Inspector 5000™

Auto Optic

Operator's Guide

Manual P/N 003-4500
Revision: A
April 2018

THIS MANUAL APPLIES **ONLY** TO **FIRMWARE 0.985 OR LATER**

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Copyrights

Reference RJS P/N 003-4500 Revision A

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1.0 Preface

1.1 Proprietary Statement

The Inspector 5000 Operator's Guide contains proprietary information of RJS. It is intended solely for the use of parties operating and maintaining the equipment described herein. This information may not be used, reproduced, or disclosed to any other parties for any other purpose without the express written permission of RJS.

1.2 Statement of FCC Compliance: USA

The equipment described in this manual has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide a reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this operator's manual, may cause harmful interference to radio communications. Operating this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the problem at their own expense.

1.3 Statement of FCC Compliance: Canada

This Class A digital apparatus meets all requirements of the Canadian interference-Causing Equipment Regulations.
Cet appareil numénque de la classe A respecte toutes les exigences du Règlement sur le maténel brouilleur du Canada.

1.4 CE:

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this operator's manual, may cause harmful interference to radio communications. Operating this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the problem at your their expense.

1.5 Documentation Updates

RJS strives to provide the best possible documentation. This manual, or any of our manuals, may be updated without notice.

1.6 Copyrights

1.7 Unpacking and Inspection

Carefully unpack the components and save the container. If the container is crushed, punctured or water damaged you can use the container to prove a claim against the carrier. RJS is not responsible for transportation damage.
Your Inspector 5000 is packaged in a custom made container. After removing the unit from the shipping box make sure you have:

- Main display unit
- Auto-optic scan head and cable
- Calibration plaque

- Operator's manual
- Print Test sheets
- Battery charger

1.8 Batteries

The Inspector 5000 has an integrated lithium ion battery pack installed in the unit.
The battery is not field replaceable and must be returned to RJS for repair/replacement.

> **Warning:**
> **DO NOT** use any battery chargers other than the Inspector 5000 battery charger. Use of non-RJS battery chargers could damage your bar code verifier and/or result in a fire.

1.9 Technical Support

Please read the manual.

If you need assistance over the phone, please have the following information ready:

- Model and serial number of your unit
- Have a test print available, if applicable
- Detailed explanation of the problem or question
- Your company's phone and email information

1.10 Trademarks

The following are trademarks of RJS:

- RJS
- RJS Systems International
- Inspector
- RJS Inspector

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2.0 Warranty

2.1 General Warranty

Warranty information: +1 (763) 746-8034

RJS warrants your Inspector 5000 to be free from defects in material and workmanship for a period of 1 year from the date of shipment from RJS' factory location.

The liability of RJS under this warranty is limited to repairing or replacing the defective part and/or unit. RJS may optionally choose to issue credit for any unit returned during the warranty period.

You must promptly notify RJS of any defect in order to receive the full protection of this warranty.

2.2 Warranty Limitations

The warranty set forth above is exclusive and no other warranty, whether written or oral is expressed or implied. RJS specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

Some states or provinces do not allow limitation on how long an implied warranty lasts, so the above limitation or exclusion may not apply to you. However, any implied warranty of merchantability or fitness is limited to the one year duration of this written warranty.

RJS shall in no event be liable for any indirect, incidental, or consequential damages, including but not limited to damages which may arise from loss of anticipated profits or production delivery delays, spoilage of material, increased costs of operation of business or otherwise.

2.3 Service during the Warranty Period

If your Inspector 5000 should fail during the warranty period, contact RJS or its authorized representative immediately upon discovery of the defect. A Return Authorization Number (RMA number) may be obtained by visiting our website address:
http://www.rjs1.com/rma-request/

You will be asked to ship the product in its original packing, freight prepaid, with the RMA number visibly written on the outside of the carton to the RJS factory in Minneapolis, MN U.S.A

Be sure to include any samples or printouts or other information that will help us to understand the problem. Your repair will be given priority treatment, or your unit may be replaced at RJS's option. The repaired item will be returned UPS/United States Postal Service ground, freight prepaid. At your request we will ship express or overnight if you need premium service and agree to pay the additional cost.

3.0 Introduction

3.1 Inspector 5000 Description and Features

The Inspector 5000 is an advanced technology bar code verifier that makes it easy to decode bar code symbols and to evaluate symbol compliance with industry standards.

Features

- Four aperture sizes selectable from setup screen
- Two light wavelengths selectable from setup screen
- Provides scan head light color and aperture size *(display/print)*
- Auto-discriminates between many different symbologies
- Auto-print mode
- Bi-directional scanning
- Profile display with color coded indications for *Decodability*, *Modulation*, and *Defects*
- Calculates the Narrow Bar Width (NBW) of bar code symbols
- Calculate and display print contrast signals (PCS)
- Low battery indicator
- Multiple scan averaging
- Power-down is automatic after short period of disuse
- Programmable, multi-scan analysis
- Specially designed Auto Optic ensures accurate scanning angle
- Store and print capabilities
- Visual and audible signals

3.2 Maintenance

To ensure the best possible scanning conditions, keep the display window clean. Use a soft, damp, lint-free cloth to clean the window.

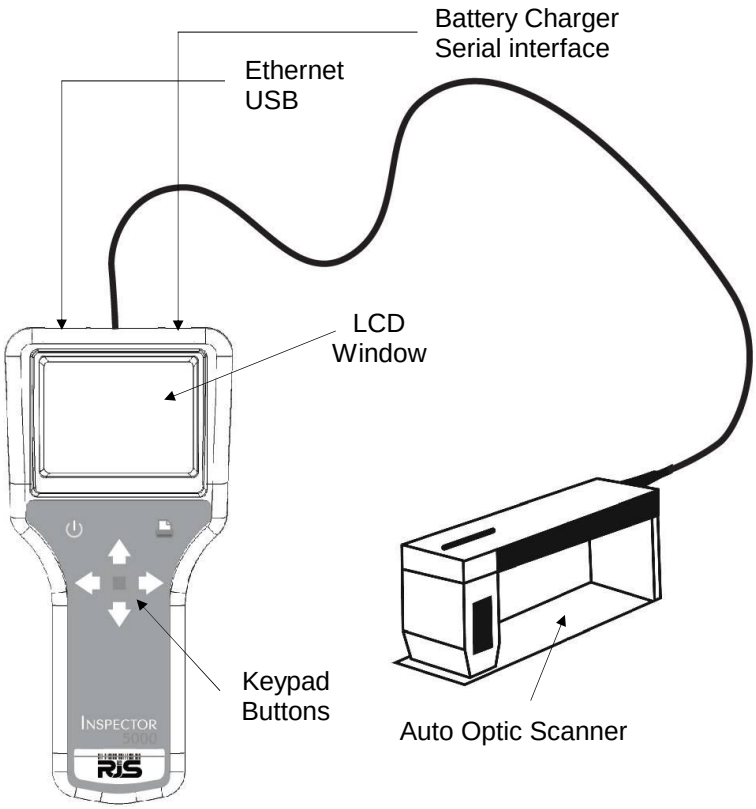
Do not use solvents on the unit or on any of the components. You may use alcohol to clean the unit.

3.3 Temperature Specs

Do not operate or store your unit or components in temperatures outside the range of 20° - 105°.

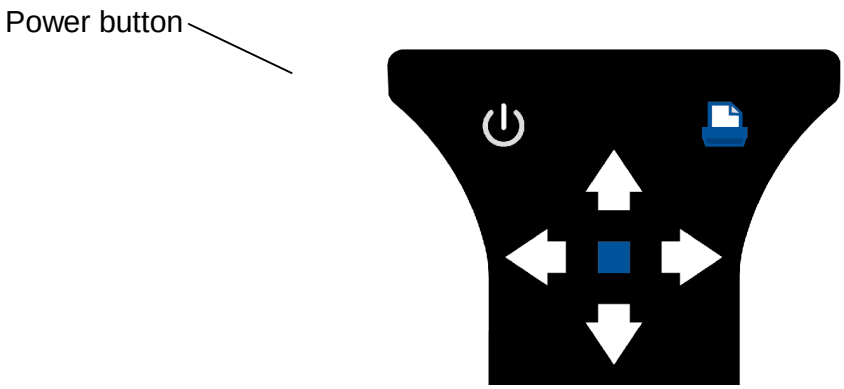
Do not operate or store your unit in conditions of high humidity—over 80%.

4.0 The Inspector 5000 Auto Optic



5.0 Main Menu Selections

5.1 Power On/Off



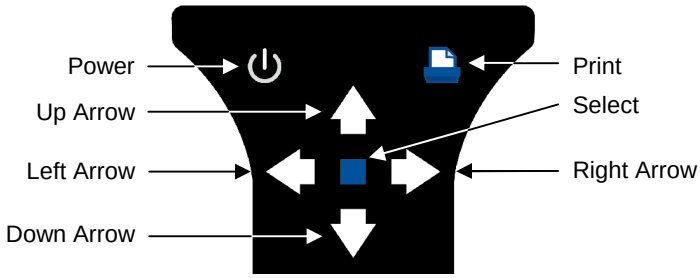
Press and hold the ***Power*** button for 1 second to turn **On** the Inspector 5000. The RJS logo will be displayed for three seconds (on the bottom of the screen is the firmware version), then the **Grade** *screen* will displayed.

The Inspector 5000 can be turned **Off** by the following methods:

1. Press and hold the ***Power*** button for 4 seconds
2. System time out (default is sleep mode after 1 minute (screen turns off) and power down after 15 minutes)

5.2 Screen Navigation

The Inspector 5000 screens are navigated by using the seven buttons on the keypad.



For normal operations

Left Arrow and ***Right Arrow*** buttons change which screen (**Grade**/**Encode**/**Profile**/**Report**) is displayed

Up Arrow and ***Down Arrow*** buttons move the cursor up and down on the current screen

Print button will send the inspection report(s) to either the TP140A printer or the VCIR PC software program.

Special Functions

Power button, in addition to turning the unit **On** and **Off**, the ***Power*** button will toggle between normal operations and displaying the **Instructions** screen

To display the **Calibration** screen - press and hold the ***Print*** button and then press the ***Left Arrow*** button

To display the **Setup** screen - press and hold the ***Print*** button and then press the ***Right Arrow*** button

To jump the cursor to the bottom of the screen, press and hold the ***Print*** button and then press the ***Down Arrow*** button

To jump the cursor to the top of the screen, press and hold the ***Print*** button and then press the ***Up Arrow*** button

Power On

When the Inspector 5000 is turned **On**, the **GRADE** (grading) screen will display the last bar code inspected:

GRADE	ENCODE	PROFILE	REPORT
Symbology			ITF14 Case Code
00005000022251 3			
ISO OVERALL GRADE			3.4/YY/XXX
ANSI OVERALL GRADE			B/YY/XXX
Decodes			10 of 10
Decodability			B 56%
Modulation			A 77%
Symbol Contrast			A 79%
Defects			B 17%

Minimum Edge Contrast	Pass	61%
* Format	Pass	
Ref Decode	A	*
Edge Determination	Pass	
Reflectance Minimum	Pass	
Quiet Zone (left)	Pass	11X
Quiet Zone (right)	Pass	10X

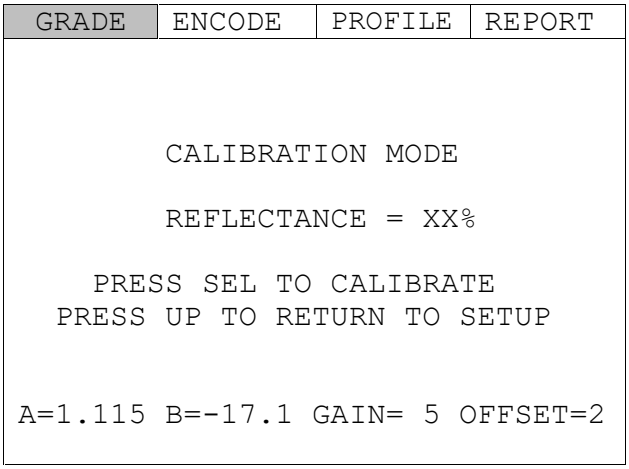
In addition to **GRADE**, the other screens are **ENCODE**, **PROFILE**, and **REPORT**.

Note: *A bar code can be scanned at any time except:*

1. *When the unit is printing*
2. ***Setup*** *screen is open*

5.3 Field Calibration

Press and hold ***Print*** button then press ***Left Arrow*** button (at the same time) to display the **Calibration** screen:



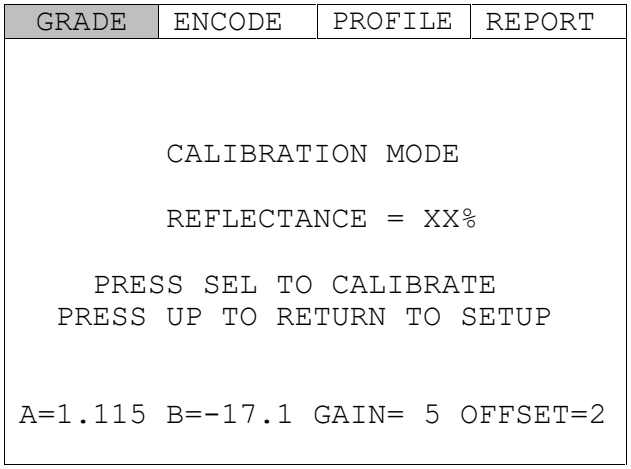
Verifying the Inspector 5000 is calibrated

From the main calibration screen the unit is setup to measure reflectance. This allows you to check the calibration of the unit by placing the Auto Optic on the RJS Calibration Plaque *(P/N 002-7410)*, white or black fields, and verifying that the reflectance value matches the stated values.

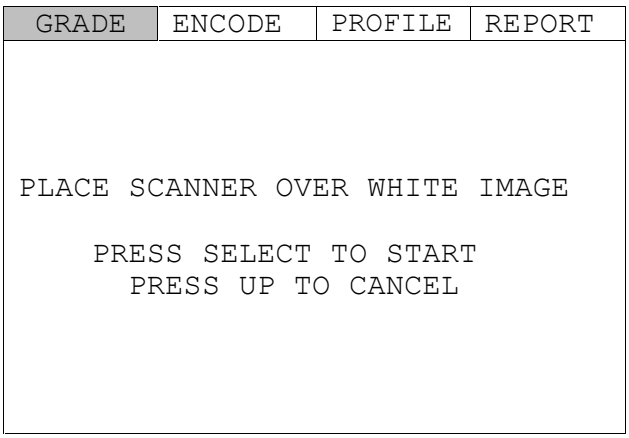
Verify that reflectance values are within 2% for white and 2% for black. If the values are *not* within these tolerances you need to calibrate the unit; otherwise, press the ***Up Arrow*** button to return to the **Setup** screen.

Calibrating the Unit

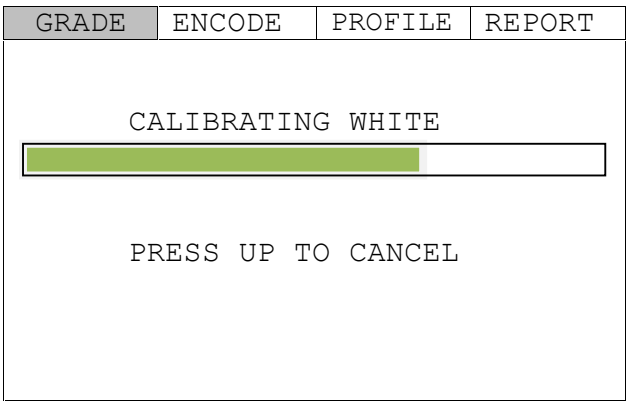
After displaying the **Calibration** screen, press the ***Select*** button to begin calibration

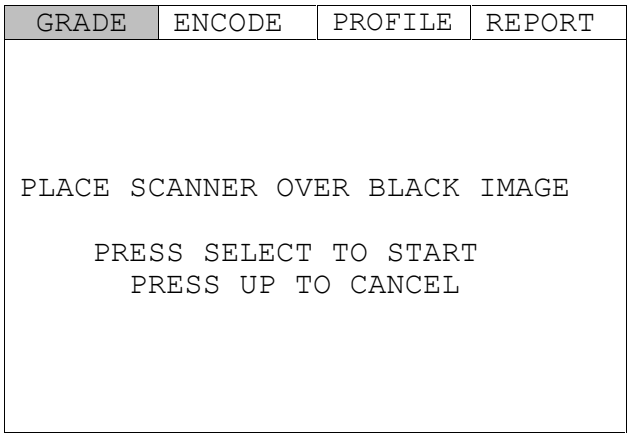


From the reflectance menu press ***Select*** button, the Calibrate menu will display:

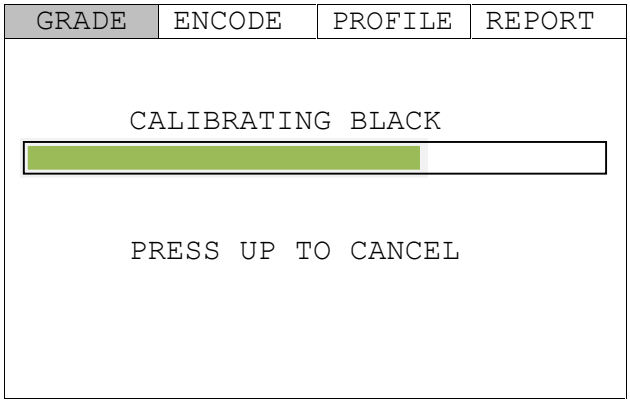


Place the Auto Optic on the white section of the calibration plaque with the inspection hole in the bottom of the Plexiglas plate flat against the surface. Press ***Select*** button and hold auto-optic scanner head still while this screen is displayed:

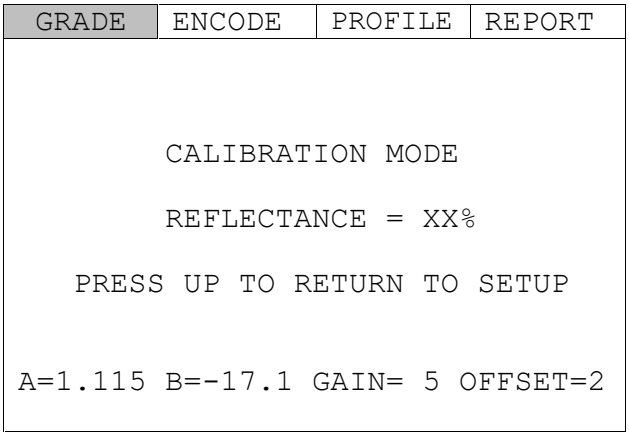




Place the Auto Optic on the black section of the calibration plaque with the inspection hole in the bottom of the Plexiglas plate flat against the surface. Press ***Select*** button and hold auto-optic scanner head still while this screen is displayed:



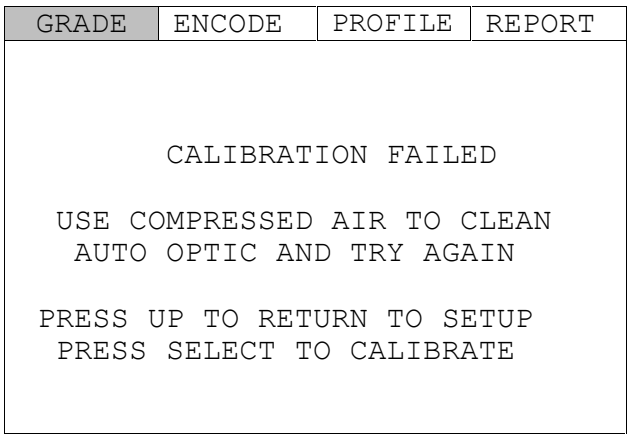
When both the light and dark reflectance values have been calibrated you hear a "chirp" sound and the following screen will display:



Verify that the unit is calibrated by again placing the Auto Optic on the light or dark area of the plaque.

The reflectance % value will display. Reflectance values should be within 2% *(of the known value of the plaque)* for white and 2% *(of the known value of the plaque)* for black.

If the *Unable to Calibrate* screen displays, then repeat the calibration.



Note: *Once the unit is calibrated, the calibration data will remain saved in memory; however, you should calibrate the unit at the beginning of each day or each shift for the proper Symbol Contrast and Modulation readings.*

Note: *Once the unit is calibrated, the calibration data will remain saved in memory; however, you should calibrate the unit at the beginning of each day or each shift for the proper Symbol Contrast and Modulation readings.*

After three failed attempts to calibrate your unit, it is an indication that your bar code verifier will need to be Factory calibrated and serviced.

A Return Authorization Number (RMA number) may be obtained by visiting our website address: ***http://www.rjs1.com/rma-request/***

5.4 Setup

Press and hold ***Print*** button then press ***Right Arrow*** button (at the same time) to bring up the **Setup** screen:

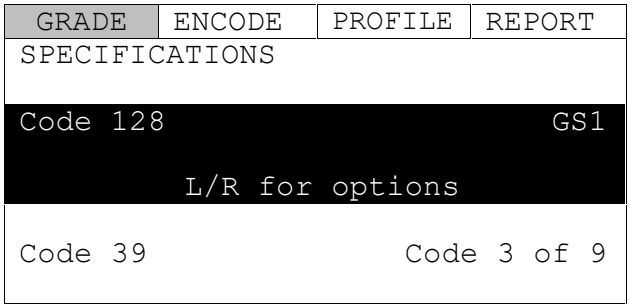
GRADE	ENCODE	PROFILE	REPORT
SPECIFICATIONS			
Code 128			GS1
Code 39			Code 3 of 9
Interleaved 2 of 5			ITF-14
L/R for options			
UPC/EAN Magnify			90-115% MAG
UPC Random Weight			NO
Output Device			Computer

The ***Down Arrow*** and ***Up Arrow*** buttons allow for changing the selected **Setup** parameter.

The ***Left Arrow*** and ***Right Arrow*** buttons allow for modification of the selected **Setup** parameter.

The first selection is Decode C128:

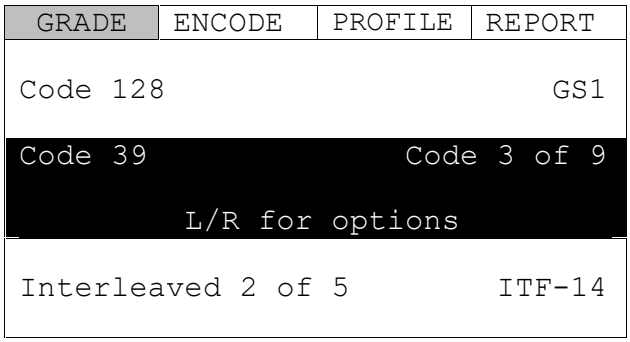
This selection is for choosing the Code 128 sub-specifications for analysis:



This selection is for choosing the Code 128 sub-specifications for analysis:

Standard
GS1

The next selection is Decode 3 of 9 as:

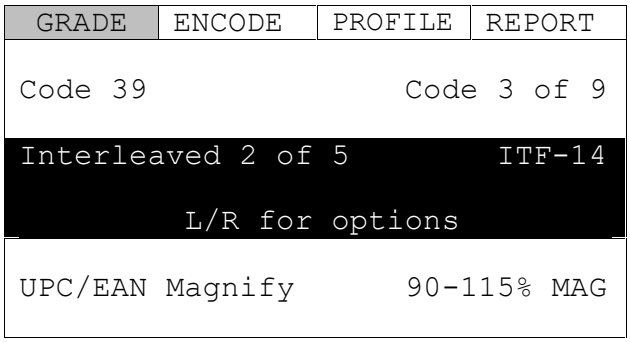


This selection is for choosing the Code 39 sub-specifications for analysis:

CODE 3 of 9
3of9 w/43
AIAG B-1
AIAG B-3/4/5/10
LOGMARS
HIBC 3of9

When using the Inspector 5000 Auto Optic (not applicable to the Inspector 5000 Laser), if either AIAG choice is entered, the scan reflectance profile analysis will performed per the AIAG grading thresholds and display numbers 4.0, 3.0, 2.0, 1.0 and 0.0 in place of the letter grades.

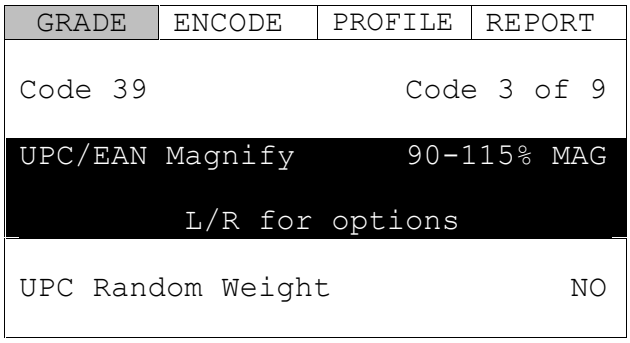
The next selection is Decode Interleaved 2 of 5:



This selection is for choosing the Interleaved 2 of 5 sub-specifications for analysis:

STD I2of5
I25 w/MOD 10
ITF14
ITF18

The next selection allows you to select a range of UPC/EAN symbol magnifications:

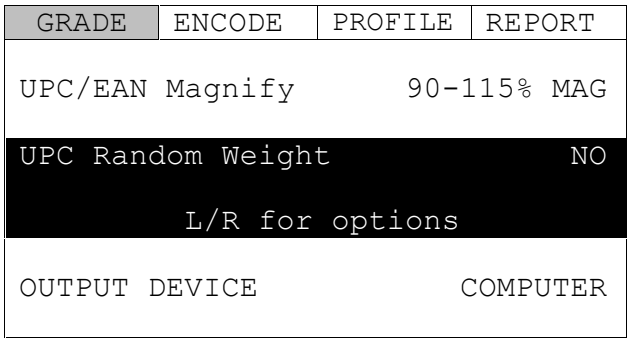


The magnifications are:

80 - 89 % Mag
90 - 115 % Mag
116 - 150 % Mag
151 - 200 % Mag

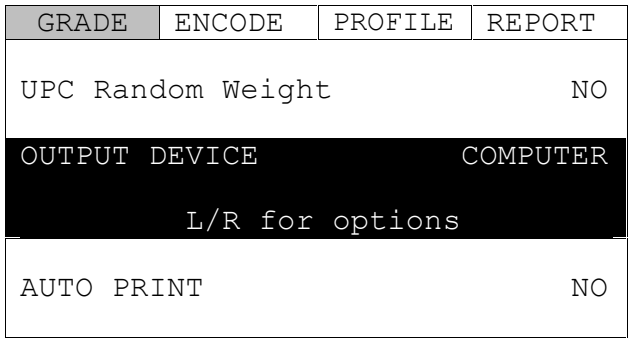
See Appendix G for an explanation of magnifications

The next selection allows you to select if UPC/EAN symbols will be inspecting Random Weight bar codes:



The options are **Yes** or **No**

The next selection is Output Device:

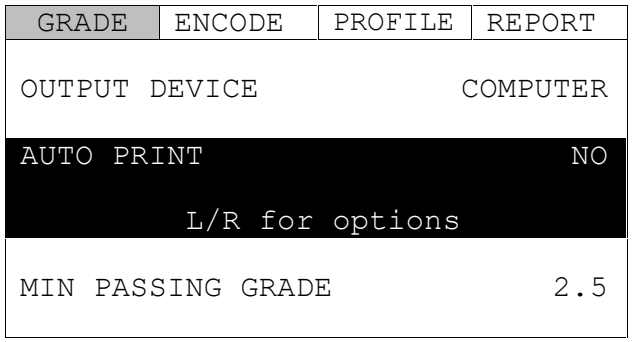


Three output choices are available:

1. When **Computer** is enabled, data is output in computer readable format (text and graphics)
2. When **TP140** is enabled, data output is in the format of analysis only
3. When **TP40** is enabled, data output is in the format of analysis only
4. When **TP140A** is enabled, data output is in the format of analysis only

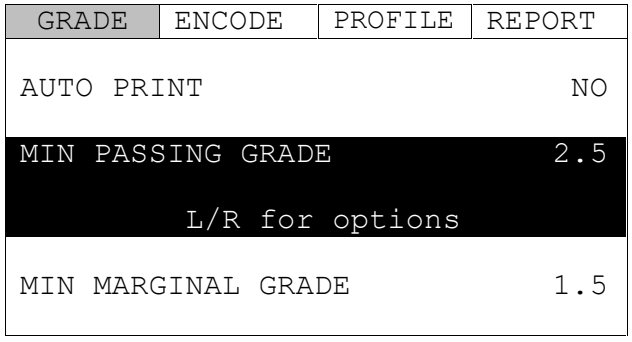
See Section 10.0, Viewing Saved Inspection Reports

The next selection is Auto Print Mode:



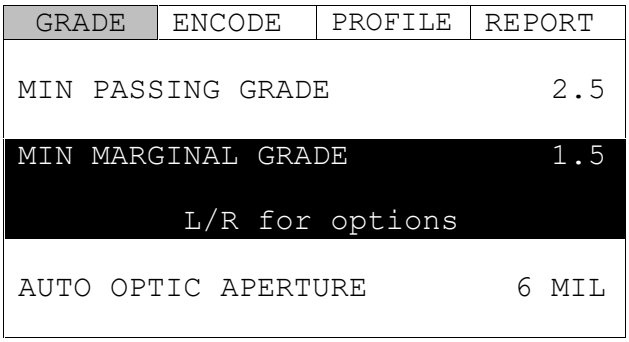
The options are **Yes** or **No**

The next selection is Minimum Passing Grade:



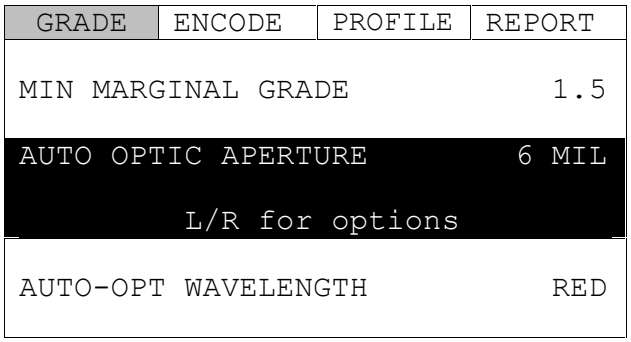
Select one of the threshold numeric grades, **0.0** - **4.0**. This value or above will be Passing "green"
See Appendix A for an explanation of ISO/ANSI grades

The next selection is Minimum Marginal Grade:



Select one of the threshold numeric grades, **0.0** - **4.0**. This value or above will be Marginal "yellow" and below this value will be Failing "red"
See Appendix A for an explanation of ISO/ANSI grades

The next selection is Aperture Size:



Two Auto Optic options are available:

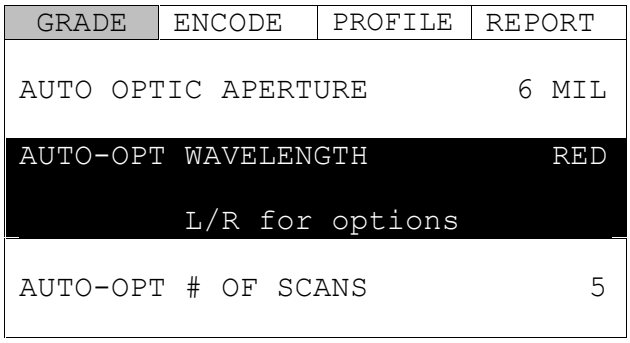
- *3, 6, 10, and 20 mil apertures Standard*
- *3, 5, 10, 20 mil apertures for Europe and Japan*

Choose the Aperture size by pressing ***Left Arrow*** or ***Right Arrow*** buttons:

3 MIL ***0.003 inches***
****5 MIL*** ***0.005 inches*** ***(for Europe and Japan)***
6 MIL ***0.006 inches***
10 MIL ***0.010 inches***
20 MIL ***0.020 inches***

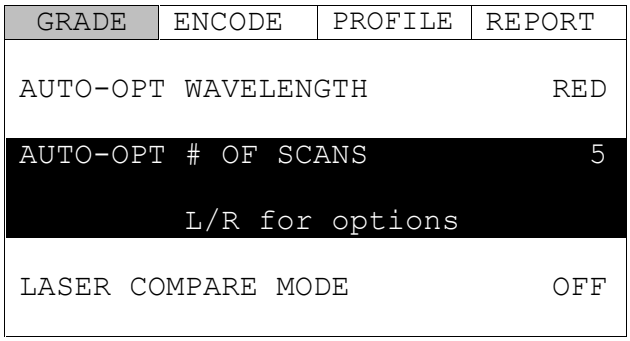
See Appendix H for an explanation of how to select the correct aperture size

The next selection is Wavelength:



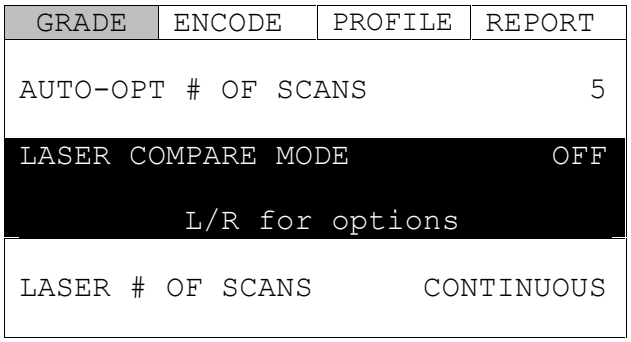
This selection allows you to select one of two light wavelengths which are **Red** (660nm) or **Infrared** (925nm - invisible). The default it RED and Infrared is used by very few customers.

The Auto Optic number of scans is next:



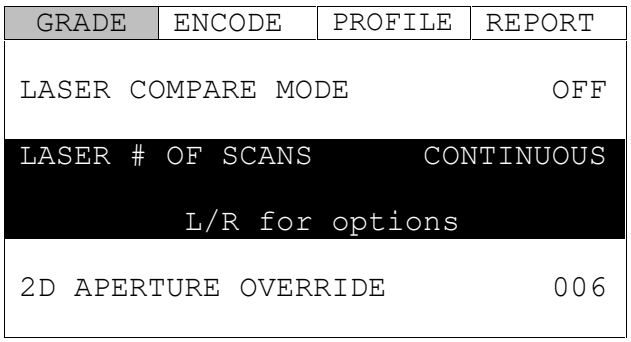
Bar code quality varies throughout the height of a bar code. It is best to take multiple scans from top to bottom and average the scan grades to calculate the overall scan grade. This parameter can be set from **1** to **10**.

The Laser Comparison Mode is next:



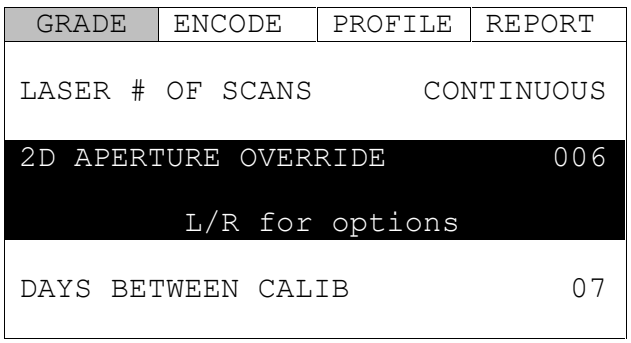
Choices are **Off**, **New**, or **On**. When **New** is selected, the next bar code scanned will be recorded as the "master" bar code. Then any future bar codes scanned where the encoded data does not match the saved Master bar code will result in an error sound and the results will not be displayed on the display. Once a "Master" bar code is saved, the comparison mode can be turned **On** or **Off**.

The Laser number of scans is next:



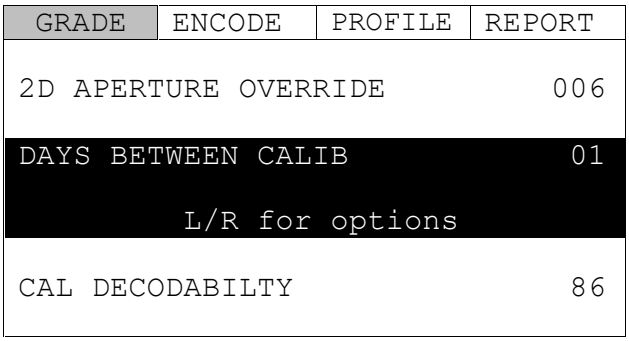
Bar code quality varies throughout the height of a bar code. It is best to take multiple scans from top to bottom and average the scan grades to calculate the overall scan grade. This parameter can be set from **1** to **10** or **Continuous**. *Continuous mode is recommended* In this mode - start with the laser beam above the bar code, slowly drag the laser through the height of the bar code, and release the trigger after passing the bottom of the bar code. The Inspector 5000 will then average the *Decodability* of all scans captured to provide an overall *Decodability* average grade.

The 2D aperture override is next:



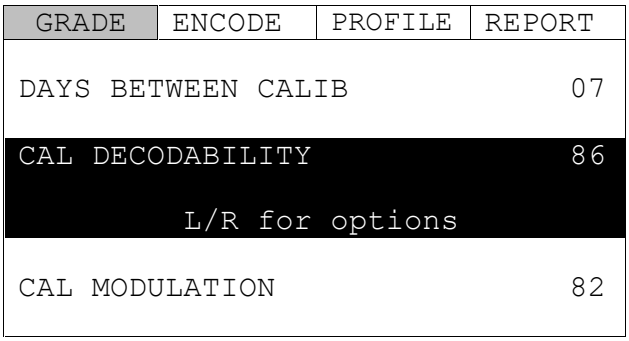
This feature is reserved for future use.

The Days Between Calibration is next:



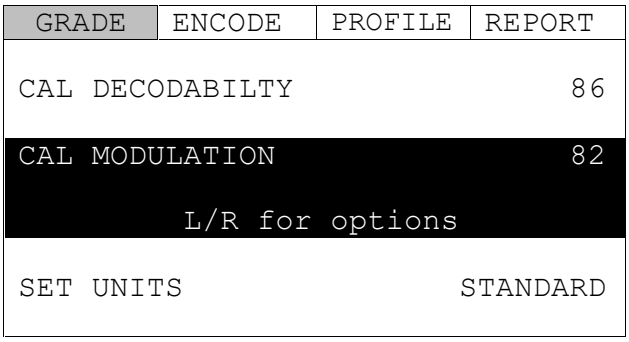
The maximum number of days allowable before the system must be field calibrated (Auto Optic only).

Cal Decodability is next:



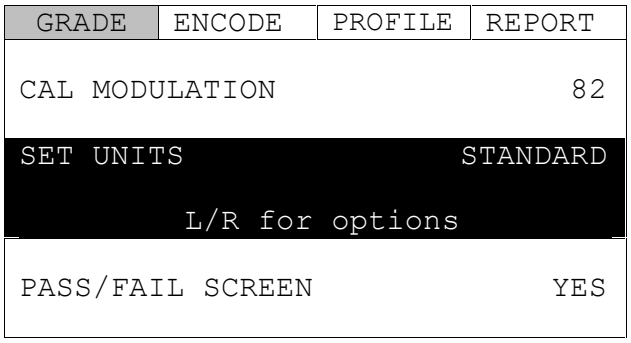
This feature is reserved for future use.

Cal Modulation is next:



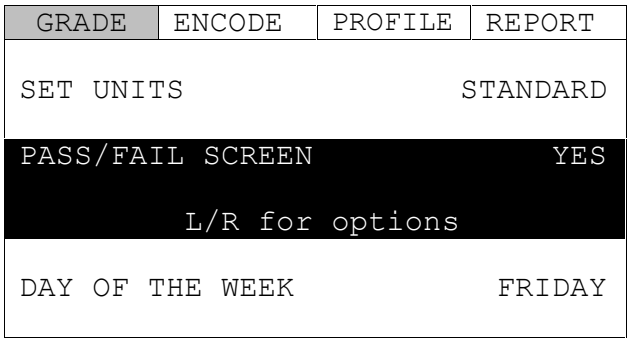
This feature is reserved for future use.

Set Units is next:



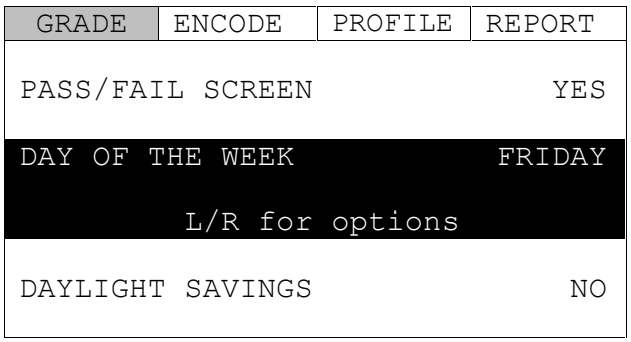
The units used can be either **Standard** or **Metric**. The bar code data will be presented either in inches (in) or in millimeters (mm).

The Pass/Fail Screen is next:



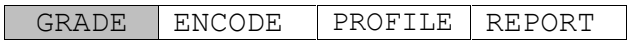
When set to **Yes**, after the completion of a bar code inspection the Pass/Fail screen will be displayed for 5 seconds or until ***Select*** button is pressed. If "Auto Optic Number of Scans" is set to more than 1, the Pass/Fail screen will only be displayed following the last scan.

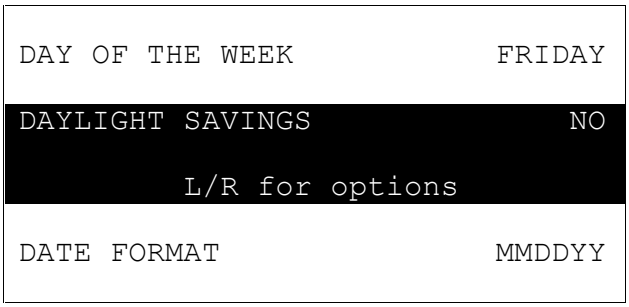
See section *6.3 Pass/Fail Screen* for a description and example of the Pass/Fail Screen.
The Day of the Week is next:



For printed reports, the day of the week is used with the real-time clock.

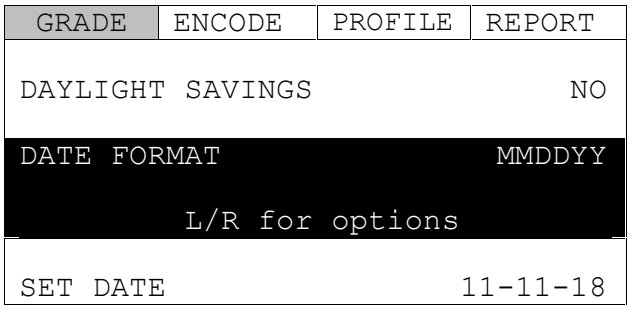
The Daylight Savings is next:





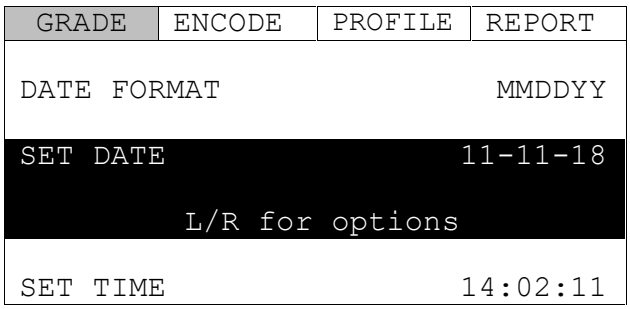
The Inspector 5000 has the ability to automatically change the real-time clock to adjust for daylight savings. Choices are **Yes** or **No**.

The Date Format is next:



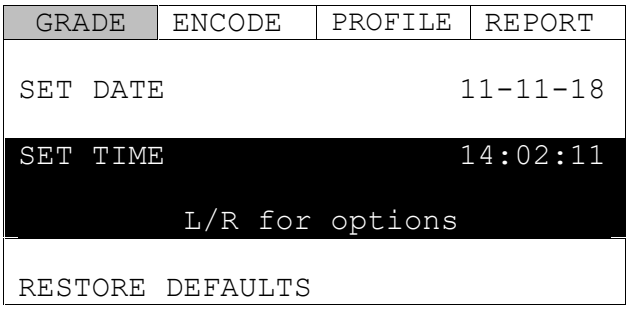
The date format can be either **MMDDYY** or **DDMMYY**. All reports and screens will be formatted to the selected method. However, GS1-128 bar codes with an Application Identifier that contains a date will follow the GS1 standards.

The Set Date is next:



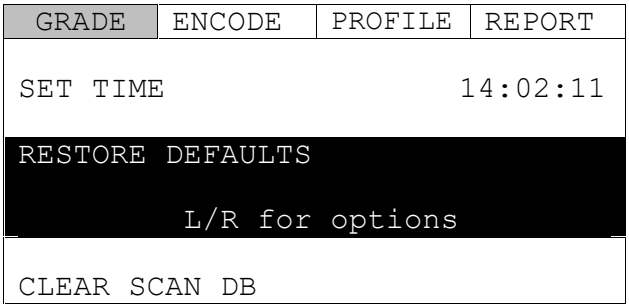
To set the real-time clock date, press the ***Select*** button. The ***Left Arrow*** and ***Right Arrow*** buttons move the cursor and the ***Up Arrow*** and ***Down Arrow*** buttons increase or decrease the field. The format will be based on the previous field *Date Format*.

The Set Time is next:



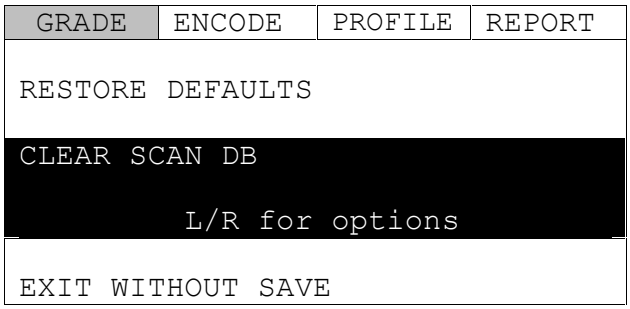
To set the real-time clock time, press the ***Select*** button. The ***Left Arrow*** and ***Right Arrow*** buttons move the cursor and the ***Up Arrow*** and ***Down Arrow*** buttons increase or decrease the field. The format will using the 24 hour clock (14:00:00 is 2:00pm)

The Restore Defaults is next:



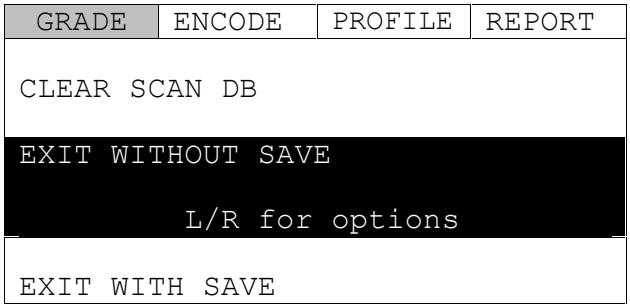
To restore the **Setup** parameters back to the system defaults, press the ***Select*** button. After pressing the ***Select*** button, press ***Up Arrow*** button to cancel or press ***Select*** button again to confirm the default values should be loaded.

The Clear Scan DB is next:



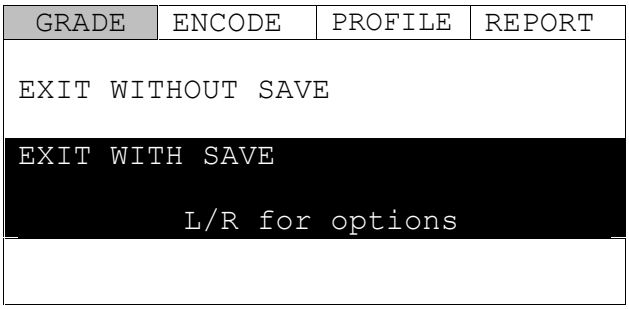
To the delete the database which contains all bar code inspection records, press the ***Select*** button. After pressing the ***Select*** button, press ***Up Arrow*** button to cancel or press ***Select*** button again to confirm the database should be erased.

The Exit Without Saving is next:



To exit the **Setup** screen without saving any changes, press the ***Select*** button. After pressing the ***Select*** button, press ***Up Arrow*** button to cancel and return to the **Setup** screen or press ***Select*** button again to exit the **Setup** screen without saving the changes.

The Exit With Saving is next:



To exit the **Setup** screen and save any changes, press the ***Select*** button. After pressing the ***Select*** button, press ***Up Arrow*** button to cancel and return to the **Setup** screen or press ***Select*** button again to confirm the changes should be saved and to exit the **Setup** screen.

6.0 Scanning Symbols

6.1 Scanning Techniques

- Lay the symbol to be scanned on a flat, non-reflective surface.
- For greatest accuracy scan a symbol more than once, in both directions.
- Begin a scan from the *quiet zone*, two inches *(5 cm)* before the symbol.
  See Appendix E for quiet zone details
- Make sure the scan head is flat against the symbol.
- Move the scan head across the symbol in a smooth motion. A constant speed of 5 to 10 inches *(13-25 cm)* per second is ideal. Scanning too fast will cause the display to read "Please Scan Slower" but faster is ALWAYS better than slower.

6.2 Scanning Results

After a bar code is scanned, the Inspector 5000 will respond with a crisp, chirp *(or beep)* sound and the **Grade** screen will be displayed:

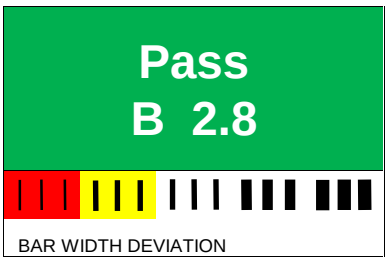
GRADE	ENCODE	PROFILE	REPORT
Symbology			ITF14 Case Code
00005000022251 3			
ISO OVERALL GRADE			3.4/YY/XXX
ANSI OVERALL GRADE			B/YY/XXX
Decodes			1 of 1
Decodability			B 56%
Modulation			A 77%
Symbol Contrast			A 79%
Defects			B 17%
Minimum Edge Contrast		Pass	61%
* Format		Pass	
Ref Decode			A *
Edge Determination		Pass	
Reflectance Minimum		Pass	
Quiet Zone (left)		Pass	11X
Quiet Zone (right)		Pass	10X

YY = indicates the aperture size in mils
XXX = indicates the wavelength *(color)* of the light represented in nanometers

Example: **660/10**
This display indicates that the installed Auto Optic uses Red light at 660nm wavelength and a 10 mil diameter aperture size.

If the **Setup** parameter **Pass/Fail Screen** is set to **Yes**, after the completion of a bar code inspection, the Pass/Fail screen will be displayed for 5 seconds or until ***Select*** button is pressed. If the **Setup** parameter **Auto Optic Number of Scans** is set to more than 1, the Pass/Fail screen will only be displayed following the last scan.

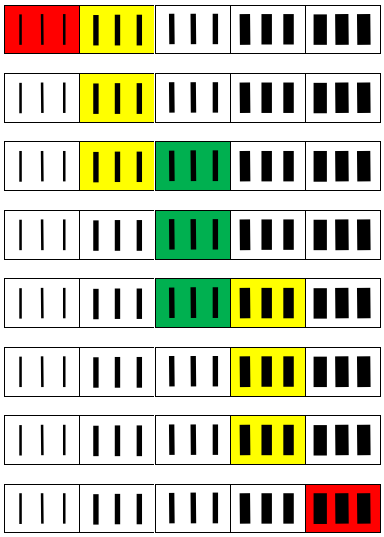
6.3 Pass/Fail Screen:



- The top section:
  - **Pass** with a **Green** background is displayed if the ISO grade is above the **Minimum Passing Grade**
  - **Fail** with a **Red** background is displayed if the ISO grade is below the **Minimum Passing Grade**
  - The ANSI **Letter** grade and ISO **Numeric** grades are displayed
- The bottom section
  - Displays the traditional (non-ISO/ANSI) bar width deviation chart (same information as the 5 LEDs on the Inspector D4000):

Out of tolerance (narrow)

Within -79 to -99%



Within -50 to -78%

Within -22 to -49%

Within +21% to -21%

Within +22 to +49%

Within +50 to +78%

Within +79 to +99

Out of tolerance (wide)

6.4 Multiple Scan Averaging Results

Inspector 5000 Display, when set to multiple scan analysis, will display the following line below the ANSI Overall Grade (highlighted below) showing how many scans have been captured and the total scans to be captured before the Overall Scan Grade is saved to the database:

GRADE	ENCODE	PROFILE	REPORT
Symbology			ITF14 Case Code
00005000022251 3			
ISO OVERALL GRADE			3.4/YY/XXX
ANSI OVERALL GRADE			B/YY/XXX
Decodes			3 of 10
Decodability		B	56%
Modulation		A	77%
Symbol Contrast		A	79%
Defects		B	17%
Minimum Edge Contrast		Pass	61%
* Format		Pass	
Ref Decode		A	*
Edge Determination		Pass	
Reflectance Minimum		Pass	
Quiet Zone (left)		Pass	11X
Quiet Zone (right)		Pass	10X

After the final scan is inspected, the Inspector 5000 will respond with two chirps *(or beep* sounds). The first is for the final scan and the second is for the overall average bar code scan grade.

Note:

See 7.0 Grade Analysis Screen section for details the inspection tests and results

7.0 Grade Analysis Screen

After the symbol is scanned the *Grade Analysis Screen* will be displayed:

GRADE	ENCODE	PROFILE	REPORT
Symbology			ITF14 Case Code
00005000022251 3			
ISO OVERALL GRADE			3.4/YY/XXX
ANSI OVERALL GRADE			B/YY/XXX
Decodes			10 of 10
Decodability			B 56%
Modulation			A 77%
Symbol Contrast			A 79%
Defects			B 17%
Minimum Edge Contrast			Pass 61%
* Format			Pass
Ref Decode			A *
Edge Determination			Pass
Reflectance Minimum			Pass
Quiet Zone (left)			Pass 11X
Quiet Zone (right)			Pass 10X

This first page of the **Grade** screen shows:

- The top section shows the symbology, symbology sub-type, and the encoded bar code data
- The second section provides the ISO and ANSI bar code quality grade, including the aperture size and light wavelength – color coded (Green/Yellow/Red) based on the "Minimum Passing Grade" and "Minimum Marginal Grade" (as selected in the **Setup** screen)
- The third section is the individual bar code inspection results – these parameters will be color coded (Green/Yellow/Red) based on the "Minimum Passing Grade" and "Minimum Marginal Grade" (as selected in the **Setup** screen)

Pressing the ***Down Arrow*** button will display the additional results

GRADE	ENCODE	PROFILE	REPORT
Narrow Bar Width			Press SEL
Ratio			Pass 2.3
Reflectance Minimum			5%
Reflectance Maximum			84%
Global Threshold			45%
Lines of Inspection			10
Average Print Growth			+32%
Maximum Print Growth			+51%
Minimum Print Growth			+22%
Inspection Date			11-11-18
Inspection Time			10:15:01

This second page of the **Grade** screen shows:

- The top section shows the bar code structure information
- The bottom section is the date and time of the bar code inspection

Results explanation

Line 1

Displays the type of bar code inspected:

```
Symbology                    ITF14 Case Code
```

Table 7-A (Code Identifier Descriptions)

LOGMARS	Code 39 symbology
AIAG B-1	Code 39 symbology
AIAG B 3/4/5/10	Code 39 symbology
Code 3 of 9	Code 39 symbology
HIBC 3 of 9	Code 39 symbology
3of9 W/43	Code 39 symbology
I 2 of 5 w/mod10	Interleaved 2 of 5 symbology
Std I2of5	Interleaved 2 of 5 symbology
ITF14 Case Code	Interleaved 2 of 5 symbology
GS1-128	Code 128 symbology
Std 128	Code 128 symbology

X - Y % UPC-A	Uniform Product Code, Ver. A
X - Y % UPCA+2	Uniform Product Code, Ver. A with 2 digit Add
X - Y % UPCA+5	Uniform Product Code, Ver. A with 5 digit Add
X - Y % UPC-E	Uniform Product Code, Ver. E
X - Y % UPCE+2	Uniform Product Code, Ver. E with 2 digit Add
X - Y % UPCE+5	Uniform Product Code, Ver. E with 5 digit Add
X - Y % EAN-13	European Article Number 13 digit
X - Y % EAN13+2	European Article Number 13 digit with 2 digit Add
X - Y % EAN13+5	European Article Number 13 digit with 5 digit Add
X - Y % EAN-8	European Article Number 8 digit
X - Y % EAN8+2	European Article Number 8 digit with 2 digit Add
X - Y % EAN8+5	European Article Number 8 digit with 5 digit Add

Note:

X and Y represent the magnification range selected for UPC/EAN tolerances

Table 7-B (Abbreviated Code Identifier Descriptions)

Identifier	Symbology Type
B-1	Code 39; B-1 sub-specification for AIAG
B345	Code 39; B3, 4, 5, or 10 sub-specification for AIAG
LOG	Code 39; LOGMARS sub-specification
HIBC	Code 39; HIBC sub-specification
3 OF 9	Code 39; Traditional ISO/ANSI sub-specification
39+C	Code 39; with Mod 43
25+C	Interleaved 2 of 5 with Mod 10
I25	Interleaved 2 of 5
CC	Interleaved 2 of 5 ITF-14 sub-specification
GS1	GS1-128 Code 128
C128	Code 128
UPCA	UPC version A
UA+2	UPC version A plus 2 digit addendum
UA+5	UPC version A plus 5 digit addendum
UPCE	UPC version E
UE+2	UPC version E plus 2 digit addendum
UE+5	UPC version E plus 5 digit addendum
EAN8	EAN 8 character
E8+2	EAN 8 plus 2 digit addendum
E8+5	EAN 8 plus 5 digit addendum
EN13	EAN 13 character
13+2	EAN 13 plus 2 digit addendum
13+5	EAN 13 plus 5 digit addendum

Line 2

Displays the data encoded in the bar code:

```
0000500002225 1
```

Note:

If more than 32 characters are encoded, additional characters will wrap to the next row of the display

Line 3
Displays the ISO numeric grade, the aperture, and the wavelength:

ISO OVERALL GRADE	3.4/YY/XXX

Note: *YY is the aperture and XXX is the wavelength*

Line 4
Displays the ANSI letter grade, the aperture, and the wavelength:

ANSI OVERALL GRADE	B/YY/XXX

Note: *YY is the aperture and XXX is the wavelength*

Line 5
Displays the number of scans for the current bar code that have been captured and the total number of scans (as selected in the **Setup** screen) necessary to calculate the Overall Scan Grade:

Decodes	3 of 10

Line 6
Displays the ISO/ANSI *Decodability* letter grade and percentage result:

Decodability	B	56%

Line 7
Displays the ISO/ANSI *Modulation* letter grade and percentage result:

Modulation	A	77%

Line 8
Displays the ISO/ANSI *Symbol Contrast* letter grade and percentage result:

Symbol Contrast	A	79%

Line 9
Displays the ISO/ANSI *Defects* letter grade and percentage result:

Defects	B	17%

Line 10
Displays the ISO/ANSI *Minimum Edge Contrast* Pass/Fail result and percentage result:

Minimum Edge Contrast	Pass	61%

Line 11
Displays the ISO/ANSI *Symbology Format* Pass/Fail result (as determined by the Check digit, Sub-Symbology and Industry specifications/standards, Ratio, and Inter-character Gap):

Format *	Pass

Line 12
Displays the ISO/ANSI *Reference Decode* Pass/Fail result, which includes testing for the Global threshold, Character encodation, Start and stop patterns, Check digits(s), *Quiet zones* and Inter-character gaps:

Ref Decode	Pass

Line 13
Displays the ISO/ANSI *Edge Determination* Pass/Fail result:

```
Edge Determination                Pass
```

Line 14
Displays the ISO/ANSI *Reflectance Minimum* Pass/Fail result (the percentage result is displayed on Line 19 with the *Reflectance Maximum* result on Line 20):

```
Reflectance Minimum               Pass
```

Line 15
Displays the ISO/ANSI *Left Quiet Zone* Pass/Fail result and the size of the *quiet zone (the minimum quiet zone size varies by Symbology and Symbology Specification)*:

```
Quiet Zone (left)                 Pass    11X
```

Line 16
Displays the ISO/ANSI *Right Quiet Zone* Pass/Fail result and the size of the *quiet zone (the minimum quiet zone size varies by Symbology and Symbology Specification)*:

```
Quiet Zone (right)                Pass    10X
```

This is the end of Page 1 Section 3 results (ISO/ANSI Bar Code Quality Parameters)

Line 17
Displays the calculated *Narrow Bar Width* (NBW or X-dim) by pressing the ***Select*** button:

```
Narrow Bar Width                  Press SEL
```

With the Narrow Bar Width screen displayed, use a ruler to measure the distance from the left most bar to the right most bar and enter this value into the *Barcode Width* field. The Inspector 5000 will automatically determine and display the Narrow Bar Width (or Magnification, depending the Symbology). Press the ***Select*** button to return to the *Grading* screen.

Line 18
Displays the *Ratio* Pass/Fail result and the numeric ratio of the Wide to Narrow bar widths *(the acceptable ratio values vary by Symbology and Symbology Specification, see Table* B-2*)*:

```
Ratio                             Pass 2.3
```

Note: *The Ratio field will not be displayed if the ratio is not applicable (UPC, EAN, or Code 128)*
Line 19
Displays the *Reflectance Minimum* percentage:

```
Reflectance Minimum                 5%
```

Line 20
Displays the *Reflectance Maximum* percentage:

```
Reflectance Maximum                84%
```

Line 21
Displays the *Global Threshold* percentage, which is the threshold which determines what is a *space* and what is a *bar* in the bar code. It is calculated as the mid-point between *Reflectance Minimum* and *Reflectance Maximum*
((Reflectance Maximum - Reflectance Minimum)/2) + Reflectance Minimum):

```
Global Threshold                          45%
```

Line 22
Displays the *Lines of Inspection*, with the Auto Optic this total number of scans of the current bar code:

```
Lines of Inspection                       10
```

Line 23
Displays the *Average Print Growth* of all of the bars in the bar code. This value is the deviation from the ideal bar width for each bar in the bar code with all of the bar deviations averaged together:

```
Average Print Growth                     +32%
```

Line 24
Displays the *Maximum Print Growth* of all of the bars in the bar code. This value is the deviation from the ideal bar width for the single bar with the largest print growth in the bar code:

```
Maximum Print Growth                     +51%
```

Line 25
Displays the *Minimum Print Growth* of all of the bars in the bar code. This value is the deviation from the ideal bar width for the single bar with the smallest print growth in the bar code:

```
Minimum Print Growth                     +22%
```

This is the end of Page 2 Top Section results (Bar code structure information)

Line 26
Displays the *Inspection Date* of when the last bar code inspection scan was captured – MMDDYY or DDMMYY is displayed as selected in the Date Format parameter in the **Setup** screen:

```
Inspection Date                       11-11-18
```

Line 27
Displays the *Inspection Time* of when the last bar code inspection scan was captured:

```
Inspection Time                       11-11-18
```

This is the end of Page 2 Bottom Section results (Time and Date information)

8.0 Encode Analysis Screen

After the symbol is scanned, the *Grade Analysis Screen* will be displayed. By pressing the ***Right Arrow*** button the *Encode Analysis* screen will be displayed.

Encode analysis screen layout:

- The top section, left shows encoded bar code data
- The top section, middle shows a brief explanation of the encoded bar code data
- The top section, right shows either a *P* or *F* for Pass/Fail for each line
- The bottom section shows a detailed explanation of the encoded bar code data and explains any errors

Acceptable GS1-128 Encode Analysis Screen

GRADE	ENCODE	PROFILE	REPORT
Start C		Start Subset C	P
FNC1		Function 1 Char	P
01		AI(01)	P
0867530912334		GTIN	P
1		GTIN Chk Digit	P
10		AI(10)	P
1234ABCD		Batch/Lot #	P
FNC1		Function 1 Char	P
(More Results? Up/Down Arrows			

Start in Subset C

Start Pattern in Subset C
Acceptable

Pressing the ***Down Arrow*** button will display any remaining information for the GS1-128 bar code inspected.

GRADE	ENCODE	PROFILE	REPORT
21		AI(21)	P
008411		Serial Number	P
1		C128 Check Digit	P
Stop		Stop Pattern	P

(More Results? Up/Down Arrows

Stop Pattern

Stop Pattern
Acceptable

Failure GS1-128 Encode Analysis Screen

If an Error occurs, the cursor will highlight in red the first error and the *bottom section* will provide a detailed explanation of the error.

GRADE	ENCODE	PROFILE	REPORT
FNC1		Function 1 Char	P
Start C		Start Subset C	P
01		AI(01)	P
0867530912334		GTIN	
3		GTIN Chk Digit	F
~		C128 Check Digit	P
Stop		Stop Pattern	P

(More Results? Up/Down Arrows

Check Digit: 3 Expected: 1

GS1-128
Invalid Character Expected: 1

Failure UPC-A Encode Analysis Screen

GRADE	ENCODE	PROFILE	REPORT
1		Reserved	P
2345678902		GTIN	P
2		Check Digit	F

(More Results? Up/Down Arrows

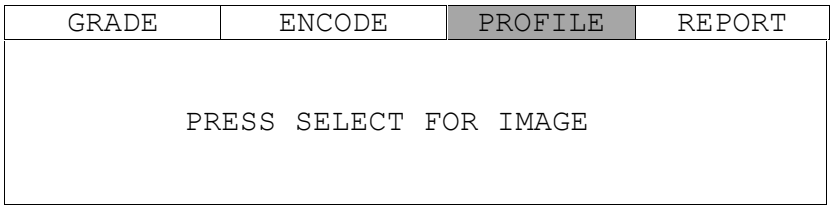
Check Digit: 2 Expected: 9

Standard UPC/EAN Item
Invalid Character Expected: 9

If an Error occurs, the cursor will jump to the first error and the *bottom section* will provide a detailed explanation of the error.

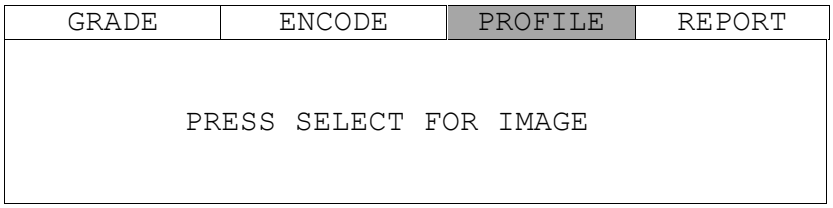
9.0 Profile Analysis Screen

An example of the Profile Analysis Screen:



Press and hold ***Print*** button and press ***Select*** button at the same time to scroll through the three **Profile** views – Analog (with color coded indications for *Decodability*, *Modulation*, and Defects), Grey-scale Image, and Black/White Image

An example of the Analog profile Analysis Screen:



The ***Up Arrow*** and ***Down Arrow*** buttons zoom in and zoom out
The ***Left Arrow*** and ***Right Arrow*** buttons move the focused area left and right

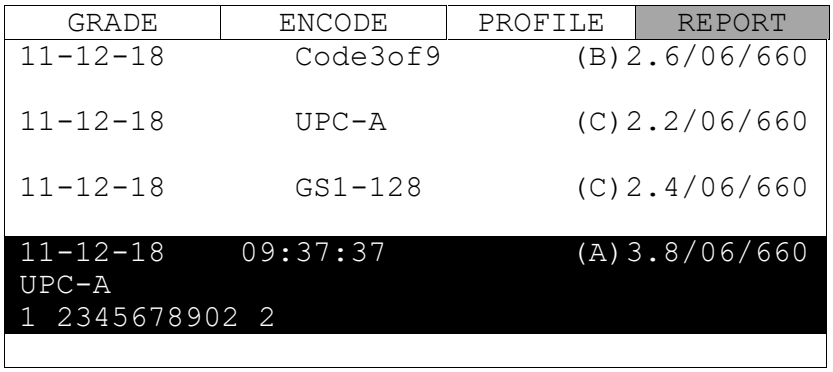
- The Red line identifies the worst case of *Defects*
- The Yellow line identifies the worst case of *Modulation*
- The Magenta line identifies the worst case of *Decodability*

10.0 Viewing Saved Inspection Reports

The Inspector 5000 can store in memory over 1,000 bar code inspection results.

When the **Report** screen is selected, the last four inspection results will be displayed. The last inspection result will be highlighted and will show the Date, Time, Grade, Symbology, and Encoded data.

Example of the Report (Database) Screen:



The ***Up Arrow*** button is used to move the cursor to view older inspection reports. The ***Down Arrow*** button will move the cursor to newer inspection reports.

To view the *Grading* and *Encodation* information for a past inspection result, highlight the bar code inspection report to be viewed and press ***Select*** button. The report will be loaded and the **Grade** screen will be displayed. The ***Right Arrow*** button will display the **Encode** information for the highlighted inspection report. The **Profile** is not available.

Example of the Report (Database) Screen after scrolling to older reports:

GRADE	ENCODE	PROFILE	REPORT
11-11-18	Code3of9	(B)	2.6/06/660
11-11-18	UPC-A	(C)	2.2/06/660
11-11-18	Code 128	(C)	2.4/06/660
11-11-18 13:41:12		(A)	3.8/06/660
UPC-A 1 2345678902 2			
11-12-18	Code3of9	(B)	2.6/06/660
11-12-18	UPC-A	(C)	2.2/06/660
11-12-18	GS1-128	(C)	2.6/06/660
11-12-18	GS1-128	(C)	2.1/06/660

11.0 Connect to other Devices

Connect to Computer

You may store and print the analysis *(and scan reflectance profile)* on a Windows PC computer using the *optional* VCIR software package.

Your Inspector 5000 Auto Optic will connect to a computer with a USB-to-Serial adapter or directly to an RS-232 port serial interface cable

Connect to Printer

Your Inspector 5000 will connect to an RJS TP140A printer with a serial interface cable.

Contact RJS to order either the VCIR software or printer:

RJS Technologies
701 Decatur Ave North, Suite 107
Minneapolis, MN 55427
+1 (763) 746-8034
Sales@rjs1.com

Appendix A (ISO/ANSI Parameter Analysis)

Table A-1 (Numeric to Letter Grade Conversion)

Numeric range	Letter grade
3.5 to 4.0	A
2.5 to <3.5	B
1.5 to <2.5	C
0.5 to <1.5	D
below 0.5	F

Reference Decode

This parameter can be graded 4.0 (A) ***or*** 0.0 (F)

- If the *Reference Decode* parameter is 0.0 (F), then the overall symbol grade is also 0.0 (F) *- regardless of the grade of any other parameter*.
- If the *Reference Decode* parameter is 4.0 (A), then the overall symbol grade is determined by the lowest of the other parameter grades.

Note:

The Inspector 5000 decodes each symbology with a more aggressive algorithm. This enables many symbols to be scanned and decoded even though the Reference Decode grade is a 0.0 (F)

The overall symbol grade is averaged for the *Reference Decode* parameter.

Example:

If two scans are averaged and one passes reference decode and the other fails reference decode, (assuming all other parameters scan 4.0 (A)), the average would be a 2.0 (C), which is the average of 4.0 (A) and 0.0 (F).The average grade for the reference decode parameter would be 0.0 (F) however as a warning that at least one scan failed this parameter.

Edge Determination

This parameter can be graded 4.0 (A) ***or*** 0.0 (F)

When a symbol contains an *edge determination* failure *(an element does not cross the global threshold) all* other parameters cannot be analyzed.

- In the case of an *edge determination* failure, *symbol contrast* calculations are valid
- In the case of an *edge determination* failure, the Inspector 5000 will force the *Decodability* grade to 00% *(a 0.0 / F grade)*
- Other affected grades will be calculated only for that portion of the symbol which was scanned up to the point of the *edge determination* failure

Reflectance Minimum

This parameter can be graded 4.0 (A) ***or*** 0.0 (F)

The reflectance value of the “lightest” space must be at least twice as great as the reflectance value of the “darkest” bar; otherwise, the grade will be 0.0 (F).

Edge Contrast Minimum

This parameter can be graded 4.0 (A) ***or*** 0.0 (F)

Edge contrast is the difference of the reflectance values of the dark and light components of an edge.

Each element of a bar code has two edges which go from dark to light. Therefore, each edge has a dark and light reflectance value component.

The parameter grade is determined by:

1. Calculating the edge contrast of every element edge in a symbol
2. Finding the lowest value *(minimum edge contrast)*
3. Comparing it to a fixed threshold in the specification *(15%)*

If the value is at least as great at the threshold, the grade is 4.0 (A), otherwise the grade is 0.0 (F).

Modulation

This parameter can be graded 4.0 ***to*** 0.0 (A ***to*** F)

Modulation grade is based on the relationship between the *minimum edge contrast* and the *symbol contrast*.

Ideally, the edge contrast should be equal to *symbol contrast*, but as an aperture size approaches an element size the amplitude of the signal received will decrease and the edge contrast will decrease.

The greater the difference between *minimum edge contrast* and *symbol contrast*, the lower the grade.

Note:

Aperture size has the greatest affect on Modulation. The substrate material can also have a major affect on Modulation

Defects

This parameter can be graded 4.0 ***to*** 0.0 (A ***to*** F)

Defects are irregularities in bars, spaces and *quiet zones*.

For example, a dark spot in a space could cause a low enough reflectance to be mistaken for a bar, and the extra bar would cause a decode error.

The defect grade is determined by a relationship between the largest defect in the symbol and the *symbol contrast (the smaller the defect, the better the grade)*.

The Inspector 5000 incorporates a feature that trims reflectance data gathered during a scan to approximately 10 times the X dimension *(5X after a UPC/EAN addendum)*. These areas, on either side of the bar-code, are assumed to be *quiet zones* and are included in the analysis.

A graphic object or text in the quiet zone will produce a 0.0 or F grade – This indicates a *quiet zone* that is too narrow. We recommend that you scan in both directions to make maximum use of this feature.

Note:

In general, when a small aperture is used to analyze very wide elements the result will be larger defects results

Decodability

This parameter can be graded 4.0 ***to*** 0.0 (A ***to*** F)

The *Decodability* grade indicates the amount of error in the width of the most deviant element in the symbol *(the lower the deviation, the higher the grade)*.

- Each symbology type has a specified method for calculating *Decodability* but the basic idea is the same for all symbologies.
- Each element size in a bar code symbol should be consistent across the symbol. In the case of Code 39 there are two element widths needed to produce a symbol, while a Code 128 has four element widths
- For optimum scanning, each narrow element *(bar or space)* should be the same dimension, and each wide element *(bar or space)* should be the same dimension.

Traditional Bar Analysis Tolerance

GRADE	ENCODE	PROFILE	REPORT
Narrow Bar Width			Press SEL
Ratio			Pass 2.3
Reflectance Minimum			5%
Reflectance Maximum			84%
Global Threshold			45%
Lines of Inspection			1
Average Print Growth			+32%
Maximum Print Growth			+51%
Minimum Print Growth			+22%
Inspection Date			11-11-18
Inspection Time			10:15:01

On the Grading screen, the traditional bar analysis tolerance results are shown as Average, Maximum, and Minimum Print Growth. Print Growth results provide information about the bars being narrow or wide.

Based on bar reflectance crossing the Global Threshold, the results represent the total percentage width deviation that the bars in a symbol have when compared to the maximum traditional dimensional specifications.

The results are normalized to plus or minus 100% tolerance with no specific dimensions. Higher density symbols such as 80% UPC may indicate larger ranges of deviation than low density symbols such as ITF-14 case code.

Appendix B (Symbology Analysis)

Symbology Analysis Parameters

Table B-1 shows error messages that will be displayed for each parameter type checked by the Inspector 5000.

Table B-1 (Parameter/Error Message)

Parameter	Data Analysis Message
Ratio	Warning Ratio
Ratio <2 or more >3.2	Rejected Ratio
Inter-Character Gap (ICG)	Bad ICG
Invalid Data Character	Invalid format
Too Few Characters	Invalid format
I 2 of 5 Case code not 14 or 18 characters	Invalid format
Code 128 GS1 Case code not 14 or 18 characters or not all numeric characters	Invalid format
Mod Check Digits	Bad Mod. Check
PCS	Rejected PCS
Bar Width Deviation Edge of Range (Wide)	Warning Wide
Bar Width Deviation Edge of Range (Narrow)	Warning Narrow
Bar Width Deviation Out of Range (Wide)	Rejected Wide
Bar Width Deviation Out of Range (Narrow)	Rejected Narrow
Addendum Parity (UPC/EAN)	Invalid Format
ISO/ANSI Decodability	Warn D/bility (DCD, in initial Pass/Fail screen)
Object in Quiet Zone	Defects F, 50% or greater
Quiet Zone Too Small	Warning QZ/SS
<Fnc1> with Standard C128	Format Warning
No <Fnc1> with GS1 Selected	Warn Missing F1

Table B-2 (Parameters Checked by Symbology)

Symbology	Ratio 1	Ratio 2	ICG	Data Character	Mod Check	Tolerance
AIAG B-1	2.2-3.2	2.0-3.2	.5X-8X	STD CODE 39	N/A	((12R-8)/81)X
AIAG B-3 B-4 B-5	2.8-3.2	2.8-3.2	.5X-8X	$/+% Not Allowed	N/A	((12R-8)/81)X
LOGMARS	2.2-3.0	2.0-3.0	.5X-8X	STD CODE 39	N/A	((12R-8)/81)X
CODE 3 OF 9	2.2-3.0	2.0-3.0	.5X-8X	STD CODE 39	N/A	((12R-8)/81)X
3 OF 9 W/43	2.2-3.0	2.0-3.0	.5X-8X	STD CODE 39 4 CHARS Min	MOD 43	((12R-8)/81)X
HIBC 3 OF 9	2.2-3.0	2.0-3.0	.5X-8X	STD CODE 39 Min 4 CHARS 1ST. = "+"	MOD 43	((12R-8)/81)X
I 2 OF 5	2.2-3.0	2.0-3.0	N/A	Even number CHARS	N/A	((18R-21)/80)X
ITF-14 CASE CODE	2.3-3.0	2.3-3.0	N/A	14 Data Chars Only	MOD 10	((18R-21)/80)X
ITF-18 CASE CODE	2.3-3.0	2.3-3.0	N/A	18 Data Chars Only	MOD 10	((18R-21)/80)X
I 2 OF 5 W/CHECK DIGIT	2.2-3.0	2.0-3.0	N/A	Min 4 Data Chars	MOD 10	((18R-21)/80)X
CODABAR	2.2-3.0	2.0-3.0	.5X-8X	STD CODABAR	N/A	((5P-8)/20)X
CODE 128	N/A	N/A	N/A	N/A	MOD 103	.35X
GS1-128	N/A	N/A	N/A	<Fnc1> with AI 00 and 18 Data Char Or <Fnc1> with AI 01 and 14 data characters Application Mod Check	Mod 10 Mod 103	.35X
UPC/EAN	N/A	N/A	N/A	N/A	MOD 10	See Note 2

Note1:

- *Ratio 1 column, applies to Auto Optic 3,5,6,and 10 mil apertures*
- *Ratio 2 column, applies to Auto Optic 20 mil aperture*
- *X = X-dimension/NBW*
- *R = Ratio in the calculations*
- *Tolerance is expressed as a fraction of the X-dimension*

Note 2:

UPC/EAN tolerances:

80 - 89%	=	*0.14X*
90 - 115%	=	*0.30X*
116 - 150%	=	*0.34X*
151 - 200%	=	*0.38X*

Appendix C (ISO/ANSI Decodability)

ISO/ANSI Decodability Calculations

There is a specified method for calculating *Decodability* for each symbology. But the method is generally the same for all. Each element width in a bar code symbol should be consistent across the symbol.

In the case of Code 39, two element widths are needed to produce a symbol. For optimum scanning, each narrow element, whether a bar or space, should have the same width dimension. Each wide element should have the same width dimension.

The *Decodability* grade indicates the amount of tolerance remaining in the width of the most deviant element in the symbol (the more tolerance remaining, the higher the grade). Grade 4.0 or "A" is the highest grade and grade 0.0 or "F" is lowest. (Even grade 0.0 or "F" may be decodable).

The grade is displayed in both its calculated numeric grade (ISO15416) and in its Letter grade (ANSI X3.182-1990) equivalent.

ISO/IEC 15416:2016(E) implemented an interpolation method as a way of reducing meaningless grade level fluctuations when small changes in measurements cause a grade to transition between grade levels.

Table C-1 (Decodability percentage ranges to Numeric and Letter Grades)

Min	Max	Numeric	Letter
62.00	100	4.0	A
60.80	61.99	3.9	A
59.60	60.79	3.8	A
58.40	59.59	3.7	A
57.20	58.39	3.6	A
56.00	57.19	3.5	A
54.80	55.99	3.4	B
53.60	54.79	3.3	B
52.40	53.59	3.2	B
51.20	52.39	3.1	B
50.00	51.19	3.0	B
48.70	49.99	2.9	B
47.40	48.69	2.8	B
46.10	47.39	2.7	B
44.80	46.09	2.6	B
43.50	44.79	2.5	B
42.20	43.49	2.4	C
40.90	42.19	2.3	C
39.60	40.89	2.2	C
38.30	39.59	2.1	C
37.00	38.29	2.0	C
35.80	36.99	1.9	C
34.60	35.79	1.8	C
33.40	34.59	1.7	C
32.20	33.39	1.6	C
31.00	32.19	1.5	C
29.80	30.99	1.4	D
28.60	29.79	1.3	D
27.40	28.59	1.2	D
26.20	27.39	1.1	D
25.00	26.19	1.0	D
22.50	24.99	0.9	D
20.00	22.49	0.8	D
17.50	19.99	0.7	D
15.00	17.49	0.6	D
12.50	14.99	0.5	D
10.00	12.49	0.4	F
7.50	9.99	0.3	F
5.00	7.49	0.2	F
2.50	4.99	0.1	F
0.00	2.49	0.0	F

Appendix D (Reflectance parameter grading)

Table D-1 (Modulation percentage ranges to Numeric and Letter Grades)

Min	Max	Numeric	Letter
70	100	4.0	A
69	69.99	3.9	A
68	68.99	3.8	A
67	67.99	3.7	A
66	66.99	3.6	A
65	65.99	3.5	A
64	64.99	3.4	B
63	63.99	3.3	B
62	62.99	3.2	B
61	61.99	3.1	B
60	60.99	3.0	B
59	59.99	2.9	B
58	58.99	2.8	B
57	57.99	2.7	B
56	56.99	2.6	B
55	55.99	2.5	B
54	54.99	2.4	C
53	53.99	2.3	C
52	52.99	2.2	C
51	51.99	2.1	C
50	50.99	2.0	C
49	49.99	1.9	C
48	48.99	1.8	C
47	47.99	1.7	C
46	46.99	1.6	C
45	45.99	1.5	C
44	44.99	1.4	D
43	43.99	1.3	D
42	42.99	1.2	D
41	41.99	1.1	D
40	40.99	1.0	D
36	39.99	0.9	D
32	35.99	0.8	D
28	31.99	0.7	D
24	27.99	0.6	D
20	23.99	0.5	D
16	19.99	0.4	F
12	15.99	0.3	F
8	11.99	0.2	F
4	7.99	0.1	F
0	3.99	0.0	F

Table D-2 (Symbol Contrast percentage ranges to Numeric and Letter Grades)

Min	Max	Numeric	Letter
70	100	4.0	A
69	69.99	3.9	A
67	68.99	3.8	A
66	66.99	3.7	A
64	65.99	3.6	A
63	63.99	3.5	A
61	62.99	3.4	B
60	60.99	3.3	B
58	59.99	3.2	B
57	57.99	3.1	B
55	56.99	3.0	B
54	54.99	2.9	B
52	53.99	2.8	B
51	51.99	2.7	B
49	50.99	2.6	B
48	48.99	2.5	B
46	47.99	2.4	C

45	45.99	2.3	C
43	44.99	2.2	C
42	42.99	2.1	C
40	41.99	2.0	C
38	39.99	1.9	C
36	37.99	1.8	C
34	35.99	1.7	C
32	33.99	1.6	C
30	31.99	1.5	C
28	29.99	1.4	D
26	27.99	1.3	D
24	25.99	1.2	D
22	23.99	1.1	D
20	21.99	1.0	D
18	19.99	0.9	D
16	17.99	0.8	D
14	15.99	0.7	D
12	13.99	0.6	D
10	11.99	0.5	D
8	9.99	0.4	F
6	7.99	0.3	F
4	5.99	0.2	F
2	3.99	0.1	F
0	1.99	0.0	F

Table D-3 (Defects percentage ranges to Numeric and Letter Grades)

Min	Max	Numeric	Letter
0	15.00	4.0	A
15.01	15.50	3.9	A
15.51	16.00	3.8	A
16.01	16.50	3.7	A
16.51	17.00	3.6	A
17.01	17.50	3.5	A
17.51	18.00	3.4	B
18.01	18.50	3.3	B
18.51	19.00	3.2	B
19.01	19.50	3.1	B
19.51	20.00	3.0	B
20.01	20.50	2.9	B
20.51	21.00	2.8	B
21.01	21.50	2.7	B
21.51	22.00	2.6	B
22.01	22.50	2.5	B
22.51	23.00	2.4	C
23.01	23.50	2.3	C
23.51	24.00	2.2	C
24.01	24.50	2.1	C
24.51	25.00	2.0	C
25.01	25.50	1.9	C
25.51	26.00	1.8	C
26.01	26.50	1.7	C
26.51	27.00	1.6	C
27.01	27.50	1.5	C
27.51	27.99	1.4	D
28.00	28.49	1.3	D
28.50	28.99	1.2	D
29.00	29.49	1.1	D
29.50	30.00	1.0	D
30.01	100.00	0.0	F

ISO/IEC 15416:2016(E) established that the Defects grade shall be 0.0 for all values greater than 30%.

Appendix E (Quiet Zone Analysis)

Quiet Zone Analysis

The Inspector 5000 trims data gathered during a scan to approximately 10 times the X dimension on each side of a bar code for all symbologies except UPC and EAN. The areas are assumed to be *quiet zones* and are included in the symbol analysis. If a low reflectance object is detected in these areas, an Overall Symbol Grade of F will result. The *Defects* calculation will be the cause of the F grade and typically be a value greater than 50%.

Symbols should be scanned in both directions since the Inspector 5000 is designed to be bi-directional.

Quiet Zone Analysis for UPC and EAN symbols are described in the following tables. In cases where an addendum is included in the bar code, an addendum gap analysis is also performed.

Table F-1 (Acceptable Parameters - Symbols Without Addendums)

Symbology	Leading QZ	Trailing QZ
UPC-A	9X Minimum	9X Minimum
UPC-E	9X Minimum	7X Minimum
EAN-13	11X Minimum	7X Minimum
EAN-8	7X Minimum	7X Minimum

Table F-2 (Acceptable Parameters - Symbols With Addendums)

Symbology	Leading QZ	Trailing QZ	GAP Size
UPC-A	9X Minimum	5X Minimum	9 - 12X
UPC-3	9X Minimum	5X Minimum	9 - 12X
EAN-13	11X Minimum	5X Minimum	7 - 10X
EAN-8	7X Minimum	5X Minimum	7 - 10X

Appendix F (Code 128)

Code 128

Code 128 can encode all the characters currently encodable in the various code formats presently in existence. This includes: All ASCII alphanumeric characters *(numbers, letters, special characters, control characters in the 128 character set and the distinction of the 3 subsets, A, B and C)*.

Code subset A includes the standard alphanumeric *(upper case only)* keyboard characters plus control and special characters.

Code subset B includes all the standard alphanumeric keyboard characters and special characters *(upper and lower case)*.

Code subset C includes a set of 100 digit pairs from 00 to 99 inclusive, allowing two numeric digits per symbol, plus special characters.

The last 7 characters in Subsets A and B *(96 - 102)* and the last 3 characters in Subset C *(100 - 102)* are special characters that are specific to the scanning device.

Code 128 also offers the flexibility to "shift" to other subsets in order to combine the "unique" features into one condensed bar code.

As indicated before, each of the 3 subsets have "unique" features:

- **Subset A** allows for encodation of control codes but not lower case alpha characters
- **Subset B** allows for lower case alpha characters but not control codes
- **Subset C** allows for only numeric data in a compressed format

Refer to Code 128 tables (subsets) on the following pages.

Note:

On the following three tables (F-1, F-2, and F-3):

- *The top grid (unshaded) displays the Code 128 character set*
- *The bottom grid (shaded) displays the data on the Inspector's LCD screen*

Note:

If the bottom grid (shaded) displays two characters (one on top of the other) this is the two rows that will be shown on the Inspector's LCD screen

Table F-1 (Code 128 — Subset A)

Character Set
LCD Screen

SP	!	"	#	$	%	&	'	(	)
	!	"	#	$	%	&	'	(	)
*	+	,	-	.	/	0	1	2	3
*	+	,	-	.	/	0	1	2	3
4	5	6	7	8	9	:	;	<	=
4	5	6	7	8	9	:	;	<	=
>	?	@	A	B	C	D	E	F	G
>	?	@	A	B	C	D	E	F	G
H	I	J	K	L	M	N	O	P	Q
H	I	J	K	L	M	N	O	P	Q
R	S	T	U	V	W	X	Y	Z	[
R	S	T	U	V	W	X	Y	Z	[
\	]	^	_	NUL	SOH	STX	ETX	EOT	ENQ
¥	]	^	_	N L	S H	S X	E X	E T	E Q
ACK	BEL	BS	HT	LF	VT	FF	CR	SO	SI
A K	B L	B S	H T	L F	V T	F F	C R	S O	S I
DLE	DC1	DC2	DC3	DC4	NAK	SYN	ETB	CAN	EM
D E	D 1	D 2	D 3	D 4	N K	S N	E B	C N	E M
SUB	ESC	GS	RS	US	FNC3	FNC2	Shft	Code C	Code B
S B	E C	G S	R S	U S	F 3	F 2	S T	C C	C B

FNC4	FNC1	Start A	Start B	Start C	Stop
F 4	F 1	* A	* B	* C	* *

Table F-2 (Code 128 — Subset B)

Character Set
LCD Screen

SP	!	“	#	$	%	&	‘	(	)
	!	“	#	$	%	&	‘	(	)
*	+	,	-	.	/	0	1	2	3
*	+	,	-	.	/	0	1	2	3
4	5	6	7	8	9	:	;	<	=
4	5	6	7	8	9	:	;	<	=
>	?	@	A	B	C	D	E	F	G
>	?	@	A	B	C	D	E	F	G
H	I	J	K	L	M	N	O	P	Q
H	I	J	K	L	M	N	O	P	Q
R	S	T	U	V	W	X	Y	Z	[
R	S	T	U	V	W	X	Y	Z	[
\	]	^	a	b	c	d	e	f	g
¥	]	^	a	b	c	d	e	f	g
h	i	j	k	l	m	n	o	p	q
h	i	j	k	l	m	n	o	p	q
r	s	t	u	v	w	x	y	z	{
r	s	t	u	v	w	x	y	z	{

|	}	~	DEL	FNC3	FNC2	Shft	Code C	FNC4	Code A
|	}	→	DEL	FNC3	FNC2	SHFT	CODE C	FNC4	CODE A

FNC1	Start A	Start B	Start C	Stop
F1	* A	* B	* C	* *

Table F-3 (Code 128 — Subset C)

Character Set
LCD Screen

00	01	02	03	04	05	06	07	08	09
0	0	0	0	0	0	0	0	0	0
0	1	2	3	4	5	6	7	8	9

10	11	12	13	14	15	16	17	18	19
1	1	1	1	1	1	1	1	1	1
0	1	2	3	4	5	6	7	8	9

20	21	22	23	24	25	26	27	28	29
2	2	2	2	2	2	2	2	2	2
0	1	2	3	4	5	6	7	8	9

30	31	32	33	34	35	36	37	38	39
3	3	3	3	3	3	3	3	3	3
0	1	2	3	4	5	6	7	8	9

40	41	42	43	44	45	46	47	48	49
4	4	4	4	4	4	4	4	4	4
0	1	2	3	4	5	6	7	8	9

50	51	52	53	54	55	56	57	58	59
5	5	5	5	5	5	5	5	5	5
0	1	2	3	4	5	6	7	8	9

60	61	62	63	64	65	66	67	68	69
6	6	6	6	6	6	6	6	6	6
0	1	2	3	4	5	6	7	8	9

70	71	72	73	74	75	76	77	78	79
7	7	7	7	7	7	7	7	7	7
0	1	2	3	4	5	6	7	8	9

80	81	82	82	84	85	86	87	88	89
8	8	8	8	8	8	8	8	8	8
0	1	2	3	4	5	6	7	8	9

90	91	92	92	94	95	96	97	98	99
9	9	9	9	9	9	9	9	9	9
0	1	2	3	4	5	6	7	8	9

Code B	Code C	FNC1	Start A	Start B	Start C	Stop
C	C	F	*	*	*	*
B	C	1	A	B	C	*

Note:

On the LCD Screen the Inspector will show a Yen symbol "¥"instead of a backslash "\" however it will print out as a backslash

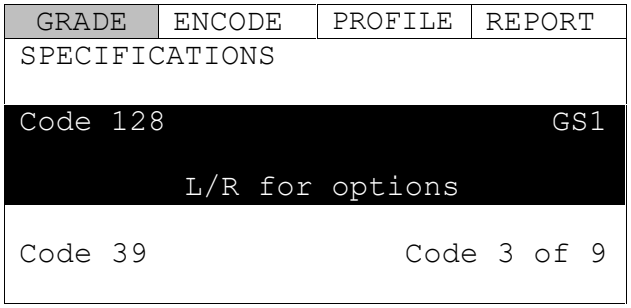
On the LCD Screen the Inspector will show a right arrow "→" instead of a tilde "~" however it will print out as a tilde.

Note:

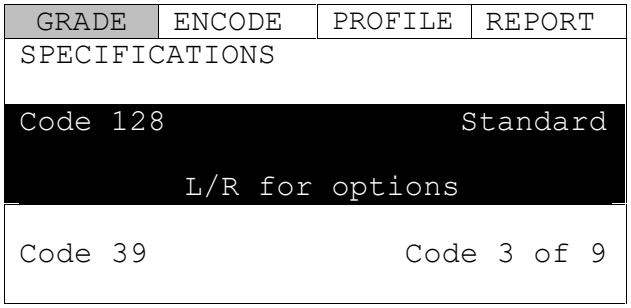
For Code 128, the Mod check character is displayed as the symbology's character value (a number from 000 to 102). One or two numeric Mod check characters may precede the 3-digit Code 128 Mod check described above. These digits represent the Mod 10 check character(s) that can be included depending on the format.

GS1-128 Symbology Specification

When a Code 128 symbol is decoded **AND** the first character *after* the Start character is **FNC1** then the symbol *must* follow the GS1-128 format and the verifier must have the following Code 128 sub-specifications setting from the **Setup** screen:



For a Standard Code 128 the verifier must have the following Code 128 sub-specifications setting from the **Setup** screen:



When a Code 128 symbol is decoded with the Code 128 sub-specifications setting of **Standard** but the first character *after* the Start character is a **FNC1** then the ***Format*** parameter on the **Grade** screen will be a Failure and on the **Encode** screen the error will be explained.

When a Code 128 symbol is decoded with the Code 128 sub-specifications setting of **GS1-128** and the first character *after* the Start character **is not** a **FNC1** then the ***Format*** parameter on the *Grading* screen will be a Failure and on the **Encode** screen the error will be explained.

Appendix G (Magnifications)

UPC/EAN Magnifications & Bar Width Deviations

UPC and EAN symbols have fixed lengths and formats; therefore, the only way to change their sizes is to magnify them. Specifications relative to bar/space tolerances are published for 80% to 200% magnifications.

While the Inspector 5000 does not measure the bars and spaces to derive a magnification, it does determine the relative sizes of the elements and therefore the bar width deviations.

When UPC and EAN symbols are analyzed, the approximate symbol magnification must be known in order to most accurately determine if the symbol is within tolerance.

For example, if a range of 90 - 115% magnification is selected and a 200% symbol is analyzed, there will be a greater chance of a warning message for the symbol *(despite its being within specification)* because of the stricter tolerances of a smaller symbol.

Conversely, if a range of 151% - 200% magnification is selected and a 100% symbol is analyzed, there will be a greater chance of an acceptance message for the symbol *(despite its possibly not being within specification)* because of the larger tolerances of a larger symbol.

Note:

Magnification choices affect only the traditional bar width deviation analysis

Appendix H (Aperture Selection)

The Inspector 5000 Auto Optic has four different aperture (light) sizes that can be used for inspecting bar codes. It is very important that the aperture selected matches the aperture of the bar code scanner that will be used in the supply chain. The aperture is selected by the user from the **Setup** screen.

General Aperture size recommendation:

X-Dim / NBW Range	Aperture Size
0.0040" ≤ X ≤ 0.0070" 0.1016mm ≤ X ≤ 0.1778mm	0.003" (3 mil) 0.0762mm
0.0070" ≤ X ≤ 0.0130" 0.1778mm ≤ X ≤ 0.3302mm	0.006" (6 mil) 0.1270mm
0.0130" ≤ X ≤ 0.0250" 0.3302mm ≤ X ≤ 0.6350mm	0.010" (10 mil) 0.2540mm
0. 0250" < X 0. 6350mm < X	0.020" (20 mil) 0.5080mm

The X-Dimension/Narrow Bar Width (NBW) can be determined by inspecting a bar code and using the ***Down Arrow*** button on the **Grade** screen to scroll to the *Narrow Bar Width or Magnification/NBW* field (varies by symbology scanned) and pressing the ***Select*** button. This will display the **Narrow Bar Width Calculator** screen. Measure the distance from the left most bar to the right most bar and enter this value into the *Barcode Width* field using the **Arrow** buttons, the Inspector 5000 will automatically determine and display the *Narrow Bar Width* (or *Magnification* depending the Symbology) which can then be looked up on the chart above.

Note:

- *6 mil (0.152mm) is used for most UPC/EAN bar codes (5 mil (0.127mm) is used in Europe)*
- *10 mil (0.254mm) is used for most GS1-128 bar codes and 150% magnification or larger UPC/EAN*
- *20 mil (0.508mm) is used for most ITF-14 and ITF-18 bar codes*

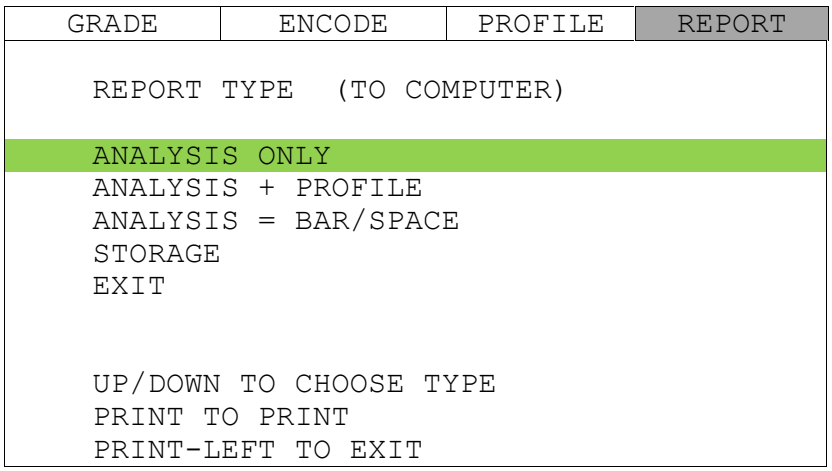
Appendix I (Print Functions)

Bar code inspection data may be printed (requires optional devices) when the Inspector 5000 is connected to the TP140A printer or to a computer using the VCIR PC software program. The Inspector 5000 will automatically detect which type of printout device is connected.

Printing Reports

From any screen press and release the ***Print*** button, below are the screens that will be displayed:

VCIR Print Screen – New bar code inspection



VCIR Print Screen – Bar code inspection from storage

GRADE	ENCODE	PROFILE	REPORT

REPORT TYPE (TO COMPUTER)

ANALYSIS ONLY
STORAGE
EXIT

UP/DOWN TO CHOOSE TYPE
PRINT TO PRINT
PRINT-LEFT TO EXIT

TP140A Printer Print Screen - All bar code inspections

GRADE	ENCODE	PROFILE	REPORT

REPORT TYPE (TO TP140A)

ANALYSIS ONLY
STORAGE
EXIT

UP/DOWN TO CHOOSE TYPE
PRINT TO PRINT
PRINT-LEFT TO EXIT

If the Inspector 5000 is unable detect a printout device the following pop-up message will be displayed:

SERIAL PORT ERROR

PRINT TO EXIT

Printout Options

Analysis Only

This option prints the *Text Analysis* data for the last symbol scanned. This option can also be used to print each individual symbol in the multiple scan mode prior to the last scan being completed. *(See Figure I-1)*

Analysis + Profile

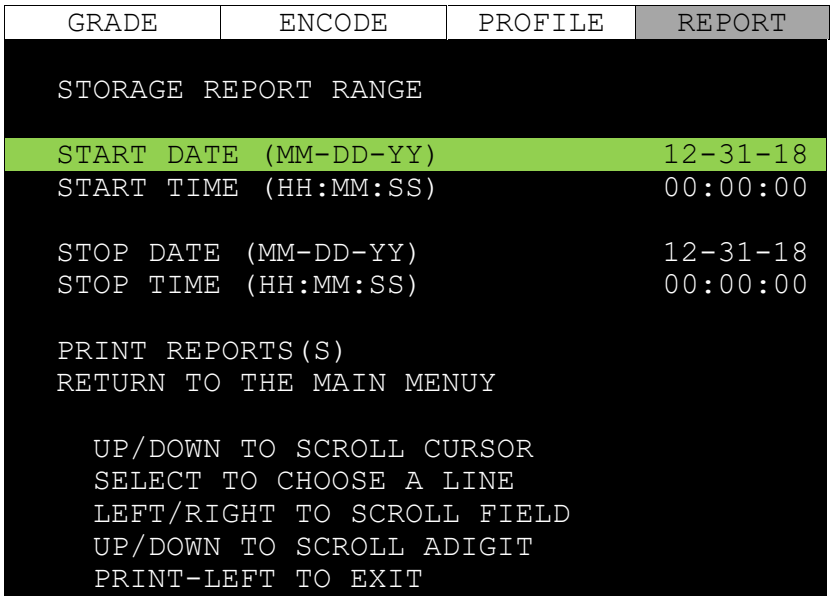
This option is the same as *Text Analysis* but in addition prints an *Analog Scan Profile (See Figure I-2).*

Analysis + Bar/Space

This option is the same as *Text Analysis* but in addition prints the dimensions of each bar and space

Storage

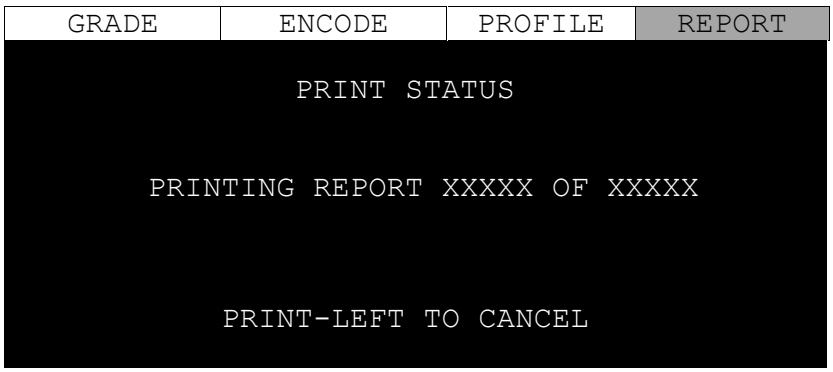
This option displays the Storage Report Range screen:



After selecting the date range for reports to be printed, move the cursor to the PRINT REPORT(S) option and press ***Select*** button. The reports will begin printing.

To cancel the print job press and hold the ***Print*** button and then press the ***Left Arrow*** button.

Report Range printing screen:



Note:

Scan reflectance profiles and Bar/Space data are not stored in the database; only the analysis data is stored.

Examples Reports

Figure I-1 (Analysis Only data)

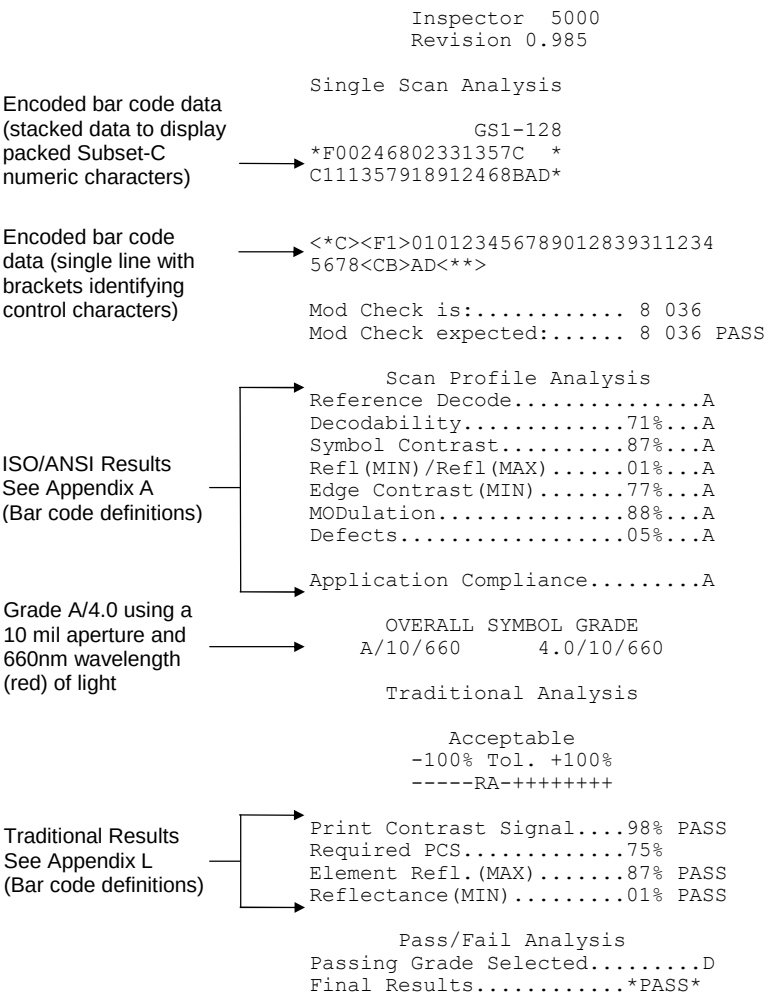
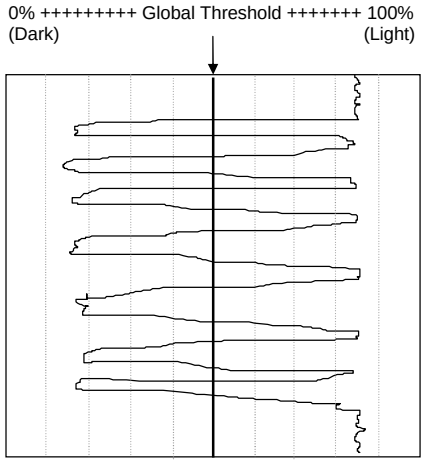


Figure I-2 (Scan Reflectance Profile data)

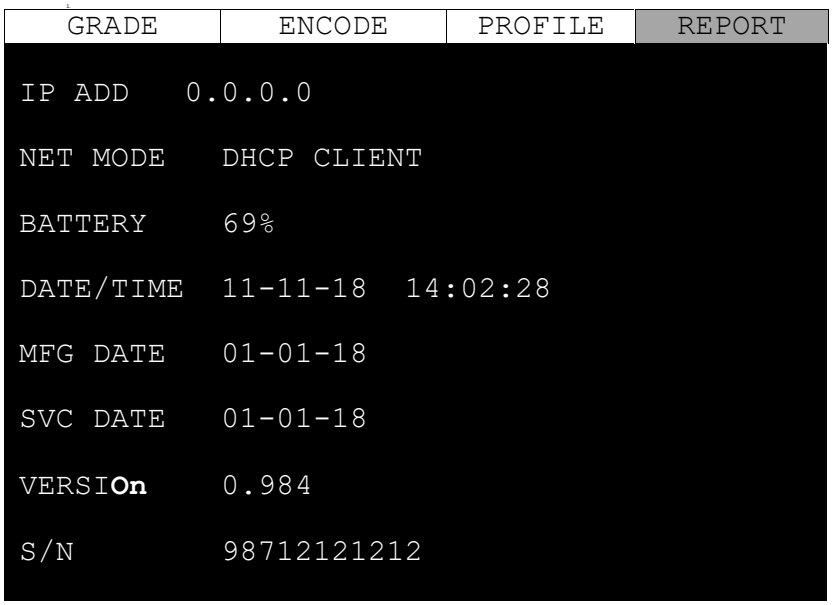


Appendix J (Battery Information)

Battery Level

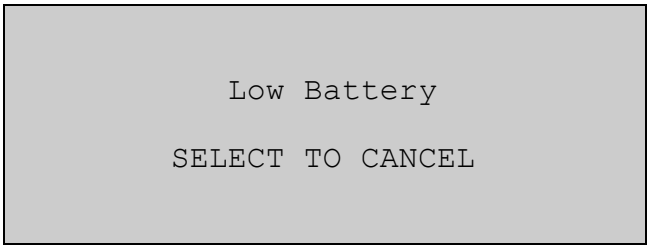
With the Inspector 5000 turned **On**:

1. Press and release ***Power*** to toggle the display to the **Instructions** screen
2. Press the ***Right Arrow*** button two times to display the **System Information** screen
3. The third line (BATTERY) displays the battery charge level as a percentage
4. Press the ***Power*** button to toggle the display back to the **Grade** screen



Low Battery Display

If the low Battery condition is displayed, there is still power left in the battery but your Inspector 5000 should be charged as soon as possible.



Battery and Charger

The Inspector 5000 has an integrated lithium ion battery pack installed in the unit

- The battery is not field replaceable and must be returned to RJS for repair/replacement

Warning:
DO NOT use any battery chargers other than the Inspector 5000 battery charger. Use of non-RJS battery chargers could damage your bar code verifier and/or result in a fire.

Additional Warnings:
NEVER open or disassemble the Inspector 5000

- Do not expose a battery to temperatures above 60 °C (140 °F)
- Always check all applicable local, national, and international regulations before transporting a Lithium-Ion battery

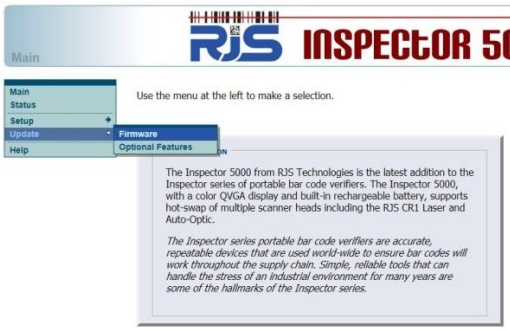
If the Inspector 5000 has a battery issue it must be returned to RJS for repair

Appendix K (Field Firmware Upgrade)

1. Power **Off** the Inspector 5000
2. Connect an Ethernet cable (not included) to your office network and the Inspector 5000
3. Turn **On** the Inspector 5000
4. After startup, press the ***Power*** button
5. Press the ***Right Arrow*** button twice to scroll to the System Status page which has the first line of "IP ADDR". The number most likely starts with 192.168…. (this depends on how your DHCP router is configured). Write down this number.
   Note:
   *Occasionally it takes a minute for the IP address to refresh, exiting the Status screen (by pressing **Power**) and the re-entering the Status screen may be necessary*
6. Go to your computer and open a web browser and in the address bar enter the IP address written down in Step 5.
7. The Inspector 5000 web server will load the following page:

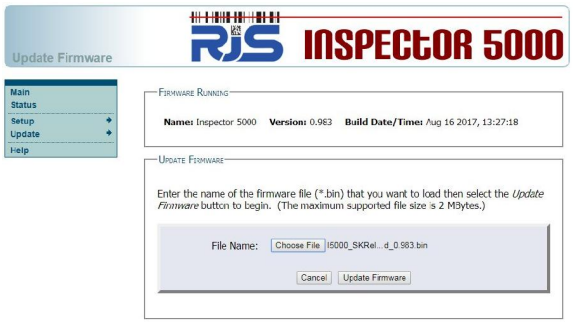
8. Click the **Continue** button
9. When prompted for a user name and password, use "admin" for the user name and "admin" for the password

10. Click **Update** and then **Firmware**



11. Select the new **.BIN** firmware file

12. Click the **Update Firmware** button



13. Wait for the firmware to be loaded and the "Complete" message to be displayed
14. Power **Off** the Inspector 5000
15. Disconnect the Ethernet cable
16. Turn **On** the Inspector 5000

Appendix L (Bar code definitions)

Achieved Width
The calculated element width based on measurements.

Alphanumeric
A character set that contains letters, digits, and other characters such as punctuation marks. Also, a character that is either numeric or alpha. (In programming an alphanumeric cannot be used to do arithmetic)

ANSI
American National Standards Institute, Inc. 25 West 43rd Street, 4th floor New York, NY 10036

Aperture
The effective opening in an optical system that established the field of view.

Application Specification
A set of rules for using bar code symbols.

Aspect Ratio
The ratio of height to width of a bar code symbol.

Bar
An element of a bar code symbol whose reflectance is less than the global threshold. A Bar is the dark (reflective) element of a bar-code. (As opposed to a space which is the light reflective element)

Bar code

A group of parallel bars and spaces constituting characters that are machine and human readable (the code numbers while readable must still be interpreted). See bar code symbol

Bar code Reader

A device used to identify and decode a bar code symbol.

Bar code symbol

An array of rectangular bars and spaces which are arranged in a predetermined pattern following specific rules to represent elements of data that are referred to as characters. A bar code symbol typically contains a leading *quiet zone*, start character, data character(s) including a check character (if any), stop character and a trailing *quiet zone*.

Bar Height

The bar dimension perpendicular to the element width. The measurement of the long dimension of a bar element. (Also called bar length)

Bar Width

The lateral dimension of a bar; bar thickness.

Bar Width Ratio

The ratio of the widest bar or space to the narrowest.

Bar Reflectance (Rb)

The smallest reflectance value in a bar.

Bi-directional Code

A bar code that can be read left to right or right to left.

Bit

The narrowest code element (bar of space) that may contain information.

Character

The smallest group of elements assigned by a symbology to uniquely represent one or more numbers, letters, punctuation marks or other information.

Character Set

The numbers and/or letters and markings included in a bar code symbol.

Check Character (or Check Digit)

A character included within a bar code symbol whose value is used for performing a mathematical check of the validity of the decoded data.

Contact Code Reader

A light pen or other scanning device that must come into physical contact with the code medium in order to read the symbol.

Continuous Code

A bar code or symbol wherein the space between the characters is part of the code.

Decodability

This parameter grade can be "A," "B," "C," "D" or "F." The *Decodability* grade indicates the amount of error in the width of the most deviant element in the symbol. The less deviation, the higher the grade. *Decodability* is a measure of print accuracy using the symbology *reference decode* algorithm.

Decode

Determining the information which has been encoded in a bar code symbol.

Decoder

The portion of a bar code reading system that performs the decode function.

Defects

This parameter grade can be "A," "B," "C," "D" or "F."

Defects are of two types, voids and spots. Voids are light areas in bars, and spots are dark areas in spaces.

The defect grade is determined by a relationship between the largest defect in the symbol and *symbol contrast*. The smaller the defect, the better the grade. Aperture size can affect grade; for example, using a small aperture to analyze a very wide element will permit detection of the largest defects.

Defects are usually voids, and these defects can be reduced by increasing the amount of ink (or equivalent).

Diffuse Reflection

Reflected light which emanates uniformly in all directions from the reflecting surface.

Dimensional Deviation (DD)

The measured deviation of bars and/or spaces of a scanned symbol from the specification.

Discrete Code

A bar code or symbol wherein the spaces between the characters are not part of the data.

Edge Contrast (EC) See Edge Contrast(min)

The difference between the space reflectance (Rs) and adjoining bar reflectance (Rb).

EC = Rs - Rb

Edge Contrast (min)

This parameter grade can be "A" or "F." Edge contrast is the Reflectance difference between adjoining bars and spaces. The *minimum edge contrast* is the smallest value of EC = R space – R bar found in the scan.

The grade is determined by calculating the edge contrast of every element in a symbol and then comparing the lowest value to a fixed threshold in the specification (15%).

If the value is equal to or greater than the threshold, the grade is "A." If the value is less than the threshold, the grade is "F."

Element

A generic term used to refer to either a bar or space in a bar code symbol.

Element Edge

The location where the scan reflectance profile intersects the midpoint between the space reflectance (R space) and bar reflectance (R bar) of adjoining elements. Visual measuring techniques will generally locate the element edge closer to the center of the bar.

Element Reflectance Non-uniformity (ERN)

The reflectance difference between the highest peak and lowest valley within each individual element and *quiet zone*. When an element consists of a single peak or valley, its element reflectance non-uniformity is zero.

Element Width

The thickness or width of a bar or space as measured from its leading edge to its trailing edge.

Encoded Area

The total linear dimensional space taken by all characters of a code pattern including start/stop and data.

First Read Rate

The percentage of successful "reads" of a bar code symbol on the first attempt.

Fixed Beam Scanner

A bar code reading device wherein coded items pass across a stationary incandescent or LED light source.

Flexo Film Master

A measurement standard symbol produced by printing the symbol on clear plastic film using the Flexographic printing process.

Gloss

A phenomenon related to the specular reflection of incident light. The effect of gloss is to reflect more of the incident light in a specular manner, and to scatter less. This effect occurs at all angles of incidence and should not be confused with the grazing angle which is specular reflection often referred to as sheen.

Global Threshold (GT)

The global threshold is drawn through the middle of a profile, to distinguish spaces above the line and bars below. The reflectance value is determined by dividing the *symbol contrast* (SC) by 2 and adding the minimum reflectance, Rmin.

GT = Rmin + (SC/2)

GS-1

GS1 designs and implements global standards and solutions to improve the efficiency and visibility of supply and demand chains globally.

Guard Bar

The first and last bars of a bar code symbol usually having the pattern 101. A guard bar generally follows the leading *quiet zone* and precedes the trailing *quiet zone*. This term is used mostly for UPC/EAN symbologies.

Infinite Pad Method

The method for measuring reflectance in which the sample substrate being measured is backed with enough thickness of the same type of substrate so that doubling the number of sheets does not change the measured value of reflectance.

Inspection Band

An area of the bar code symbol where measurements shall be taken spanning from 10% to 90% of the average bar height.

Inter-character Gap

In discrete barcodes, the space that separates two adjacent characters. When present, inter-character gaps are considered spaces (elements) for purposes of *edge determination* and reflectance parameter grades.

Interleaved

A bar code in which characters are paired together using bars to represent the first character and spaces to represent the second.

ISO

International Organization for Standardization, organization that maintains the standards related to bar codes and bar code verifiers.

Ladder Code

A bar code or symbol printed vertically with the individual bars looking like the rungs of a ladder.

Laminate

See Over-laminate

Laser Scanner

A bar code reading device that uses a low energy laser light source for illumination.

Magnification Factor

The size of a printed bar code compared to a standard (nominal) size.

Maximum Element Reflectance Non-uniformity (ERN max)

The largest element reflectance non-uniformity in a scan reflectance profile.

Maximum Reflectance (Rmx)

The greatest reflectance value in a scan reflectance profile including *quiet zone*.

***Note: eRmx** is the greatest reflectance value of an element, not including quiet zone)*

Minimum Edge Contrast (Ecmn)

The smallest edge contrast in a scan reflectance profile.

Minimum Reflectance (Rmn)

The smallest reflectance value in a scan reflectance profile.

Misread

A condition that occurs when the data output of a reader does not agree with the encoded data.

Modulation (MOD)

This parameter grade can be "A," "B," "C," "D" or "F."

The *modulation* grade is based on the relationship between *minimum edge contrast* (Ecmin) and *symbol contrast* (SC).

MOD = ECmin/SC

The greater the difference between *minimum edge contrast* and *symbol contrast*, the lower the grade.

Scanners and verifiers perceive the narrower bars and spaces to have less intensity than wider bars and spaces; the comparison of this diminished intensity of narrow elements to wide elements is called *modulation*. This condition is affected by aperture size.

Note: *Since "ink spread" will reduce the width and intensity of single module space within a symbol, this is one thing to check in seeking to correct a low modulation grade*

Module

The narrowest expected bar or space width.

Moving Beam Scanner

A laser device that dynamically searches for a bar code pattern by sweeping a moving optical beam through a field of view.

N (wide to narrow ratio)

In symbologies with two element widths, the wide to narrow ratio of elements is calculated by summing the average wide bar width and average wide space width and dividing the sum by 2 times Z. Inter-character gaps, if applicable, are not included.

N = (avg.wide bar + avg. wide space) / (2*Z)

Nanometer (nm)

A unit of measure used to define the wavelength of light, equal to 10-9 meter.

Narrow Bar Width (or NBW)

The intended width of the narrow elements dictated by the application and/or symbology specification. Also referred to as X-Dimension (X-Dim)

Nominal

The intended value for a specific parameter. Tolerances are generally specified as positive and negative deviations from this value.

No-Read (Non-read, Non-scan)

The absence of data at the scanner output after an attempted scan because of no code, defective code or operator error.

Nominal Size

The target size for a specific element or group of elements.

Numeric

A character set that contains only numbers.

Omni-directional

The ability to read a bar code symbol from any angle as long as the bar code passes across the scanner window.

Opacity

The property of a material that minimizes the show-through of printing from the back side or the next sheet.

Overhead

The number of characters in a symbol required for start, stop and checking.

Over-laminate

A coating or material adhered to the scanning surface of a bar code symbol.

Parity

A system for encoding characters as "odd" or "even" for self checking of barcodes.

Peak

The graphical pattern on a scan reflectance profile which looks like an upside down "U" or "V." Within a profile a peak represents a space. One or more peaks could also be found within an element representing a reflectance change within an element.

Plaque

A template used as a reflectance calibration standard (RCS). The known reflectance values are posted on the back of the plaque.

Print Contrast Signal (PCS)

A comparison between the reflectance (brightness difference) of bars and spaces in a symbol. PCS under a given set of illumination conditions is defined as follows:

PCS is calculated as follows:

$$\frac{L - D}{L} \times 100\%$$

Where:

L = Lightest (highest reflectance)
D = Darkest (lowest reflectance)

Profile

See Scan Reflectance Profile

Quiet Zone

The area immediately preceding the start character and following the stop character in a bar code symbol as specified in a particular application and/or symbology specification.

Reference Decode

Each symbology type specifies a specific decoding method to be used in determining overall symbol grade.

This parameter grade can be "A" or "F." ("A" is pass and "F" is fail). If this parameter is "F" the overall symbol grade will also be "F" regardless of any other parameter. If this parameter is "A" the lowest of the other parameter grades determines the overall symbol grade.

Reflectance

A measure of the amount of light reflected from an illuminated surface.

Reflectance Minimum

This parameter grade can be 4.0 / "A" or 0.0 / "F." The reflectance value of the "lightest" space in a symbol must be equal to or greater than twice the reflectance value of the "darkest" bar.

Refl(max) = or > Refl(min) x 2 if "yes" 4.0 / "A" else 0.0 / "F"

Reflectance Calibration Standard

(See plaque) A standard or "known" reflectance value, usually printed on the back of a template or plaque. Bar code readers are calibrated for reflectance using these known values.

Required PCS

This is the minimum PCS percent required for the symbol.

Resolution

The dimension of the smallest code element that can be printed; the higher the resolution the clearer the image.

Scanner

An electronic device that converts printed information into electrical signals.

Scan Reflectance Profile

A record (usually graphically represented) of the reflectance measured using the reference reflectivity method as a function of distance across the entire bar code symbol.

Segment

Refers to the left and right grouping of modules or elements into segments to designate parity for checking validity of a scan.

Self-checking

A bar code or symbol that uses a checking algorithm that can be applied to each character, to guard against undetected errors. (Non-self-checked codes may use a check digit or other redundancy in addition to the data message).

Show-through

The generally undesirable property of a substrate that allows underlying markings of materials to affect reflectance.

Space

The element of a bar code symbol whose reflectance is greater than the global threshold. A Space is the light reflective element. (As opposed to a bar which is the dark reflective element.)

Space Reflectance (Rs)

The largest reflectance value in a space or *quiet zone*.

Specular Reflection

Reflection of light from a surface at an angle equal and opposite to the angle of incidence.

Start and Stop Characters

Characters typically used at the beginning and end of each bar code symbol.

Substitution Error

This error can be seen in a mis-encodation, mis-read or human operator error where characters that were to be entered were substituted with erroneous information.

Substrate

The material (paper, plastic, metal, etc.) upon which a bar code symbol is "printed" or reproduced.

Symbol

See Bar code symbol.

Symbol Contrast (SC)

This parameter grade can be "A," "B," "C," "D" or "F."

Symbol contrast is the difference in reflectance values of the "lightest" space (including the *quiet zone*) and the "darkest" bar of the symbol. The greater the difference, the higher the grade.

SC = Rmax - Rmin

Symbol Grade

The simple average of all the overall profile grades using the standard weighing

4.0 = A
3.0 = B
2.0 = C
1.0 = D
0.0 = F

The symbol grade may be stated as a decimal or converted to a letter grade. A measuring aperture number and nominal wavelength are also specified.

Symbology

A set of rules for encoding information in a bar code symbol.

Symbology Reference Decode Algorithm

A decoding algorithm that may be found in a particular application and/or symbology specification.

TAPPI

Technical Association of Pulp and Paper Industry.
Technology Park/Atlanta, P.O. Box 105113
Atlanta, GA 30348-5115

Threshold (Global Threshold)

See Global Threshold)

Transmission Mode

The mode where light is transmitted through a film master symbol rather than reflected from a printed symbol.

Truncation

Decreasing the length of the bars in a bar code symbol below the normal specification. Truncation decreases a symbol's omni-directional readability and should be avoided.

Valley

The graphical pattern on a scan reflectance profile which looks like a "U" or "V." Within a profile a valley represents a bar. One or more valleys could also be found within an element representing a reflectance change within an element.

Vertical Redundancy

The availability of more than one scan path through a bar code symbol.

Visual Measurement

Measurements obtained by using human vision in the determination of characteristics of the bar code symbol.

Void

White or light reflective area in a bar caused by a printing error that can cause a bar to scan as a space.

Wide/Narrow Ratio

Ratio of narrow to wide elements.

X Dimension (or X-Dim)

The intended width of the narrow elements dictated by the application and/or symbology specification. Also referred to as Narrow Bar Width (NBW)

Zero Suppression

Technique used to shorten UPC symbols by omitting zeros from the bar-code.

Z Dimension

The achieved width of the narrow elements. Computation of Z is accomplished using different factors for some symbologies.