User's Manual

Series NLB 9625/9645

Fixed Position
Laser Bar Code Scanner

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Opticon
8 Olympic Drive
Orangeburg, NY 10962
Tel 845.365.0090
Fax 845.365.1251
www.opticonUSA.com

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Contents

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Organization of this Manual

This manual provides the necessary instructions for installing and using an Opticon NLB 9625/9645 Series Fixed Position Laser Scanner. The manual is organized as follows:

Section 1 Introduction and Getting Started
Describes the general operation of the NLB 9625/9645 Series scanner. Also provides a Quick Start-Up Procedure that allows you to begin using the scanner immediately.

Section 2 Technical Specifications
Provides complete specifications, including mechanical details, optical performance, RS232 communications and other technical data.

Section 3 Positioning Scanner for Optimum Performance
Provides detailed instructions and tips for mounting and positioning the scanning to obtain the best scanning performance. Application Notes describe guidelines for maximizing specific characteristics.

Section 4 Configuring Your Scanner
Describes how various parameters can be programmed to customize the scanner for your specific application.

Section 5 Application Engineering Support
Discusses the most common questions and concerns when adapting the NLB 9625/9645 Series scanner in your application.

Appendices Detailed Supporting Information
Provides detailed information in specific areas such as the programming commands for configuring various parameters of the NLB 9625/9645 Series scanner.

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Section 1
Introduction and Getting Started

Product Overview

The NLB-9625/9645 Series Fixed Position Scanners are miniature, 33 or 200 scans per second, laser bar code readers designed to be easily incorporated into host equipment. Utilizing a solid state laser diode and a brushless motor results in a minimum of wear on parts and high performance. The scanner is encased in a rugged steel enclosure to assure durability and reliability.

Advanced 16-bit microprocessor technology coupled with Opticon's proven decoding algorithms result in superior accuracy. The scanners are fully programmable allowing the user to customize parameters including changing communication settings, selecting symbologies, adding prefixes and appending suffixes. Programmable settings can be downloaded from the host CPU or computer directly to the scanner.

NLB 9625/9645 Series laser scanners are encased in compact, rugged steel enclosures. The compact size permits installation in the tightest areas. Scanners are available in both front and side view configurations allowing great flexibility in mounting and positioning the scanner for optimum performance.

Quick Start-Up Procedure

This section is for those who wish to start using the scanner before reading the complete manual. In only a few steps the scanner will be operable.

1) Turn off the power to your PC and connect the scanner to an RS232 communications port. Note: You must provide +5 Volt DC power to the scanner. This can be accomplished using the power supply and patch cable available from Opticon. Turn on the power to the PC.

2) Using communications software (e.g., Procom), set the communication parameters: 9600 baud, 1 Start / Stop Bit, 8 Data Bits, No Parity, No Handshaking, No Flow Control.

3) If you are operating in a Microsoft **Windows 3.1** environment, skip to Step 5.

4) If you are operating in a Microsoft **Windows 95** environment, you can set the communication parameters using Hyper Terminal as follows:

   - Open Hyper Terminal. This can be done from Start→Programs→Accessories
   - Select **Hypertrm.exe** to create a New Connection.
   - In the **Connection Description** dialog screen enter a name for the new file. If desired, select an Icon. Click OK.
   - In the **Phone Number** dialog screen, in the box entitled: **Connect using**. select the communication port, for example, "Direct to Com 1." Click OK.
   - In the **Com 1 Properties** screen, enter the appropriate Port Settings:
     Bits per second = 9600
     Data bits = 8
     Parity = None
     Stop Character = 1
     Handshaking = None
     …Click OK.
   - The HyperTerminal folder you just created will open. From the File pull-down menu, select **Properties**, then click on the **Setting** Tab.

- In the **Properties Settings** dialog screen:

  Select Terminal keys for the Function, arrow and control key
  Select ANSI for Emulation,
  The Backscroll buffer line can remain at the default 500

- Click on the ASCII Setup button. In the ASCII Setup screen, select Echo typed locally so that any keyboard commands you input will appear on your screen. Click OK. This returns you to the Properties Setting. Click OK.
  Your PC and the scanner should now communicate. Skip to Step 6.

5) In a Microsoft **Windows 3.1** environment, set the communication parameters using the Terminal function of Windows.

   - From Window's **Program Manager** Main Menu, select **Terminal**
   - From the **Terminal** menu, select Settings
   - From the **Settings** menu, select Terminal Emulation
   - Set the emulation to TTY (generic)
   - From the **Settings** menu, select Terminal Preferences and select the following:

     Terminal Modes: Line Wrap / Local Echo / Sound
     CR /LF: Inbound, Outbound
     Columns: 80

   - From the **Settings** menu, select Communications.
   - Select the COM port and set communication parameters as shown in Step 2, including no flow control.

6) To verify that the scanner and the PC are communicating properly, send the following command from your PC keyboard to activate the scanner's buzzer.

   Send the command: <Escape> V5 <Carriage Return>

   Note: Be sure to use capital letters (e.g. "V5", not "v5").

   The buzzer should sound, indicating that good communications have been established.

7) A red laser light should be visible. Do not stare into the laser light. If the light is not visible, the scanner may be waiting for a Trigger Command from the host to activate it. Send the following computer command to place the scanner into the "Triggered Disabled" mode:

   <ESC> S7 <CR>

   In this "Triggered Disabled" mode, the red laser light is always illuminated. You are now ready to scan barcodes.

8) Position the red laser light of the scanner over the bar code symbol to be read. When the bar code symbol is decoded, the scanner will beep and transmit the data to the screen of your PC. You may have to move the scanner closer or farther away from the bar code symbol in order to locate the best distance for reading.

This Quick Start-Up procedure will get you started reading bar code symbols. However, in order to best understand the full capabilities of this scanner, you should read the complete manual.

Section 2
Technical Specifications

Physical Specifications

Case Material	Steel, painted dark gray
Weight	7.7 ounces (220 grams) without cable
Cable Length	6-ft (2.8m) with DB25 pin female connector
Mounting	6 threaded (M-3) mounting holes. (screws should not extend more than 5 mm into case)
Dimensions (LxWxH)	
9627/9647 Front View	2.9 x 2.7 x 1.0 in (74 x 68 x 26 mm)
9626/9646 Side View	4.3 x 2.7 x 1.2 in (110 x 68 x 30 mm)

Symbologies Supported

Codabar
Code 39
Code 93
Code 128
Standard 2 of 5
Interleaved 2 of 5
MSI / Plessey
UPC / EAN / JAN

Optical Specifications

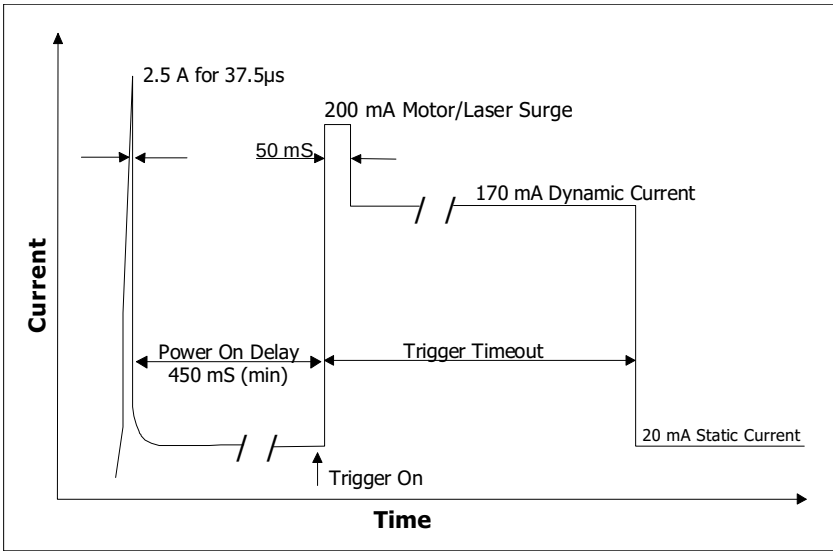
Scan Rate	
9626/9627	33 scans per second
9646/9647	200 scans per second
Light Source	Solid state laser diode (670 nm)
Light Beam Distribution	Rotating polygon
Read Sensor	2048 pixel CCD linear array
Focal Distance (nominal) from window	
9627 Front View	5.6 inches
9647 Front View	5.2 inches
9626 Side View	3.5 inches
9646 Side View	4.2 inches
Min. Bar Code	
Curvature (Radius)	0.6 inches for 10.4 mil EAN-8 label 0.8 inches for 10.4 mil EAN-13 label

Electrical Specifications

Operating Voltage +5VDC ± 10%

Current Consumption

Dynamic	170 mA typical / 200 mA max.
Static	20 mA max.
Surge	2.5 A for 37.5µS (1.0A/15µS)



Connector Pin-outs

DB25 pin Female connector with screws.

Pin No.	Signal	Color
1	Frame Ground	Black
2	RXD	White
3	TXD	Green
4	CTS	Blue
5	RTS	Gray
7	Signal Ground	Purple
16	Trigger	Brown
25	+5V	Red

RS232 Communications Specifications

Parameter	Default	Optional Settings
Timing	Asynchronous	
No. of Start Bits	1 bit	
No. of Stop Bits	1 bit	1 or 2 bits
No of Data Bits	8 bit	7 or 8 bits
Parity	None	Odd / Even / None
Baud Rate	9600 baud	150 to 19200 baud
Handshaking	None	Hardware / Software/ None

RS232 Transmit / Receive Character Format

TXD/ RXD	Start Bit	Bit LSB	7 or 8 Data Bits	MSB	Parity Bit	Stop Bit

RS232 Data Format

Transmit	Decoded Data		CR
Receive	ESC	Command	CR

RS232 Signal Level

Signal Name	In / Out	RS232C Level	
		Mark/Off	Space/On
TXD	Out	-5 to -15	+5 to +15
RXD	In	-3 to –15	+3 to +15

Environmental Specifications

Temperature
- Operating -10 to +40° C (14 to 104° F)
- Storage -30 to +60° C (-22 to 140° F)

Humidity (non-condensing)
- Operating 5% to 95%
- Storage 5% to 95%

CDRH Class II This product conforms to 21 CFR 1040.1 and 21 CFR 1040.11

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Section 3
Positioning the Scanner

Getting Optimum Performance

Three items greatly impact scanner performance:

1) Distance from the scan window to the bar code
2) Specular Reflection
3) Quality of bar code labels

1) Distance to the Bar Code

The operation of the scanner is similar to a camera. If you photograph an object that is out of focus, the resulting picture will be blurry. The same is true with the scanner. If the bar code label is out of focus, the scanner may have difficulty decoding what appears to be fuzzy bars and spaces.

Focal Distance

Ideally, the distance from the window of the scanner to the bar code label should be equal to the focal distance of the scanner. For the NLB-9625/9645 Series fixed position laser scanners, the nominal focal distances are:

9626 Side View3.5 in (88.9 mm)
9627 Front View5.6 in (142.3 mm)
9646 Side View 4.2 in (107 mm)
9647 Front View 5.2 in (132 mm)

Depth-of-Field

Just as with a camera, the scanner has a depth-of-field. It can read bar codes that are not precisely at the focal distance — maybe a little closer, or a little farther away. However, if the bar code label is positioned too far from the focal distance, the scanner may not be able to successfully decode it.

The depth-of-field varies based on the density of the bar code, i.e., the thickness of the bars. Very high density bar codes (which have very narrow bars) are readable over a much shorter distance range than low density bar codes with larger bars.

The following table shows the "typical" depth-of-field (closest to farthest reading distances) for the NLB-9625/9645 Series scanners. The actual performance may differ slightly from unit to unit. Also, it is important to note that this data was measured under ideal conditions using high quality bar code labels. In a "real world" environment the conditions will not be as ideal. Therefore, the best practice is to position the scanner at its focal distance rather than at the extremes of its depth-of-field.

Typical Reading Distance from Window (Depth-of-Field)

	9626 Side View		9627 Front View		9646 Side View		9647 Front View	
Bar Code Density	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**	**Min.**	**Max.**
13.0 mil	0.0″	7.0″	1.1″	8.0″	0.5″	7.5″	2.0″	9.5″
10.0 mil	0.5″	6.0″	2.4″	7.4″	1.9″	6.5″	3.5″	7.0″
7.5 mil	1.8″	5.4″	3.4″	6.5″	2.2″	5.6″	3.8″	6.5″

Readable Bar Code Width (Field-of-View)

The following table shows the field-of-view at various distances from the window. The field-of-view is the max. width that the scanner is capable of reading. A bar code label positioned anywhere within this field-of-view can be decoded. The field-of-view is also a measure of the widest bar code label that can be read. Remember, the width of a bar code label includes not only the bars and spaces but also the required white space (quiet zone) on each end.

Field-of-View (Maximum Readable Bar Code Width)

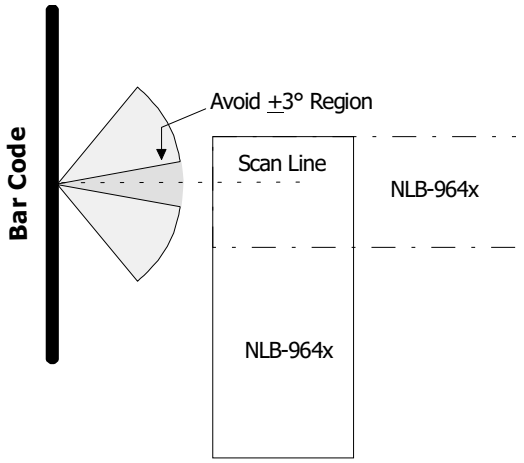
Distance from Window	9627 Front View	9647 Front View	9626 Side View	9646 Side View
2 inches	2.6″	2.6″	3.8″	3.8″
3 inches	3.3″	3.3″	4.8″	4.8″
4 inches	4.3″	4.3″	5.7″	5.7″
5 inches	5.1″	5.1″	6.6″	6.6″
6 inches	5.9″	5.9″	7.8″	7.8″
7 inches	6.8″	6.8″	N/A	N/A

Good design policy is to position the scanner at its focal distance and at the center of the field-of-view. Do not position it near the extremes of the reading range.

2) Avoiding Specular Reflection

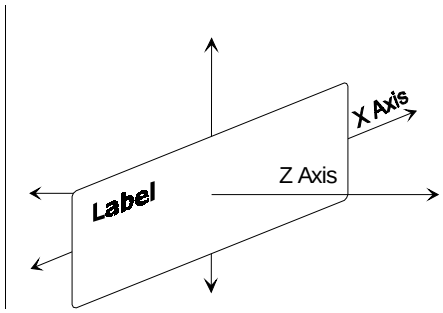
Do not position the scanner at an angle that causes the laser scan line to be reflected directly back into the scanner. This is called specular reflection. Too much reflected light can "blind" the scanner preventing a good decode.

If the bar code label is located on a flat surface, specular reflectivity occurs between ±3 degrees off perpendicular (See diagram in Section 2). If the bar code label is located on a cylindrical surface, such as a test tube, the angle of specular reflection is measured tangent to the curve. If the curved surface is also moving, there may be more than one position causing specular reflection.



Specular Reflection Area: Avoid ±3° around X axis (see diagram above).
Preferred angle is ±10°

Skew



Skew Angle	±60° around Y axis
Rotation	±60° around Z axis
Tilt Angle	+55°, -50° around X axis

3) Quality of Bar Code Labels

The quality of the bar code label can affect the scanning performance. Poor quality labels are more difficult to decode and may result in non-reads or potential misreads. The bar code label should be printed to specifications. This means that the bars are printed within spec, with the correct widths, no ink spread, crisps edges and no voids. There should be a sufficient quiet zone on both end of the bar code label.

For best results the paper or label stock should have a matte finish to diffuse light. The print contrast signal (which is a comparison of the reflectance of the bars and the background stock) should be as high as practical.

Measuring Scanner Performance

Two methods are helpful in determining the optimum position of the scanner. The first method is to program the scanner for Trigger Disable and Continuous Read modes. The scanner will be "ON" continuously and will continuously read the same bar code. Since the buzzer sounds each time the bar code is read, the sound of the buzzer can be used like a "Geiger counter." As the position of the scanner changes the sound of the buzzer will change. The buzzer sound will be loudest and most continuous at the best reading positions.

The Read Rate Test

The second method, the Read Rate Test, provides a mathematical calculation of scanning performance. In this test the scanner scans a bar code 100 times and then calculates the number of those scans that resulted in a good decode. That number, expressed as a percentage, will be transmitted to the host. For example, 93% means that the scanner decoded the bar code symbol 93 times out of the 100 scan attempts. By performing the Read Rate Test with the scanner mounted in various positions you can determine which of those locations results in the best performance.

Here's how to perform the Read Rate Test:

1) Program the scanner for Continuous Read (S2) and Trigger Enabled (S8).
2) Instruct the scanner to enter the Read Rate Test mode (ZA).
3) Locate the scanner in the desired position relative to a test bar code then enter a Z command. The scanner will read the bar code once and store it in memory.
4) Enter another Z command. The scanner will scan the bar code 100 times and then transmit the Read Rate Percentage to the host.
5) Steps 3 and 4 can be repeated as often as desired, moving the scanner to new locations before each test.
6) Exit the Read Rate Test mode (ZG).

Application Notes

Tips for Achieving High Throughput

In some applications your primary objective may be to achieve the highest possible throughput rate. The following list identifies the parameters and scanner settings that can maximize scanning and decode throughput speed. Note, by emphasizing max. throughput, other areas of performance may be affected. For example, the number of non-reads could increase. If high throughput is critical, consider some or all of these settings.

- Operate in the Trigger Disabled mode. Operation of the trigger can require as much as 200 msec before decoding begins, slowing down throughput rate.
- Only enable those symbologies that you will be decoding.
- Eliminate all suffixes and prefixes.
- Minimize the number of redundant reads required before transmitting data.
- Transmit the decoded data at the highest baud rate, 19200 baud.
- Disable both the hardware and software buzzer functions.
- If you need a buzzer, use the hardware buzzer rather than the software buzzer.

Tips for Insuring Highest Data Integrity

There are several parameters that can enhance your confidence that the correct bar code data is transmitted. Note that by emphasizing the accuracy and security of the data other areas of the scanner operation may be affected, for example, you may not achieve the highest throughput.

If accuracy and data integrity are critical, consider some or all of these settings.

- Program the scanner to require a high number of redundant decodes prior to transmitting. For example, program the scanner to decode a bar code exactly the same way three consecutive times before transmitting the data. Then decoding the bar code the same way 2 out of 3 times or any 3 out of 4 times is not sufficient. It must obtain three consecutive and identical decodes.
- Utilize a predetermined, fixed-length of bar code. Program the scanner to only decode a bar code of that length. Bar codes of any other length will be ignored.
- The quality of the printed bar code must be excellent.
- Use a bar code symbology that contains an internal check digit and program the scanner to calculate that check digit for validity prior to transmitting.
- Do not use a symbology with poor internal verification, or subject to partial decodes, such as 2 of 5 or MSI/Plessey.
- Only enable those symbologies that you will be decoding.
- Transmit data at low baud rates to minimize communication errors.
- Enable the "Number of Characters Transmitted". The scanner will calculate and transmit a number indicating the total number of characters it is transmitting. Your host application program can compare this number with the actual number of characters received to verify that the correct amount of data is received.

Tips for Verifying the Presence of a Bar Code

If the scanner is operated in the "trigger enabled" mode and the trigger is activated, one of three conditions may occur:

A bar code is scanned and decoded	Decoded data is transmitted
A bar code is scanned but is not decoded (e.g., print quality was poor)	No data is transmitted
No bar code is present	No data is transmitted

In some applications, when no data is transmitted, it may be important to know why. Was there a bar code present that could not be decoded, or was no bar code present at all?

This requirement is common in applications such as automated blood analysis equipment. Test tubes containing blood samples from many different people are loaded into a rack for automatic analysis. The bar code on each tube ties that sample and the results back to a specific individual. If no bar code data is transmitted it is critical to understand the reason.

Your Opticon scanner, when operated in the Trigger Enabled mode, can be programmed to transmit an error message that indicates whether or not a bar code was present. The following table shows the message that will be transmitted for each condition.

Presence/Absence of Bar Code	Scanner Transmits
Bar code was present and correctly decoded	Decoded Data
No bar code was present	<STX> "?" <ETX>
Bar code was present but could not be decoded	<STX> ">" <ETX>

Section 4
Configuring The Scanner

Since operation of the NLB 9625/9645 Series laser scanner is microprocessor controlled, it is possible to modify or program its operation to match your specific application. Changes in parameter settings can be changed or programmed in two ways. The first method employs specially designed programming bar codes, which instruct the scanner to modify specific parameters. The second is that the scanner can also be programmed by sending software instructions from the host PC to the scanner via the RS232 connection.

Programming Menus & Commands

Two different methods can be used to program parameters to configure the scanner:

a. Programming via Bar Codes from a menu page; or
b. Programming via Computer Commands

Most parameters can be programmed using either of these two methods. However, there are certain parameters that are only programmable via the bar code menu.

Programming via Bar Codes

Use the following steps to program parameters via the bar code menu:

1) Scan the "START" bar code. This instructs the scanner to enter the Programming Mode. While in this mode the scanner will beep intermittently.
2) Scan the bar code(s) associated with the desired parameter(s). The scanner will beep when the bar code is scanned. Note: Because of the close proximity of bar codes on the menu, approaching the desired bar codes from the side of the page will ensure that the only correct bar code is scanned.
3) Scan the "STOP" bar code. This instructs the scanner to exit the Programming Mode.

All the parameters that are programmed via bar codes are retained in non-volatile memory and stored permanently (even if the scanner is powered down) or until they are changed again.

Programming via Computer Commands

Various parameters can be programmed by sending software commands or keyboard strokes from the host computer to the scanner in the following format:

<ESC> Computer Command <CR>

Note:

1) Only upper case letters are recognized, e.g. "AB" , not "ab"
2) Each Command normally consists of two characters
3) Downloading of software commands cannot be "grouped" together. Each command must be preceded by <ESC> and followed by a <CR>

Parameters changed by downloading software commands remain in effect only while power is supplied to the scanner. If power is interrupted or terminated, the parameters return to their original settings. However, parameters programmed by downloaded commands can be stored permanently by transmitting a "Z2" Computer Command to the scanner after the commands are sent. This instructs the scanner to store the changed parameter in non-volatile memory. The scanner will then retain the setting permanently or until it is changed.

It is not necessary to send a "Z2" command after each parameter is changed. One "Z2" command will save all changes. If you want to program the scanner so that it will only decode a Code 128 bar code, you would send the following command:

<ESC> A6 <CR>

The scanner will now only decode Code 128 bar codes. It will ignore any other type of bar code. The scanner will retain this setting until power is shut off. Then it will revert to its original setting. If you want to retain this setting permanently, you would send the following commands:

<ESC> A6 <CR> then <ESC> Z2 <CR>

The "Z2" command stores the changed parameter in non-volatile memory. The scanner will now retain that setting even after power is terminated.

Appendix A contains full instructions on how to configure the scanner as well as a complete listing of the computer commands and programming bar codes that are available to customize the scanner for your application.

Factory Default Settings

Factory default settings are indicated by the word **(Default)** throughout the Programming menus located in Appendix A.

When you modify or change any parameters, the scanner can be programmed to retain the new parameter in memory, even if power interrupted or terminated. If for any reason, however, the scanner is instructed to "return all parameters to default settings", it will return to the factory default settings shown in the following table.

Parameter	**Factory Default Setting**
RS 232 Communications	9600 baud 8 data bits 1 stop bit No parity No handshaking
Trigger Function	Disabled
Read Mode	Multiple Read Mode
No. of Redundant Decodes	Two
Bar Code Symbologies	All Symbologies enabled
UPC-A (13 digits)	Add leading zero Enable check digit
UPC-E (7 digits)	Add leading zero Enable check digit
Code 39	Do not calculate check digit Enable start/stop characters (*.....*) Disable character length of one
Codabar	Enable start/stop characters as abcd/abcd Do not calculate check digit Disable character length of one
2 of 5	Do not calculate check digit Disable characters length of two
Fixed length of bar code only	Disabled
Software buzzer	Disabled
Positive bar codes only	Enabled
Error indications	Do not transmit error code
Print quality adjustment	Output from Low or High analog gain 1 MHz sampling rate

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Section 5
Application Engineering Support

Technical Assistance and Support

Opticon is eager to help you integrate the NLB 9625/9645 Series laser scanner into your application. We have a proven track record of successful applications. Our technical support staff is available to answer any questions or work with you to adapt the scanner to your specific situation. We are happy to answer your questions, assist in configuring and positioning the scanner for optimum operation, and help resolve any problems you encounter. Call us at 1 (800) 636-0090.

Common Causes of Poor Performance

The most common reasons for poor scanning performance are listed below.

- Bar codes are not positioned at the focal distance of the scanner.
- Specular reflection is impacting the scanner. Change the angle/position of the scanner or the bar code.
- Poor quality of printed bar codes. Bar codes are out of specification.
- The paper on which the bar code is printed is highly reflective or has a glossy finish causing light to be reflected into the scanner.
- The distance from the scanner to the bar code is not suitable for the density of the bar code. Or the density of the bar code beyond the scanners capability.
- If the red illuminating light of the scanner is not on, the scanner may be in the "Trigger Enable" mode expecting a trigger signal.

Modified and/or Customized Scanners

Opticon will work with you to modify or customize scanners to match your requirements. Scanners can be modified in terms of connectors type, pin-outs, cable length, default settings, custom software and many other areas.

Opticon will modify scanners in our factory and ship you scanners that match your specific requirements. By incorporating your modifications directly into production scanners, you receive scanners tailored for your need. They can be used immediately without the need for further modification or rework.

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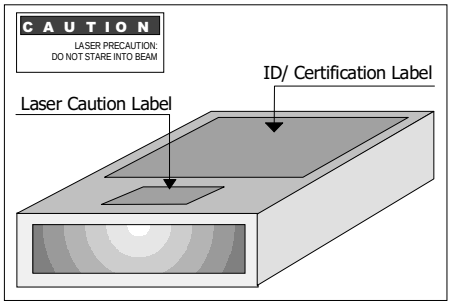
Section 6
Scanner Labeling

CDRH Class II

The NLB 9625/9645 Series scanner complies with Center for Devices and Radiological Health (CDRH) regulation 21, CFR Subchapter J.

A NLB 9625/9645 Series scanner uses a low-power, visible laser. As with any very bright light source, such as the sun, the user should light beam. Momentary exposure to a CDRH Class II laser is not known to be harmful.



Required safety label as it appears on the scanner.

Note: Do not open the scanner. The scanner contains no user adjustable or serviceable parts in the interior of the scanner. All product service must be performed by the Opticon Service Department in Orangeburg, NY. Opening the scanner will void the warranty and could expose you to laser energy. Laser diode power of up to 2 mWatt average could be accessible in the interior of the scanner. If a NLB 9625/9645 Series scanner is incorporated or interfaced to other equipment, that equipment should include an indicator that is illuminated whenever laser energy is being emitted from the scanner. This indicator may remain illuminated when the scanner is powered but the laser is not emitting energy.

CAUTION: Use of controls, adjustments or performance of procedures others than those specified herein may result in hazardous visible light exposure.

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Appendix A
Programming Menus & Commands

Index

Introduction

Two different methods can be used to program parameters to configure the scanner:

a) Programming via bar codes from a menu page; or
b) Programming via computer commands

Programming via Bar Codes

Use the following steps to program parameters via the bar code menu:

1) Scan the "START/END Programming Menu" bar code. This instructs the scanner to enter the Programming Mode. The scanner will beep intermittently while in this mode.
2) Scan the bar code(s) associated with the desire parameter(s). The scanner will beep when the bar code is scanned. Note: Because of the close proximity of bar codes on the menu, approaching the desired bar codes from the side of the page will ensure that only the desired bar code is scanned.
3) Scan the "START/END Programming Menu" bar code. This instructs the scanner to exit the Programming Mode.

All the parameters that are programmed via bar codes are retained in non-volatile memory and stored permanently (even if the scanner is powered down) or until they are changed.

Programming via Computer Commands

Various parameters can be programmed by sending software commands or keyboard strokes from the host computer to the scanner in the following format:

<ESC> Computer Command <CR>

Note: Only upper case letters are recognized, e.g. "AB", not "ab." Each command typically consists of two characters. Downloading of software commands cannot be "grouped" together. Each command must be preceded by <ESC> (Escape) and followed by <CR> (Carriage Return).

Factory default settings are indicated throughout the following menus by the pointing hand icon (☜).

NOTE: Where computer commands appear in parenthesis, bar code commands must be used to program the scanner.

Parameters modified by downloading software commands remain in effect only while power is supplied to the scanner. If power is interrupted or terminated, the parameters return to their original settings. However, parameters programmed by downloaded commands can be stored permanently by transmitting a "Z2" computer command to the scanner after the commands are sent. this instructs the scanner to store the changed parameter(s) in non-volatile memory. The scanner will then retain the setting(s) permanently or until changed.

It is not necessary to send a "Z2" command after each parameter is changed. One "Z2" command will save all changes.

Example: If programming the scanner to decode only Code 128 bar code were desired, the following command would be used:

<ESC> A6 <CR>

The scanner will now only decode Code 128 bar codes and will ignore other types of bar code. The scanner will retain this setting until power is interrupted or terminated, and will then revert to its original setting. If retaining this setting permanently is desired, the following command would be used:

<ESC> A6 <CR>
<ESC> Z2 <CR>

The "Z2" command stores the modified parameter in non-volatile memory. The scanner will not retain this setting even after power is terminated.

Global Defaults & Scanner Configuration

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
U4	Return all parameters to Default Settings	☜
1Y	Clear all prefixes	
1Z	Clear all suffixes	
Z3	Display software settings and version number	
Z4	Display prefix/suffix value length (expressed in hexadecimal format)	

Symbology Selection

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
A0	Read all symbologies	
J1	UPC Only	
J2	UPC +2 Only	
J3	UPC +5 Only	
J4	EAN Only	
J5	EAN +2 Only	
J6	EAN +5 Only	
A2	Code 39 Only	
A3	Codabar Only	
J7	Standard 2 of 5 Only	
J8	Interleaved 2 of 5 Only	
A5	Code 93 Only	
A6	Code 128 Only	
A7	MSI/Plessey Only	

Adding/Activating Specific Symbologies

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
B2	Enable Code 39	
B3	Enable Codabar	
R7	Enable Standard 2 of 5	
R8	Enable Interleaved 2 of 5	
B5	Enable Code 93	
B6	Enable Code 128	
B7	Enable MSI/Plessey	
R1	Enable UPC	
R2	Enable UPC +2	
R3	Enable UPC +5	
R4	Enable EAN	
R5	Enable EAN +2	
R6	Enable EAN +5	

Options for UPC

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
E2	UPC-A (13 Digits) Add leading zero Enable Check Digit	 ☜
E3	UPC-A (12 Digits) Do not add leading zero Enable Check Digit	
E4	UPC-A (12 Digits) Add leading zero Enable Check Digit	
E5	UPC-A (11 Digits) Do not add leading zero Disable Check Digit	
E6	UPC-E (8 Digits) Add leading zero Enable Check Digit	
E7	UPC-E (7 Digits) Do not add leading zero Enable Check Digit	 ☜
E8	UPC-E (7 Digits) Add leading zero Disable Check Digit	
E9	UPC-A (6 Digits) Do not add leading zero Disable Check Digit	

Options for Code 39

Computer Command	Function /Description	Bar Code Command	
(Z7)	START/END Programming Menu		
C0	Do not calculate Check Digit		☜
C1	Calculate Check Digit		
C2	Transmit Check Digit		
C3	Do not transmit Check Digit		
D0	Disable start/stop characters (*.....*)		
D1	Enable start/stop characters (*.....*)		☜

- 43 Data digits are available: 0 to 9, A to Z (caps only) plus . - $ / + % and space. If a check digit is present, it will appear as part of the data.
- If the scanner is programmed to calculate the check digit, and the bar code is not printed with a check digit, the bar code will not read.
- Another option available for Code 39 is to enable the reading of a single character bar code. See the section on Fixing the Digit for this option.

Options for Codabar

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
F0	Disable start/stop characters	
F1	Enable start/stop characters as ABCD/TN*E	
F2	Enable start/stop characters as abcd/tn*e	
F3	Enable start/stop characters as ABCD/ABCD	
F4	Enable start/stop characters as abcd/abcd	 ☜
F5	Transmit Check Digit	
F6	Do not transmit Check Digit	
F7	Do not calculate Check Digit	 ☜
F8	Calculate Check Digit (Modulo 10)	
F9	Calculate Check Digit (Modulo 16)	

Codabar Format

Start Character	1 to 42 Data Digits	Check Digit	Stop Character
A			. . . . T
a			. . . . t
A			. . . . A
a			. . . . a

Codabar has four different start/stop character schemes as shown. The check digit is optional and, if present, would be the last character.

- If the scanner is programmed to calculate the check digit, and the bar code is not printed with a check digit, the bar code will not be read

Options for 2 of 5

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
G0	Do not calculate Check Digit	 ☜
G1	Calculate Check Digit	
G2	Transmit Check Digit	
G3	Do not transmit Check Digit	

2 of 5 Format (Standard & Interleaved)

1 to 44 Data Digits	Check Digit
numbers only (0 to 9)	Check Digit

Opticon recommends strongly that the "Fixing the Number of Digits" feature on the next page be employed whenever 2 of 5 bar codes are used.

Fixing the Number of Digits

Computer Command	Function /Description	Bar Code Command	
(Z7)	START/END Programming Menu		
H0	Disable Fixation		☜
H1	Enable Fixation		
H2	Disable 1 character Code 39 Disable 1 character Codabar Disable 2 character 2 of 5		☜
H3	Enable 1 character Code 39 Enable 1 character Codabar Enable 2 character 2 of 5		

To avoid truncation errors, the scanner can be programmed to only decode bar codes of one specific length, i.e., containing a specific number of digits. It is also possible to program the scanner to only decode bar codes of either of two specific lengths.

To fix one (1) length (or number of digits) of bar code:	To fix two (2) different lengths of bar codes:
1. Scan "START" to enter programming mode 2. Scan "Enable fixation" bar code 3. Scan a sample bar code of desired length 4. Repeat Step #3, re-scanning the sample bar code 5. Scan "STOP" to exit programming mode	1. Scan "START" to enter programming mode 2. Scan "Enable fixation" bar code 3. Scan a sample bar code of desired length #1 4. Scan a sample bar code of desired length #2 5. Scan "STOP" to exit programming mode

"Fixing the Number of Digits" can only be applied to Code 39, Codabar, 2 or 5 and MSI/Plessey (UPC, Code 93 and Code 128 are not affected).

Creating a Prefix and/or Suffix

The scanner can be programmed to transmit a prefix and/or suffix with the decoded data. A Prefix (or a Suffix) is composed of up to 4 characters. The following steps are used to establish a Prefix that will be transmitted with the bar code data:

1. Scan "START" to enter the Programming Mode.
2. Scan the bar code representing the symbology to which you wish to add a Prefix.
3. Scan the character(s) that will comprise the Prefix. Up to 4 numeric, alpha or control character(s) may be used.
4. Scan "STOP" to exit the Programming Mode.

The same steps are used to establish a Suffix.

> ***Example***: To add the alpha character "A" as a Prefix and "B" as a Suffix to UPC-A bar code data:
>
> 1) Scan "START/END Programming Mode"
> 2) Scan N1, representing a Prefix for UPC-A
> 3) Scan 0A, representing the alpha character "A"
> 4) Scan N6, representing a Suffix for UPC-A
> 5) Scan 0B, representing the alpha character "B"
> 6) Scan "START/END Programming Mode"

Setting Prefixes (Identifying the Symbology)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
1Y	Clear all Prefixes	
M0	UPC-A +2 or UPC-A +5	
M1	UPC-E +2 or UPC-E +5	
M2	EAN-13 +2 or EAN-13 +5	
M3	EAN-8 +2 or EAN-8 +5	

CONTINUED ON NEXT PAGE…

Setting Prefixes (Identifying the Symbology) (continued)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
M4	Code 39	
M5	Codabar	
M6	Standard 2 of 5	
M7	Interleaved 2 of 5	
M8	Code 93	
M9	Code 128	
N0	MSI/Plessey	
N1	UPC-A	
N2	UPC-E	
N3	EAN-13	
N4	EAN+8	
Z4	Display Prefix value and length	

NOTE: U4, the global default, also clears all Prefixes.

Setting Suffixes (Identifying the Symbology)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
1Z	Clear all Suffixes	
N5	MSI/Plessey	
N6	UPC-A	
N7	UPC-E	
N8	EAN-13	
N9	EAN +8	
O0	UPC-A +2 or +5	
O1	UPC-E +2 or +5	
O2	EAN-13 +2 or +5	
O3	EAN-8 +2 or +5	
O4	Code 39	
O5	Codabar	
O6	Standard 2 of 5	
O7	Interleaved 2 of 5	

CONTINUED ON NEXT PAGE...

Setting Suffixes (Identifying the Symbology) (continued)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
O8	Code 93	
O9	Code 128	
Z4	Display Suffix value and length	

NOTE: U4, the global default, also clears all Prefixes.

Direct Input of Numeric Characters

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
Q0	0	
Q1	1	
Q2	2	
Q3	3	
Q4	4	
Q5	5	
Q6	6	
Q7	7	
Q8	8	
Q9	9	

Direct Input of Alpha Characters

(Z7)	START Program Menu	
0A	A	
0B	B	
0C	C	
0D	D	
0E	E	
0F	F	
0G	G	
0H	H	
0I	I	
0J	J	
0K	K	
0L	L	
0M	M	

0N	N	
0O	O	
0P	P	
0Q	Q	
0R	R	
0S	S	
0T	T	
0U	U	
0V	V	
0W	W	
0X	X	
0Y	Y	
0Z	Z	
(Z7)	END Program Menu	

Direct Input of Control Characters

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
1A	STX	
1B	ETX	
1C	CR	
1D	LF	

Enable "Number of Characters/Digits Transmitted"

This feature instructs the scanner to calculate and transmit a number indicating the total number of characters that are being transmitted to the host. This feature allows the host to verify that the correct amount of data was received.

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
3A	UPC-A	
3B	UPC-A +2 or UPC-A +5	
3C	UPC-E	
3D	UPC-E +2 or UPC-E +5	
3E	EAN-13	
3F	EAN-13 +2 or EAN-13 +5	
3G	EAN-8	
3H	EAN-8 +2 or EAN-8 +5	
3I	Code 39	
3J	Codabar	

CONTINUED ON NEXT PAGE...

Enable "Number of Characters/Digits Transmitted" (continued)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
3K	Standard 2 of 5	
3L	Interleaved 2 of 5	
3M	Code 93	
3N	Code 128	
3O	MSI/Plessey	

Disable "Number of Characters/Digits Transmitted"

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
2A	UPC-A	
2B	UPC-A +2 or UPC-A +5	
2C	UPC-E	
2D	UPC-E +2 or UPC-E +5	
2E	EAN-13	
2F	EAN-13 +2 or EAN-13 +5	
2G	EAN-8	
2H	EAN-8 +2 or EAN-8 +5	
2I	Code 39	
2J	Codabar	
2K	Standard 2 of 5	

CONTINUED ON NEXT PAGE…

Disable "Number of Characters/Digits Transmitted" (continued)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
2L	Interleaved 2 of 5	
2M	Code 93	
2N	Code 128	
2O	MSI/Plessey	

Baud Rate Settings

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
(H0)	150 baud	
(K1)	300 baud	
(K2)	600 baud	
(K3)	1200 baud	
(K4)	2400 baud	
(K5)	4800 baud	
(K6)	9600 baud	
(K7)	19200 baud	

Communication Parameters

Computer Command	Function /Description	Bar Code Command	
(Z7)	START/END Programming Menu		
(L0)	7 Data Bits		
(L1)	8 Data Bits		☜
(L2)	No Parity		☜
(L3)	Even Parity		
(L4)	Odd Parity		
(L5)	1 Stop Bit		☜
(L6)	2 Stop Bits		

Handshaking

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
(P0)	No Handshaking	☜
(P1)	Busy / Ready	
(P2)	Modem	
(P3)	ACK / NAK	
(P4)	ACK or No Response NAK	
(I0)	Wait for CTS from terminal: Unlimited	
(I1)	Wait for CTS from terminal: 100 mS	
(I2)	Wait for CTS from terminal: 200 mS	
(I3)	Wait for CTS from terminal: 400 mS	
(I4)	ACK / NAK Delay: unlimited	
(I5)	ACK / NAK Delay: 100 mS	
(I6)	ACK / NAK Delay: 500 mS	
(I7)	ACK / NAK Delay: 1000mS	

Buzzer Operation

The buzzer can be activated either by a hardware or software command. The hardware buzzer is faster, allowing greater scanning throughput. But, it is fixed and can not be adjusted. The sound and duration of the software buzzer can be programmed. These commands are useful in verifying that proper communication exists between the scanner and the host. They can only be invoked via computer command.

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
T4	Disable hardware buzzer	
W0	Disable software buzzer	 ☜
W1	Enable software buzzer of 3kHz	
W2	Enable software buzzer 3kHz with 2.5kHz interval	
W3	Enable software buzzer 3kHz with 4kHz interval	
W7	Duration of software buzzer for 0.05 sec	
W4	Duration of software buzzer for 0.10 sec	
W5	Duration of software buzzer for 0.20 sec	
W6	Duration of software buzzer for 0.40 sec	
V5	Ring software buzzer once at 3kHz for 200 mS.	Use computer command
V6	Ring software buzzer once at 3kHz, 2.5kHz interval for 200 mS.	Use computer command
V7	Ring software buzzer once at 3kHz, 4kHz for 200 mS.	Use computer command ☜

* These commands are useful in verifying that proper communication exists between the scanner and the host. They can be invoked only via computer commands.

Positive & Negative Bar Codes

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
V2	Positive bar code only (black bars/white spaces)	
V4	Both positive & negative bar code	

Setting the Trigger Function

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
S7	Disable the trigger function / Red scanning light is ON continuously	
S8	Enable the trigger function /Red scanning light is OFF until trigger is activated or "pulled"	
Z	Activate the trigger; turns on the red scanning light	

The Trigger function is disabled in the default setting. This means that the red scanning light is "ON" continuously and the scanner is always ready to read.

For some applications, you may wish to activate the scanner only at a specific time. this can be done by enabling the Trigger function. Once in the "Trigger Enabled" mode, the red scanning light if OFF until the trigger is activated or "pulled." Either a hardware trigger or a software trigger pulse may be used to activate the scanner.

The hardware trigger is actuated by pulling Pin #16 (on the standard DB25 female connector) LOW. The software trigger is actuated by downloading and <ESC> Z <CR> computer command from the host.

Selecting the Read Mode

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
S1	Multiple Read Mode	
S2	Continuous Read Mode	
S0	Single Read Mode (Trigger enabled mode only)	

Operation of the scanner in the various read modes is described in the table below. The "Continuous Read" mode is helpful in positioning the scanner for optimum reading. In "Continuous Read," the scanner's buzzer functions like a Geiger counter, sounding the most active at the position achieving the greatest number of good reads.

Mode	Trigger Function Enabled	Trigger Function Disabled
Multiple Read	After receiving a trigger pulse, scanner will read multiple, different bar codes in succession until it times out.	Scanner will read different bar codes in succession if they are presented to the read window.
	Scanner will not read the same bar code twice if they are consecutive.	Scanner will not read the same bar code twice if they are consecutive.
Continuous Read	Scanner will read the same bar code continuously after receiving a trigger pulse until scanner times out.	Scanner will read the same bar code continuously.
Single Read	Scanner will read only one bar code after receiving a trigger pulse.	Same as Multiple Read mode, above.

Scanner Timeout (Trigger Enable Mode only)

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
Y0	Infinite	
Y1	1 Second	
Y2	2 Seconds	 ☜
Y3	3 Seconds	
Y4	4 Seconds	
Y5	6 Seconds	
Y6	8 Seconds	
Y7	10 Seconds	

These commands, which are only applicable in the Trigger Enabled mode, establish the time-out period after the trigger pulse is received. The Time-out period is the same whether the scanner is operating in Single, Multiple or Continuous Read mode.

Number of Redundant Decodes

Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
X0	Read bar code once	
X1	Read bar code twice	 ☜
X2	Read bar code three times	
X3	Read bar code four times	

The Number of Redundant Decodes determines how many times the scanner must decode a bar code and obtain the same value before it will transmit the data. For example, if the redundancy is set at three times, the scanner will not transmit data until it has decoded the bar code and obtained the same values three times in succession. If it obtains the same value twice in a row, but a different value on the third read attempt, it will not transmit. If it gets the same value three out of four times, it will not transmit. It must receive three consecutive, identical reads.

Transmitting Error Indications (Trigger Enabled only)

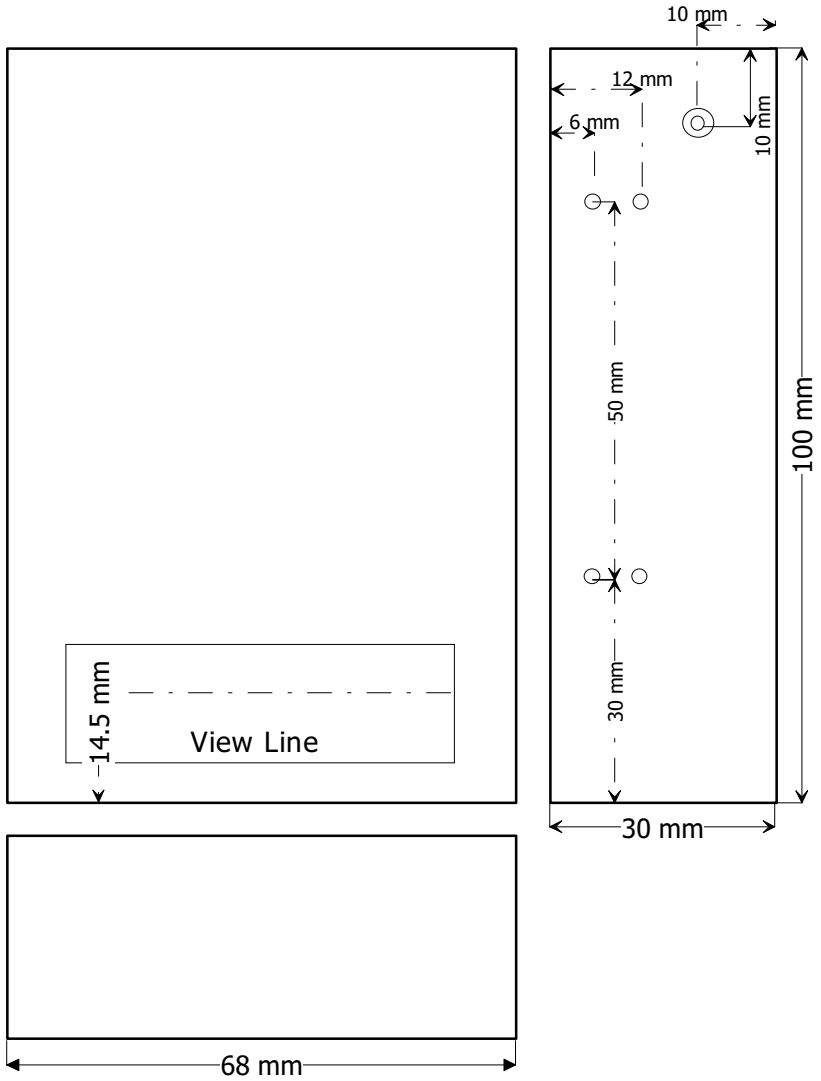
Computer Command	Function /Description	Bar Code Command
(Z7)	START/END Programming Menu	
5E	Do not transmit error code	 ☜
5F	Transmit "BR" <CR> for bad read or no read	
5G	Transmit <STX>, ">", "ETX" for bad read; <STX>, "?", "ETX" for no read	
5A	Wait 30 mS after trigger pulse before sending error code	
5B	Wait 80 mS after trigger pulse before sending error code	
5C	Wait 130 mS after trigger pulse before sending error code	
5D	Wait 220 mS after trigger pulse before sending error code	

Print Quality Adjustments

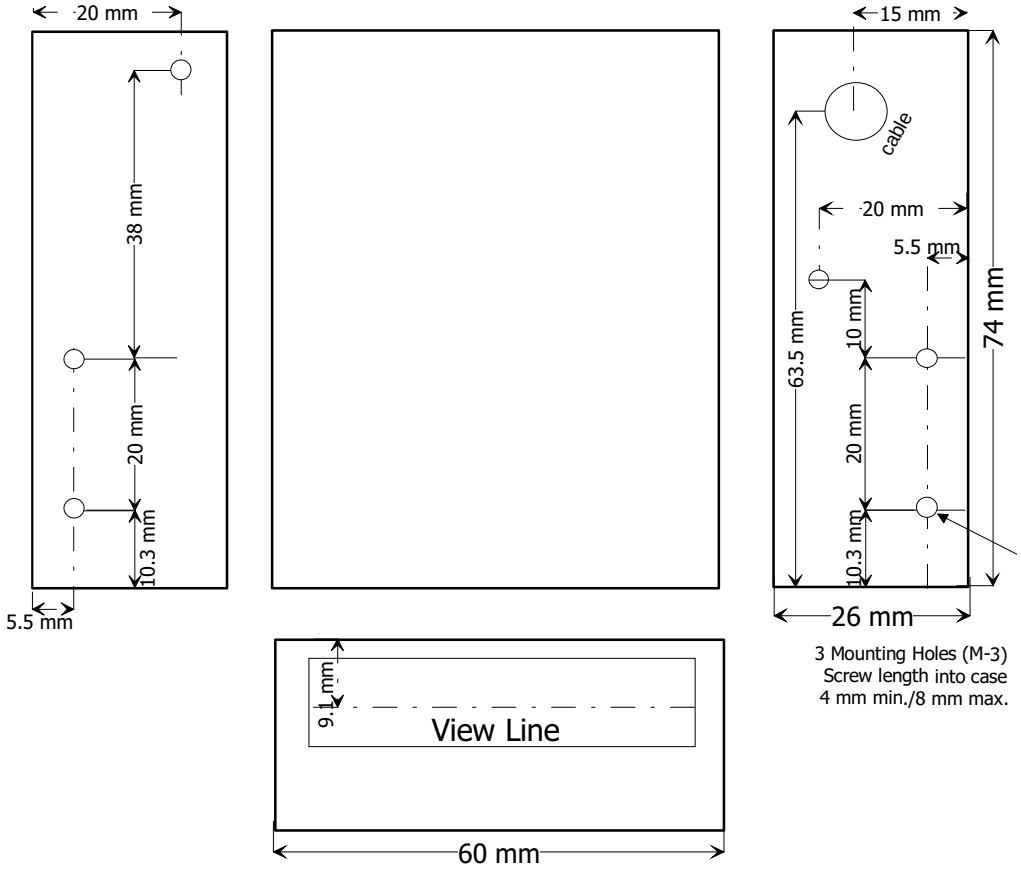
Computer Command	Function /Description	Bar Code Command	
(Z7)	START/END Programming Menu		
X4	For lower density, poor print quality bar code, e.g., dot matrix with voids (low analog gain)		
X5	For high density, good print quality bar code without voids (high analog gain)		
X6	Output data obtained from Low or High analog gain		☜
X7	Output data obtained from Low and High analog gain		
G5	Enables alternate decode algorithms. May improve performance on certain I 2 of 5, Code 39, Codabar or MSI/Plessey bar codes		
G4	Disables alternate decoding algorithms		
SB	1 mHz sampling rate for average bar codes		☜
SC	For high density bar code (activates 8 mHz sampling rate)		

Appendix B
Dimensional Drawings

NLB-9627/9647 Side View



NLB-9626/46 Front View



Appendix C
Optical Charts