Inspector D4000™
Auto Optic

Operator's Guide

Manual P/N 002-7856
Revision: B
July 2013

THIS MANUAL APPLIES **ONLY** TO **FIRMWARE A.06 OR LATER**
Use Inspector 4000 Manual (Revision H) for earlier firmware versions

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Reference RJS P/N 002-7856 Revision A

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1.0 Preface

1.1 Proprietary Statement

The RJS Inspector D4000 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 your 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 own 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 RJS Inspector D4000 is packaged in a custom made container. After removing the unit from the shipping box makes sure you have:

- Main display unit
- Auto-optic scan head and cable
- Calibration plaque
- Four size AA batteries
- Operator's manual
- Bar code "test" symbol sheet

1.8 Installing Batteries

Slide opens the plastic cover on the back of the unit. Position the cloth battery "pull strip" down then insert 4 *(included)* batteries according to the positive/negative markings.

> **Note:**
> If all 4 batteries are inadvertently installed backwards, the inspector unit will be damaged.

Remove batteries when the unit will not be used for a period of weeks. Also, remove batteries when storing the unit.

> **Note:**
> NiCad batteries and charger are available as an option

> **Warning:**
> When using the optional charger, **DO NOT** charge alkaline batteries - this will damage the verifier

1.9 Technical Support

Please read the manual and try to understand it, first.

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

- Model and serial number of your unit
- Do you have a maintenance contract in effect
- Have a test print available if applicable
- Detailed explanation of the problem or question
- Your company's phone

1.10 Trademarks

The following are trademarks of RJS:

- RJS
- RJS Systems International
- Inspector
- RJS Inspector D4000

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2.0 Warranty

2.1 General Warranty

Warranty information: +1 (763) 746-8034

RJS warrants your RJS Inspector D4000 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 RJS Inspector D4000 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/request_rma.php***

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 RJS' factory location.

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' 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 RJS Inspector D4000 Description and Features

The RJS Inspector D4000 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 menu
- Two light wavelengths selectable from setup menu
- Provides scan head light color and aperture size *(display/print)*
- Auto-discriminates between many different symbologies
- Auto-print mode
- Bi-directional scanning
- 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.

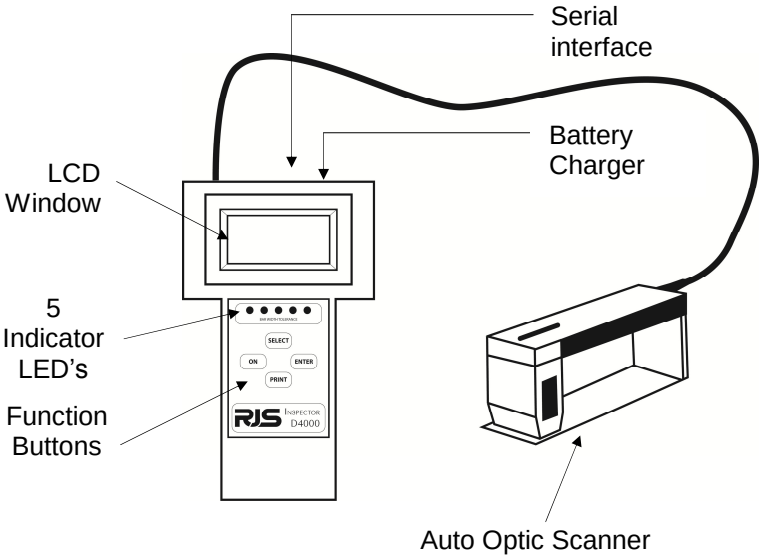
Do not use solvents on the unit or on any of the components. You may use alcohol to clean the unit.

3.3 Temperature Specs

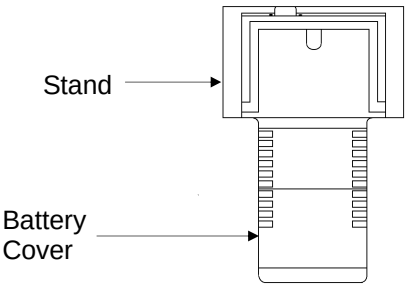
Do not operate or store your unit or components in temperatures outside the range of 50° - 105°.

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

4.0 The RJS Inspector D4000 Auto Optic



Note:
Calibration plaque is a separate component



5.0 Main Menu Selections

5.1 Calibration

Power On

When the unit is powered on, the following *"Ready Menu"* will display after a few seconds:

```
Verifier Ready
XXX  Aperture: YY
```

XXX = indicates the wavelength *(color)* of the light represented in nanometers

YY = indicates the aperture size in mils

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

Press **Enter** and **Select** at the same time to bring up the Main Menu:

```
Scan Calib Setup
Storage Inactive

D4000A Ver.x.xx
```

x.xx = Indicates the Software Version.

Press **Select** until the cursor is on **CALIB** and press **Enter**.

```
D4000A Ver x.xx
Reflectance XX%
```

Verifying that Unit is Calibrated

Selecting CALIB sets up the mode to measure reflectance. This also 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 **Enter** and **Select** at the same time to navigate back to the Main Menu.

Calibrating the Unit

After selecting Calib from the main menu, the reflectance menu will display.

```
D4000A Ver x.xx
Reflectance XX%
```

From the reflectance menu press **Enter**, the Calibrate menu will display:

```
   Calibrate
```

When the "Calibrate" menu is displayed, proceed with the following calibration steps:

```
Place Optics on
White/Enter Key
```

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 **Enter** and

hold auto-optic scanner head still until you hear a "chirp" sound.

```
Place Optics on
Black/Enter Key
```

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 **Enter** and hold auto-optic scanner head still until you hear a "chirp" sound.
When both light and dark have been calibrated the following screen will display:

```
   Calibrated
Reflectance  XX%
```

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, repeat the calibration.

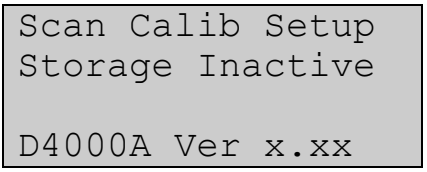
```
   Unable to
   Calibrate
```

Note:

Power drain is greatest in the calibration mode. The automatic shut-off feature is disabled in calibration mode. Once the unit is calibrated, the calibration data will remain in memory; however, you should calibrate the unit at the beginning of each day or each shift for the proper PCS readings.

5.2 Scan

After finishing calibration press **Select** and **Enter** at the same time; the "Ready Menu" will display:



In addition to **CALIB**, explained in the previous section, there are 3 additional "selectable" functions: **Scan**, **Setup** and **Storage**:

- Press **Select** to choose an option.
- Press **Enter** to initiate processing for that option.

Select Scan *(from the Main Menu)* to display the initial Pass/Fail Analysis screen for the previously scanned bar code.

Note:
A bar code can be scanned at any time except when the unit is printing

5.3 Setup

Select Setup *(from the Main Menu)* to view various system parameters:

- Press **Select** to choose an option
- Press **Enter** to initiate processing for that option

The first selection is Wavelength:

```
Wavelength
```

This selection allows you to select one of two light wavelengths; toggle the two choices by pressing **Select**.

```
Wavelength
660nm, Red
```

```
Wavelength
925nm, Infra-Red
```

Press **Enter** to enable the selection.

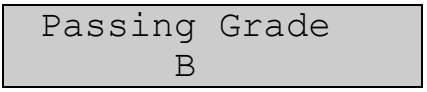
The next selection is Aperture Size:

```
Aperture Size
   .010 in.
```

Chose the Aperture size by pressing **Select**:

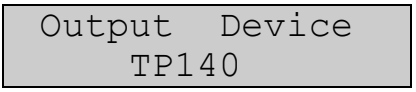
.003 in.
.006 in. (.005 for Europe)
.010 in.
.020 in.

The next selection is Passing Grade:



Select one of the threshold grades, A, B, C, or D.
(See Appendix C for an explanation of ISO/ANSI grades)

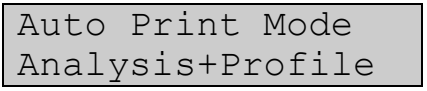
The next selection is Output Device:



Three output choices are available:

1. When **TP140** is enabled, the data is output in the format required by a **TP140/TP140A** printer
   (The **TP140A** supports graphics)
2. When **TP40** is enabled, data output is in the format of analysis only
3. When Computer is enabled, data is output in computer readable format (text and graphics)
   (See Section 10.0, Connect to Computer)

The next selection is Auto Print Mode:



Three choices are available in Auto Print Mode:

1. **Analysis Only**: *(For the TP140A / TP140 / TP40 / Computer)* Both ISO/ANSI and Traditional analysis will print automatically after a symbol is scanned.
2. **Analysis+Profile**: *(For the TP140A / Computer)* Scan reflectance profile graph will be added to the analysis only printout.
3. **Off**: You must press the print button to print. *(See Appendix H - Print Functions)*

The next selection is Scans/Analysis:

```
Scans/Analysis
    Single
```

From this screen you may choose the number of scans (from 1 (single) to 10) to be used in the analysis.

The next selection is Decode 3 of 9 as:

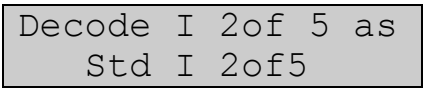
```
Decode 3of9 as
  Code 3of9
```

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 3 of 9

If either AIAG choice is entered, the RJS Inspector D4000 will automatically perform the scan reflectance profile analysis per the AIAG grading thresholds and display numbers 4, 3, 2, 1 and 0 in place of the letter grades.

The next selection is Decode I 2 of 5:

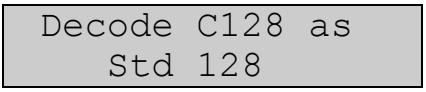


This selection is for choosing the Code I 2 of 5 sub-specifications for analysis:

Std I2of59
ITF14 Case Code
I25 w/mod 10

The next 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:

Std 128
GS1-128 (tests all Application IDs and code length)

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

```
UPC/EAN Tol.
116 - 150% Mag.
```

The magnifications are:

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

(See Appendix F for an explanation of magnifications)

Note:

When all Setup selections have been made, the RJS Inspector D4000 will navigate back to the Main Menu automatically.

All setup parameters are retained in non-volatile memory and will be saved until changed by you—even if the power is turned off.

5.4 Storage

Storage will display as either **Storage Inactive** or **Storage %** depending on whether Store and Print is enabled or disabled.

- When Store and Print is enabled, a number and a percentage sign 0 to 99% will display.
- When Store and Print is disabled, **Storage Inactive** will display.

The Storage Section *(from the Main Menu)* refers to Store and Print. The display will show either "Storage Inactive" or "Storage %."

```
Scan Calib Setup
Storage Inactive

D4000A Ver.x.xx
```

"Inactive" displays when **Store** and **Print** is inactive.

```
Scan Calib Setup
Storage XX%

D4000A Ver.x.xx
```

A storage "%" displays when **Store** and **Print** is active. If a % is displayed, it represents the percentage of the buffer that is filled with scan data.

You may enable or disable Store and Print by pressing **Enter** with the cursor on Storage.
(Toggle from one option to the other)

When Storage is active, press **Select** to move the cursor to the % sign. Press **Enter** on the % sign to clear the Store and Print buffer.

Note:

See *Appendix H* for details about printing the contents of the Store and Print buffer

6.0 PCS Analysis

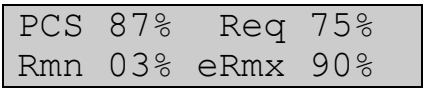
PCS scanning (overview)

This section is an overview of PCS *(print contrast signal)* analysis.

When a successful scan is made, the "Good Read" LED will illuminate and a crisp chirp or beep sound will be emitted.

Excellent results can be obtained when the auto-optic scan head is used properly. Make sure the bottom clear plastic plate of the scanner is flat against the surface to be scanned. This will assure the proper scanning angle.

In addition to the data analysis screens you will also get a PCS analysis screen:



- The top row of the display shows the calculated PCS. "Req" is the minimum PCS required for the particular symbology.
- The bottom row shows the minimum and maximum reflectance of the elements in the symbol.

  eRmx = maximum space reflectance *(light)*

  Rmn = minimum bar reflectance *(dark)*

Note:

The PCS is calculated as follows:

$$\mathbf{PCS} = \frac{\mathbf{Rmx - Rmn}}{\mathbf{Rmx}}$$

7.0 Scanning Symbols

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 D* for 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 LCD display to read "Please Scan Slower" but faster is ALWAYS better than slower.

Scanning Results

After a bar code is scanned, the RJS Inspector D4000 will respond with a crisp, chirp *(or beep)* sound.

Inspector Display after a scan when set to multiple scan analysis:

```
01928374
01 Scans Remain.
```

Press **Select** to view the grade for the previous scan:

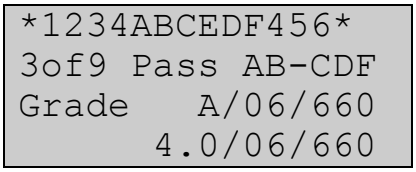
```
01928374
C39  Pass ABC-DF
Grade   B/06/660
      3.0/06/660
```

Note:
See *8.0 Pass/Fail Analysis Screen* section for details the inspection tests and results

8.0 Pass/Fail Analysis Screen

After the symbol is scanned the *Pass/Fail Analysis Screen* may be displayed.

An example of an *Pass/Fail Analysis Screen* for an acceptable symbol is shown below:



This screen shows:

- The first line is the decoded data. (If more than 16 characters are present, those characters will wrap to the next row of the display) Press **Select** to scroll through the data
- The second line provides the following:
- Symbology type *(if symbol accepted)*
- The selected grades that pass or fail *(grades to the right of the dash fail are acceptable)*
- The third line is the ANSI letter symbol grade followed by the aperture diameter in mils *(6 thousands inch in sample)* and then the wavelength in nanometers *(660, indicating red, in sample)*
- The fourth line is the ISO numeric symbol grade followed by the aperture diameter in mils *(6 thousands inch in sample)* and then the wavelength in nanometers *(660, indicating red, in sample)*

Below is a sample of scans remaining in multiple scan mode if the last scan has not been completed.

```
*1234ABCEDF456*
01 Scans Remain.
```

If the symbology code is 128, only printable characters will be displayed. See *Appendix E* for descriptions of how these codes are displayed.

The following displays are brought up by pressing **Enter** to begin results viewing mode and **Select** to scroll through the results

Table 8-A (Code Identifiers RJS Inspector D4000)

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:

On the previous tables, all ISO/ANSI symbologies use the traditional specifications for bar width deviation.

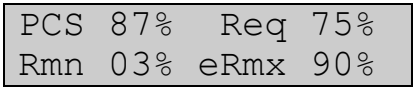
X and Y represent the magnification range selected for UPC/EAN tolerances.

Table 8-B (Code Identifier Descriptions for Pass/Fail Analysis Screen)

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 5with 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

9.0 Data Analysis Screens

After doing a scan, the Pass/Fail Analysis screens is displayed, press **Select** to bring up the Data Analysis Screen.
(See Pass/Fail Analysis, 8.0)



This is the print contrast (PCS) screen. Light and dark reflectance values are shown. eRmx is greatest reflectance of an element *(does not include quiet zone)*.

On the top row of the display, "Req" designates the minimum PCS required for the particular symbology. UPC and EAN have weighted PCS calculations, while most other symbologies require a minimum value of 75.

Note:

PCS is calculated as follows:

$$\frac{L - D}{L}$$

Where:

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

Press **Select** to bring up the next screen:

```
Ratio:     1.7 F
```

This screen provides the ratio calculation result on the top row *(when applicable)* and the Decodability calculation and grade on the bottom row. If Ratio is not appropriate *(UPC, EAN, or Code 128)*, the Ratio field will be missing.

Press **Select** to bring up the next screen.

Bar width deviations are represented graphically on the display.

```
-100% Tol. +100%
--------RRARR+++
```

- "R" letters represent "range" of bar widths in the code.
- "A" represents the average of all character bar width deviations.

Note:
The location of the "A" is indicated with the 5 LEDs also *See Table 9-A*.

The closer the "A" is to the center of the display, the better. The following shows the percentage of the scanning tolerance used at each position on the display:

-	-	-	-	-	-	-	-		+	+	+	+	+	+	+
93	79	65	50	36	22	8	1	0	8	22	36	50	65	79	93

- Negative numbers to the left indicate bars that are narrower
- Positive numbers to the right indicate bars that are wider

The closer the "A" is to the edge, the more likely the Reject.
A symbol is "Acceptable" until any calculated bar width deviation exceeds 100% of the tolerance for the symbology decoded; for example:

Acceptable

```
-100% Tol. +100%
------RRARR+++++
```

Warning

```
-100% Tol. +100%
--------++RRRARR
```

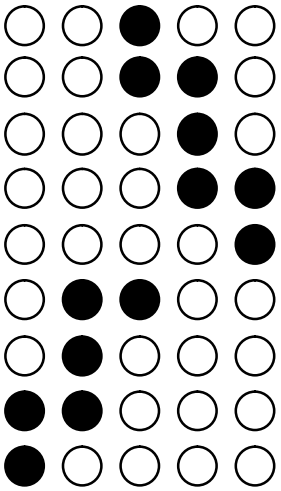
Rejected

```
-100% Tol. +100%
--------+++++++R
```

"A" is out of tolerance and off the screen.

Note:
Could also be on negative side *(See Table 9-A for visual display of deviations)*

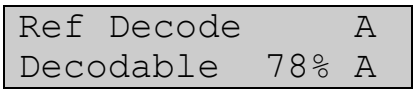
Table 9-A (LED, Bar code Width Deviations)

5 LED Display Pattern	Average Bar width deviation as a % of tolerance
	Within +21% to -21% Within +22 to +49% Within +50 to +78% Within +79 to +99% Out of tolerance (wide) Within -22 to -49% within -50 to -78% within -79 to -99% Out of tolerance (narrow)

Note:
Solid indicators represent LEDs turned on and the 9 possible patterns are displayed.

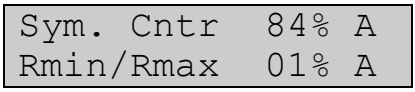
ISO/ANSI Analysis Screens

Press **Select** again to display the first technical Data Analysis screen.



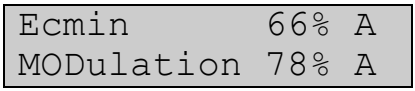
This screen shows the grades for the symbol's reference Decode and Decodability.

Press **Select** to display the next screen:



This screen shows the ISO/ANSI Symbol Contrast on the top row and Rmin/Rmax calculation on the bottom row.

Press **Select** to display the next screen:



This screen shows the symbol's ISO/ANSI Minimum Edge Contrast value on the top row and the Modulation value on the bottom row.

Press **Select** to display the next screen:

```
Defects    07% A
Appl. Compl.   A
```

The Defects value is displayed on the top row.

The Application Compliance grade is displayed on the bottom row *(A or F)*. If any symbology parameter such as mod check, ratio, character type or inter-character gap is analyzed and found in error, an "F" grade will be given, and this will affect the overall symbol grade (per the ISO/ANSI specification).

Press **Select** to display the Decoded Symbol Data:

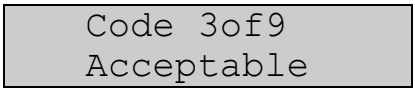
```
*1234ABCDEF456*
```

The decoded symbol data displays.
*(If more than 16 characters are present, those characters will wrap to the next row of the display. If more than 32 characters are present, press **Select** to scroll through the remaining data)*

Note:

Code 128 is displayed in sixteen columns of two alphanumerics each. Each *column* represents a decoded Code 128 symbol character. Two 16 column fields are used to represent a 32 character decode. See *Appendix E* for details regarding display of Code 128 on Data Analysis Screens.

Press **Select** to bring up the next screen:



Symbology type is indicated on the top row and the analysis overview on the bottom row.

Press **Select** to bring up the next screen:

This display indicates (**when applicable**) the Mod check character decoded and the Mod check character that should have been decoded (expected) in the symbol. PASS or FAIL is also indicated.

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.

10.0 Connect to other Devices

Connection 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 RJS Inspector D4000 Auto Optic will connect to a computer with a serial interface cable; 9600 BPS, 8 bit, no parity, 1 stop bit)

Connect to Printer

Your RJS Inspector D4000 will connect to an RJS TP140A/TP140/TP40 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 (Symbology Analysis)

Symbology Analysis Parameters

Table A-1 shows error messages that will be displayed for each parameter type checked by the RJS Inspector D4000.

Table A-1 (Parameter/Error Message)

Parameter	Data Analysis Message
Ratio	Warning Ratio
Ratio 1.8 < or > 3.4	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 (if enabled)	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 A-2 (Parameters Checked for Each Symbology)

Symbology	Ratio	ICG	Data Character	Mod Check	Tolerance
AIAG B-1	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	.5X-8X	$/+% Not Allowed	N/A	((12R-8)/81)X
LOGMARS	2.0-3.0	.5X-8X	STD CODE 39	N/A	((12R-8)/81)X
CODE 3 OF 9	2.0-3.0	.5X-8X	STD CODE 39	N/A	((12R-8)/81)X
3 OF 9 W/43	2.0-3.0	.5X-8X	STD CODE 39 4 CHARS Min	MOD 43	((12R-8)/81)X
HIBC 3 OF 9	2.0-3.0	.5X-8X	STD CODE 39 Min 4 CHARS 1ST. = "+"	MOD 43	((12R-8)/81)X
INTERLVD 2 OF 5	2.0-3.0	N/A	N/A	N/A	((18R-1)/80)X
CASE CODE	2.0-3.0	N/A	14 or 18 Data Chars Only	MOD 10	((18R-1)/80)X
I 2 of 5 with check digit	2.0	N/A	Min 4 Data Chars	MOD 10	((18R-1)/80)X
CODE 128	N/A	N/A	N/A	MOD 103	.35X
CASE CODE 128	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	MOD 10	See Note 1

Notes:

- X = X dimension
- R = Ratio in the calculations
- Tolerance is expressed as a fraction of the X dimension
- See *Appendix D* for Quiet Zone Analysis descriptions.

Note 1:

- UPC/EAN tolerances:
  80 - 89% = .14X
  90 - 115% = .30X
  116 - 150% = .34X
  151 - 200% = .38X
- UPC-A symbols with a number system character value of 2 and EAN-13 symbols with a prefix of 20 contain a random weight check digit in addition to the normal Mod 10 check digit. This extra digit is automatically analyzed and displayed in the Mod Check Data Analysis screen as shown below:

```
Modck:  1 5 PASS
Expect: 1 5
```

Note:

The 1 is the random weight check digit and the 5 is the Mod 10 check digit. The symbology specifications allow the check digit to have a value of zero in cases where it is not used

In cases where the random weight check digit is zero, when another value is expected, a Bad Mod Check Warning will not be issued. The LCD display and corresponding printout will note the discrepancy with a "CHK" message in place of "FAIL" as shown below:

```
Modck:  0  CHK
Expect: 1
```

Appendix B (ISO/ANSI Decodability)

ISO/ANSI Decodability Calculations

There is a specified method for calculating Decodability for each symbol. 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. And 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 "A" is the highest grade and grade "F" is lowest. (Even grade "F" may be decodable)

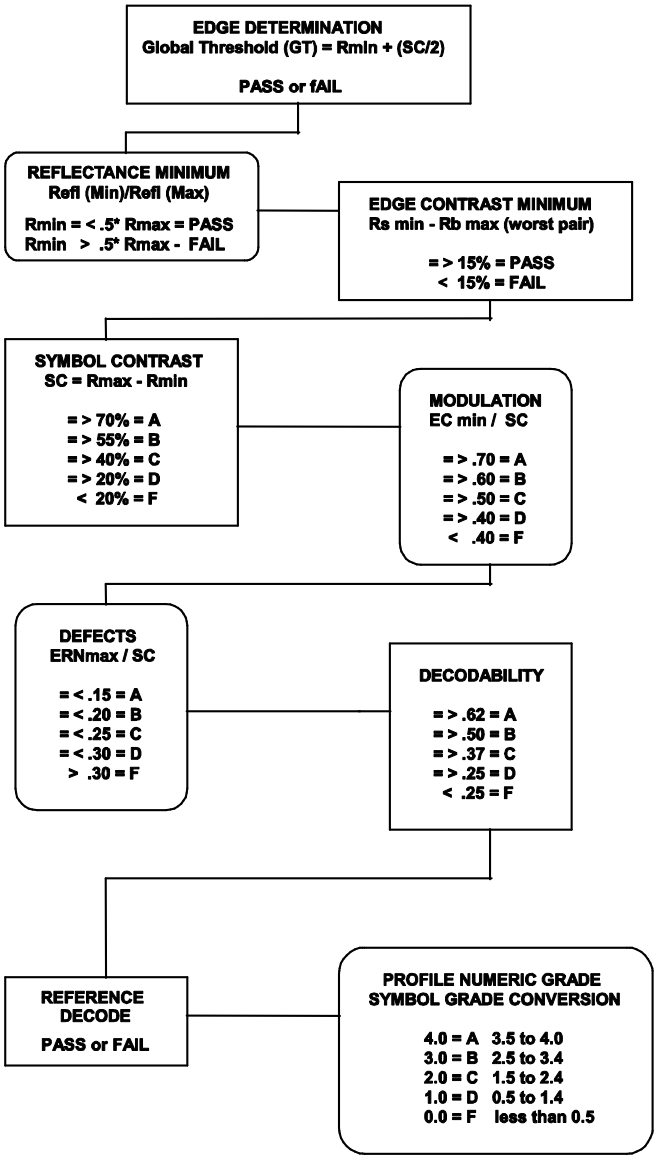
The grade is displayed in both its calculated numeric form and in its alphanumerical equivalent (the ISO15416 and ANSI X3.182-1990).

Decodability Grade Conversions

≥ .62 = A
≥ .50 = B
≥ .37 = C
≥ .25 = D
< .25 = F

Appendix C (Analysis Parameters)

ISO/ANSI Parameter Grading



RJS Inspector D4000 Analysis Parameters

Edge Determination

This parameter can be graded "A" or "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 RJS Inspector D4000 will force the Decodability grade to 00% *(an "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 "A" or "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 "F."

Edge Contrast Minimum

This parameter can be graded "A" or "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 "A," otherwise the grade is "F."

Symbol Contrast

This parameter can be graded "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)*.
Note: Bar code colors can have a large effect on this parameter.

Modulation

This parameter can be graded "A," "B," "C," "D," or "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 "A," "B," "C," "D," or "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)*.

Note:
In general, a small aperture used to analyze very wide elements will cause the largest defects.

The RJS Inspector D4000 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 barcode, are assumed to be quiet zones and are included in the analysis.

A graphic object or text in the quiet zone will produce an "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.

Reference Decode

This parameter can be graded "A" or "F."

If the Reference Decode parameter is "F," then the overall symbol grade is also "F" *(regardless of the grade of any other parameter)*.

If the Reference Decode parameter is "A," then the overall symbol grade is determined by the lowest of the other parameter grades.

The RJS Inspector D4000 also decodes each symbology with a more aggressive algorithm. This enables many symbols to be scanned and decoded even though the reference decode grade is an "F."
The overall symbol grade is averaged for the Reference Decode parameter:

> *For example: if 2 scans are averaged and one passes reference decode and the other fails reference decode, (assuming all other parameters scan "A" or "B"), the average would be a "C" (the average of "A" and "F")*

The average grade for the reference decode parameter would be "F" however as a warning that at least one scan failed this parameter.

Decodability

This parameter can be graded "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 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.

Each element size in a bar code symbol should be consistent across the symbol. In the case of Code 39 there are 2 element widths needed to produce a symbol.

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 Analysis Tolerance Graph

This graph is similar to the ISO/ANSI Decodability parameter grade previously described except this analysis is based on the average deviations of the bars of each character in a symbol instead of the most deviant element in the symbol.

The width of the graph represents the total deviation from normal reflectance that bars in a symbol can have and still be within dimensional specifications.

The graph provides information about bars being narrow or wide, whereas ISO/ANSI Decodability does not.

In the graph, "A" indicates the average bar deviation of all characters in the symbol. The "R's" *(if any)* indicate the range of average bar deviations.

The graph is 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 case code

Appendix D (Quiet Zone Analysis)

Quiet Zone Analysis

The RJS Inspector D4000 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 RJS Inspector D4000 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 D-1 (Acceptable Parameters for 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 D-2 (Acceptable Parameters for 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 E (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 definition of double density 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.

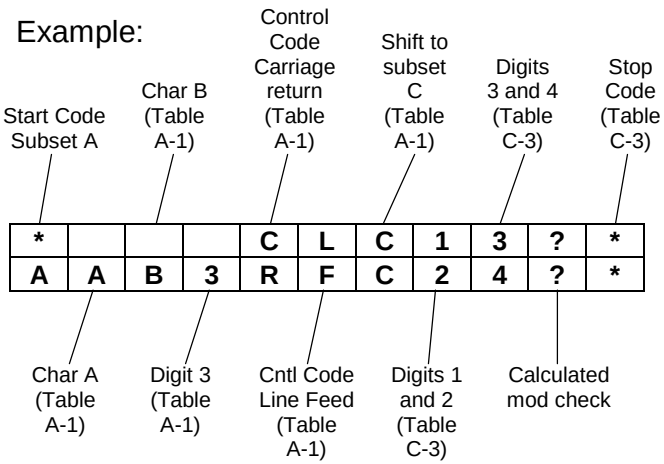
Code 128 also offers the flexibility to "shift" to other subsets in order to combine the "unique" features into one condensed bar code.

Display of Code 128

The Inspector display can accommodate up to 16 characters. However, in order to display symbols greater than 16 *(maximum of 64)*, press **Select** to display the additional characters.

The encoded data occupies 2 rows on the LCD and is encoded in a columnar display with one character above the other.

- The first character (column) displays the subset (*A = Subset A).
- The last character is a stop code (**).
- The second from the last is a mod 103 check character.
- Double characters beginning with alphanumeric characters designate non-printable control codes applicable to all subsets.
- Double numeric characters designate the compressed digit mode in subset C only.
- Single characters will always be displayed on the lower row and are applicable to only subsets A and B *(normal printable characters)*.



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 (E-1, E-2, and E-3):

- The top grid *(unshaded)* displays the Code 128 character set
- The bottom grid *(shaded)* displays the data on the Inspector's LCD screen
- 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 E-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 E-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
|	}	→	D L	F 3	F 2	S T	C C	F 4	C A

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

Table E-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 0	9 1	9 2	9 3	9 4	9 5	9 6	9 7	9 8	9 9

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

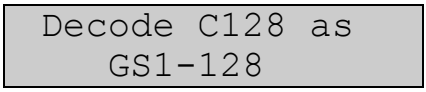
Note:

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

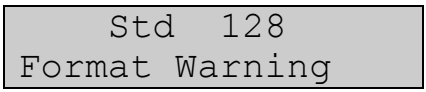
On the LCD Screen the Inspector will show a right arrow "→" instead of a tilde "~" however it will print out as a tilde.

GS1-128 Symbology Specification

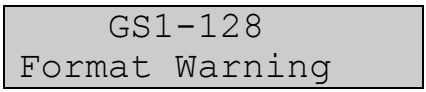
When a Code 128 symbol is decoded **AND** the first character *after* the Start character is **FNC1** then the symbol *must* follow the GS1-128 format and the verifier must have the following Code 128 sub-specifications setting:



When a Code 128 symbol is decoded with the Code 128 sub-specifications setting of **Std 128** but the first character *after* the Start character **is** a **FNC1** then the following error will be displayed:



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 following error will be displayed:



Note:

The Inspector D4000 Auto Optic will ONLY check the FNC1 and the GTIN Check Digit but it will not test the Application Identifiers or bar code maximum length.

The D4000 Laser is required to check the full GS1-128 data content.

Appendix F (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 RJS Inspector D4000 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 G (Aperture Selection)

The D4000 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** menu. Below are the aperture sizes for various sizes of bar codes (based on X dimension):

X / NBW Dimension 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

Note:
6 mil (1524mm) is specified for all UPC/EAN bar codes (5 mil (0.127mm) is used in Europe).

Appendix H (Print Functions)

Print Functions

Scanned data may be printed if the RJS Inspector D4000 is connected to a printer with an interface cable.

Press the Print button at any time to display:

```
Printout Type
Analysis Only
```

The lower row will contain one of three options that are scrolled with the **Select** button.

With the selected option chosen, press either **Enter** or **Print** to start printing.

Printout Options

Analysis

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-2)*

Analysis and Profile

This option is the same as *Text Analysis* but in addition prints an *Analog Scan Profile (See Figure I-1).*

Storage

This option prints all analysis data stored in the buffer. The last bar code that was scanned is printed first.

When printing the buffer in multiple scan mode, don't initiate printing before all scans of the current analysis are complete, otherwise, some completed scans could be lost.

Note:

Scan reflectance profiles are not stored in the Store and Print buffer; only analysis data is stored.

Appendix I (Computer Mode)

Output Data

When the **Computer** is enabled during **Setup**, as an output device, the data is output in a format that a PC can receive.

Either

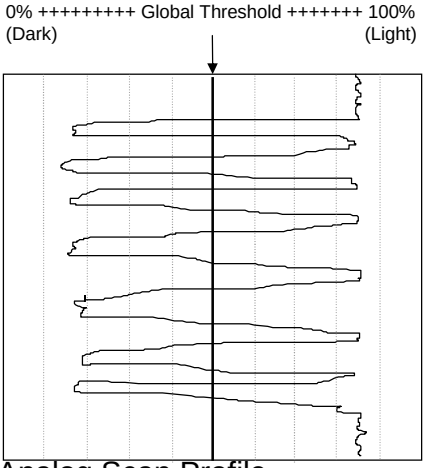
- Text Analysis (text) data (See figure I-2)

OR

- Text Analysis (text) data (See figure I-2) **AND**
- Analog Scan Profile (graphic) data (See figure I-1)

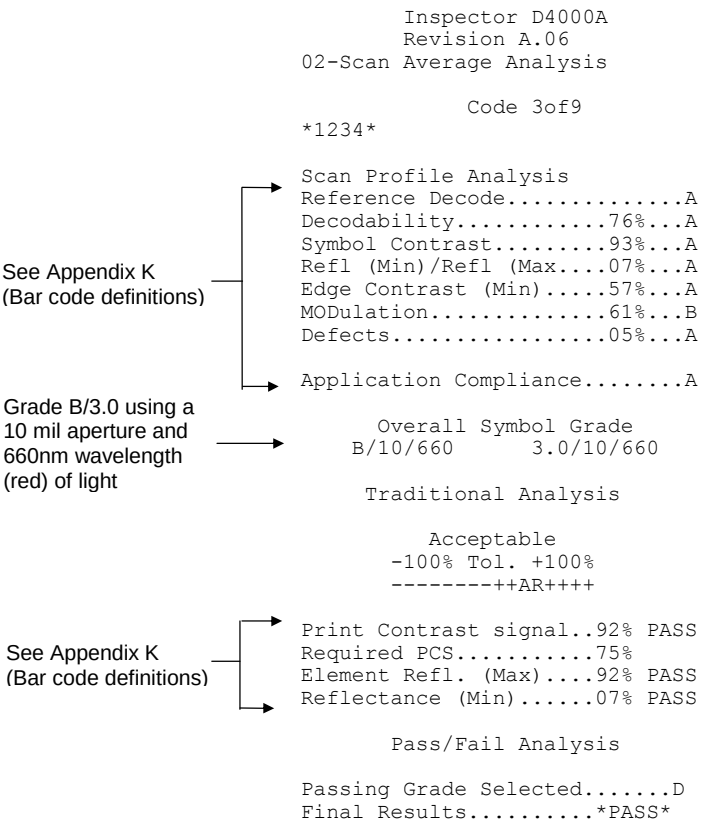
will be output, depending on your printout selection

Figure I-1



Analog Scan Profile

Figure I-2

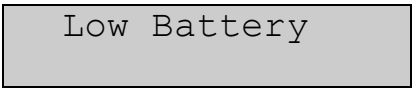


Text Analysis

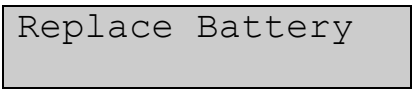
Appendix J (Battery Displays)

Battery Displays

If the "Low Battery" condition displays, there is still power left in the battery to advance to the next screen or even do a scan.



If the "Replace Battery" condition displays, batteries should be replaced immediately. The unit will not operate properly in this condition.



Note:
NiCad batteries and charger are available as an option

Warning:
When using the optional charger, DO NOT charge alkaline batteries - this will damage the verifier

Appendix K (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.

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 Minumum

This parameter grade can be "A" or "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" "A" else "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

The intended width of the narrow elements dictated by the application and/or symbology specification.

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.