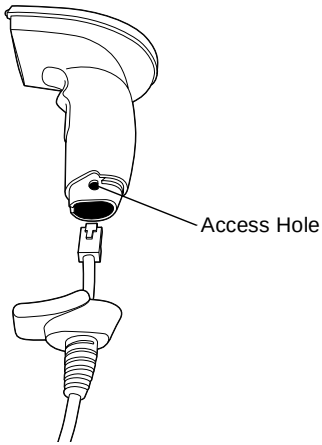


Figure 1-4. Removing Cable

3. Follow the steps for *Connecting the Interface Cable to the VS 4000* on page 1-2.

Standard RS-232 Interface

To connect the VS 4000 to your PC host via RS-232:

1. Power off your host.
2. Connect the imager's interface cable to the host. Consult the technical manual supplied with your host for the correct location of the port.

3. Connect the power supply to the power port on the host connector of the interface cable.

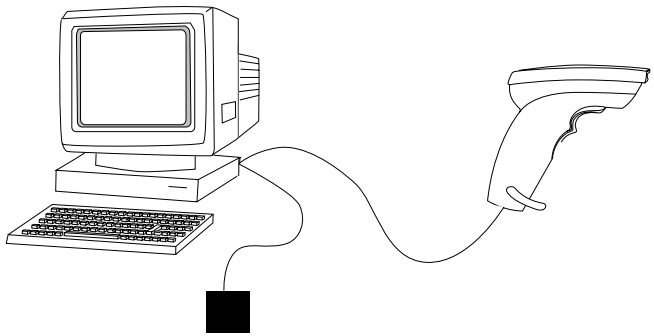


Figure 1-5. Standard RS-232 Host Interface

4. Power up the host. The imager powers on automatically.
5. Scan the appropriate *Host Type* on page 2-13 to set up the imager to communicate with your host.
6. See Chapter 2, *Programming the VS 4000* for information on selecting custom features for your imager.

Keyboard Wedge Interface

To connect the VS 4000 to your keyboard wedge host:

1. Power off your host.
2. Connect the imager's Synapse interface cable to the adapter y-cable.
3. Remove the cable connected to your keyboard, and insert the keyboard connector on the y-cable into that keyboard port. Insert the other connector of the y-cable into the back of the terminal. Consult the technical manual supplied with your terminal for the correct location of the port.

4. Connect a power supply.

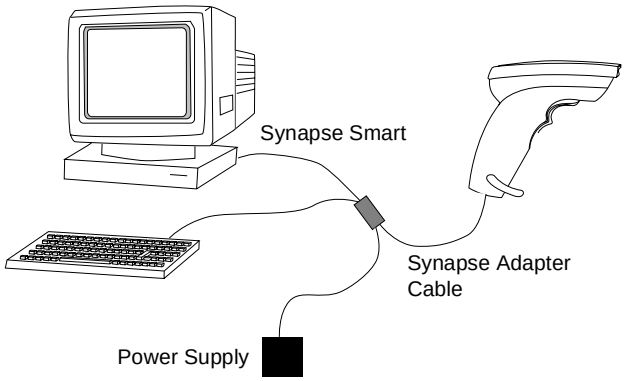


Figure 1-6. Keyboard Wedge Configuration

5. Power up the host. The imager powers on automatically.
6. Since your Synapse host is autodetected, there's no need to scan a host bar code to choose your host.
7. See Chapter 2, *Programming the VS 4000* for information on selecting custom features for your imager, and your *Synapse Interface Guide* for interface options specific to your Synapse cable.

Connecting to Symbol Hand-Held Terminals

To connect the VS 4000 to your Symbol terminal, connect the mini-D adapter to the imager's interface cable, and insert the adapter into the 15-pin port on your terminal.

Power up the terminal. The imager powers on automatically.

Accessories

Depending on your host system's configuration, the following items may be included in your imager system. These items are also available through contacting your local Symbol representative or business partner.

Standard Accessories

These items may be included in your system.

- 9-Pin Host interface cable, Female, D Connector/PC AT: TxD on Pin 2
- 100-240VAC (50/60Hz) Universal Power Supply
- User Documentation
  - *VS 4000 Series Product Reference Guide*
  - *VS 4000 Series Quick Reference Guide*

Optional Accessories

Optional accessories are not included in the standard configuration, and are available through contacting your local Symbol representative or business partner.

- 15-Pin host interface cable, Male, Mini-D Connector/PCAT: TxD on Pin 2
- Synapse keyboard wedge interface and adapter cables
- Desk stand
- Hands-free stand

Scanning

The VS 4000 uses digital camera technology to take a digital picture of a bar code. It stores the resulting image in its memory, and executes software decoding algorithms to extract the data from the image. A typical bar code decoding process is as follows:

1. The user aims the imager and pulls the trigger.
2. The red laser aiming pattern turns on to assist in aiming the imager.
3. If necessary, the imager turns on its red LEDs to illuminate the target bar code.
4. The imager takes a digital picture (image) of the bar code and stores it in memory for decoding.
5. A decode beep occurs and the imager transmits the bar code data to the host.
6. The user releases the trigger.

This process usually occurs instantaneously. Steps 2 - 4 are repeated on poor or difficult bar codes, for as long as the trigger remains pressed.

You may customize features in the VS 4000 by scanning the appropriate programming bar codes in Chapter 2, *Programming the VS 4000*.

Aiming the Imager

The VS 4000 Imager projects a laser aiming pattern (shown below) similar to those used on cameras. The aiming pattern allows you to position the bar code or object within the field of view.

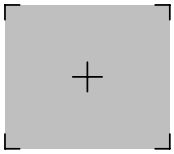


Figure 1-7. Laser Aiming Pattern

To scan a symbol with the VS 4000:

1. Center the symbol in any orientation within the aiming pattern. Be sure the entire symbol is within the rectangular area formed by the brackets in the pattern.

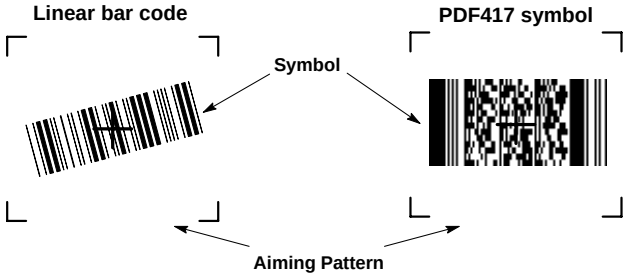


Figure 1-8. Centering Symbol in Aiming Pattern

The imager can also read a bar code presented within the aiming pattern but not centered, such as the figure below on the left. The figure on the right, however, can not be decoded.

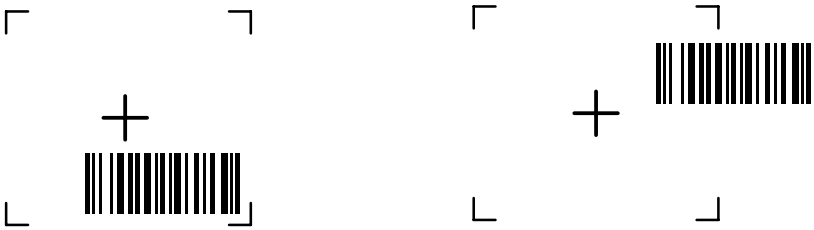


Figure 1-9. Acceptable and Incorrect Aiming

If two bar codes are present in the aiming pattern, the imager decodes the central-most bar code.

2. Hold the VS 4000 between two and nine inches (depending on symbol density) from the symbol, centering the aiming pattern cross hairs on the symbol.
3. The aiming pattern is smaller when the VS 4000 Imager is closer to the symbol and larger when it is farther from the symbol. Scan symbols with smaller bars or elements (mil size) closer to the unit, and those with larger bars or elements (mil size) farther from the unit.
4. Pull and hold the trigger until the imager beeps, indicating the bar code has been successfully decoded.

Operational Modes

The imager has three modes of operation, activated by a trigger pull:

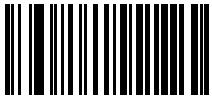
- Decode Mode
- Snapshot Mode
- Video Mode.

Decode Mode

By default, when you pull the trigger the imager attempts to locate and decode enabled bar codes within its field of view. The imager remains in this mode as long as the trigger is pulled or until a bar code is decoded.

Snapshot Mode

Snapshot Mode is used to capture a high-quality image and transmit it to the host. You may temporarily enter this mode by scanning the Snapshot Mode bar code below. While in this mode the imager blinks the yellow LED at 1-second intervals to indicate it is not in standard operating (decode) mode.



Snapshot Mode

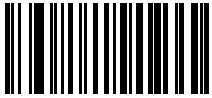
When Snapshot Mode is entered, the imager turns on its laser aiming pattern to highlight the area to be captured in the image. The next trigger pull instructs the imager to capture a high quality image and transmit it to the host. A short time may pass (less than 2 seconds) between when the trigger is pulled and the image is captured as the imager adjusts to the lighting conditions. Hold the imager steady until the image is captured, denoted by a single beep.

If you do not press the trigger within the Snapshot Mode Timeout period, the imager returns to Decode Mode. This timeout period can be adjusted using the *Snapshot Mode Timeout* on page 2-23. The default timeout period is 30 seconds.

To disable the laser aiming pattern during Snapshot Mode, see *Snapshot Aiming Pattern* on page 2-24.

Video Mode

While in this mode the imager behaves as a video camera as long as the trigger is pressed. When the trigger is released, the imager returns to Decode Mode. You may temporarily enter Video Capture Mode by scanning the bar code below.



Video Mode

Beeper Definitions

The imager communicates with the user by emitting different beep tones and patterns. The following tables define what each beep sequence means.

Standard Beeper Definitions

Table 1-1 defines general beep sequences that occur during both normal scanning and while programming the imager.

Table 1-1. Standard Beeper Definitions

Beeper Sequence	Indication
Standard Use	
Short high tone	A bar code symbol was decoded (if decode beeper is enabled).
Low/medium/high tone	Power-on or reset. Occurs immediately after the unit is turned on, indicating that the system software is working properly. Three beeps which occur during normal operation indicate a reset. Any work in progress may be lost. If this occurs often, contact the Symbol Support Center.
Parameter Menu Scanning	
Short high tone	Correct entry scanned or correct menu sequence performed.
High/low/high/low tone	Successful program exit with change in the parameter setting.
Low/high tone	Input error, incorrect bar code, or “Cancel” scanned, wrong entry, incorrect bar code programming sequence; remain in program mode.
Communication	
4 short high tones	Communication error.
High/high/high/low tone	Receive error.
Low/high/low tone	ADF transmit error.

Special Beeper/Status LED Definitions

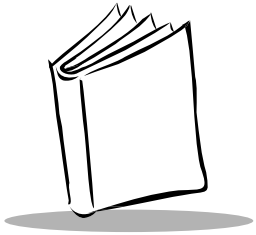
Table 1-2 define beeper and Status LED activity indicating special events.

Table 1-2. Special Beeper and Status LED Indications

Event	Beep Tone	Status LEDs
Decode	Middle	Green Flash
Trigger pull	No sound	No Lights
Bootup	Low, Middle, High	No Lights
Transmission error	Four Low	No Lights
Parity error	Three Low, Two Extra Low	No Lights
Start snapshot	Low	Blinking Yellow
Complete snapshot	Low	No Lights
Entry error	Low, High	Green Flash
Parameter entered	High, Low, High, Low	Green Flash
Defaults set	Low High, High	Green Flash
No Decode message	No sound	No Lights
Video Mode enabled	No sound	Yellow Light
Video Mode disabled	No sound	No Lights
Wakeup (from low power)	No sound	No Lights
CCD failure	Two Very Low Long	Blinking Red
Parameter scanned	Middle	Green Flash
Synapse - Invalid parameter	High, Low, High, Low	No Lights
Synapse failure	Very Low, Low, Very Low, High	Red Flash

ADF Beeper/Status LED Definitions

See Table 3-3 on page 3-8 for beeper and status LED events that occur during ADF programming.

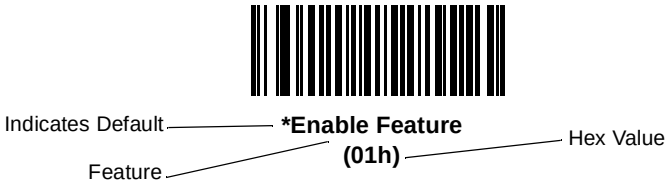


Chapter 2
Programming the VS 4000

Introduction

The VS 4000 Imager can be programmed to perform various functions, or activate different features. This chapter describes each feature and provides the programming bar codes necessary for selecting these features for your imager. Before programming, follow the setup instructions in Chapter 1, *Getting Started*.

Table 2-1 on page 2-4 shows selectable programming options and their default values for the VS 4000. Throughout the programming bar code menus, default values are indicated with asterisks (*), and the hex value of the option is provided for serial programming purposes.



If the default values suit your requirements, no programming is necessary. Features other than default values can be set by scanning single bar codes or short bar code sequences. These features may also be set from the host through the serial interface. Note that these settings are stored in non-volatile memory and are retained after powerdown.

To return all features (except Host Type) to their default values, all you need to do is scan the **Set Defaults** bar code on page 2-3.

Scanning Sequence Examples

In most cases you need only scan one bar code to set a specific parameter. For example, if you want to set the baud rate to 9600, simply scan the **9600** bar code listed under *Baud Rate* on page 2-76. The imager issues a warble tone, signifying a successful parameter entry.

If you want to set specific code lengths or specify Serial Response Time-Out, you have to scan several bar codes. This procedure is described later in this chapter.

Errors While Scanning

If you make an error during a scanning sequence, just rescan the correct parameter.

Set Default Parameter

Scan the **Set Defaults** bar code to return all parameters to the default values listed in Table 2-1.

Set Defaults

Parameter Selections and Defaults

Table 2-1 lists parameter selections, their defaults, and the page number they appear on.

Table 2-1. Parameter Tabl e

Parameter	Param. Number	Selection	Default	Page
Set Defaults		None	Set Default Values	2-3
Host Type	8Eh	RS-232 (37h)	RS-232	2-13
Parameter Scanning	ECh	Enabled (01h) Disabled (00h)	Enabled	2-14
Power Mode	80h	Continuous On Mode (00h) Low Power Mode (01h)	Continuous On Mode	2-14
Beeper Options				2-15
Beep After Good Decode	38h	Enabled (01h) Disabled (00h)	Enabled	2-15
Beeper Volume	8Ch	High (09h), Medium (03h), Low (00h)	Medium	2-16
Beeper Tone	91h	High (00h), Medium (01h), Low (02h)	Medium	2-17
Imaging Options				2-18
Decoding Autoexposure	F0h,29h	Enabled (01h) Disabled (00h)	Enabled	2-19
Decoding Illumination	F0h,2Ah	Enabled (01h) Disabled (00h)	Enabled	2-19
Image Capture Autoexposure	F0h,68h	Enabled (01h) Disabled (00h)	Enabled	2-20
Image Capture Illumination	F0h,69h	Enabled (01h) Disabled (00h)	Disabled	2-20
Gain Setting	F0h,37h	128 (0080h), 192 (00C0h), 256 (0100h), 320 (0140h), 384 (0180h), 448 (01C0h)	192	2-21

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Exposure Time	F0h,38h	5 ms (004Fh), 10 ms (009Dh), 15 ms (00ECh), 20 ms (013Bh), 25 ms (018Ah), 30 ms (01D8h)	20 ms	2-22
Decode Aiming Pattern	F0h,32h	Enabled (02h) Disabled (00h)	Enabled	2-23
Snapshot Mode Timeout	F0h,43h	0 - 9 (30 seconds - 300 seconds)	0 (30 seconds)	2-23
Snapshot Aiming Pattern	F0h,2Ch	Enabled (01h) Disabled (00h)	Enabled	2-24
Image Cropping	F0h,2Dh	Enabled (01h) Disabled (00h)	Disabled	2-24
Crop to Pixel Addresses	F0h,3Bh; F0h,3Ch; F0h,3D; F0h,3Eh	(0,0) to (639,479)	0 top, 0 left, 479 bottom, 639 right	2-25
Image Resolution	F0h,2Eh	Full (00h), 1/2 (01h), 1/3 (02h), 1/4 (03h)	Full	2-27
JPEG Image Options	F0h,2Bh	Quality (01h), Size (00h)	Quality	2-28
JPEG Quality Value	F0h,31h	5 to 100 (5 to 100 decimal)	65	2-28
JPEG Size Value	F0h,33h	1 to 150 where value is multiple of 1024 bytes (1K) (1 to 150 decimal)	40 (41K)	2-28
Image File Format Selection	F0h,30h	BMP (03h), TIF (04h), JPEG (01h)	JPEG	2-29
Bits per Pixel (BPP)	F0h,2Fh	1 (00h), 4 (01h), 8 (02h)	8 BPP	2-30
Video Options				2-31
Video View Finder	F0h,44h	Enabled (01h) Disabled (00h)	Disabled	2-31
Target Video Frame Size	F0h,48h	800 to 3300 bytes	2200 bytes	2-32

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Video View Finder Image Size	F0h,49h	800 to 3300 bytes	1700 bytes	2-32
Code Types				2-33
UPC-A	01h	Enabled (01h) Disabled (00h)	Enabled	2-34
UPC-E	02h	Enabled (01h) Disabled (00h)	Enabled	2-34
UPC-E1	0Ch	Enabled (01h) Disabled (00h)	Disabled	2-34
EAN-8	04h	Enabled (01h) Disabled (00h)	Enabled	2-35
EAN-13	03h	Enabled (01h) Disabled (00h)	Enabled	2-35
Bookland EAN	53h	Enabled (01h) Disabled (00h)	Disabled	2-35
Code 39	00h	Enabled (01h) Disabled (00h)	Enabled	2-36
Code 39 Full ASCII	11h	Enabled (01h) Disabled (00h)	Disabled	2-36
Trioptic Code 39	0Dh	Enabled (01h) Disabled (00h)	Disabled	2-36
Code 93	09h	Enabled (01h) Disabled (00h)	Disabled	2-37
Code 128	08h	Enabled (01h) Disabled (00h)	Enabled	2-37
UCC/EAN 128	0Eh	Enabled (01h) Disabled (00h)	Enabled	2-37
ISBT 128	54h	Enabled (01h) Disabled (00h)	Enabled	2-38
Codabar	07h	Enabled (01h) Disabled (00h)	Disabled	2-38

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Interleaved 2 of 5	06h	Enabled (01h) Disabled (00h)	Disabled	2-38
Discrete 2 of 5	05h	Enabled (01h) Disabled (00h)	Disabled	2-39
MSI Plessey	0Bh	Enabled (01h) Disabled (00h)	Disabled	2-39
Postal Codes				2-39
US Postnet	59h	Enabled (01h) Disabled (00h)	Enabled	2-39
US Planet	5Ah	Enabled (01h) Disabled (00h)	Enabled	2-40
UK Postal	5Bh	Enabled (01h) Disabled (00h)	Enabled	2-40
Japan Postal	F0h,22h	Enabled (01h) Disabled (00h)	Enabled	2-40
Australian Postal	F0h,23h	Enabled (01h) Disabled (00h)	Enabled	2-41
2D Symbologies				2-41
PDF417	0Fh	Enabled (01h) Disabled (00h)	Enabled	2-41
MicroPDF417	E3h	Enabled (01h) Disabled (00h)	Disabled	2-41
Data Matrix	F0h,24h	Enabled (01h) Disabled (00h)	Enabled	2-42
Maxicode	F0h,26h	Enabled (01h) Disabled (00h)	Enabled	2-42
QR Code	F0h,25h	Enabled (01h) Disabled (00h)	Enabled	2-42

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Code Lengths				2-43
Code 39 Lengths	12h, 13h	Any Length, Length Within Range, 1 or 2 Discrete Lengths (all 0 - 55 decimal)	Length Within Range: 01-55	2-44
Code 93 Lengths	1Ah, 1Bh	Any Length, Length Within Range, 1 or 2 Discrete Lengths (all 0 - 55 decimal)	Length Within Range: 04-55	2-45
Codabar Lengths	18h, 19h	Any Length, Length Within Range, 1 or 2 Discrete Lengths (all 0 - 55 decimal)	Length Within Range: 05-55	2-46
Interleaved 2 of 5 Lengths	16h, 17h	Any Length, Length Within Range (2 to 54 characters), 1 or 2 Discrete Lengths (all 0 - 55 decimal)	1 Discrete Length 14	2-47
Discrete 2 of 5 Lengths	14h, 15h	Any Length, Length Within Range (2 to 54 characters), 1 or 2 Discrete Lengths (all 0 - 55 decimal)	1 Discrete Length 12	2-48
MSI Plessey Lengths	1Eh, 1Fh	Any Length, Length Within Range, 1 or 2 Discrete Lengths (all 0 - 55 decimal)	Length Within Range: 01-55	2-49
Decode Options				2-50
Transmit UPC-A Check Digit	28h	Enabled (01h) Disabled (00h)	Enabled	2-50
Transmit UPC-E Check Digit	29h	Enabled (01h) Disabled (00h)	Enabled	2-50
Transmit UPC-E1 Check Digit	2Ah	Enabled (01h) Disabled (00h)	Enabled	2-50

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Convert UPC-E to UPC-A	25h	Enabled (01h) Disabled (00h)	Disabled	2-51
Convert UPC-E1 to UPC-A	26h	Enabled (01h) Disabled (00h)	Disabled	2-51
Decode UPC/EAN Supplementals	10h	Decode (01h), Ignore (00h), Autodiscriminate (02h)	Ignore	2-53
UPC/EAN Supplemental Redundancy	50h	2 - 20 times	20	2-54
EAN-8 Zero Extend	27h	Enabled (01h) Disabled (00h)	Disabled	2-54
Convert EAN-8 to EAN-13 Type	E0h	Type is EAN-8 (01h) Type is EAN-13 (00h)	Type is EAN-13	2-55
UPC/EAN Coupon Code	55h	Enabled (01h) Disabled (00h)	Disabled	2-55
UPC-A Preamble	22h	None (00h) System Character (01h) System Character & Country Code (02h)	System Character	2-56
UPC-E Preamble	23h	None (00h) System Character (01h) System Character & Country Code (02h)	System Character	2-57
UPC-E1 Preamble	24h	None (00h) System Character (01h) System Character & Country Code (02h)	System Character	2-57
Code 39 Check Digit Verification	30h	Enabled (01h) Disabled (00h)	Disabled	2-58
Transmit Code 39 Check Digit	2Bh	Enabled (01h) Disabled (00h)	Disabled	2-58

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Convert Code 39 to Code 32	56h	Enabled (01h) Disabled (00h)	Disabled	2-59
Code 32 Prefix	E7h	Enabled (01h) Disabled (00h)	Enabled	2-59
I 2 of 5 Check Digit Verification	31h	Disabled (00h) USS Check Digit (01h) OPCC Check Digit (02h)	Disabled	2-60
Transmit I 2 of 5 Check Digit	2Ch	Enabled (01h) Disabled (00h)	Disabled	2-60
Convert I 2 of 5 to EAN-13	52h	Enabled (01h) Disabled (00h)	Disabled	2-61
MSI Plessey Check Digits	32h	One (00h), Two (01h)	One	2-61
Transmit MSI Plessey Check Digit	2Eh	Enabled (01h) Disabled (00h)	Disabled	2-62
MSI Plessey Check Digit Algorithm	33h	Mod 10/Mod 10 (01h) Mod 11/Mod 10 (00h)	Mod 10/Mod 10	2-62
Transmit US Postal Check Digit	5Fh	Enabled (01h) Disabled (00h)	Enabled	2-63
CLSI Editing	36h	Enabled (01h) Disabled (00h)	Disabled	2-64
NOTIS Editing	37h	Enabled (01h) Disabled (00h)	Disabled	2-64
Code 128 Emulation	7Bh	Enabled (01h) Disabled (00h)	Disabled	2-65
Transmit Code ID Character	2Dh	Disabled (00h) AIM Standard (01h) Symbol Standard (02h)	Disabled	2-66
Transmit “No Decode” Message	5Eh	Enabled (01h) Disabled (00h)	Disabled	2-68
Transmit LRC Checksum	7Eh	Enabled (01h) Disabled (00h)	Disabled	2-68

Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Prefix/Suffix Values	69h, 68h	Prefix, Suffix (4-Digit ASCII Value)	Enter	2-69
Scan Data Transmission Format	EBh	<Data> (00h) <Data><Suffix> (01h) <Prefix><Data><Suffix> (05h) <Prefix><Data> (04h)	<Data>	2-70
Security Options				2-72
Linear Code Type Security Levels	4Eh	Level 1 (01h) Level 2 (02h) Level 3 (03h) Level 4 (04h)	Level 2	2-72
UPC/EAN Security Levels	4Dh	Level 0 (00h) Level 1 (01h) Level 2 (02h) Level 3 (03h)	0	2-74
Host Communication Options				2-76
Baud Rate	9Ch	600 (2 dec), 1200 (3 dec), 2400 (4 dec), 4800 (5 dec), 9600 (6 dec), 19.2K (7 dec), 28.8 K (9 dec), 38.4 K (8 dec), 57.6K (10 dec), 115.2K (11 dec)	9600	2-76
Parity	9Eh	Even (01h), Odd (00h), None (04h)	None	2-78
Check Parity	97h	Enabled (01h) Disabled (00h)	Enabled	2-78
Stop Bit Select	9Dh	One (01h), Two (02h)	One	2-79

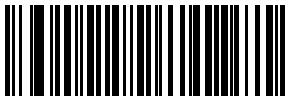
Table 2-1. Parameter Table (Continued)

Parameter	Param. Number	Selection	Default	Page
Hardware Handshaking	A0h	None (00h) Standard RTS/CTS (01h) RTS/CTS Option 1 (02h) RTS/CTS Option 2 (03h) RTS/CTS Option 3 (04h) RTS/CTS PC (05h)	None	2-79
Software Handshaking	9Fh	None (00h), ENQ (03h), ACK/NAK (01h), ACK/NAK with ENQ (02h), XON/XOFF (04h)	None	2-82
Decode Data Packet Format	EEh	Send Raw Decode Data (00h), Send Packeted Decode Data (01h)	Send Packeted Decode Data	2-84
Intercharacter Delay	6Eh	00 - 99 ms.	0	2-85
Host Serial RTS Line State	9Ah	Low RTS (00h) High RTS (01h)	Low RTS	2-86
Serial Response Time-out	9Bh	00 - 8.0 seconds	2.0 seconds	2-87
Beep on <BEL>	96h	Enabled (01h) Disabled (00h)	Disabled	2-88
ASCII Format	A2h	7-Bit ASCII (07h) 8-Bit ASCII (08h)	8-Bit ASCII	2-88
Report Version	--	Software version	--	2-89
Macro PDF				2-90
Flush Macro Buffer				2-90
Abort Macro PDF Entry				2-90

Host Type

Parameter # 8Eh

If you are using a Synapse cable, there's no need to scan a host bar code, as the imager autodetects your host.



***RS-232 Host**
(37h)

Parameter Scanning

Parameter # ECh

To disable decoding of parameter bar codes, scan the bar code below. Note that the Set Defaults parameter bar code will still be decoded. To enable decoding of parameter bar codes, either scan *Enable Parameter Scanning (01h)*, *Set Defaults* or set this parameter to 01h via a serial command.

Enable Parameter Scanning (01h)

Disable Parameter Scanning (00h)

Power Mode

Parameter # 80h

There are two power modes available for the imager. If Continuous On Mode is selected, the imager draws power continuously, even when idle. This mode is recommended when external power is applied.

If Low Power Mode is selected, the imager draws power only when active, and removes power when idle. This mode is recommended when the imager is attached to a battery-powered hand-held terminal.

Low Power Mode (01h)

***Continuous On Mode (00h)**

Beeper Options

Beep After Good Decode

Parameter # 38h

This parameter determines if the imager's beeper sounds during normal scanning. By default, the beeper sounds after a decode. In all cases, the beeper operates during parameter menu scanning and indicates error conditions. See *Beeper Definitions* on page 1-12.

Select whether or not to beep after a successful decode. If you select to beep, set the beeper volume and tone.

***Beep After Good Decode**
(01h)

Do Not Beep After Good Decode
(00h)

Beeper Volume

Parameter # 8Ch

This parameter sets the decode beep volume — low, medium, or high.

Low
(00h)

***Medium**
(03h)

High
(09h)

Beeper Tone

Parameter # 91h

This parameter sets the decode beep frequency or tone — low, medium, or high.

Low Tone
(02h)

***Medium Tone**
(01h)

High Tone
(00h)

Imaging Options

The following parameters control image capture characteristics. Image capture occurs in all modes of operation, including decode, video, and snapshot.

Generally, to brighten an image turn on illumination first, increase exposure time second, then increase gain. To darken an image, reduce gain first, remove illumination second, and reduce exposure time last.

To determine the optimal setting for manual exposure control:

1. Set the exposure time to 20 ms, the gain to 256, and the illumination on.
2. If these settings are too bright, reduce the gain. If it is still too bright, remove illumination. If it is still too bright, reduce the exposure time.
3. If the settings are too dark, increase the exposure time if this does not result in blurred images (e.g., if the VS 4000 is in a fixed mount). If the images are blurry, restore the exposure time to 20 ms. If the images are still too dark, increase the gain.

This procedure produces images that are optimized to only one light setting, so if the amount of ambient light changes, the quality of the images change. To avoid these problems, we recommend that you enable the Autoexposure feature. When Autoexposure is enabled, you can still control illumination.

Decoding Autoexposure

Parameter # F0h,29h

Select Enable Autoexposure to allow the imager to control gain settings and exposure (integration) time to best capture an image for the selected operation mode.

Select Disable Autoexposure to manually adjust the gain and exposure time (see the following pages). This option is only recommended for advanced users with difficult image capture situations.

***Enable Decoding Autoexposure (01h)**

Disable Decoding Autoexposure (00h)

Decoding Illumination

Parameter # F0h,2Ah

If you select Enable Illumination, the imager flashes on every image capture. Select Disable Illumination to prevent the imager from using artificial illumination.

Enabling illumination usually results in superior images. The effectiveness of the illumination decreases as the distance to the target is increased.

***Enable Decoding Illumination (01h)**

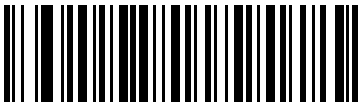
Disable Decoding Illumination (00h)

Image Capture Autoexposure

Parameter # F0h,68h

Select Enable Autoexposure to allow the imager to control gain settings and exposure (integration) time to best capture an image for the selected operation mode.

Select Disable Autoexposure to manually adjust the gain and exposure time (see the following pages). This option is only recommended for advanced users with difficult image capture situations.



***Enable Image Capture Autoexposure (01h)**

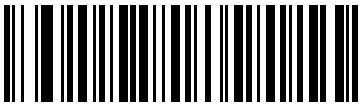
Disable Image Capture Autoexposure (00h)

Image Capture Illumination

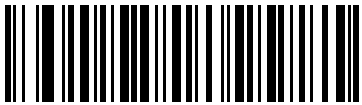
Parameter # F0h,69h

If you select Enable Illumination, the imager flashes on every image capture. Select Disable Illumination to prevent the imager from using artificial illumination.

Enabling illumination usually results in superior images. The effectiveness of the illumination decreases as the distance to the target is increased.



***Enable Image Capture Illumination (01h)**



Disable Image Capture Illumination (00h)

Gain

Parameter # F0h,37h

This parameter only applies when Decoding or Image Capture Autoexposure is disabled. Gain is a means of amplifying the raw image data before it is converted into 256 gray-scale values. Increasing the gain increases brightness and contrast, but also increases noise (undesired electrical fluctuations in the image) which makes the image less attractive and/or harder to decode. You may set the manual gain to one of the following values: 128, 192, 256, 320, 384 or 448.

Gain 128
(0080h)

***Gain 192**
(00C0h)

Gain 256
(0100h)

Gain 320
(0140h)

Gain 384
(0180h)

Gain 448
(01C0h)

Exposure Time

Parameter # F0h,38h

This parameter is only available when Decoding or Image Capture Autoexposure is disabled. Exposure Time controls the amount of time the CCD is allowed to collect light, much like the shutter speed for a camera. Generally, the brighter the environment, the lower the exposure time. You may set the manual exposure time to one of the following values: 5 ms, 10 ms, 15 ms, 20 ms, 25 ms or 30 ms. As the exposure time is increased past 20 ms, there is a risk of blurring the image due to hand jitter.

5 ms
(004Fh)

10 ms
(009Dh)

15 ms
(00ECh)

***20 ms**
(013Bh)

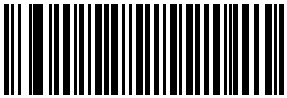
25 ms
(018Ah)

30 ms
(01D8h)

Decode Aiming Pattern

Parameter # F0h,32h

This parameter only applies when in Decode Mode. Select Enable Decode Aiming Pattern to project the aiming pattern during bar code capture, or Disable Decode Aiming Pattern to turn the aiming pattern off.



***Enable Decode Aiming Pattern (02h)**

Disable Decode Aiming Pattern (00h)

Snapshot Mode Timeout

Parameter # F0h,43h

This parameter sets the amount of time the imager remains in Snapshot Mode. The imager exits Snapshot Mode when you pull the trigger, or when the Snapshot Mode Timeout elapses. To set this timeout value, scan the bar code below followed by a bar code from *Numeric Bar Codes* on page 2-91. The default value is 0 which represents 30 seconds; values increment by 30. For example, 1 = 60 seconds, 2 = 90 seconds, etc.

Snapshot Mode Timeout

Snapshot Aiming Pattern

Parameter # F0h,2Ch

Select Enable Snapshot Aiming Pattern to project the aiming pattern when in Snapshot Mode, or Disable Snapshot Aiming Pattern to turn the aiming pattern off.

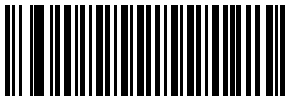
***Enable Snapshot Aiming Pattern (01h)**

Disable Snapshot Aiming Pattern (00h)

Image Cropping

Parameter # F0h,2Dh

This parameter allows you to crop a captured image. If Disable Image Cropping is selected, the full 640 x 480 pixels are presented. If Enable is selected, the imager crops the image to the pixel addresses set in *Crop to Pixel Addresses* on page 2-25.



Enable Image Cropping (01h)

***Disable Image Cropping (Use Full 640 x 480 Pixels) (00h)**

Crop to Pixel Addresses

Parameter # F0h,3Bh (Top)
Parameter # F0h,3Ch (Left)
Parameter # F0h,3Dh (Bottom)
Parameter # F0h,3Eh (Right)

If Enable Image Cropping is selected, set the pixel addresses from (0,0) to (639,479) to crop to.

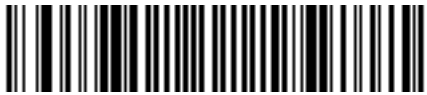
Columns are numbered from 0 to 639, rows from 0 to 479. Specify four values for Top, Left, Bottom, and Right, where Top and Bottom correspond to row pixel addresses, and Left and Right correspond to column pixel addresses. For example, for a 4 row x 8 column image in the extreme bottom-right section of the image, set the following values:

Top = 476, Bottom = 479, Left = 631, Right = 639

To set the pixel address to crop to, scan each Pixel Address bar code followed by three bar codes from *Numeric Bar Codes*, beginning on page 2-91, which represent the value. Leading zeros are required, so to enter a value of 3, for example, scan **0**, **0**, **3**.

Crop to Pixel Addresses (continued)

Top Pixel Address
(0 - 479 Decimal)



Left Pixel Address
(0 - 639 Decimal)

Bottom Pixel Address
(0 - 479 Decimal)

Right Pixel Address
(0 - 639 Decimal)

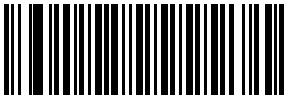
Image Resolution

Parameter # F0h,2Eh

This option alters image resolution before compression. Multiple pixels are combined to one pixel, resulting in a smaller image containing the original content with reduced resolution.

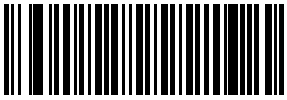
The following values can be selected:

Resolution Value	Image Size
Full	640 x 480
1/2	320 x 240
1/3	214 x 160
1/4	160 x 120



***Full Resolution (00h)**

1/2 Resolution (01h)



1/3 Resolution (02h)

1/4 Resolution (03h)

JPEG Image Options

Parameter # F0h,2Bh

JPEG images may be optimized for either size or for quality. Scan the Quality Selector bar code to enter a quality value; the imager then selects the corresponding image size. Scan the Size Selector bar code to enter a size value; the imager then selects the best image quality.

***JPEG Quality Selector (01h)**

JPEG Size Selector (00h)

JPEG Quality and Size Value

JPEG Quality = Parameter # F0h,31h
JPEG Size = Parameter # F0h,33h

If JPEG Quality Selector is selected, scan the **JPEG Quality Value** bar code followed by 3 bar codes from *Numeric Bar Codes*, beginning on page 2-91, corresponding to a value from 5 to 100, where 100 represents the highest quality image.

If JPEG Size Selector is selected, scan **JPEG Size Value** followed by 3 bar codes from *Numeric Bar Codes*, beginning on page 2-91, corresponding to a value from 1 to 150 which represents the file size in multiples of 1024 bytes (1K). For example, setting this value to 8 (008) permits the file size to be as large as 8192 bytes.

JPEG Quality Value (Default: 065) (5 - 100 Decimal)

JPEG Size Value (Default: 040) (1 - 150 Decimal)

Image File Format Selector

Parameter # F0h,30h

Select an image format appropriate for your system (BMP, TIFF, or JPEG). The imager stores captured images in the format you select.

BMP File Format
(03h)

***JPEG File Format**
(01h)

TIFF File Format
(04h)

Bits per Pixel

Parameter # F0h,2Fh

Select the number of significant bits per pixel (BPP) to use when capturing an image. Select 1BPP for a black and white image, 4BPP to assign 1 of 16 levels of grey to each pixel, or 8BPP to assign 1 of 256 levels of grey to each pixel. The imager ignores these settings for JPEG files, which always use 8BPP.

1 BPP
(00h)

4 BPP
(01h)

***8 BPP**
(02h)

Video Options

Video View Finder

Parameter # F0h,44h

Select Enable Video View Finder to project the video view finder while in Video Mode, or Disable Video View Finder to turn the video view finder off.

***Disable Video View Finder (00h)**

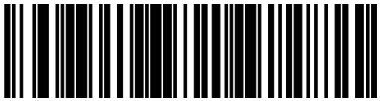
Enable Video View Finder (01h)

Target Video Frame Size

Parameter # F0h,48h

Select the number of 100-byte blocks to be transmitted per second. Selecting a smaller value allows more frames to be transmitted per second but reduces video quality; selecting a larger value increases video quality but slows transmission.

To set the Target Video Frame Size, scan the bar code below followed by 2 bar codes from *Numeric Bar Codes*, beginning on page 2-91, corresponding to the 100-byte value from 800 to 3300 bytes. For example, to select 1500 bytes, enter 1, 5. To select 900 bytes, enter 0, 9.



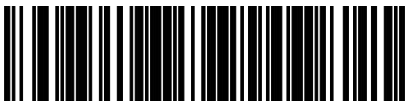
Target Video Frame Size

Video View Finder Image Size

Parameter # F0h,49h

Select the number of 100-byte blocks. Values range from 800 to 3300 bytes. Selecting a smaller value allows more frames to be transmitted per second; selecting a larger value increases video quality.

To set the Target Video Frame Size, scan the bar code below followed by 2 bar codes from *Numeric Bar Codes*, beginning on page 2-91, corresponding to the 100-byte value from 800 to 3300 bytes. For example, to select 1500 bytes, enter 1, 5. To select 900 bytes, enter 0, 9.



Video View Finder Image Size

Bar Code Symbologies

The imager can decode any or all of the following symbologies. Select the symbologies you need to scan using the bar codes in this section.

- UPC Versions A and E (EAN 8 and 13)
- Code 39
- Code 39 Full ASCII
- Trioptic Code 39
- Code 93
- MSI Plessey
- PDF417
- MicroPDF
- Australian Postal
- Japan Postal
- QR Code
- Bookland EAN
- Code 128
- UCC/EAN 128
- ISBT 128
- Interleaved 2 of 5
- Discrete 2 of 5
- Codabar
- US Postnet
- US Planet
- Australian Postal
- Maxicode
- Data Matrix (ECC 200)

The integrated decoder autodiscriminates between all these symbologies, except between Code 39 and Code 39 Full ASCII.

Code 39/Code 39 Full ASCII

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

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

Code 39 Full ASCII interprets the bar code control character ($ + % /) preceding a Code 39 symbol and assigns an ASCII character value. For example, when Code 39 Full ASCII is enabled and a **+B** is scanned, it is interpreted as **b**, %J as ?, and $H emulates the keystroke **BACKSPACE**. Scanning **ABC$M** outputs the keystroke equivalent of “ABC ENTER”.

1D Symbologies

UPC-A

Parameter # 01h

***Enable UPC-A**
(01h)

Disable UPC-A
(00h)

UPC-E

Parameter # 02h

***Enable UPC-E**
(01h)

Disable UPC-E
(00h)

UPC-E1

Parameter # 0Ch

Enable UPC-E1
(01h)

***Disable UPC-E1**
(00h)

EAN-8

Parameter # 04h

***Enable EAN-8**
(01h)

Disable EAN-8
(00h)

EAN-13

Parameter # 03h

***Enable EAN-13**
(01h)

Disable EAN-13
(00h)

Bookland EAN

Parameter # 53h

Enable Bookland EAN
(01h)

***Disable Bookland EAN**
(00h)

Code 39

Parameter # 00h

***Enable Code 39**
(01h)

Disable Code 39
(00h)

Code 39 Full ASCII

Parameter # 11h

Enable Code 39 Full ASCII
(01h)

***Disable Code 39 Full ASCII**
(00h)

Trioptic Code 39

Parameter # 0Dh

Enable Trioptic Code 39
(01h)

***Disable Trioptic Code 39**
(00h)

Code 93

Parameter # 09h

Enable Code 93
(01h)

***Disable Code 93**
(00h)

Code 128

Parameter # 08h

***Enable Code 128**
(01h)

Disable Code 128
(00h)

UCC/EAN 128

Parameter # 0Eh

***Enable UCC/EAN-128**
(01h)

Disable UCC/EAN-128
(00h)

ISBT 128

Parameter # 54h

***Enable ISBT 128**
(01h)

Disable ISBT 128
(00h)

Codabar

Parameter # 07h

Enable Codabar
(01h)

***Disable Codabar**
(00h)

Interleaved 2 of 5

Parameter # 06h

Enable I 2 of 5
(01h)

***Disable I 2 of 5**
(00h)

Discrete 2 of 5

Parameter # 05h

Enable Discrete 2 Of 5
(01h)

***Disable Discrete 2 Of 5**
(00h)

MSI Plessey

Parameter # 0Bh

Enable MSI Plessey
(01h)

***Disable MSI Plessey**
(00h)

Postal Codes

US Postnet

Parameter # 59h

***Enable US Postnet**
(01h)

Disable US Postnet
(00h)

US Planet

Parameter # 5Ah

***Enable US Planet**
(01h)

Disable US Planet
(00h)

UK Postal

Parameter # 5Bh

***Enable UK Postal**
(01h)

Disable UK Postal
(00h)

Japan Postal

Parameter # F0h,22h

***Enable Japan Postal**
(01h)

Disable Japan Postal
(00h)

Australian Postal

Parameter # F0h,23h

***Enable Australian Postal**
(01h)

Disable Australian Postal
(00h)

2D Symbologies

PDF417

Parameter # 0Fh

***Enable PDF417**
(01h)

Disable PDF417
(00h)

MicroPDF417

Parameter # E3h

Enable MicroPDF417
(01h)

***Disable MicroPDF417**
(00h)

Data Matrix

Parameter # F0h,24h

***Enable Data Matrix**
(01h)

Disable Data Matrix
(00h)

Maxicode

Parameter # F0h,26h

***Enable Maxicode**
(01h)

Disable Maxicode
(00h)

QR Code

Parameter # F0h,25h

***Enable QR Code**
(01h)

Disable QR Code
(00h)

Code Lengths

Code lengths for certain one-dimensional code types (i.e., Code 39, Codabar, etc.) may be set for any length, one or two discrete lengths, or lengths within a specific range. The length of a code refers to the number of characters (i.e., human readable characters) the code contains.

Table 2-2. Code Length Options

Length Option	Description
Length Within Range	This option allows you to decode a 1D symbol within a specified range. For example, to decode a Code 39 symbol containing between 4 and 12 characters, first scan Code 39 Length Within Range. Then scan 0, 4, 1 and 2 (single-digit numbers must always be preceded by a leading zero).
One Discrete Length	This option allows you to decode only 1D codes containing a selected length. For example, if you select **Codabar - One Discrete Length**, then scan **1** and **4**, only Codabar codes containing 14 characters are decoded. No discrete lengths can be set for Code 128.
Two Discrete Lengths	This option allows you to decode only 1D codes containing two selected lengths. For example, if you select **I 2 Of 5 Two Discrete Lengths**, then scan **0**, **2**, **1**, **4**, only Interleaved 2 of 5 codes containing 2 or 14 characters are decoded. No discrete lengths can be set for Code 128.
Any Length	Scanning this option allows you to decode the selected 1D code type containing any number of characters. For example, if you scan **Codabar Any Length**, you can decode a Codabar symbol containing any number of characters.

To select lengths for each code type:

1. Scan the desired option.
2. Scan two *Numeric Bar Codes*, beginning on page 2-91, for each desired length. For example, for a length of “12”, scan “1” then “2”. For a length of “3”, scan “0”, then “3”. You must always scan two bar codes for each length.
3. If you make an error, or wish to change your selection, scan *Cancel* on page 2-92.

Code 39 Lengths

L1 = Parameter # 12h; L2 = Parameter # 13h

Code 39 Any Length

***Code 39 Length Within Range**
(0 - 55 decimal)

Code 39 1 Discrete Length
(0 - 55 decimal)

Code 39 2 Discrete Lengths
(0 - 55 decimal)

Code 93 Lengths

L1 = Parameter # 1Ah; L2 = Parameter # 1Bh

Code 93 Any Length

***Code 93 Length Within Range**
(0 - 55 decimal)

Code 93 1 Discrete Length
(0 - 55 decimal)

Code 93 2 Discrete Lengths
(0 - 55 decimal)

Codabar Lengths

L1 = Parameter # 18h; L2 = Parameter # 19h

Codabar Any Length

***Codabar Length Within Range**
(0 - 55 decimal)

Codabar 1 Discrete Length
(0 - 55 decimal)

Codabar 2 Discrete Lengths
(0 - 55 decimal)

Interleaved 2 of 5 Lengths
L1 = Parameter # 16h; L2 = Parameter # 17h

I 2 Of 5 - Any Length

I 2 Of 5 - Length Within Range
(0 - 55 decimal)

***I 2 Of 5 1 Discrete Length**
(14 Characters)
(0 - 55 decimal)

I 2 Of 5 2 Discrete Lengths
(0 - 55 decimal)

Discrete 2 of 5 Lengths

L1 = Parameter # 14h; L2 = Parameter # 15h

D 2 Of 5 Any Length

D 2 Of 5 Length Within Range
(0 - 55 decimal)

***D 2 Of 5 1 Discrete Length**
(12 Characters)
(0 - 55 decimal)

D 2 Of 5 2 Discrete Lengths
(0 - 55 decimal)

MSI Plessey Lengths
L1 = Parameter # 1Eh; L2 = Parameter # 1Fh

MSI Plessey - Any Length

***MSI Plessey - Length Within Range**
(0 - 55 decimal)

MSI Plessey 1 Discrete Length
(0 - 55 decimal)

MSI Plessey 2 Discrete Lengths
(0 - 55 decimal)

Decode Options

Transmit UPC-A Check Digit

Parameter # 28h

Select if decoded UPC-A symbols are transmitted with or without a check digit.

***Transmit UPC-A Check Digit (01h)**

Do Not Transmit UPC-A Check Digit (00h)

Transmit UPC-E Check Digit

Parameter # 29h

Select if decoded UPC-E symbols are transmitted with or without a check digit.

***Transmit UPC-E Check Digit (01h)**

Do Not Transmit UPC-E Check Digit (00h)

Transmit UPC-E1 Check Digit

Parameter # 2Ah

Select if decoded UPC-E1 symbols are transmitted with or without a check digit.

***Transmit UPC-E1 Check Digit (01h)**

Do Not Transmit UPC-E1 Check Digit (00h)

Convert UPC-E to UPC-A

Parameter # 25h

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

Convert UPC-E To UPC-A (01h)

***Do Not Convert UPC-E To UPC-A (00h)**

Convert UPC-E1 to UPC-A

Parameter # 26h

This parameter converts UPC-E1 (zero suppressed) decoded data to UPC-A format before transmission. After conversion, data follows UPC format and is affected by UPC-A programming selections (e.g., Preamble, Check Digit).

Convert UPC-E1 To UPC-A (01h)

***Do Not Convert UPC-E1 To UPC-A (00h)**

Decode UPC/EAN Supplementals

Parameter # 10h

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

- If UPC/EAN with supplemental characters is selected, the imager does not decode UPC/EAN symbols without supplemental characters.
- If UPC/EAN without supplemental characters is selected, and the imager is presented with a UPC/EAN plus supplemental symbol, it decodes the UPC/EAN and ignores the supplemental characters.
- An autodiscriminate option is also available. If you scan this option, also select a value for *Decode UPC/EAN Supplemental Redundancy* on page 2-54. A value of 5 or more is recommended.

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

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

Decode UPC/EAN With Supplementals (01h)

***Ignore UPC/EAN With Supplementals (00h)**

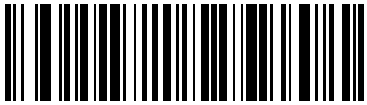
Autodiscriminate UPC/EAN Supplementals (02h)

Decode UPC/EAN Supplemental Redundancy

Parameter # 50h

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

Scan the bar code below to select a decode redundancy value. Next scan two numeric bar codes beginning on page 2-91. Single digit numbers must have a leading zero. If you make an error, or wish to change your selection, scan the *Cancel* bar code on page 2-92.



Decode UPC/EAN Supplemental Redundancy

EAN-8 Zero Extend

Parameter # 27h

This parameter adds five leading zeros to decoded EAN-8 symbols to make them compatible in format to EAN-13 symbols.

Enable EAN-8 Zero Extend (01h)

***Disable EAN-8 Zero Extend (00h)**

Convert EAN-8 to EAN-13 Type

Parameter # E0h

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

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

Type Is EAN-8
(01h)

Type Is EAN-13
(00h)

UPC/EAN Coupon Code

Parameter # 55h

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

Enable UPC/EAN
Coupon Code
(01h)

***Disable UPC/EAN**
Coupon Code
(00h)

UPC-A/UPC-E Preamble

There are three options for the lead-in characters of decoded UPC-A, UPC-E, or UPC-E1 symbols transmitted to the host device. Select a preamble for each of the UPC decodes (UPC-A, UPC-E, and UPC-E1). These lead-in characters are considered part of the symbol itself. The three options are:

- a system character only
- the country code and system character
- no preamble.

The system character is the digit printed to the extreme left of a UPC symbol. The country code for UPC is always zero, and it cannot be transmitted without the system character.

UPC-A Preamble

Parameter # 22h

Select an option for the UPC-A preamble by scanning the appropriate bar code.

None
(00h)

***System Character**
(01h)

System Character &
Country Code
(02h)

UPC-E Preamble

Parameter # 23h

Select an option for the UPC-E preamble by scanning the appropriate bar code.

None
(00h)

***System Character**
(01h)

System Character &
Country Code
(02h)

UPC-E1 Preamble

Parameter # 24h

Select an option for the UPC-E1 preamble by scanning the appropriate bar code.

None
(00h)

***System Character**
(01h)

System Character &
Country Code
(02h)

Code 39 Check Digit Verification

Parameter # 30h

When enabled, this parameter checks the integrity of a Code 39 symbol to ensure that it complies with specified algorithms. Only those Code 39 symbols which include a modulo 43 check digit are decoded when this parameter is enabled.

Enable Code 39 Check Digit (01h)

***Disable Code 39 Check Digit (00h)**

Transmit Code 39 Check Digit

Parameter # 2Bh

When Code 39 Check Digit Verification is enabled, select if you want to transmit data with or without the check digit.

Transmit Code 39 Check Digit (Enable) (01h)

***Do Not Transmit Code 39 Check Digit (Disable) (00h)**

Convert Code 39 to Code 32

Parameter # 56h

Scan the appropriate bar code below to enable or disable converting Code 39 to Code 32.

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

Convert Code 39 to Code 32 (01h)

Do Not Convert Code 39 to Code 32 (00h)

Code 32 Prefix

Parameter # E7h

Scan the appropriate bar code below to enable or disable adding the prefix character “A” to all Code 32 bar codes.

Note: *Convert Code 39 to Code 32 must be enabled for this parameter to function.*

***Code 32 Prefix Enable (01h)**

Code 32 Prefix Disable (00h)

I 2 of 5 Check Digit Verification

Parameter # 31h

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

***Disable**
(00h)

USS Check Digit
(01h)

OPCC Check Digit
(02h)

Transmit I 2 of 5 Check Digit

Parameter # 2Ch

Select if decoded I 2 of 5 symbols are transmitted with or without a check digit.

Transmit I 2 Of 5
Check Digit
(01h)

***Do Not Transmit**
I 2 Of 5 Check Digit
(00h)

Convert I 2 of 5 to EAN-13

Parameter # 52h

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

Convert I 2 Of 5 To EAN-13 (01h)

***Do Not Convert I 2 Of 5 To EAN-13 (00h)**

MSI Plessey Check Digits

Parameter # 32h

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

***One MSI Plessey Check Digit (00h)**

Two MSI Plessey Check Digits (01h)

Transmit MSI Plessey Check Digit

Parameter # 2Eh

Select if you want to transmit data with or without the check digit.

Transmit MSI Plessey Check Digit (01h)

***Do Not Transmit MSI Plessey Check Digit (00h)**

MSI Plessey Check Digit Algorithm

Parameter # 33h

When two MSI Plessey Check Digits are selected, an additional verification is required to ensure integrity. Select either the Mod 10/Mod 10 or Mod 11/Mod 10 algorithm.

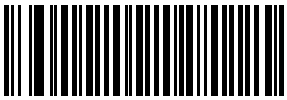
MOD 11/MOD 10 (00h)

***MOD 10/MOD 10 (01h)**

Transmit US Postal Check Digit

Parameter # 5Fh

Select if you want to transmit US Postal data with or without the check digit.



***Transmit US Postal Check Digit (01h)**

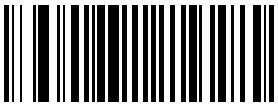
Do Not Transmit US Postal Check Digit (00h)

CLSI Editing

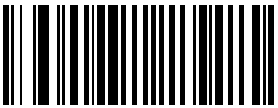
Parameter # 36h

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

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



Enable CLSI Editing (01h)

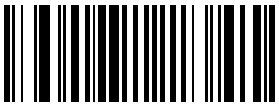


***Disable CLSI Editing (00h)**

NOTIS Editing

Parameter # 37h

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



Enable NOTIS Editing (01h)

***Disable NOTIS Editing (00h)**

Code 128 Emulation

Parameter # 7Bh

When this parameter is enabled, the imager transmits data from certain MicroPDF417 symbols as if it was encoded in Code 128 symbols. Transmit AIM Symbology Identifiers must be enabled for this parameter to work.

If Code 128 Emulation is enabled, these MicroPDF417 symbols are transmitted with the one of the following prefixes:

]C1 if the first codeword is 903-907, 912, 914, 915

]C2 if the first codeword is 908 or 909

]C0 if the first codeword is 910 or 911

If disabled, they are transmitted with one of the following prefixes:

]L3 if the first codeword is 903-907, 912, 914, 915

]L4 if the first codeword is 908 or 909

]L5 if the first codeword is 910 or 911

Scan a bar code below to enable or disable Code 128 Emulation.

Enable Code 128 Emulation
(01h)

Disable Code 128 Emulation
(00h)

Transmit Code ID Character

Parameter # 2Dh

A code ID character identifies the code type of a scanned bar code. This may be useful when the imager is decoding more than one code type. If a prefix is selected, the code ID character is sent after the prefix and before the decoded symbol.

You may select no code ID character, a Symbol code ID character, or an AIM ID character. Symbol code ID characters are listed below. AIM ID characters are listed in *AIM Code Identifiers* on page A-1.

Table 2-3. Symbol Code ID Characters

Code Type	Symbol Identifier
UPC-A, UPC-E, UPC-E1, EAN-13, EAN-8	A
Code 39, Code 39 Full ASCII, Code 32	B
Codabar	C
Code 128, ISBT 128	D
Code 93	E
Interleaved 2 of 5	F
Discrete 2 of 5, D 2 of 5 IATA	G
MSI Plessey	J
EAN 128	K
Bookland EAN	L
Trioptic Code 39	M
Coupon Code	N
PDF417, Micro PDF	X
Data Matrix	P00
QR Code	P01
MaxiCode	P02
US Postnet	P03
US Planet	P04
Japan Postal	P05
UK Postal	P06
Australian Postal	P09

Transmit Code ID Character (continued)

Transmit Symbol Code ID Character
(02h)

Transmit AIM Code ID Character
(01h)

***Do Not Transmit Code ID Character**
(00h)

Transmit “No Decode” Message

Parameter # 5Eh

When this feature is enabled, the imager transmits “NR” (No Read), along with enabled prefixes and suffixes, if the trigger is released before a successful decode.

Transmit “No Decode” Message (01h)

***Do Not Transmit “No Decode” Message (00h)**

LRC Checksum

Parameter # 7Eh

When this option is enabled, it allows an LRC checksum character to be appended at the end of a decode transmission. The format of output data is as follows:

<STX> <DATA...> <ETX> <LRC>.

If <**DATA**...> contains the special characters STX, ETX, and DLE, a DLE character is added as an escape character before each special character, to instruct the host not to interpret the special characters in the data as control characters. The LRC character is the exclusive OR of all characters (including STX, ETX, and any DLE escape characters inserted) except for the LRC character itself.

Enable LRC Checksum (01h)

***Disable LRC Checksum (00h)**

Prefix/Suffix Values

Prefix = Parameter # 69h; Suffix = Parameter # 68h

A prefix/suffix may be appended to scanned data for use in data editing. Set these values by scanning a four digit number (i.e., four bar codes) that correspond to ASCII characters for various terminals. See Table A-3 on page A-7 for ASCII values.

To set a Prefix/Suffix value:

1. Scan the Scan Suffix or Scan Prefix bar code.
2. Scan four *Numeric Bar Codes*, beginning on page 2-91, which correspond to the ASCII value or keystroke value you wish to assign (see Table A-3 on page A-7). The **Enter** key is the default for all options.
3. If you make an error, or wish to change your selection, scan *Cancel* on page 2-92.

Scan Suffix (Value 1)

Scan Prefix (Value 2)

Data Transmission Formats

Parameter # EBh

You may select one of the following scan data format options:

Standard: <data>
Option 1: <data> <SUFFIX>
Option 2: <PREFIX> <data> <SUFFIX>
Option 3: <PREFIX> <data>

<data> = scanned bar code data

<PREFIX> and <SUFFIX> as selected by the user.

To select a data transmission format:

1. Scan the **Scan Options** bar code.
2. Scan the bar code corresponding to the desired converted data format.
3. Scan **Enter**. If you make a mistake, scan **Cancel** on the next page.

Note: *RS-232C hosts treat the extended keypad default suffix (7013) as ASCII data.*

Scan Options

***Data As Is**
(00h)

<DATA> <SUFFIX>
(01h)

Data Transmission Formats (continued)

<PREFIX> <DATA> <SUFFIX>
(05h)

<PREFIX> <DATA>
(04h)

Enter

Cancel

Security Options

Linear Code Type Security Level

Parameter # 4Eh

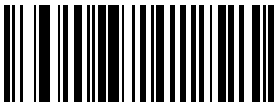
Note: *This option does not apply to Code 128.*

The VS 4000 offers four levels of decode security for linear code types (e.g., Code 39, Interleaved 2 of 5). Select higher security levels for decoding poor quality bar codes. As security levels increase, the imager's aggressiveness decreases to prevent misdecodes. Select the security level appropriate for your bar code quality.

Linear Security Level 1

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

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



Linear Security Level 1
(01h)

Linear Security Level 2

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

***Linear Security Level 2**
(02h)

Linear Security Level 3

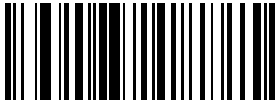
Code types other than the following must be successfully read twice before being decoded. The following codes must be read three times:

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

Linear Security Level 3
(03h)

Linear Security Level 4

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



Linear Security Level 4
(04h)

UPC/EAN Security Level

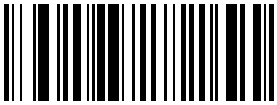
Parameter # 4Dh

The VS 4000 offers four levels of decode security for UPC/EAN bar codes. Select higher security levels for decoding poor quality bar codes. As security levels increase, the imager's aggressiveness decreases to prevent misdecodes, so be sure to choose only that level of security necessary for your application.

Table 2-4. UPC/EAN Security Levels

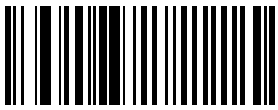
UPC/EAN Security Level	Description
UPC/EAN Security Level 0	This is the default setting which allows the imager to operate in its most aggressive state, while providing sufficient security in decoding "in-spec" UPC/EAN bar codes.
UPC/EAN Security Level 1	As bar code quality levels diminish, certain characters become prone to misdecodes before others (i.e., 1, 2, 7, 8). If you are experiencing misdecodes of poorly printed bar codes, and the misdecodes are limited to these characters, select this security level.
UPC/EAN Security Level 2	If you are experiencing misdecodes of poorly printed bar codes, and the misdecodes are not limited to characters 1, 2, 7, and 8, select this security level.
UPC/EAN Security Level 3	If you have tried Security Level 2, and are still experiencing misdecodes, select this security level. Be advised, selecting this option is an extreme measure against misdecoding severely out of spec bar codes. Selection of this level of security significantly impairs the decoding ability of the imager. If this level of security is necessary, you should try to improve the quality of your bar codes.

UPC/EAN Security Level (continued)

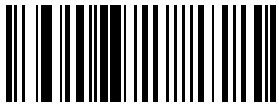


***UPC/EAN Security Level 0**
(00h)

UPC/EAN Security Level 1
(01h)



UPC/EAN Security Level 2
(02h)



UPC/EAN Security Level 3
(03h)

Host Communication Options

Baud Rate

Parameter # 9Ch

Baud rate is the number of bits of data transmitted per second. The imager's baud rate settings should match the data rate settings of the host and auxiliary devices. If not, data may not reach the devices or may reach them in distorted form.

Set the baud rate for transmission.

600
(2 decimal)

1200
(3 decimal)

2400
(4 decimal)

4800
(5 decimal)

Baud Rate (continued)

***9600**
(6 decimal)

19200
(7 decimal)

28800
(9 decimal)

38400
(8 decimal)

57600
(10 decimal)

115200
(11 decimal)

Parity

Parameter # 9Eh

A parity check bit is the most significant bit of each ASCII coded character and is helpful in detecting transmission errors.

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

Set the type of parity for data transmission.

Odd
(00h)

Even
(01h)

***None**
(04h)

Check Parity

Parameter # 97h

Select whether or not the parity of received characters is checked. The type of parity used is selectable through the **Parity** parameter.

***Check Parity**
(01h)

Do Not Check Parity
(00h)

Stop Bit Select

Parameter # 9Dh

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

Select the desired number of stop bits for serial communications.

***1 Stop Bit**
(01h)

2 Stop Bits
(02h)

Hardware Handshaking

Parameter # A0h

The host exchanges data with the imager via a serial port, either with or without the hardware handshaking lines, *Request to Send (*RTS*)*, and *Clear to Send (*CTS*)*.

Standard RTS/CTS

If Standard RTS/CTS handshaking is selected, scanned data is transmitted according to the following sequence:

- The CTS line must initially be deasserted by the host. If the imager detects that CTS is asserted (indicating that the host may still be receiving a previous transmission), the imager waits up to 2 seconds for the host to deassert the CTS line. If, after 2 seconds (default), the CTS line is still asserted, the imager sounds a transmit error and any scanned data is lost.
- When the CTS line is deasserted, the imager asserts the RTS line and waits up to 2 seconds for the host to assert CTS. When the host asserts CTS, the imager transmits the data. If, after 2 seconds (default), the CTS line is not asserted, the imager sounds a transmit error and discards the data.

- When data transmission is complete, the imager deasserts RTS 10 msec after sending the last character.
- The host responds by deasserting CTS. The imager checks for a deasserted CTS upon the next transmission of data.

During data transmission, the CTS line is asserted. If CTS is asserted for less than 50 ms between characters, the transmission is aborted, the imager sounds a transmission error, and the data is discarded.

If the previous communications sequence fails, the imager issues an error beep. In this case, the data is lost and must be rescanned.

Note: *The **DTR** signal is jumpered active.*

Other RTS/CTS Options

The following options offer alternatives to Standard RTS/CTS Handshaking.

- **RTS/CTS Option 1**: The imager asserts RTS before transmitting and ignores the state of CTS. The imager deasserts RTS when the transmission is complete.
- **RTS/CTS Option 2**: RTS is always high or low (user-programmed logic level). However, the imager waits for CTS to be asserted before transmitting data. If CTS is not asserted within two seconds, the imager issues an error beep and discards the data.
- **RTS/CTS Option 3**: The imager asserts RTS before transmitting, regardless of the state of CTS. The imager waits up to two seconds for CTS to be asserted. If CTS is not asserted during this time, the imager issues an error beep and discards the data. The imager deasserts RTS when transmission is complete.
- **RTS/CTS PC**: Standard RTS/CTS hardware handshaking used by the PC. The host can deassert CTS to prevent the imager from transmitting, and the imager can deassert RTS to prevent the host from transmitting.

Hardware Handshaking

***None**
(00h)

Standard RTS/CTS
(01h)

RTS/CTS Option 1
(02h)

RTS/CTS Option 2
(03h)

RTS/CTS Option 3
(04h)

RTS/CTS PC
(05h)

Software Handshaking

Parameter # 9Fh

This parameter offers control of the data transmission process, and may be used in conjunction with hardware handshaking. **ACK**/**NAK** handshaking may be combined with **ENQ** handshaking.

Select the type of software handshaking protocol:

- **No Software Handshaking:** Data is transmitted immediately.
- **ACK/NAK Only:** When this option is selected, after transmitting data, the imager expects either an ACK or NAK response from the host. If a NAK is received, the imager transmits the same data again and waits for either an ACK or NAK. After three unsuccessful attempts to send data when NAKs are received, the imager issues an error beep and discards the data.
- **ENQ Only**: When this option is selected, the imager waits for an ENQ character from the host before transmitting data. If an ENQ is not received within 2 seconds, the imager issues an error beep and discards the data. The host must transmit an ENQ character at least every 2 seconds to prevent transmission errors.
- **ACK/NAK with ENQ**: This combines the two previous handshaking options.
- **XON/XOFF**: An XOFF character turns the imager transmission off until the imager receives an XON character. There are two situations for XON/XOFF:
  - XOFF is received before the imager has data to send. When the imager has data to send, it then waits for an XON character before transmission. The imager waits up to 2 seconds to receive the XON. If the XON is not received within this time, the imager issues an error beep and discards the data.
  - XOFF is received during a transmission. Data transmission then stops after sending the current byte. When the imager receives an XON character, it sends the rest of the data message. The imager waits indefinitely for the XON.

Software Handshaking (continued)

***None**
(00h)

ACK/NAK
(01h)

ACK/NAK with ENQ
(02h)

ENQ Only
(03h)

XON/XOFF
(04h)

Decode Data Packet Format

Parameter # EEh

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

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

Send Raw Decode Data
(00h)

***Send Packeted Decode Data**
(01h)

Intercharacter Delay

Parameter # 6Eh

Select the intercharacter delay option matching host device requirements. The intercharacter delay gives the host system time to service its receiver and perform other tasks between characters. Select from no delay to a 99 ms delay between the transmission of each character.

To set a host communications intercharacter delay:

1. Scan the **Intercharacter Delay** bar code below.
2. To set the desired delay, scan two *Numeric Bar Codes* on page 2-91. You must always scan two bar codes.
3. If you make an error, or wish to change your selection, scan *Cancel* on page 2-92.

Intercharacter Delay
(Default: 0)

Host Serial RTS Line State

Parameter # 9Ah

This parameter sets the default host serial RTS line state to either high or low.

To select **Low RTS**, scan the bar code below.

***Host: Low RTS**
(00h)

To select **High RTS**, scan the bar code below.

Host: High RTS
(01h)

Serial Response Timeout

Parameter # 9Bh

This parameter specifies how long the imager waits for an ACK, NAK or CTS from the host before determining that a transmission error has occurred. This only applies when one of the ACK/NAK software handshaking modes, or RTS/CTS hardware handshaking options, is selected. The delay period can range from 0.0 to 8.0 seconds in 0.1 second increments.

To set a serial response timeout:

1. Scan the **Serial Response Timeout** bar code below.
2. Scan two *Numeric Bar Codes*, beginning on page 2-91, to select the desired timeout. You must always scan two bar codes.
3. If you make an error, or wish to change your selection, scan *Cancel* on page 2-92.

Serial Response Timeout
(Default: 2.0)

Beep On <BEL>

Parameter # 96h

When this parameter is enabled, the imager issues a beep when a <**BEL**> character is detected on the serial data line. <**BEL**> is used to alert the user of an illegal entry or other important event.

Select whether to enable or disable this parameter.

Beep On <BEL> Character (01h)

***Do Not Beep On <BEL> Character (00h)**

Data Transmission - 7 or 8-Bit ASCII Data Format

Parameter # A2h

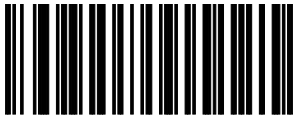
This parameter determines whether data transmissions occur in the 7-bit or 8-bit ASCII format. Select this parameter according to the requirement of the receiving device. The default value is 8-bit ASCII.

7-Bit (07h)

***8-Bit (08h)**

Report Version

Scan the bar code below to report the version of software currently installed in the imager.



Report Software Version

Macro PDF Features

Macro PDF is a special feature for concatenating multiple PDF symbols into one file. The imager can decode symbols that are encoded with this feature, however, the 64K version cannot buffer large sets of macro PDF symbols.

Caution

When printing, keep each Macro PDF sequence separate, as each sequence has unique identifiers. Do not mix bar codes from several Macro PDF sequences, even if they encode the same data. When scanning Macro PDF sequences, scan the entire Macro PDF sequence without interruption. If you scan a mixed sequence, you get two long low beeps (Lo Lo) for inconsistent file ID or inconsistent symbology error.

Flush Macro Buffer

This flushes the buffer of all decoded Macro PDF data stored to that point, transmits it to the host device, and aborts from Macro PDF mode.

Flush Macro PDF Buffer

Abort Macro PDF Entry

This clears all currently-stored Macro PDF data in the buffer without transmission and aborts from Macro PDF mode.

Abort Macro PDF Entry

Numeric Bar Codes

0

1

2

3

4

5

Numeric Bar Codes

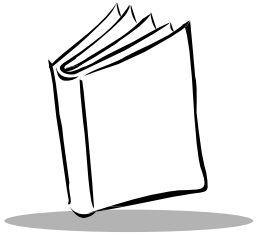
6

7

8

9

Cancel



Chapter 3
Advanced Data Formatting (ADF)

Introduction

Advanced Data Formatting (ADF) is a means of customizing, or editing, the data scanned by the imager before transmitting the data to your host device. Scanned data can be edited to suit your particular requirements.

ADF is implemented by scanning a related series of bar codes to create rules to apply to the scanned data. These bar codes appear later in this chapter.

Rules: Criteria Linked to Actions

In ADF, data is customized through **rules**. These rules perform specific actions when the data meets certain criteria. One rule may consist of single or multiple actions applied to single or multiple criteria.

For instance, a data formatting rule could be the following:

Criteria: *When scan data is Code 39, length 12,*
and data at the start position is the string "129",

Actions: *pad all sends with zeros to length 8,*
send all data up to X,
send a space.

In this example, if a Code 39 bar code of 1299X1559828 is scanned, the following is transmitted: 00001299<space>. If a Code 39 bar code of 1299X15598 is scanned, this rule is ignored because the length (10 characters) does not pass the criteria.

The rule specifies the editing conditions and requirements before data transmission occurs.

Using ADF Bar Codes

When you program a rule, make sure the rule is logically correct. Plan ahead before you start scanning.

To program each data formatting rule:

1. **Start the Rule**. Scan the **Begin New Rule** bar code on page 3-11.
2. **Criteria**. Scan the bar codes for all pertinent criteria. Criteria can include code type (e.g., Code 128), code length, or data that contains a specific character string (e.g., the digits “129”). These options are described in *Criteria* on page 3-14.
3. **Actions**. Scan all actions related to, or affecting, these criteria. The actions of a rule specify how to format the data for transmission. These options are described in *Actions* on page 3-27.
4. **Save the Rule**. Scan the **Save Rule** bar code on page 3-11. This places the rule in the “top” position in the rule buffer.

If you make errors during this process, some special-purpose bar codes may be useful: **Erase Criteria and Start Again**, **Erase Actions and Start Again**, **Erase Previously Saved Rule**, and **Erase All Rules**. See *Erase* on page 3-12.

Beeper Definitions for ADF on page 3-8 help guide you through the programming steps.

ADF Bar Code Menu Example

This section provides an example of how to enter an ADF rule to apply to scanned data.

An auto parts distribution center wants to encode manufacturer ID, part number, and destination code into their own Code 128 bar codes. The distribution center also has products that carry UPC bar codes, placed there by the manufacturer. The Code 128 bar codes have the following format:

MMMMMPPPPPDD

Where: M = Manufacturer ID

P = Part Number

D = Destination Code

The distribution center uses a PC with dedicated control characters for manufacturer ID <CTRL M>, part number <CTRL P>, and destination code <CTRL D>. At this center the UPC data is treated as manufacturer ID code.

The following rules need to be entered:

When scanning data of code type Code 128, send the next 5 characters, send the manufacturer ID key <CTRL M>, send the next 5 characters, send the part number key <CTRL P>, send the next 2 characters, send the destination code key <CTRL D>.

When scanning data of code type UPC/EAN, send all data, send the manufacturer ID key <CTRL M>.

To enter these rules, follow these steps:

Rule 1: The Code 128 Scanning Rule

Table 3-1. Code 128 Scanning Ru le

Step	Bar Code	On Page	Beep Indication
1	Begin New Rule	3-11	High High
2	Code 128	3-14	High High
3	Send next 5 characters	3-28	High High
4	Send <CTRL M>	3-56	High High
5	Send next 5 characters	3-28	High High
6	Send <CTRL P>	3-56	High High
7	Send next 2 characters	3-27	High High
8	Send <CTRL D>	3-54	High High
9	Save Rule	3-11	High Low High Low

Rule 2: The UPC Scanning Rule

Table 3-2. UPC Scanning Rule

Step	Bar Code	On Page	Beep Indication
1	Begin New Rule	3-11	High High
2	UPC/EAN	3-17	High High
3	Send all remaining data	3-27	High High
4	Send <CTRL M>	3-56	High High
5	Save Rule	3-11	High Low High Low

If you made any mistakes while entering this rule, scan the **Quit Entering Rules** bar code on page 3-12. If you already saved the rule, scan the **Erase Previously Saved Rule** bar code on page 3-12.

Alternate Rule Sets

ADF rules may be grouped into one of five alternate sets that can be turned on and off when needed. This is useful when you want to format the same message in different ways. For example, a Code 128 bar code contains the following information:

Class (2 digits), Stock Number (8) digits, Price (5 digits)

This bar code might look like this:

245671243701500

where:

Class = 24

Stock Number = 56712437

Price = 01500

Ordinarily you would send this data as follows:

24 (class key)

56712437 (stock key)

01500 (enter key)

But, when there is a sale, you may want to send only the following:

24 (class key)

56712437 (stock key)

and the cashier keys the price manually.

To implement this, first enter an ADF rule that applies in the normal situation. This rule may look like this:

When scanning a bar code of length 15, send the next 2 characters, send the class key, send the next 8 characters, send the stock key, send the data that remains, send the Enter key.

The “sale” rule may look like this:

When scanning a bar code of length 15, send the next 2 characters, send the class key, send the next 8 characters, send the stock key.

To switch between the two sets of rules, a “switching rule” must be programmed. This rule specifies what type of bar code must be scanned to switch between the rule sets. For

example, in the case of the “sale” rule above, the rule programmer wants the cashier to scan the bar code “M” before a sale. To do this, a rule can be entered as follows:

> **When scanning a bar code of length 1 that begins with “M”, select rule set number 1**.

Another rule could be programmed to switch back.

> **When scanning a bar code of length 1 that begins with “N”, turn off rule set number 1.**

The switching back to normal rules can also be done in the “sale” rule. For example, the rule may look like this:

> **When scanning a bar code of length 15, send the next 2 characters, send the class key, send the next 8 characters, send the stock key, turn off rule set 1.**

It is recommended that you scan the **Disable All Rule Sets** bar code after programming a rule belonging to an alternate rule set.

In addition to enabling and disabling rule sets within the rules, you can disable them by scanning the appropriate bar codes in *Disable Rule Set* on page 3-13.

Rules Hierarchy (in Bar Codes)

The order of programming individual rules is important. The most general rule should be programmed first.

All programmed rules are stored in a buffer. As they are programmed, they are stored at the “top” of a rules list. If three rules have been created, the list would be configured as follows:

Third Rule

Second Rule

First Rule

When data is scanned, the rules list is checked from top to bottom to determine if the criteria matches (and therefore, if the actions should occur). Input is modified into the data format specified by the first matching set of criteria it finds. Be sure that your most general rule is the first one programmed.

For example, if the THIRD rule states:

> **When scanning a bar code of any length, send all data, then send the ENTER key.**

And the SECOND rule states:

> **When scanning a Code 128 bar code of length 12, send the first four characters, then send the ENTER key, then send all remaining data.**

If a Code 128 bar code of length 12 were scanned, the THIRD rule would be in effect. The SECOND rule would appear to not function.

Note also that ADF rules are actually created when you use the standard data editing functions. Scan options are entered as ADF rules, and the hierarchy mentioned above also applies to them. For the VS 4000, this applies to prefix/suffix programming in the parameter *Scan Data Transmission Format.*

These rules reside in the same “rule list” as ADF Rules, so the order of their creation is also important.

Default Rules

Every unit has a default rule to send all scan data. Units with custom software may have one or more default rules burned in. The rules hierarchy checks user programmable rules first, then the default rules. Default rules can be disabled by entering the following general rule in the user programmable buffer:

> **When receiving scan data, send all data.**

Since this rule always applies, ADF will never go into the default rules.

Beeper Definitions for ADF

The following table defines beep sequences that occur during rule entry.

Table 3-3. Beeper Definition s

Beeper Sequence	Indication
Normal Data Entry. Duration of tones are short.	
High-Low	Entry of a number is expected. Enter another digit. Add leading zeros to the front if necessary.
Low-Low	Entry of an alphabetic character is expected. Enter another character or scan the End of Message bar code.
High-High	Entry of Criterion/Action is expected. Enter another criterion or action, or scan the Save Rule bar code.
High-Low-High-Low	Rule saved. Rule entry mode exited.
High-Low-Low	All criteria or actions were cleared for rule currently being entered; continue entry of rule.
Low	Last saved rule was successfully deleted. The rule presently being entered is left intact.
Low-High-High	All rules are now deleted. The rule presently being entered is left intact. (This beep sequence has a different meaning outside of ADF.)
Error Indications. Duration of tones are very long.	
Low-High-Low-High	Out of rule memory. Erase some existing rules, then try to save rule again. (The current rule need not be re-entered.)
Low-High-Low	Cancel rule entry. Rule entry mode exited because of an error or the user asked to exit rule entry.
Low-High	Entry error, wrong bar code scanned. Re-enter criterion or action. All previously entered criteria and actions are retained. Criteria or action list is too long for a rule.

ADF Bar Codes

The following table helps you locate the bar codes you need to create an ADF rule.

Table 3-4. ADF Bar Codes

Bar Code	Description	Page
Special Commands		
Begin New Rule	Starts data formatting rule.	3-11
Save Rule	Completes and saves rule.	3-11
Erase	Erases criteria, actions, or rules.	3-12
Quit Entering Rules	Quits entering rules.	3-12
Disable Rule Set	Disables rule sets.	3-13
Criteria		
Code Types	Selects code types to be affected by rule.	3-14
Code Lengths	Defines the number of characters each code type must contain.	3-18
Message Containing A Specific Data String	Select whether formatting affects data that begins with or contains a specific character or data string.	3-23
Numeric Keypad	Used for specifying a data string.	3-24
Rule Belongs To Set	Selects which set a rule belongs to.	3-26
Actions		
Send Data	Sends all data that remains, sends all data up to a specific character, or sends N characters.	3-27
Setup Field(s)	Moves the cursor in relation to a specified character.	3-31
Set Preset Value	Sends prefix and suffix values.	3-39

Table 3-4. ADF Bar Codes

Bar Code	Description	Page
Modify Data	Modifies data as follows:	3-41
♦ Remove All Spaces	♦ Removes all spaces in the send commands.	3-41
♦ Crunch All Spaces	♦ Leaves one space between words.	3-41
♦ Stop Space Removal	♦ Stops space removal.	3-41
♦ Remove Leading Zeros	♦ Removes all leading zeros.	3-42
♦ Stop Zero Removal	♦ Stops removal of zeros.	3-42
♦ Pad Data With Spaces	♦ Pads data to the left with spaces.	3-43
♦ Pad Data With Zeros	♦ Pads data to the left with zeros.	3-48
Beeps	Selects beep sequence for each rule.	3-53
Send Keystroke	Specifies control and keyboard characters to send.	3-54
♦ Control Characters	♦ Sends control characters.	3-54
♦ Keyboard Characters	♦ Sends keyboard characters.	3-59
♦ Send ALT Characters	♦ Sends ALT characters.	3-71
♦ Send Command Characters	♦ Sends command characters.	3-75
♦ Send Special Characters	♦ Sends special characters.	3-77
♦ Send Keypad Characters	♦ Sends keypad characters.	3-78
♦ Send Function Keys	♦ Sends function keys.	3-82
Turn On/Off Rule Sets	Turns rule sets on and off.	3-88
Alphanumeric Keyboard	Used to specify characters and strings when creating a rule.	3-89

Special Commands

Bar codes and explanations of the following special commands are provided on the next few pages.

- Begin New Rule
- Save Rule
- Erase
- Quit Entering Rules
- Disable Rule Set

Begin New Rule

Scan this bar code to start entering a new data formatting rule.

Begin New Rule

Save Rule

Scan this bar code to complete and save the rule you entered.

Save Rule

Erase

Use these bar codes to erase criteria, actions, or rules.

Erase Criteria And Start Again

Erase Actions And Start Again

Erase Previously Saved Rule

Erase All Rules

Quit Entering Rules

Scan this bar code to quit entering rules.

Quit Entering Rules

Disable Rule Set

Use these bar codes to disable rule sets.

Disable Rule Set 1

Disable Rule Set 2

Disable Rule Set 3

Disable Rule Set 4

Disable All Rule Sets

Criteria

Code Types

Select any number of code types to be affected. All selected codes must be scanned in succession, prior to selecting other criteria. If you don't select a code type, all code types are affected.

Code 39

Codabar

Code 128

EAN 128

Discrete 2 Of 5

I 2 Of 5

UPC-A

Code Types (continued)

UPC-E1

EAN-8

EAN-13

PDF417

Code 93

MSI/Plessey

Bookland EAN

Code Types (continued)

US Postnet

US Planet

UK Postal

Japan Postal

Australian Postal

MaxiCode

Datamatrix

Code Types (continued)

UPC-E

Trioptic 39

IATA 2 of 5

QR Code

Code Lengths

Define the number of characters the selected code type must contain. Select one length per rule only. If you don't select a code length, selected code types of any length are affected.

Note: *These codes are used to set the code length only; this is not a keypad.*

1

2

3

4

5

6

Code Lengths (continued)

7

8

9

10

11

12

Code Lengths (continued)

13

14

15

16

17

18

Code Lengths (continued)

19

20

21

22

23

24

Code Lengths (continued)

25

26

27

28

29

30

Message Containing A Specific Data String

Select whether the formatting affects data that begins with a specific character or data string, or contains a specific character or data string.

Specific String at Start

To apply formatting to data that begins with a specific character or data string:

1. Scan the bar code below.
2. Enter a string representing the desired character or characters (up to a total of 8) using the *Alphanumeric Keyboard* beginning on page 3-89.
3. Scan **End Of Message** on page 3-98.

Specific String At Start

Specific String, Any Location

To apply formatting to data that contains a specific character or data string:

1. Scan the bar code below.
2. Scan a two-digit number representing the ***position*** (include a leading “zero” if necessary) using the *Numeric Keypad* on page 3-24.
3. Enter the desired character or characters (up to a total of 8) using the *Alphanumeric Keyboard* beginning on page 3-89.
4. Scan **End Of Message** on page 3-98.

Specific String Any Location

Any Message OK

By not scanning any bar code, all selected code types are formatted, regardless of information contained.

Numeric Keypad

Bar codes on this page should not be confused with those on the alphanumeric keyboard.

0

1

2

3

4

5

Numeric Keypad (continued)

Bar codes on this page should not be confused with those on the alphanumeric keyboard.

6

7

8

9

Cancel

Rule Belongs To Set

Scan a bar code below to select which set a rule belongs to.

Rule Belongs To Set 1

Rule Belongs To Set 2

Rule Belongs To Set 3

Rule Belongs To Set 4

Actions

Select how to format the data meeting the defined criteria before transmission.

Send Data

Use the following bar codes to send all data that remains, send all data up to a specific character selected from the *Alphanumeric Keyboard* on page 3-89, or send the next N characters. N = any number from 1 to 254, selected from the *Alphanumeric Keyboard* on page 3-89.

Send Data Up To Character

Send All Data That Remains

Send Next Character

Send Next 2 Characters

Send Next 3 Characters

Send Data (continued)

Send Next 4 Characters

Send Next 5 Characters

Send Next 6 Characters

Send Next 7 Characters

Send Next 8 Characters

Send Next 9 Characters

Send Next 10 Characters

Send Next 11 Characters

Send Data (continued)

Send Next 12 Characters

Send Next 13 Characters

Send Next 14 Characters

Send Next 15 Characters

Send Next 16 Characters

Send Next 17 Characters

Send Data (continued)

Send Next 18 Characters

Send Next 19 Characters

Send Next 20 Characters

Send Next 50 Characters

Send Next 100 Characters

Send Next 150 Characters

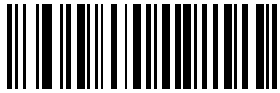
Send Next 200 Characters

Send Next 250 Characters

Pause Duration

For transmissions using Synapse, use the following bar codes to insert a pause at any point in the data transmission. Scan the **Send Pause** bar code, then the **Pause Duration** bar code, and then two bar codes from the *Numeric Bar Codes* on page 2-91. A pause is measured in 1/10 second intervals. For example, scanning bar codes “0” and “1” inserts a 1/10 second pause; “0” and “5” inserts a 1/2 second pause.

Pause Duration



Send Pause

Setup Field(s)

Use the following bar codes to move the cursor in relation to a specified character.

Note: *If there is no match when the rule is interpreted and the rule fails, the next rule is checked.*

Move Cursor To a Character

Scan the **Move Cursor To Character** bar code, then any printable ASCII character from the *Alphanumeric Keyboard* on page 3-89. This moves the cursor to the position after the matching character. If the character is not there, the rule fails and ADF tries the next rule.

Move Cursor To Character

Move Cursor to Start of Data

Scan this bar code to move cursor to the beginning of the data.

Move Cursor To Start

Move Cursor Past a Character

This parameter moves the cursor past all sequential occurrences of a selected character. Scan the **Move Cursor Past Character** bar code on page 3-32, then select a character from the *Alphanumeric Keyboard* on page 3-89. If the character is not there, the cursor does not move (i.e., has no effect).

Move Cursor Past Character

Skip Ahead “N” Characters

Scan one of these bar codes to select the number of positions ahead you wish to move the cursor.

Skip Ahead 1 Character

Skip Ahead 2 Characters

Skip Ahead 3 Characters

Skip Ahead 4 Characters

Skip Ahead (continued)

Skip Ahead 5 Characters

Skip Ahead 6 Characters

Skip Ahead 7 Characters

Skip Ahead 8 Characters

Skip Ahead 9 Characters

Skip Ahead 10 Characters

Skip Ahead (continued)

Skip Ahead 50 Characters

Skip Ahead 100 Characters

Skip Ahead 150 Characters

Skip Ahead 200 Characters

Skip Ahead 250 Characters

Skip Back “N” Characters

Scan one of these bar codes to select the number of positions back you wish to move the cursor.

Skip Back 1 Characters

Skip Back 2 Characters

Skip Back 3 Characters

Skip Back 4 Characters

Skip Back (continued)

Skip Back 5 Characters

Skip Back 6 Characters

Skip Back 7 Character

Skip Back 8 Characters

Skip Back 9 Characters

Skip Back 10 Characters

Skip Back (continued)

Skip Back 50 Characters

Skip Back 100 Characters

Skip Back 150 Characters

Skip Back 200 Characters

Skip Back 250 Characters

Set Preset Value

Set Values 1 through 6 by scanning the appropriate bar code and send the preset value by scanning a bar code in *Send Preset Value* on page 3-40.

Value 1 = Scan Suffix

Value 2 = Scan Prefix

Value 3 = Scan Suffix 2

Use these bar codes to set the preset values.

Set Value 1

Set Value 2

Set Value 3

Set Value 4

Set Value 5

Set Value 6

Send Preset Value

Send Values 1 through 6 by scanning the appropriate bar code. These values must be set using *Prefix / Suffix Values* on page A-7 and bar codes in *Set Preset Value* on page 3-39. Values 1, 2, and 3 are reserved for the following:

Value 1 = Scan Suffix

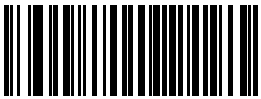
Value 2 = Scan Prefix

Value 3 = Scan Suffix 2

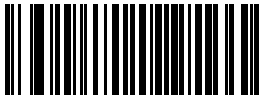
Use these bar codes to send preset values.

Send Value 1

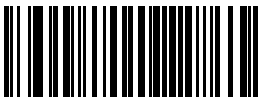
Send Value 2



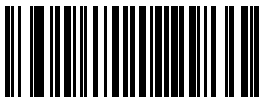
Send Value 3



Send Value 4



Send Value 5



Send Value 6

Modify Data

Modify data in the ways listed. The following actions work for all send commands that follow it within a rule. If you program *pad zeros to length 6, send next 3 characters, stop padding, send next 5 characters,* three zeros are added to the first send, and the next send is unaffected by the padding. These options do not apply to the **Send Keystroke** or **Send Preset Value** options.

Remove All Spaces

To remove all spaces in the send commands that follow, scan this bar code.

Remove All Spaces

Crunch All Spaces

To leave one space between words, scan this bar code. This also removes all leading and trailing spaces.

Crunch All Spaces

Stop Space Removal

Scan this bar code to disable space removal.

Stop Space Removal

Remove Leading Zeros

Scan this bar code to remove all leading zeros.

Remove Leading Zeros

Stop Zero Removal

Scan this bar code to disable the removal of zeros.

Stop Zero Removal

Pad Data With Spaces

To pad data to the left, scan the bar code containing the desired number of spaces. This parameter is activated by Send commands.

Pad Spaces To Length 1

Pad Spaces To Length 2

Pad Spaces To Length 3

Pad Spaces To Length 4

Pad Spaces To Length 5

Pad Spaces To Length 6

Pad Data with Spaces (continued)

Pad Spaces To Length 7

Pad Spaces To Length 8

Pad Spaces To Length 9

Pad Spaces To Length 10

Pad Spaces To Length 11

Pad Spaces To Length 12

Pad Data with Spaces (continued)

Pad Spaces To Length 13

Pad Spaces To Length 14

Pad Spaces To Length 15

Pad Spaces To Length 16

Pad Spaces To Length 17

Pad Spaces To Length 18

Pad Data with Spaces (continued)

Pad Spaces To Length 19

Pad Spaces To Length 20

Pad Spaces To Length 21

Pad Spaces To Length 22

Pad Spaces To Length 23

Pad Spaces To Length 24

Pad Data with Spaces (continued)

Pad Spaces To Length 25

Pad Spaces To Length 26

Pad Spaces To Length 27

Pad Spaces To Length 28

Pad Spaces To Length 29

Pad Spaces To Length 30

Stop Pad Spaces

Pad Data With Zeros

To pad data to the left, scan the bar code containing the desired number of zeros. This parameter is activated by Send commands. Use these bar codes to pad data with zeros.

Pad Zeros To Length 1

Pad Zeros To Length 2

Pad Zeros To Length 3

Pad Zeros To Length 4

Pad Zeros To Length 5

Pad Zeros To Length 6

Pad Data With Zeros (continued)

Pad Zeros To Length 7

Pad Zeros To Length 8

Pad Zeros To Length 9

Pad Zeros To Length 10

Pad Zeros To Length 11

Pad Zeros To Length 12

Pad Data With Zeros (continued)

Pad Zeros To Length 13

Pad Zeros To Length 14

Pad Zeros To Length 15

Pad Zeros To Length 16

Pad Zeros To Length 17

Pad Zeros To Length 18

Pad Data With Zeros (continued)

Pad Zeros To Length 19

Pad Zeros To Length 20

Pad Zeros To Length 21

Pad Zeros To Length 22

Pad Zeros To Length 23

Pad Zeros To Length 24

Pad Data With Zeros (continued)

Pad Zeros To Length 25

Pad Zeros To Length 26

Pad Zeros To Length 27

Pad Zeros To Length 28

Pad Zeros To Length 29

Pad Zeros To Length 30

Stop Pad Zeros

Beeps

Select a beep sequence for each ADF rule.

Beep Once

Beep Twice

Beep Three Times

Send Keystroke (Control Characters and Keyboard Characters)

Scan the “Send __” bar code for the keystroke you wish to send.

Control Characters

Scan these bar codes to send control characters.

Send Control 2

Send Control A

Send Control B

Send Control C

Send Control D

Send Control E

Control Characters (continued)

Send Control F

Send Control G

Send Control H

Send Control I

Send Control J

Send Control K

Control Characters (continued)

Send Control L

Send Control M

Send Control N

Send Control O

Send Control P

Send Control Q

Control Characters (continued)

Send Control R

Send Control S

Send Control T

Send Control U

Send Control V

Send Control W

Send Control X

Control Characters (continued)

Send Control Y

Send Control Z

Send Control [

**Send Control **

Send Control]

Send Control 6

Send Control -

Keyboard Characters

Use these bar codes to send keyboard characters.

Send Space

Send !

Send “

Send #

Send $

Send %

Send &

Send ‘

Keyboard Characters (continued)

Send (

Send)

Send *

Send +

Send ,

Send -

Send .

Send /

Keyboard Characters (continued)

Send 0

Send 1

Send 2

Send 3

Send 4

Send 5

Send 6

Send 7

Keyboard Characters (continued)

Send 8

Send 9

Send :

Send ;

Send <

Send =

Send >

Send ?

Keyboard Characters (continued)

Send @

Send A

Send B

Send C

Send D

Send E

Send F

Send G

Keyboard Characters (continued)

Send H

Send I

Send J

Send K

Send L

Send M

Send N

Send O

Keyboard Characters (continued)

Send P

Send Q

Send R

Send S

Send T

Send U

Send V

Send W

Keyboard Characters (continued)

Send X

Send Y

Send Z

Send [

**Send **

Send]

Send ^

Send _

Keyboard Characters (continued)

Send ‘

Send a

Send b

Send c

Send d

Send e

Send f

Send g

Keyboard Characters (continued)

Send h

Send i

Send j

Send k

Send l

Send m

Send n

Send o

Keyboard Characters (continued)

Send p

Send q

Send r

Send s

Send t

Send u

Send v

Send w

Keyboard Characters (continued)

Send x

Send y

Send z

Send {

Send |

Send }

Send ~

Send ALT Characters

Use these bar codes to send ALT characters

Send ALT 2

Send ALT A

Send ALT B

Send ALT C

Send ALT D

Send ALT E

Send ALT F

Send ALT G

Send ALT Characters (continued)

Send ALT H

Send ALT I

Send ALT J

Send ALT K

Send ALT L

Send ALT M

Send ALT N

Send ALT O

Send ALT Characters (continued)

Send ALT P

Send ALT Q

Send ALT R

Send ALT S

Send ALT T

Send ALT U

Send ALT V

Send ALT W

Send ALT Characters (continued)

Send ALT X

Send ALT Y

Send ALT Z

Send ALT [

**Send ALT **

Send ALT]

Send ALT 6

Send ALT -

Send Command Characters

Send PA 1

Send PA 2

Send CMD 1

Send CMD 2

Send CMD 3

Send CMD 4

Send Command Characters (continued)

Send CMD 5

Send CMD 6

Send CMD 7

Send CMD 8

Send CMD 9

Send CMD 10

Send Special Characters

Send Yen Character

Send Pound Sterling Character

Send Bomb Character

Send Hook Character

Send Bullet Character

Send 1/2 Character

Send Paragraph Character

Send Section Character

Send Vertical Character

Send Keypad Characters

Send Keypad *

Send Keypad +

Send Keypad -

Send Keypad .

Send Keypad /

Send Keypad 0

Send Keypad 1

Send Keypad 2

Send Keypad 3

Send Keypad 4

Send Keypad Characters (continued)

Send Keypad 5

Send Keypad 6

Send Keypad 7

Send Keypad 8

Send Keypad 9

Send Keypad ENTER

Send Keypad
NUM LOCK

Send Keypad Characters (continued)

Send Break Key

Send Delete Key

Send Page Up Key

Send End Key

Send Page Down Key

Send Pause Key

Send Scroll Lock Key

Send Backspace Key

Send Tab Key

Send Print Screen Key

Send Keypad Characters (continued)

Send Insert Key

Send Home Key

Send Enter Key

Send Escape Key

Send Up Arrow Key

Send Down Arrow Key

Send Left Arrow Key

Send Right Arrow Key

Send Back Tab Character

Send Function Keys

Send F1 Key

Send F2 Key

Send F3 Key

Send F4 Key

Send F5 Key

Send F6 Key

Send F7 Key

Send F8 Key

Send F9 Key

Send F10 Key

Send Function Keys (continued)

Send F11 Key

Send F12 Key

Send F13 Key

Send F14 Key

Send F15 Key

Send F16 Key

Send F17 Key

Send F18 Key

Send F19 Key

Send F20 Key

Send Function Keys (continued)

Send F21 Key

Send F22 Key

Send F23 Key

Send F24 Key

Send F25 Key

Send F26 Key

Send F27 Key

Send F28 Key

Send F29 Key

Send F30 Key

Send Function Keys (continued)

Send PF1 Key

Send PF2 Key

Send PF3 Key

Send PF4 Key

Send PF5 Key

Send PF6 Key

Send PF7 Key

Send PF8 Key

Send PF9 Key

Send PF10 Key

Send Function Keys (continued)

Send PF11 Key

Send PF12 Key

Send PF13 Key

Send PF14 Key

Send PF15 Key

Send PF16 Key

Send PF17 Key

Send PF18 Key

Send PF19 Key

Send PF20 Key

Send Function Keys (continued)

Send PF21 Key

Send PF22 Key

Send PF23 Key

Send PF24 Key

Send PF25 Key

Send PF26 Key

Send PF27 Key

Send PF28 Key

Send PF29 Key

Send PF30 Key

Turn On/Off Rule Sets

Use these bar codes to turn rule sets on and off within a rule.

Turn On Rule Set 1

Turn On Rule Set 2

Turn On Rule Set 3

Turn On Rule Set 4

Turn Off Rule Set 1

Turn Off Rule Set 2

Turn Off Rule Set 3

Turn Off Rule Set 4

Alphanumeric Keyboard

Space

#

$

%

*****

+

-

.

Alphanumeric Keyboard (continued)

/

!

“

&

‘

(

)

:

Alphanumeric Keyboard (continued)

;

<

=

>

?

@

Alphanumeric Keyboard (continued)

[

\

]

^

_

`

Alphanumeric Keyboard (continued)

Bar codes on this page should not be confused with those on the numeric keypad.

0

1

2

3

4

5

Alphanumeric Keyboard (continued)

Bar codes on this page should not be confused with those on the numeric keypad.

6

7

8

9

Alphanumeric Keyboard (continued)

A

B

C

D

E

F

G

H

Alphanumeric Keyboard (continued)

I

J

K

L

M

N

O

P

Alphanumeric Keyboard (continued)

Q

R

S

T

U

V

Alphanumeric Keyboard (continued)

W

X

Y

Z

Cancel

End Of Message

Alphanumeric Keyboard (continued)

a

b

c

d

e

f

g

h

Alphanumeric Keyboard (continued)

i

j

k

l

m

n

o

p

Alphanumeric Keyboard (continued)

q

r

s

t

u

v

w

x

Alphanumeric Keyboard (continued)

y

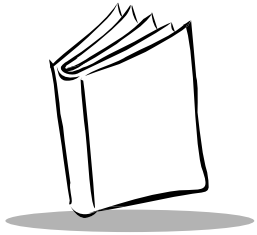
z

{

|

}

~



Chapter 4
Maintenance and Troubleshooting

Maintenance

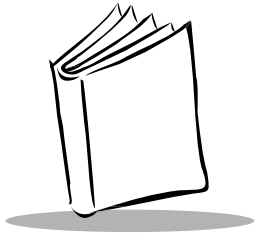
The only maintenance required for the imager is periodic cleaning of the exit window.

- Do not allow any abrasive material to touch the window.
- Do **not** spray water or other cleaning liquids directly into the window.
- Remove any dirt particles with a damp cloth.
- Wipe the window using a tissue moistened with ammonia/water.

Troubleshooting

If your imager is not functioning properly, review the following table to try to identify the problem.

Problem	Possible Cause	Probable Solution
The aiming pattern in the imager does not illuminate when the trigger is pressed.	The interface cable is loose.	Check that the cable is connected properly.
	Power is not applied.	Be sure that power is supplied to the imager via the host or a power supply.
	The aiming pattern is not enabled in the imager.	Enable the laser aiming parameter.
The imager is having trouble reading symbols.	The symbology you are scanning is not enabled.	Enable that the symbology.
	The symbol is damaged.	Be sure the symbols aren't smeared, rough, scratched, or exhibiting voids.
	Environmental conditions inhibit the symbol's quality.	Be sure the symbols aren't coated with frost or water droplets on the surface.
	The symbol is not within the aiming pattern.	Be sure the symbol is completely within the area outlined by the aiming pattern.
The imager operates but scanned data is not displayed, or displays incorrectly.	Communication parameters are inconsistent between the imager and host.	Check that the communication parameters (baud rate, parity, stop bits, etc.) are set properly for your host device.



Appendix A
Programming Reference

AIM Code Identifiers

AIM is the industry standard for identifying the code type of a scanned bar code. You may choose to transmit the AIM identifier with each bar code scanned using the *Transmit Code ID Character* on page 2-66. Each AIM Code Identifier contains the three-character string **]cm** where:

] = Flag Character (ASCII 93)
c = Code Character
m = Modifier Character

Table A-1. AIM Code Identifiers

Code Character	Code Type
A	Code 39, Code 32, Code 39 Full ASCII
C	Code 128, ISBT 128
d	Data Matrix
E (note 1)	UPC/EAN
E + E (note 2)	EAN 8+2, EAN 8+5, EAN 13+2, EAN 13+5, UPCA+2, UPCA+5, UPCE+2, UPCE+5, UPCE1+2, UPCE1+5

Table A-1. AIM Code Identifiers (Continued)

Code Character	Code Type
F	Codabar
G	Code 93
I	Interleaved 2 of 5
L	PDF417, Micro PDF
M (note 3)	MSI Plessey
Q	QR Code
S	D 2 of 5, IATA 2 of 5
U	MaxiCode
X	Code 39 Trioptic, Bookland EAN, Planet, Postal Codes, Coupon Code
Notes: 1. UPCE, UPCE1, and UPCA are converted to EAN-13 for AIM ID. 2. E + E requires 2 AIM IDs; one ID prefixes the main UPC/EAN block, the second ID prefixes the supplemental block. 3. Presently does not conform to any AIM standard.	

The modifier character is the sum of the applicable option values based on Table A-2.

Table A-2. Modifier Characters

Code Type	Option Value	Option
Code 39	0	No Check character or Full ASCII processing.
	1	Reader has checked one check character.
	2	Reader has stripped check character.
	4	Reader has performed Full ASCII character conversion.
		Example: A Full ASCII bar code with check character W, **A+I+MI+DW**, can be transmitted as **]A7**AimId where 7 = (1+2+4).

Table A-2. Modifier Characters (Continued)

Code Type	Option Value	Option
Trioptic Code 39	0	No option specified at this time. Always transmit 0. Example: A Trioptic bar code 412356 is transmitted as **]X0**412356.
Code 93	0	No option specified at this time. Always transmit 0. Example: A Code 39 bar code 012345678905 is transmitted as **]G0**012345678905.
Code 128	0 1 2	Standard data packet, No Function code 1 in first symbol position. Function code 1 in first symbol character position. Function code 1 in second symbol character position. Example: A Code (EAN) 128 bar code with Function 1 character in the first position, **Fcnt1**AimId is transmitted as **]C1**AimId.
EAN/UPC	0 1 2 4	Standard packet in full EAN country code format, which is 13 digits for UPC-A and UPC-E (not including supplemental data). Two digit supplement data only. Five digit supplement data only. EAN-8 data packet. Example:A UPC-A bar code 012345678905 is transmitted as **]E0**0012345678905.
Interleaved 2 of 5	0 1 2	No check digit processing. Reader has checked check digit. Reader has stripped check digit before transmission. Example: An I 2 of 5 bar code without check digit, 4123, will be transmitted as **]I0**4123.
Discrete 2 of 5	0	No option specified at this time. Always transmit 0. Example: A D 2 of 5 bar code 4123 is transmitted as **]S0**4123.

Table A-2. Modifier Characters (Continued)

Code Type	Option Value	Option
MSI Plessey	0	Single check digit checked.
	1	Two check digits checked.
	2	Single check digit verified and stripped before transmission.
	3	Two check digits verified and stripped before transmission.
		Example: An MSI Plessey bar code 4123, with a single check digit checked, is transmitted as **]M0**4123.
Bookland EAN	0	No option specified at this time. Always transmit 0.
		Example: A Bookland EAN bar code 123456789X is transmitted as **]X0**123456789X.
PDF417	0	Reader set to conform to protocol defined in 1994 PDF417 symbology specifications. **Note:** When this option is transmitted, the receiver cannot reliably determine whether ECIs have been invoked or whether data byte 92_{DEC} has been doubled in transmission.
	1	Reader set to follow the ECI protocol (Extended Channel Interpretation). All data characters 92_{DEC} are doubled.
	2	Reader set for Basic Channel operation (no escape character transmission protocol). Data characters 92_{DEC} are not doubled. **Note:** When decoders are set to this mode, unbuffered Macro symbols and symbols requiring the decoder to convey ECI escape sequences cannot be transmitted.
	3	The bar code contains a UCC/EAN-128 symbol, and the first codeword is 903-907, 912, 914, 915.
	4	The bar code contains a UCC/EAN-128 symbol, and the first codeword is in the range 908-909.
	5	The bar code contains a UCC/EAN-128 symbol, and the first codeword is in the range 910-911.
		Example: A PDF417 bar code ABCD, with no transmission protocol enabled, is transmitted as]L2ABCD

Table A-2. Modifier Characters (Continued)

Code Type	Option Value	Option
MaxiCode	0	Mode 4 or 5.
	1	Mode 2 or 3.
	2	Mode 4 or 5 with ECI.
	3	Mode 2 or 3 with ECI.
Data Matrix	0	ECC 000-140 (not supported).
	1	ECC 200.
	2	ECC 200, FNC1 in first or fifth position.
	3	ECC 200, FNC1 in second or sixth position.
	4	ECC 200 supporting ECI protocol.
	5	ECC 200, FNC1 in first or fifth position, supporting ECI protocol.
	6	ECC 200, FNC1 in second or sixth position, supporting ECI protocol.

Enable AIM ID Characters

To enable or disable AIM code ID characters, scan a bar code below. These bar codes can also be found in *Transmit Code ID Character* on page 2-66.

<FN3>2051701

Transmit AIM Code ID Character

<FN3>2051700

***Do Not Transmit Code ID Character**

Prefix / Suffix Values

The following values can be assigned as ASCII prefixes or suffixes to scanned data (see *Prefix/Suffix Values* on page 2-69, and *Set Preset Value* on page 3-39).

Table A-3. Prefix/Suffix Values

Prefix/Suffix Value	Full ASCII Code 39 Encode Char.	ASCII Character	Prefix/Suffix Value	Full ASCII Code 39 Encode Char.	ASCII Character
1000	%U	NUL	1030	%D	RS
1001	$A	SOH	1031	%E	US
1002	$B	STX	1032	Space	Space
1003	$C	ETX	1033	/A	!
1004	$D	EOT	1034	/B	"
1005	$E	ENQ	1035	/C	#
1006	$F	ACK	1036	/D	$
1007	$G	BELL	1037	/E	%
1008	$H	BCKSPC	1038	/F	&
1009	$I	HORIZ TAB	1039	/G	‘
1010	$J	LF/NW LN	1040	/H	(
1011	$K	VT	1041	/I	)
1012	$L	FF	1042	/J	*
1013	$M	CR/ENTER	1043	/K	+
1014	$N	SO	1044	/L	,
1015	$O	SI	1045	-	-
1016	$P	DLE	1046	.	.
1017	$Q	DC1	1047	/	/
1018	$R	DC2	1048	0	0
1019	$S	DC3	1049	1	1
1020	$T	DC4	1050	2	2
1021	$U	NAK	1051	3	3
1022	$V	SYN	1052	4	4
1023	$W	ETB	1053	5	5
1024	$X	CAN	1054	6	6
1025	$Y	EM	1057	7	7
1026	$Z	SUB	1056	8	8
1027	%A	ESC	1057	9	9
1028	%B	FS	1058	/Z	:
1029	%C	GS	1059	%F	;

Table A-3. Prefix/Suffix Values (Continued)

Prefix/Suffix Value	Full ASCII Code 39 Encode Char.	ASCII Character	Prefix/Suffix Value	Full ASCII Code 39 Encode Char.	ASCII Character
1060	%G	<	1095	%O	_
1061	%H	=	1096	%W	`
1062	%I	>	1097	+A	a
1063	%J	?	1098	+B	b
1064	%V	@	1099	+C	c
1065	A	A	1100	+D	d
1066	B	B	1101	+E	e
1067	C	C	1102	+F	f
1068	D	D	1103	+G	g
1069	E	E	1104	+H	h
1070	F	F	1105	+I	i
1071	G	G	1106	+J	j
1072	H	H	1107	+K	k
1073	I	I	1108	+L	l
1074	J	J	1109	+M	m
1075	K	K	1110	+N	n
1076	L	L	1111	+O	o
1077	M	M	1112	+P	p
1078	N	N	1113	+Q	q
1079	O	O	1114	+R	r
1080	P	P	1115	+S	s
1081	Q	Q	1116	+T	t
1082	R	R	1117	+U	u
1083	S	S	1118	+V	v
1084	T	T	1119	+W	w
1085	U	U	1120	+X	x
1086	V	V	1121	+Y	y
1087	W	W	1122	+Z	z
1088	X	X	1123	%P	{
1089	Y	Y	1124	%Q	|
1090	Z	Z	1125	%R	}
1091	%K	[	1126	%S	~
1092	%L	\	1127		Undefined
1093	%M	]			
1094	%N	^	7013		ENTER

Host Qualification of Trigger, RS-232 Host Mode

When enabled, the host application controls when the imager responds to a physical trigger pull by sending a SYN (ASCII 22) character to the imager. This ensures that the imager only responds to the trigger when the host is expecting data.

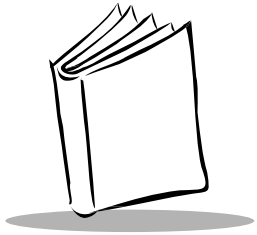
Note: *If this mode is enabled accidentally or when not connected to a host that provides the SYN character, hold the trigger for 5 seconds to override the SYN character requirement, and enable scanning.*

<FN3>14B0071

Enable Host Qualification of Trigger

<FN3>14B0070

***Disable Host Qualification of Trigger**



Appendix B
VS 4000 Imager Specifications

Technical Specifications

Table 2-1 lists the specifications for the imager.

Table 2-1. VS 4004HD-I000 Imager Specification s

Item	Description
Power Requirements: Low Power Mode Current Normal Current Peak Current	+4.75V to 5.25V, 400 mA Typical 1.5 ma 400 ma 930 ma, duration 10 ms typical
Laser Diode Output Power	0.8 mW, max.
Field of View	32^{o} horizontal typical 24^{o} vertical typical
Optical Resolution	VS 4004: Can decode a 6.6 mil (minimum x-dimension) PDF417 symbol; y-dimension must be 2X or greater. VS 4004HD: Can decode a 5 mil (minimum x-dimension) PDF417 symbol; y-dimension must be 2X or greater.
Angular Orientation Tolerances:	
Pitch Tolerance	$\pm 60^{o}$ (“front to back”)
Skew	$\pm 60^{o}$ from plane parallel to symbol (“side-to-side”)
Rotational Tolerance	$\pm 180^{o}$
Print Contrast Resolution	25% (1-D symbologies) or 35% (PDF417) absolute dark/light reflectance differential, measured at 650 nm.

Table 2-1. VS 4004HD-I000 Imager Specifications (Continued)

Item	Description
Ambient Light Immunity	Up to 9000 ft-candles of sunlight
Humidity	5 - 70% (non-condensing)
Shock	Multiple 4-ft / 1.2m drops to concrete
Operating Temperature	0^{o} to 40^{o} C; 32^{o} to 104^{o} F
Storage Temperature	-20^{o} to 60^{o} C; -4^{o} to 140^{o} F
Imager Connector	10-pin modular connector at base of handle **Pin 1**: Reserved **Pin 2**: +5V power supply **Pin 3**: Ground **Pin 4**: Reserved for Synapse control data **Pin 5**: Reserved for Synapse control clock **Pin 6**: Receive (RxD) **Pin 7**: Transmit (TxD) **Pin 8**: Data Terminal Ready (DTR) **Pin 9**: Clear to Send (CTS) **Pin 10**: Request to Send (RTS)
Coil Cable Length	6 ft. / 1.8m
Weight	7.3 oz / 205 g (without cable)
Height	6.3 in. / 16 cm
Length	5 in. / 12.7 cm
Width	2.8 in. / 7.1 cm
Decode Capability	1-D Symbologies: UPC-A, UPC-E, UPC-E1, EAN-8, EAN-13, Code 39, Code 39 Full ASCII, Trioptic Code 39, Code 93, Code 128, UCC/EAN 128, ISBT 128, Codabar, Interleaved 2 of 5, Discrete 2 of 5, Bookland EAN, UPC Coupon Code, MSI Plessey, US Postnet. Cannot autodiscriminate between Code 39 and Code 39 Full ASCII. 2-D Symbologies: PDF417 (up to 928 codewords at security level 0 - 8), DataMatrix (ECC 200), Maxicode, Postal Codes (US Planet, UK, Japanese, Australian), QR Code, Micro PDF.
Memory	4MB RAM, 1MB Flash

VS 4000 Decode Zones

The following illustrations provide the decode ranges for the standard and high-density imager models, for both 1D and 2D bar code types.

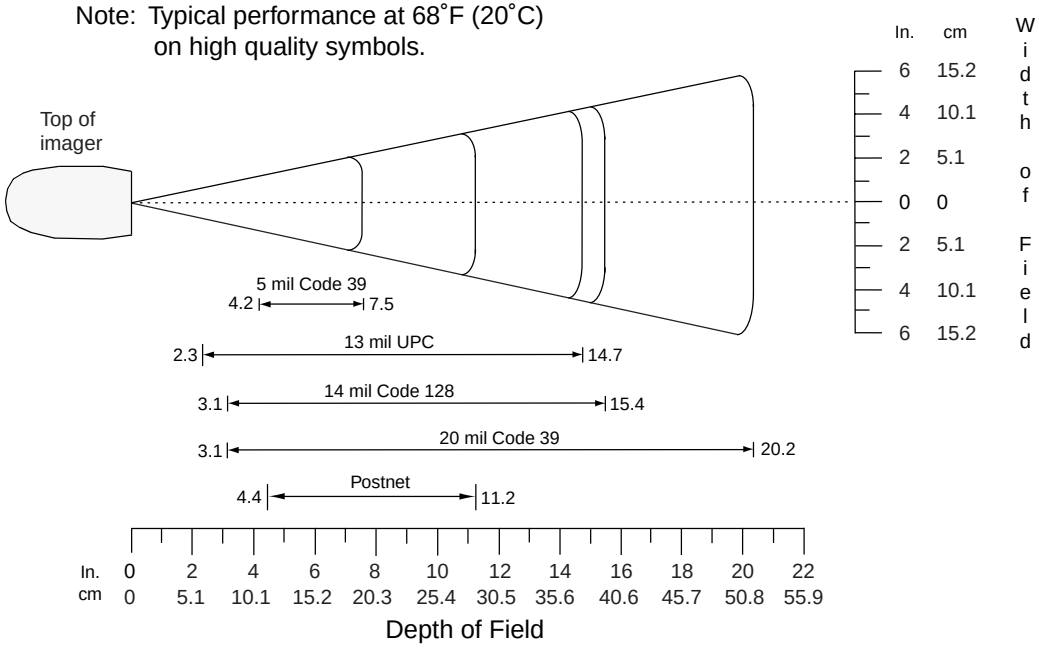


Figure 2-1. VS 4004 (Standard) Decode Zone for 1-D Bar Codes

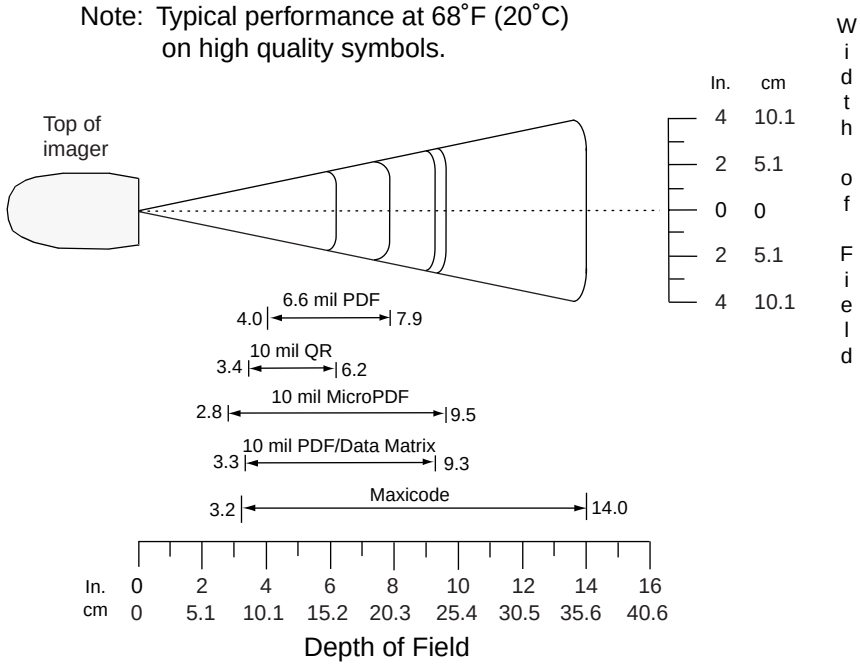


Figure 2-2. VS 4004 (Standard) Decode Zone for 2-D Bar Codes

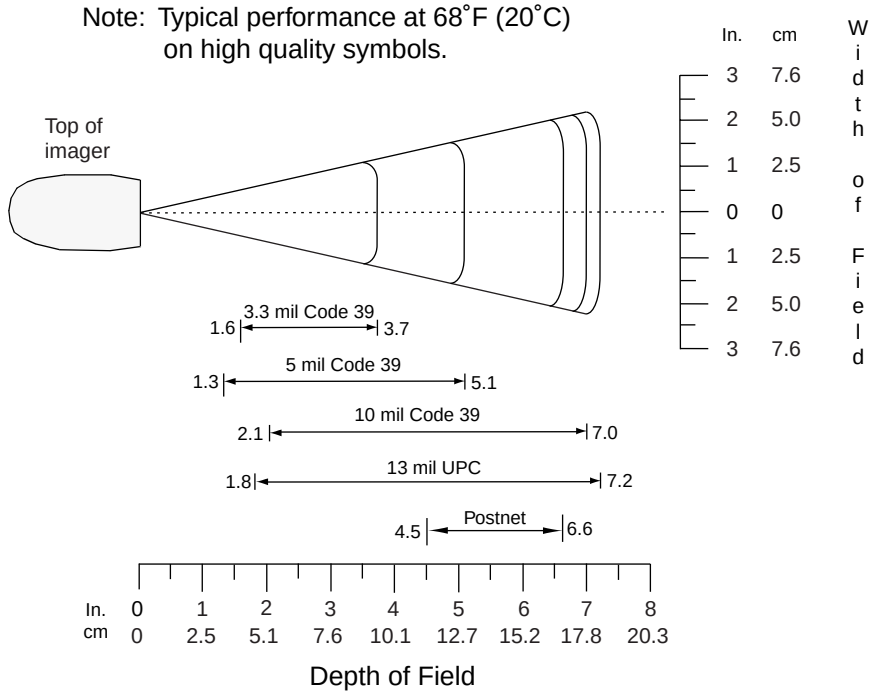


Figure 2-3. VS 4004HD (High Density) Decode Zone for 1-D Bar Codes

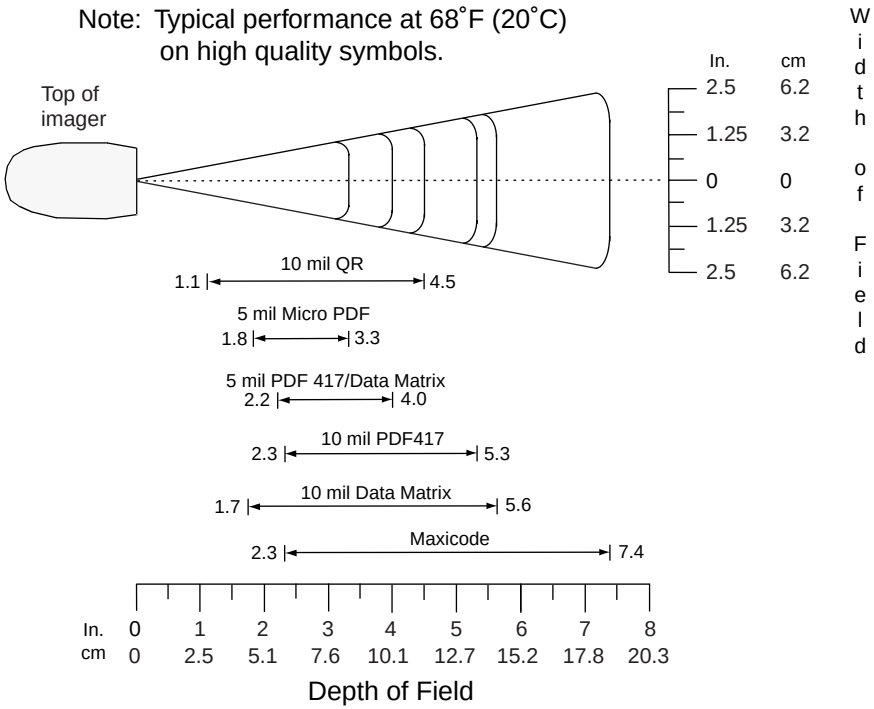


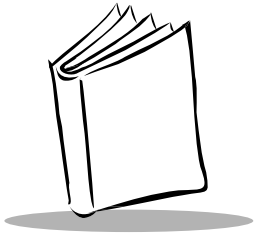
Figure 2-4. VS 4004HD (High Density) Decode Zone for 2-D Bar Codes

Cable Pinouts

The following table describes the pinouts for the host end of the interface cable.

Table 2-2. Single-Port RS-232C, 9-Pin Female D-Type Connector (PC/AT) P/N 25-16456-05

Pin	Signal	Function
2	TxD	Serial data transmit output. It drives the serial data receive input on the device communicating with the imager.
3	RxD	Serial data receive input. It is driven by the serial data transmit output on the device communicating with the imager.
5	Ground	Power supply input ground pin and reference for both output signals. It must be capable of sinking all return current.
7	CTS	Clear-to-send handshaking input line. It may be used optionally by another device to signal the imager that it may begin transmitting data. It can be used only in conjunction with the RTS line.
8	RTS	Request-to-send handshaking output line. It may be used optionally by the imager to signal another device that data is available to send. It can be used only in conjunction with the CTS line.



Glossary

ASCII	American Standard Code for Information Interchange. A 7 bit-plus-parity code representing 128 letters, numerals, punctuation marks, and control characters. It is a standard data transmission code in the U.S.
Asymmetric Width Growth	Non-uniform growth of elements in a printed symbol.
Autodiscrimination	The ability of an imager to determine the code type of a scanned bar code. After this determination is made, the information content can be decoded.
Average Bar Width Growth	Average deviation of bars from nominal widths over the entire symbol.
Bad Check Digit	Error message resulting from failure of the check digit to calculate properly.
Bad Data Character	Error message caused by failure of one or more data characters to decode properly.
Bar	The dark element in a printed bar code symbol.
Bar Code Data Density	The number of characters represented per unit of measurement (e.g., characters per inch in one-dimensional symbologies, characters per square inch in PDF417).
Bar Code Print Density	The bar width of the smallest (thinnest) element in the bar code.
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.
Bar Width Deviation	Increase or decrease in bar width as compared with nominal bar width.
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.
Bidirectional Reading Capability	The ability to decode a symbol successfully by reading in complementary (opposite) directions across bars and spaces.
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."
Buffer	An area of memory allocated for data storage. In this context, a buffer's data storage capacity is needed when data can flow into the device more quickly than the device can process that data. Buffering the data preserves it until it can be processed.
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.
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 and Code 128 but are optional for other symbologies. Using check digits decreases the chance of substitution errors when a symbol is decoded.
Cluster	One of three subsets of mutually exclusive codeword definitions within PDF417.
Codabar	A discrete self-checking code with a character set consisting of start/stop characters (A B C D or * T N E), digits 0 to 9, and these additional characters: (- $: / , +).
Code	Set of unambiguous rules specifying the way in which data may be represented.
Codeword	In PDF417, a single group of bars and spaces (4 bars and 4 spaces, for a total of 17 module widths) which represents one or more numbers, letters, or other symbols.
Codeword Pd (Codeword Percent Decode)	Within a PDF417 symbol, the percentage of codewords which decoded successfully; the number of good codewords divided by the total number of codewords (data codewords plus error correction codewords).
Code Length	Number of data characters in a bar code between the start and stop characters, not including those characters.
Code 128	A high density symbology which allows the interface 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.

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.
Country Flag	In EAN-8 and EAN-13 codes, two or three digits which appear immediately following the left guard bar pattern.
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. To translate the bar/space pattern into defined characters within a defined symbology.
Decode Algorithm	A decoding scheme that converts pulse widths into data representation of the letters or numbers encoded within a bar code symbol.
Depth Of Field	The range between minimum and maximum distances at which a scanner can read a symbol with a certain minimum element width.
Discrete Code	A bar code or symbol in which the spaces between characters (intercharacter gaps) are not part of the code (e.g., Code 39).
Discrete 2 Of 5	A binary bar code symbology representing each character by a group of five bars, two of which are wide. The location of wide bars in the group determines which character is encoded; spaces are insignificant. Only numeric characters (0 to 9) and START/STOP characters may be encoded.
EAN	European Article Number. This European/International version of the UPC provides its own coding format and symbology standards. Element dimensions are specified metrically. EAN is used primarily in retail. Main variants are EAN-8 and EAN-13.
Edge Roughness	Edge irregularities as compared with a nominal bar edge.
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.
Error Correction	In addition to error detection, the recovery capability of PDF417 over missing, destroyed, or misdecoded codewords. Error correction capability is based on the level of security (0 - 8) selected when the PDF417 label is printed.
Extraneous Ink	Ink in a scan area not intended to be there (i.e., tracking and splatter).
First Read Rate	Percentage of correct readings obtainable by one pass of a scanning device over a bar code.
Flash	Derived from EEPROM, this is a type of memory that holds its content without power but must be erased in bulk — or in a “flash.” Typically, these memory chips are less expensive and provide higher bit densities.
Guard Bars	The start, stop, and center delimiting bars of UPC and EAN symbols.
Host Computer	A computer that serves other terminals in a network, providing such services as computation, database access, supervisory programs, and network control.
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 represents the first character and the intervening spaces to represent the second.
Interleaved 2 Of 5	A binary bar code symbology representing character pairs in groups of five bars and five interleaved spaces. Interleaving provides for greater information density. The location of wide elements (bar/spaces) within each group determines which characters are encoded. This continuous code type uses no intercharacter spaces. Only numeric (0 to 9) and START/STOP characters may be encoded.

Laser	An acronym for Light Amplification by Stimulated Emission of Radiation. The laser is an intense light source. Light from a laser is all the same frequency, unlike the output of an incandescent bulb. Laser light is typically coherent and has a high energy density.
Led Indicator	A semiconductor diode (LED - Light Emitting Diode) used as an indicator, often in digital displays. The semiconductor uses applied voltage to produce light of a certain frequency determined by the semiconductor's particular chemical composition.
Mil	1 mil = 1 thousandth of an inch.
Minimum Reflectance Difference (MRD)	The difference in percentage between light reflected from spaces (R_S) and light reflected from bars (R_B). **MRD = $\%R_S - \%R_B$.**
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.
Module	The narrowest bar or space (unit of measure) in a code. The term is used by the Uniform Code Council in its description of UPC/EAN code; it is also used in the description of Code 128. Contiguous modules are used to form bars or spaces which are wider than one unit.
Module Aspect Ratio	The ratio of height to width of the narrowest bar or space, or unit of measure, in a bar code.
Nanometer	A unit of measure used to define the wavelength of light. Equal to 10^{-9} metre.
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).

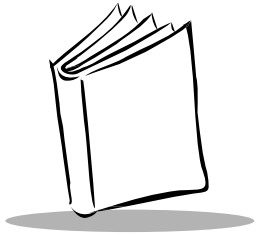
Number System Character	In the UPC/EAN code used in a retail application, the mandatory, first encoded character, after the left guard bars. The corresponding human readable character identifies the coded character and appears at the bottom left-hand margin of the symbol. The assigned system number corresponds to a usage category for the bar coded item.
One-dimensional Symbology	Symbologies which encode data only in a linear or horizontal dimension (X-dimension); the symbol's vertical height (Y-dimension) is redundant (e.g., UPC/EAN, Code 39).
Opacity	The capacity for material to interfere with transmission of light.
Overhead	The number of characters required for start, stop, and checking for a given symbol (in PDF417, also left and right row indicators and error correction codewords). For example, a one-dimensional symbol requiring start/stop and two check characters contains four characters of overhead. Thus, to encode three data characters, seven characters are required.
Parameter	A variable that can have different values assigned to it.
Parity Type	A parity check bit is the most significant bit of each ASCII coded character. The parity should be set to help detect transmission errors. The parity should be set to match that of the receiving device. If even parity is selected, the parity bit has a value (0 or 1) to ensure that an even number of 1 bits are contained in the coded character. If odd parity is selected, the parity bit will have a value (0 or 1) to ensure that an odd number of 1 bits are contained in the coded character. If 0 parity is selected, the parity bit always will be set to 0. If 1 parity is selected, the parity bit always will be set to 1.

PDF417	A two-dimensional, or stacked, bar code symbology which can encode over one kilobyte of data per label and which represents data in the form of codewords (values 0 - 928). Each codeword consists of four bars and four spaces, for a total of 17 module widths; modules vary in width from one to six element widths. The symbology permits encoding up to 30 data columns and from 3 to 90 data rows. For ease of reading while still maintaining high data density, codewords are encoded in three mutually-exclusive encodation sets, or clusters, with the same cluster repeating sequentially each third row.
Percent Decode	The average probability that a single scan of a bar code would result in a successful decode. In a well-designed bar code scanning system, that probability should approach near 100%.
Print Contrast Signal (PCS)	Measurement of the contrast (brightness difference) between the bars and spaces of a symbol. A minimum PCS value is needed for a bar code symbol to be scannable. PCS = (RL - RD) / RL, where RL is the reflectance factor of the background and RD the reflectance factor of the dark bars.
Prom	Acronym for Programmable Read Only Memory. An integrated circuit which can be programmed through special processes and accessed at random during normal operation. Reprogramming is possible, but only through processes such as ultraviolet light erasing and electrical rewriting of data.
Protocol	For a specific signaling type, a set of recognized rules governing the format and timing of message exchange. Between data communications devices, this includes an exchange of predetermined signals arranged for both establishing connection and for disconnecting.
Quiet Zone	A clear space, containing no dark marks, which precedes the start character of a bar code symbol and follows the stop character.
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.
Row Indicators	To help synchronize a PDF417 symbol's structure, codewords which collectively indicate which row a particular one is, which is the left and right side of that row, how many rows are in the symbol, what security level is encoded in the symbol, and how many data columns are in the rows. Left Row Indicators occur in each row immediately after the Start pattern; Right Row Indicators occur in each row immediately before the Stop pattern.
Scan	Search for a symbol to be optically recognized.
Scan Area	Area intended to contain a symbol.
Scanner	An electronic device used to scan bar code symbols and produce a digitized pattern that corresponds to the bars and spaces of the symbol. Its three main components are: 1. Light source (laser or photoelectric cell) - illuminates a bar code. 2. Photodetector - registers the difference in reflected light (more light reflected from spaces). 3. Signal conditioning circuit - transforms optical detector output into a digitized bar pattern.
Self-checking Code	A symbology that uses a checking algorithm to detect encoding errors within the characters of a bar code symbol.
Show-through	The generally undesirable property of a substrate that permits underlying markings to be seen.
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.
Spot Size	Size of the scanning aperture.
Spots	The presence of ink in a bar code's spaces or clear areas. These generally reduce the percent decode.

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 the first and last encoded characters of a bar code.
Substrate	A foundation material on which a substance or image is placed.
Substrate Scattering	Optical phenomenon which causes bars to appear larger and spaces narrower than they are actually printed. It is caused by the scattering of incident light rays within the medium.
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).
Symmetric Bar Width Growth	Uniform growth of bars evenly distributed.
Tolerance	Allowable deviation from the nominal bar or space width.
Two-dimensional Symbology	Designed for high information density and higher encoding capability than one-dimensional bar codes, a symbology which encodes data in both the horizontal (X-dimension) and vertical dimensions, usually in a “stacked” or multi-row arrangement.

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. Depending on the type of diode used, the emitted laser light has a wavelength between 635 to 670 nanometers.
Void	Absence of ink within printed bars.
X-dimension	Width of the narrowest element (bar of space) in a bar code symbol.
Y-dimension	Element height, as applied to a two-dimensional symbology, which must equal or exceed a required minimum.
Zero-suppressed Code	A version of UPC/EAN which reduces the number of characters in the code. The resulting code combines the manufacturer's code and the product's code of Version A in a retail application.



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

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_____
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