ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

User's Manual

Bulletin 2755 Enhanced Medium-Speed Scan Head

(Catalog No. 2755-L4FAA, -L4FBA, -L4FCA, -L4FDA,
2755-L4RAA, -L4RBA, -L4RCA, -L4RDA,
2755-L5RAA, -L5RBA, -L5RCA, -L5RDA)

40062-133-01(A)

Publication 2755-829 – October, 1989

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. "Application Considerations for 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 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, 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.

$25.00

Table of Contents

Chapter 1 Using This Manual

Chapter Objectives

Read this chapter to familiarize yourself with the rest of the manual. You will learn about:

- Contents of the manual.
- Intended audience.
- Warnings and cautions.

Overview of This Manual

This manual is for Catalog No. 2755-L4FAA, -L4FBA, -L4FCA, -L4FDA, -L4RAA, -L4RBA, -L4RCA, -L4RDA, -L5RAA, -L5RBA, -L5RCA, and -L5RDA Enhanced Medium-Speed Scan Heads.

Chapter	Title	Purpose
1	Using This Manual	Provides an overview of the manual.
2	Description	Features and capabilities are described.
3	How the System Operates	Bar code operation is explained.
4	Installing the Scan Head	Rules and recommendations are detailed.
5	Maintenance and Troubleshooting	Troubleshooting guidelines are provided.
6	Specifications	Electrical, mechanical, environmental and operational information is listed.
–	Glossary	
–	Index	

Intended Audience

No special knowledge is needed to read this manual and follow its directions. If the system will be used to communicate with a higher level controller, we assume you are familiar with communication terminology.

Warnings and Cautions

Both warnings and cautions are found in this manual and on the equipment. The following symbols are used:

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

WARNING: A warning symbol means people might be injured if the procedures are not followed.

CAUTION: A caution symbol is used when machinery could be damaged if the procedures are not followed.

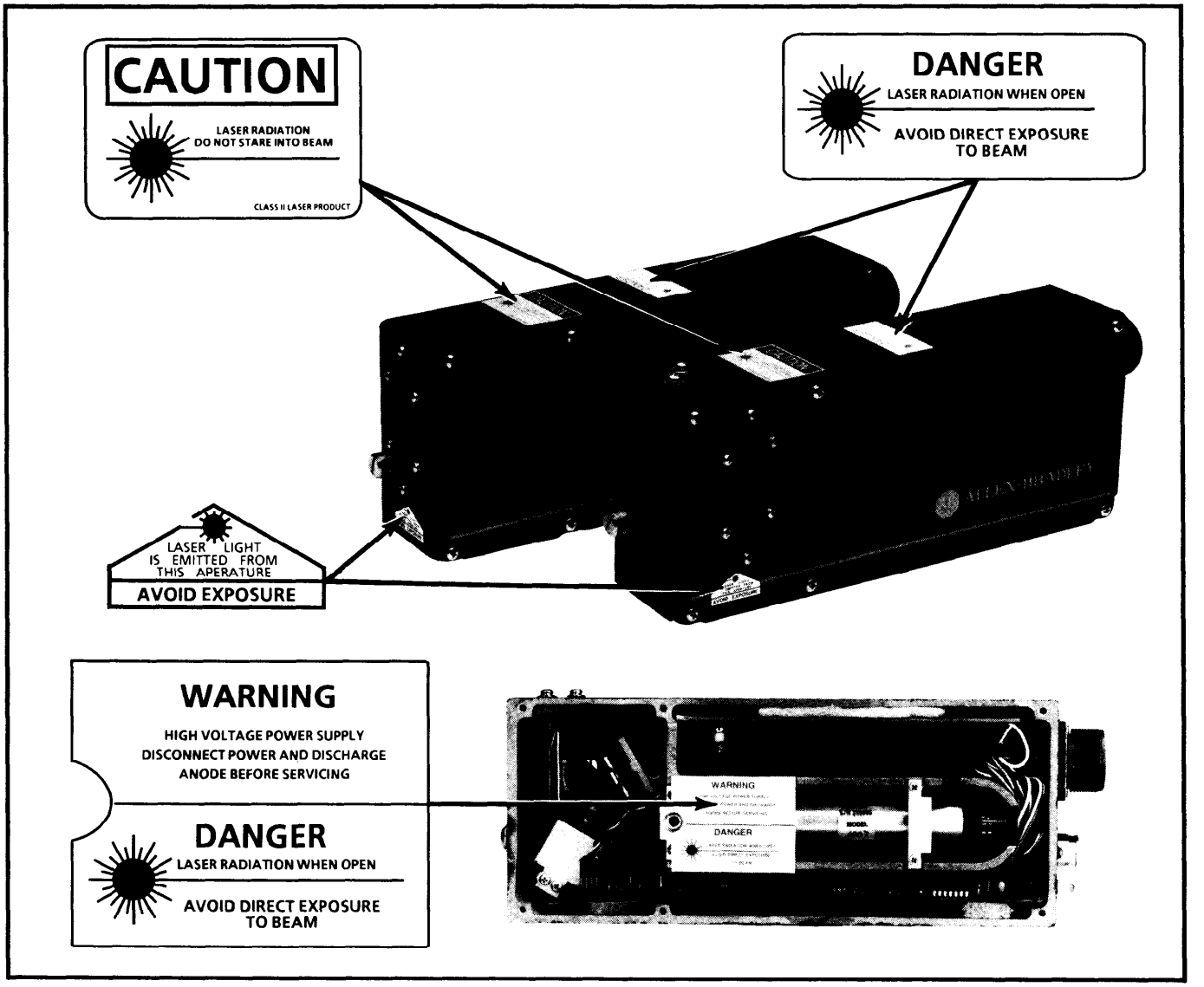
Danger and Caution Labels

The scan head is labeled in accordance with federal regulations. If any label is removed, lost, or becomes illegible, order a replacement from your Allen-Bradley representative. Figure 1.1 shows location of the labels on the scan head.

WARNING: No user maintenance of the scan head is required. **Do not open the enclosure!**

WARNING: Improperly controlling, adjusting, or operating the scan head can result in hazardous radiation exposure.

Figure 1.1
Location of Warning and Caution Labels on the Scan Head



89-285-3

Chapter 2 Description

Chapter Objectives

The capabilities of the scan head are described when connected to a Catalog No. 2755-DM1 or DM6 Decoder.

Overview

The Enhanced Medium-Speed Scan Head is a moving beam, bar code scan head capable of scanning symbols up to 50 inches away, when connected to a Catalog No. 2755-DM1 or -DM6 Decoder. Scanning is bi-directional at approximately 200 scans per second. Scan heads are available in 3 different configurations:

- Front scanning (Catalog No. 2755-L4F*x*A*)
- Side scanning (Catalog No. 2755-L4R*x*A*)
- Raster scanning (Catalog No. 2755-L5R*x*A*)

* The *x* stands for one of 4 different range selections, The range selections, A through D, are illustrated in Figure 2.1

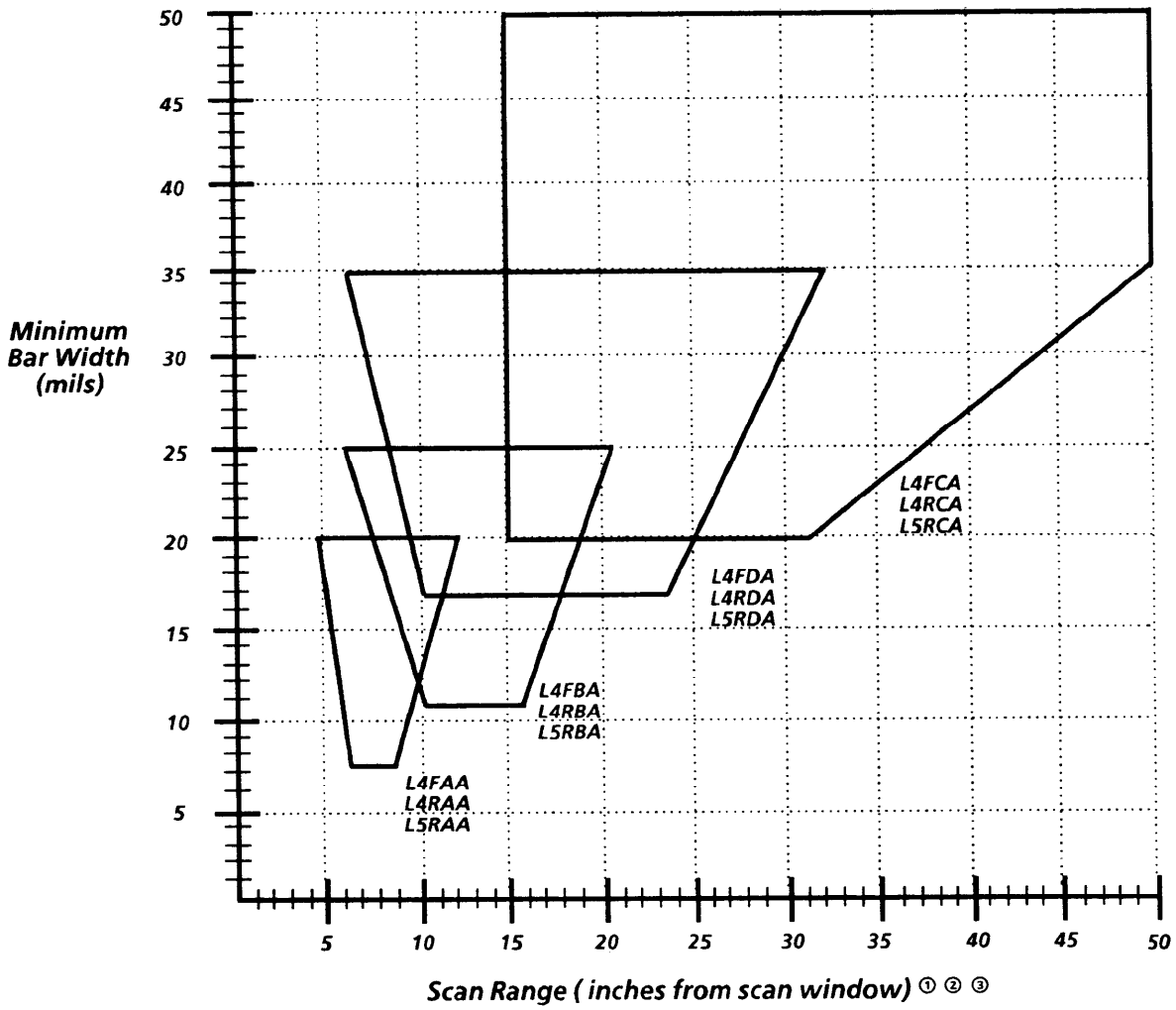
The *front scanning model* allows the beam to exit through the front of the scan head. The *side scanning model* uses an additional mirror to reflect the beam out the side of the scan head. The *raster scanning model* uses a mirror, oscillating at 20Hz, to project what appears to be a number of parallel beams. This type of scan head is useful when attempting to scan poor quality or misaligned labels. Chapter 3 explains how to correctly position labels and illustrates a raster pattern (figure 3.6) created by a raster scan head.

Figure 2.1 illustrates the **average reading ranges**, relative to the symbol's minimum bar width, that you should expect when using a Catalog No. **2755-DM1 or DM6 Decoder.**

Not all symbols or applications are perfect, so, slight variations in the the reading distances will occur.

Overview
(continued)

Figure 2.1
Average Scan Range vs. Minimum Bar Width



① Distances will be reduced by 10% on all side scanning models (2755-L4R, -L5R)
② Scan Range will vary with symbol quality. This application was based on no more than 30° pitch and 20° skew.
③ For applications outside of the designated areas, and for applications using a 2755-DM1 to decode UPC or Code 128 labels, consult the factory.

Lens Combinations

Table 2.A compares the minimum bar width to the scan range of each catalog number.

Table 2.A
2755-L4 Catalog Number identification

Minimum Bar Width	Scan Range (inches)①②③④	Front Scanning	Side Scanning	Raster Scanning
7.5 mil 10 mil 20 mil	6.5 - 8.5 6 -9 5 - 12	2755-L4FAA	2755-L4RAA	2755-L5RAA
11 mil 20 mil 25 mil	10 - 16 8 - 19 6 - 21	2755-L4FBA	2755-L4RBA	2755-L5RBA
20 mil 35 mil 50 mil	15 - 32 15 - 50 15 - 50	2755-L4FCA	2755-L4RCA	2755-L5RCA
17 mil 25 mil 35 mil	10 - 24 8 - 27 6 - 33	2755-L4FDA	2755-L4RDA	2755-L5RDA

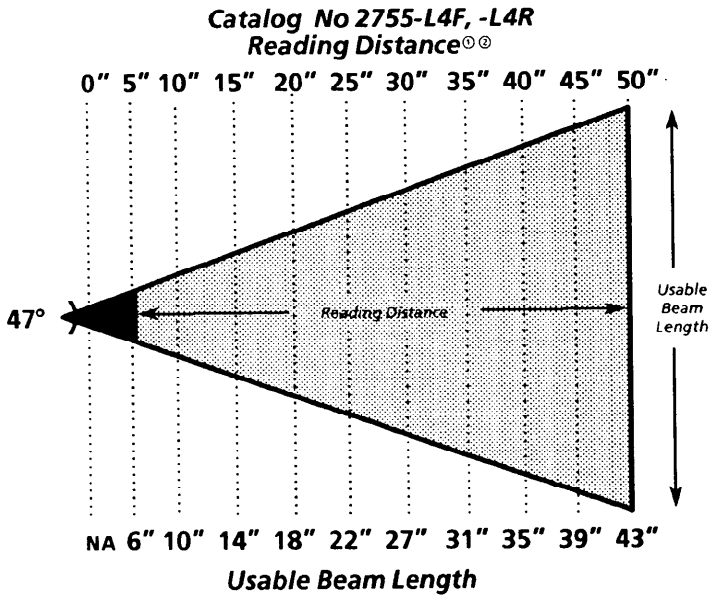
① Distances will be reduced by 10% on all side scanning models (2755-L4R, -L5R)
② Scan Range will vary with symbol quality. This application guide was based on no more than 30° pitch and 20° skew.
③ For applications outside of the designated areas, and for applications using a 2755-DM1 to decode UPC or Code 128 labels, consult the factory.
④ Symbol lengths greater than one half the usable beam width will restrict the near range.

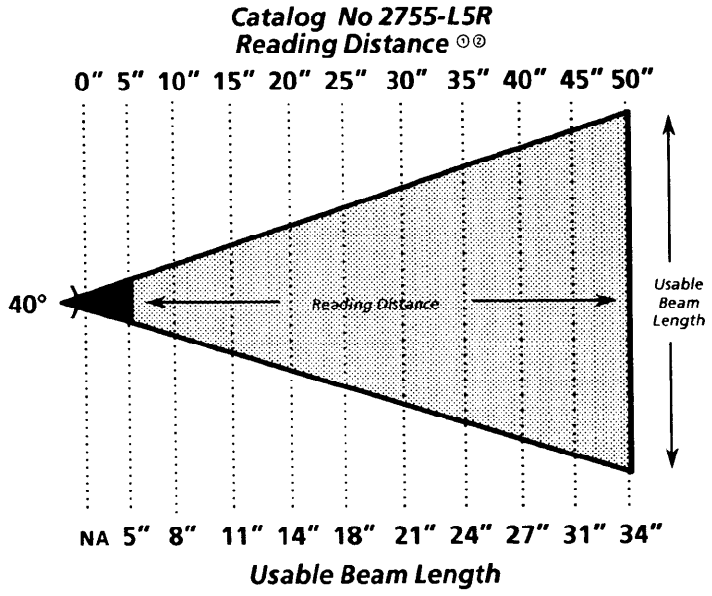
Reading Distance

Figure 2.2 shows the size and shape of the scanning window. The black area is a no read area.

The *Usable Beam Length* (bottom of chart) is compared to the the *Reading Distance* (top of chart). The Usable Beam Length is slightly less than the total beam length. The reading distance is measured from the scan window to the center of the label.

Figure 2.2
Reading Distance vs. Usable Beam Length





① Measured from the scan window to the center of bar code symbol
② Distances will be reduced by 10% on all side scanning models (2755-L4R, -L5R)

Features

Shutter control. Rotate this knob to prevent projection of the laser beam.

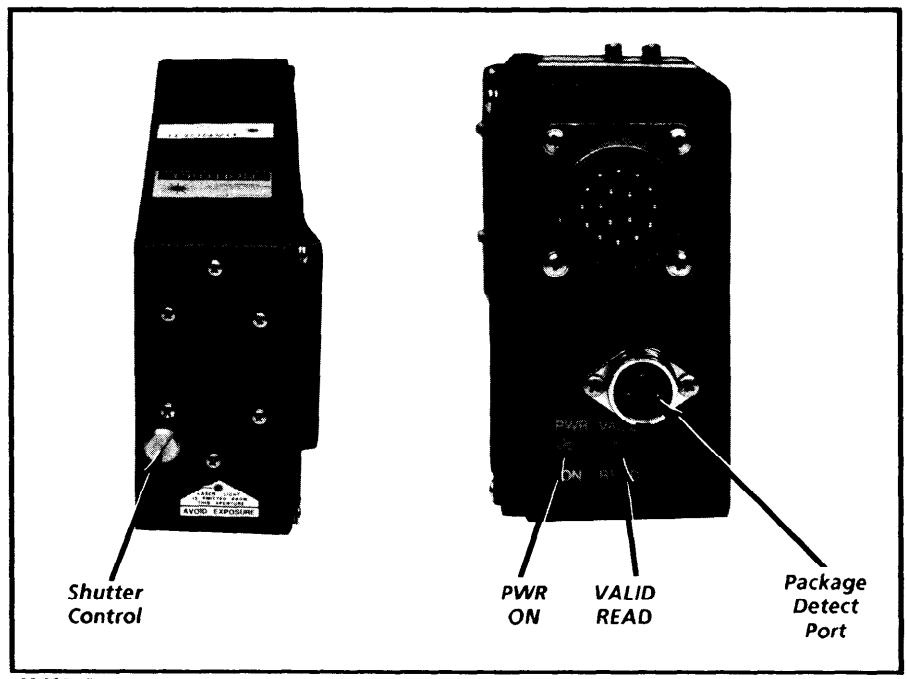
LED indicators. There are two LEDs on the back of the scan head. They are defined in Table 2.B.

Table 2.B
The LEDs on the Scanner

Label	Meaning
PWR ON	The scan head must be connected to the decoder and the decoder must be ON before this LED lights.
VALID READ	Flashes momentarily after any valid label is scanned.

Package Detect Port. Connect the optional Package Detect Assembly (Catalog No. 2755-NP1) to this port to allow the scan head to be turned on only when there is a package present.

Figure 2.3
Scan Head Features



89-285-15 89-285-16

Cabling

To provide maximum installation and application possibilities, the scan head is housed in a separate enclosure from the decoder. The small size of the scan head allows it to be installed in tight areas. Refer to table 2.C for information necessary to order a cable.

Accessories

Several accessories are available to provide installation and operational flexibility, including:

- **Package detector assembly.** This assembly consists of a photoelectric switch and a reflector. You use the switch to indicate to the Decoder when a package is present.
- **Mounting hardware.** A swivel ball mounting base and flat mounting plate are available for the scan head to provide installation flexibility.
- **Replaceable Windows.** Replaceable glass and plastic windows are available.

Table 2.C lists system accessories.

Table 2.C
Accessories Available for the Scan Head

Catalog Number	Item	Description
2755-NP1	Package Detector Assembly	An infrared photoelectric switch and reflector. For "package present" detection.
2755-NC7	Package Detector Port Connector	Use to connect user-supplied package detector to scan head
2755-NM1	Swivel Mounting Base	Universal swivel ball mount for greater installation flexibility. **Note:** Must be used with "T" Mounting Plate (Catalog No. 2755-NM2).
2755-NM2	"T" Mounting Plate	Use to mount Swivel Mounting Base (Catalog No. 2755-NM1) to scan head.
2755-NM3	Flat Mounting Plate	Attach this plate to scan head in order to use your own brackets, or to use the Swivel Mounting Base (Catalog No. 2755-NM1) when you want the swivel ball close to the base of the scan head.
2755-C1	10-ft Cable	Connects Catalog No. 2755-DM1 Decoder to scan head
2755-C2	25-ft Cable	Connects Catalog No. 2755-DM1 Decoder to scan head
2755-CK10	10-ft Cable	Connects Catalog No. 2755-DM6 Decoder to scan head
2755-CK25	25-ft Cable	Connects Catalog No. 2755-DM6 Decoder to scan head
W77119-023-01①	Replacement Window	Anti-reflective, optical glass replacement window
W77119-159-01①	Replacement Window	Hard coated, anti-reflective, plastic replacement window

① *Replacement part number*

Chapter 3 How the System Operates

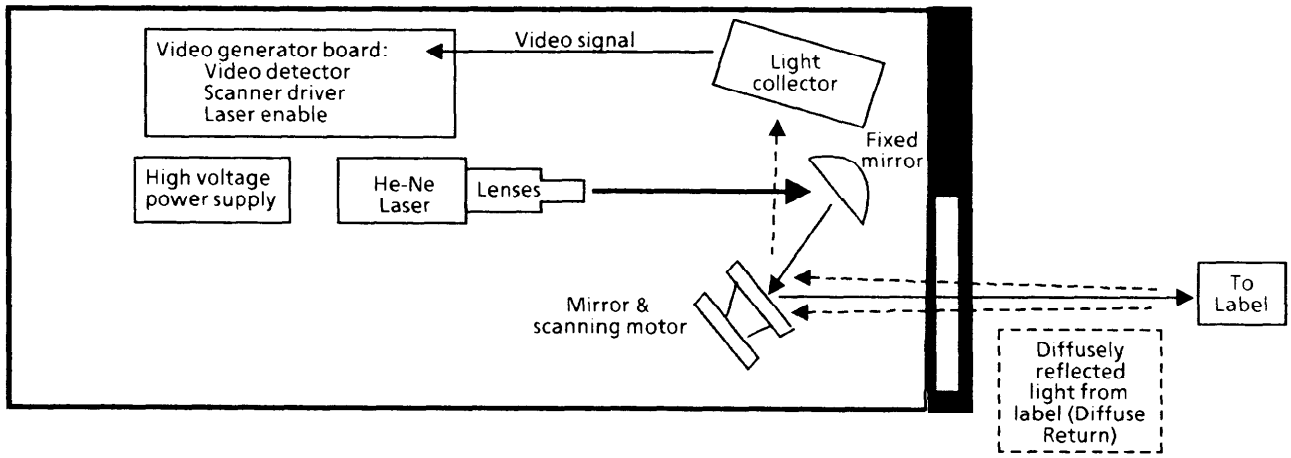
Chapter Objectives

Bar code operation is briefly described. The importance of proper symbol positioning and movement is also discussed.

How the Scan Head Operates

Inside the scan head is the laser, the lens and mirror system and the electronics. The laser generates a small, concentrated light beam that is focused and projected through a window. This light is reflected by a label and returned to the scan head for processing. The signal is then sent to the decoder for further processing. Refer to figure 3.1

Figure 3.1
How the Scan Head Operates



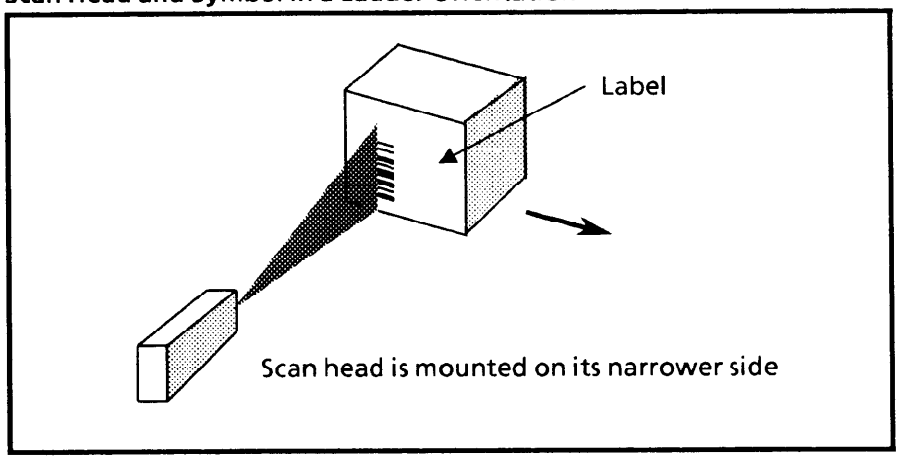
Positioning the Symbols Correctly

As the symbols move past the scan head, they must be correctly oriented. The laser's line of light must cut through all the bars and spaces in one sweep.

Positioning the Symbols Correctly (continued)

For example, if the scan head is mounted so the laser beam is in the vertical direction, then the symbol must also be mounted vertically, commonly known as the *ladder orientation*. Figure 3.2 shows a vertically oriented system.

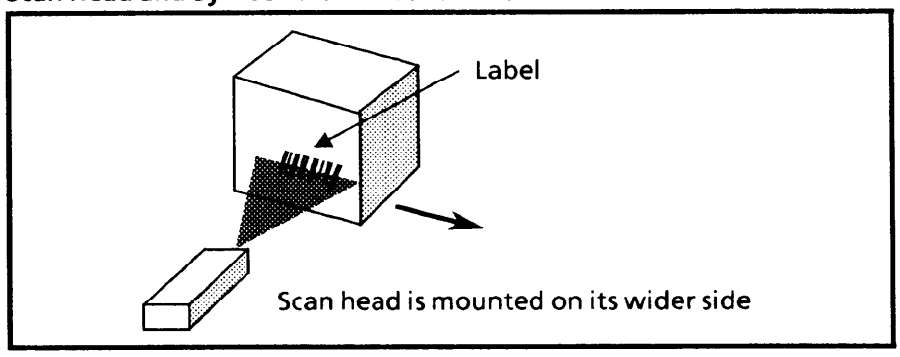
Figure 3.2
Scan Head and Symbol in a Ladder Orientation



If the scan head is mounted so the beam is in the horizontal direction, the symbol must also be in the horizontal direction. This is termed *picket fence orientation.*

Refer to figure 3.3 for an example of the scan head and symbol in a *picket fence* orientation.

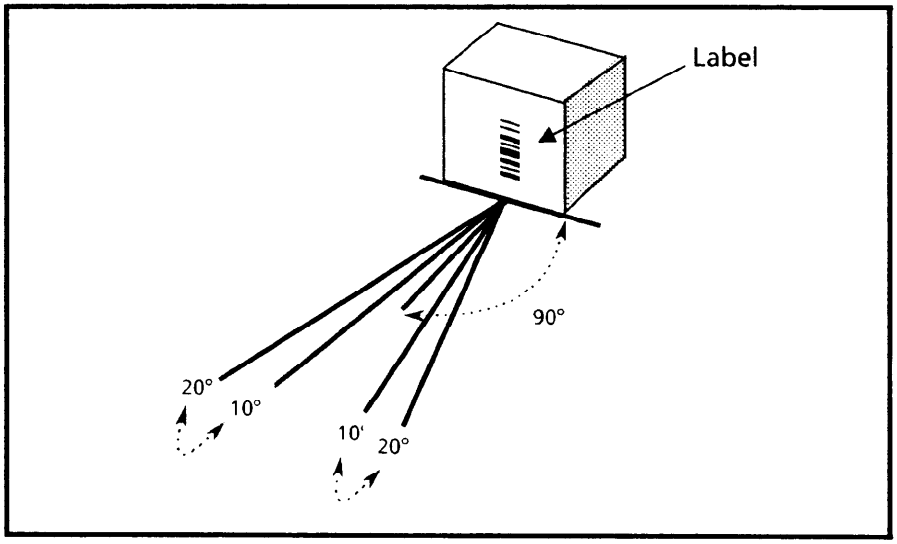
Figure 3.3
Scan Head and Symbol in a Picket Fence Orientation



Positioning the Symbols Correctly (continued)

When setting up a front or side scanning model, you should attempt to have the laser line of light perpendicular to the bars and spaces of the symbol. For optimal performance, mount the scan head at a 10° to 20° angle off normal from the label, as shown in figure 3.4.

Figure 3.4
Proper Mounting of Scan Head

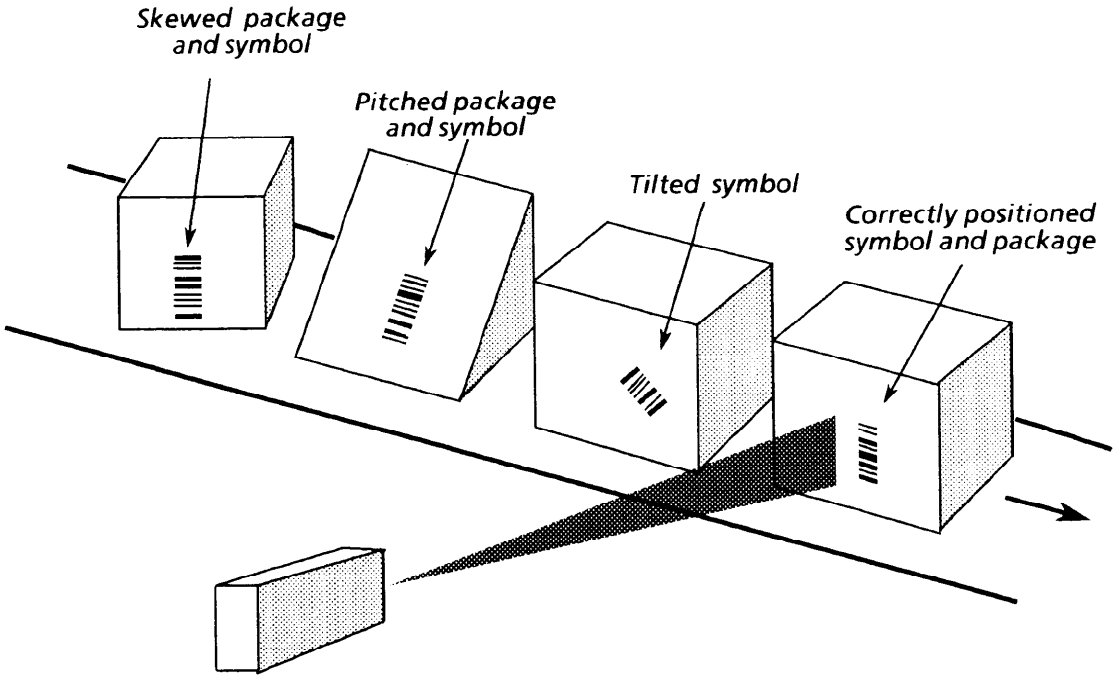


The scan head can successfully decode symbols that are up to ±50° out of alignment, provided that the projected, or apparent, bar element widths are within the minimum widths shown in table 2.A. Symbols that are pitched or tilted up to ±45°, are still readable. Skewed symbols can also be read as long as the misalignment is less than ±50°. Figure 3.5 shows a correctly placed symbol as well as misaligned symbols.

WARNING: If at any time during operation an intense dot of light is reflected onto a label instead of a line of light, rotate the shutter control knob on the scan head to close the scan window. Then turn the decoder OFF.

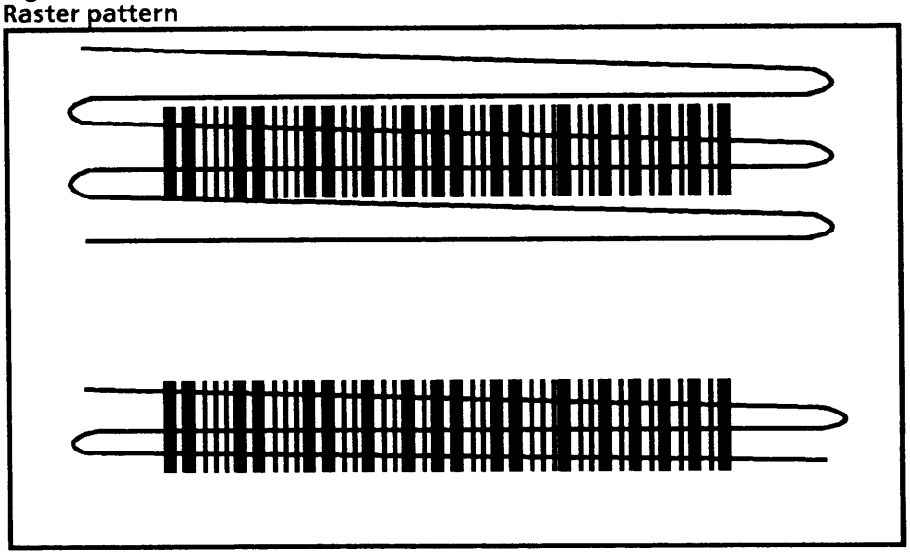
Positioning the Symbols Correctly (continued)

Figure 3.5
Examples of Correctly Positioned and Misaligned Symbols



When setting up a raster scaning model, the pattern created by the raster can overlap the entire symbol, to aid in the scanning of misaligned symbols, or be restricted to cover only a portion of the label, which is helpful when scanning symbols of poor quality. Refer to figure 3.6

Figure 3.6
Raster pattern



Chapter 4 Installing the Scan Head

Chapter Objectives

Carefully read this chapter before installing the system. We will present rules and recommendations for installing and connecting the scan head.

Warnings and Cautions

- **WARNING:** Do not make adjustments to the equipment. Only use procedures specified in this manual.
- **WARNING:** If at any time during operation an intense dot of light is generated instead of a thin line of light, immediately close the shutter control on the scan head and remove power.

CAUTION: Do not look directly into the laser beam since you could damage your eyes.

CAUTION: No user maintenance of the hardware is required. **Do not open the unit's housing!**

WARNING: Do not open the unit's housing. No user maintenance of the scan head is required.

Before You Start

The angle and distance between the scan head and the labels is an important consideration. These considerations, orientation and alignment, are described in Chapter 3.

Tools You Will Need

Normally, the only tool you will need for installation is an adjustable, open-ended wrench. If the optional Swivel Mounting Base and Plate are used (Catalog No. 2755-NM1 and 2755-NM2), you will also need a screwdriver and a $^{3}/_{16}$-inch allen wrench.

How to Handle Excessive Noise

When the system is operating in a noise-polluted industrial environment, special consideration should be given to possible electrical interference. The effect of electrical interference has been minimized by the basic design of the hardware. Properly grounding the equipment, correctly routing wires and the use of shielded cables will also help minimize interference.

Grounding Recommendations

Grounding is an important safety measure in electrical installations. With solid-state systems, grounding also helps limit the effects of noise due to electromagnetic interference (EMI).

An authoritative source on grounding requirements is the National Electrical Code published by the National Fire Protection Association of Boston, Massachusetts. Article 250 of the Code discusses the types and sizes of wire conductors and safe methods of grounding electrical equipment and components.

Connecting Your Equipment

Connect your equipment using the appropriate cables. Follow the step-by-step procedure described below.

Step 1 Connect the scan head to the port labeled SCAN HEAD on the back of the decoder.

Step 2 Connect the terminal that will be used for programming to the proper port on the decoder (refer to the User' Manual supplied with your decoder).

Step 3 The initial programming should be done at this time, if it was not done earlier (refer to the User's Manual supplied with your decoder).

Connecting Your Equipment (continued)

Step 4 If a host computer will be used, connect it to the port labeled COMM on the back of your Catalog No. 2755-DM1 decoder, or the port marked HOST on your Catalog No. 2755-DM6 decoder (refer to the User's Manual supplied with your decoder).

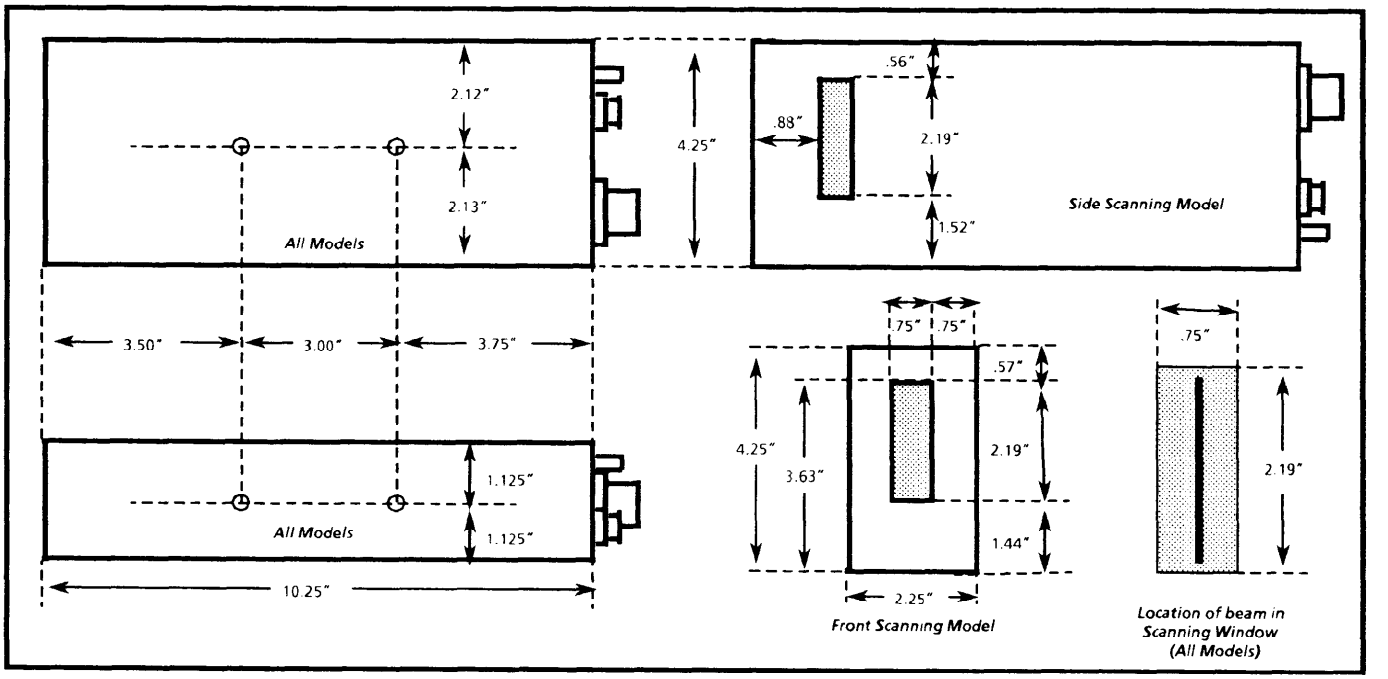
Step 5 If output devices will be used, connect them to the decoder (refer to the User's Manual supplied with your decoder).

Step 6 If a package detector will be used, connect it to the small port on the scan head.

Determining the Space Requirements

The decoder and scan head are separate units that can be mounted on separate surfaces. A 10- or 25-foot cable is used to connect the two units. Figure 4.1 illustrates the dimensions of the scan head.

Figure 4.1
Mounting Dimensions of the Scan Head



Installing the Scan Head

Before installing the scan head, review the following information:

- Determine the optimum position of the scan head relative to the labels that are to be read. Refer to Chapter 3 for positioning information.
- If you are using the optional swivel base or brackets, add their dimensions into your positioning calculations.
- Allow a minimum clearance of 8 inches at the rear of the scan head so you can attach the cables to the various ports.
- Securely mount the scan head to a rigid surface to ensure proper operation of the scanning mechanism.

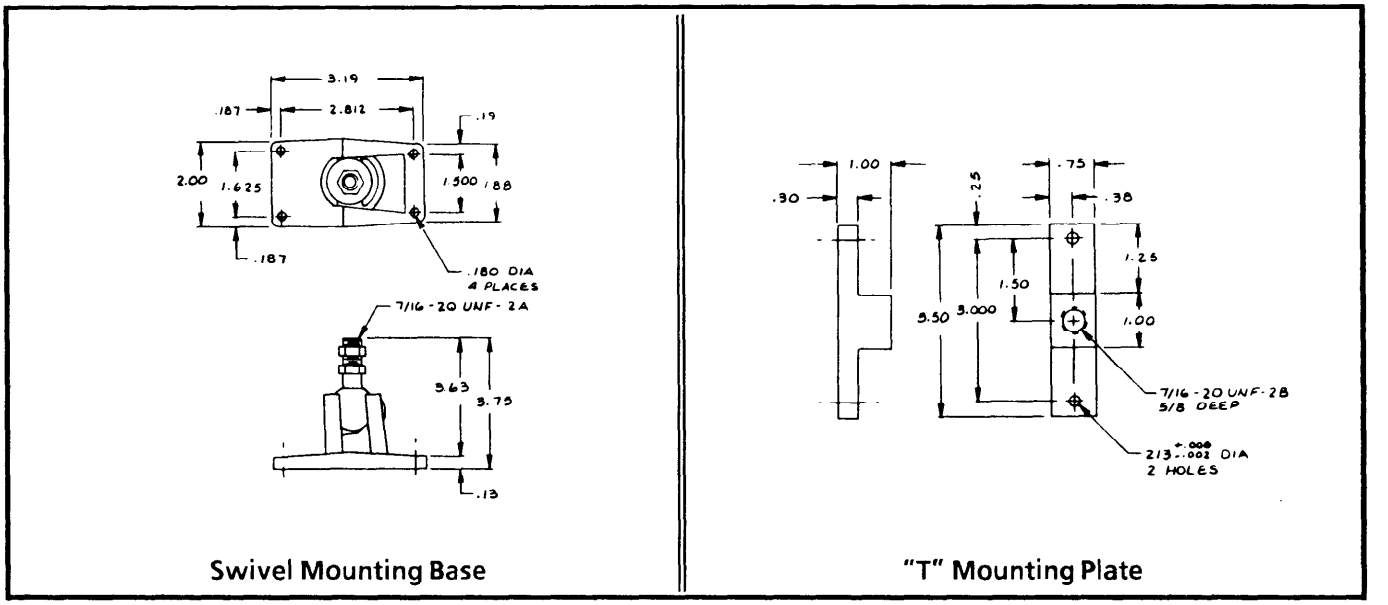
Because the thickness of the mounting surface (table top, shelf or bracket) determines the length of the screws or bolts required, fasteners are not supplied with the scan head.

You will need two 10-32 hexagon-head cap screws, with flat and split washers. Select a length that equals the thickness of the mounting surface, thickness of the washers plus 3/8-inch (depth of screw holes).

How to Install the Swivel Mounting Base (Catalog No. 2755-NM1 and 2755-NM2)

For greater installation flexibility, you can attach the scan head to an optional Swivel Mounting Base. The installation dimensions of the Swivel Base and its associated "T" Mounting Plate are shown in Figure 4.2.

Figure 4.2
Mounting Dimensions of Swivel and "T" Mounting Plate



Swivel Mounting Base

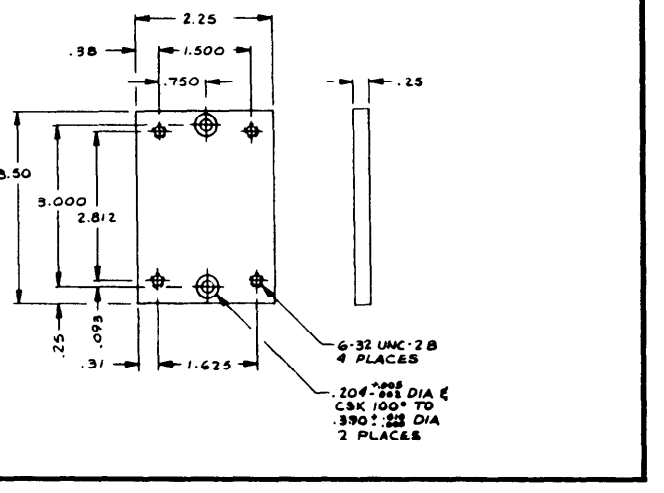
"T" Mounting Plate

Using the Flat Mounting Plate (Catalog No. 2755-NM2)

A Flat Mounting Plate is also available. By attaching this plate to the bottom of your scan head, you can position the swivel mounting ball close to the base of the scan head. You may also use the Flat Mounting Plate when you want to mount the scan head with brackets of your own design.

The dimensions are shown in Figure 4.3.

Figure 4.3
Mounting Dimensions of the Flat Plate



Installing the Package Detect Assembly (Catalog No. 2755-NP1)

The Package Detect Assembly consists of:

1. A self-contained photoelectric switch.
2. A 3-inch diameter reflector.

The switch has the following specifications:

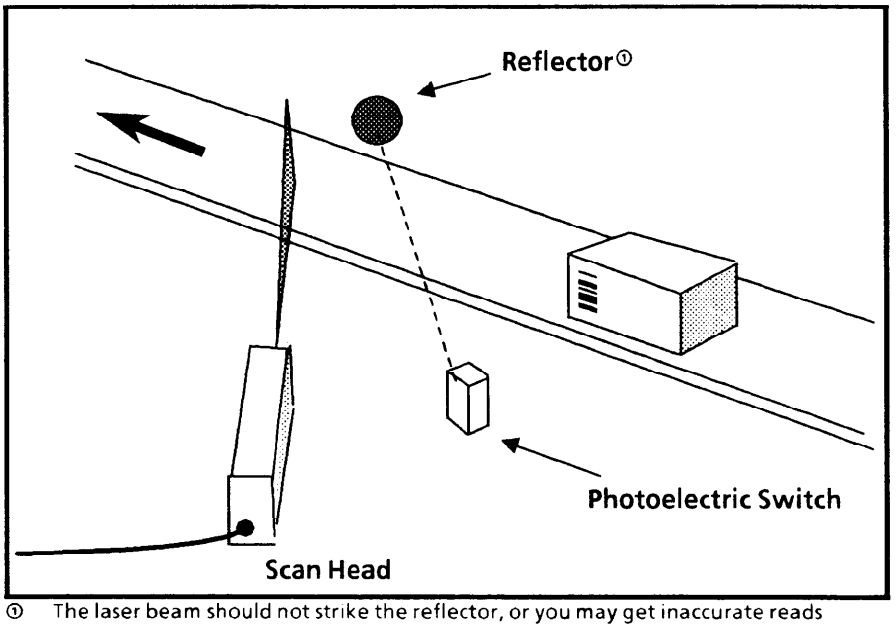
- Maximum operating range: 18 feet.
- Operating temperature: -13° to 158° F (-25° to 70° C).
- Tolerance to ambient sunlight: 10,000 foot candles.

When installing the switch, we recommend you observe the following guidelines:

- Install the switch at an angle to the labels to minimize the affect of light reflecting off the labels.
- Install the reflector so it does not exceed its operating range.
- The package detector beam must be broken before the label is in position to be read.

Figure 4.4 shows a typical package detector installation.

Figure 4.4
Recommended Placement of the Package Detect Switch and Reflector.

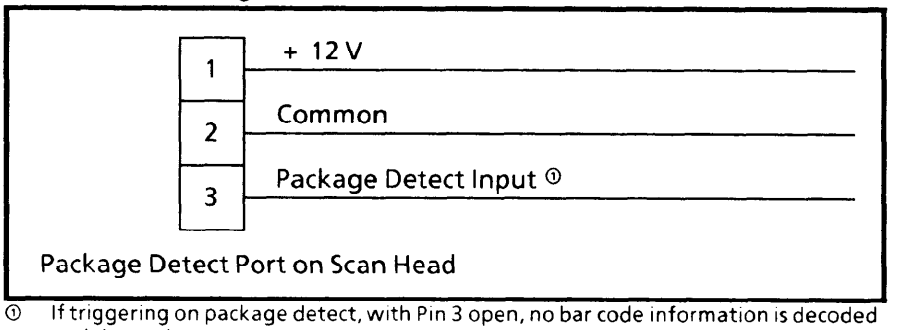


① The laser beam should not strike the reflector, or you may get inaccurate reads

Installing the Package Detect Assembly (Catalog No. 2755-NP1) (continued)

Figure 4.5 specifies which pins on the Package Detector Port Connector (Catalog No. 2755-NC7) are used.

Figure 4.5
Pins Used on Package Detector Connector



① If triggering on package detect, with Pin 3 open, no bar code information is decoded and the Package Detect LED is OFF. The package detect input must be pulled low in order to decode information. The package detect LED on the Decoder will light when the package detect input is active.

Note: If the laser is programmed to be ON only upon a package detect, the laser will be OFF until the package detector is triggered.

Chapter 5 Maintenance and Troubleshooting

Chapter Objectives

Maintenance procedures are stated and troubleshooting charts are provided in this chapter.

Maintaining the Equipment

WARNING: No user maintenance of the scan head is required. **Do not open the enclosure!**

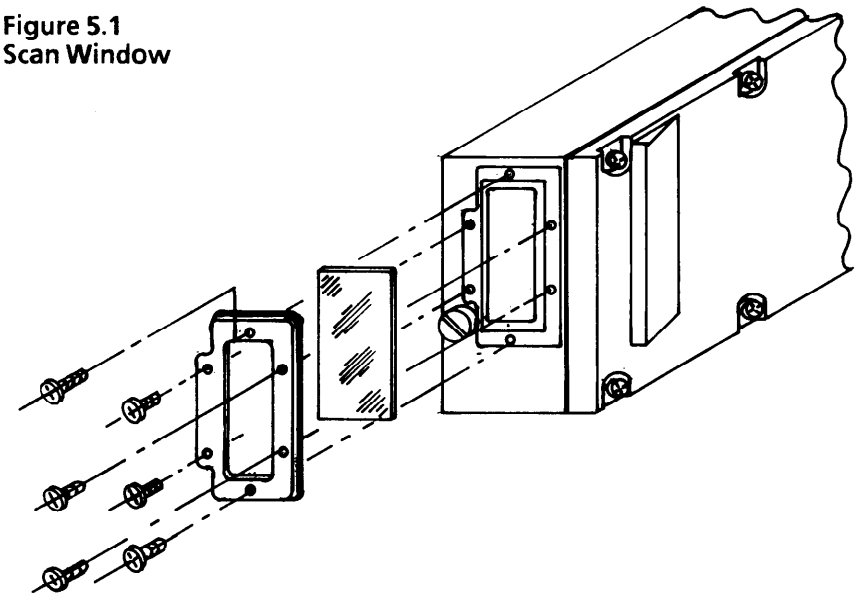
Scan Window Removal

The scan window fits into a cut-out in the front or side of the scan head. A gasketed cover is then tightly secured over the window to ensure a Nema 12/13 rating.

To remove the scan window:

1. Remove the six Phillips head screws from the cover.
2. Lift the cover away from the scan head. Handle the scan window by the edges to avoid finger prints. Make sure the scan window does not fall out. Refer to figure 5.1

Figure 5.1
Scan Window



Cleaning the Glass Window

Do not use abrasive materials, such as disposable paper wipes, to clean the glass scan window. Most disposable wipes, or paper towels, use glass fibers which will scratch and cloud the window. Instead, you may use the following materials:

Solvent: Isopropyl alcohol (100% solution).

Wipe: Optics quality lens cleaning paper and cotton-tipped swabs.

Use the following procedure to clean the glass:

CAUTION: Do not use abrasive materials, such as disposable paper wipes, to clean the glass scan window. Most disposable wipes, or paper towels, use glass fibers which will scratch and cloud the window.

Step 1 Turn the decoder OFF. The switch is located on the rear of the decoder.

Step 2 Check that the PWR ON indicators on both the decoder and scan head are OFF.

Step 3 Remove the scan window. Figure 5.1 illustrates the removal.

Step 4 Use the lens cleaning paper to wipe any dust or foreign material from the window. Be careful not to scratch the window with any grit that might be on the window.

Step 5 For stubborn film and finger prints, use isopropyl alcohol (100% solution) and cotton-tipped swabs. To avoid smearing film and fingerprints, rotate the cotton-tipped swab, while it's on the glass, nearly one revolution then discard it.

Step 6 Replace the scan window.

Step 7 Turn the decoder ON. The PWR ON indicators on both the decoder and scan head should be ON.

Note: When the window is clean, you will barely be able to see the reflection of the laser beam on the clear glass.

Cleaning the Plastic Window

Do not use abrasive materials, such as disposable paper wipes, to clean the plastic scan window. Most disposable wipes, or paper towels, use glass fibers which will cloud and blur the window, thus reducing the effectiveness of the scan head. Instead, you may use the following materials:

Air: Optics rated clean air

Solution: Optics rated cleaning solution designed for use on plastic coated lenses

Wipe: Optics quality lens cleaning paper designed for use on plastic lenses

Use the following procedure to clean the plastic window:

CAUTION: Do not use organic solvents on the plastic window.

CAUTION: Do not use abrasive materials, such as disposable paper wipes, to clean the scan window. Most disposable wipes, or paper towels, use glass fibers which will scratch and cloud the window.

Step 1 Turn the decoder OFF. The switch is located on the rear of the decoder.

Step 2 Check that the PWR ON indicators on both the decoder and scan head are OFF.

Step 3 Remove the scan window. Figure 5.1 illustrates the removal.

Step 4 Use the optics rated clean air to blow any any dust or foreign material off of the window.

Step 5 For stubborn film and finger prints, apply any optics rated cleaning solution designed for plastic lenses. To avoid smearing film and fingerprints you should blot, not rub, the surface of the window. Each time you blot the surface, use a new (dry) section of the optics quality lens cleaning paper.

Step 6 Replace the scan window.

Step 7 Turn the decoder ON. The PWR ON indicators on both the decoder and scan head should not be ON.

Note: When the window is clean, you will barely be able to see the reflection of the laser beam in the window.

Troubleshooting the System

Problem	Probable Cause	Possible Solution
PWR ON indicators on **both** scan head and decoder do not light.	Decoder is not turned ON.	Turn decoder ON.
	Improper connection to power supply.	Reconnect power cord to source.
	Line fuse on decoder is blown.	Replace fuse on decoder:
	Faulty power cord or switch.	Check that voltage is present at service outlet.
	No incoming power.	
PWR ON indicator on scan head does not light, but PWR ON indicator on decoder is lit.	Interconnect cable between decoder and scan head is loose.	Reconnect cable and check connections.
	Interconnect cable is damaged.	Replace cable.
	Scan head is damaged	Replace scan head
No laser beam emitted from window of scan head	Shutter on scan head is closed.	Rotate shutter control knob.
	No scan trigger signal.	Verify sending of scan trigger by either package detect or host command.
Unable to read a label.	Improperly positioned labels.	Check that reading distance is correct and orientation of labels to scan head is correct.
	Poor quality labels.	Check that labels are good quality and within specifications.
	Shutter control knob is not fully open.	Rotate shutter control knob on Scan head.
	Decoder is improperly programmed.	Refer to the appropriate User's Manual
	Loose cables or connections.	Check cables and connections.
Laser beam expands and contracts.	Shutter on scan head is not fully open.	Rotate shutter control knob.
	Scan head is not securely mounted.	Improve mounting.
Warning! Laser beam is an intense dot of light.	Laser scanning mechanism is not operating correctly.	Rotate shutter control knob in order to close window and then turn decoder OFF.

Chapter 6 Specifications

Chapter Objectives

Scan Head (Catalog No. 2755-L)

Electrical	Receives power from decoder.
Mechanical	
Enclosure	Cast aluminum NEMA 12/13
LED Indicators	• Power On • Valid Read
Weight	4 lbs (1.8 kg)
Dimensions	10.25" x 4.25" x 2.50" (26.0 x 10.8 x 2.50 cm)
Environment	Ambient temperature range, 32° to 122°F (0° to 50°C)
CDRH Standards	Meets Class II standards
Optical	
Light Source	Focused helium-neon (He-Ne) laser (632.8nm)
Power	1.5 mW max.
Fixed Scan Rate	200 scans/second, ± 5% Raster at 20 cycles per second
Scan sweep angle	Front scanning unit 47° Side scanning unit 47° Raster scanning unit 40°
Scan Range	5" to 50" from scan window ①②
Depth of Field	5" to 50" from scan window ①②
Label Skew	5° to 50° from normal ③
Label Pitch	5° to 45° from normal ③
Package Detect	
Min. OFF-State Voltage	11 VDC
Max. ON-State Voltage	2 VDC

① Depending on the model selected

② Distances will be reduced by 10% on all side scanning models

③ Depending on label quality

G Glossary

A

AIM
Acronym for Automatic Identification Manufacturers.

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

alphanumeric or alphameric
The character set which contains letters, digits, and other characters such as punctuation marks.

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 $\frac{1}{2}$ or 0.5.

attended system
A Scanner/decoder combination that must be activated, or attended, by an operator.

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.

average edge
An imaginary line bisecting the irregularities of the character edge.

B

background
The area surrounding a printed symbol.

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 lineal inch.

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

bar code reader
A device used to identify and read a bar code symbol. Also know as a decoder

bar code symbol
A group of vertical bars ,that represents a character or group of characters whose spacing is determined by a specific set of rules. In most cases, human readable characters are also 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.

bi-directional symbol
A bar code symbol that can be read in complementary (two) directions.

binary code
A power-of-two code; each bit position has a weighted value.

bit
An acronym for Binary Digit. The smallest unit of information in the binary numbering system. Represented by the digits 0 and 1.

C

CCD
Acronym for Charge Couple Device; a linear image sensor that scans at high speeds (approximately 4,000 times per second) and detects the presence or absence of marks passing under the device.

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 reading
Reading of alpha or numeric characters,and/or symbols, by optical means.

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 the read.

clear area
A clear space, containing no dark marks, that precedes the start character of a symbol and follows the stop character. That region of a document reserved for OCR characters and the required clear space around these characters.

code
A set of rules governing how the bars and spaces of the symbol will represent characters and groups of characters. **bar code.**

code medium
The material used to construct a machine readable code. Such materials may be retroreflective or opaque.

code reader or scanner
A device that examines a spatial pattern, one part after another, and generates analog or digital signals corresponding to the pattern.

contact scanner
A code reader that requires physical contact with the code medium.

continuous code
A bar code or symbol that does not use an intercharacter gap between characters in the code. Code 128 is an example of intercharacter gap.

D

decoder
An unattended device used to decode, or make usable, a digital or analog signal transmitted from a scanning device.

decoder logic
The electronic package which receives the signals from the scanner, interprets the signals into meaningful data and provides the interface to other devices.

depth of field
The distance between the maximum and minimum plane where a symbol can be read.

diffuse reflection
Reflection of light in all directions. Diffuse reflection occurs from non-glossy surfaces. (Also see specular reflection)

dirt
In paper, refers to the presence of relatively non-reflective foreign particles imbedded in the sheet. The size and lack of reflectance of the particles may cause the optical scanner to mistake the dirt for inked areas.

discrete code
A bar code or symbol where the space between characters, intercharacter gap, are not part of the code; as with Code 39. (Also see continuous code)

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

E

EAN
Acronym for European Article Numbering System, the international standard bar code for retail food packages.

edge error
Irregularities with respect to the average edge of an element.

element
1) A single binary position in a character. 2) Dimensionally the narrowest width in a character, bar or space.

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.

F

first read rate
The first read rate is the percentage of bar code symbols that are read with the first pass of the bar code wand under ideal conditions. Bar code symbols should have a first read at least 90% of the time. A first read rate of less than 90% usually means that either the bar code symbols or scanning device need some type of adjustment or modification. This does not mean that a system which has a first read rate of less than 90% is unacceptable.

G

guard bars
The bars at the ends and center of a UPC and EAN symbol. They ensure a complete scan of the bar code.

H

hand held scanner
Refers to any scanning device that must be held over the bar code symbol.

height-of-scan
The maximum vertical scanning dimension of a moving beam scanner at a specific distance from the face of the scanner.

helium neon laser
The type of laser most commonly used in bar code scanners. Because the laser beam is bright red, bars must not be printed with red ink since they would be indistinguishable from the background.

horizontal bar code (Picket Fence)
A bar code or symbol presented in such a manner that its overall length dimension is parallel to the horizon. The bars look like a picket fence.

I

incandescent light source
Intense white light used to illuminate an object as it passes under a CCD camera.

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

interleaved bar code
A bar code in which characters are paired together using bars to represent the first character and spaces to represent the second; as in USS-I 2/5

K
key mark or trigger
A code bit(s) that provides the scanner with the instruction that the code is in a position to be read; used in some fixed beam readers.

L
ladder orientation
See **vertical bar code.**

laser scanner
An optical bar code reading device using a low energy laser light beam as the source of illumination.

Light Emitting Diode (LED)
A semiconductor diode generally made from gallium arsenide, that can serve as a near infrared light source when voltage is applied continuously or in pulses. LED's have extremely long lifetimes when properly operated; being solid-state, they are very resistant to shock and vibration.

light operated
Condition in which the control operates when the light beam in uninterrupted.

M
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 reader does not agree with the encoded data presented. See **substitution error**.

module
A group of elements.The term module is used by the Uniform Product Code Council in it descriptions of the UPC code. A module is the narrowest unit of measure in the code. A module may be "black" or "white". Contiguous modules are used to form bars or spaces that are wider than one unit.

modulo check digit or character
A calculated character within a data field used for error detection. The calculated character is determined by applying a code algorithm to the data field contents.

modulus 43 check character
Used in Code 39 for data security in addition to the built-in self-checking characters. The check-character is the modulus 43 sum of all of the character values in a given message and is the last character in the code.

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

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

no-read, non-read, non-scan
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.

O
OCR
Acronym for Optical Character Reader. An information processing device that scans and decodes human readable OCR symbols.

OCR-A
An abbreviation commonly applied to the character set contained in ANSI Standard x3.17-1974.

OCR-B
An abbreviation commonly applied to the character set contained in ANSI Standard x3.49-1975.

off-line
Refers to devices that operate independently of a central processing unit.

on-line
An operation in which peripheral devices are connected directly to the computer central processor unit.

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.

scanning range
The sum of the scan head's optical throw and depth-of-field.

optical throw
The distance from the face of the scanning device to the center of the depth of field.

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

overhead
The fixed number of characters required for start, stop and checking in a given symbol. For example, a symbol requiring a start/stop and two check characters contains four characters of overhead. To encode three characters of data, seven characters are required.

P

parallel beam
A beam of light that is optically controlled so the light travels in a parallel path. Generally used when the object is larger than the lens diameter.

parallel code
A code configuration that is optically scanned in its entirety at one time. Since all codes marks are read simultaneously, the code can move pass the reader in either direction.

parity bar, parity bit, parity module
A parity bit is added to a binary array to make the sum of all the bits always odd or always even; a fundamental check.

permanent code
A code which is indefinitely reused in a bar code application.

picket fence code
See **horizontal bar code**.

pitch
1) Rotation of a code pattern about the X 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. PCS values can be calculated and displayed automatically on suitable instruments.

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.

proximity sensor
A method of object detection in which the source and detector are located on the same side; the detector senses energy from the source which is bounce back by the object being detected.

Q

quiet area, quiet zone
See **clear area**.

R

raster scanner
Also available as an optional raster assembly. Raster scanners are similar to standard scanners. The beam still travels from left to right, but it now does so in a sinusoidal, or top to bottom, pattern. This allows the scanner to see different scan paths so if a bar is deformed or soiled in one place it may still be read due to the sinusoidal sweep of the beam.

read
A successful scan 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; such as reflection from a non-glossy surface.

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.

reflex
A method of object detection in which the source and detector are located on the same side; a retroreflector on the far side returns the energy from the source to the detector.

reject
See **no-read, non-read, non-scan**.

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.

retro
See retroreflective.

retroreflective
Characteristic of material causing it to reflect light back to its source regardless of angle of incidence.

retroreflector
A reflector, specially constructed, which reflects energy back to the source from which it came. It is also known as a "corner reflector".

reverse image
A symbol in which the normal dark areas are represented in the light areas.

S

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

scan area
The area intended to contain a symbol.

scan head, 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.

scanning curtain
The effective reading area (width x height) of a moving beam scanner, which is equal to its depth-of-field and height-of scan at a specific operating range.

scanning range
The combined distance of optical throw and depth of field.

scanning wand
See **wand.**

segment
See **element.**

self-checking
A bar code or symbol using a checking algorithm which can be applied to each character to guard against undetected errors. Non-self-checked codes may employ a check digit or other redundancy in addition to the data message.

serial code
A bar code symbol typically used with a fixed beam scanner where the scanning action is caused by the motion of the symbol past the scanning head. The bits of the symbol are evaluated one at a time (serially).

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

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

space encoding
See **interleaved bar code.**

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 character
A bar code character that provides the scanner with start and stop reading instructions as well as code orientation.

stepladder code
See **vertical bar code**.

substitution error
This error can be seen in a mis-encodation, mis-read, or human operator error. Characters are substituted with erroneous information. Example: correct information is 1, 2, 3, 4; substitution is 1, 2, 5, 4. 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.

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.

U

unattended system
A Scanner/decoder combination that is triggered, or activated, by an external source such as a computer, PLC or mechanical switch.

UPC
Universal Product Code. The standard bar code symbol for retail food packaging in the United States.

V

vertical bar code (ladder orientation)
A code pattern in which the overall coded area from start to stop is perpendicular to the horizon. The individual bars appear as rungs of a ladder.

void(s)
The absence of ink within printed bars. The absence of ink within the confines of a character.

W

wand
A hand held scanning device used as a contact bar code or OCR reader.

Index

G

I

L

M

N

O

P

R

S

T

U

W

ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

With offices in major cities worldwide.

WORLD HEADQUARTERS
1201 South Second Street
Milwaukee, WI 53204 USA
Tel: (414)382-2000
Telex: 43 11 016
FAX: (414)382-4444

EUROPE/MIDDLE EAST/AFRICA SALES HEADQUARTERS
Allen-Bradley Europa B.V.
Amsterdamseweg 15
1422 AC Uithoorn
The Netherlands
Tel: (31)2975/60611
Telex: (844) 18042
FAX: (31)2975/60222

ASIA/PACIFIC HEADQUARTERS
Allen-Bradley (Hong Kong) Limited
2901 Great Eagle Center
23 Harbour Road
G.P.O. Box 9797
Wanchai, Hong Kong
Tel: (852)5/739391
Telex: (780) 64347
FAX: (852)5/834 5162

CANADA HEADQUARTERS
Allen-Bradley Canada Limited
135 Dundas Street
Cambridge, Ontario N1R 5X1
Canada
Tel: (519)623-1810
Telex: (069) 59317
FAX: (519)623-8930

LATIN AMERICA HEADQUARTERS
1201 South Second Street
Milwaukee, WI 53204 USA
Tel: (414)382-2000
Telex: 43 11 016
FAX: (414)382-2400

Publication 2755-829 – October, 1989

40062-133-01(A)