Allen-Bradley

AtomScan+ Bar Code Readers

(Cat. Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, and 2755-LS7-RBV)

User Manual

Important User Information

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

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

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

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

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

Attention statements help you to:

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

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

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European Union Directives

Preface

Chapter Objectives

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

- contents of this manual
- conventions used in this manual
- intended audience
- related publications
- technical support services

Contents of this Manual

The following table describes the contents of this manual.

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Introduction to AtomScan+ Bar Code Readers	Provides an introduction for the use of the AtomScan+ Bar Code Readers.
2	Hardware Features	Provides an overview of the readers and interface boxes. Includes a description of accessory items.
3	Designing Your Scanner System	Provides information needed to design and implement a scanner system.
4	Installing Your Hardware	Describes how to connect your scanner system hardware.
5	Configuring Your Reader	Describes configuration options for the reader.
6	Hardware Operation	Describes how to operate your system hardware.
7	Maintenance and Troubleshooting	Describes how to maintain and troubleshoot your scanner system hardware.
Appendix A	Specifications	Provides physical, electrical, environmental, and functional specifications for the readers and interface box.
Appendix B	Cable Pinouts	Lists the cable pinouts for reader cable.
Appendix C	ASCII Table	Lists ASCII conversion chart.
Appendix D	Multidrop Communications	Describes the rules for setting up a concentrator or controller to communicate with an AtomScan+ Bar Code Reader.
Appendix E	Application Examples	Illustrates various applications.
Appendix F	European Union Directives	Provides requirements for readers when used within the European Union.
	Glossary	Provides terms found within this document.

Conventions Used in this Manual

The following conventions are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps.
- *Italic* type is used for emphasis.
- Text within square brackets **`[in this font]`** represent the keys you press.

Intended Audience

No special knowledge is required to understand this document or use the AtomScan+ Bar Code Readers (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, and 2755-LS7-RBV).

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

Related Publications

The following table lists the other publication related to the AtomScan+ Bar Code Readers.

Publication Number	Title
2755-921	Bar Code Basics

Technical Support Services

If you have any questions about the AtomScan+ Bar Code Reader, please consult this manual first. If you can't find the answer, contact Rockwell Automation International Support:

Rockwell International
Technical Support
6680 Beta Drive
Mayfield Village, Ohio 36849

Inside USA and Canada, call 1–800–289–2279.

Outside USA and Canada, contact your Allen-Bradley office or call USA (216) 646–6800.

Introduction to AtomScan+ Bar Code Readers

This chapter can help you to get started using the AtomScan+ Bar Code Readers. We base the procedures here on the assumption that you have an understanding of bar code scanners and control equipment.

Because it is an introduction, this chapter *does not* contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information.

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, *always read the referenced chapters* and other recommended documentation before trying to apply the information.

This chapter tells you:

- what tools and equipment you need
- procedures for getting your scanner system up and running

Required Tools and Equipment

Have the following tools and equipment ready:

- screwdriver
- drill
- tape measure
- personal computer with terminal program and an RS-232 cable

Procedures

1.	Check the contents of shipping boxes.	Reference

Unpack the shipping boxes making sure that the contents include:

- AtomScan+ Bar Code Readers (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, or 2755-LS7-RBV)
- *AtomScan+ Bar Code Readers User Manual* on disk (Publication No. 2755-6.9-DISK)
- *AtomScan+ Bar Code Readers Installation Instructions* (Publication No. 2755-5.13)
- Interface Boxes for the AtomScan+ Bar Code Readers (Catalog Nos. 2755-LS7-IB1 or 2755-LS7-IB2)
- *Interface Boxes for the AtomScan+ Bar Code Readers Installation Instructions* [Catalog No. 40062-366-01 (A)]
- Mounting Plate for the AtomScan+ Bar Code Readers (Catalog No. 2755-LS7-N1)
- *Mounting Plate for the AtomScan+ Bar Code Readers Installation Instructions* [Catalog No. 40062-367-01 (A)]
- Power Supply for the AtomScan+ Bar Code Readers (Catalog No. 2755-LS7-PW1)
- *Power Supply for the AtomScan+ Bar Code Readers Installation Instructions* [Catalog No. 40062-368-01 (A)]

If the contents are incomplete, call your local Allen-Bradley representative for assistance.

2.	Design the scanner system.	Reference

Each application must be evaluated carefully. Successful bar code scanning begins with quality bar code symbols and the correct number, type, and location of readers, decoders, and package sensors. Refer to the following when designing your scanner system.

Chapter 3 *(Designing Your Scanner System)*

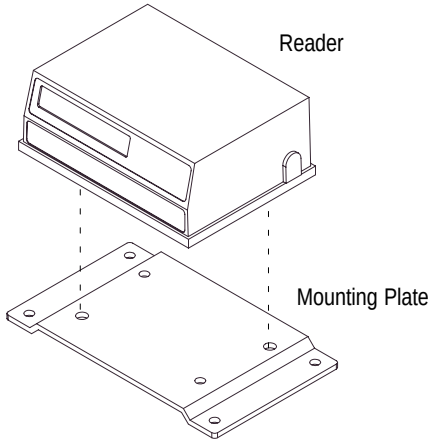
- Before setting up the system, calculate the expected number of scans per symbol. Make sure the reader can view the number of scans it needs. If necessary, adjust the symbol speed and/or the distance between bar-coded packages.
- Position the reader at a distance from the symbol that is within the range specified. A read rate test should be made to verify the range, and also to ensure optimum scanning and decoding.
- Avoid aiming the reader perpendicular to the symbol, to avoid directly reflected laser light.
- If a package sensor is used, position it so it can sense the package 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 reader temporarily.

3.	Install the reader.	Reference

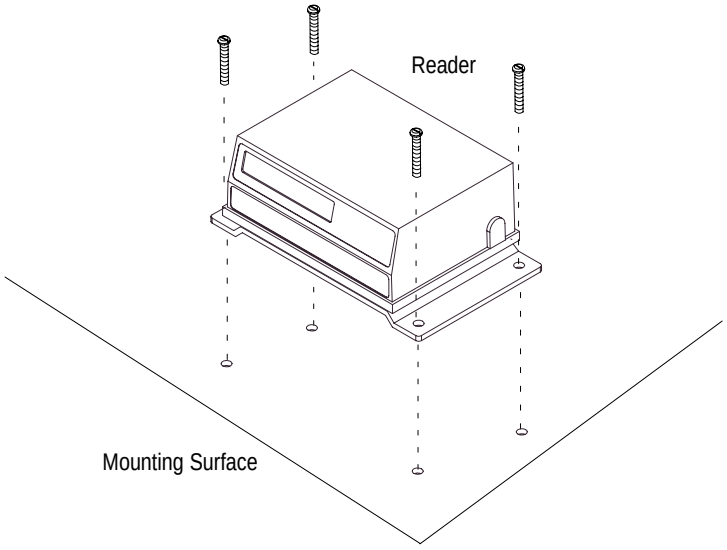
Mount the reader (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, or 2755-LS7-RBV) to the mounting plate (Catalog No. 2755-LS7-N) or directly to your mounting surface. [The maximum distance from the reader to another device is 3 ft. (0.91 m)]. Use # 6 screws with maximum penetration of 0.15 in. (3.81 mm). If you are not using the mounting plate, go to step #4.

Chapter 4 *(Installing Your Hardware)*



Mount the plate to your mounting surface. You can mount the plate to the top, bottom, or side of your mounting surface. Use # 6 screws.

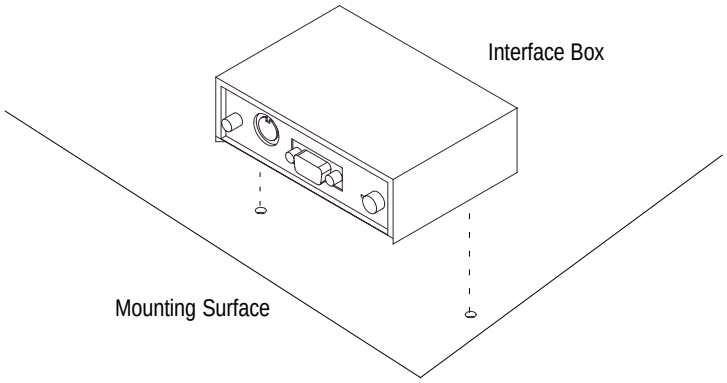
Make sure placement of the mounting plate will allow you to connect the reader to the interface box (Catalog Nos. 2755-LS7-IB1 or 2755-LS7-IB2) or other network device. The maximum distance from the interface box to the reader is 3 ft. (0.91 m). Skip steps #4 and #5 if you are *not* using an interface box.



4.	Install the interface box.	Reference

Mount the interface box to your mounting surface. Use # 6 screws with maximum penetration of 0.25 in. (6.35 mm).

Chapter 4 *(Installing Your Hardware)*



5.	Install the power supply.	Reference

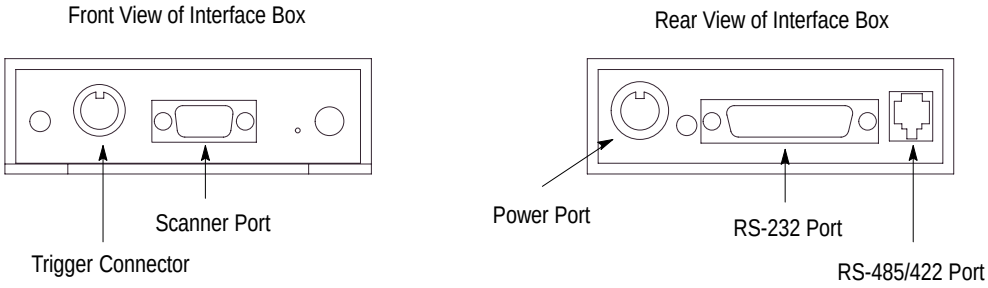
Place the power supply within 6 ft. (1.83 m) of the interface box.

Chapter 4 *(Installing Your Hardware)*

6.	Connect the hardware components together.	Reference

If you are using an interface box, connect the reader, power supply, package detect, and host or configuration terminal to the interface box. If you are *not* using an interface box, connect the reader to the host device, power supply, and any input or output device via a custom cable.

Chapter 4 *(Installing Your Hardware)*



For information regarding installing the reader for use with an auxiliary monitor or in a daisy-chain configuration, refer to chapter 4 of this manual.

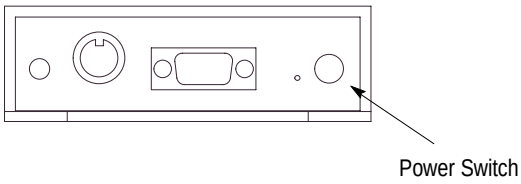
Chapter 4 *(Installing Your Hardware)*

7.	Apply power to the scanner system.	Reference

After all of your hardware components are installed, apply power to your scanner system. Push the power button in on the interface box.

Chapter 4
(Installing Your Hardware)

Front View of the Interface Box



8.	Check the reader defaults.	Reference

Check the following configuration parameters on your host device. (Make sure you have a Windows ™ terminal utility software on your personal computer.) Make sure the defaults match the settings listed below. If the defaults do not match, communication between the reader and host device will not occur.

Chapter 5
(Configuring Your Reader)

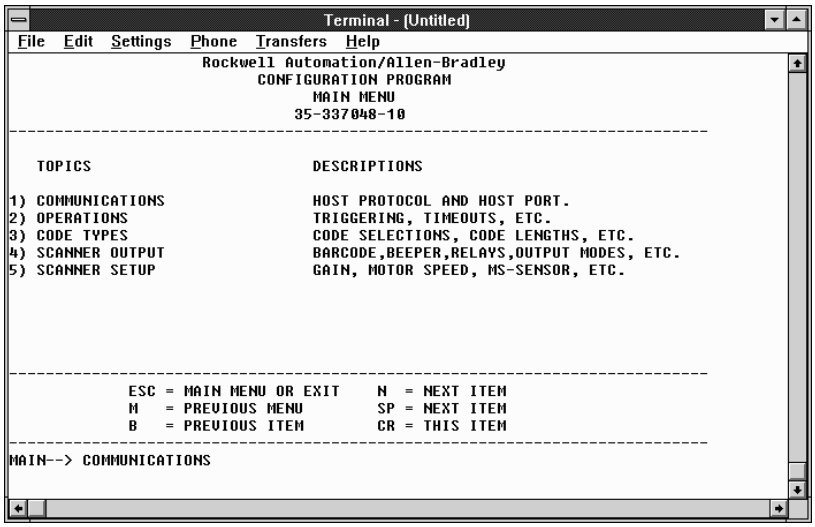
- baud rate = 9600
- parity = even
- stop bits = one
- data bits = 7

Read a test bar code to verify that the default settings are correct (i.e., the reader is communicating with the configuration device).

9.	Change the appropriate configuration settings.	Reference

Press **[<D>]** to access the Main menu. The Main menu appears:

Chapter 5
(Configuring Your Reader)



From the Main menu you are able to access the configuration settings and change the settings needed for your application. Use the designated keys to scroll to and select the parameter you wish to change. Press space bar key (SP) or **[N]** to scroll ahead, **[B]** to scroll back, carriage return key (CR) to select, and **[M]** to return to the previous higher level menu. To return to the Main menu at any time, press **[ESC]** and **[M].**

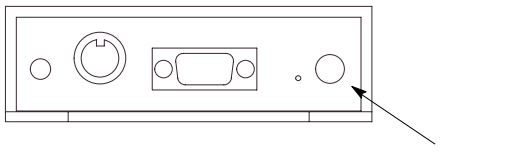
If you need to set the reader to the default settings, refer to chapter 6.

10.	Turn off power to the interface box.	Reference

Push the power button in on the interface box.

Chapter 4
(Installing Your Hardware)

Front View of the Interface Box

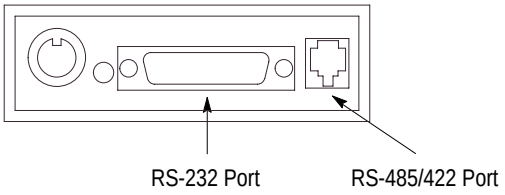


11.	Unplug the configuration terminal from the interface box.	Reference

Unplug the configuration terminal from the RS-232 or RS-485/422 port on the interface box.

Chapter 4
(Installing Your Hardware)

Rear View of the Interface Box

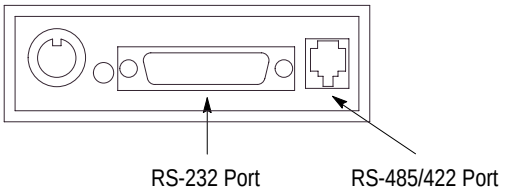


12.	Plug in the host device to the interface box.	Reference

Plug in the host device to the RS-232 or RS-485/422 port on the interface box.

Chapter 4
(Installing Your Hardware)

Rear View of the Interface Box

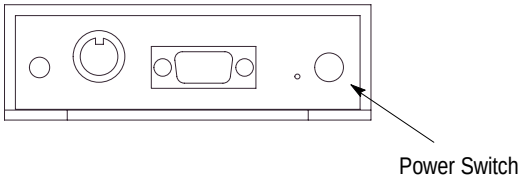


13.	Reapply power to the interface box.	Reference

Push the power button in on the interface box.

Chapter 4
(Installing Your Hardware)

Front View of the Interface Box



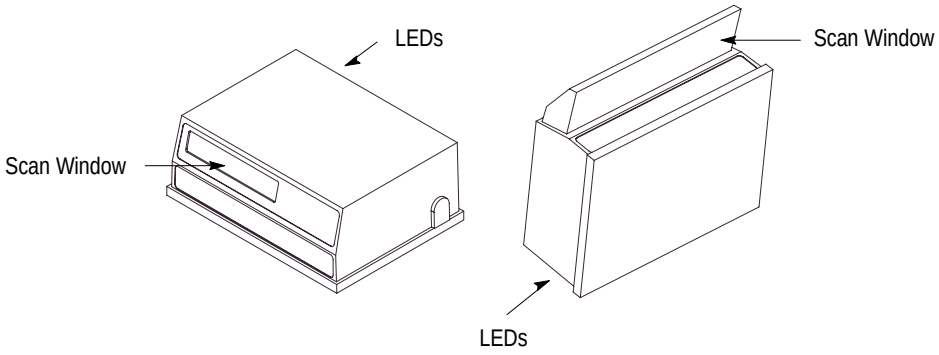
Hardware Features

This chapter describes the features of the AtomScan+ Bar Code Readers (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, and 2755-LS7-RBV) and interface boxes (Catalog Nos. 2755-LS7-IB1 and 2755-LS7-IB2). Included are descriptions of:

- reader features
- reader LEDs
- interface box features
- decoding
- safety information
- scan beam options
- accessories

Reader Features

The reader features are shown below.



Reader LEDs

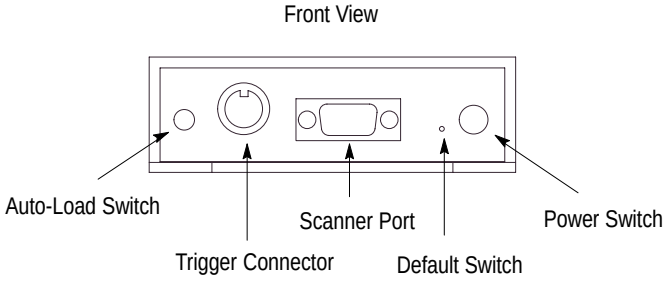
There are three LEDs on the back of the readers.

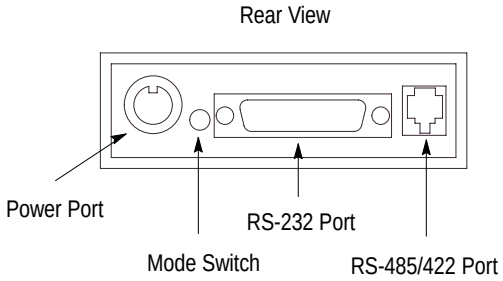
LED	When	Indicates
GD/RD (Good Read)	Green	Good quality label.
RDY (Ready)	Green	Reader is ready to read a label.
PWR (Power)	Red	The reader has power.

Interface Box Features

The interface boxes route signals between the readers and other devices. The interface boxes have the following switches and connectors.

- Auto-load switch. Allows you to load a new match code by pressing the switch when the reader is scanning a bar code.
- Trigger connector. Connects the interface box to a package detector such as a PHOTOSWITCH photoelectric sensor (Catalog Nos. 42GRP-9000, 42GRU-9000, 42GRU-9200, 42GRC-9000, or 42GRR-9000). Contact your local Allen-Bradley sales office or distributor for more information regarding PHOTOSWITCH photoelectric sensors.
- Scanner port. Connects the interface box to the reader cable.
- Default switch. Allows you to restore factory configuration settings to the reader.
- Power switch. Provides power to the interface box and anything connected to to the interface box.
- Power port. Allows you to connect the power supply to the interface box.
- Mode switch. Allows you to toggle the 2755-LS7-IB1 host communications between RS-232 and RS-485 communications.
- RS-232 port. Connects the interface box to equipment with an RS-232 port.
- RS-485/422 port. Connects the interface box to equipment with an RS-485 port (Catalog No. 2755-LS7-IB1) or RS-422 (Catalog No. 2755-LS7-IB2).





Decoding

The readers can decode the following symbologies:

- UPC-A
- UPC-E
- EAN 8
- EAN 13
- Code 39
- Code 128
- EAN 128
- Codabar
- Interleaved 2 of 5

Refer to chapter 5 for more information on the code types listed above.

Safety Information

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with this user manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

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

ATTENTION: There are no user serviceable parts in the readers. Opening the scan head could expose the user to laser diode power of up to 5 mW.

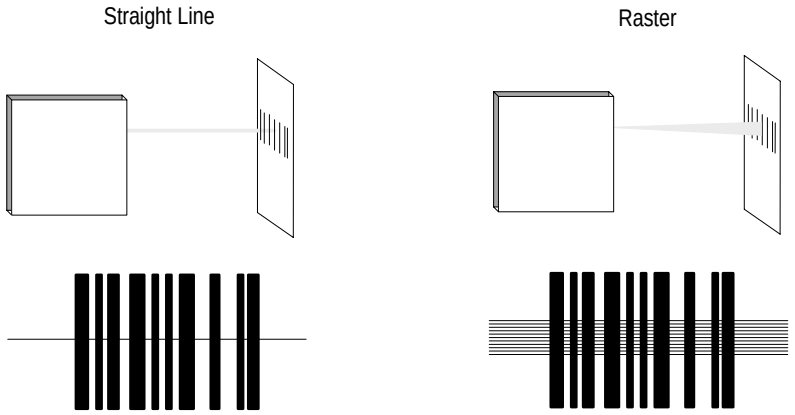
ATTENTION: The laser beam can be harmful to eyesight. Avoid direct eye contact with the laser beam Never point the beam at other people, or in a direction where people may be passing.

Be aware of the following laser caution symbol on the readers.

Scan Beam Options

Scan beams are projected either as a single line or as a raster pattern.

- 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.



The raster type reader is useful for reading dot matrix print bar code symbols.

Accessories

The following accessories are available. Contact your local Allen-Bradley sales office or distributor for more information regarding product availability and pricing.

Description	Catalog Number
Straight ahead high density read, single line bar code reader	2755-LS7-SA
Straight ahead low density read, single line bar code reader	2755-LS7-SB
Straight ahead high density read, raster pattern bar code reader	2755-LS7-RA
Straight ahead low density read, raster pattern bar code reader	2755-LS7-RB
Right angle low density read, single line bar code reader	2755-LS7-SBV
Right angle low density read, raster pattern bar code reader	2755-LS7-RBV
Interface box with RS-232 and RS-485 communication	2755-LS7-IB1
Interface box with RS-232 and RS-422 communication	2755-LS7-IB2
Power supply (120V ac, 60 Hz)	2755-LS7-PW1
Mounting plate	2755-LS7-N1

Designing Your Scanner System

This chapter provides the information needed to set up a scanner system correctly. Items include:

- setup goals
- symbol height and length
- symbol quality
- symbol orientation
- tilt, pitch, and skew
- determining read range
- calculating the number of scans

Setup Goals

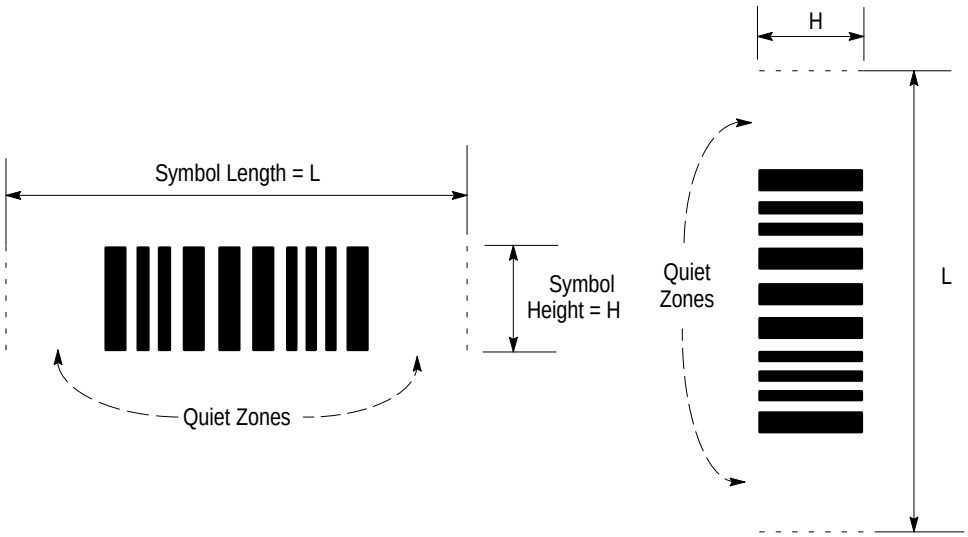
Each application must be evaluated carefully. Successful bar code scanning begins with quality bar code symbols and the correct number, type, and location of readers, decoders, and package sensors. Refer to the following when designing your scanner system.

- 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 packages.
- Position the reader at a distance from the symbol that is within the range specified. A read rate test should be made to verify the range, and also to ensure optimum scanning and decoding.
- Avoid aiming the reader perpendicular to the symbol, to avoid directly reflected laser light.
- If a package sensor is used, position it so it can sense the package 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 reader temporarily.

Symbol Height and Length

The 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.



Symbol Quality

A bar code reader cannot reliably read a poor quality symbol. Test proposed bar code symbol samples to ANSI Standard X3.182-1990, Bar Code Print Quality Guideline.

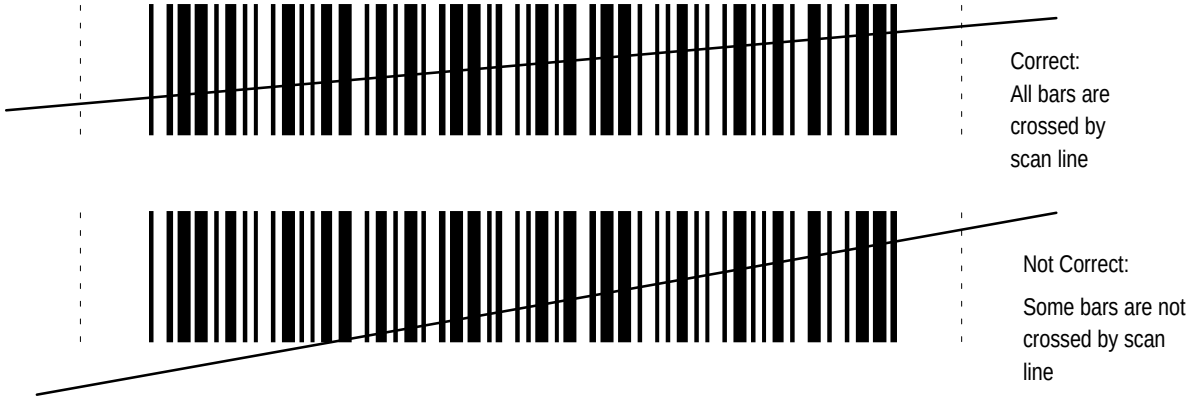
- Low-cost verifiers that can test this standard are available from several companies.
- Symbol samples can be submitted to an independent symbology testing company.

The ANSI guideline specifies 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, or FAIL assigned to the symbol.

- Grade A printed symbols. Any reader should be able to read them.
- Grade B symbols. Many readers can read them, including AtomScan^{+} readers.
- Grade C symbols. Symbols may appear to decode successfully, but in production the performance may drop substantially.

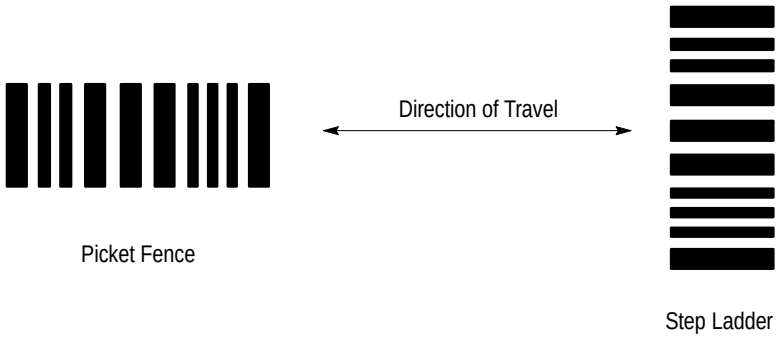
Symbol Orientation

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



Picket Fence and Step Ladder Orientation

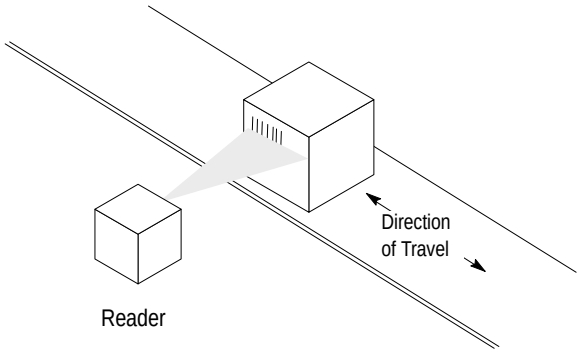
The primary orientation of the bar code symbol can be either picket fence or step ladder. The orientation is not determined by the horizontal or vertical position of the symbol itself but rather by the direction of travel of the bar code past the reader. With picket fence, the bars are perpendicular to the direction of travel and with step ladder, the bars are parallel to the direction of travel.

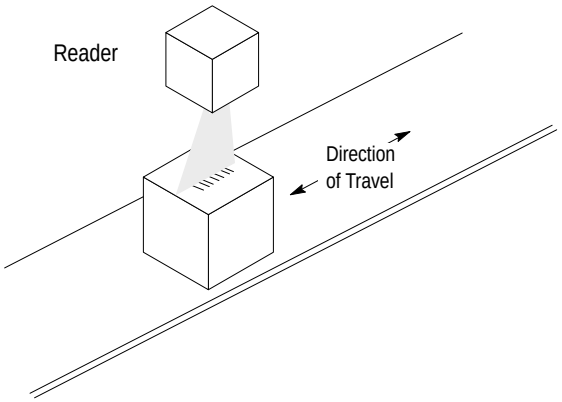


Picket Fence

In picket fence orientation, 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.

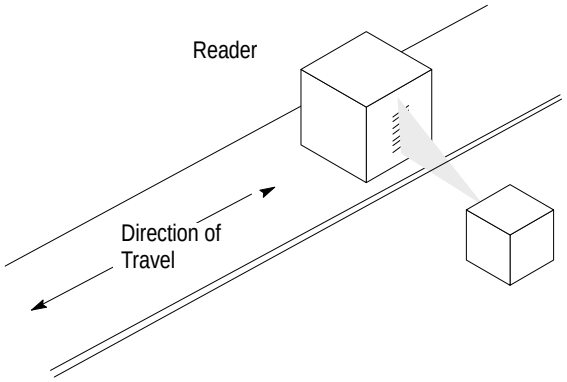


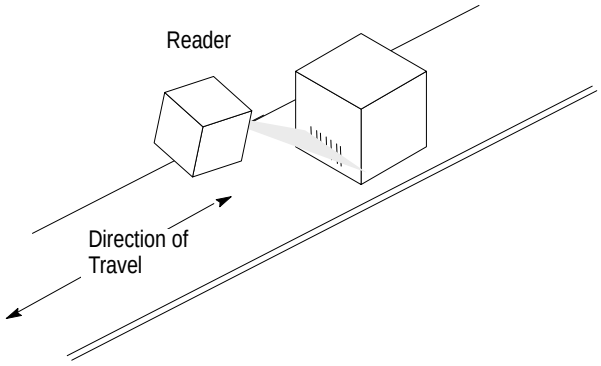


Step Ladder

In general, step ladder orientation is preferred over picket fence orientation 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, and
- symbol placement is not as critical.



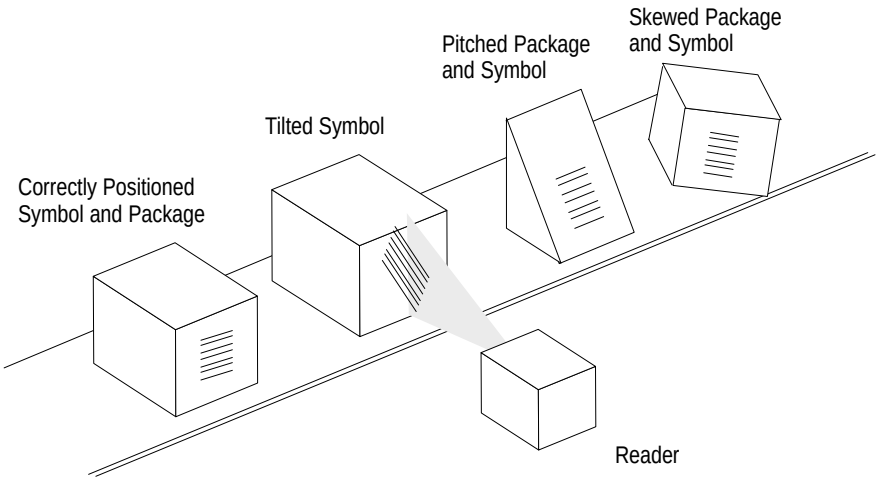


When to Use a Raster Reader

Single line readers should always used in step ladder orientation. Raster readers are beneficial in picket fence applications with symbols printed by a dot matrix printer, where the bars have ragged edges or voids, or where the spaces have specks in them.

Tilt, Pitch, and Skew

The AtomScan+ reader might read a symbol correctly even if the symbol or package is not correctly oriented. Refer to the figure below for various package orientations. Tilt, pitch, and skew can affect the reader's ability to read bar code symbols.



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.

Pitch

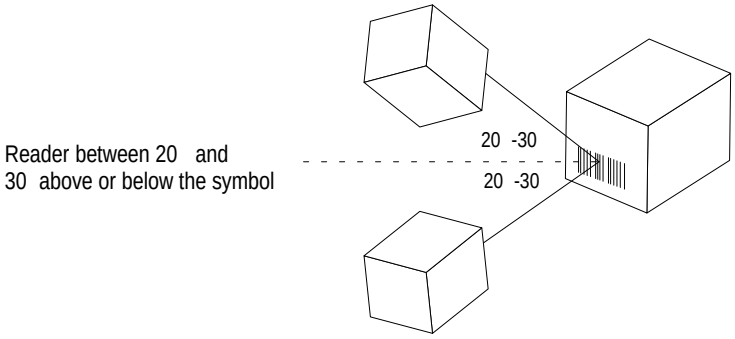
A symbol is pitched when the symbol's bars are at different distances from the reader. From the reader's perspective, a pitched symbol appears to have a smaller narrow element width than it actually has. This may reduce both the read rate and the read range. However, the symbol can still be read if the apparent narrow element width is within the reader's specifications.

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 reader. The symbol can be read if the distance of both ends of the bar are within the reader'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 the following angle.

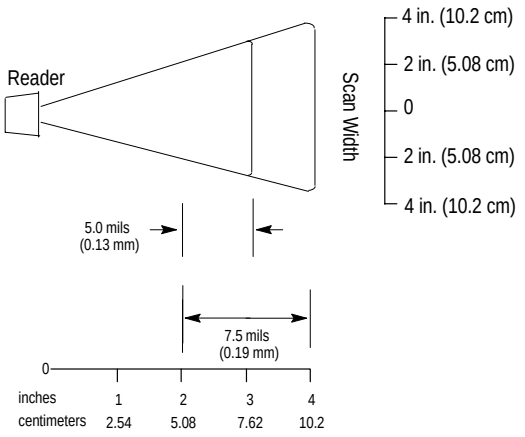


Determining Read Range

The readers can read bar code symbols at various distances depending upon the type of reader and the narrowest bar code element width (width of smallest bar or space). With picket fence orientated labels, scan width is a factor in determining the time it takes to read a bar code symbol.

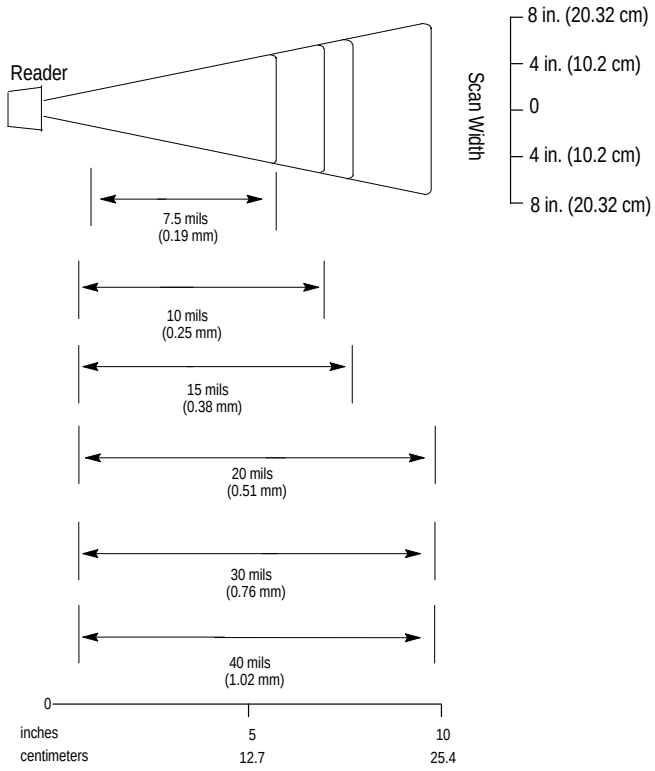
Catalog Number	Minimum Bar Code Width	Read Range	Maximum Scan Width
2755-LS7-SA, 2755-LS7-RA	5.0 mils (0.13 mm)	2.0 to 3.1 in. (5.08 to 7.87 cm)	2.1 in. (5.33 cm)
	7.5 mils (0.19 mm)	2.0 to 4.0 in. (5.08 to 10.2 cm)	3.6 in. (9.14 cm)
2755-LS7-SB, 2755-LS7-RB	7.5 mils (0.19 mm)	2.5 to 5.5 in. (6.35 to 14.0 cm)	4.0 in. (10.2 cm)
	10 mils (0.25 mm)	2.0 to 6.5 in. (5.08 to 16.5 cm)	5.0 in. (12.7 cm)
	15 mils (0.38 mm)	2.0 to 7.5 in. (5.08 to 19.0 cm)	6.0 in. (15.2 cm)
	20 mils (0.51 mm)	2.0 to 10.0 in. (5.08 to 25.4 cm)	7.0 in. (17.8 cm)
	30 mils (0.76 mm)	2.0 to 10.0 in. (5.08 to 25.4 cm)	7.0 in. (17.8 cm)
	40 mils (1.02 mm)	2.0 to 10.0 in. (5.08 to 25.4 cm)	7.0 in. (17.8 cm)
2755-LS7-SBV, 2755-LS7-RBV	7.5 mils (0.19 mm)	1.25 to 4.0 in. (3.18 to 10.2 cm)	4.0 in. (10.2 cm)
	10 mils (0.25 mm)	1.0 to 5.0 in. (2.54 to 12.7 cm)	5.0 in. (12.7 cm)
	15 mils (0.38 mm)	1.0 to 6.0 in. (2.54 to 15.2 cm)	6.0 in. (15.2 cm)
	20 mils (0.51 mm)	1.0 to 8.5 in. (2.54 to 21.6 cm)	7.0 in. (17.8 cm)
	30 mils (0.76 mm)	1.0 to 8.5 in. (2.54 to 21.6 cm)	7.0 in. (17.8 cm)
	40 mils (1.02 mm)	1.0 to 8.5 in. (2.54 to 21.6 cm)	7.0 in. (17.8 cm)

Catalog Numbers 2755-LS7-SA and 2755-LS7-RA



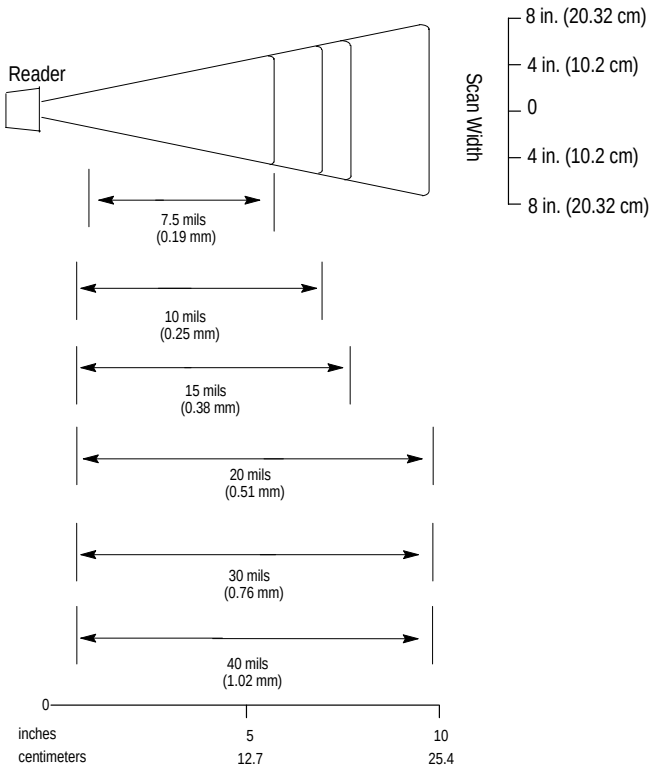
Distance From Front of Reader

Catalog Numbers 2755-LS7-SB and 2755-LS7-RB



Distance From Front of Reader

Catalog Numbers 2755-LS7-SBV and 2755-LS7-RBV



Calculating the Number of Scans

To ensure a successful read of a bar code symbol, the bar code symbol should be scanned 5 times. With fewer scans there will be more No Read counts, even when the symbol is good. If the symbol quality is poor, more scans per symbol may also be required.

If the number of scans you derive from one of the following calculations is less than the minimum for your application, put in the minimum number of scans and solve for another parameter that might be changed, such as label speed or scans per second.

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

Step Ladder Calculation

To calculate scans per symbol for step ladder applications, use the following formula.

$$S = \frac{R \times H}{C} - 3^{①}$$

S = Scans per Symbol (should be greater than 5)
R = Scan Rate
H = Symbol Height (length of bars of the symbol)
C = Conveyor Speed

① The –3 accounts for the incomplete scans at the beginning and end and one for the Automatic Gain Adjustment.

Conveyor speed and symbol height must be expressed in similar units. The calculation assumes that the reader is triggered for the entire time the symbol is present and the symbol has a 0° pitch.

Step Ladder Example

A bar code symbol is 1 inch tall. The conveyor speed is 10 inches per second. The scan rate is 500 scans per second. Substitute in the following values to determine the number of scans the bar code symbol will receive.

R = 500 scans/second
H = 1 inch
C = 10 inches/second

$$\frac{500 \times 1}{10} - 3 = 47 \text{ scans}$$

Picket Fence Calculation

To calculate scans per symbol for picket fence applications, use the following formula.

$$S = \frac{R\,(W-L)}{C} - 3^{①}$$

S = Scans per Label
R = Scan Rate
W = Scan Width at the Minimum Read Distance
L = Symbol Length (including quiet zones)
C = Conveyor Speed

① The –3 accounts for the incomplete scans at the beginning and end and one for the Automatic Gain Adjustment.

Scan width, symbol length, and conveyor speed must be expressed in similar units. The calculation assumes that the reader is triggered for the entire time the symbol is present and the symbol has a 0° pitch.

Picket Fence Example

A bar code symbol is 2 inches long. The conveyor speed is 10 inches per second. The scan rate is 500 scans per second. The scan width is 8 inches. Substitute in the following values to determine the number of scans the bar code symbol will receive.

R = 500 scans/second
W = 8 inches
L = 2 inches
C = 10 inches/second

$$\frac{500(8-2)}{10} - 3 = 297 \text{ scans}$$

Installing Your Hardware

This chapter provides the information needed to install the readers and interface boxes. Items include:

- installing the system hardware
- connecting system hardware together when using an interface box
- connecting system hardware together when using an auxiliary monitor
- connecting system hardware together when using a daisy-chain configuration
- connecting system hardware together when not using an interface box

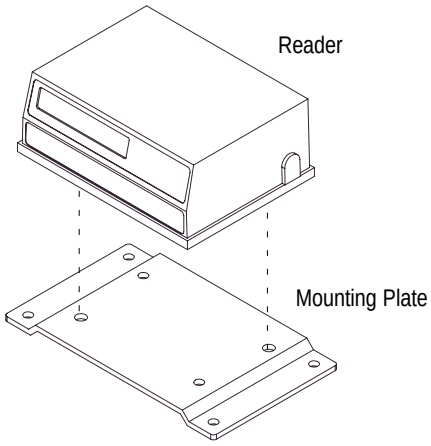
Installing the System Hardware

Refer to the following steps to install your system hardware properly.

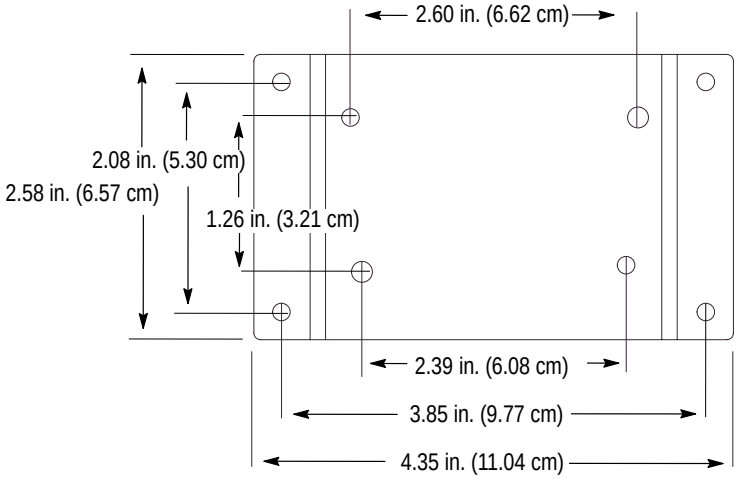
1. Make sure your scanner system is planned out properly. Refer to chapter 3 for information regarding planning your scanner system.
2. Mount the reader (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, or 2755-LS7-RBV) to the mounting plate (Catalog No. 2755-LS7-N) or directly to your mounting surface.

   The dimensions of the reader are shown on the next page. The dimensions of the mounting plate are shown below.

   The maximum distance from the reader to another device is 3 ft. (0.91 m). Use # 6 screws with maximum penetration of 0.15 in. (3.81 mm). If you are not using the mounting plate, go to step #4.



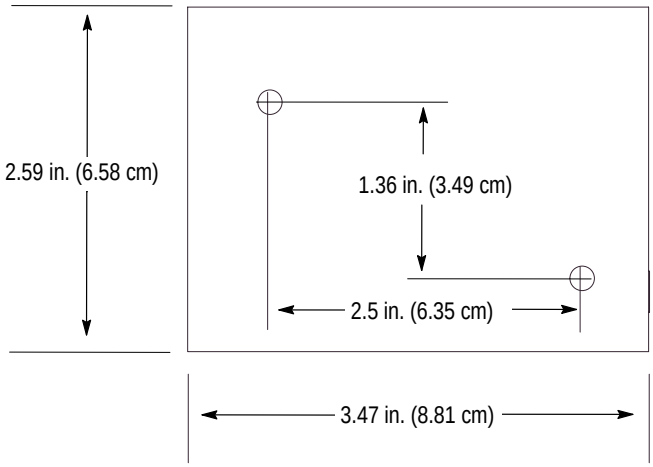
Note: The drawing below is not to scale.



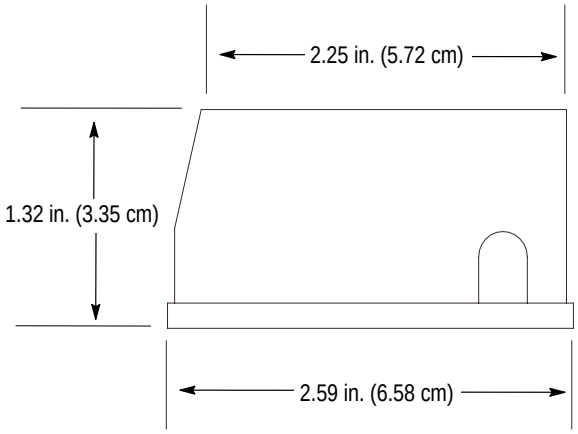
The dimensions of the readers are shown below.

Note: The drawing below is not to scale.

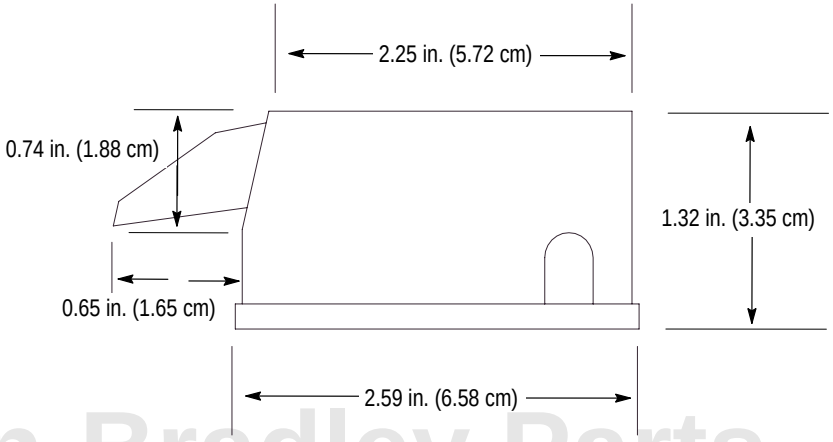
Bottom View



Side View (Catalog Nos. 2755-LS7-SA, -SB, -RA, and -RB)

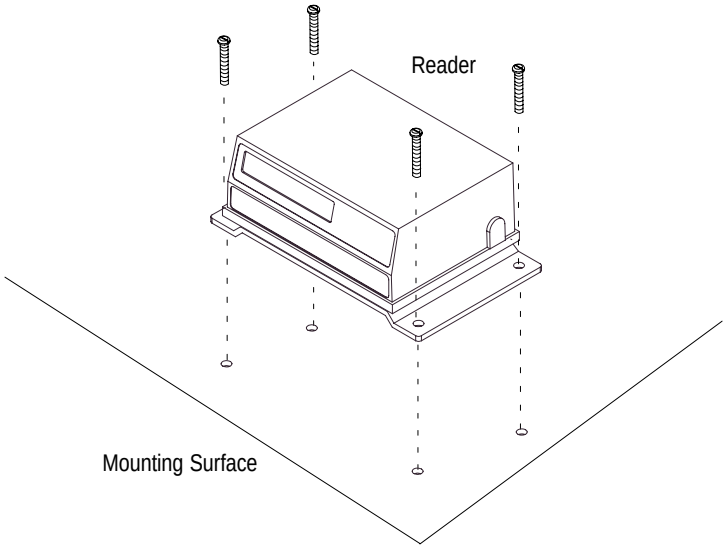


Side View (Catalog Nos. 2755-LS7-SBV and -RBV)

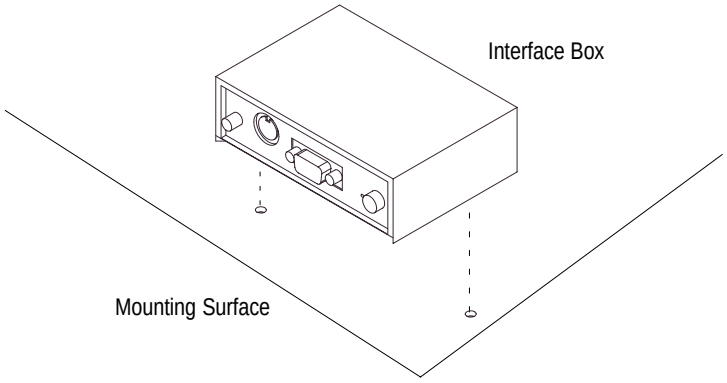


3. Mount the plate to your mounting surface. You can mount the plate to the top, bottom, or side of your mounting surface. Use # 6 screws.

Make sure placement of the mounting plate will allow you to connect the reader to the interface box (Catalog Nos. 2755-LS7-IB1 and 2755-LS7-IB2) or other network device. The maximum distance from the interface box to the reader is 3 ft. (0.91 m). Skip steps #4 and #5 if you are *not* using an interface box.



4. Mount the interface box to your mounting surface. Use # 6 screws with maximum penetration of 0.25 in. (6.35 mm).

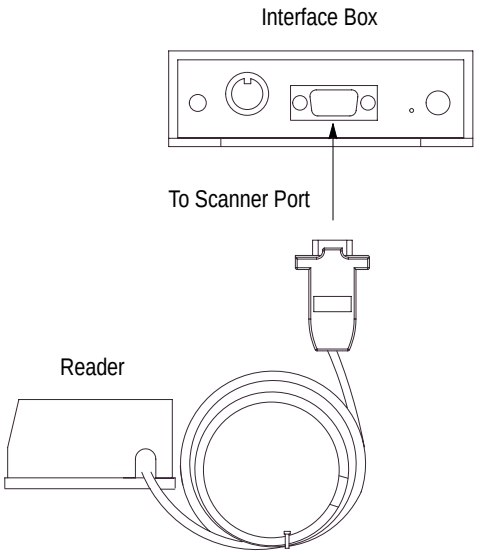


5. Place the power supply within 6 ft. (1.83 m) of the interface box.

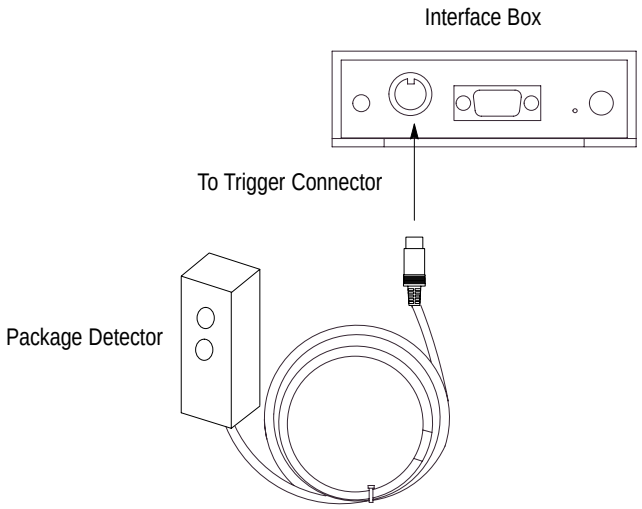
Connecting System Hardware Together When Using an Interface Box

Follow the steps starting below to connect your system hardware together when using an interface box. Refer to appendix B for cable pinouts.

1. Plug the reader into the interface box.



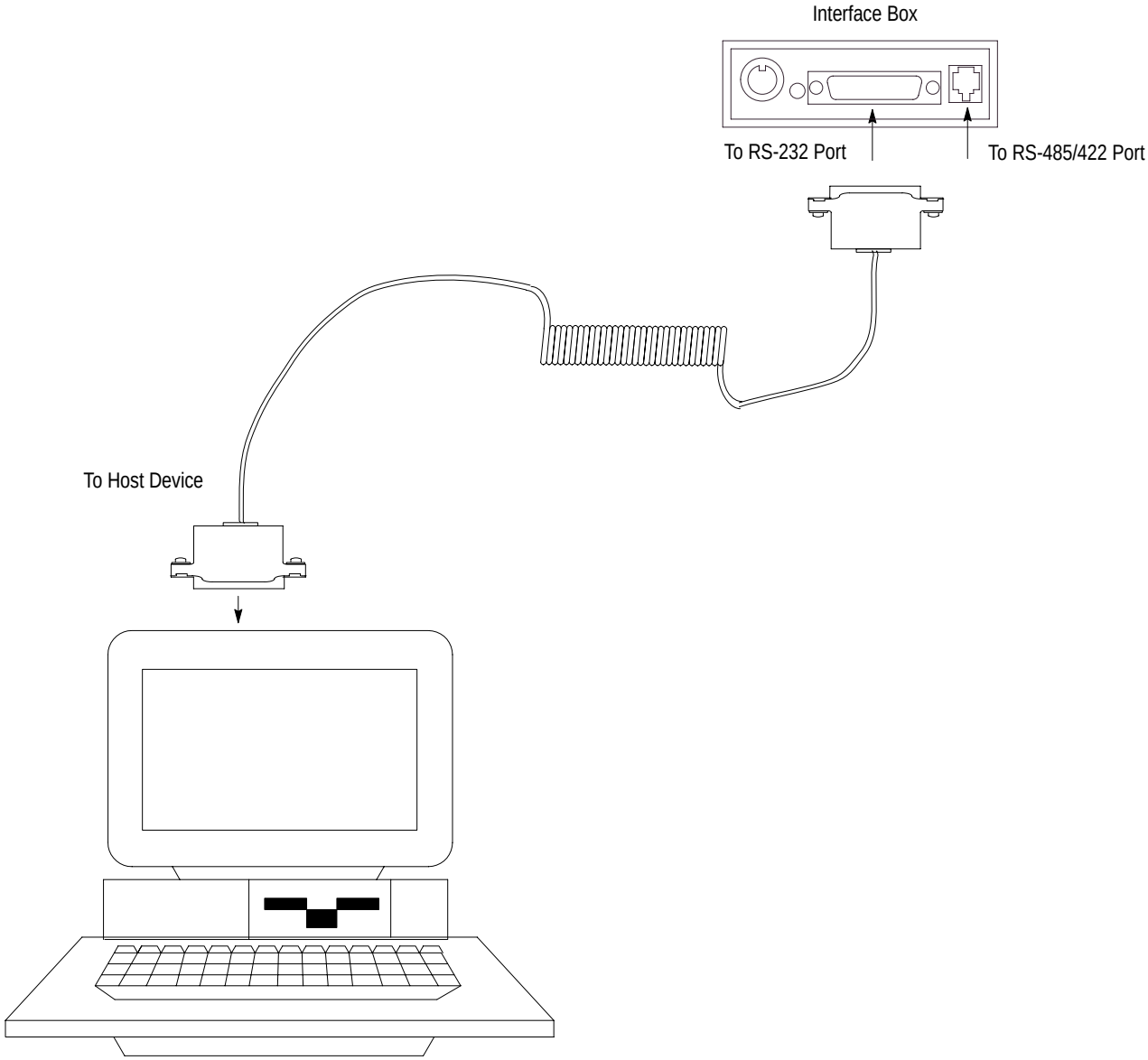
2. Plug any sinking package detect or relay options to the trigger connector port on the interface box. For example, use a Switchcraft connector (No. 12BL6M) or equivalent to connect to the trigger connector port. Contact Switchcraft at (312) 631–1234 for connector availability and pricing.



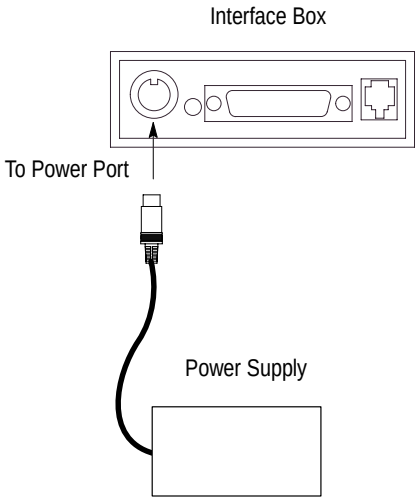
To wire the Switchcraft connector, refer to the following table. Contact your local Allen-Bradley sales office or distributor for more information regarding PHOTOSWITCH photoelectric sensors.

Switchcraft Connector Pin	Function of Connection	PHOTOSWITCH Wire Color
One	Trigger from switch	Black (Output)
Four	+12V dc from interface box	Brown
Five	Ground	Blue

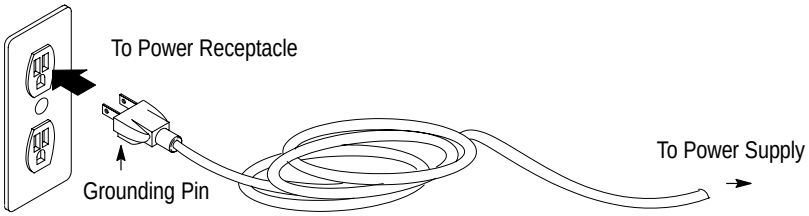
3. Plug host device or configuration terminal into the RS-232 or RS-485/422 port on the interface box. If you are using the RS-485/422 port, press the mode switch on the interface box to access the correct communication protocol.



4. Plug the power supply into the interface box.



5. Connect the power supply cable to the power supply and to the power receptacle supplying 100-240V ac.



6. Turn on the interface box.

If you are using a configuration terminal, you can now perform the configuration sequence. Refer to chapter 5 for the reader configuration sequence information.

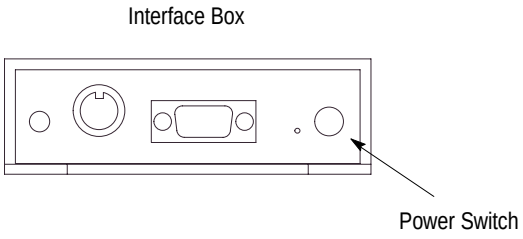
After performing the configuration sequence:

1. Turn off power to the reader.

2. Unplug the configuration terminal from the interface box.

3. Connect the interface box to the host device.

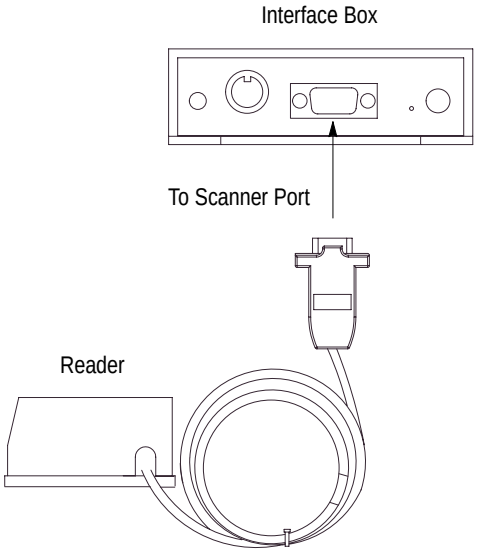
4. Turn on the interface box.



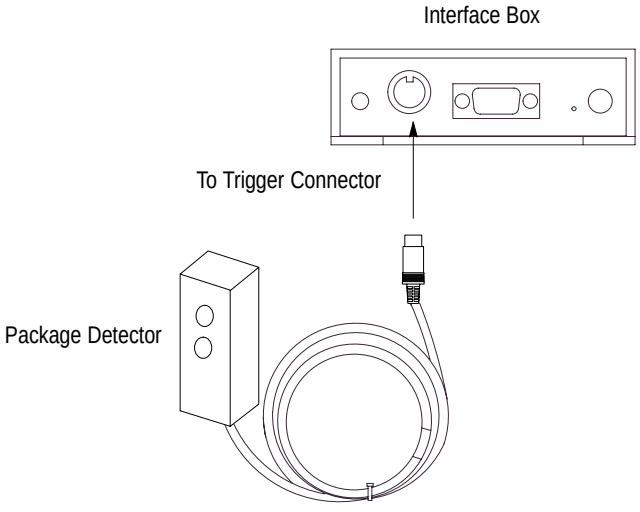
Connecting System Hardware Together When Using an Interface Box with an Auxiliary Monitor

Follow the steps starting below to connect your system hardware together when using an auxiliary monitor. You can only use Series B or higher of the reader when using an auxiliary monitor. Refer to appendix B and page 6–11 for cable pinouts.

1. Plug the reader into the interface box.



2. Plug any sinking package detect or relay options into the trigger connector port on the interface box. For example, use a Switchcraft connector (No. 12BL6M) or equivalent to connect to the trigger connector port. Contact Switchcraft at (312) 631–1234 for connector availability and pricing.

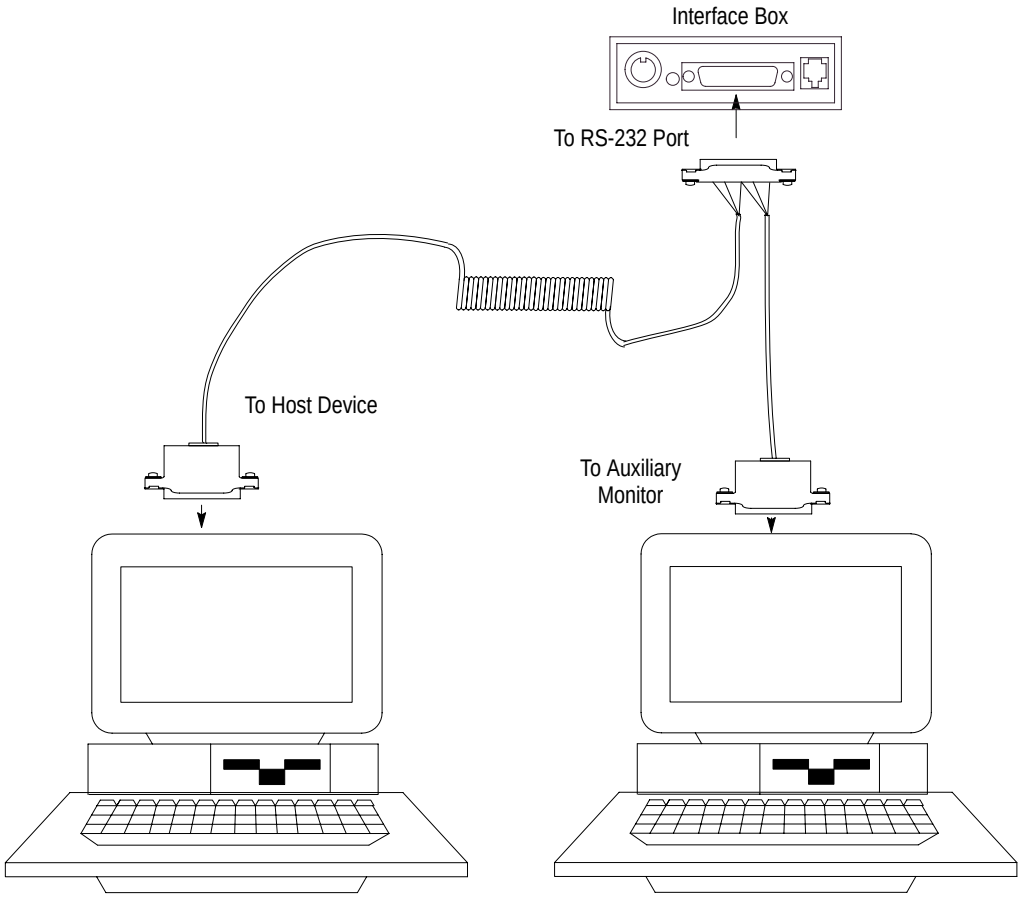


To wire the Switchcraft connector, refer to the following table. Contact your local Allen-Bradley sales office or distributor for more information regarding PHOTOSWITCH photoelectric sensors.

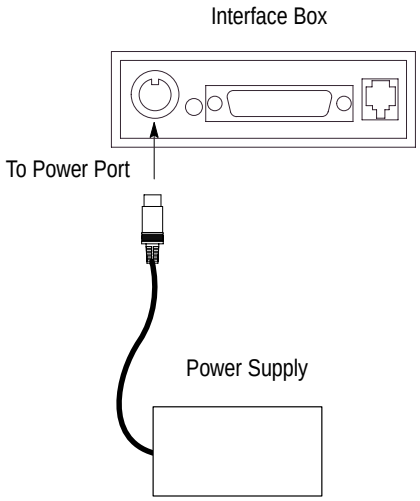
Switchcraft Connector Pin	Function of Connection	PHOTOSWITCH Wire Color
One	Trigger from switch	Black (Output)
Four	+12V dc from interface box	Brown
Five	Ground	Blue

3. Construct a cable that has three 25-pin connectors and will allow you to connect the host device or configuration terminal, interface box, and auxiliary port together. Refer to appendix B and page 6–11 for information regarding cable pinouts.

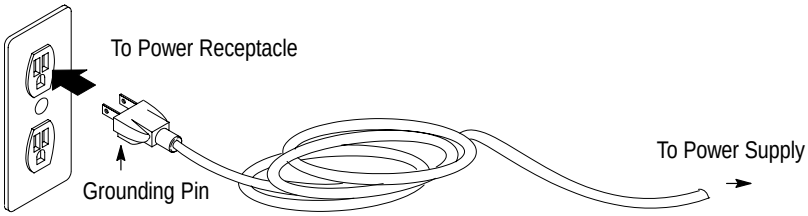
4. Connect the interface box to host device or configuration terminal and auxiliary port.



5. Plug the power supply into the interface box.



6. Connect the power supply cable to the power supply and to the power receptacle supplying 100-240V ac.



7. Turn on the interface box.

If you are using a configuration terminal, you can now perform the configuration sequence. Refer to chapter 5 for the reader configuration sequence information.

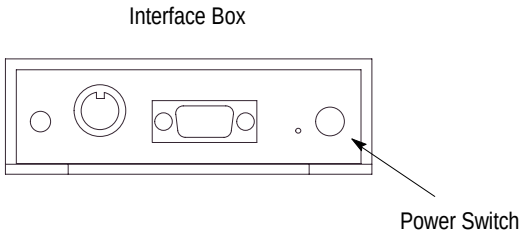
After performing the configuration sequence:

1. Turn off power to the reader.

2. Unplug the configuration terminal from the interface box.

3. Connect the interface box to the host device.

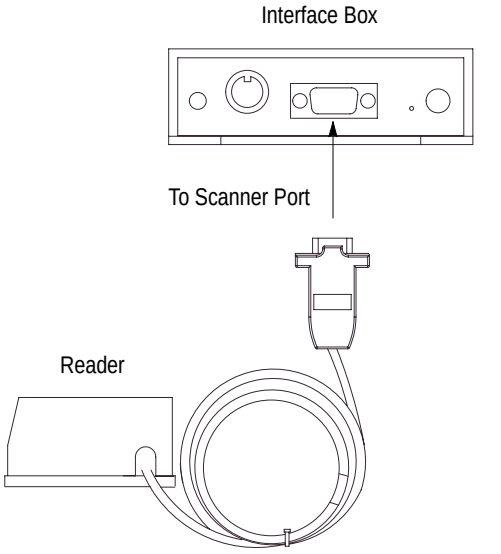
4. Turn on the interface box.



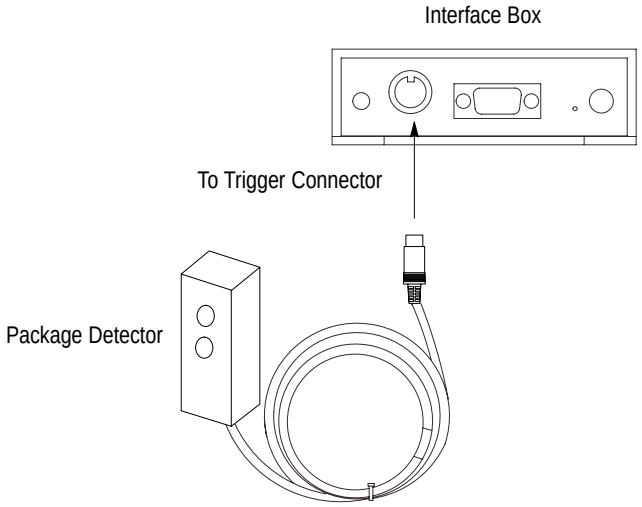
Connecting System Hardware Together When Using an Interface Box in a Daisy-Chain Configuration

Follow the steps starting below to connect your system hardware together when using an interface box. You can only use Series B or higher of the reader when using the daisy-chain configuration except for the last reader used in the chain. Refer to appendix B and page 6–9 for cable pinouts.

1. Plug each reader into a separate interface box.



2. Plug any sinking package detect or relay options to the trigger connector port on each of the interface boxes. For example, use a Switchcraft connector (No. 12BL6M) or equivalent to connect to the trigger connector port. Contact Switchcraft at (312) 631–1234 for connector availability and pricing.

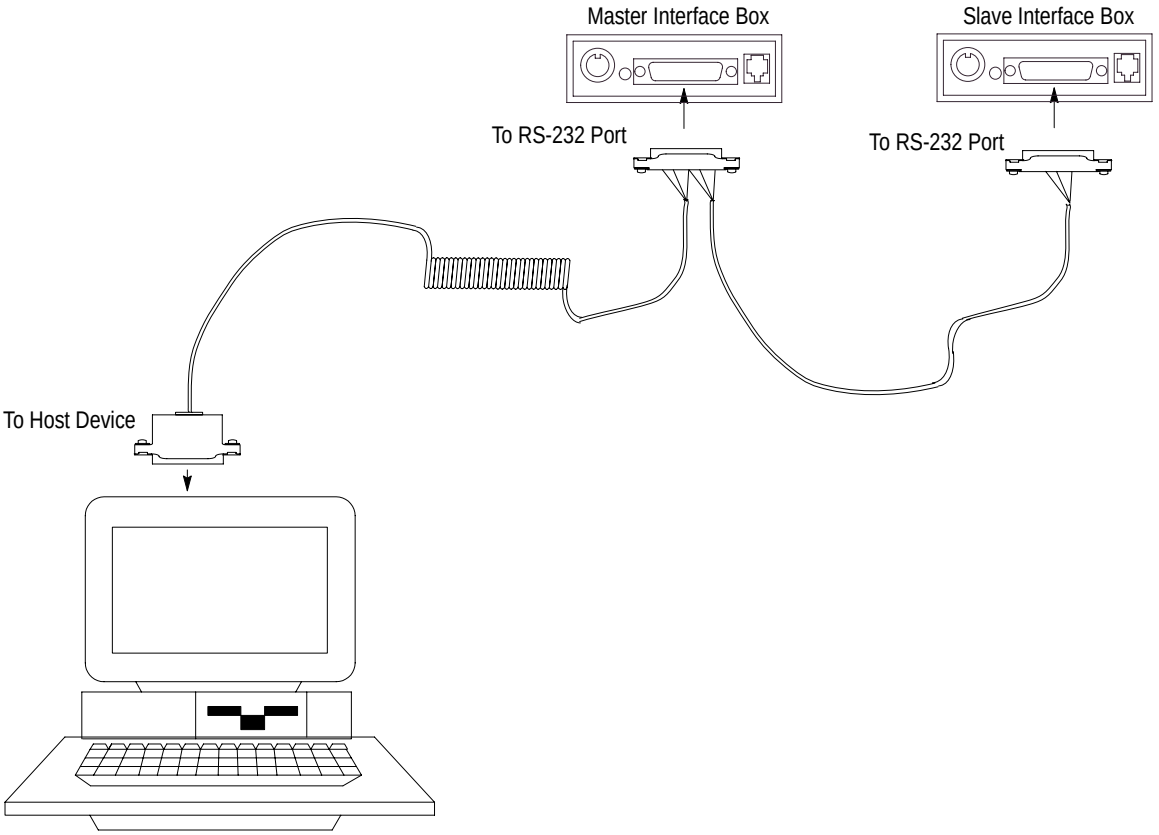


To wire the Switchcraft connector, refer to the following table. Contact your local Allen-Bradley sales office or distributor for more information regarding PHOTOSWITCH photoelectric sensors.

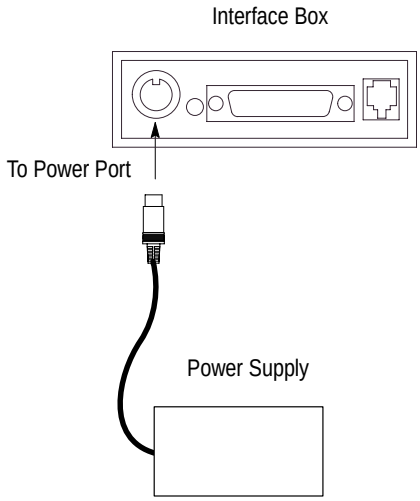
Switchcraft Connector Pin	Function of Connection	PHOTOSWITCH Wire Color
One	Trigger from switch	Black (Output)
Four	+12V dc from interface box	Brown
Five	Ground	Blue

3. Construct a cable that has 25-pin connectors and will allow you to connect the host device or configuration terminal and interface boxes together. Refer to appendix B and page 6–9 for information regarding cable pinouts.

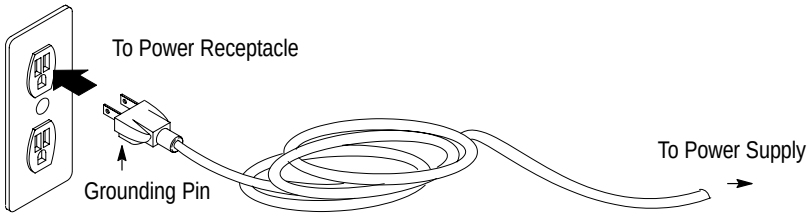
4. Connect the master interface box to the host device or configuration terminal and slave interface box. (The master interface box is connected to the master reader and the slave interface box is connected to the slave reader.)



5. Plug a power supply into each interface box.



6. Connect a power supply cable to each power supply and to the power receptacle supplying 100-240V ac.

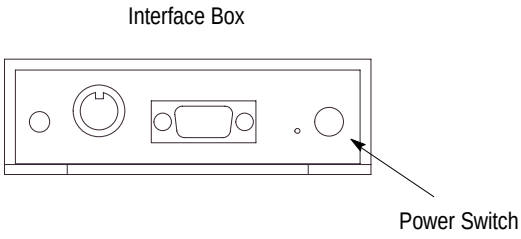


7. Turn on each interface box.

If you are using a configuration terminal, you can now perform the configuration sequence for the master reader. Refer to chapter 5 for the reader configuration sequence information.

After performing the configuration sequence on the master reader:

1. Turn off power to the master reader.
2. Unplug the configuration terminal from the master interface box.
3. Connect the master interface box to the host device.
4. Turn on the master interface box.



5. Turn off power to the slave reader.

6. Disconnect the slave interface box from the master interface box.
7. Connect the configuration terminal to the slave interface box.
8. Turn on the slave interface box.
9. Configure the slave reader. Refer to chapter 5 for the reader configuration sequence information.
10. Turn off power to the slave reader.
11. Unplug the configuration terminal from the slave interface box.
12. Connect the slave interface box to the master interface box.
13. Turn on the slave interface box.

Connecting System Hardware Together When Not Using an Interface Box

Follow the steps below to connect your system hardware together when *not* using an interface box.

1. Determine which pins on the reader cable connector are needed. Refer to appendix B for a listing of the connector pins of the reader cable.

2. Construct a mating cable that attaches to the reader cable on one end and to the other devices on the other end, used in the application. These devices include:
   - RS-232 host device
   - 5 V, 500 mA power supply
   - package detect sensor
   - new master input
   - default configuration input
   - devices connected to the reader which uses the TTL relay outputs

3. Plug the reader into the mating cable.

4. Plug the mating cable into the host device, power supply, and other devices as required by the application.

Configuring Your Reader

This chapter describes the configuration options for the readers. Items include:

- menu configuration
- serial configuration
- decode test
- adjusting reader parameters

Menu Configuration

You can change the reader's configuration through the use of menus. Follow the steps starting below to change the reader's configuration.

To Access the Reader Configuration Main Menu

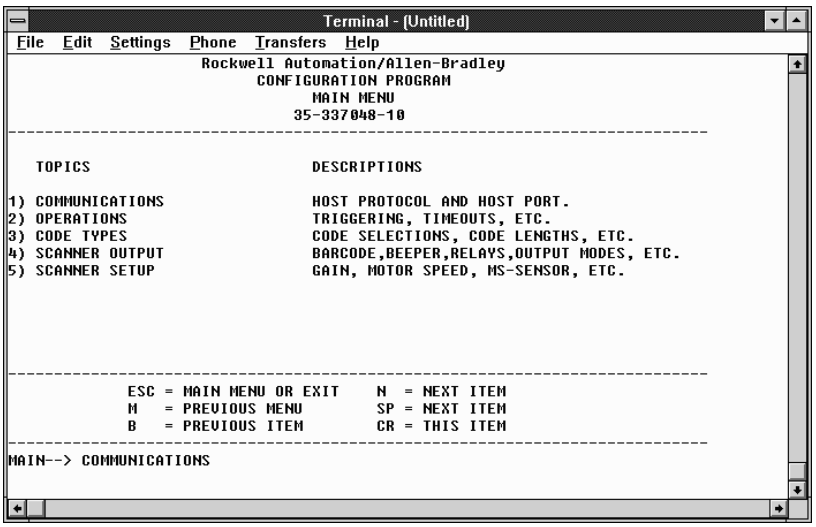
1. Make sure you have a terminal utility software running on your configuration device.
2. Check the following communication port parameters on your configuration device. Make sure the parameters match the settings listed below. If the parameters do not match, communication between the reader and configuration device will not occur.

Description	Default Setting
Baud Rate	9600
Parity	Even
Stop Bits	One
Data Bits	7

3. Read a test bar code to verify that the default settings are correct (i.e., the reader is communicating with the host device. The bar code value will appear on the screen.). If you cannot read a test bar code:
   - verify that you are using the correct communication cable or
   - default the reader directly or via the interface box. Refer to chapter 6 for information regarding defaulting the readers.

   Also refer to chapter 7 for information regarding troubleshooting the readers.

4. Press **[<D>]** to access the Main menu. The Main menu appears:

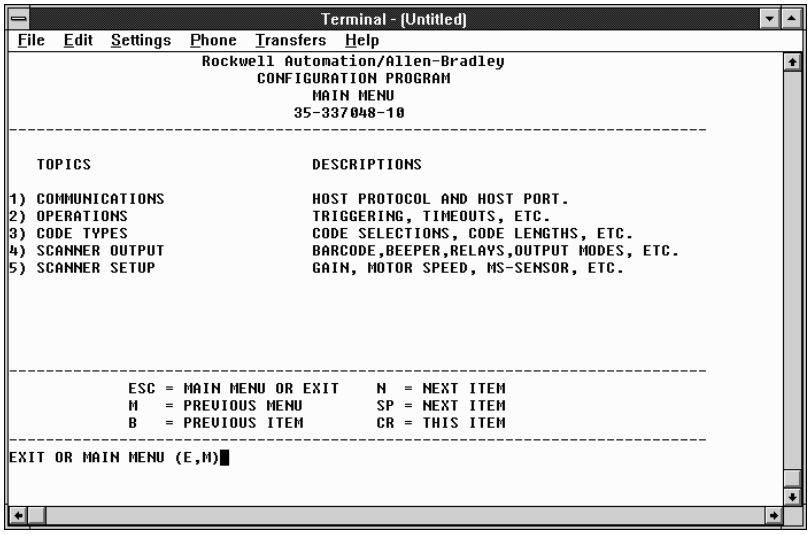


The bottom line on the screen is called the command line. The command line identifies your place in the menu program, shows current status, and allows you to review and change options. Use the designated keys to scroll to and select the parameter you wish to change. Press space bar key (SP) or **[N]** to scroll ahead, **[B]** to scroll back, carriage return key (CR) to select, and **[M]** to return to the previous higher level menu. To return to the Main menu at any time, press **[ESC]** and **[M]**.

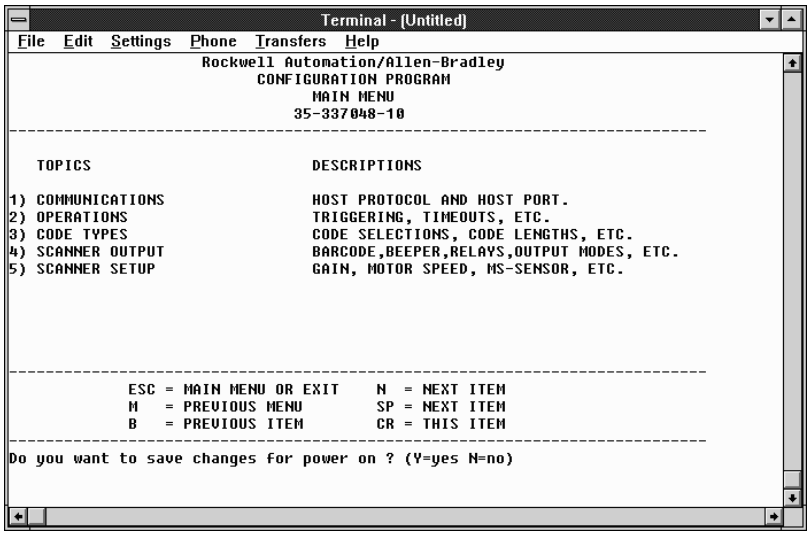
Saving Menu Changes

To save menu changes:

1. Press **[ESC]** to see the following on the command line.



2. Press **[M]** to return to the Main menu, or press **[E]** to exit the Menu Configuration program. If **[E]** is pressed, the following screen will appear.



3. Press **[N]** to exit without saving changes, or press **[Y]** to retain the current settings for power-on. If **[Y]** is selected, a second beep will indicate the save has been carried out.

Note: Unlike most configuration settings, Scanner Type, Scans per Second, and Gain Adjustment are not saved for power-on (but are initialized) when you press **[Y]**. To save new settings to NOVRAM for these parameters, press **[<ZP>]**.

Losing Communication

Making changes to communications parameters such as Baud Rate, Parity, Stop Bits, LRC, etc. without corresponding changes in linked device(s), can result in the loss of menu access. If this loss occurs, default the reader with the <Zd> Restore/Save Default Configuration for Power-on command.

Note: Defaulting the reader will reset all configuration parameters to their original default values except Scanner Type, Scans per Second, and Gain Adjustment. Power must be available to the reader during the default procedure.

Defining Special Characters

To define any control character from the ASCII table, press the space bar once. Then enter the control character by holding down the control key and simultaneously pressing the desired character. For example, to define a line feed, press the space bar and then **[Control]** and **[J]** simultaneously. The result is displayed as ^J on the command line and as <LF> in the menu when the screen is refreshed.

To define CR as a character, press the space bar, then **[Control]**. It is displayed as ^M on the command line and as <CR> in the menu when the screen is refreshed.

To define a space as a character, press the space bar twice. It is displayed as a blank space in the menu when the screen is refreshed. While it appears that nothing has been assigned, the hex value 20 will be sent during data transmission.

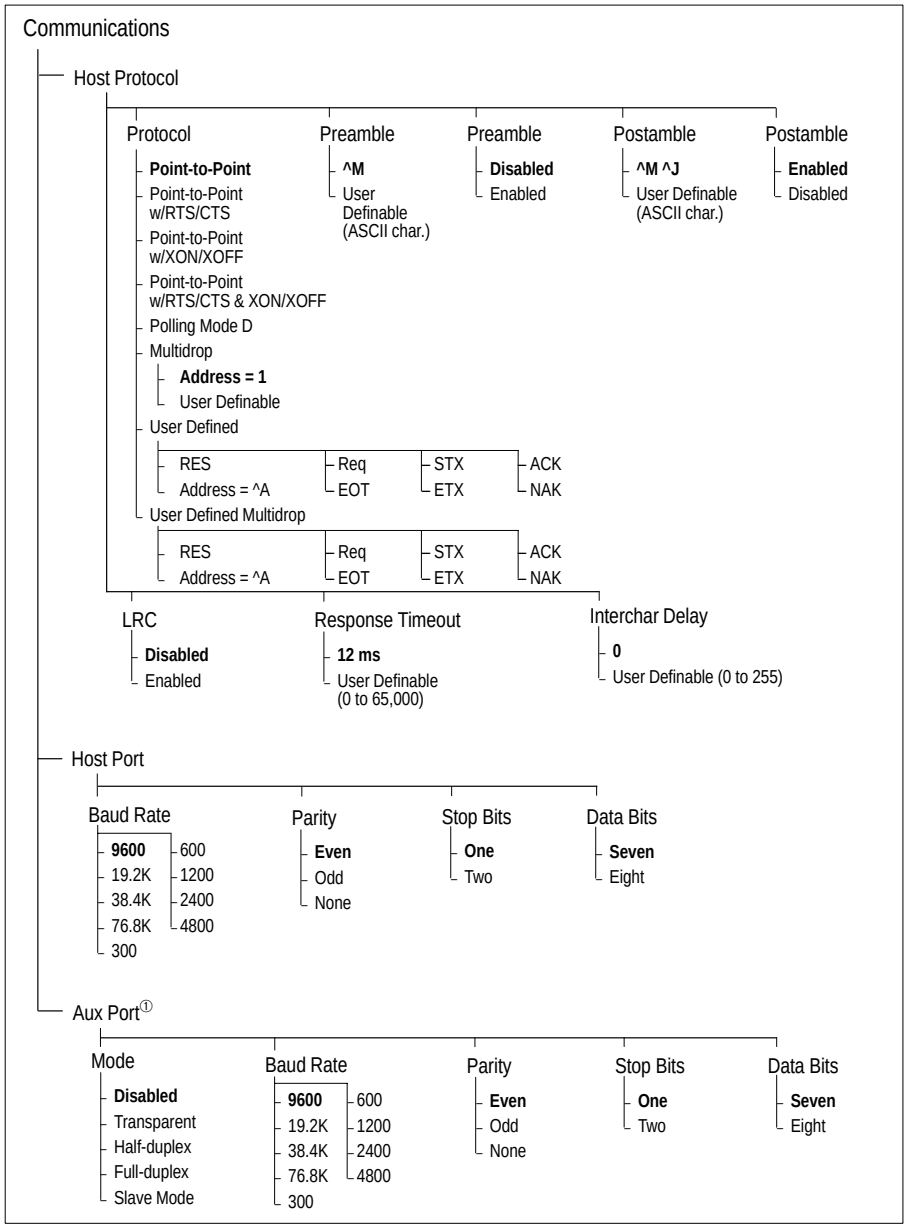
To select NUL as a character, press the space bar, then a **[0]** (zero). It is displayed as <NUL> in the menu when the screen is refreshed.

Communications Menu

The Communications menu allows you to set the communication protocols between the reader and the host device.

Note: Changes in communications parameters or assigning an address to the reader can cause loss of communications with the configuration terminal when you exit the menu program (whether or not changes are saved for power-on).

The Communications menu is shown below. Default settings are in **bold** type face.



① The auxiliary port is available through the interface box (Catalog Nos. 2755-LS7-IB2 or -IB2).

Host Protocol Parameters

- Protocol. Protocols define the sequence and format in which information is transferred between devices. The protocol options are listed in the following table.

Parameter	Description
Point-to-Point	Has no address and sends data to the host (RS-232) whenever it is available and without any request or handshake from the host.
Point-to-Point with RTS/CTS (Request-to-Send/Clear-to-Send)	Used only with RS-232. This is a simple handshaking protocol that allows a device to initiate data transfers to the host with an RTS (request-to-send) transmission. The host, when ready, responds with a CTS (clear-to-send) and the data is transmitted. CTS and RTS signals are transmitted over two dedicated wires (pins 6 and 10) as defined in the RS-232 standard.
Point-to-Point with XON/XOFF (Transmitter On/Off)	Used only with RS-232. This selection enables the host to send a single byte transmission command of start (XON) or stop (XOFF). If an XOFF has been received from the host, data will not be sent to the host until the host sends an XON. During the XOFF phase, the host is free to carry on other chores and accept data from other devices.
Point-to-Point with RTS/CTS & XON/XOFF	Used only with RS-232. It is a combination of Point-to-Point with RTS/CTS and Point-to-Point with XON/XOFF.
Polling Mode D	Like Point-to-Point, Polling Mode D requires a separate connection to the host; but unlike Point-to-Point, it requires an address and must wait for a poll from the host before sending data. When in Polling Mode D, an address of 1 is automatically displayed on the configuration screen. However, during transmission, a 1C hex poll address (FS) and a 1D hex select address (GS) are substituted for the 1.
Multidrop①	Similar to Polling Mode D except that a unique poll address and select address are required for each multidrop device, and only one host port connection is needed for up to 50 devices. Requires a concentrator or controller using RS-485 communications. When Multidrop is selected, the protocol characters for RES, REQ, etc. are assigned automatically.
User Defined	Used only with RS-232. ASCII characters can be assigned as an address and as protocol commands (RES, REQ, EOT, STX, ETX, ACK, and NAK). User Defined is necessary when a new protocol must be defined to match a specific host protocol. When User Defined is selected, the displayed protocol commands match those of the previously selected protocol. User Defined is considered to be in a polled mode only if an address has been assigned. The address can be any ASCII character except NUL②.
User Defined Multidrop	Used when connecting to a concentrator or other device that does not match standard Multidrop protocol. Any single character (01 hex to 7E hex) in the ASCII table can be assigned as the address character. The character chosen is used as the poll character and the subsequent ASCII character becomes the select character. For example, if a ^A (01 hex) is selected as the address, ^B (02 hex) becomes the select address that the host will use in sending host select commands.

① Once the reader is configured for Multidrop, a terminal connected to the auxiliary RS-232 pins or a default procedure must be used to access the configuration menus again (although serial commands will continue to function).

② For example a simple ACK/NAK protocol can be developed by first selecting Point-to-Point, then User Defined, and then assigning characters to ACK and NAK commands. First scroll to the following command:

HOST PROTOCOL --> PROTOCOL --> USER DEFINED--> ACK = --> Press **[^F]** by holding down the Control key while pressing the F key, and then press **[CR]** to see the following:
HOST PROTOCOL --> PROTOCOL --> USER DEFINED --> ACK = ^F

Note: Definitions of commands in User Defined and User Defined Multidrop must be duplicated in host applications to enable poll and select sequences to execute correctly during transmission.

Typically, parameters in User Defined Multidrop are defined by first enabling Multidrop, then enabling User Defined Multidrop. This pre-loads Multidrop characters into the parameters. You then change individual characters to match the host or other requirements.

- Preamble. Allows you to define a one or two character data string that can be added to the front of the decoded data. For example, a carriage return and line feed would display each decoded message on its own line.
- Preamble. Allows you to enable or disable the preamble character(s).
- Postamble. Allows you to define a one or two character data string that can be added after the decoded message.
- Postamble. Allows you to enable or disable the Postamble character(s).
- Longitudinal Redundancy Check (LCR). An error-checking routine that verifies the accuracy of transmissions. It is the exclusive OR of all characters following the SOM (start of message) up to and including the EOM (end of message).
- Response Timeout. Allows you to set the time the reader will wait before timing out if ACK, NAK, and ETX are enabled, and a host response is expected.
- Intercharacter Delay. Allows you to set the time interval in milliseconds between individual characters transmitted from the reader to the host. A high setting will significantly slow down communications. For example, a 200 setting will result in a 1/5 second delay between each transmitted character.

Host Port Parameters

- Baud Rate. Allows you to set the number of bits transmitted per second.
- Parity. Allows you to select an error detection routine in which one data bit in each character is set to 1 or 0 so that the total number of 1 bits in the data field is even or odd.
- Stop Bits. Allows you to select the last one or two bits in each character to indicate the end of the character.
- Data Bits. Allows you to establish the total number of bits in each character.

Auxiliary Port Parameters

Auxiliary Port Parameters allow you to set communications parameters between daisy-chained readers or between the reader and an auxiliary monitor. An auxiliary monitor can be used to configure the menus, send data to the host, and display data transmissions originating from the host or reader. The auxiliary port cannot be used in conjunction with RS-485 or RTS/CTS on the host port.

Note: The Aux Port baud rate should never exceed Host Port baud rate or auxiliary port data could be lost.

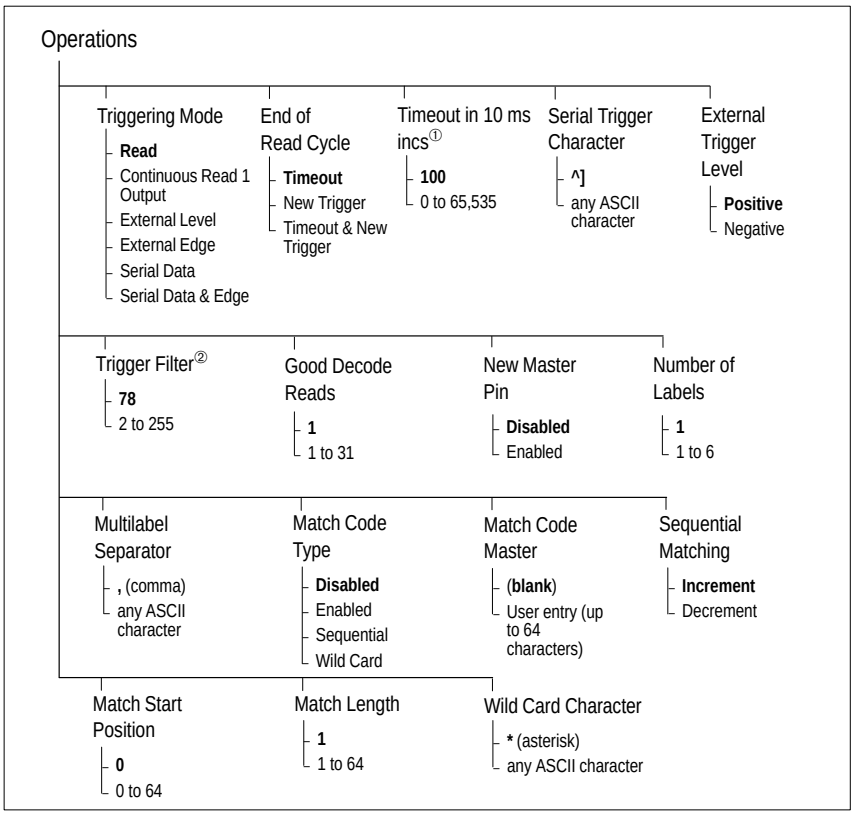
- Mode.

Parameter	Description
Disabled	Data is not sent to the auxiliary monitor.
Transparent	Used to batch data from the auxiliary monitor to the host. The decoder buffers data from the auxiliary monitor and displays the keyed data on the auxiliary monitor. The decoder transmits auxiliary monitor data to the host when a label is scanned or a carriage return is entered from the auxiliary monitor. Transparent mode can work with all protocols.
Half-duplex	Operates exactly like Full-duplex except that the bar code data is displayed on the auxiliary monitor screen at the same time the data is sent to the host. Half-duplex mode can work with all protocols except polled protocols. The auxiliary characters are echoed to the host without the optional inter-character delay and without checking for the optional XON/XOFF status.
Full-duplex	All the auxiliary monitor data and bar code data is sent directly to the host. The bar code data is not displayed on the auxiliary monitor screen. Full-duplex mode can work with all protocols except polled protocols. The auxiliary characters are echoed to the host without the optional inter-character delay and without checking for the optional XON/XOFF status.
Slave	Allows a reader connected to the auxiliary port to input data replacing the no read message. In a daisy-chain setup, Slave Mode is enabled in the master reader and all slave readers except the last one in line because the last one in line does not use the auxiliary port pins.

- Baud Rate. Allows you to set the number of bits transmitted per second.
- Parity. Allows you to select an error detection routine in which one data bit in each character is set to 1 or 0 so that the total number of 1 bits in the data field is even or odd.
- Stop Bits. Allows you to select the last one or two bits in each character to indicate the end of the character.
- Data Bits. Allows you to establish the total number of bits in each character.

Operations Menu

The Operations menu, shown below, allows you to set the operations parameters for the reader. Default settings are in **bold** type face.



① Divide the number entered on the command line by 100 for time in seconds.

② Multiply the number entered on the command line by 128 for time in microseconds, then divide by 1000 for time in milliseconds.

- Triggering Mode. Allows you to establish the type of trigger event that will initiate or end the read cycle. The trigger event options are listed in the following table.

Parameter	Description
Continuous Read	Trigger input options are disabled and the reader is always in the read cycle. Bar code data is decoded, and label information is transmitted repeatedly, as long as the label is in the read range of the reader. When To Output options have no affect on Continuous Read. Continuous Read is useful in testing label or reader functions. If both Continuous Read and Match Code are enabled the reader defaults to Continuous Read, 1 Output mode.
Continuous Read, 1 Output	Label data is immediately transmitted once every time new label data is placed in front of the reader. With Timeout enabled for End Of Read Cycle, if the label doesn't change, the reader will repeat the output at the end of each subsequent timeout period. For example, if Timeout were set to one second, the reader would output the label data immediately, and then repeat the output at intervals of one second, for as long as the label continued to be scanned. With Timeout disabled (that is, End Of Read Cycle set to New Trigger), the reader will output the current label data immediately, but output it only once. A new label appearing at any time in the scan range will produce a new read output as long as the new label is not identical to the previous label. Enabling Continuous Read, 1 Output when Number of Labels is set to any number greater than one will cause Number of Labels to default back to one.
External Level	Allows a read cycle to be initiated by a trigger signal from a package detector when a package appears within the detector's range. The read cycle exists as long as the detector "sees" the package and ends when the package moves out of the detector's range①.
External Edge	As with Level, Edge allows a read cycle to be initiated by a trigger signal from a package detector when it detects the appearance of a package (rising edge). But unlike Level mode, the removal of a package (falling edge) does not end the read cycle. With Edge enabled, the read cycle ends with a good read output, a timeout, or a new trigger.
Serial Data	The reader accepts an ASCII character from the host or controlling device as a trigger to start a read cycle. Serial data trigger behaves the same as External Edge.
Serial Data and External Edge	The reader accepts either an external trigger or a serial ASCII command to start a read cycle.

① Level and Edge apply to the active logic state (positive or negative) that exists while the package is in a read cycle, between the rising edge and falling edge. Rising edge is the trigger signal associated with the appearance of a package. Falling edge is the trigger signal associated with the subsequent disappearance of the package.

- End of Read Cycle. Allows you to choose the circumstances that will end the read cycle. The read cycle is the time during which the reader will receive and process label data. When the Triggering Mode option is set in an External or Serial mode of operation, the trigger event initiates the read cycle.

  Note: When operating in Continuous Read or Continuous Read, 1 Output, the reader is always in the read cycle.

  The End of Read Cycle options are listed in the following table.

Parameter	Description
Timeout	Can end the read cycle after a specified period of time, and if no label has been read, causes a no read message, if enabled, to be transmitted. With either External Edge, Serial Data, or Serial Data & Edge enabled, a timeout ends the read cycle. With External Level enabled, the read cycle does not end until the falling edge trigger occurs, and the next read cycle does not begin until the next rising edge trigger. With Continuous Read, 1 Output enabled, a timeout initiates a new read cycle and allows the same label to be read again.
New Trigger	Ends the read cycle at the occurrence of a new trigger event, and if no label has been read, causes a no read message, if enabled, to be transmitted at the occurrence of the new trigger event. With either External Edge, Serial Data, or Serial Data & Edge enabled, an edge or serial trigger ends a read cycle and initiates the next read cycle. With External Level enabled, a falling edge trigger ends a read cycle. However, the next read cycle does not begin until the occurrence of the next rising edge trigger.
Timeout and New Trigger	Ends the read cycle after a specified period of time or at the occurrence of new trigger event, and if no label has been read, causes a no read message, if enabled, to be transmitted. With either External Edge, Serial Data, or Serial Data & Edge enabled, a timeout, or an edge or serial trigger, whichever comes first, ends the read cycle. With External Level enabled, the read cycle does not end until the occurrence of a falling edge, and the next read cycle does not begin until the next rising edge trigger.

- Timeout. Allows you to define the duration of the timeout period in 10 millisecond increments.
- Serial Trigger Character. Allows you to define a single ASCII character as the host serial trigger character that initiates the read cycle. The serial trigger is considered an on-line host command and requires the same command format as all host commands (that is, to be entered within the < > brackets).

  Note: Serial Data or Serial Data & Edge must be enabled for Serial Trigger Character to take effect. “N/A” is displayed in the menu when all other triggering modes are enabled.

- External Trigger Level. Allows you to determine whether a positive or negative transition will initiate the read cycle.

  Note: External Level, External Edge, or Serial Data & Edge must be enabled for External Trigger Level to take effect. "N/A" is displayed in the menu when all other triggering modes are enabled.

- Trigger Filter. Allows you to set a trigger bounce filter duration.
- Good Decode Reads. Allows you to select the number of good reads (from 1 to 31) required per label before a good decode output.

  Note: Be sure to set the value within the determined scan rate for the scanning setup so that the reader is capable of scanning a label the required number of times.

- Match Code Type. When enabled, allows you to enter a master label into the reader's memory to be compared with subsequently scanned labels. The Match Code Types are listed in the table below.

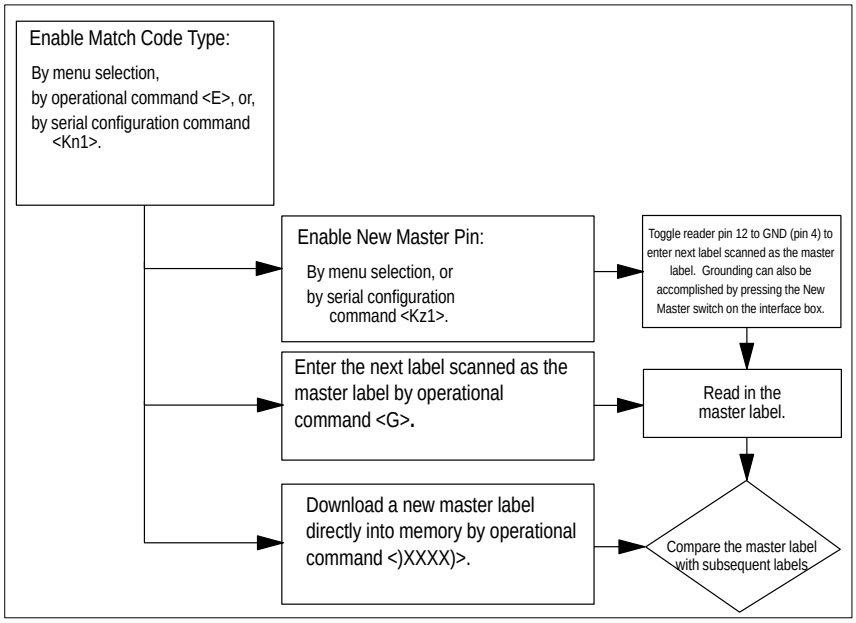
Selecting	Causes
Disabled	no effect on reader operation.
Enabled	the reader to compare labels or portions of labels with the master label.
Sequential	the reader to compare labels or portions of labels for sequential numbers in ascending or descending order.
Wild Card	you to enter user defined wild card characters in the master label. For example, you have a ten digit label of which only the first six digits "URGENT" need to match. You can enter URGENT**** as your master label, assuming of course that the wild card is currently defined as the default asterisk (*).

With Match Code Type enabled, a master label can be entered three ways as shown on page 5–13.

Note: A triggered mode must be enabled for Match Code Type to take effect.

Note: Enabling Match Code Type when Number of Labels is set to any number greater than one will cause Number of Labels to default back to one.

Note: If you wish to send a pulse on a Good Read, Match Code Type must be disabled.



- New Master Pin. Allows you to momentarily connect pin 12 to ground in order to clear any existing master label information from memory and allows the next label to be read as the new master label information.

  Note: Match Code and a triggered mode must be enabled for New Master Pin to take effect.

- Number of Labels. Allows you to choose the number of different labels that will be read in a single trigger event. The following conditions apply.
  - Each label must be different to be read.
  - The maximum number of characters in any one label is 64.
  - The maximum number of characters in a single scan line is 384.
  - The maximum number of characters for all labels is 384, including preamble, postamble, and all spaces and commas.
  - All no read messages are posted at the end of the data string.
  - If more than one label is within the scan beam at the same time, label data may not be displayed in the order of appearance.

  Note: If Number of Labels is set to any number greater than one while Match Code or Continuous Read, 1 Output is enabled, Number of Labels will default back to one.

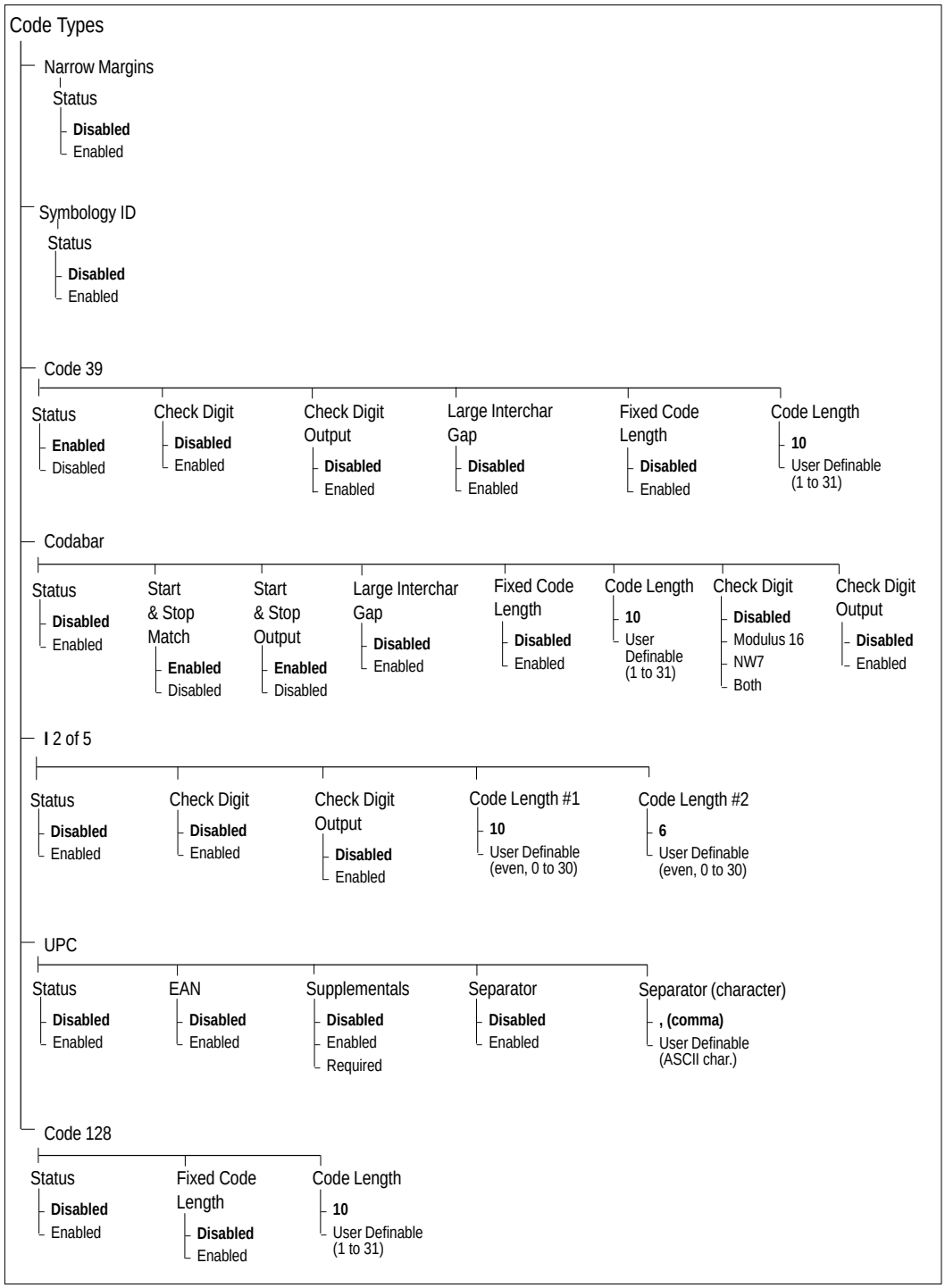
- Multilabel Separator. Allows you to choose the separator character to be inserted between each label.

- Match Code Master. Allows you to edit an existing master or type in a new master label from your keyboard. You can display current master and accept entry up to 64 characters.
- Sequential Matching. Defines the order (ascending or descending) in which labels will be compared when Match Code Type is set to Sequential.
- Match Start Position. Defines the first character in the label (from left to right) that will be compared with those of the master label when Match Code Type is set to Enabled or Sequential. For example, if you set Match Start Position to 3, the first 2 characters read in the label will be ignored and only the 3rd and subsequent characters to the right will be compared, up to the number of characters specified by Match Length. Match Start Position must be set to one or greater to enable this feature.
- Match Length. Defines the length of the character string that will be compared with that of the master label when Match Code Type is set to Enabled or Sequential and Match Start position is set to 1 or greater. For example, If Match Length is set to 6 in a 10 character label, and Match Start Position is set for 2, only the 2nd through 7th characters (from left to right) will be compared.
- Wild Card Character. Allows you to define the Wild Card Character that can be used when defining a Master Label. A Master label can be entered 4 different ways.
  - By typing in from the keyboard at the command line of the Operations menu under Match Code Master.
  - With New Master Pin enabled, toggling reader pin 12 to ground (or by momentarily pressing the New Master button on the interface box) will save the next label read as the master label.
  - Pressing **[<G>]** allows the next label read to be the master label.
  - Sending a serial command in the format <)XXXX)> downloads data as the master label.

Code Types Menu

The Code Types menu, shown below, allows you to choose among five bar code types and define their parameters. Default settings are in **bold** type face.

Options can be defined for any bar code type whether or not the bar code itself is enabled at the time.



Narrow Margins

Allows the reader to read bar codes with quiet zones less than 10 times the narrow-bar-width. Quiet zone is a term used to describe the minimum space at the leading and trailing ends of a label. Each quiet zone can be as small as five times the narrow bar element when Narrow Margins is enabled.

Symbology ID

The symbology ID is a string of 3 characters prefixed to label data messages. The first character is]. The] symbol is used whenever the option is enabled. The second character indicates the label type. Refer to the first table below for the label types. The third character is the sum of the applicable option values per symbology used.

For example, you have code 39 with no character check and data is 1234. When symbology ID is disabled, the result is 1234. When the symbology ID is enabled, the result is]A01234.

Label Type Indicator	Equals
A	Code 39
F	Codabar
I	I 2 of 5
E	UPC/EAN
C	Code 128

Code 39 Option Value	Option Definition
0	No check character.
1	Reader has checked the check character.
2	Reader has removed the check character.

Codabar Option Value	Option Definition
0	No check character.
2	Reader has checked the check character.
4	Reader has removed the check character.

I 2 of 5 Option Value	Option Definition
0	No check character.
1	Reader has checked the check character.
2	Reader has removed the check character.

UPC/EAN Option Value	Option Definition
0	Always zero and does not follow the AIM spec.

Code 128 Option Value	Option Definition
0	Always zero and does not follow the AIM spec.

Code 39

- Status
- Check Digit. Code 39 is self-checking and does not normally require a check digit. However, for additional data integrity, a Modulus 43 check digit can be added to the bar code message. With Check Digit and an External or Serial Trigger option enabled, an invalid check digit calculation will cause a no read message to be transmitted at the end of the read cycle.
- Check Digit Output. When enabled, the check digit character is sent along with the label data. When disabled, label data is sent without the check digit.
- Large Intercharacter Gap. Allows the reader to read labels with gaps between bar code characters exceeding three times the narrow element width.
- Fixed Code Length. Used to increase data integrity by ensuring that only one label length will be accepted.
- Code Length. Allows you to specify the exact number of characters that the reader will recognize (this does not include start and stop). The reader will ignore any code not having the specified length.

  Note: Fixed Code Length must be enabled for Code Length to take effect.

Codabar

- Status
- Start and Stop Match. Requires the Codabar start and stop characters (a, b, c, or d) to match before a valid read can occur.
- Start and Stop Output. Allows the start and stop characters to be transmitted with bar code data.
- Large Intercharacter Gap. Allows the reader to read labels with gaps between bar code characters exceeding three times the narrow element width.
- Fixed Code Length. Used to increase data integrity by ensuring that only one label length will be accepted.
- Code Length. Allows you to specify the exact number of characters that the reader will recognize (this does not include start and stop). The reader will ignore any code not having the specified length.

  Note: Fixed Code Length must be enabled for Code Length to take effect.
- Check Digit. Allows you to select the type of checksum system Codabar will use.

- Check Digit Output. When enabled, the check digit character is sent along with the label data. When disabled, label data is sent without the check digit.

I 2 of 5

- Status. Because I 2 of 5 is a continuous code, it is prone to substitution errors. Therefore, a code length must be defined and a bar code label containing an even number of digits must be used. It is also recommended that a Modulus 10 check digit be used to ensure the best possible data integrity.
- Check Digit. I 2 of 5 uses a Modulus 10 check digit.
- Check Digit Output. When enabled, the check digit character is sent along with the label data. When disabled, label data is sent without the check digit.
- Code Length #1. With I 2 of 5, two code lengths can be defined. When using only one label length in an application, set Code Length #2 to 0 to ensure data integrity. If a check digit is used, it must be included in the code length count.
- Code Length #2. If using a second label, you may also specify a zero or any even code length from 2 to 30. If you are not using a second label, set Code Length #2 to 0 to ensure data integrity.

UPC

- Status. When enabled, the reader will read UPC version A and UPC version E only.
- EAN. When EAN is enabled, the reader will read UPC version A, UPC version E, EAN 13, and EAN 8. It will also append a leading zero to UPC version A label information and transmit 13 digits. If you do not want to transmit 13 digits when reading UPC version A labels, disable EAN.

  Note: UPC must be enabled for EAN to take effect.
- Supplementals. Allows the reader to read supplemental bar code data that has been appended to the standard UPC or EAN codes. When set to Required, the reader treats the supplemental data and the bar code label as a single label. Also, supplemental data must be found or a no read will result. When set to Enabled, the reader treats the supplemental data and the bar code label as separate labels.

  Note: If Supplementals is set to Enabled, Number of Labels must be set to two (for each label used) and Triggering Mode must not be set to Continuous Read, 1 Output. For example, if you are using one (UPC) label and Supplementals is Enabled, set Number of Labels to 2 (but if you are using two labels under the same conditions, set Number of Labels to 4).
- Separator. Allows you to insert a character between the standard UPC or EAN code and the supplemental code.

- Separator (Character). Allows you to change the separator character from a comma to a new value.

Code 128

- Status
- Fixed Code Length. Allows you to increase data integrity by ensuring that only one label length will be accepted.
- Code Length. Allows you to specify the exact number of characters that the reader will recognize. The reader will ignore any code not having the specified length.

  Note: Fixed Code Length must be enabled for Code Length to take effect.

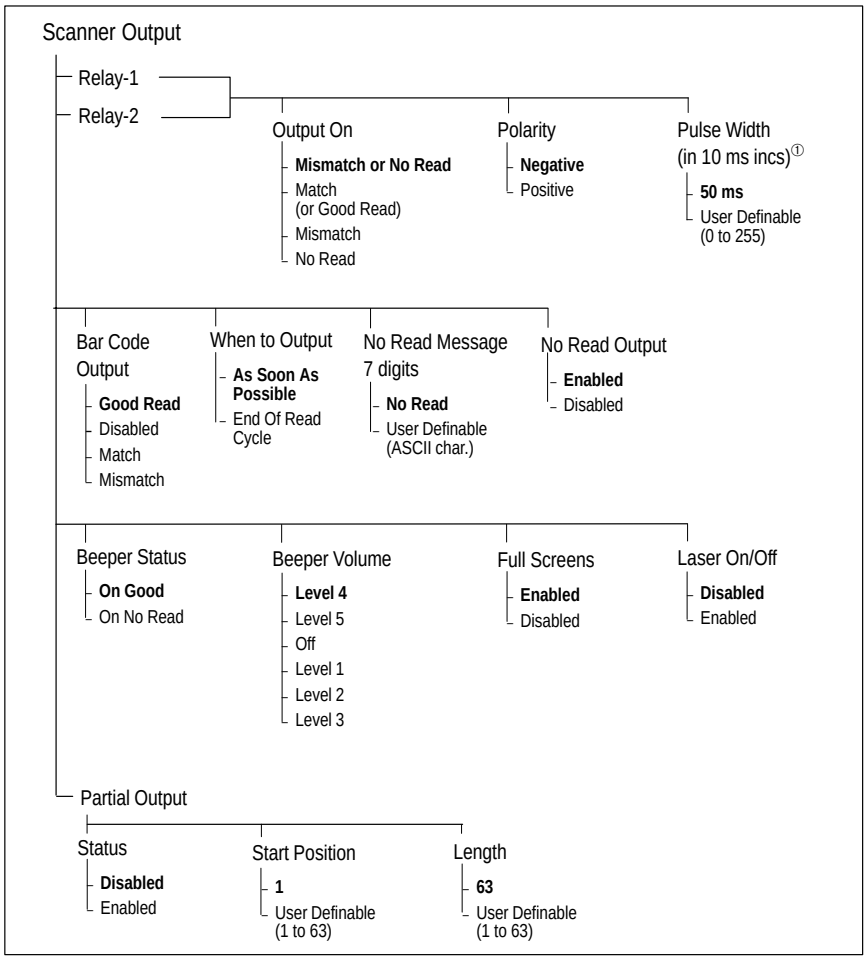
Scanner Output Menu

The Scanner Output menu, shown below, allows you to configure the reader's output. Default settings are in **bold** type face.

Bar code output data and no read messages are transmitted on pin 2 under conditions set principally in Bar Code Output.

Relay pulses are transmitted via pins 7 and 14 (Relay-1 and Relay-2, respectively) and individually configured under conditions set in Relay-1 and Relay-2.

Relay-1 and Relay-2 can allow simultaneous output under individually programmed conditions.



① Divide the number entered on the command line by 100 for time in seconds.

Relay–1 and Relay–2

- Output On. Allows you to set the conditions that will output a relay pulse either to pin 7 (Relay-1) or to pin 14 (Relay-2).

Parameter	Description
Mismatch or No Read	Sends a pulse when the label's data does not match that of the master label or the label is not decoded before the end of the read cycle.
Match (for good read)	Sends a pulse when the decoded label matches the master label. (To send the pulse on a good read, disable Match Code.)
Mismatch	Sends a pulse when the label's data does not match that of the master label.
No Read	Sends a pulse when the label's data is not decoded before the end of the read cycle.

Note: If Output On is set to Mismatch or No Read, Match, or Mismatch, a relay pulse will not output unless Match Code is enabled and a master label is downloaded into memory.

Note: To send a pulse on a Good Read, enable Match and disable Match Code.

- Polarity. Allows you to choose between positive and negative output signals for the relay output pin that is enabled.
- Pulse Width. Allows you to set the duration of the good match/no read output signals at the relay output pin that is enabled.

  Note: After completing changes to Output On, Polarity, and Pulse Width, press **[M]** to advance to Bar Code Output and continue scrolling through the Scanner Output options.
- Bar Code Output. Allows you to choose the conditions that will send label data (or no read messages) to the host.

Parameter	Description
Good Read	The reader will output on any good read independent of how Match Code is set.
Disabled	The reader will not output label data or no read messages to the serial port.
Match (with Match Code enabled)	The reader will output when the label data information matches the master label. However, if Match Code is disabled it will output on any good read.
Mismatch (with Match Code enabled)	The reader will output when the label data information does not match the master label. However, if Match Code is disabled it will output on any good read.

Note: If Bar Code Output is set to Match or Mismatch, label data will not output unless Match Code is enabled and a master label is downloaded into memory.

- When to Output. Allows you to choose when bar code data is sent to the host.

Parameter	Description
As soon as Possible	Causes bar code data (good reads) to be transmitted immediately upon a good decode.
End of Read Cycle	Causes bar code data output to be delayed until the end of the read cycle.

- No Read Message. Allows you to define any combination of ASCII characters (except NUL) up to seven characters as the no read message. When enabled, the no read message will be transmitted to the host at a timeout or the end of a read cycle if the bar code label has not been decoded.
- No Read Output. Allows you to enable or disable the no read message.

  Note: If No Read Output is enabled, the no read message will only output if Bar Code Output is also enabled and MS-sensor Status is disabled.
- Beeper Status. A beep is emitted either after each good read of a bar code label or after each no read.

  Note: The beep period will be short for triggered modes where a new trigger occurs immediately or the output is delayed to the end of the read cycle on edge and serial triggers.
- Beeper Volume
- Full Screens. Allows you to display either the full menu screen or just the command line. When Full Screens is disabled, only the command line will be displayed.
- Laser On/Off. When enabled, the laser is ON only during the read cycle. When disabled, the laser operates continuously.

  Note: A serial or external trigger must be enabled for Laser On/Off to take effect.

  Note: Laser On/Off does not relate to the <H> (Enable Laser Scanning) or <I> (Disable Laser Scanning) operational commands.

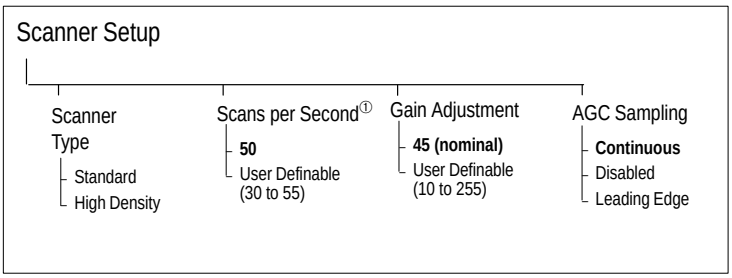
Partial Output

- Status. When enabled, allows you to transmit part of the label to the host.
- Start Position. Allows you to define the starting character of label information that is sent to the host.
- Length. Allows you to define the number of characters of a label that are sent to the host.

Scanner Setup Menu

The Scanner Setup menu, shown below, allows you to set specific bar code scanning parameters that affect decode rate. Default settings are in **bold** type face.

Note: Unlike most configuration settings, Scanner Type, Scans per Second, and Gain Adjustment are not saved for power-on (but are initialized) when you press **[Y]**. To save new settings to NOVRAM for these parameters, press **[<ZP>]**.



① Multiply the number entered on the command line by 10 for actual scans per second.

- Scanner Type. The Scanner Type "default" from the factory indicates the density type of the reader (with the unit's optics adjusted accordingly).

  Note: Entering the <Zp> command will save the current setting for Scanner Type to NOVRAM. If you need to verify the density type of a unit, see the FIS options.

- Scans per Second. Allows you to set the number of scans per second by controlling mirror motor speed. The range is 300 to 550 scans per second.

- Gain Adjustment. Allows you to specify a gain value for the analog circuitry. Changes to Gain Adjustment should typically be done by qualified technicians.

  Note: Gain Adjustment is optimized at the factory before shipment; your default value may not be 45.

  Note: Before saving any changes to Gain Adjustment, first record the optimized factory setting for future reference.

- AGC Sampling. Allows you to specify how automatic gain control sampling will be done. Continuous mode continually samples 14 transitions and stores the highest value of the samples and adjusts the AGC value at the end of the scan. Leading Edge mode finds the leading edge by looking for a 40 ms quiet zone followed by 14 transitions and stores the highest value of the samples and adjusts the AGC at the end of the scan. Leading Edge is especially effective when labels are skewed. Changes to AGC Sampling should typically be done by qualified technicians.

Serial Configuration

Most of the configuration changes to the reader that can be made in the menu can also be accomplished by command strings from the host.

Serial command strings are entered from an ASCII device. As with menu configuration commands, serial configuration commands relate to the initial reader setup.

Serial Configuration Command Format

The format for a serial configuration command is:

<Kparameterdata,data,...etc.><initializing command>

Keep the following in mind when using serial configuration commands.

- Less than < and greater than > symbols are included as part of the commands.
- “parameter,” as used here, are those character(s) that precede the data.
- The “initializing command” <A> or <Z> is sent after configuration is complete. <Z> resets and saves for power up. <A> initializes the change to RAM.
- Parameters and data are “case sensitive.” That is, characters must be entered as upper or lower case, as specified.
- All data fields (except the last) must be followed by a comma (without a space).
- If there is no change in a given field, then commas can be entered alone, or with the existing data (for example, <Ka,,,0> or <Ka4,1,0,0>).
- All fields preceding the modified field must be included. For example, in Host Port, to change Data Bits to Eight without changing any other field, press either: **[<Ka,,,1>]** or **[<Ka4,1,0,1>]**.
- All fields following the modified field can be left out. For example, in the RS-232 port, to change Baud Rate to 4800, press **[<Ka3>]**.

To ensure that a serial configuration command will take affect, follow it with one of the operational commands below.

- <A> To reset but not save changes for power-on
- <Z> To reset and save changes for power-on

For example, to change Baud Rate and reset without saving changes for power-up, press **[<Ka3><A>]**.

To change Baud Rate and reset, saving the changes to NOVRAM, press **[<Ka3><Z>]**.

To ensure that a command was received and accepted, you can enter the Show Scanner Status command, <?>.

Concatenating Serial Commands

Commands can be concatenated (added together) to a maximum of 64 characters in a single string or data block. Additional data blocks of 64 or less characters can be sent provided there is at least a 10 ms pause between blocks.

For example, <Kc1><Kh1><Ko1><A> enables LRC, sets End of Read Cycle mode to New Trigger, enables Narrow Margins and resets the data buffers (without saving the changes for power-on).

Serial Command Status Request

The status of serial commands can be requested by entering the command followed by a question mark. For example, press **[<Ke?>]** to request the Postamble status.

Losing Communications

Making changes to communications parameters such as Baud Rate, Parity, Stop Bits, LRC, etc. without corresponding changes in linked device(s) can result in the loss of menu access. If this should occur, default the reader with the <Zd> Restore/Save Default Configuration for Power-on command.

Note: Defaulting the reader will reset all standard configuration parameters except Scanner Type, Scans per Second, and Gain Adjustment to their original default values.

Note: Power must be available to the reader during the default procedure.

Serial Configuration Commands

The table starting below lists the serial configuration commands.

Function	Command	Parameter	Format
Communications	Communications Protocol	Kf	<Kfprotocol,address>
	Preamble	Kd	<Kdstatus,ASCII characters>
	Postamble	Ke	<Kestatus,ASCII characters>
	LRC	Kc	<Kcstatus>
	Response Timeout	KA	<KAtimeout setting>
	Intercharacter Delay	KB	<KBnumber>
	Host Port	Ka	<Kabaud,parity,stop bits,data bits>
	Auxiliary Port	Ky	<Kymode,baud rate,parity,stop bits,data bits>
	Communications Status Request	KT	<KT?>
Operations	Triggering Mode	Kg	<Kgmode,filter time>
	End of Read Cycle	Kh	<Khmode,time>
	Serial Trigger Character	Ki	<Kicharacter>
	External Trigger Level	Kj	<Kjmode>
	Good Decode Read	Km	<Kmnumber>
	Match Code Type	Kn	<Kntype,sequential matching,match start position,match length,wild card character,sequence on no read,sequence on every mismatch>
	New Master Pin	Kz	<Kzstatus>
	Number of Labels	KL	<KLnumber of labels,multilabel separator>
	Operations Status Request	KV	<KV?>
Code Types	Narrow Margins	Ko	<Konarrow margin status,symbology ID status>
	Code 39	Kp	<Kpstatus,check digit status,check digit output status,large intercharacter gap,fixed code length status,code length>
	Codabar	Kq	<Kqstatus,start & stop match status,start & stop output status,large intercharacter gap,fixed code length status,code length,check digit type,check digit output>
	I 2 of 5	Kr	<Krstatus,check digit,check digit output,length 1,length 2>
	UPC/EAN	Ks	<Ksstatus,EAN status,supplementals status,separator status,separator cha.>
	Code 128	Kt	<Ktstatus,fixed length,length>
	Code Types Status Request	KW	<KW?>

Table continued on the next page.

Function	Command	Parameter	Format
Scanner Output	Relay 1	Kv	<Kvoutput on,polarity,pulse width>
	Relay 2	Kw	<Kwoutput on,polarity,pulse width>
	Bar Code Output	Kl	<Klstatus,when to output>
	No Read Message	Kk	<Kkstatus,output>
	Beeper	Ku	<Kustatus,volume>
	Laser On/Off	KC	<KCstatus>
	Serial Verification	KS	<Ksserial command status,serial command beep status,control/hex output>
	Scanner Output Status Request	KX	<KX?>
	Partial Output	KY	<KYstatus,start position,length>
Scanner Setup	Scanner Type	KP	<KPdensity>
	Scans per Second	KE	<KEspeed>
	Auto Gain Control	KD	<KDgain adjustment,AGC sampling,tracking>
	Bad Bar Code Message	KM	<KMstatus,message>
	No Bar Code Message	KN	<KNstatus,message>
	No Object Bar Code Message	KO	<KOstatus,message>
	Scanner Setup Status Request	KU	<KU?>

The sections that follow describe the commands listed in the table starting on the previous page. The defaults listed in the tables are in **bold** type.

Communications Commands

- Protocol. If selecting one of the options from 0 to 4 (Point-to-Point, Point-to-Point with RTS/CTS, Point-to-Point with XON/XOFF, Point-to-Point with RTS/CTS and XON/XOFF, or Polling Mode D), use the format below.

Command	Parameter	Format	Example
Protocol	Kf	<Kfprotocol>	To change the Protocol to Polling Mode D, press **[<Kf4>]**.
0 = Point-to-Point			
1 = Point-to-Point with RTS/CTS			
2 = Point-to-Point with XON/XOFF			
3 = Point-to-Point with RTS/CTS and XON/XOFF			
4 = Polling Mode D			

If selecting Multidrop (5), you must define an address and append it to the command string. The address can be from 1 to 50.

Command	Parameter	Format	Example
Protocol	Kf	<Kfprotocol,address>	To change the Protocol to Multidrop with an address of 33, press **[<Kf5,33>]**.
5 = Multidrop			

If selecting User Defined (6) or User Defined Multidrop (7), complete the format by either choosing new parameters or concatenating unchanged data fields (separate by commas).

For User Defined, first select Point-to-Point <Kf0> and then User Defined <Kf6...>. For user Defined Multidrop, first select Multidrop <Kf5>, then User Defined Multidrop <Kf7...>.

Command	Parameter	Format	Example
Protocol	Kf	<Kfprotocol,RES,address, REQ,EOT,STX,ETX,ACK, NAK>	To select an unpolled ACK/NAK User Defined protocol with LRC disabled, press **[<Kf0><Kf6,,,,,,, ^F,^U><Kc0>]**①. ACK and NAK will be displayed in the menu②.
6 = User Defined			
7= User Defined Multidrop			

① <Kf0> nulls the address and <Kc0> disables LRC.

② A control character, represented here as two characters (^F or ^U, etc.), is actually a single ASCII character that is entered on the keyboard by holding down the control key while pressing the desired letter.

- Preamble. You can enter one or two preamble characters except a null (00H).

Command	Parameter	Format	Example
Status	Kd	<Kdstatus,preamble character(s)>	To enable Preamble with just one character, an FF (form feed), press **[<Kd1,^L>]**.
0 = Disabled			
1 = Enabled			

- Postamble. You can enter one or two postamble characters except a null (00H).

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	Ke	<Kestatus,postamble character(s)>	To disable Postamble, press **[<Ke0>]**.

- LRC

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	Kc	<Kcstatus>	To enable LRC, press **[<Kc1>]**.

- Response Timeout. You can use any number from zero to 65,000. (A zero causes an indefinite wait.) The default is 12 ms.

Parameter	Format	Example
KA	<KAtimeout setting>	To change Response Timeout to 30 ms, press **[<KA30>]**.

- Intercharacter Delay. You can use any number from zero to 255. The default is zero.

Parameter	Format	Example
KB	<KAtime interval>	To change Intercharacter Delay to 30 ms, press **[<KB30>]**.

- Host Port. Changes made in the reader's communications parameters such as baud rate, parity, stop bits, LRC, etc., must be matched in the other device(s) or communications will be lost. If this occurs, default the reader with the <Zd> Restore/Save Default Configuration for Power-on command.

Command	Parameter	Format	Example
Baud Rate	Ka	<Kabaud rate,parity,stop bits,data bits>	To change Host Port Baud Rate to 2400, press **[<Ka2>]**.
0 = 600			
1 = 1200			
2 = 2400			
3 = 4800			
4 = 9600			
5 = 19200			
6 = 38400			
7 = 76800			
8 = 300			
Parity			
0 = None			
1 = Even			
2 = Odd			
Stop Bits			
0 = One			
1 = Two			
Data Bits			
0 = Seven			
1 = Eight			

- Auxiliary Port

Command	Parameter	Format	Example
Mode	Ky	<Ky mode,baud rate,parity,stop bits,data bits>	To change Auxiliary Port Baud Rate to 2400, press **[<Ky2>]**.
0 = Disabled			
1 = Transparent			
2 = Half-duplex			
3 = Full-duplex			
4 = Slave Mode			
Baud Rate			
0 = 600			
1 = 1200			
2 = 2400			
3 = 4800			
4 = 9600			
5 = 19200			
6 = 38400			
7 = 76800			
8 = 300			
Parity			
0 = None			
1 = Even			
2 = Odd			
Stop Bits			
0 = One			
1 = Two			
Data Bits			
0 = Seven			
1 = Eight			

- Communications Status Request. Allows you to return the status of each command in the group.

Parameter	Format
KT	<KT?>

Operations Commands

- Triggering Mode. The trigger filtering time occurs in 128 microsecond increments. You can use any number between 2 and 255. The default is 78 (approximately 10 seconds).

Command	Parameter	Format	Example
Triggering Mode	Kg	<Kgtriggering mode,filter time>	To select External edge, press **[<Kg3>]**.
0 = Continuous Read			
1 = Continuous Read, 1 Output			
2 = External Level			
3 = External Edge			
4 = Serial Data			
5 = Serial Data and Edge			

- End of Read Cycle. The timeout occurs in 10 millisecond increments. You can use any number between zero and 65535. The default is 100 (one second).

Command	Parameter	Format	Example
End of Read Cycle Mode **0 = Timeout** 1 = New Trigger 2 = Timeout and New Trigger	Kh	<Khend of read cycle mode,timeout>	To select Timeout and change the timeout value to 6 seconds, press **[<Kh0,600>]**.

- Serial Trigger Character. You can use any available ASCII character. The default character is ^. Pressing **[<^>]** when using the default character with the serial triggering mode selected, will trigger the reader.

Parameter	Format	Example
Ki	<Kiserial trigger character>	To define the Serial Trigger Character as a lower case c, press **[<Kic>]**.

- External Trigger Level

Command	Parameter	Format	Example
External Trigger Level 0 = Negative **1 = Positive**	Kj	<Kjexternal trigger level>	To change External Trigger Level to negative, press **[<Kj0>]**.

- Good Decode Reads. You can use any number between 1 and 31. The default is 1.

Parameter	Format	Example
Km	<Kmnumber of reads>	To change Good Decode Reads to 3, press **[<Km3>]**.

- Match Code Type

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled 2 = Sequential 3 = Wild Card Sequential Matching **0 = Increment** 1 = Decrement Match Start Position 0 to 64. **0** is the default. Match Length 1 to 64. 1 is the default. Wild Card Character Any character. ***** (asterisk) is the default.	Kn	<Kntype,sequential matching,match start position,match length,wild card character,sequence on no read,sequence on every mismatch>	To enable Match Code Type for Sequential, set Sequential Matching for Decrement, and enable Sequence on Every Mismatch, press **[<Kn2,1,,,,,1>]**.

For a sequence on a No Read, refer to the following table. When disabled, the reader does not sequence (increment or decrement) on a No Read. When enabled, the reader sequences on every No Read.

Command	Example
Status	
0 = Disabled	If 001, 002, No Read, then search for 003.
1 = Enabled	If 001, 002, No Read, then search for 004.

For a sequence on every mismatch, refer to the following table. When disabled, if a mismatch is out of sequence by more than 1, the sequence resumes. When enabled, the reader sequences the on every mismatch.

Command	Example
Status	
0 = Disabled	If 001, 002, 004 (mismatch), then search for 005.
1 = Enabled	If 001, 002, mismatch, then search for 004.

- New Master Pin

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	Kz	<Kzstatus>	To enable New Master Pin, press **[<Kz1>]**.

- Number of Labels. You can use any number between 1 and 6. The default is 1. The multilabel separator is any valid ASCII character.

Parameter	Format	Example
KL	<KLnumber, multilabel separator>	To change Number of Labels to 3, press **[<KL3>]**.

- Operations Status Request. Allows you to return the status of each command in the group.

Parameter	Format
KV	<KV?>

Code Types Commands

- Narrow Margins

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	Ko	<Konarrow margin status,symbology ID status>	To enable Narrow Margins, press **[<Ko1>]**.

- Code 39. You can use any number between 1 and 64 for the Fixed Code Length. The default is 10.

Command	Parameter	Format	Example
Status	Kp	<Kpstatus,check digit status,check digit output status,large intercharacter gap,fixed code length status,code length>	To set Fixed Code Length to 30, press **[<Kp,,,,1,30>]** or **[<Kp1,0,0,0,1,30>]**.
0 = Disabled			
1 = Enabled			
Check Digit Status			
0 = Disabled			
1 = Enabled			
Check Digit Output Status			
0 = Disabled			
1 = Enabled			
Large Intercharacter Gap			
0 = Disabled			
1 = Enabled			
Fixed Code Length Status			
0 = Disabled			
1 = Enabled			

- Codabar. You can use any number between 1 and 31 for the Fixed Code Length. The default is 10.

Command	Parameter	Format	Example
Status	Kq	<Kqstatus,start & stop match status,start & stop output status,large intercharacter gap,fixed code length status,code length,check digit type,check digit output>	To set Fixed Code Length to 9, press **[<Kq1,,,,1,9>]** or **[<Kq1,1,1,0,1,9>]**.
0 = Disabled			
1 = Enabled			
Start and Stop Match Status			
0 = Disabled			
1 = Enabled			
Start and Stop Output Status			
0 = Disabled			
1 = Enabled			
Large Intercharacter Gap			
0 = Disabled			
1 = Enabled			
Fixed Code Length Status			
0 = Disabled			
1 = Enabled			
Check Digit Output			
0 = Disabled			
1 = Enabled			
Check Digit Type			
0 = Disabled			
1 = Mod 16			
2 = NW7			
3 = Both			

- I 2 of 5. Code length #1 can be zero or any even number from 2 to 64. The default is 10. Code length #2 can be zero or any even number from 2 to 64. The default is 6.

Command	Parameter	Format	Example
Status	Kr	<Krstatus,check digit,check digit output,length 1, length 2>	To set Fixed Code Length #1 to 8 and #2 to 4, press **[<Kr1,,,8,4>]** or **[<Kr1,0,0,8,4>]**.
0 = Disabled			
1 = Enabled			
Check Digit Status			
0 = Disabled			
1 = Enabled			
Check Digit Output Status			
0 = Disabled			
1 = Enabled			

- UPC/EAN. The Separator character can be any ASCII character except NUL. The default is , .

Command	Parameter	Format	Example
UPC Status	Ks	<KsUPCstatus,EAN status,supplementals status,separator status,separator cha.>	To change Supplementals to Required, and change Separator Character to a dash (–), press **[<Ks1,1,2,1,–>]**.
0 = Disabled			
1 = Enabled			
EAN Status (UPC must be enabled)			
0 = Disabled			
1 = Enabled			
Supplementals Status			
0 = Disabled			
1 = Enabled			
2 = Required			
Separator Status			
0 = Disabled			
1 = Enabled			

- Code 128. You can use any number between 1 and 64 for the Code Length. The default is 10.

Command	Parameter	Format	Example
Status	Kt	<Ktstatus,fixed length,length>	To enable Code 128, enable Fixed Code Length, and set Code Length to 9, press **[<Kt1,1,9>]**.
0 = Disabled			
1 = Enabled			
Fixed Code Length Status			
0 = Disabled			
1 = Enabled			

- Code Types Status Request. Allows you to return the status of each command in the group.

Parameter	Format
KW	<KW?>

Scanner Output Commands

- Relay–1. The pulse width occurs in 10 millisecond increments. You can use any number between 2 and 255. The default is 5.

Command	Parameter	Format	Example
Output On	Kv	<Kvoutput on,polarity,pulse width>	To set Relay 1 to Mismatch and change Pulse Width to 40 ms, press **[<Kv2,0,4>]** or **[<Kv2,4>]**.
0 = Mismatch or No Read			
1 = Match or Good Read			
2 = Mismatch			
3 = No Read			
Polarity			
0 = Negative			
1 = Positive			

- Relay–2. The pulse width occurs in 10 millisecond increments. You can use any number between 2 and 255. The default is 5.

Command	Parameter	Format	Example
Output On	Kw	<Kwoutput on,polarity,pulse width>	To set Relay 2 to Mismatch and change Pulse Width to 40 ms, press **[<Kw2,0,4>]** or **[<Kw2,4>]**.
0 = Mismatch or No Read			
1 = Match or Good Read			
2 = Mismatch			
3 = No Read			
Polarity			
0 = Negative			
1 = Positive			

- Bar Code Output

Command	Parameter	Format	Example
Status	KI	<Klstatus,when to output>	To set When to Output to End of Read Cycle, press **[<KI3,1>]**.
0 = Disabled			
1 = Match			
2 = Mismatch			
3 = Good Read			
When to Output			
0 = As soon as Possible			
1 = End of Read Cycle			

- No Read Message. You can use any ASCII string up to 7 characters in length. The default is No Read.

Command	Parameter	Format	Example
Status	Kk	<Kkstatus,output>	To enable No Read Message and send the message FAIL, press **[<Kk1,FAIL>]**.
0 = Disabled			
1 = Enabled			

- Beeper

Command	Parameter	Format	Example
Beeper Status	Ku	<Kustatus,volume>	To set the beeper for On No Read and set the beeper volume to Off, press **[<Ku1,0>]**.
0 = On Good			
1 = On No Read			
Beeper Volume			
0 = Off			
1 = Level 1			
2 = Level 2			
3 = Level 3			
4 = Level 4			
5 = Level 5			

- Laser On/Off

Command	Parameter	Format	Example
Status	KC	<KCstatus>	To enable Laser On/Off, press **[<KC1>]**.
0 = Disabled			
1 = Enabled			

- Serial Verification

Command	Parameter	Format	Example
Serial Command Echo Status	KS	<KSserial command status,serial command beep status,control/hex output>	To enable Serial Command Echo Status, Beep status, and Hex Output, press **[<KS1,1,1>]**.
0 = Disabled			
1 = Enabled			
Serial Command Beep Status			
0 = Disabled			
1 = Enabled			
Control/hex Output			
0 = Control			
1 = Hex			

- User Output Status Request. Allows you to return the status of each command in the group.

Parameter	Format
KX	<KX?>

- Partial Label Output. Allows you to transmit a portion of the label to the host.

Command	Parameter	Format	Example
Status	KY	<KYstatus,start position,length>	To enable Partial Label Output starting at character 4 and ending at character 8 of the string, press **[<KY1,4,5>]**.
0 = Disabled			
1 = Enabled			
Start Position			
1 to 63. **1** is the default.			
Length			
1 to 63. **63** is the default.			

Scanner Setup Commands

- Scanner Type. You determine the type of reader you are using.

  Entering the <Zp> command will save the current setting for Scanner Type to NOVRAM.

Command	Parameter	Format	Example
Scanner Type 0 = Standard 1 = High Density	KP	<KPdensity>	Do not change the reader type.

- Scans per Second. The scan occurs in 10 millisecond increments. You can use any number between 30 and 55. The default is 50.

Parameter	Format	Example
KE	<KEspeed>	To set the reader to 400 scans per second, press **[<KE40>]**.

- Auto Gain Control. Gain adjustment can be any number from 10 to 255. The default is 45.

  Before saving any changes to Gain Adjustment, first record the optimized factory setting for future reference. Press **[<KU?>]** to read factory settings.

Command	Parameter	Format	Example
AGC Sampling 0 = Disabled 1 = Leading Edge **2 = Continuous**	KD	<KDgain adjustment,AGC sampling,tracking>	To set the gain threshold to 40 and the AGC status to Leading Edge, press **[<KD40,1,0>]**.

- Bad Bar Code Message. You can use any ASCII string up to 7 characters. The default is Bad Code.

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	KM	<KMstatus,message>	To change the message to "FAULTY", press **[<KM1,FAULTY>]**.

- No Bar Code Message. You can use any ASCII string up to 7 characters. The default is No Label.

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	KN	<KNstatus,message>	To change the message to "NO LABEL, press **[<KN1,NOCODE>]**.

- No Object Message. You can use any ASCII string up to 7 characters. The default is Missing.

Command	Parameter	Format	Example
Status **0 = Disabled** 1 = Enabled	KO	<KOstatus,message>	To change the message to "VACANT", press **[<K01,VACANT>].**

- Scanner Setup Status Report. Allows you to return the status of each command in the group.

Parameter	Format
KU	<KU?>

Decode Test

To test the decode rate:

1. Position the label in front of a functioning reader.
2. Press **[<C>]** from the host terminal to launch the decode rate test.
3. Observe decode rate.
4. Check depth-of-field (minimum/maximum range) by moving the label closer and further relative to the reader and noting the points where the decode rates fall below a level acceptable to your application. The label used in your application should pass through or near the center of the depth-of-field.
5. Repeat steps 1 through 5 for other labels used in your application and end the decode rate test by pressing **[<J>]**.

If the decode rate is acceptable, no adjustments are needed to your reader. If the decode rate is unacceptable, adjust your reader parameters.

Note: If, after making adjustments, you have changed the read range or another parameter used in the number of scans formula, you should recalculate the number of scans.

Note: Variations between labels are common. For this reason, the greater number of sample labels you test, the more likely you are to achieve optimum decode rates.

Adjusting Reader Parameters

To help improve decode rates, adjustments can be made in the following areas.

Scan Rate

Scan rate is a function of motor speed and is adjustable from 300 to 550 within the Scanner Setup menu. The reader is factory set at the rate of 500 scans per second. A slower scan rate may allow greater label range and/or higher decode rates, but at the cost of fewer scans per label. To adjust the scan rate (motor speed), press **[<D>]** and select the Scanner Setup menu.

Range

Adjusting the label's range, if possible, is one of the quickest and most effective ways to improve decode rates. However, in some applications you may need to select a less than optimum range, or one that is beyond the fringes of the ranges.

Scan Width

Increasing scan width will increase the number of scans in a picket fence oriented application. Scan width is linked with scan range and changing one will usually require a change in the other.

Label Speed

Applies to both picket fence and step ladder oriented labels. If your application allows it, label speed (the time in seconds that a label is fully within the scan width of the reader) is an effective way to alter the number of scans.

Label Dimensions, Label Density, and Label Ratio

Not usually an option in most applications, but changes to label parameters can affect number-of-scan calculations and possibly decode rates.

If your application allows it, shortening the length of a picket fence label means the label will be in the scan range longer and hence receive a greater number of scans. Increasing the height of a step ladder label means it will receive more scans. Changing label density and/or bar code ratio is another way ranges, decode rates, etc. can be altered.

Gain

This adjustment, typically made by qualified technicians, is done from within the Scanner Setup menu.

Hardware Operation

This chapter provides information on how to operate your scanner system hardware. Items include:

- using operational commands
- operating scanner system hardware

Using Operational Commands

On-line serial operational commands are sent from the host to the reader to carry out routine operations “on the fly” as distinguished from serial configuration commands that are generally used in initial setup.

Operational commands are preceded by a < left angle bracket symbol and followed by a > right angle bracket symbol. Command start character by default is a left angle bracket, <. It may be redefined by menu or serial command. However, the end character, a right angle bracket, >, cannot be changed.

The table on the next page lists the operational commands.

Function	Command	Action
Program Management	<A>	Software Reset (does not save for power-on)
	<Ad>	Software Reset/Restore Default
	<An>	Software Reset/Read NOVRAM
	<D>	Enter Configuration Mode
	<Z>	Software Reset/Save Parameters for Power-on
	<Zd>	Restore/Save Default Configuration for Power-on
	<Zp>	Save Scanner Type, SPS, and Gain for Power-on
Device Control	<H>	Enable Laser Scanning (Laser On)
	<I>	Disable Laser Scanning (Laser Off)
	<KE>	Motor On
	<KF>	Motor Off
	<L1>	Relay-1 Pulse
	<L2>	Relay-2 Pulse
Code Types	<P>	Autodiscriminate All Codes
	<Q>	Enable Code 39 Only①
	<R>	Enable Codabar Only①
	<S>	Enable I 2 of 5 Only①
Counter	<N>	No Read Counter
	<O>	No Read Counter Reset
	<T>	Trigger Counter
	<U>	Trigger Counter Reset
	<V>	Match Code/Good Read Counter
	<W>	Match Code/Good Read Counter Reset
	<X>	Mismatch Counter
	<Y>	Mismatch Counter Reset
Test	<C>	Enter Decode Rate Test
	<Ce>	Enter Extended Decode Rate Test
	<J>	Exit Decode Rate Test; Exit Extended Decode Rate Test
Status	<#>	Display Software Part Number
	<!>	Display Checksum of EPROM
	<?>	Show Scanner Status
	<?1>	Show Software Status (Send Status Byte, Part Number, and ROM Checksum. Display NOVRAM Checksum at Power Up, then Display Current NOVRAM Checksum)
Master Label	<E>	Enable Match Code Option①
	<F>	Disable Match Code Option①
	<G>	Store Next Label Scanned as Master Label
	<)XXXX)>	Download Master Label Information
	<)>	Request Master Label Information
	<))>	Delete Master Label Information

① The command can also be set in the configuration menu or with a serial configuration command.

Program Management Commands

- Software Reset, **[<A>]**. Initializes all serial configuration commands in RAM and resets all counters and operating parameters.

  Note: Software Reset will cause the numeric counters in use to lose their count; record all data that you wish to save prior to sending this command.

- Software Reset/Restore Default, **[<Ad>]**. Restores the ROM default values to RAM then initializes them. Does not effect Scanner Type, Scans per Second, or Gain Adjustment.
- Software Reset/Read NOVRAM, **[<An>]**. Reads the NOVRAM settings then initializes them to RAM.
- Enter Configuration Mode, **[<D>]**. Enters the Menu Configuration Program.
- Software Reset/Save Parameters for Power-on, **[<Z>]**. Allows you to save all but Scanner Type, Scans per Second, and Gain Adjustment to NOVRAM. The values of numeric counters are not saved by this command.

  Note: The Software Reset/Save Parameters for Power-on command can be executed at least 10,000 times. In normal usage this will exceed the life of the reader. If frequent changes to the operating parameters are required, it is recommended that the <Z> command be used only when the current configuration has been changed and the changes are to be permanent.

- Restore/Save Default Configuration for Power-on, **[<Zd>]**. Allows you to restore and save default settings for all but Scanner Type, Scans per Second, and Gain Adjustment to NOVRAM.

  Note: Power must be available to the reader during the default procedure.

  Defaulting might be necessary after temporary changes or if communications between the reader and another device are lost or interrupted, or if you are using incompatible equipment. For example, a terminal is set to communicate at 9600 baud, but the reader is configured at 38.4K baud.

- Save Scanner Type, SPS, and Gain for Power-on, **[<Zp>]**. Allows you to save the current settings for Scanner Type, Scans per Second, and Gain Adjustment to NOVRAM. Once you send this command, default values can only be recalled if you reenter them individually and then save them again with this command.

  Note: This command will replace the optimized factory setting for Gain Adjustment with your new setting; record and save this setting for future reference prior to sending this command.

Device Control Commands

- Enable Laser Scanning (Laser On), **[<H>]**.
- Disable Laser Scanning (Laser Off), **[<I>]**. This feature is useful during extended periods of time when no bar code labels are being scanned. Disabling laser scanning will not affect any downloaded commands to the reader.
- Motor On, **[<KE>**]. Turns the motor on (reaches full speed after a short time delay).
- Motor Off, **[<KF>]**. Turns the motor off.
- Relay-1 Pulse, **[<L1>]**. Allows you to send a pulse to pin 7 (at any time regardless of Match Code or Relay-1 Driver status).
- Relay-2 Pulse, **[<L2>]**. Allows you to send a pulse to pin 14 (at any time regardless of Match Code or Relay-2 Driver status).

Code Types Commands

- Autodiscriminate All Codes, **[<P>]**. Enables the reader to decode all available bar code types without changing reader configuration settings.

  Note: For maximum scanning speed, enable only those bar code symbologies used in the application.
- Enable Code 39 Only, **[<Q>]**. Allows only Code 39 labels to be read.
- Enable Codabar Only, **[<R>]**. Allows only Codabar labels to be read.
- Enable I 2 of 5 Only, **[<S>]**. Allows only Interleaved 2 of 5 labels to be read.

Counter Commands

The Xs in all counter commands that follow denote a numeric value from 00000 to 65,535. After reaching the maximum numeric limit of 65,535, you will receive an error message and the counter will automatically rollover and start counting again at 00000. To obtain the cumulative total of counts after the rollover has occurred, add 65,536 per each rollover (the reader does not keep track of the number of rollovers) to the current count.

Note: You will lose all counter values if you cycle power to the reader, press **[<A>]**, or enter the Menu Configuration Program.

Note: If you activate the counter command during a read cycle, the reader will not output the count until the read cycle ends.

- No Read Counter, **[<N>]**. The message N/XXXXX displays the total number of no reads that have occurred since power-on or the last No Read Counter Reset command.
- No Read Counter Reset, **[<O>]**. Sets No Read Counter to 00000.
- Trigger Counter, **[<T>]**. The message T/XXXXX displays the total number of triggers since power-on or the last Trigger Counter Reset command.
- Trigger Counter Reset, **[<U>]**. Sets the trigger counter to 00000.
- Match Code/Good Read Counter, **[<V>]**. The message V/XXXXX displays either (1) the total number of good reads that match the master label or (2) the total number of good reads, or decodes. The count begins from the last power-on or Match Code/Good Read Counter Reset command. To count the good reads that match the master label, enable Match Code; to count good reads only, disable Match Code. This counter is always active and can be requested at any time.
- Match Code/Good Read Counter Reset, **[<W>]**. Sets the Match Code/Good Read Counter to zero.
- Mismatch Counter, **[<X>]**. The message X/XXXXX displays the number of labels successfully read that do not match the master label since power-on or the last Mismatch Counter command.
- Mismatch Counter Reset, **[<Y>]**. Sets the Mismatch Counter to zero.

Test Commands

- Enter Decode Rate Test, **[<C>]**. Instructs the reader to output the decode rate and label data (if any). (If in a triggered mode, the reader will output the number of good reads based on the number of accepted triggers received.) The decode rate can vary dramatically due to the angle and location of the label in relation to the scan beam (or scan line, if using a scan head with a moving beam). This test is very useful in aligning and positioning the scanning device during installation.
- Enter Extended Decode Rate Test, **[<Ce>]**. Instructs the reader to output decode rate, label data (if any), reflectance threshold, and number of label space transitions. This test is necessary to determine how to set Minimum Label Transitions and Reflectance Threshold.
- Exit Decode Rate Test, **[<J>]**. Ends both the decode rate test and the extended decode rate test.

  Note: It is not necessary to use the <J> command while switching between the decode rate test and the extended decode rate test.

Status Commands

- Display Software Part Number, **[<#>]**. Displays software part number.
- Display Checksum of EPROM, **[<!>]**. Displays a four-digit hex number (corresponding to a given firmware version) used to verify a reader's EPROM.
- Show Scanner Status, **[<?>]**. This command is used to display certain operating parameters (NOVRAM, command, and operation status). After sending this command, the reader immediately responds with <X>, where "X" is an ASCII character. Refer to appendix C for the ASCII table.

  To check the reader's status:

  A. Locate the ASCII character's Hex value in the ASCII table. For example, the ASCII character "M" has a hex. value of 4D.

  B. Compare the hex value to the binary equivalent in the table below. The binary equivalent of 4D is 01001101. The 0100 is the binary equivalent of the 4 and 1101 is the binary equivalent of the D.

Hex. Value	Binary Bit Digits			
00	0	0	0	0
01	0	0	0	1
02	0	0	1	0
03	0	0	1	1
04	0	1	0	0
05	0	1	0	1
06	0	1	1	0
07	0	1	1	1
08	1	0	0	0
09	1	0	0	1
0A	1	0	1	0
0B	1	0	1	1
0C	1	1	0	0
0D	1	1	0	1
0E	1	1	1	0
0F	1	1	1	1

C. Compare the bit digits (1 or 0) to each bit location to determine the reader function. For the binary number 01001101 (with the first zero being in bit location 7), the reader's status is even parity (bit = 0), (skip bit location 6; it will always equal 1), the reader is not in a read cycle (bit = 0), the motor is spinning and the reader is ready to read (bit = 0), no NOVRAM error detected (bit = 0), a communications error is detected (bit = 1), the command is not received (bit = 1), and a command error is detected (bit = 1).

Bit Location	Reader Function	Bit	Is
7	Parity	0	Even
		1	Odd
6	Always set to one	0	Not Applicable
		1	Not Applicable
5	Reader is in a read cycle	0	Inactive
		1	Active
4	Motor is spinning, reader is ready to read	0	Active
		1	Inactive
3	NOVRAM① error detected	0	Active
		1	Inactive
2	Communication error detected	0	Inactive
		1	Active
1	Command received	0	Inactive
		1	Active
0	Command error detected	0	Inactive
		1	Active

① NOVRAM status is valid only after the first status request after a NOVRAM read or write and is only valid for one read or write.

If you are using the <?> command, refer to the following table.

If you Press [<?>]	The Reader Reports	Example
After power-on (NOVRAM Read)	Whether the NOVRAM was read correctly the first time the status command was received.	With the reader in a triggered mode without a serial or edge trigger present, power–off, then power–on and press **[<?>]**. The reader responds with <@> for a good load or <H> for a bad load.
After sending a Command	Whether the command was sent correctly.	With the reader in a triggered mode without a serial or edge trigger present, press **[<?>]** to clear the error flags. Then enter the desired command, <L1> for example. Press **[<?>]** again. The reader responds with <B> if the command was received, <C> if there was an error in the command, or <F> if there was a serial data error.
After NOVRAM Write	Whether the NOVRAM was written correctly.	The reader responds in the same manner as after power–on (NOVRAM read).

- Show Software Status, **[<?1>]**. Sends the following in this order: status byte, part number, ROM checksum for both possible lengths of ROM (1 megabyte and 512 bytes), NOVRAM checksum at power up, then the current NOVRAM checksum.

  Note: Continuous Read, 1 Output or Match Code will change the current NOVRAM checksum.

Master Label Commands

- Enable Match Code Option, **[<E>]**. Identical to match code command. Instructs the reader to compare bar code labels being scanned with a master label that has been entered in nonvolatile or volatile RAM, and may under certain conditions send out a relay driver signal and update internal counters.

  If no master label has been entered, every decoded label will be a "mismatch" and will increment the mismatch counter by one.

  Enable Match Code Option is intended for use when the reader is in a triggered mode. If the Match Code option is enabled in the Continuous Read mode, the reader defaults to Continuous Read, 1 Output mode, and the label data must change before the reader will output data again, unless a timeout, if enabled, occurs.
- Disable Match Code Option, **[<F>]**. Disables Match Code.
- Store Next Label Scanned as Master Label, **[<G>]**. Causes the reader to read the next bar code label scanned as the master label if Match Code has been enabled. All subsequently decoded labels are compared against the master label information stored in RAM.
- Download Master Label Information, **[<)XXXX)>]**. Downloads master label information from the host or a terminal. The master label information can be downloaded at any time, and can be saved in nonvolatile memory with a <Z> command. A stored master label will not affect standard operation unless Match Code option is enabled.
- Request Master Label Information, **[<)>]**. Immediately sends the master label information to the host. To prevent conflicts with outputting label data, press **[<I>]**, Disable Laser Scanning command.

  Note: If the master label information has previously been stored in nonvolatile RAM (by a <Z> command), cycling the power will restore that information.
- Delete Master Label Information, **[<))>]**. Deletes master label information that has previously been loaded by either <)XXXX)> Download Master Label Information Command or <G> Store Next Label as Master Label command.

Operating Scanner System Hardware

The following sections describe how to operate your scanner system hardware.

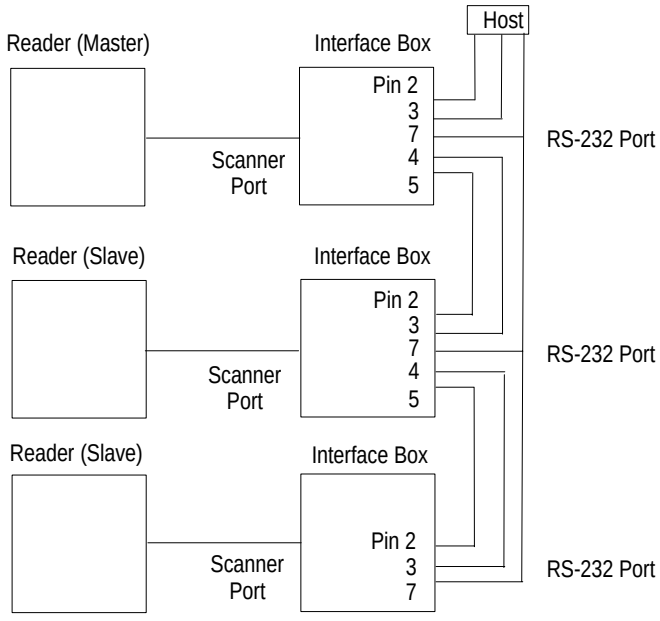
Operating the Reader

The reader turns on as soon as power is applied to it. The reader reads bar codes after the settings are configured through the menu commands or through the serial commands. At the Main menu, press **[Esc]**. This will give you a blank screen. When a bar code is read by the reader, the data will be visible on the terminal screen.

To make changes to the reader's parameters while the reader is reading bar codes, type the appropriate operational command. You do not need to access the Main menu or access the serial commands to make changes.

Daisy-Chain Operation

The daisy-chain configuration option allows you to read different bar codes on different sides of the same package. The various readers act as a single device, as far as the host device is concerned, and can be connected to a single serial port. You can only use Series B or higher of the reader when using the daisy-chain configuration except for the last reader used in the chain. Refer to the drawing below for daisy-chain connections.



The reader will check the auxiliary port parameter for data when the reader is about to send a no read message after exiting a read cycle. The reader will wait up to 20 ms for the first character from the next reader down the line. If there is no data within 20 ms, the reader will send a no read message. If there is a character, the reader will wait for a terminating CR up to 20 ms after every auxiliary character received and sends the message up the line to the next reader (or to the host if it is the master scanner). If no CR is received in time, the reader will send a no read message up to the line to the next reader (or to the host if it is the master reader).

If you are using more than one label, field separators are necessary to separate each label and are used by the master reader to count the number of labels received by the auxiliary port parameter. The master reader must receive and read at least the number of bar codes set in Number of Labels. If the reader reads less, the reader will interpret the auxiliary data it receives as the missing labels and will add a no read message to the data for each missing label.

The reader connected to the auxiliary port must have the following settings.

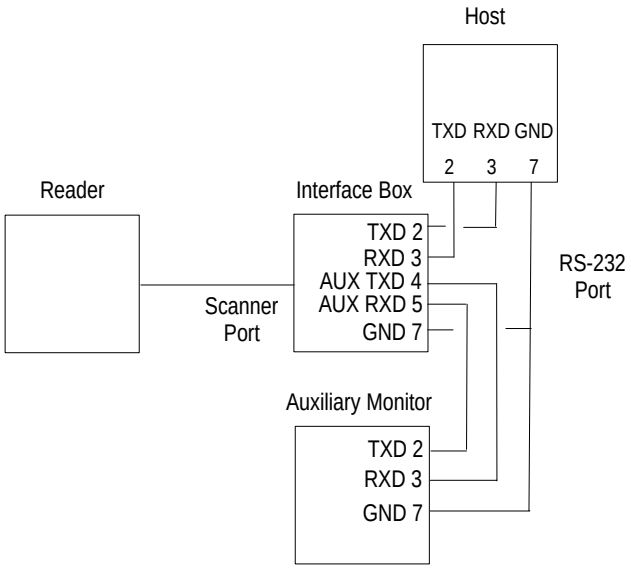
- Postamble = CR (^M).
- Postamble is enabled.
- Multilabel separator and serial trigger character must match the master setting.

Auxiliary Port Operation

Auxiliary Port Parameters allow you to set communications parameters between daisy-chained readers or between the reader and an auxiliary monitor. An auxiliary monitor can be used to configure the menus, send data to the host, and display data transmissions originating from the host or reader. The auxiliary port cannot be used in conjunction with RS-485 or RTS/CTS on the host port.

Note: The Aux Port baud rate should never exceed Host Port baud rate or auxiliary port data could be lost.

You can only use Series B or higher of the reader when using an auxiliary monitor. Refer to the drawing below for auxiliary port connections.



The monitor can be configured to operate in one of three modes. The modes are:

- transparent
- non–buffered full-duplex
- non-buffered half-duplex

Transparent mode can work with all protocols. Full-duplex and half-duplex modes can work with all protocols except polled protocols.

Transparent mode is used to batch data from the auxiliary monitor to the host. The decoder buffers data from the auxiliary monitor and displays the keyed data on the auxiliary monitor. The decoder transmits auxiliary monitor data to the host when a label is scanned or a carriage return is entered from the auxiliary monitor.

When	Then
Data is initiated from the monitor	• monitor data is passed through to the host whenever a return key is pressed at the monitor or whenever bar code data is sent. If monitor data is sent with bar code data, monitor data is processed first-in/first-out basis. • monitor data to the host is always sent with a preamble and a postamble. • monitor data will still pass through if the decoder is in a polled mode to the host. • a <D> command is the only command accepted by the decoder from the monitor. All other commands will pass through to the host.
Data is initiated from the reader	• transmission to the monitor occurs immediately upon a good read. • scan data to the monitor does not include a preamble or a postamble. • transmission to the host conforms to all the parameters specified in the configuration menu. • communications with the monitor is always point-to-point protocol even if the host is in a polled protocol mode.
Data is initiated from the host	• in a polled mode, data echoed from the host to the monitor must be in the format <B_>. • in unpolled mode, all host data is echoed to the monitor.

Full-duplex allows the auxiliary monitor data and bar code data to be sent directly to the host. The bar code data is not displayed on the auxiliary monitor screen.

When	Then
Data is initiated from the monitor	• monitor data is passed directly through the host whenever it is received by the reader, unless the reader is in a polled mode, in which case the data will be ignored. • monitor data is not echoed. • monitor data to the host will not have a preamble or a postamble. • a <D> command is the only command accepted by the decoder from the monitor. All other commands will pass through to the host.
Data is initiated from the reader	• scan data is not sent to the monitor.
Data is initiated from the host	• in a polled mode, data echoed from the host to the monitor must be in the format <B_>. • in unpolled mode, all host data is echoed to the monitor.

Half-duplex operates exactly like Full-duplex except that the bar code data is displayed on the auxiliary monitor screen at the same time the data is sent to the host.

When	Then
Data is initiated from the monitor	• monitor data to the host is ignored if the reader is in a polled mode. • monitor data or scanned data is sent to the host whenever it is received. • monitor data is not echoed. • monitor data to the host will not have a preamble or a postamble. • a <D> command is the only command accepted by the decoder from the monitor. All other commands will pass through to the host.
Data is initiated from the reader	• scan data is transmitted to the monitor at the same time it is transmitted to the host. • transmission to the host conforms to all the parameters specified in the configuration menu.
Data is initiated from the host	• in a polled mode, data echoed from the host to the monitor must be in the format <B_>. • in unpolled mode, all host data is echoed to the monitor.

Defaulting the Reader

Defaulting the reader resets all reader configuration parameters except Gain Adjustment to their original default values. The value for Gain Adjustment is saved to NOVRAM for power-on by pressing **[<Zp>]** (Save SPS/Gain for Power-on).

Note: The reader can also be defaulted using various methods with the interface box, if used. Refer to page 6–15 for more information regarding faulting the reader via the interface box.

Defaulting is necessary if:

- You wish to quickly restore default settings to the configuration program after making some temporary changes.
- Communications between the reader and another device are interrupted because of incompatible settings (for example, a terminal is set to communicate at 9600 baud, but the reader is configured at 38.4K baud).
- The reader has been assigned a polling address and you wish to access the reader's menu.

Note: Power must be available to the reader during all default procedures.

Software Default

The software default is done by pressing **[<Zd>]** (Restore/Save Default Configuration for Power-on).

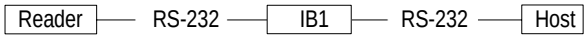
Operating the Interface Box

There are two interface boxes available for your application. The units have:

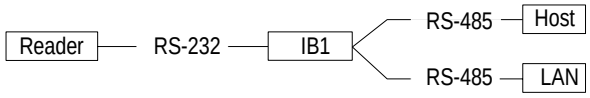
- RS-232 and RS-485 communication (Catalog No. 2755-LS7-IB1)
- RS-232 and RS-422 communication (Catalog No. 2755-LS7-IB2)

RS-232 and RS-485 Communication (Catalog No. 2755-LS7-IB1)

When the Mode switch is in the out position, the RS-232 signals go through to the 25-pin (host) connector.



When the Mode switch is in the in position, the interface box takes RS-232 signals (TXD, pin 2, RXD, pin 3) and converts them to RS-485 levels. The RS-485 levels are present at both the RS-485/422 (LAN) connector and the 25-pin (host) connector.



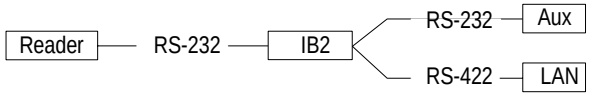
Note: In this mode the reader must be set up for Multidrop communications.

Note: The second RS-232 TXD pin (pin 4 of the host connector) is not available in this mode.

RS-232 and RS-422 Communication (Catalog No. 2755-LS7-IB2)

In this configuration the Mode switch must be in the in position for proper operation.

The second serial port (aux) is present on pins 2 and 3 of the 25-pin (host) connector. This allows a standard RS-232 cable to connect to the second serial port.



Defaulting the Interface Boxes

Access to the configuration menus of a reader that is in a polled mode can be forced (without defaulting) by pressing **[<D>]** from an auxiliary terminal via the auxiliary RS-232 port.

Using the Default Switch on the Interface Box to Default the Reader

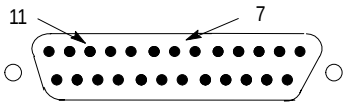
To default the reader with the default switch, insert 16 to 26 gauge wire (paper clip) into the small hole to the left of the Power switch. Listen for a series of short beeps. While the beeping is occurring, insert the wire into the hole again within 3 seconds. A longer beep should be heard. If not, repeat the process.

Shorting Pins 7 and 11

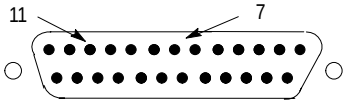
You may also default the reader by shorting pins 7 and 11 of the 25-pin (host) connector together on the interface box. To short the interface box:

ATTENTION: Be certain that the correct pins are shorted. Shorting the wrong pins can cause serious damage to the unit.

1. Turn power to the reader and interface box ON.
2. Locate pins 7 and 11 on the interface box's host connector and mark with a pen.



3. Short pins 7 and 11 momentarily by inserting mating connector or wire. (The length of light wire should be approximately 4 inches, 18 to 26 gauge).
4. Listen for a series of short beeps. While the beeping is occurring, insert the wire into the hole again within 3 seconds. A longer beep should be heard. If not, repeat the process.



Operating the Power Supply

To operate the power supply, make sure the power supply is connected to the interface box and to the power receptacle supplying 100-240V ac. Refer to chapter 4 for more information regarding installing the power supply.

Operating the Host Device

To operate the host device, refer to documentation specific to that product's operation.

Maintenance and Troubleshooting

This chapter provides information on how to maintain and troubleshoot your readers. Items include:

- cleaning the scan window
- troubleshooting the readers
- contacting GTS

Cleaning the Scan Window

Carefully clean the window by first removing loose particles of dirt with canned ultra filtered air. Then use an *optical quality cloth* moistened with an *optical quality cleaning fluid* for plastic lenses and wipe the window in a single direction (don't wipe cloth back and forth across window). Do not leave streaks.

ATTENTION: Do not use abrasive materials such as disposable wipes and facial tissue. Do not use solvents like alcohol or acetone. These materials will damage the window and the finish on the reader.

ATTENTION: The reader has no serviceable parts. Be careful if you open the housing of the reader.

Troubleshooting the Readers

The following table provides a list of the most common operating problems, probable causes, and corrective actions.

Problem	Probable Cause (s)	Corrective Action
Menus do not display when configuration command is sent.	1. Host cable defective or not wired properly.	1. Check cable connections and wiring.
	2. Wrong configuration command (or lower case d) entered.	2. Verify that a <D> serial command (with an *upper case* D) is being entered.
	3. Reader configuration settings do not match host's.	3. Reset reader to default and/or match host settings with reader's.
Getting unintelligible code.	1. Host and reader baud rates or parity not matched.	1. Check baud rates and parity and change to match the host's settings.
Menu display but no decode rate in decode rate test (<C>).	1. Wrong label type or different label type being scanned than that enabled in firmware.	1. Check label configuration settings to be certain that they match the label type being scanned. If label type is in doubt, enable Autodiscriminate All Codes (<P> command). Also ensure that fixed length and check sums, if enabled, are set correctly.
	2. Incorrect label range or label too long to be totally covered by scan beam.	2. Reposition label and check the decode rate (<C> command).
	3. Poor label quality.	3. Try a readable label.
	4. Excessive ambient light, sunlight, or strobes.	4. Shield the bar code and/or scan head to verify that excessive light is not the problem.
	5. Object detector or another reader is interfering with reads.	5. Remount, eliminate interference, or shielding. (Many object detectors emit pulsed infrared signals that can seriously degrade the decode rate if they shine into the reader or onto the bar code label when it is being read.)
Low decode rates during decode rate test (<C>).	1. Poor label, range, placement, etc.	1. Use better quality labels, place reader closer to label, etc.
Decode rate okay but not getting any output (including no reads) in triggered mode.	1. Object detector not positioned properly.	1. Ensure read cycle is active during the time the label is in the scan line.
	2. End of Read Cycle not properly defined.	2. Ensure that the proper End of Read Cycle is defined in reader configuration.
	3.. Reader not triggered when in external mode.	3. Ensure trigger device is operating properly. Also do a Decode Rate Test <C>. If it reads successfully, the problem is triggering.
	4. Reader not triggered when in serial mode.	4. Ensure that correct serial trigger character is entered with start/stop characters (a left angle bracket < (unless redefined) and a right angle bracket >).
	5. Label misaligned or reflecting direct laser light.	5. Ensure the label is not excessively skewed, tilted, or otherwise disoriented. Ensure the bar code is in the scan line when it is supposed to be. Ensure that the bar code is pitched or skewed slightly so as to avoid spicular reflection.

Table continued on the next page.

Problem	Probable Cause (s)	Corrective Action
Decode rate okay but getting only no read messages in triggered mode	1. Triggering/timeout out of sync.	1. Review triggering and timing.
	2. Object detector or another reader interfering with reads.	2. Remount, eliminate interference, or shielding. (Many object detectors emit pulsed infrared signals that can seriously degrade the decode rate if they shine into the reader or onto the bar code label when it is being read.)
	3. Window dirty or obstructed.	3. Clean or remove obstruction.
Previous label read, but subsequent label will not read.	1. Reader configured in Continuous Read 1 Output.	1. Scan a label that contains different data than that of the one being read.
	2. Reader in polled mode.	2. Check communications protocol.
Reader not entering read cycle in triggered mode (trigger not working)	1. Proper trigger levels not enabled.	1. Ensure that the trigger pulse and the trigger polarity settings are correct.
	2. Trigger circuit not correctly wired.	2. Ensure that the trigger circuit wiring meets the reader requirements.
	3. Object detector inoperative.	3. Check detector range and sensitivity. Try a detector that is known to be good.
"Bad bar code" message	1. Poor bar code quality or incorrect label position.	1. Reposition label or test with a label that is known to be good.
"No bar code" message	1. No label is present.	1. Scan an object with a bar code on it.
"No object" message	1. No object is present.	1. Scan an object with a bar code on it.

Technical Support Services

If you have any questions about the AtomScan^{+} Bar Code Reader, please consult this manual first. If you can't find the answer, contact Rockwell Automation International Support:

Rockwell International
Technical Support
6680 Beta Drive
Mayfield Village, Ohio 36849

Inside USA and Canada, call 1–800–289–2279.

Outside USA and Canada, contact your Allen-Bradley office or call USA (216) 646–6800.

Specifications

This appendix provides the specifications for the:

- readers (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, and 2755-LS7-RBV)
- interface boxes (Catalog Nos. 2755-LS7-IB1 and 2755-LS7-IB2)
- power supply (Catalog No. 2755-LS7-PW1)

Reader Specifications

Description	Specification					
	Catalog No. 2755-LS7-SA	**Catalog No. 2755-LS7-RA**	**Catalog No. 2755-LS7-SB**	**Catalog No. 2755-LS7-RB**	**Catalog No. 2755-LS7-SBV**	**Catalog No. 2755-LS7-RBV**
Read Range Direction	Straight ahead	Straight ahead	Straight ahead	Straight ahead	Right angle	Right angle
Scan Pattern	Single scan line	Raster pattern	Single scan line	Raster pattern	Single scan line	Raster pattern
Power Requirements	Input + 5V dc ± 4% regulated @ 480 mA with 200 mV p–p maximum ripple					
Scan Repetition Time	Approximately 300 to 550 scans per second					
Laser Cooling	Thermostatically controlled thermocooler					
Primary Mirror Type	Rotating, 10-faceted					
Skew Tolerance	± 40 from normal					
Pitch Angle	± 50 from normal					
Decode Depth of Field	Refer to chapter 3					
Maximum Element Width	7.0 in. (177.8 mm)					
Print Contrast Minimum	25% absolute dark/light reflectance differential, measured @ 670 nm					
Output Wavelength	670 nm nominal					
Ambient Light Immunity						
Artificial Lighting	450 ft candles (indoor: fluorescent, incandescent, mercury vapor, and sodium vapor)					
Sunlight	1800 ft candles					
Housing Rating	NEMA 12, IP 64					
Operating Temperature	32 F to 122 F (0 C to 50 C)					
Storage Temperature	-20 F to 158 F (–29 C to 70 C)					
Humidity	up to 95% noncondensing					
CDRH Class	II					
Agency Certification	• cUL listed • UL listed • CE marked for all applicable directives. • TUV EN approved					

Interface Box Specifications

Description	Specification
Catalog Numbers	2755-LS7-IB1 and 2755-LS7-IB2
Supply Voltage	5V dc @ 20 mA
Operating Temperature	32 F to 122 F (0 C to 50 C)
Humidity	90% @104 F (40 C)
Agency Certification	CE marked for all applicable directives.

Power Supply Specifications

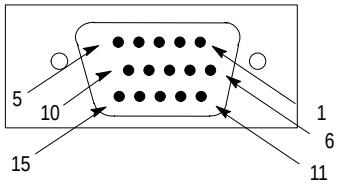
Description	Specification
Catalog Number	2755-LS7-PW1
Input Voltage	90 to 264V ac
Input Frequency	47 to 63 Hz
Output Voltage	+5 V
Vibration	
Frequency	5 to 50 Hz
Acceleration	± 7.35 M/ (s*S)
Direction	x, y, and z axis
Operating Temperature	32 F to 104 F (0 C to 40 C)
Storage Temperature	–4 F to 185 F (–20 C to 85 C)
Humidity	8% to 90%
Agency Certification (registered under Potrans WP10050l)	• cUL listed • UL listed • CE marked for all applicable directives • TUV approved

Cable Pinouts

This appendix provides the cable pinouts for the readers and interface boxes.

Reader Cable Pinouts

The reader cable pinouts are listed below.

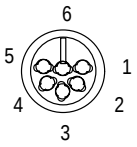


Pin	Signal	Function
1	Power	Reader receives power from the power supply.
2	TXD	Cable pin transmits data to host device.
3	RCD	Cable pin receives data from host device.
4	GND	Ground
5	Not Used	Pin not used.
6	RTS	Host is requesting data from the reader.
7	Output	TTL relay output
8	Input	When voltage is applied to the pin, the reader is set to default settings.
9	Input	Package detect. When voltage is applied to the pin, the reader turns on.
10	CTS	The reader is asking for data from the host.
11	Not Used	Pin not used.
12	Input	Pin allows you to use the Auto–Load feature.
13	GND	Ground
14	Output	TTL relay output
15	Not Used	Pin not used.

Interface Box Pinouts

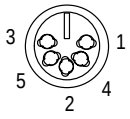
The interface box pinouts are listed in the tables starting below.

Trigger Connector



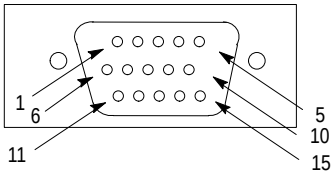
Pin	Function
1	Trigger input. The reader receives a signal from a host device.
2	Normally open relay contact. (Driven by relay #1 from reader.)
3	+5 V
4	+12 V
5	Ground
6	Relay common

Power Port



Pin	Function
1	Signal ground
2	Chassis ground
3	5V dc
4	Not used.
5	Not used.

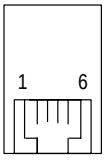
Scanner Port



Pin	Signal	Function
1	Power	Provides power to the reader.
2	TXD	Cable pin transmits data to host device.
3	RCD	Cable pin receives data from host device.
4	GND	Ground
5	Not Used	Pin not used.
6	RTS	Host is requesting data from the reader.
7	Output	TTL relay output
8	Input	When voltage is applied to the pin, the reader is set to default settings.
9	Input	Package detect. When voltage is applied to the pin, the reader turns on.
10	CTS	The reader is asking for data from the host.
11	Not Used	Pin not used.
12	Input	Pin allows you to use the Auto–Load feature.
13	GND	Ground
14	Output	TTL relay output
15	Not Used	Pin not used.

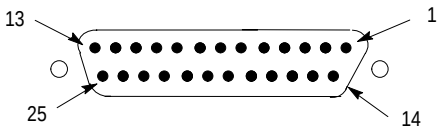
RS-485/422 Port

Use an Alpha 1606 cable for this port.



Pin	Signal	Function
1	GND	Chassis ground
2	RXB+	Reader receives data from the host device.
3	RXA–	Reader receives data from the host device.
4	TXB+	Reader transmits data to host device.
5	TXA–	Reader transmits data to host device.
6	GND	Chassis ground

RS-232 Port



Pin	Signal	Function
1	GND	Chassis ground
2	TXD	Reader transmits data to host device.
3	RXD	Reader receives data from the host device.
4	RTS, TXD, or RS-485 Enable	Host RS-232 RTS or under software control aux RS-232 TXD, or RS-485 transmitter enable.
5	CTS or RXD	Host RS-232 CTS or under software control aux RS-232 RXD.
6	Output	TTL relay output (5V dc @ 2 mA). Sink is 10 mA and source is 2 mA.
7	GND	Signal ground
8	Output	TTL relay output (5V dc @ 2 mA). Sink is 10 mA and source is 2 mA.
9	5 Volts	5 V
10	Input	Trigger input; same as pin 1 of trigger connector.
11	Input	Default configuration pin goes to pin 8 of the reader connector and the default switch.
12	Not Used	No connection
13	RXB+	Reader receives data from the host device in RS-485 and RS-422 modes.
14	TXA–	Reader transmits data to host device.
15	Output	Relay contact normally open
16	RXA–	Reader receives data from the host device in RS-485 and RS-422 modes.
17	Common	Common
18	Not Used	No connection
19	TXB+	Reader transmits data to host device in RS-485 and RS-422 modes.
20	Not Used	No connection
21	Not Used	No connection
22	GND	Ground
23	Not Used	No connection
24	Not Used	No connection
25	Input	New Master input to pin 12 of the reader connector and New Master button.

ASCII Table

This appendix provides ASCII characters.

ASCII Characters

Dec.	Hex.	Mne.	Char.	Dec.	Hex.	Char.	Dec.	Hex.	Char.	Dec.	Hex.	Char.
00	00	NUL	^@	32	20	SP	64	40	@	96	60	‘
01	01	SOH	^A	33	21	!	65	41	A	97	61	a
02	02	STX	^B	34	22	“	66	42	B	98	62	b
03	03	ETX	^C	35	23	#	67	43	C	99	63	c
04	04	EOT	^D	36	24	$	68	44	D	100	64	d
05	05	ENQ	^E	37	25	%	69	45	E	101	65	e
06	06	ACK	^F	38	26	&	70	46	F	102	66	f
07	07	BEL	^G	39	27	’	71	47	G	103	67	g
08	08	BS	^H	40	28	(	72	48	H	104	68	h
09	09	HT	^I	41	29	)	73	49	I	105	69	i
10	0A	LF	^J	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	^K	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	^L	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	^M	45	2D	–	77	4D	M	109	6D	m
14	0E	SO	^N	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	^O	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	^P	48	30	0	80	50	P	112	70	p
17	11	DC1	^Q	49	31	1	81	51	Q	113	71	q
18	12	DC2	^R	50	32	2	82	52	R	114	72	r
19	13	DC3	^S	51	33	3	83	53	S	115	73	s
20	14	DC4	^T	52	34	4	84	54	T	116	74	t
21	15	NAK	^U	53	35	5	85	55	U	117	75	u
22	16	SYN	^V	54	36	6	86	56	V	118	76	v
23	17	ETB	^W	55	37	7	87	57	W	119	77	w
24	18	CAN	^X	56	38	8	88	58	X	120	78	x
25	19	EM	^Y	57	39	9	89	59	Y	121	79	y
26	1A	SUB	^Z	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	^[	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	^\	60	3C	<	92	5C	\	124	7C	|
29	1D	GS	^]	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	^^	62	3E	>	94	5E	^	126	7E	~
31	1F	US	^_	63	3F	?	95	5F	_	127	7F	⌂

Multidrop Communications

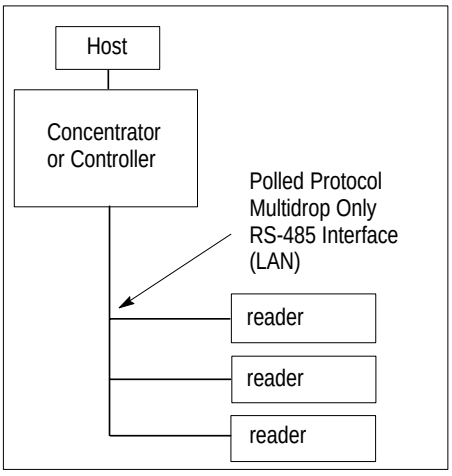
This appendix describes the rules for setting up a concentrator or controller to communicate with a reader in standard Multidrop protocol.

Multidrop Addresses

Multidrop networks allow you to connect up to 50 readers to a single host via a concentrator or controller. Be aware of the following when setting up for multidrop communication.

- No two readers in the multidrop network can have the same address.
- Each reader in the network must have an address (from 1 to 50) assigned in its configuration program.
- Each address has its own separate poll and select address (from 1C to 7F hex).

Refer to the table on page D–2 for the poll and select addresses.



The poll and select addresses are listed in the table below.

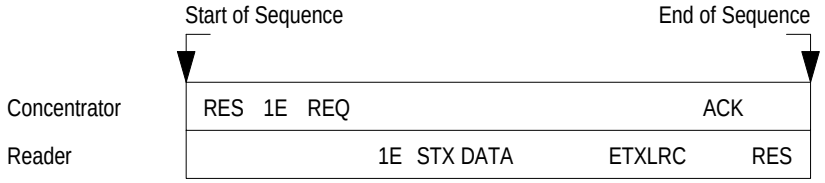
Reader	Poll Address	Select Address	Reader	Poll Address	Select Address
01	1C	1D	26	4E	4F
02	1E	1F	27	50	51
03	20	21	28	52	53
04	22	23	29	54	55
05	24	25	30	56	57
06	26	27	31	58	59
07	28	29	32	5A	5B
08	2A	2B	33	5C	5D
09	2C	2D	34	5E	5F
10	2E	2F	35	60	61
11	30	31	36	62	63
12	32	33	37	64	65
13	34	35	38	66	67
14	36	37	39	68	69
15	38	39	40	6A	6B
16	3A	3B	41	6C	6D
17	3C	3D	42	6E	6F
18	3E	3F	43	70	71
19	40	41	44	72	73
20	42	43	45	74	75
21	44	45	46	76	77
22	46	47	47	78	79
23	48	49	48	7A	7B
24	4A	4B	49	7C	7D
25	4C	4D	50	7E	7F

Polling Sequence

The polling sequence occurs when the host device solicits information from the readers. The host device sends out poll requests to the readers.

The polling sequence example below begins with a RES (reset) from the controller followed by poll address 1E (ASCII hex value for reader 02) and a REQ (request). The reader responds by first transmitting its own address, 1E, followed by a STX (start of text) character, and then the data. Next it transmits an ETX (end of text) character and an LRC (longitudinal redundancy check) character.

If the controller (or concentrator) receives the data from the reader and is able to validate it with an LRC calculation, it responds with an ACK (acknowledgment). If the reader in turn receives the ACK, the ends this successful exchange with a RES (reset).



Polling Reset

A polling reset is when the polling sequence is interrupted. A polling reset occurs when:

- the reader has no information and it responds by transmitting a RES (reset),
- the reader receives a NAK instead of the ACK after transmitting its data string. The reader will re-attempt to transmit the data string up to three times. If the reader still does not receive an ACK, it will transmit a RES (reset) and discard the data in its buffers, or
- the reader transmits data to the controller and the controller responds with an ACK or NAK, but the reader doesn't receive the controller's response. The reader will timeout and transmit a REQ to the controller and request another response. If after three retries (the number of times it transmits a REQ to the controller) the reader receives no response, it ends the transmission with a RES (reset).

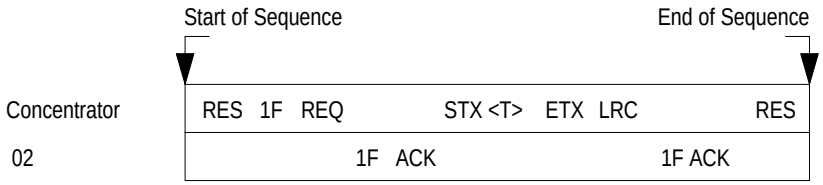
Select Sequence

Unlike poll requests, select commands always originate from the host device and consist of serial configuration or operation commands to devices that are configured in Multidrop. The reader complies with the command when it is polled during the cycle.

A RES (reset) is the first command in the select sequence. The 1F hex is the select address associated with 02 address. It is followed by a REQ (request). The reader responds with its own select address, 1F hex, and an ACK (acknowledge). The controller then transmits an STX (start of text), the data (in this case a <T>), an ETX (end of text), and an LRC character.

The reader replies by transmitting its own address, followed by an ACK, acknowledging receipt of the command. Upon receipt of an ACK, the controller concludes the successful exchange with a RES.

In the example below, the reader only acknowledges a trigger counter request from the controller. The reader does not respond to the trigger counter request until a subsequent poll. For example, if the reader trigger count was 12 at the time the trigger counter request was received, on a subsequent poll the reader would transmit 02T/00012. (The 02 at the beginning of the string is the reader address.)



Select Reset

If the reader receives bad data from the controller, it transmits a SEL (its select address) and a NAK to the controller. The controller re-transmits the data up to three times. The controller will end the sequence with a RES (reset) if no ACK is received.

Application Examples

This appendix is designed to illustrate various applications for the AtomScan+ Bar Code Readers. Application examples include:

- enhanced decoder
- flexible interface module
- SLC 5/03™ and SLC 5/04™ controllers
- PLC-5 controller
- DTAM™ Plus DeviceNet™

Because of the variety of uses for this information, the user and those responsible for applying this information must satisfy themselves as to the acceptability of each application. In no event will Allen–Bradley Company be responsible or liable for indirect or consequential damages resulting from the use of application of this information.

The examples shown in this appendix are intended solely to illustrate the principles of the readers and some of the methods used to apply them. Particularly because of the many requirements associated with any particular installation, Allen–Bradley Company cannot assume responsibility or liability for actual use based upon the illustrative uses and applications.

Enhanced Decoder

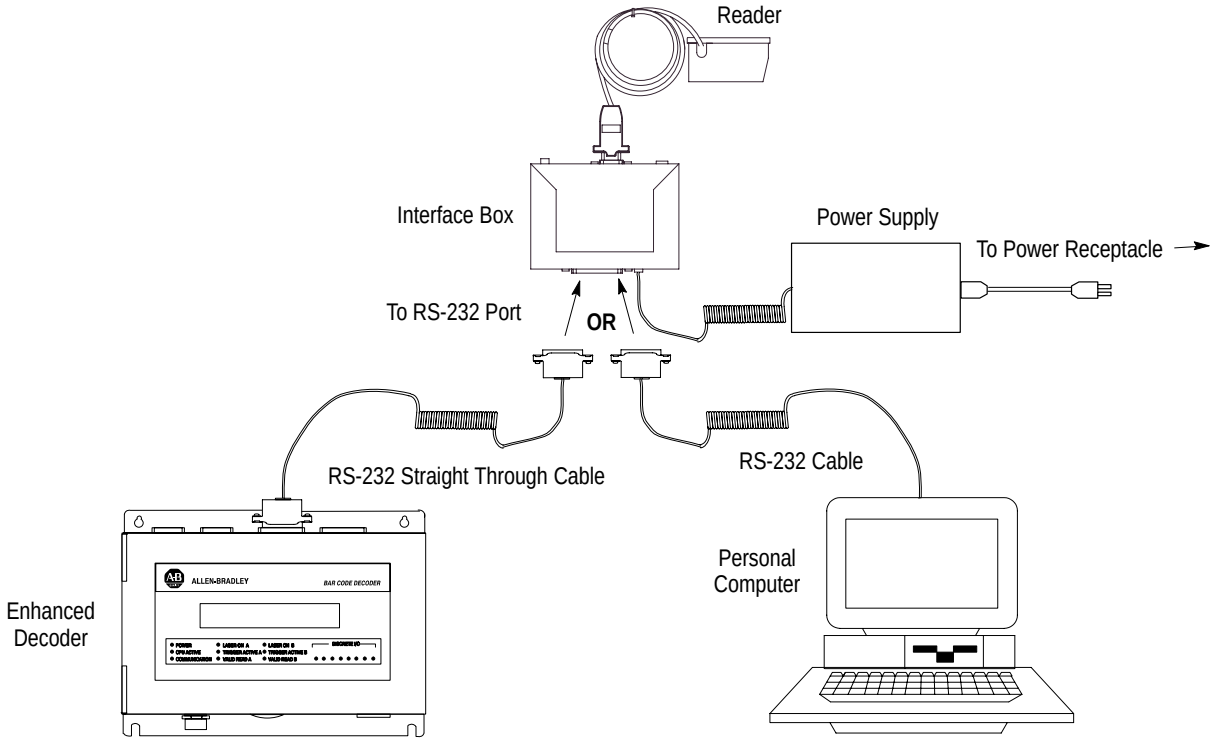
This application example describes how to configure and operate the readers when using an RS-232 cable connected to the AUX port of an Allen-Bradley Enhanced Decoder (Catalog No. 2755-DD/DS). This application example also provides configuration information for an Auxiliary Port Pass-Through application for the enhanced decoder.

ATTENTION: Do not install the RS-232 cable with power applied to either the interface box or enhanced decoder. Failure to follow this caution may result in damage to the reader, interface box, or enhanced decoder.

Refer to the *Enhanced Decoder User Manual* (Publication No. 2755-833) for additional information on the enhanced decoder.

Hardware Connections for AUX Port Pass-Through

The interface box connects to an auxiliary port on the enhanced decoder with an RS-232 cable.



Configuration Codes for the AUX Port Pass-Through

After making the necessary connections, set the reader to the settings in the table below to allow the reader to communicate with the enhanced decoder.

Description	Menu Setting	Serial Command Setting
Baud Rate	9600	<Ka4,1,0,1>
Parity	Even	
Stop Bits	One	
Data Bits	8	

Enhanced Decoder Setup for the AUX Port Pass-Through

You need to configure the enhanced decoder. Follow the steps below or refer to the *Enhanced Decoder User Manual* (Publication No. 2755-833).

1. Select Aux Terminal Data Entry (Screen 8) from the Main menu.
2. Set Enable Keyboard Entry = **Yes**

3. Save and exit the configuration.
4. Move internal selector (jumper) to the data entry position on the system board (B-5, B-6).
5. See Chapter 13 of *Enhanced Decoder User Manual* (Publication No. 2755-833) for additional information.

Flexible Interface Module

This application example describes how to configure and operate the readers when using an RS-232 cable connected to the flexible interface module (Catalog No. 2760-RB).

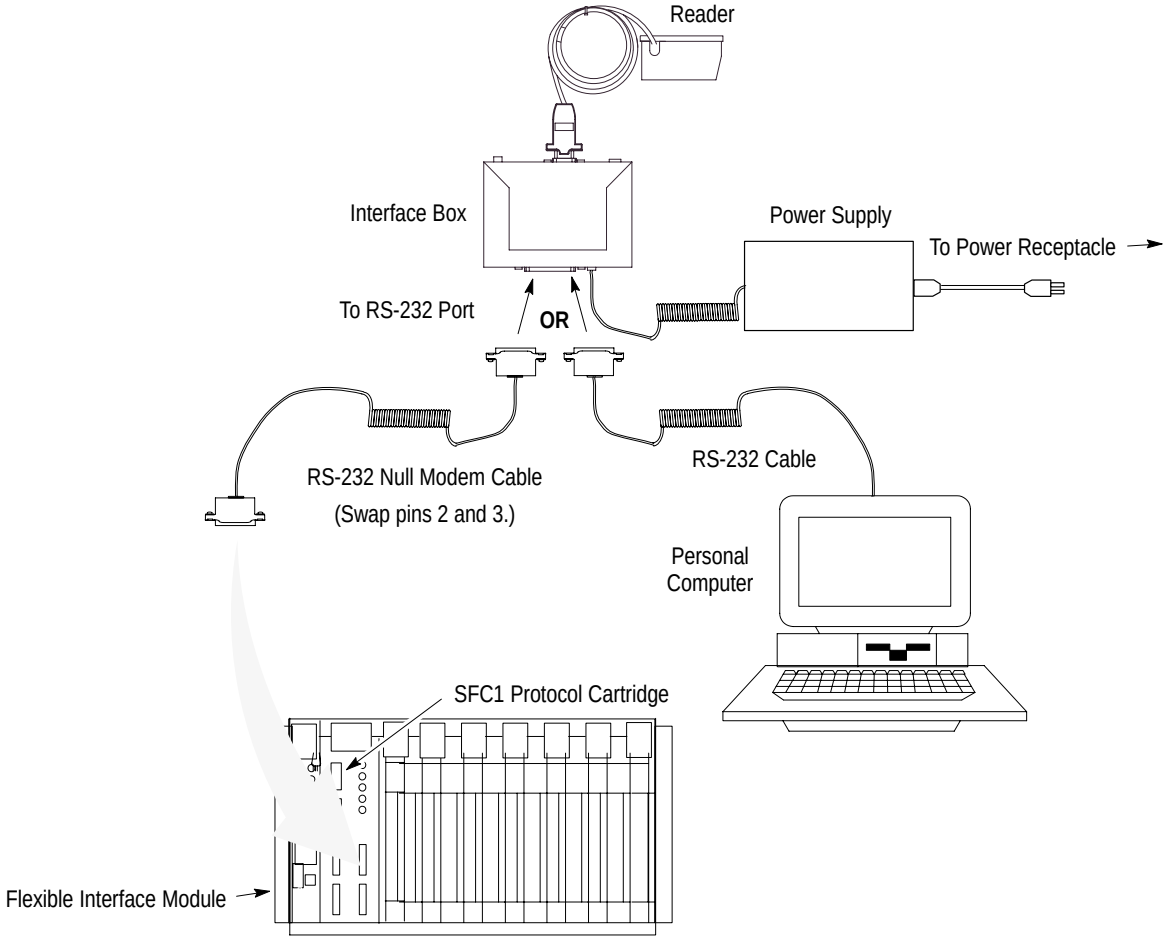
ATTENTION: Do not install the RS-232 cable with power applied to either the interface box or flexible interface module. Failure to follow this caution may result in damage to the reader, interface box, or flexible interface module.

Refer to the following publications for additional information.

- *Flexible Interface Module User Manual* (Publication No. 2760-ND001)
- *SFC1 or SFC2 Protocol Cartridge User Manuals* (Publication Nos. 2760-ND002 or 2760-822)

Hardware Connections for the Flexible Interface Module

The interface box connects to one of the three communication ports on the flexible interface module with an RS-232 cable. The interface module requires an SFC1 Protocol Cartridge.



Configuration Codes for the Flexible Interface Module

After making the necessary connections, set the reader to the settings in the table below to allow the reader to communicate with the flexible interface module.

Description	Menu Setting	Serial Command Setting
Baud Rate	9600	<Ka4,0,0,1>
Parity	None	
Stop Bits	One	
Data Bits	8	

Flexible Interface Module Setup

You need to configure the flexible interface module. Follow the steps below or refer to the *Flexible Interface Module User Manual* (Publication No. 2760-ND001) or the *SFC1 or SFC2 Protocol Cartridge User Manuals* (Publication Nos. 2760-ND002 or 2760-822).

1. Select 90B to reset the configuration to factory defaults.
2. Configure screens 3, 21, and 11 (in this order) as shown starting below.

```
        2760–RB        SERIES A  REVISION J
   COPYRIGHT 1989                ALLEN–BRADLEY COMPANY, INC.
   ____________________________________________________________

1X  – CONFIGURATION PARAMETERS        2X  – IDENTIFICATION NUMBERS
3   – DEVICE PORT PROTOCOL NAMES      4DM – MATCH CODE ENTRIES
5I  – DISCRETE BYTE INPUT ENTRIES     6   – THE DATA MATRIX ENTRIES
7   – THE PASS THROUGH ENTRIES        8   – NON–VOLATILE SCRATCH PAD AREA
9XF – RB MODULE FUNCTIONS             AX  – HARDWARE DIAGNOSTICS
BX  – SOFTWARE DIAGNOSTICS            C   – EXIT CONFIGURATION MODE

WHERE X (0 TO 7) AND D (1 TO 3) ARE PORT NUMBERS WHICH ARE DEFINED BELOW :

0 – RB CMMND PRCSS   2 – SERIAL PORT 2   4 – CONFIG PORT     6 – I/O RACK SLT 1
1 – SERIAL PORT 1    3 – SERIAL PORT 3   5 – I/O RACK SLT 0   7 – RESERVED

WHERE F (A TO E) ARE FUNCTIONS THAT RB CAN PERFORM WHICH ARE DEFINED BELOW :

A – RESET   B – SET DEFAULTS   C – FLUSH   D – INITIALIZE   E – CLEAR DIAGS

WHERE M (A TO T) AND I (A TO H) ARE ENTRY NUMBERS FOR THE SELECTION MADE ABOVE.

            ENTER A MAIN MENU SELECTION:
```

```
            ENTER A MAIN MENU SELECTION: 3

PORT 1 = COPYRIGHT 1989          ALLEN–BRADLEY COMPANY, INC.
 2760–SFC1 DT    , SERIES A , REVISION B    (YES/NO) = YES.

PORT 2 = COPYRIGHT 1989          ALLEN–BRADLEY COMPANY, INC.
2760–SFC1 DT    , SERIES A , REVISION B    (YES/NO) = YES.

PORT 3 = COPYRIGHT 1989          ALLEN–BRADLEY COMPANY, INC.
2760–SFC1 DT    , SERIES A , REVISION B    (YES/NO) = YES.

EDIT THIS SELECTION (YES/NO) ?
```

```
ENTER A MAIN MENU SELECTION: 21

DUMB TERM. UNSPECIFIED PROTOCOL, 13fh (YES/NO) = YES.

EDIT THIS SELECTION (YES/NO) ?
```

```
ENTER A MAIN MENU SELECTION: 11

MODEM CONTROL (ENABLE/DISABLE) = DISABLE.
9600 BITS PER SECOND (YES/NO) = YES.
8 BITS NO PARITY (YES/NO) = YES.
XON/XOFF (ENABLE/DISABLE) = DISABLE.
RS232 (YES/NO) = YES.
RECEIVE MATRIXING (ENABLE/DISABLE) = DISABLE.
BYTE SWAPPING (ENABLE/DISABLE) = ENABLE.
BINARY DATA NO CONVERSIONS (YES/NO) = YES.
HDR/TLR ON OUTPUT (ENABLE/DISABLE) = ENABLE.
HEADER BYTE LENGTH (DEC 0...4) = 0.
HEADER DATA[0] (HEX 0...ff) = 0.
HEADER DATA[1] (HEX 0...ff) = 0.
HEADER DATA[2] (HEX 0...ff) = 0.
HEADER DATA[3] (HEX 0...ff) = 0.
TRAILER BYTE LENGTH (DEC 0...4) = 2.
TRAILER DATA[0] (HEX 0...ff) = a.
TRAILER DATA[1] (HEX 0...ff) = d.
TRAILER DATA[2] (HEX 0...ff) = 0.
TRAILER DATA[3] (HEX 0...ff) = 0.
MAX DATA BYTE LENGTH (DEC 0...124) = 0.
MIN DATA BYTE LENGTH (DEC 0...124) = 0.

CONTINUE THIS SELECTION (YES/NO) ?
```

3. Make sure PLC program is written to access Flexible Interface Module data.

SLC 5/03 and SLC 5/04 Controllers

This application example describes how to configure and operate the readers when using an RS-232 cable connected to the SLC 5/03 (Catalog No. 1747-L532) and SLC 5/04 controllers (Catalog Nos. 1747-L541, 1747-L542, and 1747-L543).

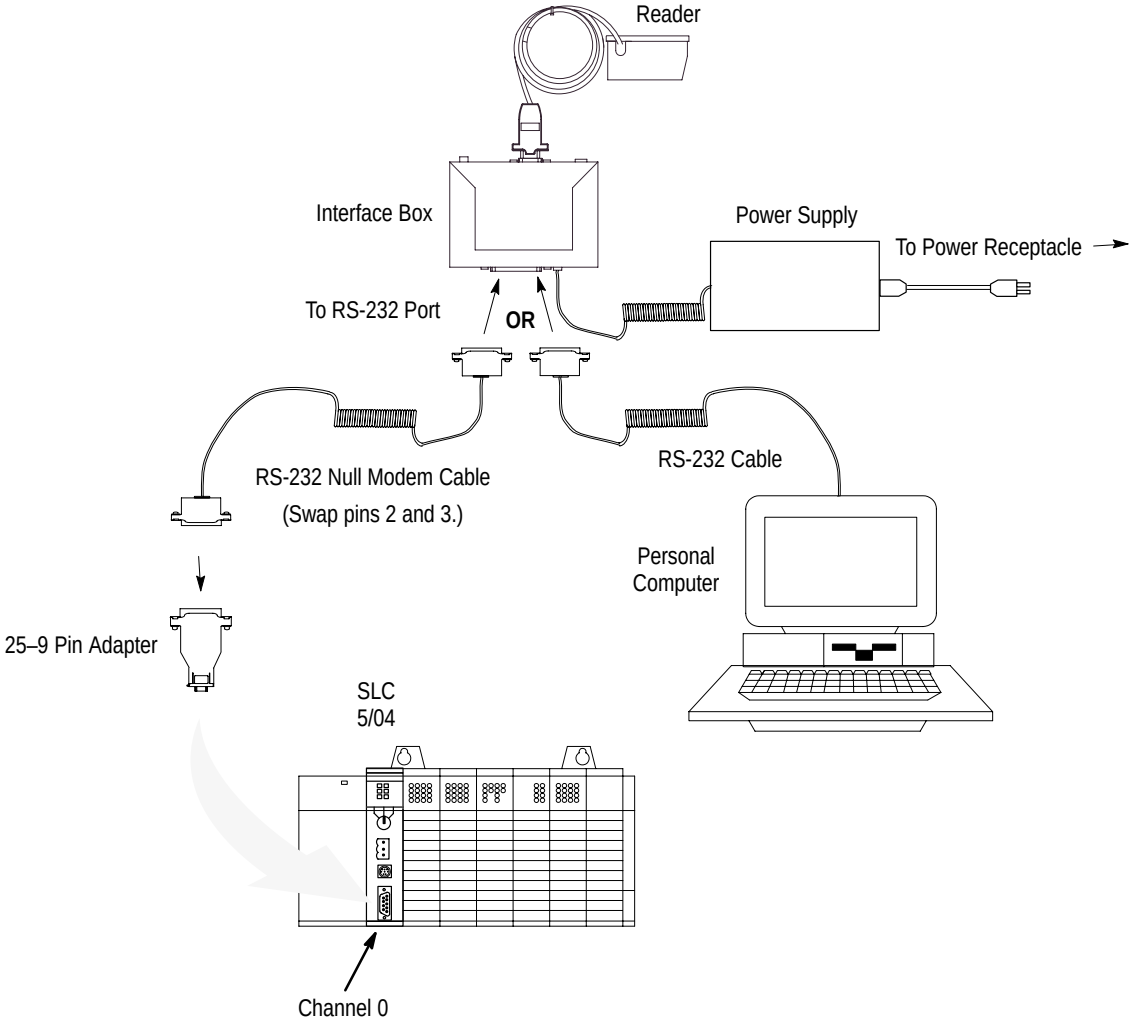
ATTENTION: Do not install the RS-232 cable with power applied to either the interface box or SLC 5/03 or SLC 5/04 controllers. Failure to follow this caution may result in damage to the reader, interface box, or SLC 5/03 or SLC 5/04 controllers.

Refer to the following publications for additional information.

- *SLC 500 Modular Hardware Style Installation and Operation Manual* (Publication No. 1747-6.2)
- *SLC 500 and MicroLogix™ 1000 Instruction Set Reference Manual* (Publication No. 1747-6.15)
- *Advanced Programming Software User Manual* (Publication No. 9399-APSUM-11.15.95)

Hardware Connections for the SLC 5/03 and SLC 5/04 Controllers

The interface box connects to one of the communication ports on the SLC 5/03 or SLC 5/04 controllers with an RS-232 cable. You need to use a 25–9 pin cable or a 25–9 pin connector as shown below.



Configuration Codes for the SLC 5/03 and SLC 5/04 Controllers

After making the necessary connections, set the reader to the settings in the table below to allow the reader to communicate with the SLC 5/03 or SLC 5/04 controllers.

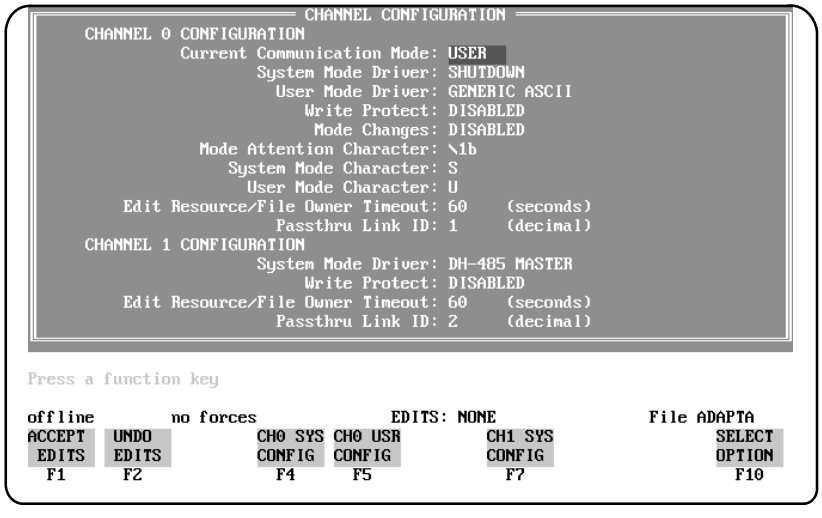
Description	Menu Setting	Serial Command Setting
Preamble	Disable	<Kd0>
Postamble	Enable Control J	<Kel,^M,^J>
Baud Rate	9600	<Ka4,0,0,1>
Parity	None	
Stop Bits	One	
Data Bits	8	

SLC 5/03 and SLC 5/04 Controllers Setup

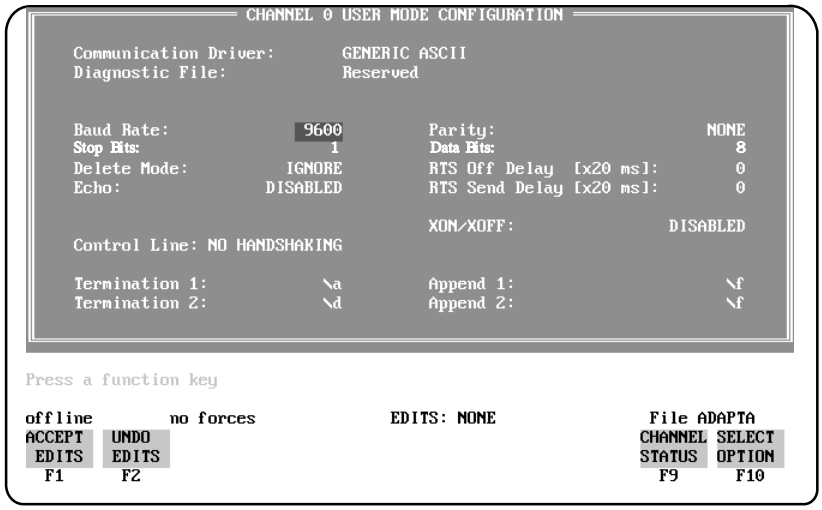
You need to configure the SLC 5/03 and SLC 5/04 controllers. Follow the steps starting below or refer to the following publications:

- *SLC 500 Modular Hardware Style Installation and Operation Manual* (Publication No. 1747-6.2)
- *SLC 500 and MicroLogix™ 1000 Instruction Set Reference Manual* (Publication No. 1747-6.15)
- *Advanced Programming Software User Manual* (Publication No. 9399-APSUM-11.15.95)

1. Set the SLC Channel 0 to **User** in the Channel 0 Configuration screen



2. Configure Channel 0 in the Channel 0 User Mode Configuration screen.

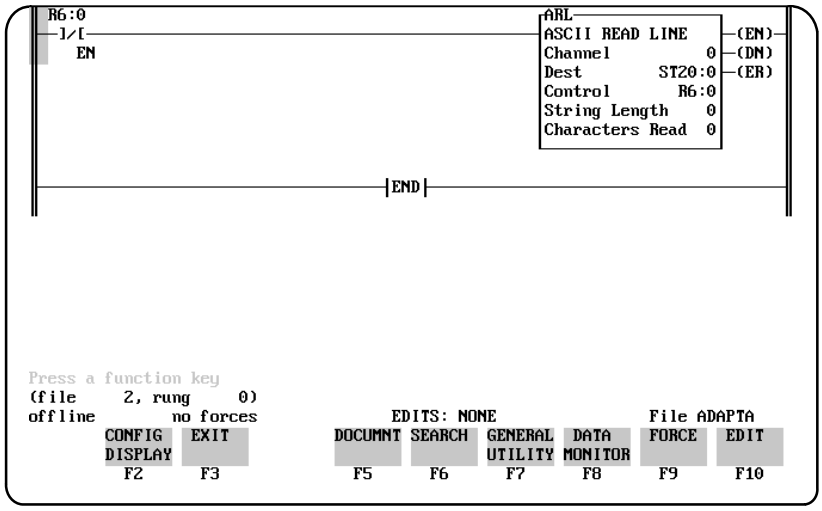


Note: Termination 1 is set for **\a** or Line Feed **[LF]**, and Termination 2 is set for **\d** or Carriage Return **[CR]**. These terminators, along with the **ARL** instruction in the SLC, allow you to read one message at a time with **[CR] [LF]** terminators.

SLC Program

The sample ladder logic listing below instructs the SLC 5/03 and SLC 5/04 controllers to:

Rung 2:0 – Read one string of ASCII data terminated with a **[CR] [LF]**.



PLC-5 Controller

This application example describes how to configure and operate the readers when using an RS-232 cable connected to the PLC-5 controllers (Catalog Nos. 1785-L11B, 1785-L20B, 1785-L30B, 1785-L40B, 1785-L60B, and 1785-L80B)

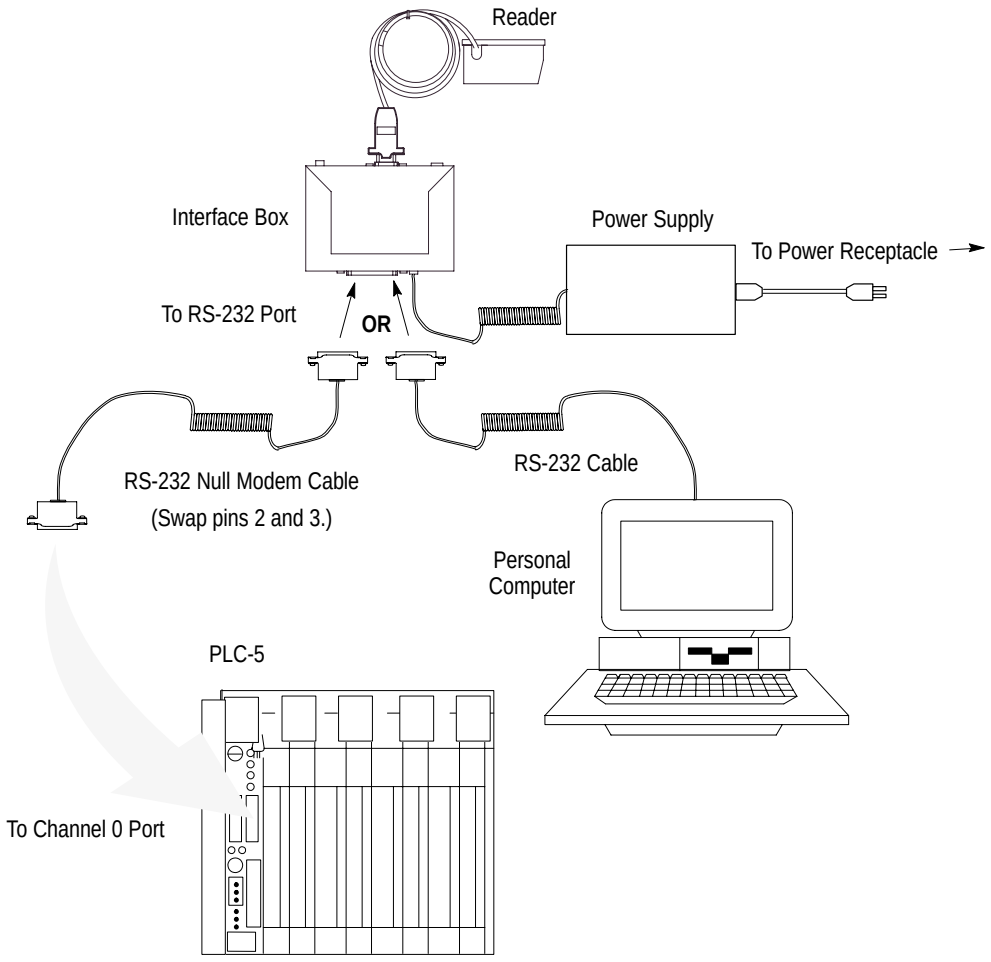
ATTENTION: Do not install the RS-232 cable with power applied to either the interface box or PLC-5 controllers. Failure to follow this caution may result in damage to the reader, interface box, or PLC-5 controllers.

Refer to the following publications for additional information.

- *Classic PLC-5 Family Programmable Controllers Hardware Installation Manual* (Publication No. 1785-6.6.1)
- *PLC-5 Programming Software Instruction Set Reference Manual* (Publication No. 6200-6.4.11)
- *PLC-5 Programming Software Configuration and Maintenance Manual* (Publication No. 6200-6.4.6)

Hardware Connections for the PLC-5 Controllers

The interface box connects to the PLC-5 controllers with an RS-232 cable.



Configuration Codes for the PLC-5 Controllers

After making the necessary connections, set the reader to the settings in the table below to allow the reader to communicate with the PLC-5 controllers.

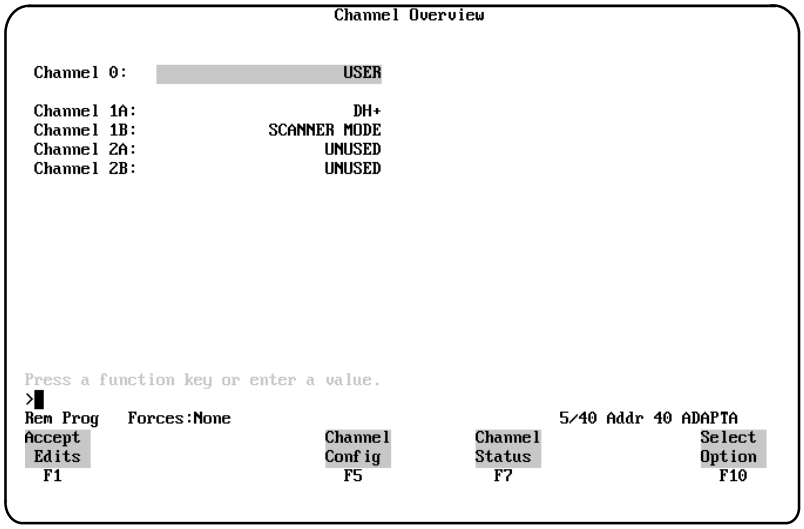
Description	Menu Setting	Serial Command Setting
Preamble	Disable	<Kd0>
Postamble	Control J	<Kel,^M,^J>
Baud Rate	9600	<Ka4,0,0,1>
Parity	None	
Stop Bits	One	
Data Bits	8	

PLC-5 Controllers Setup

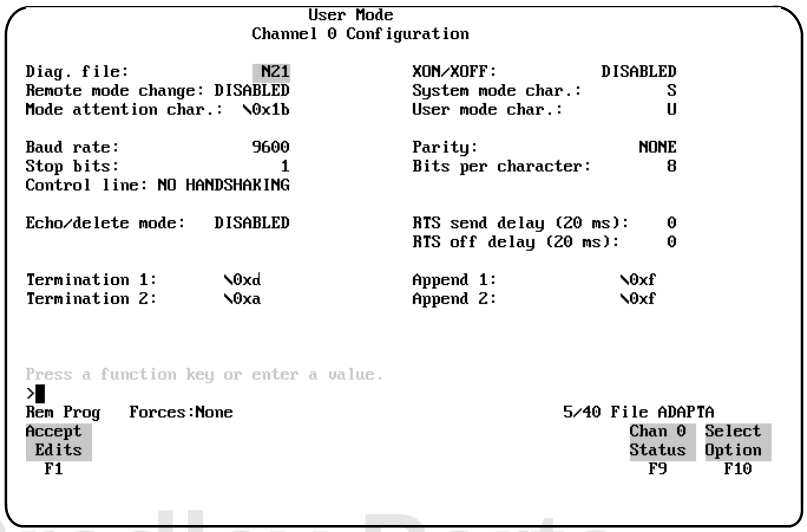
You need to configure the Channel 0 port of the PLC-5 controllers. Follow the steps below or refer to the following publications:

- *Classic PLC-5 Family Programmable Controllers Hardware Installation Manual* (Publication No. 1785-6.6.1)
- *PLC-5 Programming Software Instruction Set Reference Manual* (Publication No. 6200-6.4.11)
- *PLC-5 Programming Software Configuration and Maintenance Manual* (Publication No. 6200-6.4.6)

1. Set the PLC-5 Channel 0 to **User** in the Channel 0 Configuration screen.



2. Configure Channel 0 in the User Mode Channel 0 Configuration screen.

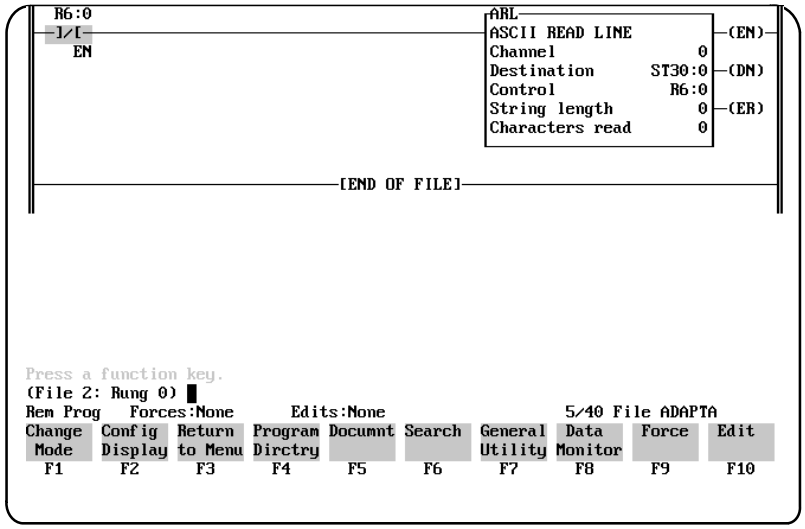


Note that Termination 1 is set for **\0xa** or Line Feed **[LF]**, and Termination 2 is set for **\0xd** or Carriage Return **[CR]**. These terminators, along with the **ARL** instruction in the PLC-5 controllers, allow you to read one message at a time with **[CR] [LF]** terminators.

PLC Program

The sample ladder logic listing below instructs the PLC-5 controllers to:

Rung 2:0 – Read one string of ASCII data terminated with a **[CR] [LF]**.



DTAM Plus DeviceNet

This application example describes how to configure and operate the readers when using an RS-232 cable connected to a DTAM Plus Operator Interface (Catalog Nos. 2707-L8P1D, 2707-L8P2D, 2707-L40P1D, 2707–L40P2D, 2707-V40P1D, 2707-V40P2D, or 2707-V40P2ND) on a DeviceNet network.

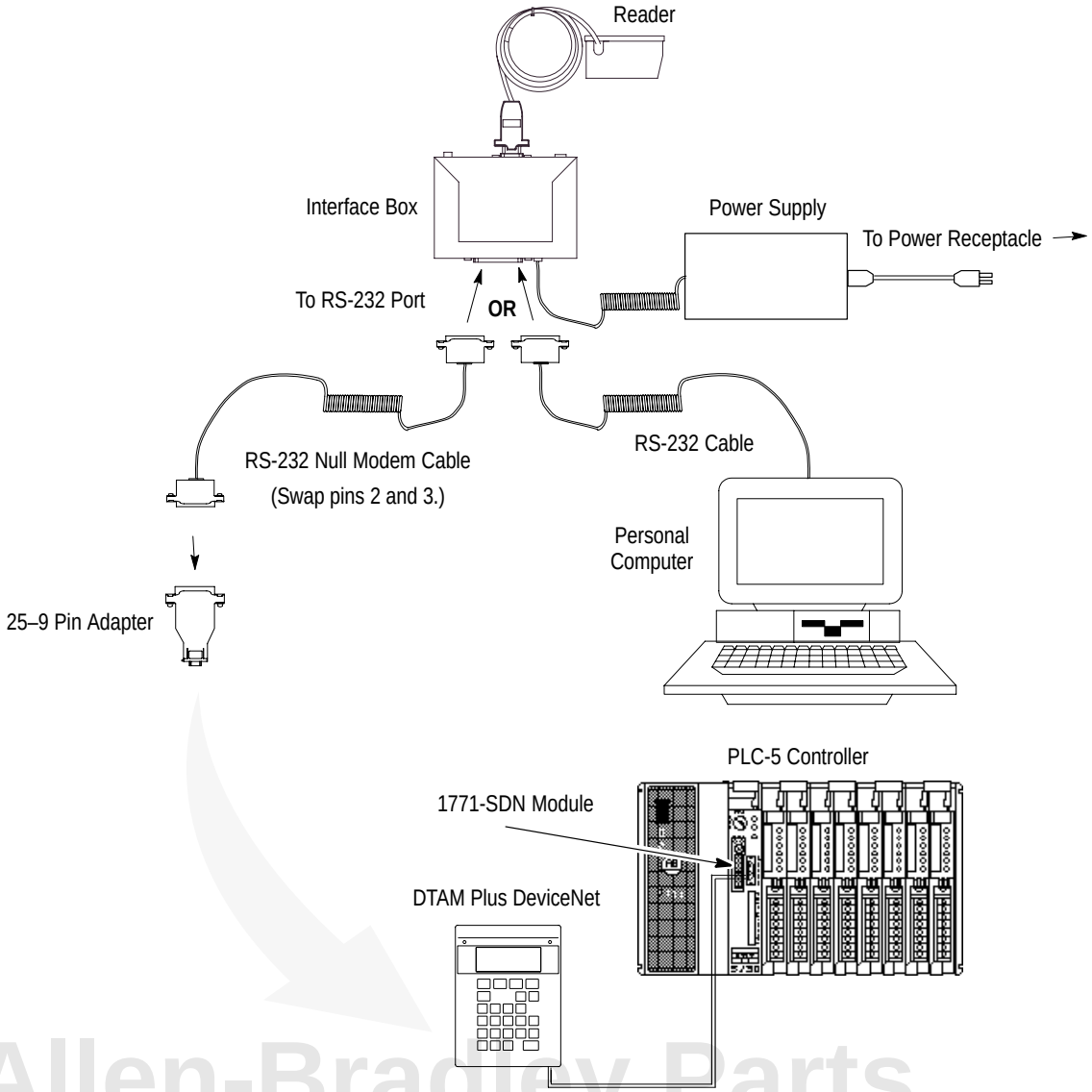
ATTENTION: Do not install the RS-232 cable with power applied to either the interface box or DTAM Operator Interface. Failure to follow this caution may result in damage to the reader, interface box, or DTAM Operator Interface.

Refer to the following publications for additional information.

- *DTAM Plus Operator Interface Module User Manual* (Publication No. 2707-800)
- *DTAM Plus Devicenet Operator Interface Document Update* (Publication No. 2707-800.5)
- *DTAM Programming Software Programming Manual* (Publication No. 2707-802)
- *Getting Started with DTAM Plus User Manual* (Publication No. 2707-802)

Hardware Connections for the DTAM Plus Operator Interface

The readers connect to the DTAM Plus Operator Interface with the RS-232 cable. You need to use a 25–9 pin cable or a 25–9 pin connector as shown below.



Configuration Codes for the DTAM Plus Operator Interface

After making the necessary connections, set the reader to the settings in the table below to allow the reader to communicate with the DTAM Plus Operator Interface.

Description	Menu Setting	Serial Command Setting
Preamble	Disable	<Kd0>
Postamble	Control J	<Kel,^M,^J>
Baud Rate	9600	<Ka4,0,0,1>
Parity	None	
Stop Bits	One	
Data Bits	8	

DTAM Plus Operator Interface Setup

You may need to configure the DTAM Plus Operator Interface RS-232 port to accept the reader data. Follow the steps below or refer to the *DTAM Programming Software Programming Manual* (Publication No. 2707-802).

1. Open Screen Builder.
2. Open Create Screen.
3. Open Data Entry Screen.
4. Select Set Up Screen.
5. Select Data Entry.
6. Select ASCII Input.
7. Set up DTAM.

DeviceNet Operation

The DTAM Plus DeviceNet operates as a Group 2 Server on the DeviceNet network. It supports the Unconnected Message Manager (UCMM). The DTAM Plus DeviceNet implements the predefined master/slave connection set, operating as a slave device. It does not initiate communications except for a Duplicate Node Address check on power-up.

The DTAM Plus DeviceNet supports the polled I/O method of exchanging data with a master, in the following sequence:

1. The designated master writes an output image to the DTAM Plus DeviceNet using the Poll Command message.
2. The DTAM Plus DeviceNet responds to the poll command by returning an input image back to the master in a Poll Response message.

   Note: The size of the input and output images (also referred to as files) are individually configurable from 0 words to 121 words each, to optimize DeviceNet network loading.

3. The DTAM Plus DeviceNet application program interacts with data contained in the input and output files.
4. Data Display screens are used to view input and output data.
5. Data Entry screens are used to modify input and output data from the reader.

European Union Directives

This appendix provides information regarding:

- compliance to European Union Directives
- declaration of conformity

Compliance to European Union Directives

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

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

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131–2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111

Declaration of Conformity

Below is a copy of the Declaration of Conformity for the AtomScan+ Bar Code Readers (Catalog Nos. 2755-LS7-SA, 2755-LS7-SB, 2755-LS7-RA, 2755-LS7-RB, 2755-LS7-SBV, and 2755-LS7-RBV) and power supply (Catalog No. 2755-LS7-PW1).

DECLARATION OF CONFORMITY

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

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

Applied Council Directive(s):
Electromagnetic Compatability Directive (EMC) 89/336/EEC,
Low Voltage Directive 73/23/EEC,
and amending directives 91/263/EEC, 92/31/EEC, 93/68/EEC

We,

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

declare under our sole responsibility that the product(s) (name, type/model, batch/serial number):
Fixed mount laser diode barcode scanners and power supply identified by the following Allen-Bradley Catalog Numbers: Bul 2755-LS7 -SA, -SB, -RA, -RB, -SBV, -RBV, -SAX, -SBX, -RAX, -RBX, -SBVX, -RBVX, -PW1

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

Bul 2755-LS7 -SA, -SB, -RA, -RB, -SBV, -RBV, -SAX, -SBX, -RAX, -RBX, -SBVX, -RBVX Scanners
EN 55 022 : 1988
EN 50 082-1 : 1992 (IEC 801.1 : 1988, IEC 801.2 : 1988, IEC 801.3 : 1988, IEC 801.4 : 1988)
EN 60 950 : 1992 + A1 : 1993 + A2 : 1993
EN 60-825-1: 1994

Bul 2755-LS7-PW1 Power Supply:
EN 60 950 : 1992 + A1 : 1993 + A2 : 1993

Test Information is maintained at:
Allen-Bradley Company, Inc.
1201 South Second Street
Milwaukee, WI 53204 USA

Year of CE Marking (Low Voltage Directive): 1996

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

Manufacturer

Signature: Robert Gardiner
Full Name: Robert Gardiner
Position: Manager, Quality Engineering
Date: 15 OCT 96

Authorized Representative in the Community through its Responsible Person

Signature: i. V.
Full Name: Viktor Schiffer
Position: Engineering Manager
Date: 20 Oct 96

Chg Ltr: A Rel. No.: 782-96 Sheet 1 of 1 43500-256-01

Glossary

Autodiscriminate – The ability to decode several different bar code symbologies without changing configuration.

AWG – Abbreviation for American Wire Gauge. This is a standard measuring system for wire sizes, listed from 0 (biggest) to 40 (smallest). A 26 AWG is equivalent to 0.0159 in. (0.405 mm) in diameter.

Bar Code – Data that has been encoded into an array of parallel bars and spaces of varying widths.

Bar Code Density – Number of characters per inch or other unit of measure.

Baud Rate – The term used to describe the number of discrete signal events per second. In RS-232 and RS-422/485 systems, baud rate is the same as bits per second (bps).

Code 39 – An alphanumeric bar code with a character set containing a start/stop character, 10 numbers, 26 letters, 6 symbols, and a space. This code is discrete, variable length, and self-checking.

Configuration – The method used to change factory default settings for operational features to match a specific application. Configuration can be done through menu selection or with serial commands.

Connector – Physical device (plug or socket) on unit or cable to provide in/out connectivity for various circuits and pins.

Counter – Memory space provided to keep track of read cycle events.

Decode Rate – The number of good reads per second decoded by the reader.

Depth of Field – The distance between the minimum and maximum range in which a reader can read bar code labels.

EPROM – Erasable, programmable, read only memory.

End of Read Cycle – The time at which the reader stops expecting label information to decode. This can be caused by a timeout, a trigger event, or a good read.

Focal Length – The distance measured from the reader to the center of the depth of field, or *focal* point.

Good Read – The event that occurs when a label's data is accurately scanned and decoded.

Intercharacter Gap – The extra space between the last element of one character and the first element of the adjacent character of a specific bar code symbol.

Label Height – Regardless of orientation, the measurement taken along the length of a label's individual bars.

Label Length – Regardless of orientation, the measurement taken across the label's bars from one end to the other, including the quiet zone.

Label Speed – The rate in inches or centimeters per second at which a label moves through the scan beam.

Label Transitions – The transition of bars and spaces on a label, used by the MS-sensor to detect the presence of a label on a package.

Ladder Label Orientation – A bar code label in which the bars are parallel to the label's direction of travel.

Match Code – The ability to compare bar code labels being scanned against a master label that is stored in the memory of the reader.

Menu Configuration – The process of changing factory default settings via a sequence of menus displayed on a terminal monitor.

Mil – One thousandths of an inch or 0.0254 mm. In bar-coding, a measurement that identifies a bar code label by the width of its narrowest element.

Mismatch – An event that occurs when the scanned bar code label does not match the master label that is stored in the memory of the reader.

Narrow-bar-width – The width of the narrowest bar of a given label, expressed in thousands of an inch (or mils).

Non-volatile RAM (NOVRAM) – Random Access Memory that is available on power-on; that is, after power to the unit has been recycled.

No Read – A non-read. A condition that occurs when the reader is set up to decode labels, and no labels are decoded during the read cycle.

Number of Scans Calculation – The number of times a bar code label is scanned by the reader during one pass through the laser beam.

Operational Commands – Serial commands from the host to the reader that control current operating parameters, counters, master label operations, and program management that are not stored in non-volatile RAM.

Package Detector – A photo electric device used to sense to presence or absence of a package.

Picket Fence Label Orientation – A bar code label in which the bars are perpendicular to the label's direction of travel.

Pitch – Label (or reader) rotation around the center a line perpendicular to the label's bars.

Point-to-Point – A protocol consisting of a single communications event, typically used to connect a bar code reader to a terminal or host computer.

Port – Logical circuit for data entry and exit. (One or more ports may be included within a single connector.)

Protocol – The rules for communication between devices, providing a means to control the orderly flow of information between linked devices.

Quiet Zones – Specified "clear" (nonprinted) areas immediately before and after the bar code symbol. The area is usually white (for black and white bar code) and at least 10 times the width of the narrowest bar, as measured in thousands of an inch. The zones can be other than white as long as their densities remains consistent and they have the required contrast relative to the bars.

RAM – Random Access Memory. Memory that is lost after power is recycled to the unit.

Read Cycle – A programmed period of time or condition during which the reader will accept bar code label input.

Reader – A scanning device that is comprised of a scan head and a decoder integrated in one package.

Read Range – The distances in which a label can be reliably read, as measured from the front of the reader. See Depth of Field.

Reflectance Threshold – A user-defined setting of reflection (a few digits higher than an empty space reading) that is a point-of-reference for the MS-sensor. A reading lower than the threshold indicates that a package is not present whereas a higher reading indicates the presence of a package.

Relay Driver – A TTL signal sent by the reader. The output is determined by the relay driver selection (by operational command).

ROM – Read Only Memory. Memory that cannot be changed.

RS-232 – RS-232 defines an interface between two devices such as the reader and host. It differs from the other interfaces by dedicating individual pins to specific functions and by requiring both devices to share a common ground line (pin 4). Since both device chassis are connected to a common ground, a ground loop potential and the possibility of noise interference exists. Therefore, cable lengths are limited to a maximum of 50 feet (19.7 m). Despite being the most limited, this interface is used frequently because of the large installed base of RS-232 equipment.

RS-422 – RS-422, unlike RS-232, measures signals differentially. The receiver looks at the potentials between the two receive (or transmit) wires rather than the potential between signal and ground. As a result, cables, if shielded, can be up to 4000 ft (1219 m) in length. Like RS-232, RS-422 communication is designed for only two devices on a single line. It can be used wherever RS-232 is used.

RS-485 – RS-485, like RS-422, can transmit up to 4000 ft (1219 m) using differential voltages but unlike RS-422, RS-485 transmitters are turned off until a request for data is received from the host. RS-485 is used exclusively in multidrop protocol.

Scan Rate – Number of scans per second that the reader projects.

Scan Width – That portion of the scan line in which a label can be read.

Serial Commands – Online data strings (including configuration and operations) from a host or other terminal to the reader, that are always preceded by a < left angle bracket symbol and followed by a > right angle bracket symbol.

Sinking/Sourcing – Describes a current signal flow relationship between field input and output devices in a control system and their power supply. A sourcing interface box supplies current (source) to a sinking field device (e.g., package detect).

Skew – Label (or reader) rotation around the center of the skew axis.

Spicular Reflection – The direct, mirror-like reflection of laser light back to the reader, causing over-light saturation.

Symbology – A set of bar code symbols, such as Code 39 or Code 128, that have special rules to define the widths and positions of bars and spaces to represent specific numeric or alphanumeric information.

Tilt – Label (or reader) rotation around the centerline of the scan beam.

Timeout – A user-selected period of time that ends a reader's read cycle.

Rockwell Automation

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Rockwell Automation Headquarters, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414 382-2000 Fax: (1) 414 382-4444
Rockwell Automation European Headquarters, Avenue Hermann Debroux, 46, 1160 Brussels, Belgium, Tel: (32) 2 663 06 00, Fax: (32) 2 663 06 40
Rockwell Automation Asia Pacific Headquarters, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846
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