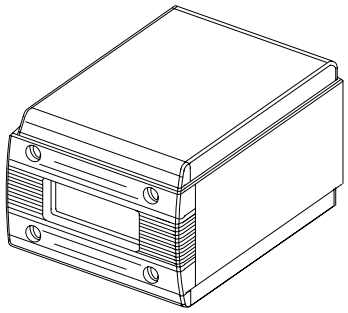
Allen-Bradley

High Performance Visible Laser Diode Scanner

(Cat. No. 2755-LD4z1, -LD4z4, -LD8z1, -LD8z4)



User Manual

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

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Using this Manual

Chapter Objectives

This chapter gives an overview of the manual, including:

- contents of manual
- what you need to know
- conventions and terminology
- European Union Directive Compliance
- laser warning symbol
- related publications

What You Need to Know

No special knowledge is required to read this manual or use the scanner. However, if using the scanner to communicate with a programmable controller or host device, you should be familiar with communication terminology.

Contents of Manual

This manual describes how to install and operate the Catalog No. 2755-LD4 and -LD8 family of Visible Laser Diode (VLD) Scanners. The contents of each chapter are as follows:

Chapter	Title	Purpose
1	Using this Manual	Provides an overview of the manual.
2	Features of the Scanner	Describes the main features of the scanners.
3	Installation Considerations	Provides guidelines on correct setup of the scanner and label positioning. Other topics include usable beam length and compensation for pitched symbols.
4	Installing the Scanner	Describes how to install the scanner and supporting equipment.
5	Operating the Scanner	Covers topics related to operation of the scanner including scan angle adjustment.
6	Troubleshooting and Maintenance	Provides troubleshooting and maintenance information for the scanner.
7	Specifications	Lists specifications of the scanner.

Terminology

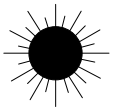
This manual contains many terms that are used within the bar code industry and terms that are unique to the scanner. Refer to the glossary at any time for definitions of these terms.

European Union Directive Compliance

Refer to Appendix A for details on installing the scanner in industrial environments requiring compliance with European Union Directives.

Laser Warning Symbol

The following caution symbol is used where laser light is present.



CAUTION: This laser caution symbol appears where laser radiation is present.

Related Publications

You many want to refer to the following publication:

- **Publication No. 2755-833**
  User Manual for Catalog No. 2755-DS/DD, Series B
  Single and Dual-Head Enhanced Bar Code Decoders

Features of Scanner

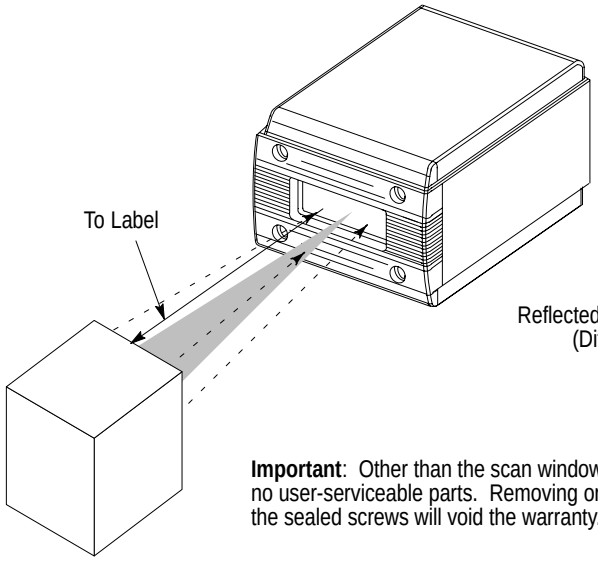
Chapter Objectives

This chapter gives an overview of scanner features including:

- overview of scanner
- LED indicators
- scan angle adjustment
- safety labels
- available accessories

Overview of Scanner

The high performance, fixed-mount scanners use a visible laser diode for non-contact scanning applications. The laser generates a small, concentrated light beam that exits the scan window. Light, reflected off the bar code symbols, passes back through the window and is detected by a light sensor. The signal is then sent to the decoder for further processing.



Important: Other than the scan window, the scanner contains no user-serviceable parts. Removing or attempting to remove the sealed screws will void the warranty.

The scanners are compatible with these Allen-Bradley bar code decoders:

- Catalog No. 2755-DS1A/DS4A Enhanced Single-Head Decoders
- Catalog No. 2755-DD1A/DD4A Enhanced Dual-Head Decoders

Equipped with either a NEMA Type 1 or Type 4 connector, the environmentally sealed enclosure is suitable for a wide range of applications. Each scanner has a permanently attached 10 foot (3 meter) cable for connecting to a decoder, and an 11.5 inch (.29 meter) package detector cable. Extension cables are available to increase the scanner-to-decoder distance to 25 or 50 feet (7.6 or 15.2 meters).

Overview of Scanner

The scanners feature two scan rates, multiple read ranges and a NEMA Type 1 or NEMA Type 4 connector.

Catalog Number	Description
2755-LD4z1①	200 scans per second, NEMA Type 1 Connector
2755-LD4z4①	200 scans per second, NEMA Type 4 Connector
2755-LD8z1②	500 scans per second, NEMA Type 1 Connector
2755-LD8z4②	500 scans per second, NEMA Type 4 Connector

① *z* = A, B, C or E read range for LD4 scanners. See Figure 3.5.

② *z* = A, B or C read range for LD8 scanners. See Figure 3.8.

Figure 2.1
Cabling Options

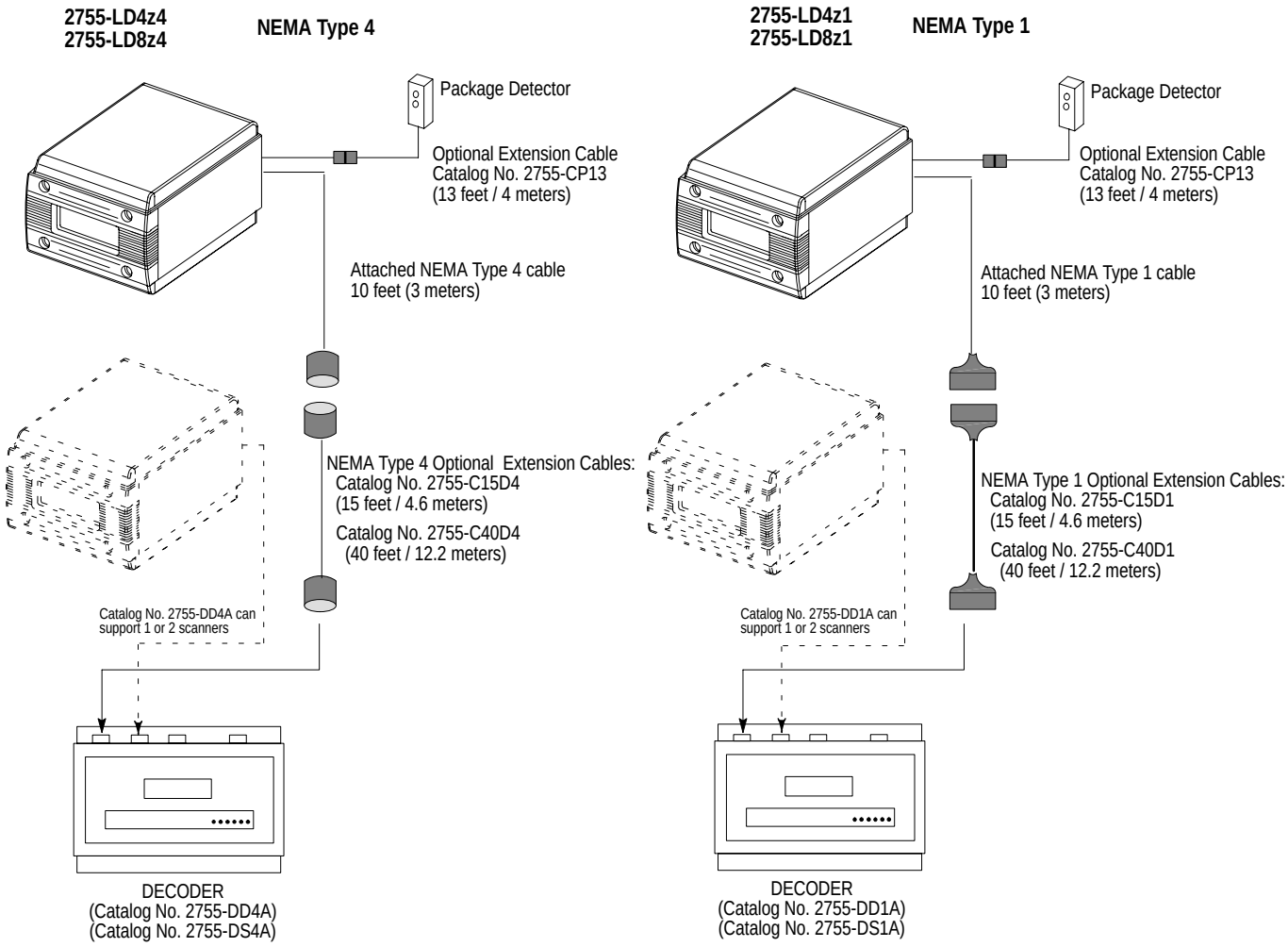
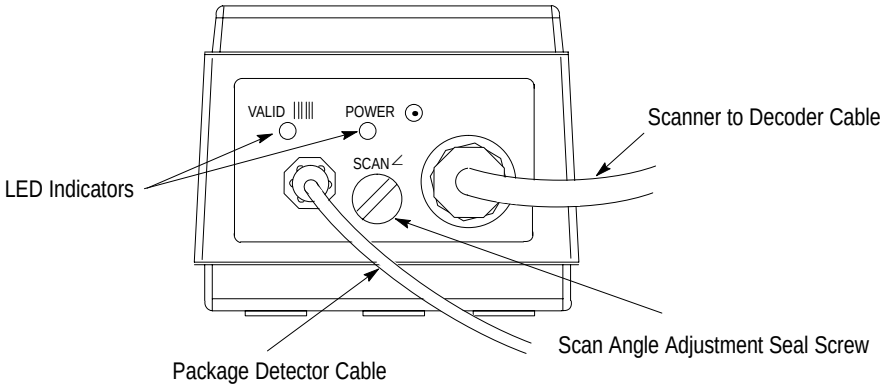


Figure 2.2
Back of Scanner



LED Indicators

The back of the scanner (Figure 2.2) has two LED Indicators: *VALID* and *POWER*. These LEDs provide a visual indication of scanner operation. Table 2.A defines the color and function of each LED.

Table 2.A
LED Indicators

LED Label	Color	Function
POWER ⊙	Amber	Lights when the scanner is receiving power from the decoder. The scanner must be connected to the decoder and the decoder turned on before this LED lights.
VALID |||||	Green	Flashes momentarily to indicate a successful decode.

Scan Angle Adjustment

A multi-position rotary switch lets you adjust the scan angle to ½, ¾, or a maximum angle.

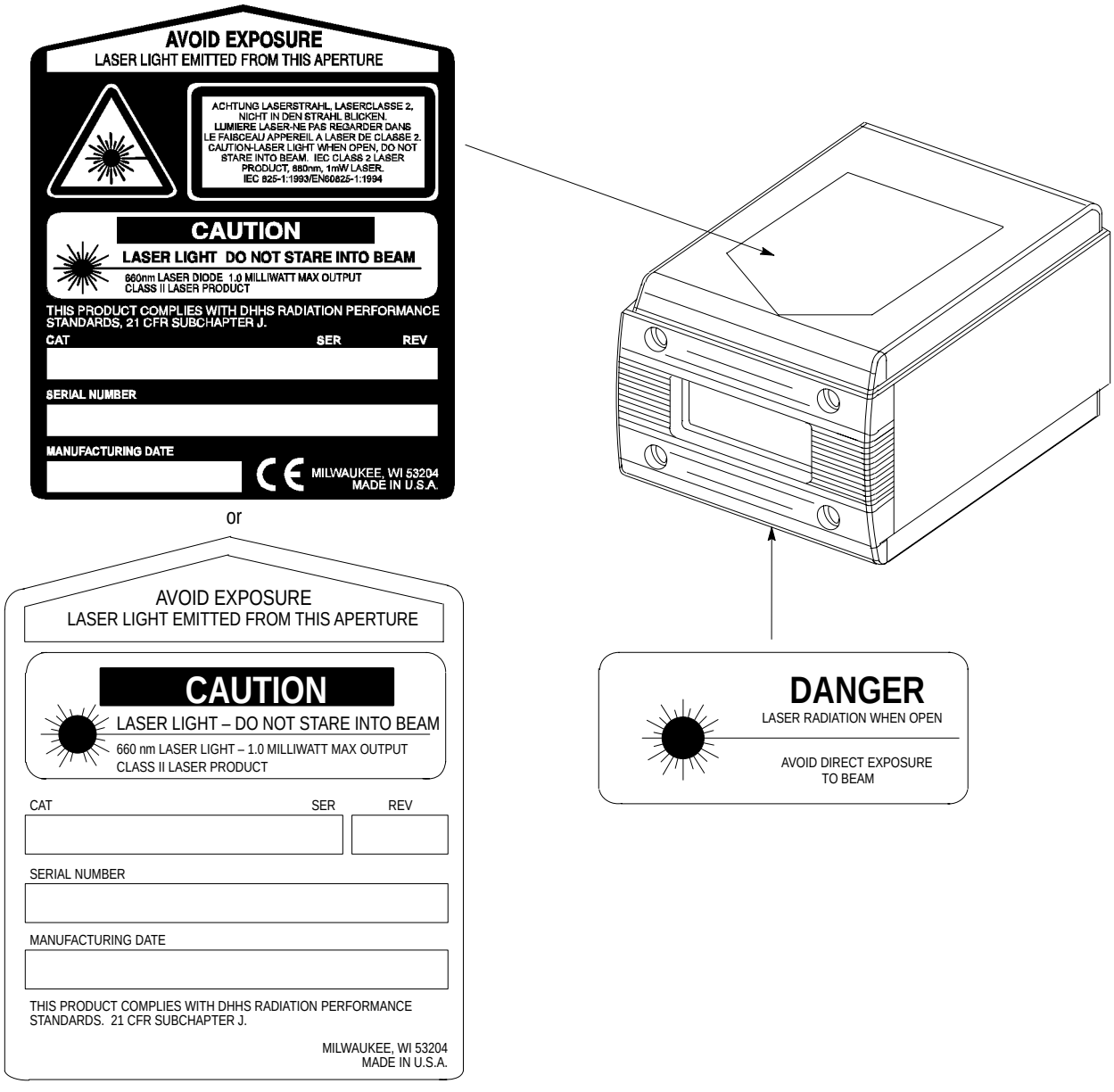
The scan angle adjustment switch is located behind a seal screw on the back of the scanner. Chapter 5 describes how to adjust the scan angle.

Safety Labels

The scanners use a low power visible laser diode. As with any bright light source, such as the sun, you should avoid staring directly into the beam. Momentary exposure to a CDRH Class II laser is not known to be harmful.

Figure 2.3 shows the location of all scanner safety labels.

Figure 2.3
Safety Labels



ATTENTION: Use of controls, adjustments, or procedures other than those specified herein may result in hazardous laser light exposure.

Accessories

Extension cables and replacement windows are available for each of the scanners.

Scanner Extension Cables

Each scanner has a permanently attached 10 foot (3 meter) cable which attaches to the decoder. Extension cables are available to increase the distance between the scanner and decoder to 25 or 50 feet (7.6 or 15.2 meters). Table 2.B lists the extension cables.

Table 2.B
Optional Scanner Extension Cables

Catalog Numbers	Description
2755-C15D1	15 feet (4.6 meters), NEMA Type 1 extension cable
2755-C40D1	40 feet (12.2 meters), NEMA Type 1 extension cable
2755-C15D4	15 feet (4.6 meters), NEMA Type 4 extension cable
2755-C40D4	40 feet (12.2 meters), NEMA Type 4 extension cable

Package Detectors

Allen-Bradley Photoswitch® package detectors are recommended for use with the scanner. Select a switch from the Photoswitch Series 6000 (-QD) or Series 9000 (-QD Micro Style) product lines that best fits your application. You must order a **sinking** type sensor that can operate from a 12V DC supply with the -QD suffix (Quick Disconnect) added to the catalog number.

For example: Catalog Number 42SRU-6203-**QD** or
Catalog Number 42GRU-9200-**QD**

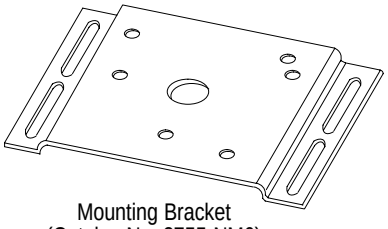
The connector on the -QD sensors and the LD4/LD8 scanners are compatible with Brad Harrison Micro-Change® connectors and Crouse-Hinds Micro-Mini® connectors. The table below lists the vendor part numbers.

Length	Brad Harrison Part Number	Crouse-Hinds Part Number	Allen-Bradley Catalog Number
2 Meter (6.56 feet)	81428-003	5000118-40	
3 Meter (9.84 feet)		5000118-41	
4 Meter (13.1 feet)	81428-005	5000118-42	2755-CP13
5 Meter (16.4 feet)	81428-004	5000118-43	

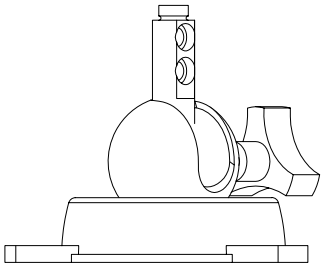
Various mounting brackets for the switches are also available from Allen-Bradley Photoswitch.

Mounting Bracket

A mounting bracket (Cat. No. 2755-NM6) lets you mount the scanner on most flat surfaces. The bracket can be used with or without the optional Mounting Bracket Kit (Cat. No. 2755-NM42).



Mounting Bracket
(Catalog No. 2755-NM6)



Mounting Bracket Kit
(Catalog No. 2755-NM42)

Replacement Windows

Customer installed plastic and glass replacement windows are available for the scanners. To order replacement windows, refer to Table 2.C.

Table 2.C
Replacement Scan Windows

Replacement Numbers	Description
77125-898-01	Replacement Glass Window Kit Includes bezel/window assembly with anti-reflective, optical **glass** window.
77125-899-01	Replacement Plastic Window Kit Includes bezel/window assembly with hard coated, anti-reflective, optical quality **plastic** window.

Safety Label Kit

Use this kit to replace damaged safety labels.
Kit part number is 77121-802-01.

Installation Considerations

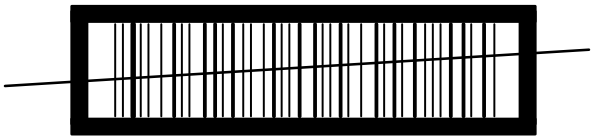
Chapter Objectives

This chapter provides information relevant to the installation and set up of the scanner including:

- proper positioning of bar code symbols
- read ranges
- usable beam length
- calculating minimum scans/symbol
- compensating for pitched symbols
- code element distance

Positioning Symbols Correctly

Bar code symbols must be in the correct orientation as they move by the scanner. The scan line must cross every bar, space and quiet zone on the symbol in one sweep.



The orientation of the bar code symbol can be picket fence or step ladder. The orientation is determined by the symbol's direction of travel relative to the scan line, not the horizontal or vertical orientation of the symbol.

Figure 3.1
Picket Fence Orientation

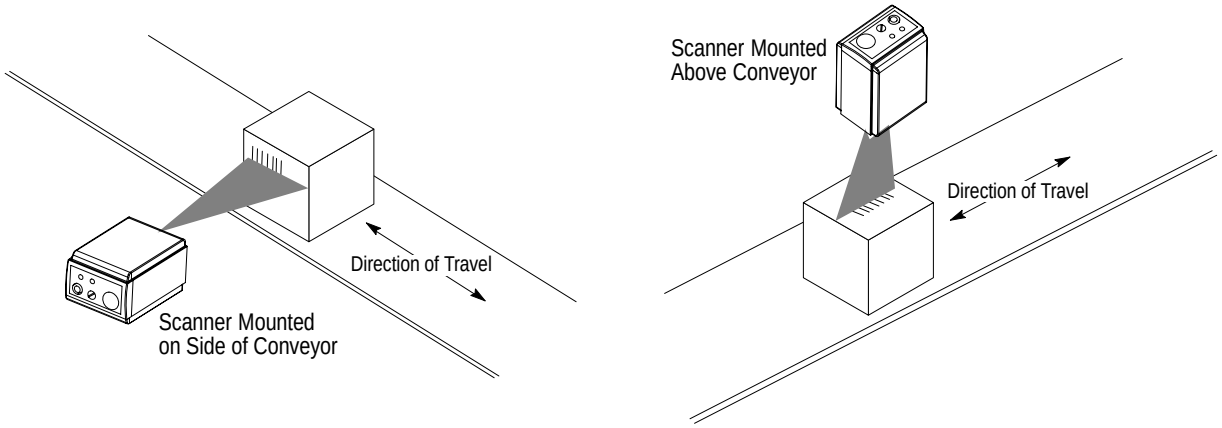
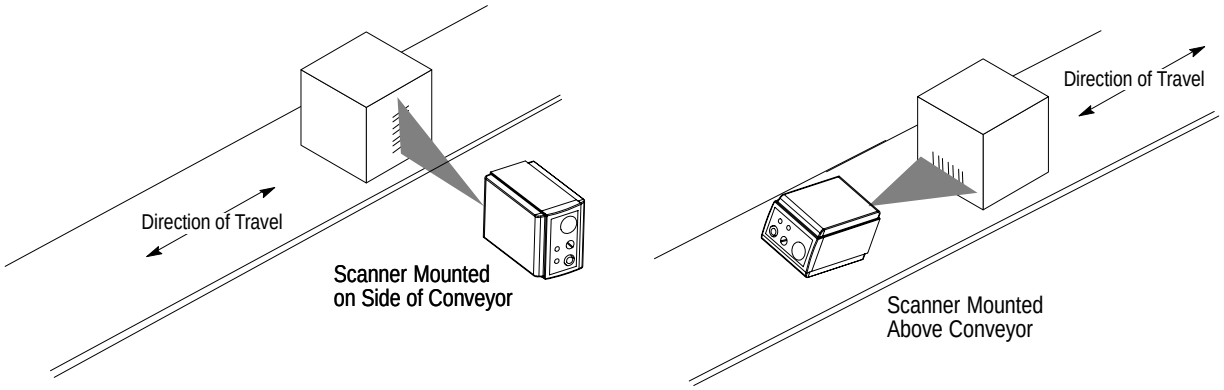
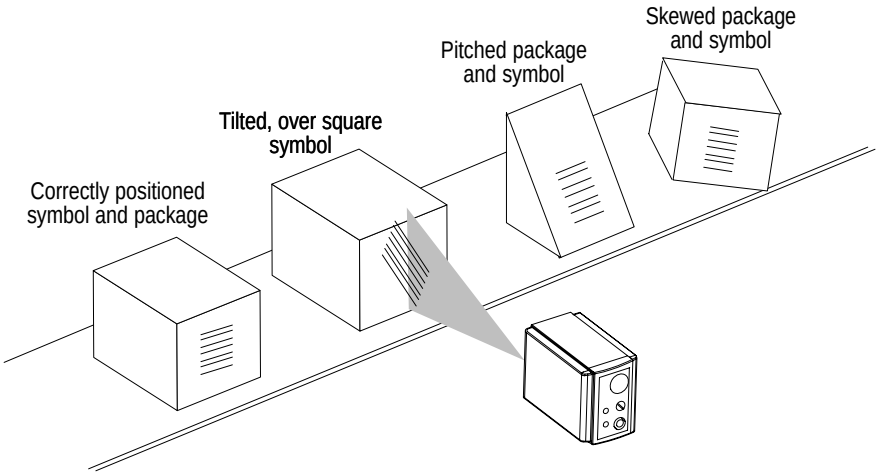


Figure 3.2
Step Ladder Orientation



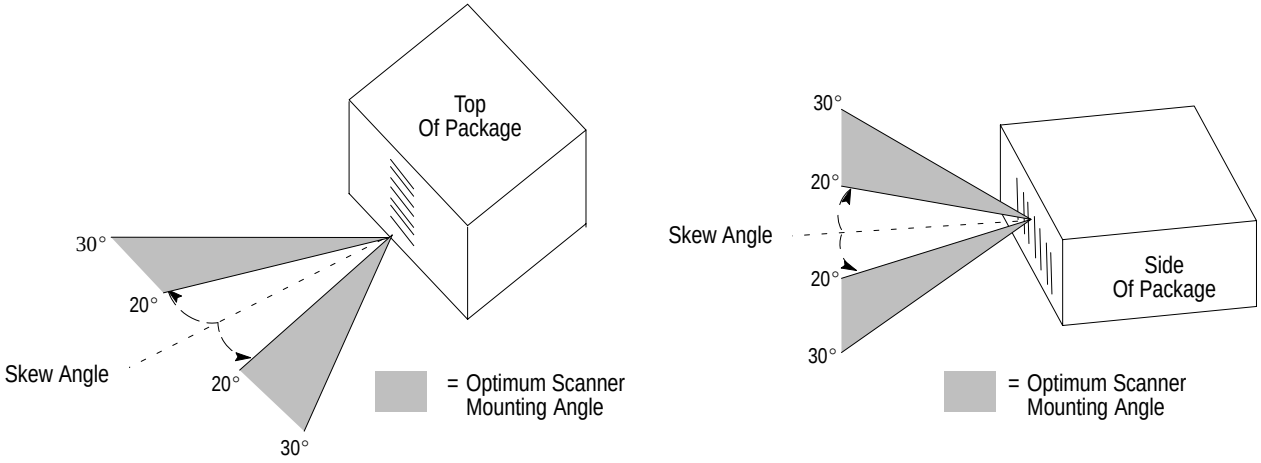
Symbols that are pitched or tilted ± 45° are still readable. Skewed symbols can also be read as long as the misalignment is less than ± 50°. Figure 3.3 shows a correctly placed symbol and misaligned symbols.①

Figure 3.3
Positioning Terminology



Set up the scanner so the laser beam is nearly perpendicular to the bars and spaces of the symbol. For optimal performance mount the scanner in a skewed position, 20° to 30° angle off normal from the symbol (Figure 3.4).

Figure 3.4
Correct Setup of Scanner



The scanner can successfully decode symbols that are out of alignment if the projected, or apparent, bar element widths are within the minimum widths shown in Tables 3.A or 3.B.

When using ”A” range scanners to read labels with high paper noise, increasing the skew to 30° may enhance performance.

① Read ranges vary with bar code symbol quality.

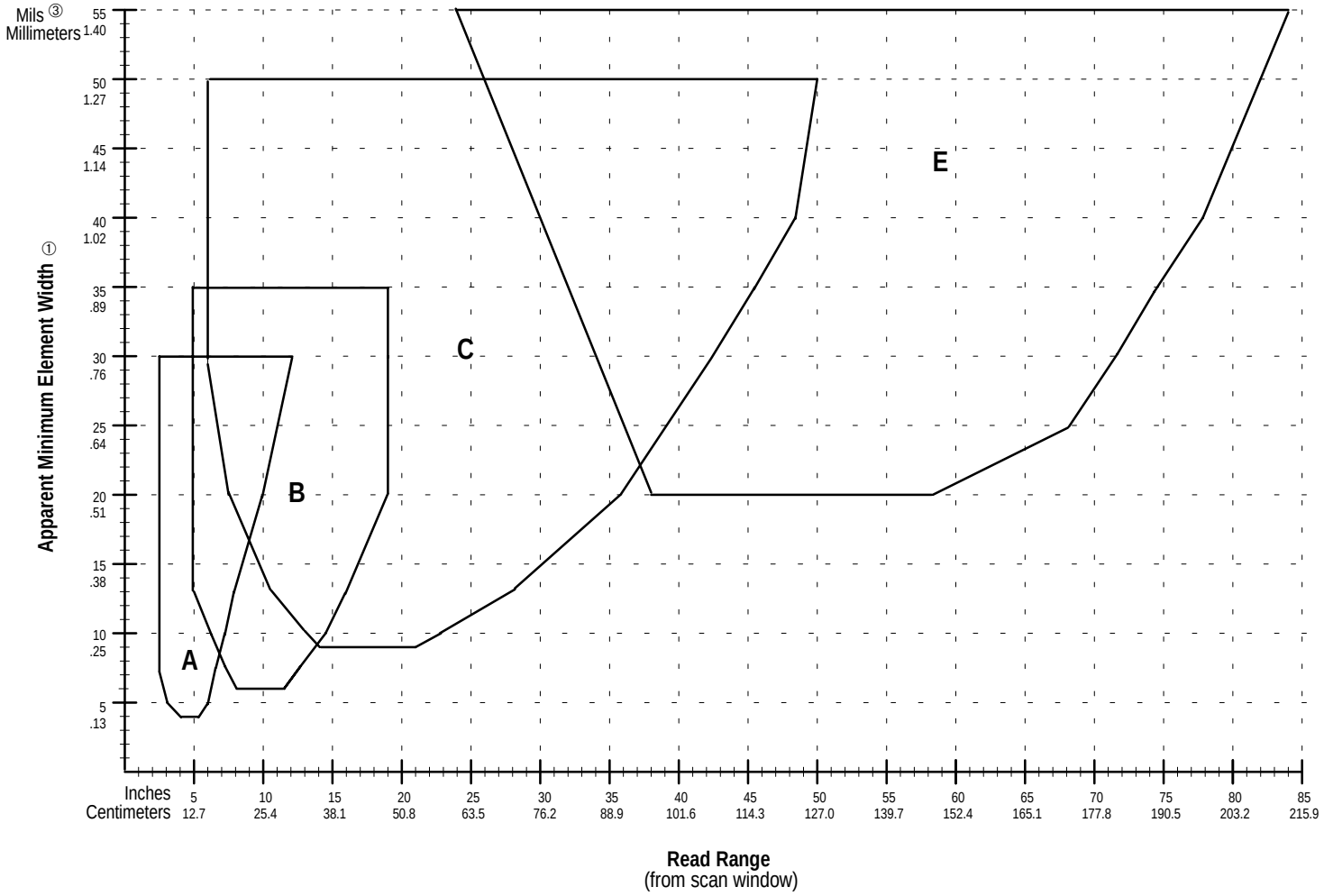
2755-LD4 Read Ranges

The LD4 scanners can read bar code labels at various distances depending on the apparent minimum element width① and scanner to label pitch. The scanner can read labels within one of four read ranges: A, B, C or E.

Figure 3.5 shows the *reading distances* for each range of the LD4 scanner. Table 3.A lists the read ranges for the LD4 scanners in numeric format.

Refer to ”Compensating for Pitched Symbols” if your labels are pitched.

Figure 3.5
Read Range vs Apparent Minimum Element Width (LD4 Scanners)②



① For minimum element width, refer to ”Determining Apparent Minimum Element Width” in Chapter 3.

② Read ranges based on four character, Code 39 labels with a wide to narrow bar ratio of 2.6 to 1 and a print contrast ratio of .75 or better. Read ranges vary with bar code symbol quality.

③ 1 mil = 0.001 inches

Table 3.A
LD4 Read Ranges ①

Minimum Element Width ②		Read Range		Catalog Number
Mils	Millimeters	Inches	Centimeters	
4	.10	4.0 - 5.25	10.2 - 13.3	
5	.13	3.0 - 6.0	7.6 - 15.2	
7.5	.19	2.5 - 6.5	6.4 - 16.5	
10	.25	2.5 - 7.25	6.4 - 18.4	2755-LD4A1
13	.33	2.5 - 8.0	6.4 - 20.3	2755-LD4A4
20	.51	2.5 - 9.75	6.4 - 24.8	
30	.76	2.5 - 12.0	6.4 - 30.5	
6	.15	8.0 - 11.5	20.3 - 29.2	
7.5	.19	7.25 - 12.75	18.4 - 32.4	
10	.25	6.25 - 14.5	15.9 - 36.8	
13	.38	5.0 - 16.0	12.7 - 40.6	2755-LD4B1
20	.51	5.0 - 19.0	12.7 - 48.3	2755-LD4B4
30	.76	5.0 - 19.0	12.7 - 48.3	
35	.89	5.0 - 19.0	12.7 - 48.3	
9	.23	14 - 21.0	35.6 - 53.3	
10	.25	13.25 - 22.75	33.6 - 57.8	
13	.38	10.75 - 28.25	27.3 - 71.7	
20	.51	7.5 - 36.0	19.0 - 91.4	2755-LD4C1
30	.76	6.0 - 42.25	15.2 - 107.3	2755-LD4C4 ③
35	.89	6.0 - 45.5	15.2 - 115.6	
40	1.02	6.0 - 48.5	15.2 - 123.2	
50	1.27	6.0 - 50.0	15.2 - 127.0	
20	.51	38.0 - 58.0	96.5 - 147.3	
25	.64	36.0 - 68.0	91.4 - 170.0	
30	.76	34.0 - 71.5	86.4 - 181.6	
35	.89	32.0 - 74.5	81.3 - 189.2	2755-LD4E1
40	1.02	30.0 - 78.0	76.2 - 198.1	2755-LD4E4 ③
45	1.14	28.0 - 80.0	71.1 - 203.2	
50	1.27	26.0 - 82.0	66.0 - 208.3	
55	1.40	24.0 - 84.0	61.0 - 213.4	

① Read ranges based on 4 character, Code 39 labels with a wide to narrow bar ratio of 2.6 to 1 and a print contrast ratio of .75 or better. Read ranges will vary with bar code symbol quality.

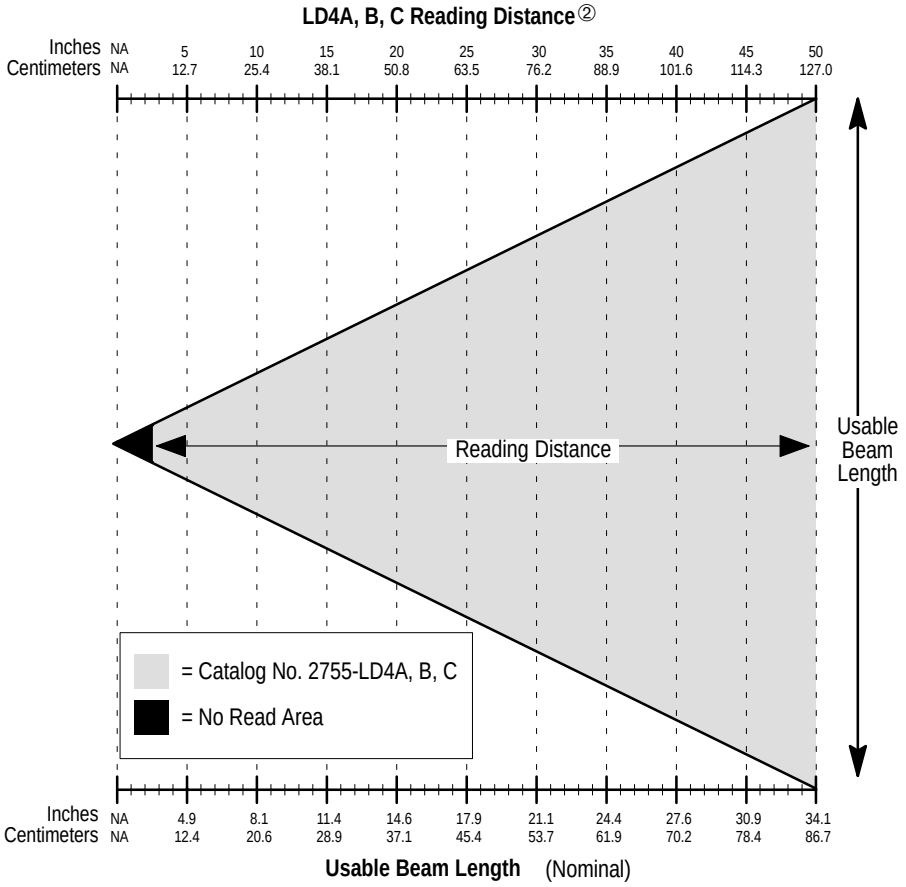
② For minimum element width, refer to "Determining Apparent Minimum Element Width" in Chapter 3.

③ The glare that results from the laser striking reflective objects (conduit, metal conveyors) may affect performance of the LD4C and LD4E scanners when used at long ranges. To minimize this effect, mask the area behind the symbol with a non-glossy material (flat black paint) or reduce the scan line to avoid reflective objects. Reducing the scan line will affect reading distances of the scanner.

2755-LD4 Usable Beam Length (A,B,C Ranges)

Figures 3.6 and 3.7 show the *Usable Beam Length* versus *Distance* for the LD4 scanners. The black area is a no read area. The *Usable Beam Length* (bottom of chart) is compared to the *Reading Distance* (top of chart). The Usable Beam Length is approximately 20% less than the projected beam length (10% on each end of the scan line). The reading distance is measured from the scan window to the center of the symbol.

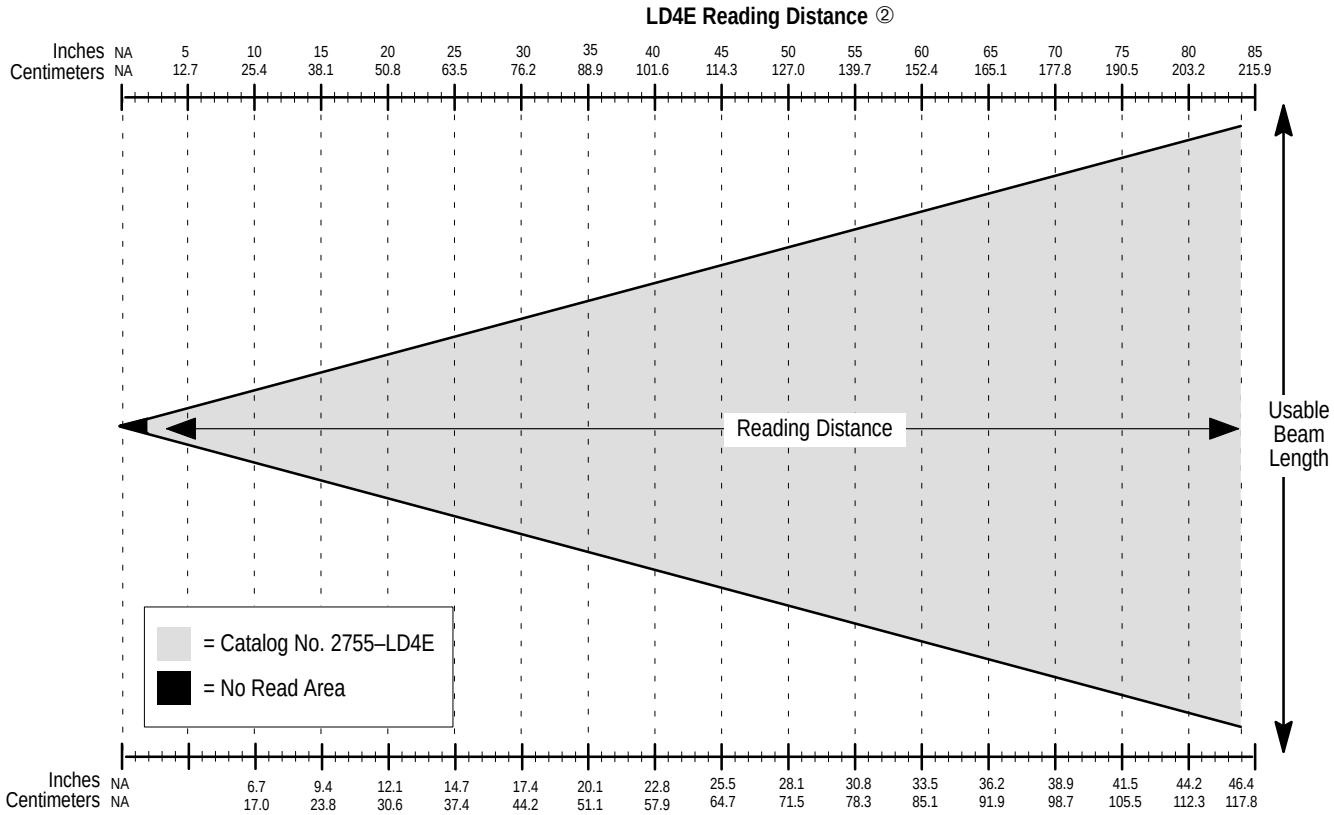
Figure 3.6
LD4A, B, C Usable Beam Length ①



① Usable Beam Length for LD4A, B, C Scanners = 0.65 x (Reading Distance + 2.5 inches)
② Measured from the scan window to the center of the bar code symbol.

2755-LD4
Usable Beam Length
(E Range)

Figure 3.7
LD4E Usable Beam Length ①



① Usable Beam Length for LD4E Scanners = 0.536 x (Reading Distance + 2.5 inches)

② Measured from the scan window to the center of the bar code symbol.

To estimate the *Usable Beam Length*:

- Determine the distance from the window of the scanner to the center of the bar code symbol. This is your *Reading Distance*.
- Locate your *Reading Distance* on Figure 3.6 or 3.7. The reading distances are displayed across the top of the charts.

  The bottom of the charts show the nominal Usable Beam Lengths.

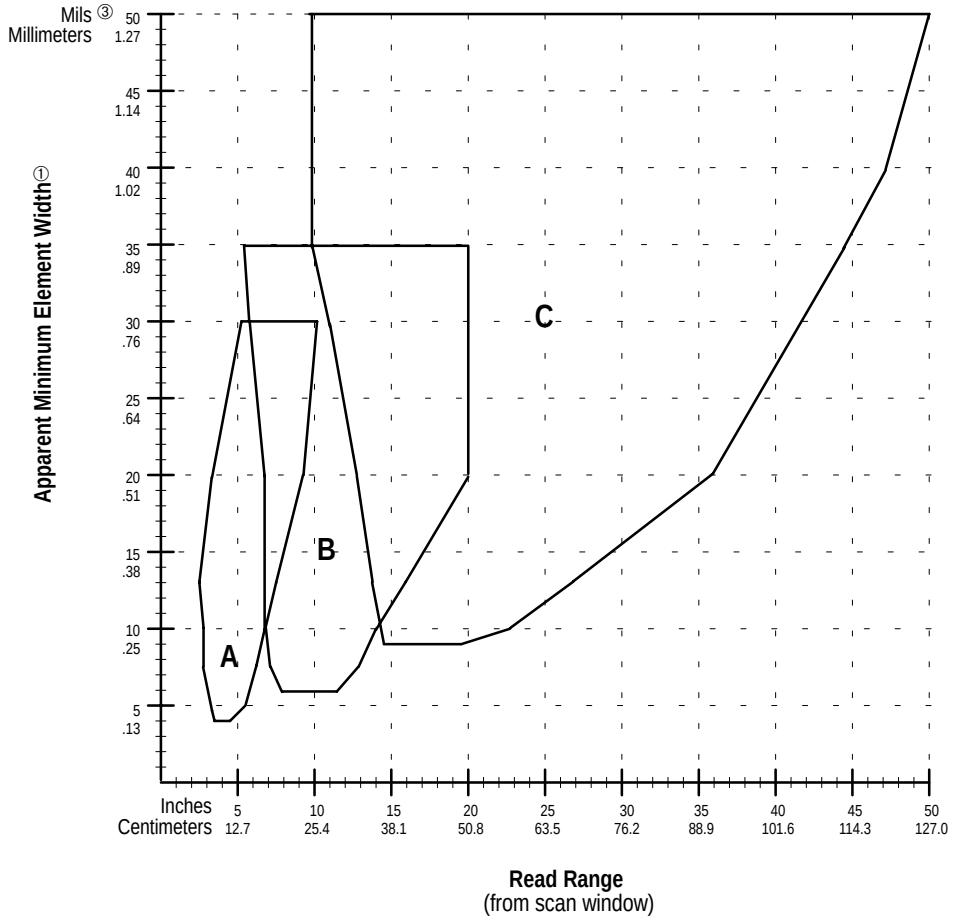
2755-LD8 Read Ranges

The LD8 scanners can read bar code labels at various distances depending on the apparent minimum element width① and scanner to label pitch. The scanner can read labels within one of three read ranges: A, B, or C.

Figure 3.8 shows the *reading distances* for each range of the LD8 scanner. Table 3.B lists the read ranges for the LD8 scanners in numeric format.

Refer to ”Compensating for Pitched Symbols” if your labels are pitched.

Figure 3.8
Read Range vs Apparent Minimum Element Width (LD8 Scanners) ②



① For minimum element width, refer to ”Determining Apparent Minimum Element Width” in Chapter 3.

② Read ranges based on four character, Code 39 labels with a wide to narrow bar ratio of 2.6 to 1 and a print contrast ratio of .75 or better. Read ranges will vary with bar code symbol quality.

③ 1 mil = 0.001 inches

Table 3.B
LD8 Read Ranges ①

Minimum Element Width ②		Read Range		Catalog Number
Mils	Millimeters	Inches	Centimeters	
4	.10	3.5 - 4.5	8.9 - 11.4	
5	.15	3.25 - 5.5	8.3 - 14.0	
7.5	.19	2.75 - 6.25	7.0 - 15.9	
10	.25	2.75 - 6.75	7.0 - 17.1	2755-LD8A1
13	.33	2.5 - 7.5	6.4 - 19.0	2755-LD8A4
20	.51	3.25 - 9.25	8.3 - 23.5	
30	.76	5.25 - 10.25	13.3 - 26.0	
6	.15	7.0 - 11.75	17.8 - 29.8	
7.5	.19	7.0 - 12.5	17.8 - 31.8	
10	.25	6.75 - 14.0	17.1 - 35.6	
13	.33	6.75 - 16.0	17.1 - 40.6	2755-LD8B1
20	.51	6.75 - 20.0	17.1 - 50.8	2755-LD8B4
30	.76	6.0 - 20.0	15.2 - 50.8	
35	.89	5.5 - 20.0	14.0 - 50.8	
9	.23	14.5 - 19.5	36.8 - 49.5	
10	.25	14.25- 22.75	36.2 - 57.8	
13	.38	13.75- 26.75	34.9 - 67.9	
20	.51	12.75- 36.0	32.4 - 91.4	2755-LD8C1
30	.76	11.0 - 41.75	27.9 - 106.0	2755-LD8C4 ③
35	.89	10.0 - 44.5	25.4 - 113.0	
40	1.02	10.0 - 47.5	25.4 - 120.6	
50	1.27	10.0 - 50.0	25.4 - 127.0	

① Read ranges are based on 4 character, Code 39 labels with a wide to narrow bar ratio of 2.6 to 1 and a print contrast ratio of .75 or better. Read ranges will vary with bar code symbol quality.

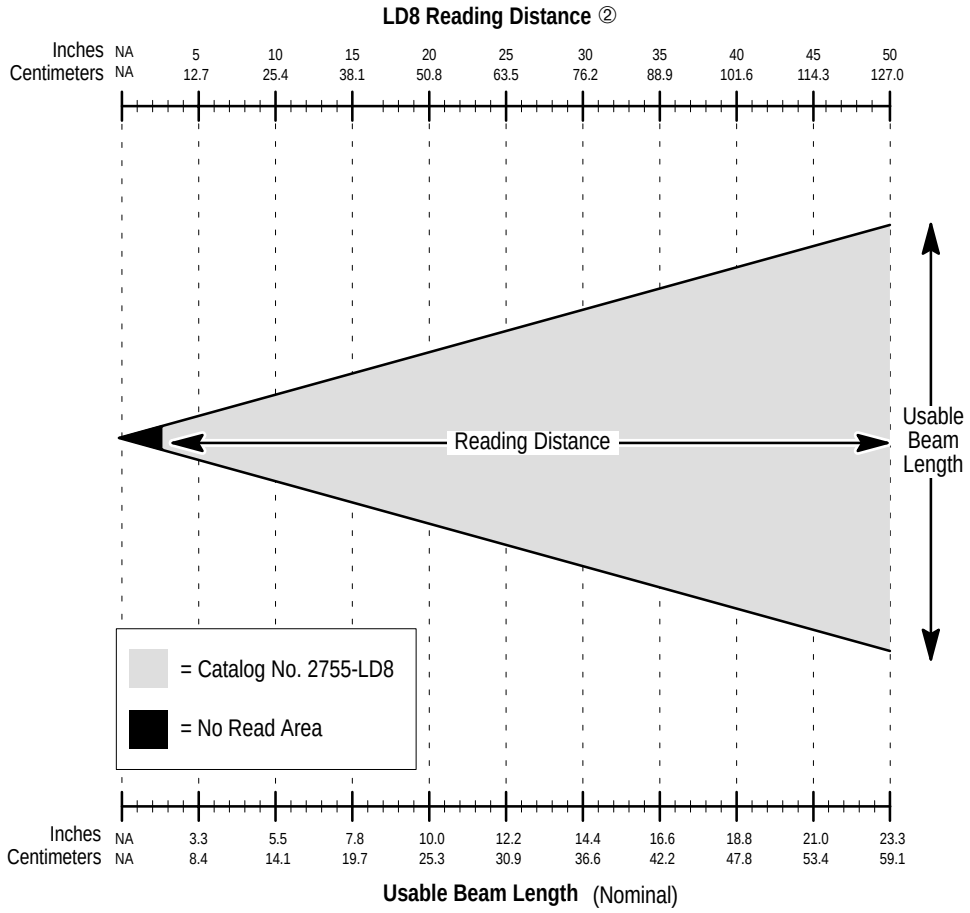
② For minimum element width, refer to "Determining Apparent Minimum Element Width" in Chapter 3.

③ The glare that results from the laser striking reflective objects (conduit, metal conveyors) may affect performance of the LD8C scanner when used at long ranges. To minimize this effect, mask the area behind the symbol with a non-glossy material (flat black paint) or reduce the scan line to avoid reflective objects. Reducing the scan line will affect reading distances of the scanner.

2755-LD8 Usable Beam Length

Figure 3.9 shows the *Usable Beam Length* versus *Distance* for the LD8 scanner. The black area is a no read area. The *Usable Beam Length* (bottom of chart) is compared to the *Reading Distance* (top of chart). The Usable Beam Length is approximately 20% less than the projected beam length (10% on each end of the scan line). The reading distance is measured from the scan window to the center of the symbol.

Figure 3.9
LD8 Usable Beam Length ①



① Usable Beam Length for LD8 Scanners = 0.443 x (Reading Distance + 2.5 inches)
② Measured from the scan window to the center of the bar code symbol.

To estimate the *Usable Beam Length*:

- Determine the distance from the window of the scanner to the center of the bar code symbol. This is your *Reading Distance*.
- Locate your *Reading Distance* on Figure 3.9. The reading distances are displayed across the top of the chart.

  The bottom of the chart shows the nominal Usable Beam Lengths.

Calculating Scans/Symbol

This section explains how to calculate minimum scans per symbol for picket fence and step ladder applications.

Picket Fence Applications

To calculate **minimum** scans per symbol for picket fence applications, use this formula:

$$S = \frac{A\,(X-Y)}{Z}$$

S = Scans per Symbol **(must be at least 5)**
A = Derated Scan Rate (nominal scan rate – 5%)
X = Usable Beam Length at Minimum Read Distance
Y = Symbol Length (including quiet zones)
Z = Conveyor Speed

Express Usable Beam Length, Symbol Length, and Conveyor Speed in similar units. Calculations assume that the scanner and decoder are triggered for the entire time the symbol is present and the symbol has a 0° pitch. (See "Compensating for Pitched Symbols".)

Example 1:

A 40 mil case code label that is 1 inch tall and 4.75 inches long (including quiet zones) is to be read in a picket fence orientation at 125 ft/min. Space is limited so the scanner must be positioned as close as possible to the labels.

Since the 2755-LD8C1 scanner cannot read a 40 mil label until the scanner is 10 inches away, let's assume that the 2755-LD4C1 scanner can read the label. At 6 inches, the LD4C1 scanner has a usable beam length of 5.525 inches.

The following calculation converts Conveyor Speed to similar units (inches).

125 feet/minute x 12 inch/feet x 1 minute/60second = 25 inch/seconds

To calculate minimum scans per symbol for this application, insert these values into the formula:

A = 200 scans/second – 5% = 190 scans/second (minimum scan rate)
X = 5.525 inches
Y = 4.75 inches
Z = 25 inches/second

S = 190 scans/second x (5.525 inches – 4.75 inches) / (25 inches / second)
S = 5.89 scans

Since S (scans per symbol) is greater than 5 and the application uses good quality labels, the 2755-LD4C1 scanner is appropriate for this application.

Calculating Scans/Symbol

Example 2:

Increasing the conveyor speed in Example 1 to 300 ft/min. decreases the number of scans per symbol to less than 3. This means the 2755-LD4C1 scanner is no longer appropriate.

To increase the number of scans per symbol for picket fence applications, you can do one of the following:

- select a higher speed scanner
- increase the usable beam length by backing the scanner away from the bar code symbol

Selecting Higher Speed Scanner

The LD8C1 scanner has a scan rate of 500 scans/second. It reads 40 mil labels at a minimum distance of 10 inches. At 10 inches, the LD8C1 has a usable beam length of 5.5 inches.

To calculate minimum scans per symbol, use these values:

A = 500 scans/second – 5% = 475 scans/second (minimum scan rate)
X = 5.5 inches
Y = 4.75 inches
Z = 60 inch/second (equivalent to 300 ft/min.)

S = 475 scans/second x (5.5 inches – 4.75 inches) / (60 inches / second)
S = 5.94 scans

Since S (scans per symbol) is greater than 5 and the application uses good quality labels, the 2755-LD8C1 scanner is appropriate for this application.

Increasing Usable Beam Length

The LD4C1 scanner at 10 inches produces a usable beam length of 8.1 inches. Minimum scans per symbol are now calculated using these values.

A = 200 scans/second – 5% = 190 scans/second (minimum scan rate)
X = 8.1 inches
Y = 4.75 inches
Z = 60 inches/second (equivalent to 300 ft/min.)

S = 190 scans/second x (8.1 inches – 4.75 inches) / (60 inches / second)
S = 10.6 scans

Because of the increased scan angle of the LD4, some picket fence applications can be performed with a higher number of reads using the lower speed scanner.

Step Ladder Applications

To calculate **minimum** scans per symbol for step ladder applications, use this formula:

$$S = \frac{A \times H}{Z}$$

S = Scans per Symbol **(must be at least 5)**
A = Derated Scan Rate (nominal scan rate – 5%)
H = Symbol Height (length of bars of symbol)
Z = Conveyor Speed

Conveyor Speed and Symbol Height must be expressed in similar units. Calculations assume that the scanner and decoder are triggered for the entire time the symbol is present and the symbol has a 0° pitch. (See Compensating for Pitched Symbols)

Example 1:

A 40 mil case code label that is 1 inch tall and 4.75 inches long is to be read in step ladder orientation at 125 ft/min. Space is limited so the scanner must be positioned as close as possible to the labels.

Since the 2755-LD8C1 cannot read a 40 mil label unless the scanner is 10 inches away, let's assume the 2755-LD4C1 scanner can read the label. The usable beam must be long enough to cover the entire symbol, including quiet zones. At 6 inches, the LD4C1 scanner has a usable beam length of 5.525 inches.

The calculation below converts Conveyor Speed to similar units (inches).

125 feet/minute x 12 inch/feet x 1 minute/60second = 25 inch/second

To calculate minimum scans per symbol for this step ladder application, use the following values:

A = 200 scans/seconds – 5% = 190 scans/second (minimum scan rate)
H = 1 inch
Z = 25 inches/second

S = 190 scans/second x 1 inch / (25 inches / second)
S = 7.6 scans

Since S (scans per symbol) is greater than 5 and the application uses good quality labels, the 2755-LD4C1 scanner is appropriate for this step ladder application.

Calculating Scans/Symbol

Example 2:

Increasing the conveyor speed in Example 1 to 300 ft/min. decreases the minimum number of scans per symbol to approximately 3. This value is below the recommended value of 5 scans per symbol making the 2755-LD4C1 inappropriate. The label would have to be at least 1.6 inches tall to be read by an LD4C1 scanner.

To increase the number of scans per symbol for step ladder applications,you can select a higher speed scanner or increase the height of the symbol.

Selecting Higher Speed Scanner

The LD8C1 scanner has a scan rate of 500 scans/second. It reads 40 mil labels at a minimum distance of 10 inches.

To calculate the minimum number of scans per symbol use these values:

A = 500 scans/second – 5% = 475 scans/second (minimum scan rate)
H = 1 inch
Z = 60 inches/second (equivalent to 300 ft/min.)

S = 475 scans/second x 1 inch / (60 inches / second)
S = 7.9 scans

Since S (scans per symbol) is greater than 5 and the application uses good quality labels, the 2755-LD8C1 scanner is appropriate for this application.

Because of the increased speed of the LD8 scanners, most high speed step ladder applications will use this scanner.

Compensating for Pitched Symbols

You must consider the following when reading symbols that are pitched:

- The apparent minimum element width
- The nearest and farthest code elements must be within the scanner's read range.

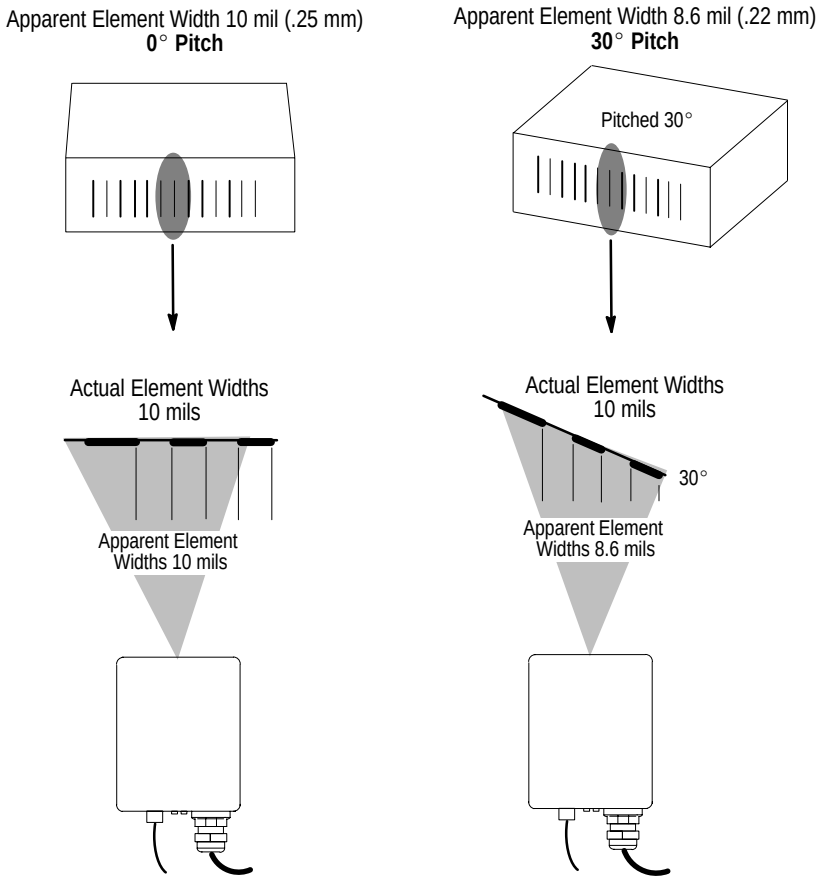
Determining Apparent Minimum Element Width

When a symbol is pitched, the bars appear to be narrower and closer to one another. This *apparent element width* is a reduction of the actual element width. Before positioning the scanner using the read ranges in Figures 3.5 or 3.8, determine the symbol's *apparent minimum element width*.

Note: If the symbol has narrow spaces that are smaller than the narrow bars, base the read range on the narrow spaces.

Figure 3.10 shows two boxes, each containing the same bar code symbol. Below each box is an exaggerated view of 5 elements (3 black, 2 white) as seen from the top down.

Figure 3.10
Actual vs Apparent Element Width



Compensating for Pitched Symbols

For example, a 10 mil (0.25 mm) symbol with 0° pitch can be scanned at 17 inches (43.2 cm) with a Catalog No. 2755-LD8C1 scanner. If you pitch the symbol 30° and determine the apparent minimum element width using the formula below, the apparent element width is 8.6 mils (0.22 mm).

Apparent Minimum Element Width = Actual Element Width x Cosine (Pitch Angle)

In the above example, the following conditions apply:

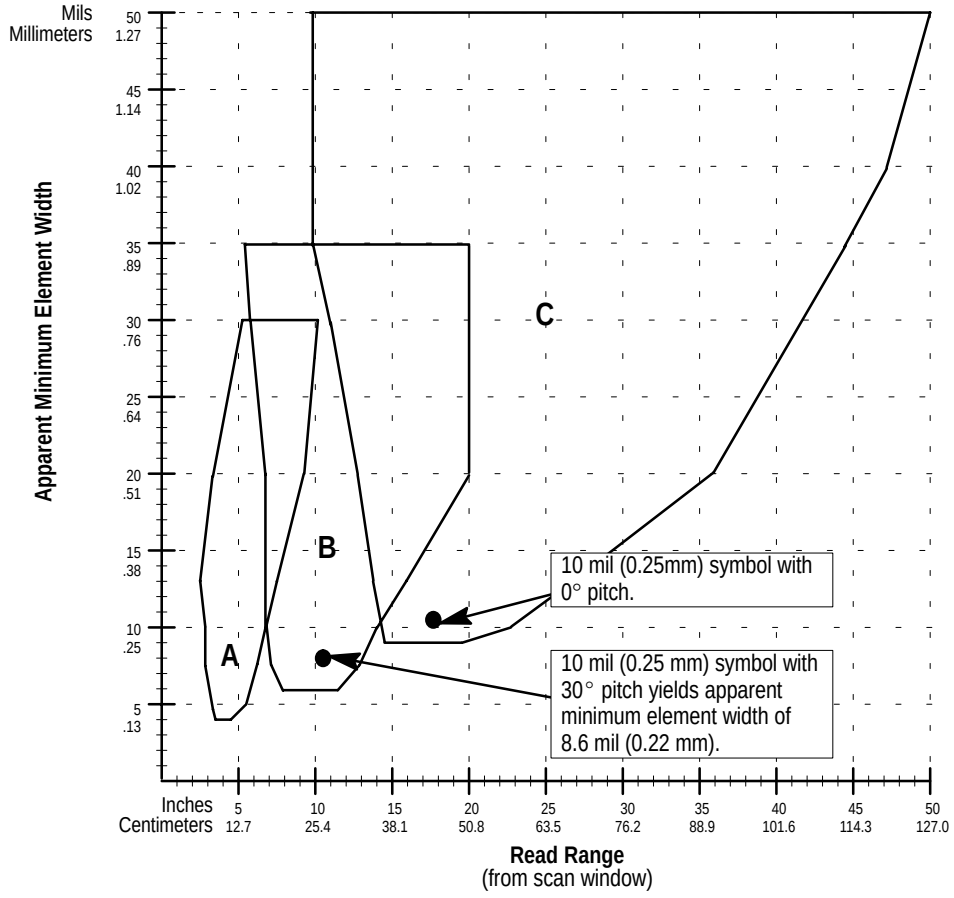
Actual Element Width = 10 mil (0.25 mm)
Pitch Angle = 30°

Therefore: 10 x (cos 30°) = 8.6 mil (0.22 mm)

The minimum recommended bar width that the Catalog No. 2755-LD8C1 scanner can read is 9 mil (0.23 mm). Because of the pitch of the symbol, you need to use the Catalog No. 2755-LD8B1 scanner. However, the distance between the scanner and the symbol is decreased. The maximum read range of the Catalog No. 2755-LD8B1 scanner for a 8.6 mil symbol is 13 inches (33 cm).

In summary, increasing the pitch of the symbol decreases the apparent minimum element width. Figure 3.11 illustrates the above example.

Figure 3.11
Effect of Pitch on Read Range

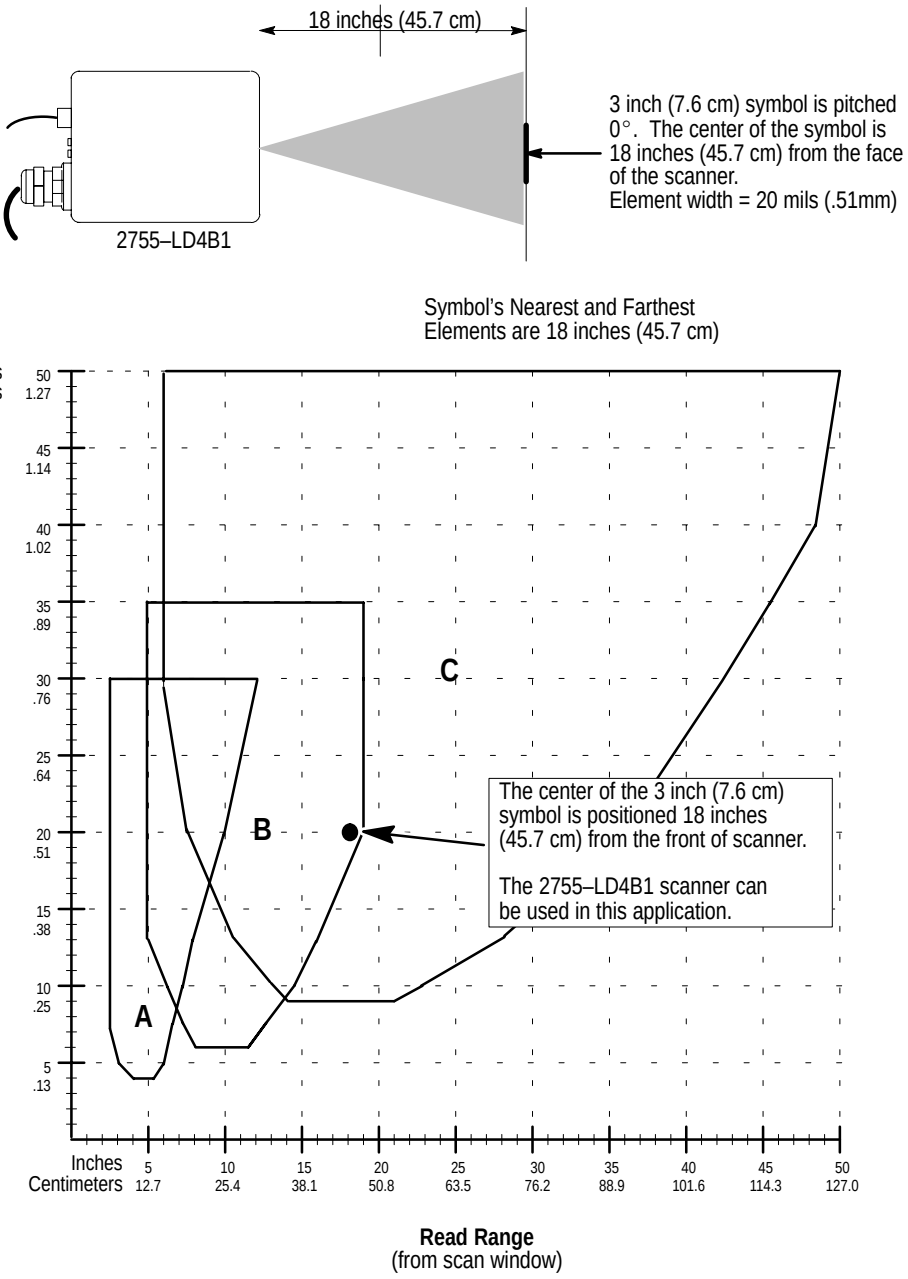


Code Element Distance

The nearest and farthest elements of a pitched symbol must be within the minimum and maximum reading distance of the scanner.

Centering the symbol within the scanner's read range helps to prevent pitched symbols from exceeding the read range limits. You can still exceed the read range with a pitched symbol, as shown in Figures 3.12 and 3.13.

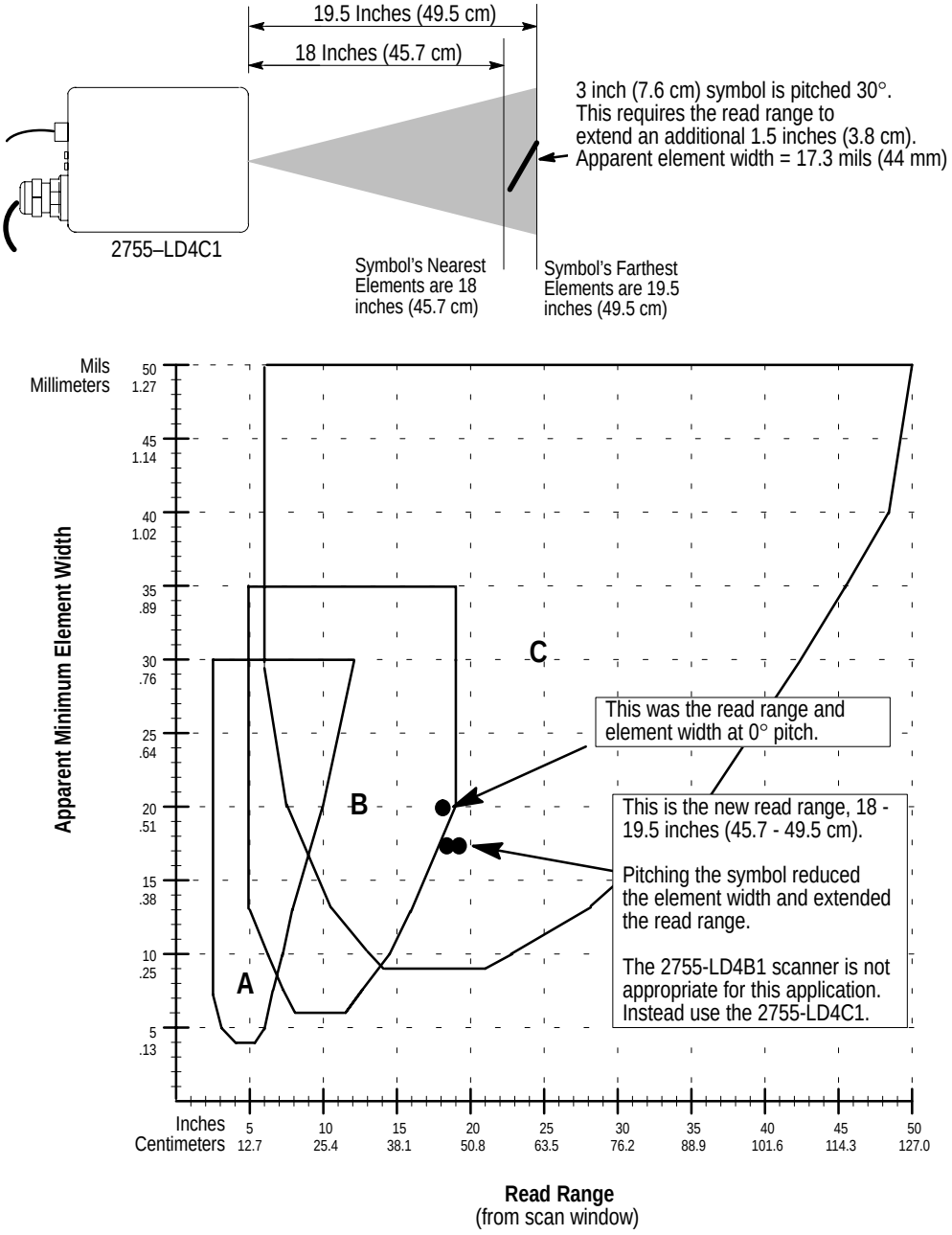
Figure 3.12
Read Range and Symbol Resolution at 0° Pitch



Compensating for Pitched Symbols

Figure 3.13 further illustrates how a pitched symbol can change the read range enough to require a different scanner.

Figure 3.13
Read Range and Symbol Resolution Changed By Pitch



Installing the Scanner

Chapter Objectives

This chapter provides guidelines and recommendations on how to install and connect your scanner including;

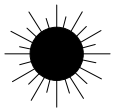
- Space Requirements
- Mounting Scanner
- Connecting Equipment
- Installing Package Detector

Warnings and Cautions

ATTENTION: No user maintenance of the hardware is required. Do not make adjustments to the scanner other than those specified in this manual and **do not open the scanner housing.** Opening the housing may damage static sensitive components, and void the warranty.

ATTENTION: If during operation an intense dot of light is generated instead of a thin line of light, turn the laser off via the decoder configuration software and remove power from decoder.

ATTENTION: The package detect cap or package detector must be installed whenever the scanner is in operation to maintain the NEMA Type 4 seal. Removing the cap during scanner operation makes the scanner susceptible to ESD damage.



CAUTION: This laser caution symbol appears where laser radiation is present.

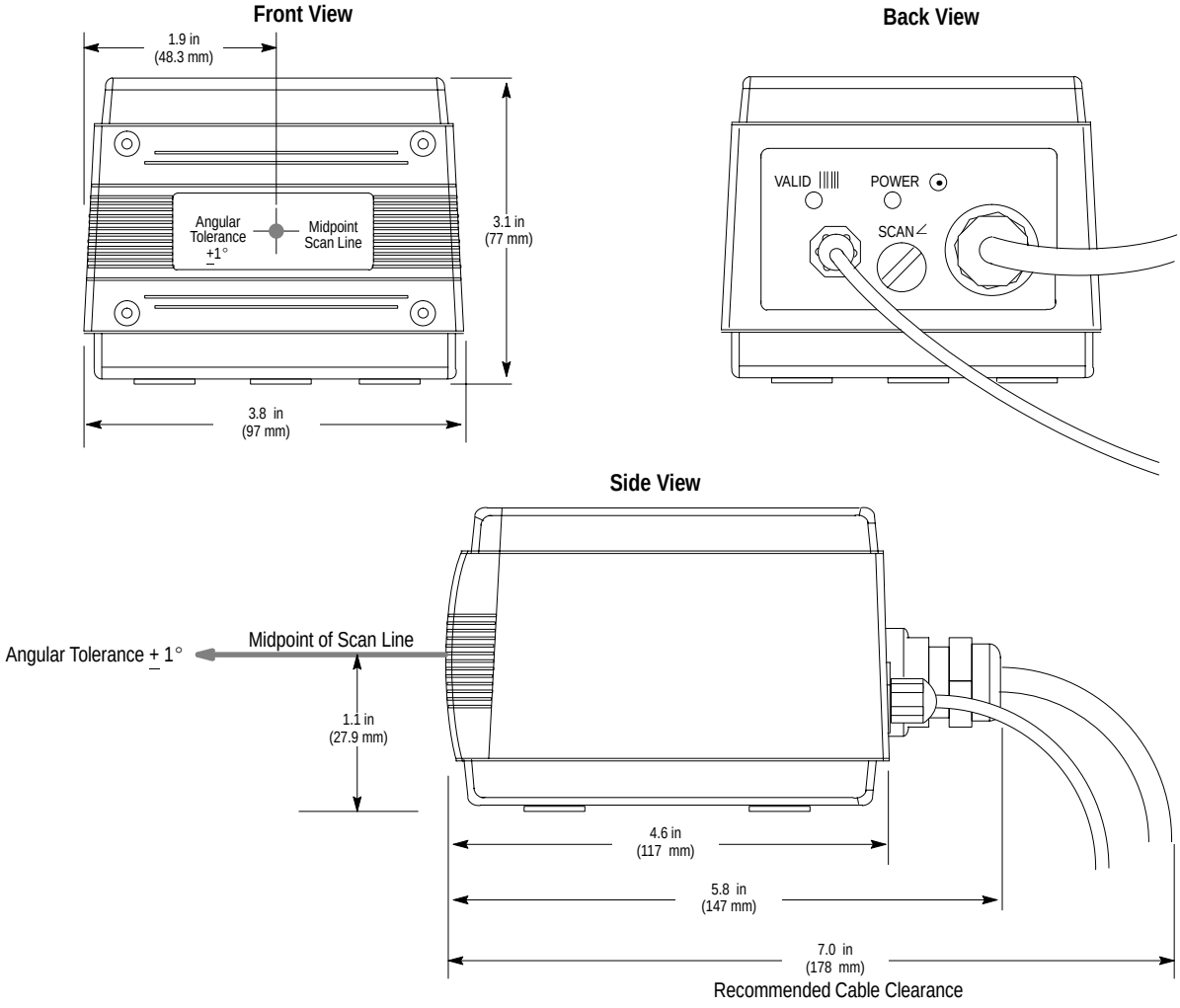
Tools You Need

Typically, the only tool you need for installation is the adjustment tool supplied with the scanner and a screwdriver.

Determining Space Requirements

The scanner and decoder are mounted separately. The scanner-to-decoder cable is 10 feet (3.0 meters) long. The scanner to package detect cable is approximately 11.5 inches (.29 meters) long. Extension cables increase the scanner-to-decoder distance to 25 or 50 feet (7.6 or 15.2 meters). Figure 4.1 shows nominal dimensions of the scanner.

Figure 4.1
Dimensions of Scanner (Nominal)



Mounting Scanner

Before installing the scanner, review the following:

- Determine optimum position of the scanner relative to the bar code labels to be read. Refer to Chapter 3 for positioning information.
- Allow adequate clearance at back of scanner for cables. See Figure 4.1.
- Securely mount scanner to a rigid surface to ensure proper operation of the scanner.

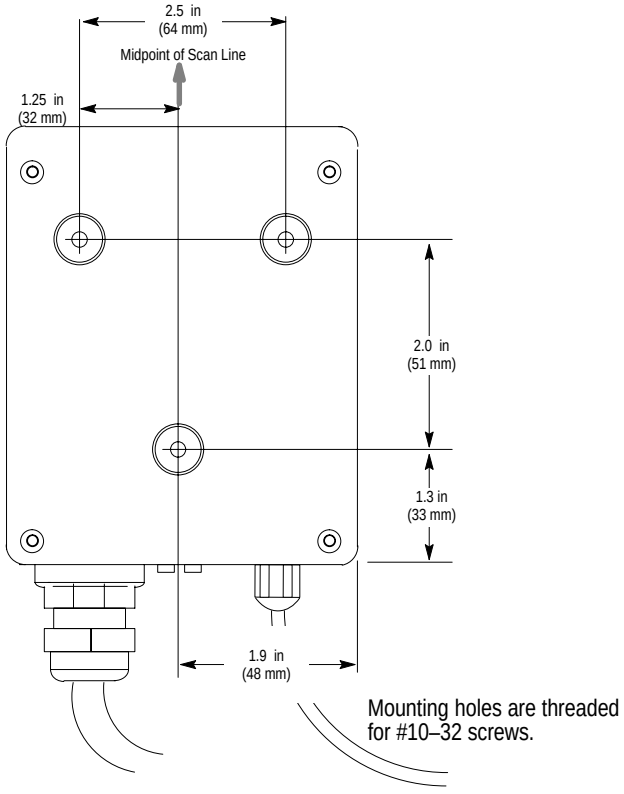
Note: If using the mounting bracket, refer to the next page.

The thickness of the mounting surface determines the length of the #10-32 screws required. Select a screw length no greater than the thickness of the mounting surface plus the thickness of the washers plus ⅜ inches (9.5 mm).

Note: The 3 screws supplied with the scanner may not be suitable for all applications. Add washers or use longer screws as required.

ATTENTION: Do not use screws that extend more than $^3/_8$ inch (9.5 mm) into the scanner. Screws which extend more than $^3/_8$ inch (9.5 mm) beyond the mounting surface may damage the threads.

Figure 4.2
Mounting Dimensions (Nominal)

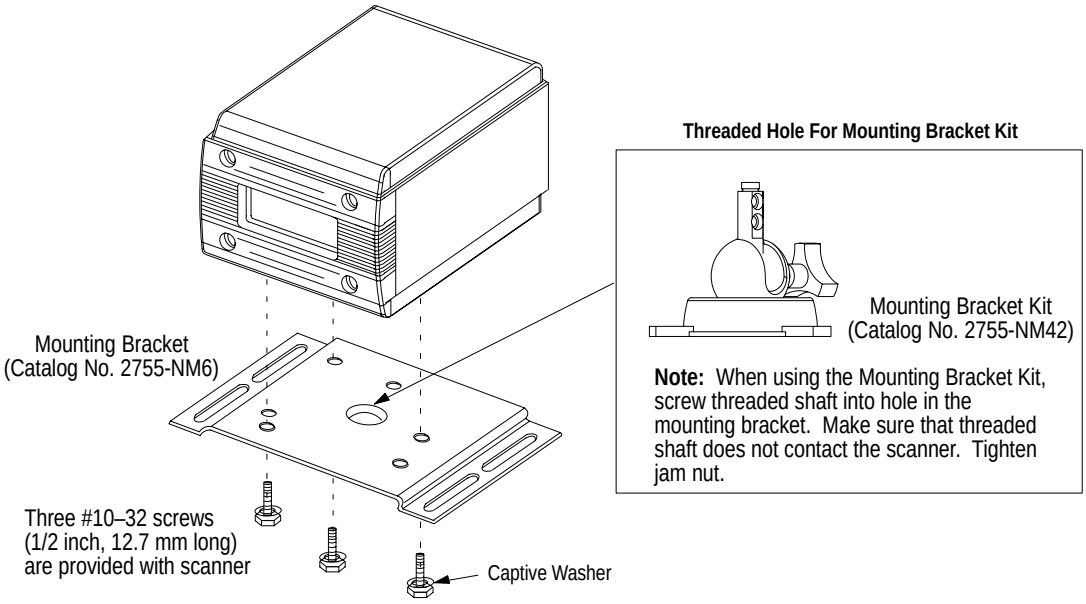


Mounting Bracket

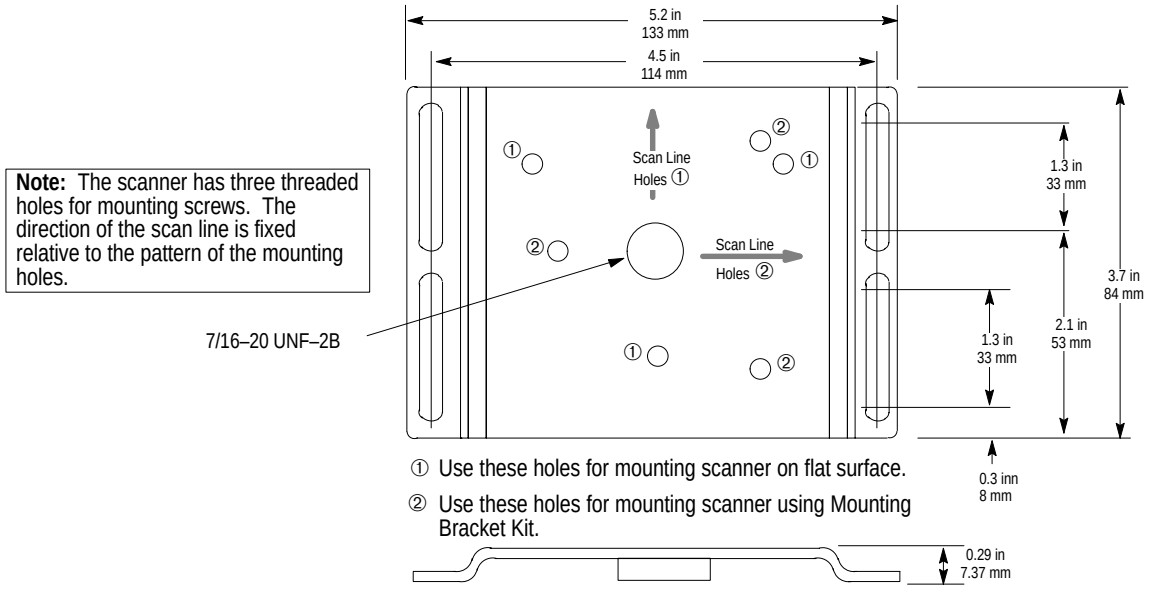
The Mounting Bracket (Catalog No. 2755-NM6) allows mounting on flat surfaces. The scanner is supplied with three #10-32 screws ($^1/_2$ inch, 12.7 mm long) for mounting. Two sets of mounting holes allow you to mount the scanner to the bracket as shown below or turned 90°. The Mounting Bracket Kit (Catalog No. 2755-NM42) provides additional flexibility.

If creating your own mounting bracket, make holes large enough to prevent binding and damage to the internal threads of the scanner. The bracket should be in full contact with the scanner bosses to conduct heat away from scanner.

Figure 4.3
Mounting Bracket



Mounting Bracket Dimensions (Nominal)



Connecting Equipment

Use the steps below as a guideline when connecting equipment. Refer to the User Manual for your decoder when necessary.

1. Verify that the power to the decoder is **TURNED OFF**.
2. Connect optional package detector to the package detector cable on back of scanner. See next section.
3. Connect the scanner to the decoder by attaching the scanner cable (with the connected extension cable if appropriate) to the scanner port on the back of the decoder.
4. Set up decoder.
   - Connect the configuration terminal to the AUX port of the decoder.
   - Configure the decoder for your application if you have not already done so. Refer to Decoder User Manual.
5. Refer to Chapter 5 on scanner operation.

Installing Package Detector

Use the following guidelines when installing the package detector.

- Mount the package detector and reflector so that the scan line does not strike either of them.
- Install the reflector within the operating range of the package detector.
- The package detector's beam should be broken before the label is in position. The package detect should remain active while the entire symbol is within the scan line.

ATTENTION: The package detect cap or package detector must be installed whenever the scanner is in operation to maintain the NEMA Type 4 seal. Removing the cap during scanner operation makes the scanner susceptible to ESD damage.

Figure 4.4
Recommended Placement of Package Detector and Reflector

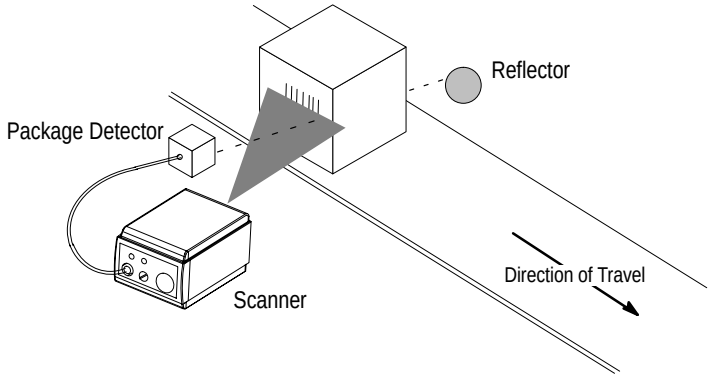


Table 4.A shows the connector pinout of the package detector cable (attached to back of scanner). The package detector must be able to operate using the +12V DC source (pin 1) and not draw more than 100mA. The package detect sense line (pin 2) must be able to sink 5mA at +12V DC.

Table 4.A
Pins Used on Package Detector Port

Package Detect Port	Pin #	Pin Function	Wire Color
Face View Female 	1	+12V DC	Brown
	2 ①	Package Detector Sense	White
	3	Ground	Blue
	4	No Connection (internally pulled up to 12V DC)	Black

① Triggers the decoder to start decoding. The trigger active LED on the decoder lights when the package detect input is active.

If the decoder is configured to turn the laser on only upon a package detect, the laser will not turn on until the package detector is triggered. Refer to the Decoder User Manual.

Operating the Scanner

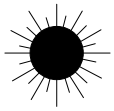
Chapter Objectives

This chapter provides information on how to operate the scanner when connected to a decoder.

Warnings and Cautions

ATTENTION: Do not make any adjustments to the scanner other than those specified in this manual.

ATTENTION: If during operation an intense dot of light is generated instead of a thin line of light, immediately turn the laser off via the decoder configuration software, and then remove power from decoder.



CAUTION: This laser caution symbol appears where laser radiation is present.

Laser On/Off Control

You can disable or turn off the laser from the decoder (Catalog No. 2755-DS/DD) configuration screen by setting the *Laser-on Mode* parameter to *Off*. ①

To turn off the laser when using a Catalog No. 2755-DM6 or -DM9 decoder, set the configuration parameters as follows:

- *Laser-on Mode* to *Triggered*
- *Decode Trigger* to *Package Detect*
- *Package Detect Input Sense* to *Lo = Package* (Catalog No. 2755-DM9 only)

If using package detect control, make sure that a package is not present.

Note: Turning off the decoder will also turn off the laser.

① The Laser-on Mode=OFF parameter is supported only by the Catalog Number 2755-DD and -DS type decoders.

Scan Angle Adjustment

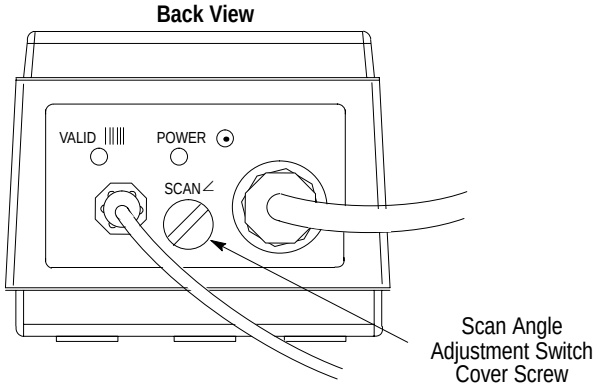
Each scanner has a multi-position rotary switch which lets you adjust the scan angle ∠ to ½, ¾, or maximum angle.

Catalog No. 2755-LD4 A,B,C		Catalog No. 2755-LD4 E		Catalog No. 2755-LD8	
Setting	Nominal Scan Angle	Setting	Nominal Scan Angle	Setting	Nominal Scan Angle
½	25°	½	20°	½	15°
¾	37.5°	¾	30°	¾	22.5°
MAX	50°	MAX	40°	MAX	30°

The scan angle adjustment switch is located behind a ¼-20 cover screw (with gasket) on the back of the scanner. This cover screw is necessary to maintain a NEMA Type 4 rating. After making the scan angle adjustment, the cover screw must be tightened to 20 inch-lbs.

ATTENTION: The enclosure is not completely sealed without the scan angle adjustment screw. Dust and moisture may enter the enclosure causing deterioration in performance.

Figure 5.1
Scan Angle Adjustment Switch



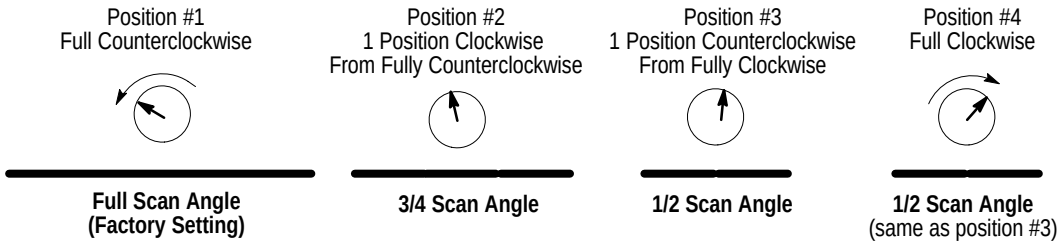
The scan angle adjustment switch has 4 positions:

- Position #1 is full scan angle
- Position #2 is $^3/_4$ scan angle
- Position #3 and #4 is $^1/_2$ scan angle

To avoid an unnecessarily long scan, rotate this switch counterclockwise. The scan angle will reduce from full to approximately ¾, and ½.

Figure 5.2 shows the scan angle relative to the switch position. In each case, the usable beam will be approximately 80% of the actual beam width.

Figure 5.2
Scan Angle Adjustment Switch Positions



Maintenance and Troubleshooting

Chapter Objectives

This chapter provides troubleshooting information to assist with problem detection and resolution. It also describes how to remove the scan window for cleaning or to replace the window.

Maintenance of Scanner

ATTENTION: No user maintenance of the scanner is required. **Do not open the enclosure!** Removing or attempting to remove sealed screws will void the warranty.

Cleaning Scan Window

For optimum performance the scan window should be clean.

To clean the scan window:

ATTENTION: Only use reagent grade alcohol to clean the window. Do not use organic solvents. Do not use abrasive materials, such as disposable paper wipes, to clean the plastic scan window. Disposable wipes usually contain glass fibers which will scratch and cloud the window.

1. **Turn the decoder off.**

ATTENTION: Do not attempt to clean the window while the scanner is turned on. Although momentary exposure to the laster light is not harmful, precautions should be taken to avoid looking into the beam.

2. Verify that the POWER indicators on both the scanner and the decoder are OFF.
3. Dust off the scan window and adjacent areas with optics rated air.
4. Clean the window using a reagent grade alcohol, cotton-tipped swabs and lens cleaning paper. To avoid smearing film and fingerprints, rotate the cotton-tipped swab while it's on the window, nearly one full turn. Then discard it.
5. Turn the decoder ON. The POWER indicators on both the decoder and scanner should be ON.

When the window is clean, you will barely see the reflection of the laser beam on the window.

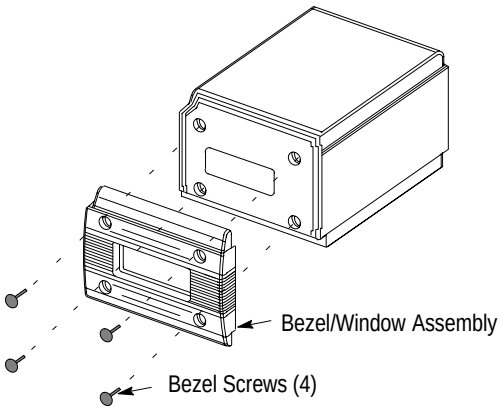
Replacing Scan Window

The scan window fits into an opening behind the front of the scanner. A bezel and gasket create a NEMA Type 4 seal.

The table below lists replacement numbers for ordering a glass or plastic window kit. Do not substitute other material for a damaged window. The windows have an optical coating necessary to scanner performance.

Replacement Numbers	Window Kit Description
77125-898-01	Replacement Glass Window Kit Includes bezel/window assembly with anti-reflective, optical glass window.
77125-899-01	Replacement Plastic Window Kit Includes bezel/window assembly with hard coated, anti-reflective, optical quality, plastic window.

Figure 6.1
Scan Window Removal



To remove the scan window:

1. Remove four screws from front cover of scanner.

ATTENTION: Many electronic components in the scanner are static sensitive. Anyone servicing the scanner should be well grounded through an ESD strap and ground cord. For additional protection from static discharge, the scanner should be attached to the decoder.

ATTENTION: Do not touch the internal mirrors! Smudges from fingerprints will deteriorate read performance. The internal mirrors cannot be serviced in the field.

2. Lift bezel/window assembly away from scanner.

3. Replace window with the appropriate window kit.

4. Tighten screws to a torque of 10 inch-pounds.

Troubleshooting

This section lists problems that may occur with the scanner and/or connected decoder. Each problem lists possible causes and solutions.

Problem: **"Power" indicator on both the scanner and decoder do not light.**

Cause: Decoder power switch is in OFF position.
Solution: Turn decoder power switch to ON position.

Cause: No incoming power.
Solution: Verify power source.

Cause: Improper connection to power source.
Solution: Check connections.

Cause: Faulty decoder.
Solution: Return decoder to Allen-Bradley for repair.

Problem: **Decoder "Power" indicator lights but Scanner "Power" indicator does not light.**

Cause: Improperly connected or faulty cable between scanner and decoder.
Solution: Verify connections, replace cable.

Cause: Internal decoder or scanner failure.
Solution: Return scanner or decoder to Allen-Bradley for repair.

Problem: **No laser beam emits from scan window.**

Cause: No scan trigger signal.
Solution: Verify decoder *Laser On Mode* and *Decode Mode* for proper configuration.
Verify sending of scan trigger by either package detect or trigger from decoder.

Problem: “Power” indicator lights but the laser beam is not on.

Cause: Decoder setup parameters are not set up properly.

Solution: Verify decoder configuration.

Cause: Package detector not operating.

Solution: Verify decoder configuration / package detect operation.

Cause: Laser scanning mechanism is not operating correctly.

Solution: Return scanner to Allen-Bradley for service.

Problem: Unable to read a label.

Cause: Decoder not configured correctly.

Solution: Check decoder configuration to verify that parameters are set appropriately for your application. After making changes, SAVE configuration to EEPROM and restart decoder.

Cause: Label(s) out of specification.

Solution: Use good quality labels that are within specifications.

Cause: Scan window is dirty.

Solution: Clean window as described in previous sections of this chapter.

Cause: Scanner is at incorrect angle or distance from bar code symbols.

Solution: Check that the scanning distance is correct and orientation of labels to scanner is correct.

Determine the optimum reading angle by using a static bar code label position and checking the decoder performance indicators with the *Decode Mode* set to *Continuous.* Refer to ”Compensating for Pitched Symbols”.

Fix the scanner at a position that results in a high decoder performance value. After properly positioning the scanner, return the decoder configuration to the correct operating mode.

Specifications

Electrical	Receives power from decoder
Mechanical	
Enclosure	NEMA Type 4
Connectors	NEMA Type 1 (Subminiature DB15) NEMA Type 4 (Cannon KPT Series)
Package Detect	NEMA Type 4 Micro-Mini Connector (Crouse-Hinds) NEMA Type 4 Micro-Change Connector (Brad Harrison)
LED Indicators	
POWER ON	Amber
VALID READ	Green
Weight (Approximate)	4.0 lbs (1.8 kg)
Dimensions	
Inches	3.1 (H) x 3.8 (W) x 4.5 (D)
Millimeters	78.7 (H) x 96.5 (W) x 116.8 (D)
Shock	30G operating, 50G nonoperating
Vibration	2.5G 5 to 2,000 Hz (3 axis) operating 5G 5 to 2,000 Hz (3 axis) non-operating
Environment	
Ambient Temperature	
Operating	0 to 40° C (32 to 104° F)
Storage	-30 to 70° C (-22 to 158° F)
Relative Humidity	5 to 95%, non-condensing
Optical	
Light Source	Visible Laser Diode
Wavelength	660 nm
Average Output Power	1.0 mW maximum
Scan Rate (Nominal)	
Catalog No. 2755-LD4	200 Scans/Second
Catalog No. 2755-LD8	500 Scans/Second
Scan Angle Adjustment	
Catalog No. 2755-LD4A, B, C	½ (25°), ¾ (37.5°), Full (50°)
Catalog No. 2755-LD4E	½ (20°), ¾ (30°), Full (40°)
Catalog No. 2755-LD8	½ (15°), ¾ (22.5°), Full (30°)
Maximum Usable Scan Angle	
Catalog No. 2755-LD4A, B, C	36°
Catalog No. 2755-LD4E	30°
Catalog No. 2755-LD8	25°
Read Ranges for LD4/LD8	Refer to Tables 3.A & 3.B

Package Detect	External, +12 V DC, @ 100 mA max. 5 mA current sink (minimum)
CDRH Standards	Meets Class II Standards
Agency Certifications	CE marked for all applicable directives

European Union Directive Compliance

European Union Directive Compliance

If this product is installed within the European Union or EEA regions and has the CE mark, the following regulations apply.

EMC Directive

This apparatus is tested to meet Council Directive 89/336 Electromagnetic Compatibility (EMC):

- EN 50081-2 EMC – Generic Emission Standard, Part 2 – Industrial Environment
- EN 50082-2 EMC – Generic Immunity Standard, Part 2 – Industrial Environment

The product described in this manual is intended for use in an industrial environment.

Intended Use of Product

According to these Standards, the factor which determines, for EMC purposes, whether an apparatus is deemed to be “Industrial” or “Residential, commercial and light industrial”, is given in Clause 1 of EN50081-2 as follows:

> Apparatus covered by this standard is not intended for connection to a public mains network but is intended to be connected to a power network supplied from a high- or medium-voltage transformer dedicated for the supply of an installation feeding a manufacturing or similar plant.

The product described in this manual is intended for use solely in an industrial environment as defined above. When installed in Europe, any other application is in contravention of European Union Directives, and a breach of these laws.

Declaration of Conformity

DECLARATION OF CONFORMITY

This Declaration of Conformity is suitable to the European Standard EN 45014, "General criteria for supplier's declaration of conformity." The basis for the criteria has been found in international documentation, particularly in: ISO/IEC Guide 22, 1982, "Information on manufacturer's declaration of conformity with standards or other technical specifications."

Allen-Bradley liability under this declaration is limited to that set forth in the current Allen-Bradley publication 6500, Terms and Conditions of Sale as well as similar publications from Allen-Bradley affiliates doing business in the European Community.

Applied Council Directive(s):
Electromagnetic Compatability Directive (EMC) 89/336/EEC
and amending directives 91/263/EEC, 92/31/EEC, 93/68/EEC

We,

Manufacturer:	Allen-Bradley Company, Inc. 1201 South 2nd Street Milwaukee, WI 53204 U.S.A.	**Authorized Representative in the Community (and location of Responsible Person):**	Allen-Bradley, subsidary of Rockwell International GmbH Düsselberger Str. 15 D-42781 Haan, Germany

declare under our sole responsibility that the product(s) (name, type/model, batch/serial number):

Industrial barcode reading systems including the Bul 2755-DS and -DD family of decoders and the Bul 2755-LD4 and -LD8 family of scanners

to which this declaration relates is in conformity with the relevant provisions of the following standard(s) or other normative document(s):

EN 50082-2 :1995 Generic Immunity Standard - Industrial
EN 50081-2 :1993 Generic Emission Standard - Industrial

Test Report is maintained at:	**Report No. 3530 & 3556 August 1995**
Allen-Bradley Company, Inc.	**D.L.S. Electronic Systems, Inc**
1201 South Second Street	**1250 Peterson Drive**
Milwaukee, WI 53204	**Wheeling, IL 60090**

We, the undersigned, hereby declare that the product(s) specified above conforms to the listed directive(s) and standard(s).

Manufacturer

Signature: Robert A. Gardiner

Full Name: Robert Gardiner
Position: Manager, Quality Engineering
Date: Nov 3, 1995

Authorized Representative in the Community through its Responsible Person

Signature: Viktor Schiffer

Full Name: Viktor Schiffer
Position: Engineering Manager
Date: Nov 3, 1995

Glossary

AIM
Acronym for Automatic Identification Manufacturers.

Alignment
The relative position of a scanner or light source to the target of the receiving element.

Alphanumeric
The character set containing letters, numbers, punctuation marks, and symbols.

Aspect Ratio
The ratio of height to width of a bar code symbol. A code twice as high as wide would have an aspect ratio of 2; a code twice as wide as high would have an aspect ratio of ½ or 0.5.

Average Background Reflectance
Expressed as a percent, this is the simple arithmetic average of the background reflection reading from at least five different points on a sheet.

Bar
The dark element of a printed symbol.

Bar Code
The vertical bars and spaces found in a bar code symbol.

Bar Code Density
The number of characters which can be represented in a linear inch.

Bar Code Label
A label that carries a bar code and is suitable to be affixed to an article.

Bar Code Symbol
A group of vertical bars that represent a character or group of characters whose spacing is determined by a specific set of rules. In most cases, human readable characters are printed below the bars.

Bar Length
The bar dimension perpendicular to the bar width.

Bar Width
The thickness of a bar measured from the edge closest to the symbol's start character to the trailing edge of the same bar.

Character
A single group of bars and spaces representing an individual number, letter or punctuation mark. A graphic shape representing a letter, number or symbol.

Character Alignment
The vertical or horizontal position of characters with respect to a given reference line.

Character Density
The dimension, in linear inches, required to encode one character.

Character Set
Those characters available for encoding purposes.

Character Skew
See skew.

Character Spacing
The horizontal distance between two adjacent characters.

Check Digit
A digit included within a symbol whose value is based mathematically on other characters included in the symbol. It is used to mathematically check the accuracy of a symbol.

Clear Area
A clear space, containing no dark marks, that precedes the start character of a symbol and follows the stop character. Also referred to as the symbol's *Quiet Zone*.

Code Medium
The material used to construct a machine readable code. Such materials may be retrospective or opaque.

Code Type
See symbology.

Continuous Code
A bar code or symbol that does not use an intercharacter gap between characters in the code. Interleaved 2 of 5 is an example of a continuous code.

Decode
The process of translating a bar code into data characters using a specific set of rules for each symbology.

Decoder
A device used to convert the signal from the scanning device into a usable format (usually ASCII characters).

Depth of Field
The distance between the maximum and minimum reading distances where a symbol can be read.

Diffuse Reflection
Reflection of light in all directions. Diffuse reflection occurs from non-glossy surfaces. See specular reflection.

Dirt
In paper, refers to the presence of relatively non-reflective foreign particles embedded in the sheet. The size and lack of reflectance of the particles may cause the optical scanner to mistake the dirt for inked areas (i.e. paper noise).

Discrete Code
A bar code or symbol that contains spaces between the encoded characters, i.e. intercharacter gap. Code 39 is an example of a discrete bar code symbol. See continuous code.

Diverging Beam
A beam of light that is optically controlled so the light extends in different directions from the source.

Element
Any bar or space in a bar code symbol.

Encoded Area
The total linear dimension consisting of all the characters of a code pattern, including start/stop characters and data.

Extraneous Ink
Ink in a scan area not intended to be there.

Guard Bars
Bars at the ends and center of a UPC and EAN symbol. They ensure a complete scan of the bar code.

Height of Scan
The maximum vertical scanning dimension of a moving beam scanner at a specific distance from the face of the scanner.

Intercharacter Gap
The space between two adjacent bar code characters. For example, the white space between two characters in AIM USS-39.

LED
Light emitting diode.

Mis-encodation
When the characters which were to be represented in symbol form are not correctly encoded. Example: desired number is 1, 2, 3, 4; the encoded number is 1, 2, 5, 4.

Misread
A condition which occurs when the data output of a decoder does not agree with the encoded data presented. See substitution error.

Moving Beam Scanner
A device which dynamically searches for a bar code pattern by sweeping a moving optical beam through a field of view.

Nanometer
Unit of measure used to define the wavelength of light. 10^{-9} meters.

No-read
The absence of data at the scanner output after an attempted scan due to no code, defective code, scanner failure or operator error.

Nominal Size
The standard size for a bar code symbol. Most codes can be used over a range of magnifications from 0.80 to 1.20, nominal.

Numeric
A machine vocabulary that includes only the numbers as contrasted to alphanumeric which includes both letters and numerals.

Opacity
1) The property of paper that minimizes the show through of printing from the back side or the next sheet. 2) The ratio of the paper reflectance with a black backing to the paper reflectance with a white backing.

Optical Throw
The distance from the face of the scanner to the beginning of the depth of field.

Orientation
The alignment of bars and spaces to the scanner. Often referred to as vertical (ladder) or horizontal (picket fence).

Paper Noise
A term used to describe the reflective effect of the laser beam on paper (or any other surface) where microstructure causes variability not attributed to the bars and spaces. This effect can result in reduced readability of labels and decreased read ranges.

Permanent Code
A code which is indefinitely reused in a bar code application.

Pitch
1) Rotation of a code pattern about the Y axis. 2) The normal distance between the centerline or adjacent characters.

Pre-printed Symbol
A symbol which is printed in advance of application either on a label or on the article to be identified.

Print Contrast Signal (PCS)
A measurement of contrast (brightness difference) between the bars and spaces of a symbol. A minimum PCS value is needed for a symbol to be scannable. PCS - $(R_L - R_D)/R_L$, where R_L is the reflectance factor of the light background and R_D is the reflectance factor of the dark bars.

Print Quality
The complete analysis of a printed symbol with regard to reflectance properties as well as bar and space resolution with regard to symbol specification. The inter-relationship of printed material and imprinted material that affects the optimum performance of the scanner.

Quiet Zone, Quiet Area
An area preceding and following a bar code symbol that contains no printing. The length of the quiet zone must be at least 10 times the narrow bar width.

Read
A successful read of a bar code symbol.

Reflectance
The amount of light returned from an illuminated surface.

Reflectance, Absolute
The ratio of the total reflectance by a document to the total light incident on the document.

Reflectance, Diffuse
Reflected light whose angle of reflection varies from the angle of incidence of the illuminating light, as in reflection from a mirror.

Reflectance, Specular
Reflected light whose angle of reflection is equal, or nearly equal, to the angle of incidence of the illuminating light, as in reflection from a mirror. Specular reflectance is the reason why the scanner should be aligned 10 to 20° off center.

Resolution
1) The measure of the ability of a lens, a photographic material or a photographic system to distinguish detail under certain specific conditions. 2) The dimension of the smallest element which can be printed employing a particular technique. 3) The narrowest element dimension which can be distinguished by a particular reading device.

Retroflective
Characteristics of material causing it to reflect light back to its source regardless of angle of incidence.

Retroflector
A reflector, specially constructed, which reflects energy back to the source from which it came.

Reverse Image
A symbol in which the normal dark areas are represented in the light areas.

Scan
The search for a symbol or marks which are to be optically recognized.

Scan Area
The area intended to contain a bar code symbol.

Scanner
A device that optically scans bar code symbols and converts the optical information into digital or analog form and sends it to a decoder.

Self-checking
A bar code or symbol using a checking algorithm which can be applied to each character to guard against undetected errors. Codes that are not self-checking may employ a check digit or other redundancy in addition to the data message.

Skew
Rotation about the X axis. Rotational deviation from correct horizontal and vertical orientation may apply to a single character, line or encoded item.

Space
The lighter element of a bar code formed by the background between bars.

Special Symbol/Character
In a character set, a character that is neither a numeral, letter, or a blank: for example, @ $ % & *.

Spectral Response
The variation in sensitivity of a device to light of different wavelengths.

Specular Reflection
Reflection of light from a surface at an angle equal but opposite to the angle of incidence. See reflectance, specular.

Spots
Ink or dirt spots within the spaces or clear area of a bar code which may reduce first read rate.

Start/Stop Characters
Bar code characters that provide the scanner with information on the how the code is bounded and its orientation. The start character is normally at the left end of a horizontal code and adjacent to the most significant character. The stop character is normally at the end of a horizontal code and adjacent to the least significant character.

Substitution Error
This error can be seen in a mis-encodation, misread, or human operator error. Characters are substituted with erroneous information. Example: correct data is 1, 2, 3; substitution is 1, 2, 5. Substitution errors are usually the result of bar code labels with printing defects. Substitution errors are extremely difficult to determine and are usually not found until the data has been processed and an obvious data error is noticed.

Symbol
A combination of characters including start/stop characters and check characters, as required, which form a complete scannable entity.

Symbology
The conventions, or rules, which govern the formation of characters and strings in bar codes. The language of the bar code symbol.

Symbol Density
The number of characters per linear inch.

Symbol Length
The length of the symbol measured from the beginning of the quiet area adjacent to the start character to the end of the quiet area adjacent to a stop character.

Valid Read
A condition in which a bar code has been successfully decoded.

VLD
Visible Laser Diode.

Void
The absence of ink within printed bars. The absence of ink within the confines of a character.

White Zone
See quiet zone.

Rockwell Automation

Rockwell Automation helps its customers receive a superior return on their investment by bringing together leading brands in industrial automation, creating a broad spectrum of easy-to-integrate products. These are supported by local technical resources available worldwide, a global network of system solutions providers, and the advanced technology resources of Rockwell.

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