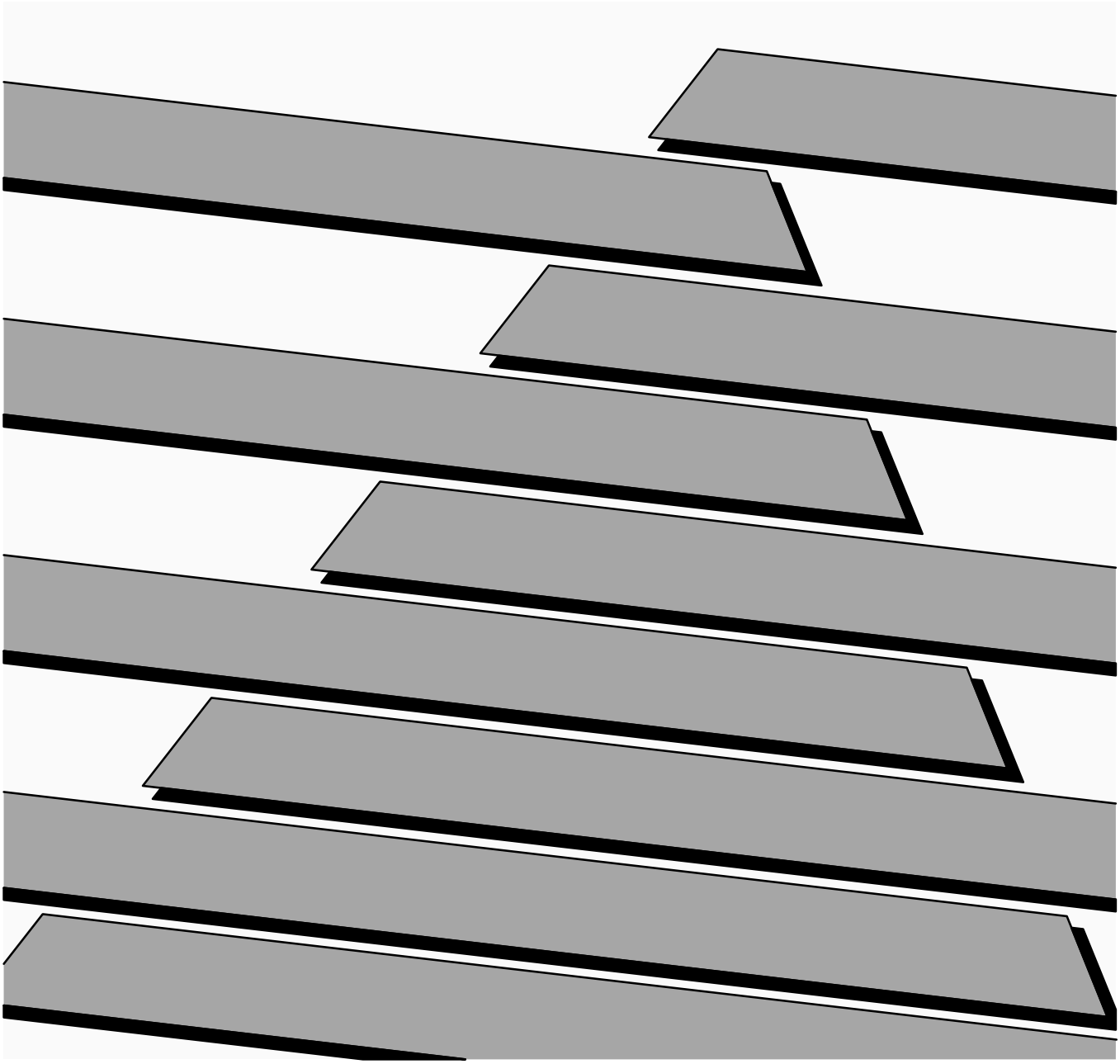
ALLEN-BRADLEY

AtomScan™ Bar Code Scanner

(Catalog No. 2755-L6SA, -L6RA, -L6SB, -L6RB)

User Manual



Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. “Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls” (Publication SGI-1.1) describes some important differences between solid state equipment and hard–wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this manual.

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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.

Attentions help you:

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

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

Using This Manual

Chapter 1

AtomScan Product Family

Chapter 2

Designing the System

Chapter 3

Chapter 1

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
- Laser warning symbol
- Related publications

What You Need to Know

No special knowledge is required to read this manual. Some knowledge of trigonometry and solving simple equations is helpful in operating the scanner.

Convention Used

In this manual, the Catalog No. 2755-L6SA, -L6RA, -L6SB, -L6RB AtomScan Bar Code Scanners are referred to as the scanners.

Contents of Manual

This manual describes how to install and operate the Catalog No. 2755-L6SA, -L6RA, -L6SB, -L6RB AtomScan Bar Code Scanners. The contents of each chapter are as follows:

Chapter	Title	Purpose
1	Using this Manual	Provides an overview of the manual.
2	AtomScan Product Family	Describes the main features of the scanner and its accessories.
3	Designing the System	Provides information needed to select a scanner and use it to best effect.
4	Installing the Scanner	Describes how to mount, aim and wire the scanner.
5	Operating the Scanner	Provides information for the safe operation of the scanner.
6	Maintenance and Troubleshooting	Provides information on maintaining the scanner, and on what to do if problems occur.
Appendix	Specifications	Lists specifications of the scanner.
Glossary	Glossary	Defines bar code terms.

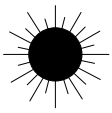
Terminology

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

Laser Warning Symbol

AtomScan scanners are Class II Laser Devices as specified by the Center for Detection of Radiation Hazards (CDRH). Momentary exposure to Class II laser light is not known to be harmful. However,

- do not stare at the laser light.
- do not look into the scanner window when the mirror is not spinning. The steady beam of laser light could possibly injure your eye.



CAUTION: This laser caution symbol is required where laser radiation is present. It can be seen on top of AtomScan scanners.

Related Publications

Another publication you may want to refer to:

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

Chapter 2

AtomScan Product Family

Chapter Objectives

This chapter gives an overview of features and accessories of AtomScan scanners:

- Overview of the AtomScan scanner reading system
- Choosing an AtomScan scanner
- Available decoders and accessories
- Package detector and extension cables

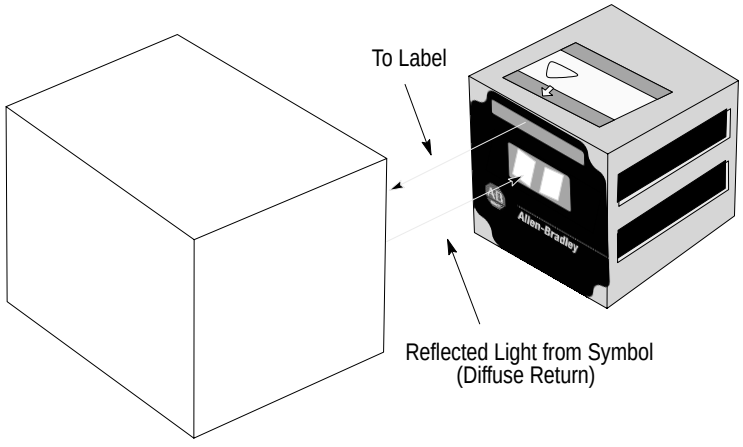
Overview of Scanner

The AtomScan scanner uses a visible laser diode for non-contact reading of bar code symbols. The laser generates a small, concentrated light beam. The beam is reflected off a 10-sided rotating mirror through the upper window in the scanner. Light reflected from the symbol comes back through the lower window, and is detected by a light sensor, which changes it to electrical signals. The signals are sent to a decoder for further processing.

AtomScan scanners are designed for applications needing a small scanner to fit into a limited space. It is particularly suited to small packaging and labeling machines.

Note: AtomScan scanners are designed for use in clean environments.

Figure 2.1
How the AtomScan Scanner Works



ATTENTION: The AtomScan scanner contains no user-serviceable parts. If the scanner is opened, the warranty is void.

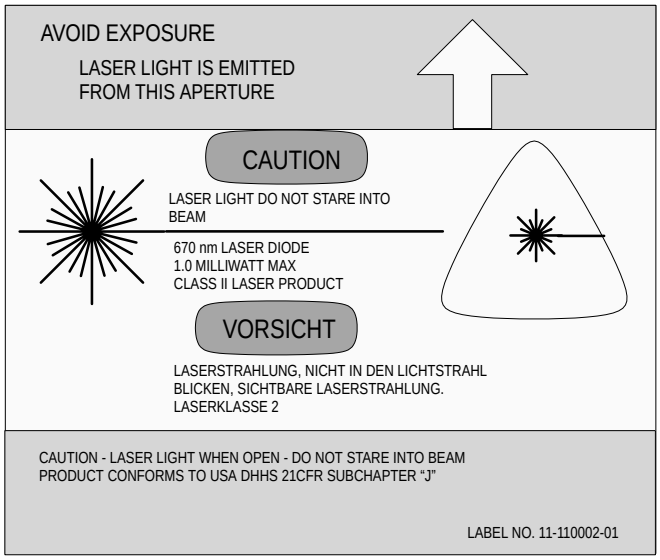
Safety Labels

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.

ATTENTION: The laser beam can be harmful to eyesight.
Avoid direct eye contact with the laser beam when the mirror is not spinning
Avoid prolonged eye contact with the laser beam when the mirror is spinning.

ATTENTION: Never point the beam at other people, or in a direction where people may be passing.

Figure 2.2
Safety Label on Top of AtomScan scanners



Overview of Scanner

Features of AtomScan scanners include:

- low power consumption
- wide field of view
- the ability to read a wide range of bar code densities.
  Note: Bar code density is the width of the narrowest bar or space.
- high scan speed of 330 scans per second
- small size
- choice of raster or single line scanning

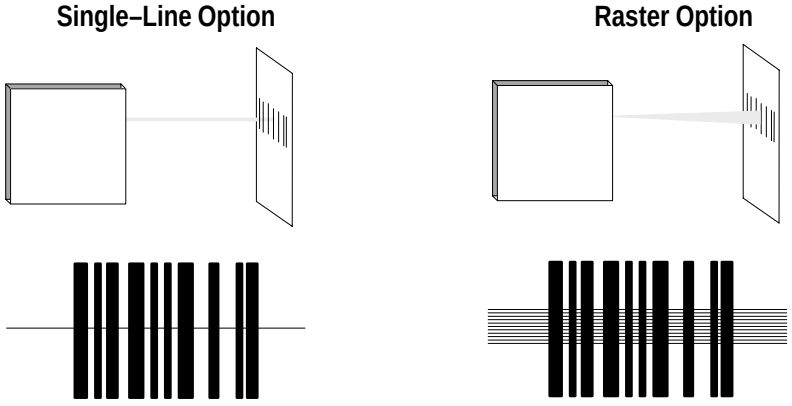
Catalog Number	Scan Beam	Narrow Element Range (Nominal)
2755-L6SA	Single Line	5-8 mil (.12-.20 mm)
2755-L6RA	Raster	
2755-L6SB	Single Line	8-50 mil (.20-1.27 mm)
2755-L6RB	Raster	

Scan Beam Options

Scan beams are projected either as a single line or as a raster pattern, depending on the Catalog Number ordered. Both options use a 10-sided mirror to reflect the laser beam out the scanner window.

- The Single-Line Option projects its ten scan lines per rotation so they follow the same path, and appear to be a single scan line.
- The Raster Option deflects its ten scan lines up and down through 2 degrees of arc during each rotation.

Figure 2.3
Single-Line and Raster Options



The raster type scanner is useful for reading poor quality bar code symbols. See Chapter 3 for application details.

Accessories

AtomScan scanners require an adapter and a cable to connect with an Enhanced Decoder.

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

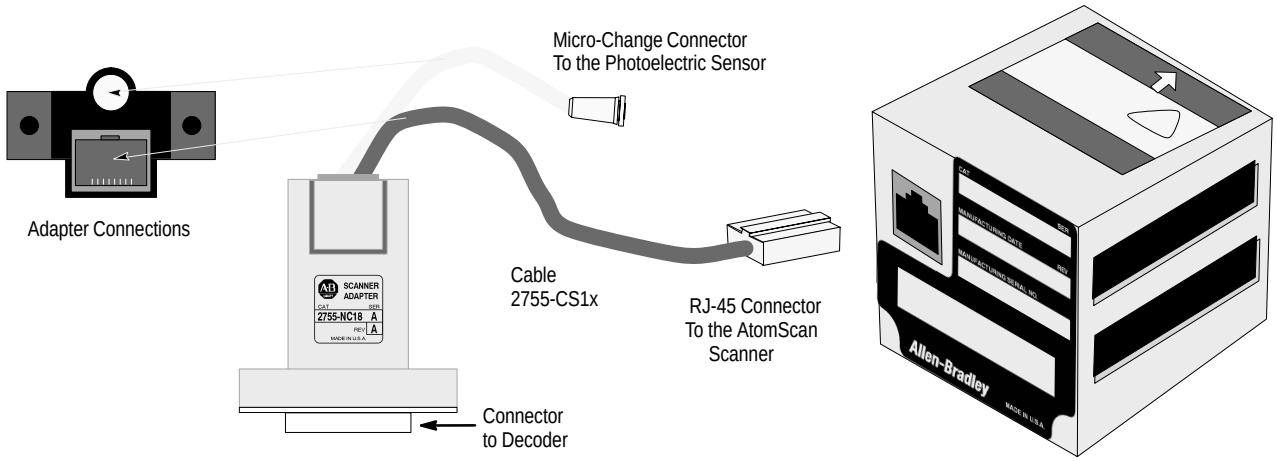
- Catalog No. 2755-DS1A Enhanced Single-Head Decoder
- Catalog No. 2755-DD1A Enhanced Dual-Head Decoder

The gasketed enclosure is equipped with a NEMA Type 1 connector, so it is suitable for a wide range of applications.

An AtomScan scanner is often mounted by driving screws up through holes in the mounting surface. If this is impractical, the mounting plate may be used for top-side mounting.

Catalog Number	Accessories
2755-CS10	Cable, Scanner to Adapter, 10 feet (3 meters)
2755-CS15	Cable, Scanner to Adapter, 15 feet (4.6 meters)
2755-CP13	Package Detect Extension Cable, 13 ft. (4 meters)
2755-NC18	Adapter Cable to Decoder
2755-NM7	Mounting Plate for Top Mounting
2755-DS1A or -DD1A	Decoder (Single Scanner or Dual Scanner)

Figure 2.4
Back of Scanner



Package Detectors

A Package Detector is used to sense when a package containing a bar code symbol is in position to have that symbol scanned and decoded.

Allen-Bradley Photoswitch® retro-reflective photoswitches, Series 6000 or Series 9000 with the QD (Quick Disconnect) option are recommended. The QD option provides a Micro-Change connector compatible with the connector on the Adapter Module (2755-NC18). You must order a **sinking** type sensor that can operate from a 12V DC supply with the -QD suffix added to the catalog number.

Select a Package Detect sensor that operates on 12 V DC and is a **sinking** type sensor. Acceptable sensors are:

Catalog Number 42SRU-6203-QD
Catalog Number 42GRU-9200-QD

Be sure to obtain a reflector suitable to the application.

An extension cable may be needed to connect the sensor. The following table includes cables available from sources other than Allen-Bradley.

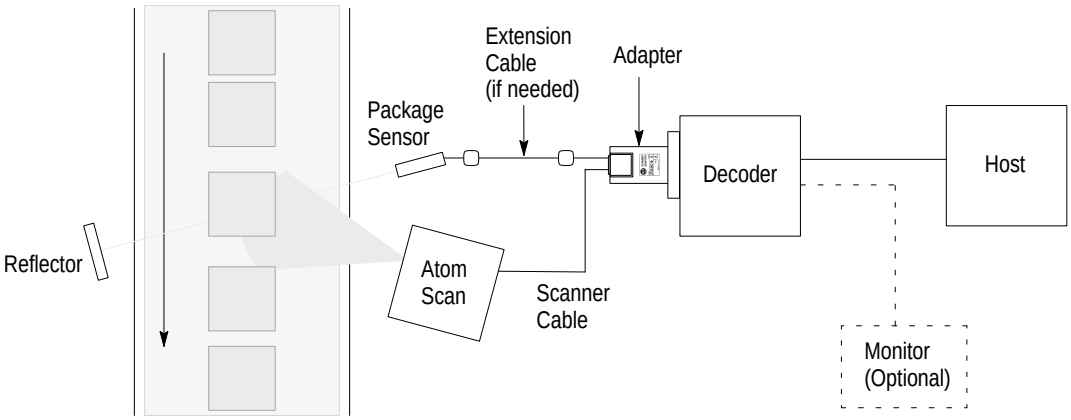
Table 2.A
Cables for Package Detectors

Length	Brad Harrison Part Number	Crouse-Hinds Part Number	Allen-Bradley Catalog Number
2 Meter (6.5 feet)	81428-003	5000118-40	-
3 Meter (9.8 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 sensors are available from Allen-Bradley Photoswitch.

The Scanning System

Figure 2.5
A Possible Setup for a Scanning System



Chapter 3

Designing the System

Chapter Objectives

This chapter provides information needed to set up the scanner correctly, including:

- Bar code symbols
- Symbol orientation
- Selecting the appropriate AtomScan scanner for your application

Setup Goals

Each application must be evaluated carefully. Successful bar code scanning begins with quality bar code symbols, and the correct number, type, and location of scanners, decoders, and object sensors. Also:

- Before setting up the system, calculate the expected number of scans per symbol. Make sure the application has the number of scans it needs. If necessary, adjust the symbol speed and/or the distance between bar-coded objects.
- Position the scanner at a distance from the symbol that is within the range specified (see Table 3.A). A read rate test (see the Enhanced Decoder user's manual, in which read rate is called "decoder performance indicator") should be made to verify the range, and also to ensure optimum scanning and decoding.
- Avoid aiming the scanner perpendicular to the symbol, to avoid directly reflected laser light.
- If a package sensor is used, position it so it can sense the object before the symbol reaches the scan area.

  Note: Make **sure** that the scan beam does not hit the sensor's reflector; the resulting glare can blind the scanner temporarily.

Bar Code Symbols

There are two basic types of bar code symbols.

One-dimensional

The one-dimensional bar code symbols have one row of bars and spaces. These were among the first to be developed. Examples that can be successfully scanned by AtomScan scanners are:

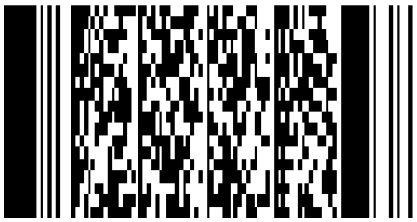
- Code 39
- Code 128
- Interleaved 2-of-5
- Pharmacode
- UPC
- EAN

Example of UPC-A Bar Code Symbol

Two-dimensional

Two-dimensional bar codes are also referred to as “stacked bar codes”, because they look like standard, one-dimensional bar code symbols stacked tightly together. Examples of two-dimensional symbols are:

- PDF417
- Code 16K
- Code 49



Example of PDF417

Note: Two-dimensional symbols generally cannot be successfully scanned by AtomScan scanners.

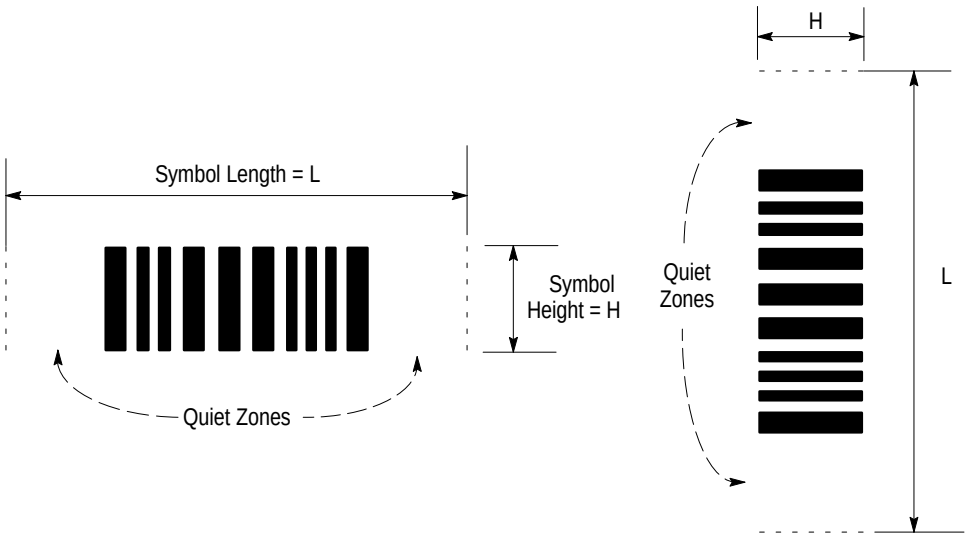
Narrow Element Width

It is very important to know the Narrow Element width of the target symbol when selecting and applying bar code scanners. The Narrow Element is defined as the narrowest bar or space in the symbol. All narrow bars and narrow spaces would be the same width if perfectly printed. However this is seldom true. Measure the narrowest bar and space and use the smaller dimension as the Narrow Element Width, to determine expected read capability.

Bar Code Symbol Length and Height

When measuring a symbol, orientation must be ignored. Its height is measured from one end of a bar to the other, and its length is always the distance from one end of the symbol to the other, including the “Quiet Zones”. A Quiet Zone is the empty space before or after the bars, and is usually equal to 10 times the Narrow Element Width.

Figure 3.1
Parts of a symbol



Symbol Quality

A bar code reader cannot reliably read a symbol of poor quality. We strongly advise testing proposed bar code symbol samples to ANSI Standard X3.182-1990, “Bar Code Print Quality Guideline”.

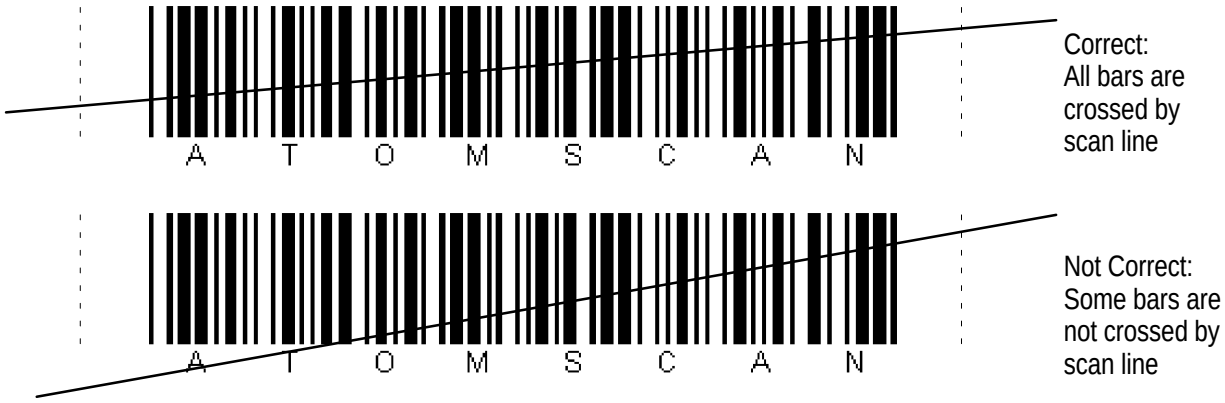
- Low-cost verifiers that can test this standard are available from several companies.
- Symbol samples can be submitted to an independent symbology testing company.

The ANSI guideline specified six parametric tests plus two pass/fail tests to determine the printed symbol quality. The tests result in an overall letter grade of A, B, C, D, or FAIL assigned to the symbol.

- Grade A printed symbols: any scanner should be able to read them.
- Grade B symbols: many scanners can read them, including AtomScan scanners.
- Grade C symbols may appear to decode successfully, but in production the performance may drop substantially. It is usually not worth taking a chance on symbols lower than Grade B.

Symbol Orientation

Bar code symbols must be in the correct position as they move by the scanner. The scan line must cross every bar, space, and both quiet zones on the same sweep.



Picket Fence and Step Ladder Orientation

The primary orientation of the bar code symbol can be either picket fence or step ladder. The orientation is **not** determined by the horizontal or vertical position of the symbol itself.

- **picket fence:** bars are perpendicular to the direction of travel
- **step ladder:** bars are parallel to the direction of travel

Figure 3.2
Picket Fence Orientation

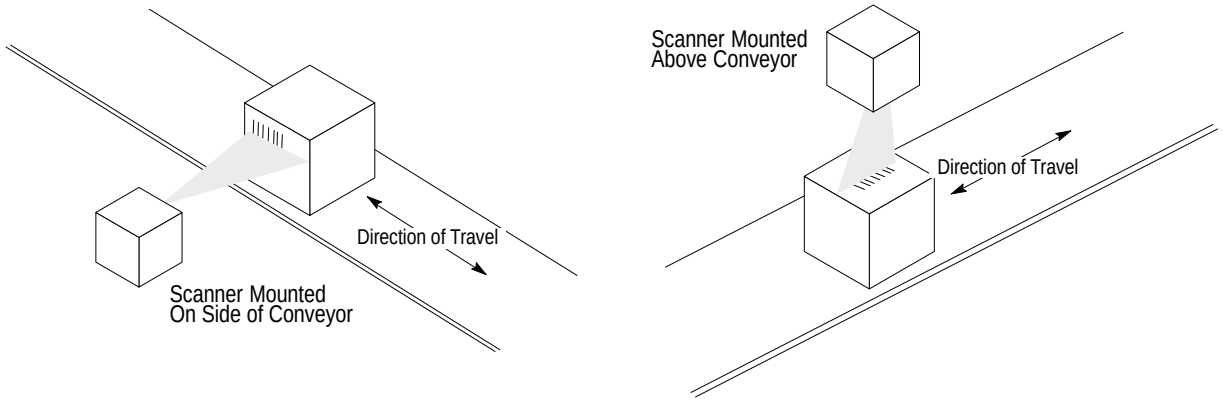
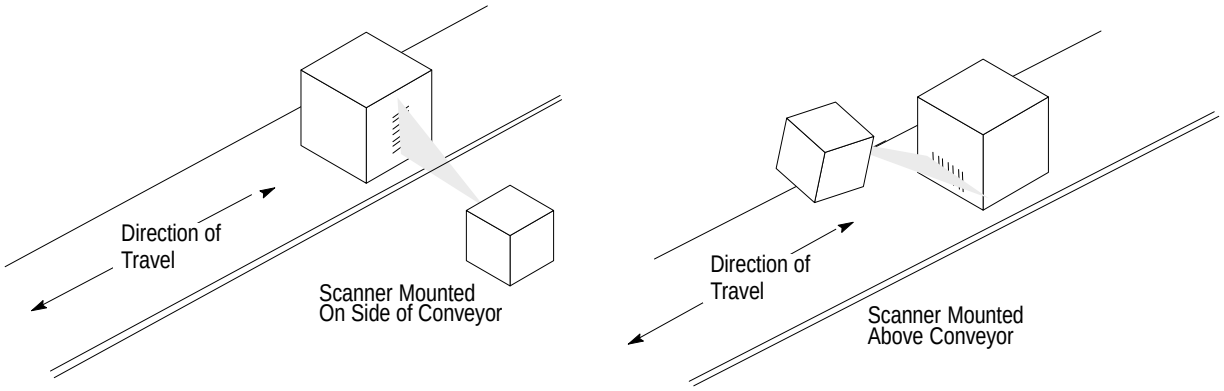


Figure 3.3
Step Ladder Orientation



In general, **ladder orientation** (Figure 3.3) is preferred, because each scan covers a slightly different part of the symbol. This means that:

- imperfections in the symbol are less liable to prevent a successful read.
- symbol placement is not as critical.

In **picket fence orientation** (Figure 3.2) the symbol can be read the whole time it is in the Read Range, rather than being limited by the height of the bar code. However picket fence allows scanning of only a small part of the whole symbol. Slight imperfections such as extraneous ink or voids can cause misreads or non-reads. The quality of data in picket fence orientation can be improved by any of the following:

- Make sure the printing on the symbol is of good quality.
- Tilt the scan line slightly to allow a larger part of the symbol to be scanned as it passes through the scan line. This simulates rastering.
- Use an AtomScan scanner with the raster option, since a raster scanner places ten scan lines through the symbol while the single-line scanner places only one.

When to Use a Raster Scanner

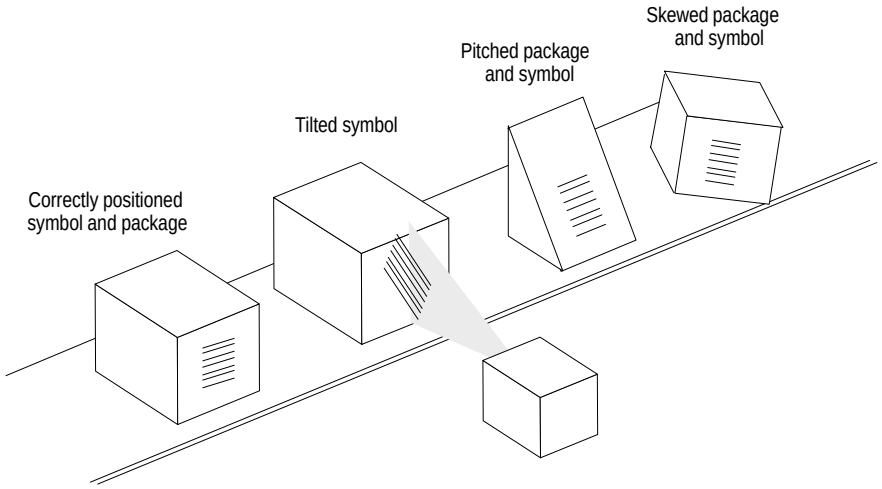
Single line scanners are always used in step ladder orientation.

Raster scanners are beneficial in picket fence applications with symbols printed by a dot matrix printer, or where the bars have ragged edges or voids, or where the spaces have specks in them.

Tilt, Pitch, and Skew

The AtomScan scanner can read a symbol correctly even if the symbol or package is not correctly oriented. Figure 3.4 shows several possible positions.

Figure 3.4
Positioning Terminology



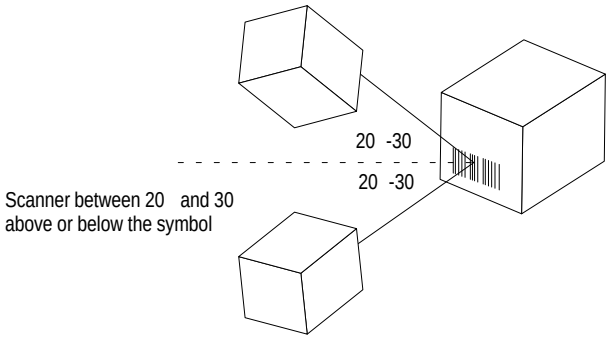
- **Tilt:** A symbol is tilted when the symbol's bars are not 90° to the scan line. The symbol can be read with any tilt, provided the scan line passes through all bars and quiet zones on each sweep for the required minimum number of scans. Tilt may reduce the number of scans in a given application. Scanners 2755-L6SB and -L6RB have elliptical spots, which may limit their tolerance for tilted symbols.
- **Pitch:** A symbol is pitched when the symbol's bars are at different distances from the scanner. From the scanner's perspective, a pitched symbol will **appear** to have a smaller Narrow Element width than it actually has. This may reduce both the read rate and the Read Range. However the symbol can still be read if the **apparent** Narrow Element width is within the scanner's specifications. See the section at the end of this chapter, Compensating for Pitched symbols.

  Note: Like skew, pitch may be used deliberately to reduce specular reflection, as long as the application still has the number of scans per symbol it needs.

- **Skew:** A symbol is skewed when the ends of the symbol's bars are not at the same distance from the scanner. The symbol can be read if the distance of both ends of the bar are within the scanner's Read Range, and the skew is less than ±40 degrees from the centerline. Unlike pitch, skew does not affect the read range.

  Note: Some skew is necessary to prevent strong reflected light (specular reflection) from interfering with a successful read. A skew between 20°-30° is ideal. Or skew may be combined with pitch to give this angle.

Figure 3.5
Correct Setup of Scanner



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

Selecting the Correct AtomScan Scanner

To select the correct AtomScan scanner for your application, you must measure:

- the distance between the scanner and the symbol (which must be within the Read Range)
- the apparent Narrow Element width. This equals the actual measured Narrow Element width if the symbol is not pitched. See the section later in this chapter, Compensating for Pitched Symbols.
- the bar code symbol’s length and height (see Figure 3.1)
- the speed at which the symbol will be travelling

Determining the Read Range

The Read Range is the distance from the face of the scanner over which a bar code symbol can be read reliably. Read Range varies with:

- the bar code symbol's Narrow Element width
- bar code symbol quality, including print contrast

In picket fence applications the scanner and symbol are usually set as far apart as possible within the Read Range, to give the greatest number of scans per symbol.

Table 3.A
Read Ranges

Scanner	(Apparent) Narrow Element Width		Nearest and Farthest Distances from Scanner (Read Range)	
	mils	millimeters	inches	centimeters
2755-L6SB and 2755-L6RB	7.5	.19	2.5 - 6	6.4 - 15.2
	10	.25	2.0 - 7	5.1 - 17.8
	20	.51	2.0 - 9	5.1 -22.9
	30	.76	3.0 -10	7.6 - 25.4
	40	1.0	4.0 -10	10.2 - 25.4
	50	1.3	5.0 -10	12.7 - 25.4
2755-L6SA and 2755-L6RA	5.0	.13	2.0 - 3	5.1 - 7.6
	7.5	.19	1.0 - 4.5	2.5 -11.4

Useable Scan Width

The *useable scan width* is the distance across the scan beam in which a given symbol can be read reliably. A larger scan width will give:

- more time in which a moving symbol can be read by the scanner, and/or
- more scans that can be made per symbol

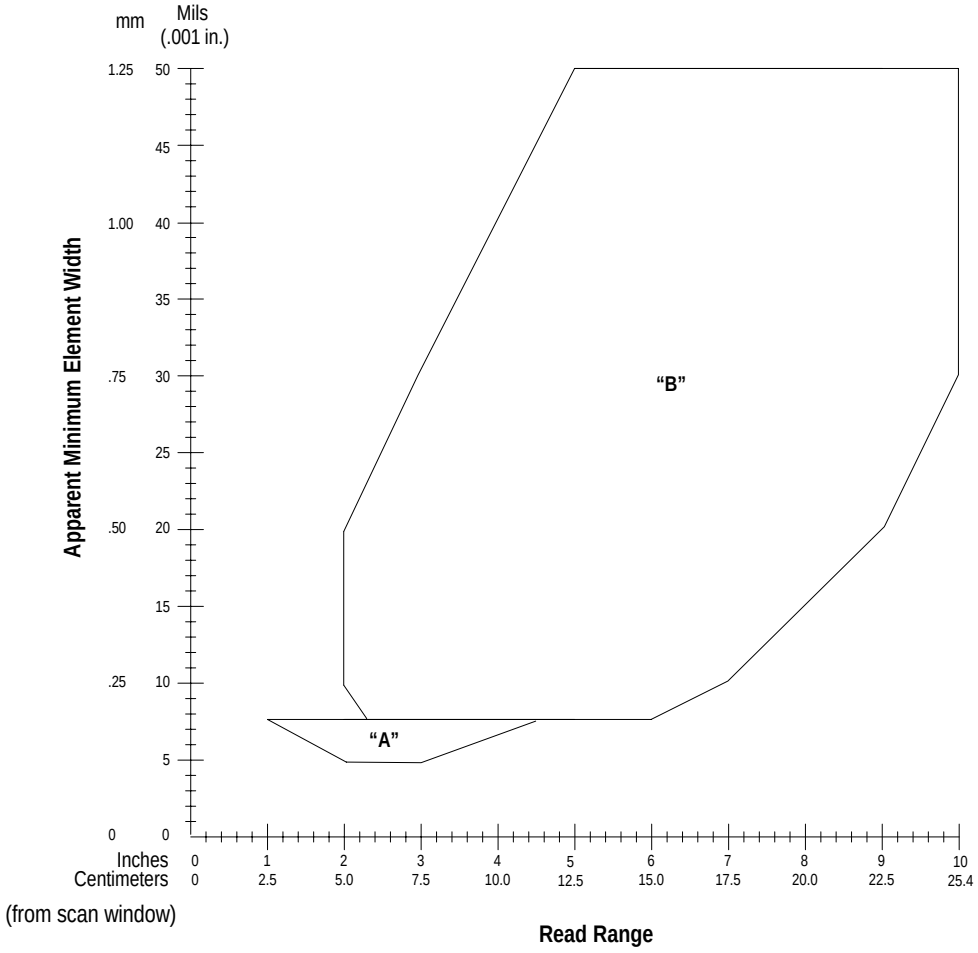
Table 3.B
Useable Scan Width

Distance from the Scanner		Useable Scan Width	
inches	centimeters	inches	centimeters
1	2.5	1.5	3.8
2	5.1	2.5	6.4
3	7.6	3.5	8.9
4	10.2	4.5	11.4
5	12.7	5.5	14.0
6	15.2	6.5	16.5
7	17.8	7.5	19.0
8	20.3	8.5	21.6
9	22.9	9.5	24.1
10	25.4	10.5	26.7

Table 3.A and Table 3.B show the relationship among the symbol density (width of the narrowest bar or space), the Read Range, and the usable scan width. The performance may vary slightly for raster units.

Figure 3.6 gives the same information as Table 3.A in graphic form.

Figure 3.6
Read Range vs. Narrow Element Width



Read rates will vary due to differences in symbol quality and positioning. For optimum performance with your application:

1. Configure the decoder for Decode Mode = Continuous. See the Enhanced Decoder user's manual (Publication No. 2755-833). The section in Chapter 14 titled Display Status and Counters has a discussion of the "decoder performance indicator" (decoder performance = read rate).
2. Map out a symbol placement area by manually moving your symbol in and out, back and forth, while observing decoder performance on the screen.

Raster Height

A raster scanner is used when the bar code symbol is of poor quality:

- symbols printed on a dot matrix printer
- bars and spaces not uniform
- bars have voids or spaces have spots

The raster scanner puts lines through ten locations in the symbol, which increases the probability of finding a location that can be reliably decoded.

The Raster Height is the distance between the raster scan lines farthest apart at a given distance from the scanner.

Distance from the Scanner		Raster Height	
inches	**centimeters**	**inches**	**millimeters**
1	2.5	.06	.15
2	5.1	.09	.24
3	7.6	.13	.33
4	10.2	.16	.42
5	12.7	.20	.50
6	15.2	.24	.59
7	17.8	.27	.68
8	20.3	.30	.77
9	22.9	.34	.86
10	25.4	.37	.95

Calculating the Number of Scans Per Symbol

For good quality bar code symbol and a correctly aimed bar code scanner, at least 5 scans must pass through an entire symbol to assure that the symbol is decoded. With fewer scans there will be more “No Read” counts, even when the symbol is good. If the symbol is of poor quality, more scans per symbol may be required.

Ladder orientation gives a different number of scans than picket fence orientation, depending on symbol height, symbol width, and scan width.

Picket Fence Applications

To calculate **minimum** scans per symbol, use this formula:

$$S = \frac{R\,(W-L)}{C}$$

S = Scans per label **(must be at least 5)**
R = Scan Rate
W = Scan Width at the minimum read distance
L = Symbol Length (including quiet zones)
C = Conveyor Speed

Scan Width, Symbol Length, and Conveyor Speed 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 the section at the end of this chapter, “Compensating for Pitched Symbols”.)

Example:

A 40 mil symbol 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 to the symbols as possible.

The scan width must be large enough to cover the entire symbol, including the two quiet zones. At 6 inches, the 2655-L6SB scanner has a Scan Width (from Table 3.B) of 6.5 inches.

The following calculation converts Conveyor Speed to inches per second:

$$\frac{25}{\cancel{125\ \text{feet}}\ /\ \text{minute}} \times \frac{\cancel{12\ \text{inches}}\ /\ \text{foot}}{} \times \frac{\cancel{1\ \text{minute}}\ /\ \cancel{60}\ \text{seconds}\ /\ 5}{} = \frac{25\ \text{inches}}{\text{second}}$$

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

R = 330 scans/second
W = 6.5 inches
L = 4.75 inches
C = 25 inches/second

$$\frac{\dfrac{13.2}{\cancel{330\ \text{scans}}\ /\ \text{second}} \times \dfrac{1.75}{(6.50-4.75)\ \cancel{\text{inches}}}}{\dfrac{25\ \text{inches}}{\text{second}}} = 23\ \text{scans}$$

Since S (scans per symbol) is greater than 5 and the application uses good quality symbols, the 2755-L6SB scanner is appropriate for this application.

Step Ladder Applications

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

$$S = \frac{R \times H}{C}$$

S = Scans per Symbol **(must be at least 5)**
R = Scan Rate
H = Symbol Height (length of bars of the symbol)
C = 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 the section at the end of this chapter, Compensating for Pitched Symbols.)

Example:

A 40 mil bar code symbol 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 symbols.

Since the Scan Rate is measured using seconds, and the symbol height uses inches, convert Conveyor Speed to similar units (see the previous example).

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

R = 330 scans/second
H = 1 inch
C = 25 inches/second

$$\frac{\frac{330 \text{ scans}}{\text{second}} \times 1 \text{ inch}}{\frac{25 \text{ inches}}{\text{second}}} = 13.2 \text{ scans}$$

Since S (scans per symbol) is greater than 5 and the application uses good quality symbols, the 2755-L6SB scanner is appropriate for this step ladder application.

Compensating for Pitched Symbols

When a symbol is pitched, the bars appear to the scanner to be narrower and closer together than if it faced the scanner squarely. For pitched symbols, you must allow for the following:

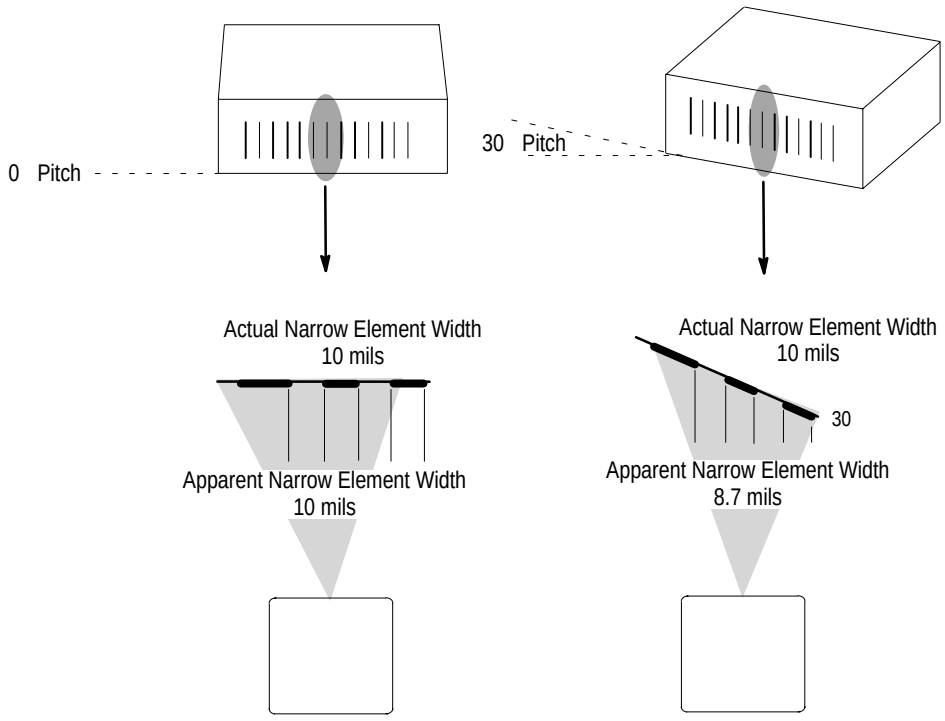
- The *apparent Narrow Element width*, rather than the *actual Narrow Element width*, must be used in determining the Read Range.
- The nearest and farthest symbol elements must be within the scanner's Read Range.

Calculating Apparent Narrow Element Width

Determine the symbol's *apparent Narrow Element width* before using the Read Ranges in Table 3.A or Figure 3.6.

The exaggerated view of Figure 3.7 demonstrates the *apparent Narrow Element width* concept. With a zero degree pitch angle, the scanner views the actual Narrow Element width. When the symbol is pitched, the Narrow Element appears smaller.

Figure 3.7
Actual vs Apparent Narrow Element Width



The *apparent* Narrow Element width is approximately the Cosine of the pitch angle, multiplied by the *actual* Narrow Element width. From Table 3.C, cos (30) is 0.866.

Example:

A 10 mil (0.25 mm) symbol including Quiet Zones is 3 inches (7.6 cm) long. It is pitched at 30 . What difference does this make in placing the scanner and in reading the symbol?

Two factors reduce the Read Range of the scanner with respect to a pitched symbol:

1. the apparent Narrow Element width is first used with Table 3.A or Figure 3.6 to give the useable Read Range
2. the far end of the symbol (the end of the quiet zone) must be within the Read Range as calculated in step 1, but the near end (the other quiet zone) determines the *effective* distance from the scanner.

Step 1. With 0 pitch the symbol can be scanned at any distance between 2" and 7" (5.1-17.8 cm) from the face of the scanner. With 30 pitch, the apparent Narrow Element width is calculated using this formula:

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

Table 3.C gives cos (30) = 0.866
10 mils x 0.866 = 8.7 mils

Using Figure 3.6, for a Narrow Element width of:

- 10 mils, the Read Range is from 2.0" to 7.0" (5.1 to 17.8 cm)
- 8.7 mils, the Read Range is from about 2.2" to 6.5" (5.6 to 16.5 cm)

Figure 3.8
A Portion of Figure 3.6

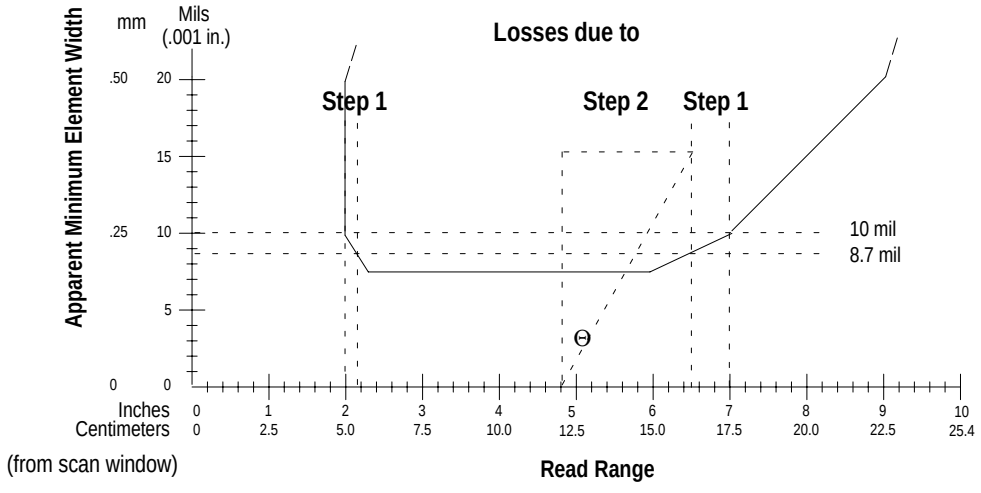


Table 3.C
Cosines and Tangents for Various Pitch Angles

Use for Apparent Narrow Element		Use for Lost Read Distance	
Pitch Angle = Θ	Cosine (Θ)	Pitch Angle = Θ	Tangent (Θ)
0	1.0	0	0
5	.996	5	.087
10	.985	10	.176
15	.966	15	.268
20	.940	20	.364
25	.906	25	.466
30	.866	30	.577
35	.819	35	.700
40	.766	40	.839
45	.707	45	1.
50	.643	50	1.192

Step 2. The Read Range is further shortened by the *lost* Read Range: (the distance of the far end of the symbol from the scanner) less (the distance of the near end).

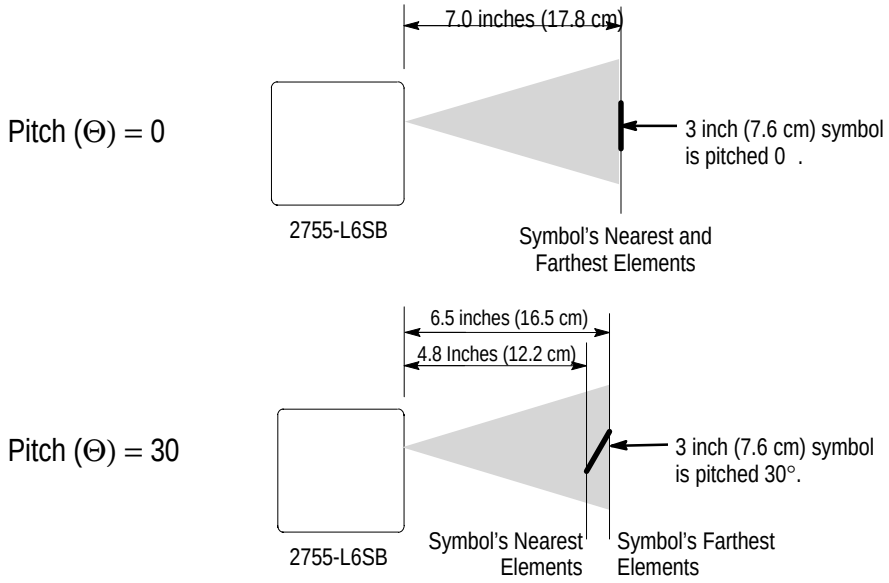
- the far end must be within the scanner's Read Range for the apparent Narrow Element width
- the near end determines the useable scan width. See Table 3.B for scan widths at different distances from the scanner.

The loss of Read Range is calculated using this formula:

Lost Read Range =
Bar Code Symbol Length x Tan (Pitch Angle)

Table 3.C gives tan (30) = 0.577
3" x 0.577 = 1.7"

Figure 3.9
Read Range and Symbol Resolution at 0 and 30 Pitch



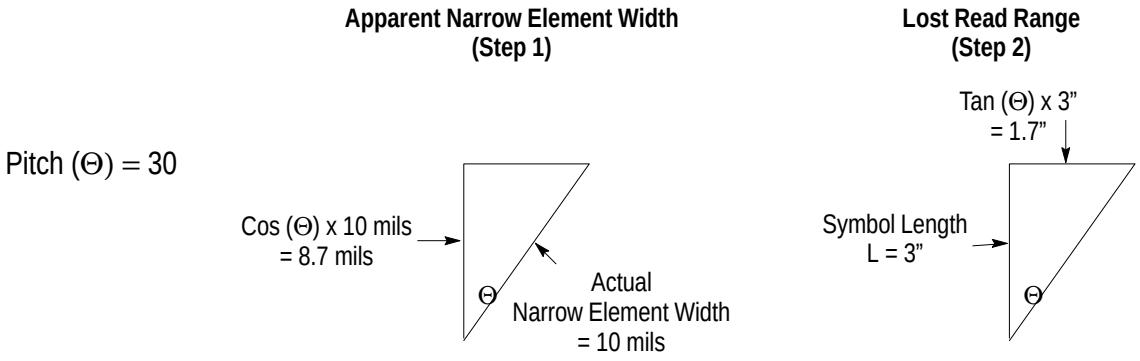
Step 1 + Step 2. With both of these aspects working together, the Read Range is shorter with a pitched symbol than with one that is not pitched. This results in:

a smaller *depth of field*, the region within which the symbol must be located if it is to be read.

a smaller *scan width*, which is required in the formula for calculating the number of scans in picket fence orientation.

In Figure 3.9, if the farther end of the symbol extends past 6.5” (16.5 cm), the scanner will not be able to read part of the symbol, causing a No-Read. In such a case, move the scanner closer to the conveyor. Conversely, if the nearer end extends past 2.2” (5.6 cm), a No-Read will result; move the scanner farther from the conveyor.

Figure 3.10
Calculating the Effects of Pitch



	Read Range with 0 pitch		**Read Range with 30 pitch**
		Read Range allowing for Narrow Element width	2.2” to 6.5” (5.6 to 16.5 cm)
		Loss due to distance between near & far ends of the symbol	1.7” (4.4 cm)
Read Range	2.0” to 7.0” (5.1 to 17.8 cm)	Useable Read Range	2.2” to 4.8” (5.6 to 12.2 cm)
Depth of field	5.0” (12.7 cm)	Depth of field	2.6” (6.6 cm)
Scan Width	2.5” to 7.5” (6.4 to 19.0 cm)	Scan Width	2.8” to 5.2” (7.1 to 13.2 cm)

In picket fence orientation, the scanner and symbol are set as far apart as possible within the Read Range, to give the greatest number of scans per symbol. However with pitched symbols, the range is so narrow that the symbol is often placed in the center of the depth of field, where it is less apt to exceed the Read Range limits in either direction.

Chapter 4

Installing the AtomScan Scanner

Chapter Objectives

This chapter provides the information needed to mount, wire, and correctly aim the scanner. The following subjects are covered:

- Environmental Issues
- Aiming the scanner
- Mounting Options
- Package Sensor Orientation
- Connecting the Scanner and Package Sensor

Environmental Considerations

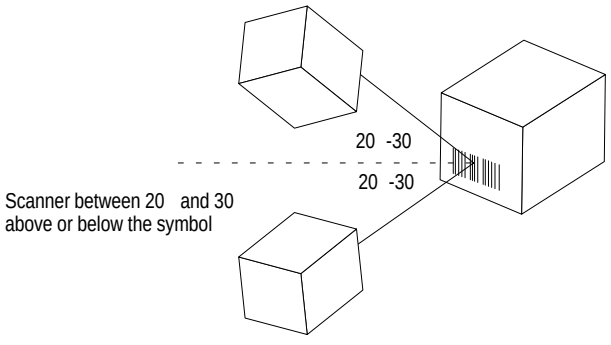
The AtomScan scanner is totally enclosed. It can tolerate light dust. However it is not designed for use in harsh environments such as wash-down. If your environment is harsh, consider using the NEMA Type 4 enclosed 2755-LD4x4 or 2755-LD8x4, where x is the focus code, A, B, C, or D.

Aiming the Scanner

Chapter 3 presented information necessary to select the correct scanner for your application. The most important factors to consider in mounting the scanner are:

- make sure the bar code symbol passes within the scanner's reading range
- make sure the scan line will pass through all the symbol's bars and the quiet zones
- mount the scanner so the scanning plane is 20°-30° off the perpendicular

Figure 4.1
Correct Setup of Scanner



CAUTION:
Do not stare into laser beam, to avoid damage to your eyes.

Mounting Operations

The scanner can be mounted either from the bottom, or from the top with the optional mounting plate. The only tool you need for installation is a screwdriver.

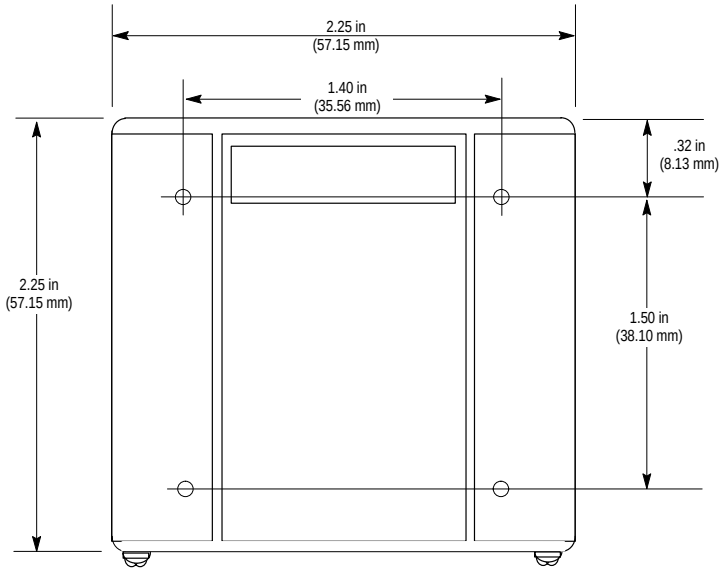
> **Note:** The scanner must be located in a dry place, away from sunlight or bright light from any source.

The decoder is mounted separately from the scanner. So is the package sensor, if used.

The thickness of the mounting surface determines the length of the four #6-32 screws required. Select a screw length no greater than the thickness of the mounting surface plus the thickness of the washers plus .175 inches (4.4mm).

ATTENTION: Screws projecting more than .175 inches (4.4 mm) into the scanner may damage the scanner.

Figure 4.2
Mounting Dimensions (Nominal)



Mounting holes are threaded for four #6-32 screws.

- **If you do not use the mounting plate**, use the measurements given in Figure 4.2 to locate centers of mounting holes. Drill four 5/32 inch (4 mm) holes.

  Note: If you use the mounting plate, refer to Figure 4.3. Mount the scanner directly to the four inner holes on the plate, and use the four perimeter holes for mounting the plate to its work location..

Using the Mounting Plate

The Mounting Plate (Catalog No. 2755-NM7) allows mounting on any flat surface.

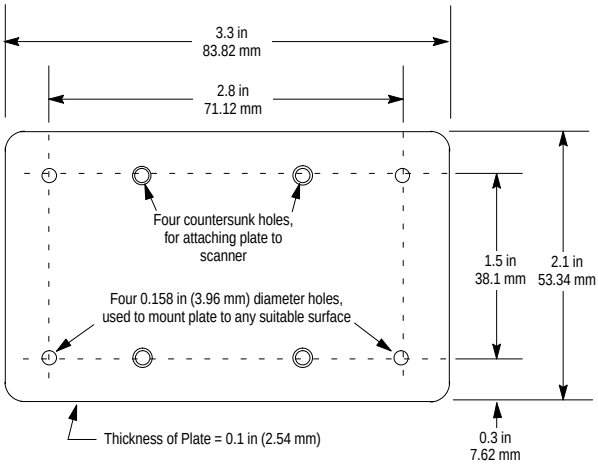
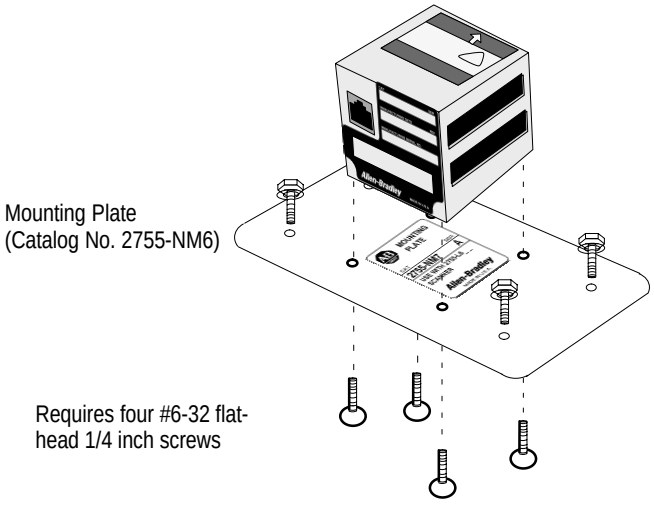


Figure 4.3
Installing With the Mounting Plate



Note: The scanner has four threaded holes for mounting screws.

Connecting Equipment

The scanner is connected to the Enhanced Decoder through the Adapter Module. The scanner cable is plugged into the Adapter Module, and then into the scanner. Cables are available in 10-foot and 15-foot lengths, so mount the decoder within that distance. Use the steps below as a guideline when connecting equipment.

1. Make sure that power to the decoder is **TURNED OFF.**

ATTENTION: Do ***NOT*** connect or disconnect scanner when the decoder has power on.

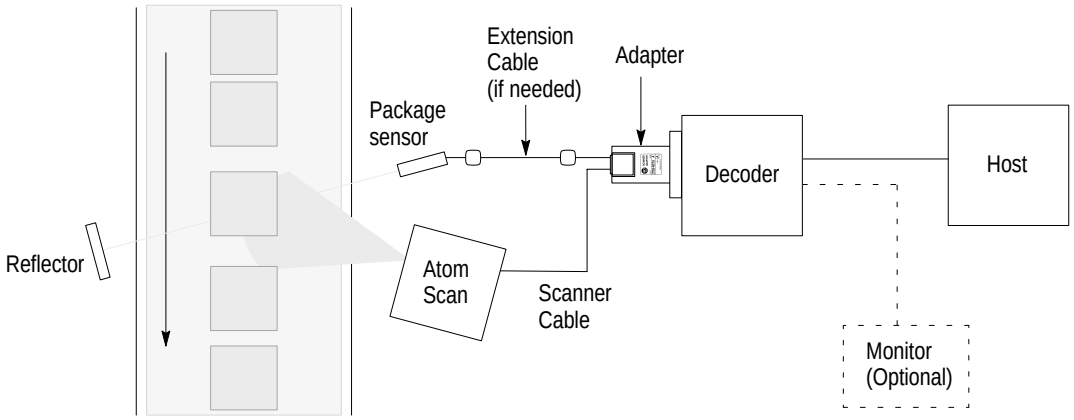
---

2. Connect the scanner to the Adapter Module (Catalog No. 2755-NC18) using the RJ-45 connector of the 10-foot or 15-foot cable.
3. If a package sensor is used, connect it to the Micro-Change connector of the Adapter Module.
4. Set up the decoder.

- Connect the DB15 connector of the Adapter Module to the Scanner 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.

Figure 4.4
A Possible Setup for a Scanning System



Package Sensor Orientation

A package sensor may be used to trigger the scanner and decoder. It must be placed so that it is tripped for the entire time that the bar code symbol is in the scan line. The sensor may remain tripped even after the symbol has moved on, but it must go OFF and then back ON to trigger the next package.

Use the following guidelines when installing the package sensor.

- Mount the package sensor and its reflector so that the scan line does not strike either of them.
- Install the reflector within the operating range of the package sensor.
- The package sensor's beam should be broken before the label is in position.
- The package sensor should remain active while the entire symbol is within the scan line.
- Make sure there is no chance that the scan from the scanner will strike the reflector. The resulting glare will blind the scanner temporarily.

Connecting the Package Sensor

Chapter 2 gives the information needed to select a retro-reflective photo switch, and also lists the extension cable options.

The Adapter Module has a yellow stub cable with a Micro-Change connector. The extension cable is connected to the Adapter Module's connector, and then to the connector on the sensor.

In case the sensor does not have a connector, the pinout is given in Table 4.A. The package sensor 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 sensor Port

Package Detect Port	Pin #	Pin Function	Wire Color
Face View Female 	1	+12V DC	Brown
	2 ①	Package sensor 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 laser is not ON, it could be because

- the decoder has not been triggered, or
- the symbol has already been decoded

The package sensor must go OFF then ON to trigger the decoder before a new symbol can be decoded. Refer to the Enhanced Decoder user manual (Publication No. 2755-833) for further details.

Chapter 5

Operating the Scanner

Chapter Objectives

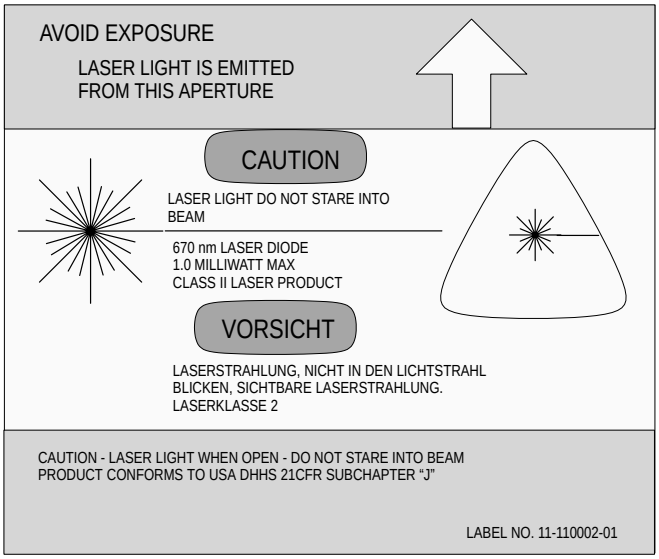
This chapter provides information on how to set up and operate the AtomScan bar code scanner. This includes:

- Laser Safety
- Laser-On Indicator
- Turning the Laser Light OFF and ON
- Verifying Operation

Laser Safety

All products that emit laser light have a safety label attached, as required by Federal law. It is meant to provide basic information about the potential hazards of laser light.

Here is a reproduction of the AtomScan scanner safety label:

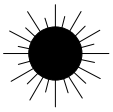


Momentary exposure to Class II laser light is not known to be harmful. However:

ATTENTION: Avoid direct eye contact with the laser beam when the mirror is not spinning
Avoid prolonged eye contact with the laser beam when the mirror is spinning.

ATTENTION: Never point the beam at other people, or in a direction where people may be passing.

ATTENTION: If during operation an intense dot of light is generated instead of a thin line of light, immediately remove power from decoder and replace the scanner.



CAUTION:
Do not stare into laser beam to avoid damage to your eyes.

ATTENTION: The scanner contains no user-serviceable parts. Laser safety regulations require that only people with the proper training can open the housing.

Laser On Indicator

Laser light is difficult to see. The front window of the scanner contains a Red LED to warn the operator when the laser is ON.

Turning the Laser Beam ON and OFF

The 2755-DS1A and -DD1A Enhanced Decoders have controls that allow the laser to be:

- ON continuously
- triggered ON by the package sensor

  Note: In this mode, assume that the beam from the package sensor to its reflector could be interrupted at any time, which will turn the scanner ON until the symbol is decoded.

- always OFF: used during maintenance so it cannot turn ON accidentally and damage someone's eyes.

  Note: If the scanner is OFF, do not assume that it is in this mode. Verify the decoder control setting each time you set up or adjust the scanner.

This control is accessed through a standard computer terminal or personal computer with a terminal emulator. See the Enhanced Decoder Manual (Publication No. 27550-833) for more information.

Verifying Operation

1. Place the bar code symbol where it can be read.
2. Assure that the scan line crosses all the bars and both quiet zones. Set up the Enhanced Decoder to read the symbology of your bar code label.
3. Set it for “Continuous Trigger”, and monitor the “Decoder Performance”.
4. If the decoder is properly set for the symbology, and if the scanner is aimed according to the instructions in this manual, the Decoder Performance should be at or near 100%. If it is not, try to orient the scanner to obtain a Decoder Performance greater than 80%.
5. Once the scanner is properly aimed and decoding has been verified, set the decoder for “Triggered” operation, and run your system.

Operational Tips

SUGGESTIONS:

- Test scanner readability with a label that is known to be good, and log the results.
- Check label speed, length and height to ensure the minimum number of scans per label required by your application.
- Avoid excessive tilt, pitch and skew of the label as much as possible.
- Clean the laser window regularly (see Chapter 6).

WARNINGS:

- Recheck that decoder power is OFF before connecting or disconnecting any of the interface cables:
  Scanner to Adapter
  Adapter to Decoder
  Adapter to Package Sensor
  Decoder to host
- Make sure the scanner(s), decoder(s) and host system are all connected to the same ground potential.
- Do not aim the scanner into sunlight, reflectors, or other sources of light.
- Do not obstruct the laser windows with mounting hardware or anything else.
- Make sure the temperature remains within the limits specified in Appendix A.

Chapter 6

Maintenance and Troubleshooting

Chapter Objectives

This chapter provides information necessary to maintain your scanner. These topics are covered:

- Cleaning the windows
- If the Scanner does not scan
- If the Decoder does not decode

Cleaning the Scan Windows

For optimum performance the scan and return signal windows should be clean. When they are clean, you will barely see the reflection of the laser beam on the window.

To clean the scan 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 laser light is not harmful, precautions should be taken to avoid looking into the beam.

2. Verify that the POWER indicator on the decoder is OFF.
3. Dust off the scan window and adjacent areas with optics rated air.
4. Clean the window using 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.

ATTENTION: 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.

5. Turn the decoder ON.
6. Verify operation.

Troubleshooting

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

If the scanner does not scan, go down this list in order:

1. Verify that power is applied to the decoder.
2. Verify the connections to the scanner.

   Note: Do not unplug the scanner cable until you have checked that power to the decoder is cut off.
3. Set the decoder for the laser light to be “Always ON”.
4. If the laser light turns ON, then reset the decoder to cause the laser light to be “Triggered.”
5. Then verify proper operation of the Package Sensor by blocking and un–blocking the beam to the reflector.
6. If nothing else in the system is wrong, replace the Scanner.

ATTENTION: The AtomScan scanner does not require **ANY** user maintenance. **Do not open the enclosure!**
If you remove or attempt to remove the screws, you will void the warranty.

If Decoder does not Decode, go down this list in order:

1. Verify that the scanner is scanning.
2. Verify that the decoder is set up for the correct symbology.
3. Verify operation according to the instructions in Chapter 5.
4. Consult the decoder manual for further troubleshooting information.

Appendix A

Specifications

Laser Specifications		
	Wavelength	670 nm nominal
	Safety Class	CDRH Class II
	Operating Life	50,000 hrs. @ 25 C
Scanning Parameters		
	Scan Type	Rotating 10-sided mirror
	Scan Rate	330 scans per second
	Scan Angle	60
	Pitch	±50 maximum
	Skew	±40 maximum
Optical		
	Operating Range	1 to 10 inches from the front window (See Table 3.A)
	Scan line Width	8.5 inches at an 8-inch distance (21.5 cm at a 20 cm distance)
	Label Contrast	25% minimum absorption dark/light differential at 670 nm
	Raster Image	10 raster scan lines over a 2-degree arc, or 0.24 inch raster height at 6 inch distance (6 mm raster height at 15 cm distance)
Environment		
	Operating Temperature	32 to 104 F (0 to 40 C)
	Storage Temperature	-58 to 167 F (-50 to 75 C)
	Relative Humidity	Up to 95%, non-condensing
Mechanical		
	Dimensions: (inches)	2.25 (L) x 2.25 (W) x 2.25 (H)
	Dimensions: (centimeters)	5.7 (L) x 5.7 (W) x 5.7 (H)
	Weight	8 oz. (227 g)
	Color	Black
Cable		
	Maximum Length	15-feet (4.5 m)
	Interface Connector	RJ-45 8-pin modular socket
Ambient Light Immunity		
	Indoor	450 foot candles (4500 lux): fluorescent, incandescent, mercury vapor
	Soft outdoor	2000 foot candles (20,000 lux)

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World Headquarters, Allen-Bradley, 1201 South Second Street, Milwaukee, WI 53204 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444

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