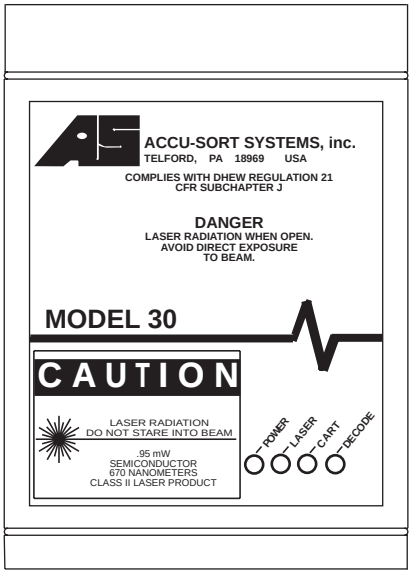
Model 30

Hardware Operations Manual

Please record your Product Serial Number
in the Customer Service Section of this manual.

Please refer to your ACUSETUP Operations Manual
for Programming Instructions.



Accu-Sort® Systems, inc. 511 School House Road, Telford, PA 18969

Rev. 1 11/94 LCH

Statement of Warranty/Repair

Accu-Sort Systems, inc. warrants that its scanner and component parts will be free from defects in material and workmanship for a period of one (1) year from the date of shipment. ASI warrants that its systems will be free from defects for a period of one (1) year from the earlier of date of initial use or 30 days after shipment. Unless otherwise stated, warranty for products not manufactured by ASI is limited to the manufacturer's warranty. Accu-Sort's sole obligation with respect to damage (whether direct, incidental or consequential, resulting from the use or performance of the terminal) is to repair or replace the defective parts thereof.

EQUIPMENT OR COMPONENT FAILURES DUE TO MISUSE, ABUSE OR NEGLECT ON THE PART OF THE USER OR HIS AGENTS ARE NOT COVERED IN THIS WARRANTY.

There is no charge to the customer for any parts or labor required to repair equipment in warranty when the defective item has been returned to the factory for repair. On-site warranty service is available in the continental United States during the one (1) year warranty period at a price equal to 75% of the standard service charge in effect at the time of service, plus travel related expenses.

or

If the equipment is installed in the continental United States by an Accu-Sort service technician and billed at the then current service rate, the on-site service during the first year is free of all charges including labor, parts and travel expenses.

Service requests due to abuse, neglect or changes in the original specifications or service calls not related to the Accu-Sort equipment, will be charged at the then current service rate plus all travel related expenses. Warranty coverage lasts for one calendar year. If the device or a part of the device is replaced, the warranty coverage does not start over; however, the replacement part or unit (no charge) is covered under warranty for the remainder of the one year period, with a minimum time period of 90 days.

Accu-Sort Systems, inc. also offers the "**Blue Ribbon Extended Service Plan**" (BRES) in addition to the standard product warranty. Through this plan, equipment maintenance and repair are offered with fixed cost and fast turnaround for unexpected repairs. Additional details on the coverage, support, and services available for your bar code scanning and automated systems equipment is available from:

Accu-Sort Systems, inc. • 511 School House Road • Telford, PA 18969-1196
Phone: (215) 723-0981 or 1-800-BAR-CODE FAX: (215) 723-1515

Laser Safety

CAUTION

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

To prevent possible exposure to laser light that may exceed the CDRH's Accessible Emission Limit for a Class II laser, your Model 30 has a "Scanning Safeguard" feature, a Laser Shutoff Flip Panel. It shuts off the laser power if the mirror wheel fails to rotate, which ensures that a stationary laser beam cannot exit the scan head. **This is a required feature, and it should not be tampered with. Use only in case of an emergency**.

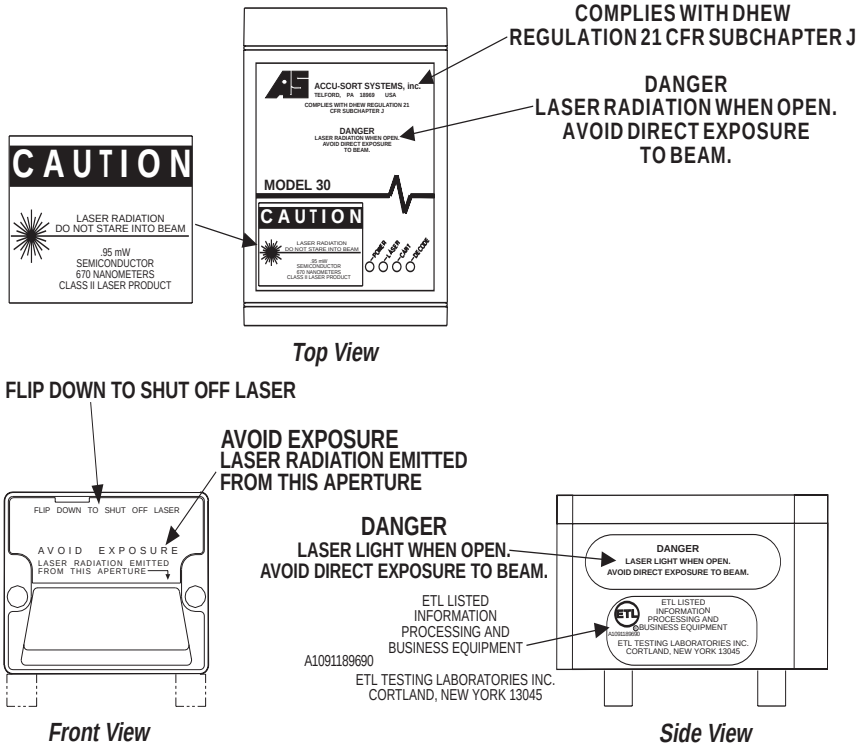
The radiation level from the laser does not constitute a health hazard. Exercise care to avoid any unnecessary, direct exposure to the eyes. Avoid staring at the light source, since prolonged exposure could result in eye damage. Avoid deliberate eye exposure to the beam. Inadvertent contact, however, is not a cause for alarm.

Any service should be performed so as not to violate compliance with the *Code of Federal Regulations, Title 21, Part 1040, Section 10* (21 CFR 1040.10), as administered by the Center for Devices and Radiological Health, a service of the Food and Drug Administration under the Department of Health and Human Services. Do not attempt to defeat any safety provisions.

CAUTION

The use of optical instruments with this product will increase eye hazard. Do not look into the laser beam with instruments such as telescopes, binoculars, or cameras.

The Model 30 is in compliance with the requirements of the Standard for Information-Processing Equipment including Electrical Business Equipment (UL-1950, 1st Edition)..



Standard Laser Caution Labels

Customer Service

If you have any problems or questions that require Accu-Sort's help, direct your questions to the Customer Service & Assistance Department for technical support, or the Parts Order Entry Department for parts requests or for questions about parts.

As soon as you unpack your Accu-Sort product, write the Serial Number in the box below:

Product Serial Number

To make sure that Accu-Sort's response is prompt and accurate, have the following information ready to give the Customer Service Department:

- Product Serial Number
- Product Model Number or name
- Description of the question or problem
- Customer contact and phone number

CAUTION

If for any reason your Model 30 does not work, do not attempt to open the unit. The Model 30 is designed to be returned to the factory for replacement.

Phone: (215) 723-0981
or
1-800-BAR-CODE
FAX: (215) 723-1515

Accu-Sort Systems, inc.
511 School House Road
Telford, PA 18969-1196

SERIAL WWXXXXXX

DATE January 1, 2000

Example of Product Serial Tags
Model 30

The WWXXXXXX field is bar coded with a Code 128 type C bar code.

Serial Number Breakdown:
WWXXXXXX
where:

WW - Two digit year of manufacture
XXXXXX - Six digit sequential build number

About This Manual

This is the hardware operations manual for the Model 30. It provides details on what to do with the Model 30 and its components, how to use them, keep them in working order, and what to do if something goes wrong. The manual also provides general information on bar codes and decoding them.

This document does not provide detailed information about any equipment used in or with this system that Accu-Sort Systems does not manufacture.

This manual is not a troubleshooting or service procedure guide. Customers can purchase technical service training directly from Accu-Sort. Direct any questions about detailed troubleshooting or service to the Accu-Sort Systems Customer Service Department.

The following symbols are displayed in the left margin of some pages of this manual.

This symbol appears when important information about the unit or its procedures is provided.

This symbol appears when the task you are about to perform may provide unexpected results, and if personal injury or damage to the unit may result from not following the correct procedures.

This equipment has been tested and found to comply with the limits for a Class A 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 the instruction 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 own expense.

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Chapter

1 Getting Started With Your Model 30

Chapter Contents

Introduction

This chapter describes what a bar code is, how one is read, and the different types of bar codes. It also describes the Accu-Sort Model 30 scanning system and how it reads bar codes.

About the Model 30

The Accu-Sort Model 30 Bar Code Scanning System is interfaced with a decoder logic to read bar codes. The Model 30 uses a laser diode generated laser beam. The laser beam sweeps across a bar code pattern. The dark bars absorb the laser light and the light spaces reflect the laser light emitted by the scan head. This is the basic principle of bar code scanning. The Model 30 sends the scanned information to a decoder logic for interpretation.

Accu-Sort Systems developed the Model 30 with the various needs of their customers in mind. Because of this, the Model 30 is designed with many powerful features that make bar code scanning easier to implement and maintain. The standard features include:

- Operator LED indicators
- Front exit scanning to scan codes in front of, instead of below the reader

Optional features designed to enhance the performance of the Model 30 are also available. These features include:

- High speed scanning (up to 800 scans per second)
- Raster scanning to handle varying code positions and inconsistent quality
- Vibrating Vane to adjust the width of the raster pattern
- Presence detector: Photoeye, TTL, Form A, or Form C signal indicating the object is within scan head field-of-view

Model 30 Specifications

PHYSICAL

Size and Weight: 4.0" L (101.6mm) x 3.0" W (76.2mm) x 2.5" H (63.5mm); 16 ozs. (448 grams)
Enclosure: NEMA 12 standard (gasketed, drip-proof and dust-tight)
Visual Diagnostics: Four LED's that indicate Power, Laser, Trigger and Decode
Laser Type: Visible laser diode Class II
Connections: Power, Carton Presence Input, Output to Decoder

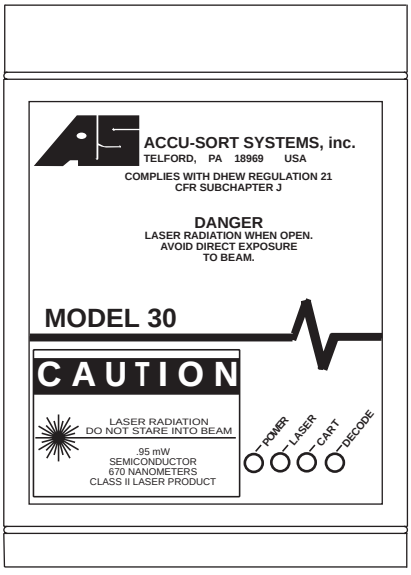
ENVIRONMENTAL

Temperature Range: 32 to 113 degrees F (0-45 degrees C)
Relative Humidity: 20-90% non-condensing

OPERATING PARAMETERS

Power Requirements: +12 Volt DC
Power Consumption: less than 5 watts
Scanning Parameters: Bidirectional (High / Medium / Low Density)
Scan Rate: 40 to 800 scans per second
Scanning Range: 1" (25.4mm) to 30" (762.0mm)

A drawing of the Model 30 is shown below:



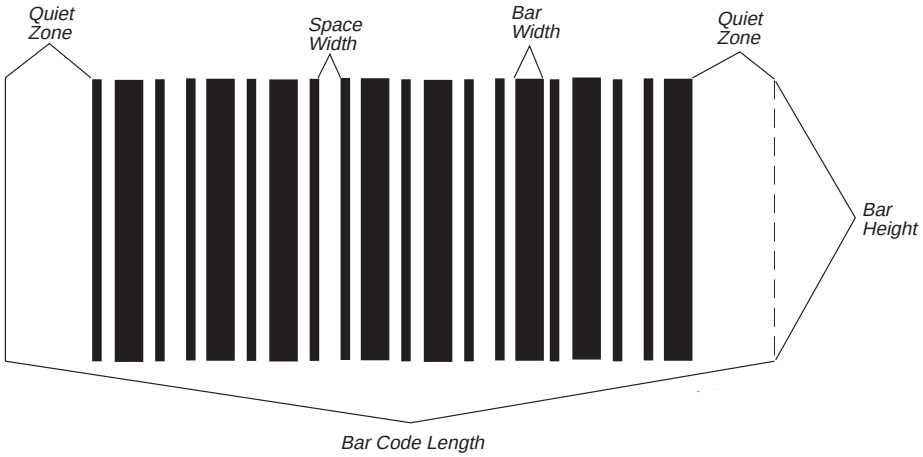
The Model 30 Bar Code Scanner

Bar Code Basics

A bar code is a group of rectangular bars and spaces arranged in a preset pattern. The pattern is organized to represent elements of data referred to as characters. The standard industry codes can represent several alphanumeric characters.

There are many different types of bar codes. Each type uses its own symbology, which defines how the bars and spaces represent the letters and numbers.

The figure below shows each part of a bar code. The labels for each part remain the same even if the position, orientation, or type of bar code changes.



The Model 30 is capable of reading several different bar codes simultaneously. The code types can be chosen from the following list:

Straight 2 of 5 - fixed or variable length - Developed in the late 1960's, Straight 2 of 5 is the predecessor to Interleaved 2 of 5. It is widely used for numbering airline tickets and warehouse sortation systems. All of the data information is contained in the bars, the spaces are simply there to separate the bars. Straight 2 of 5 is usually found in applications that have been in existence for a number of years.

Interleaved 2 of 5 - fixed or variable length - More commonly called I 2 of 5, this numeric only bar code was developed in the early 1970's. Because of its high code densities, I 2 of 5 is most often found in distribution applications. Due to the limited amount of characters I 2 of 5 can use, and the simple structure of the start and stop characters, even partial scans can result in valid reads. If I 2 of 5 is chosen for your application Accu-Sort recommends that the Model 30 is programmed to a fixed length in all scanning applications.

Code 39 - fixed or variable length - Code 39, or Code 3 of 9, was the first bar code developed that used both numbers and upper-case letters. It is the most recognized and widely used for non-retail applications. Each character is represented by a stand-alone group of 5 bars and 4 spaces. The basic code set includes 0-9, A-Z, * which is used for the start and stop characters, and six other symbols - . $ / + and % for a total of 43 characters. Because each of the characters are discrete and self-checking, Code 39 provides a high level of data security. The Model 30 automatically checks all data for this symbology.

Code 128 - Code 128 is a continuous code made up of 3 bars and 3 spaces for each character. The Uniform Code Council and the International Article Numbering Association have developed standards for the use of bar codes in the global distribution of retail, industrial, commercial, pharmaceutical, meat and other products using Code 128 as an application identifier. Since the nature of Code 128 is such that each character depends on the characters before and after it for code structure, a check digit is incorporated in the bar code. The check digit, which is automatically checked by the Model 30, provides a high level of data security.

Codabar - Widely used in libraries, photo-finishing systems, and blood bank applications, Codabar uses numbers along with 6 special characters. Four different combinations of start and stop characters can be used to mean specific things for each application. The Model 30 can be programmed to either transmit or suppress the start and stop characters.

UPCA (Universal Product Code, version A) - This bar code type is most often found in the fast-paced retail and supermarket industries. The first character, of the 12 character code, is the number system, the next ten characters identify the product and manufacturer, and the last character is the check digit. In many applications, the UPC code is compared with a look-up table for added security.

UPCE (Universal Product Code, version E) - This version of the UPC bar code shortens the information to 6 characters. This allows the code to fit on smaller packages.

EAN-13 (European Article Number) - This bar code type is almost the same as the UPC code. The EAN-13 contains the same number system, manufacturer, and product information as the UPC code, but also includes parity information.

EAN-8 is a shortened version which identifies the country code in the first two characters, the next five characters are for data, and the last is a check digit.

Extensions are two or five character additional encodations that are available to add to the end of UPC or EAN bar code types.

Decoding Bar Codes

The Model 30 scans a bar code, turns the reflected light into electronic signals and then amplifies the signals. It then converts the analog signal to digital pulses. The Model 30 requires a device called a *decoder logic* to interpret the pulses.

The scanner passes the digital pulses to the logic. The microprocessor in the logic determines the width of each bar and space based on the amount of time it took the laser to sweep across each element. The logic also detects the edges of the code. The digital signal is then interpreted to recover all the information in the original bar code. Using a complex algorithm, the logic unit checks to see if the code was read correctly.

After all this calculating, the logic transmits the decoded bar code information to a CRT or host computer.

Examples of decoder logics that interface with the Model 30 are the PLUS II, the 9000 Decoder Logic, and the 9000 DRX.

How Your Model 30 Scanning System Works

As soon as you set up and install your Model 30 as discussed in the remaining chapters of this manual, it is ready to read bar codes, and will execute all of its functions automatically.

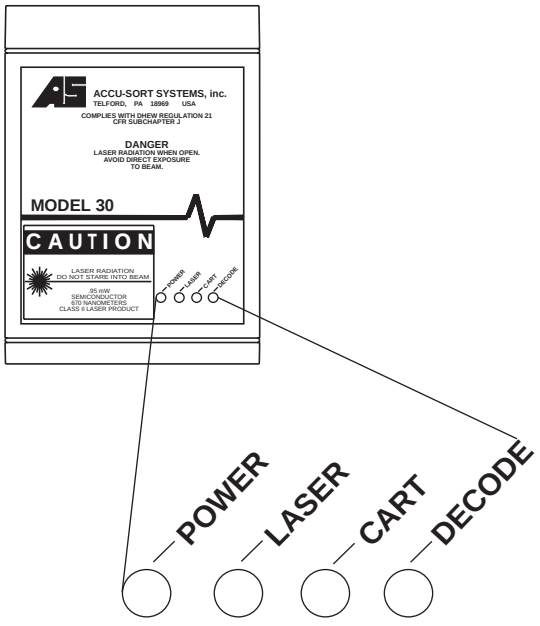
The Model 30 provides visual diagnostics that are useful tools for monitoring the scan head performance. Four status LED indicators on top of the unit provide you with operational information. The locations of these LED's are shown below. They provide status on power, Trigger (carton presence), good read, no read or NVC (non-valid code), and failure. The following are descriptions of each LED.

"POWER" LED (Green) - This LED indicates that power is being provided to the scan head. This LED remains 'on'.

"LASER" LED (Red) - This LED lights to indicate that the laser should be on and visible below the laser exit window.

"CART(Trigger)" LED (Yellow) - This LED lights to indicate that something is blocking the photoeye. When the photoeye is not connected, the Trigger LED defaults to the on state. For example, continuous read.

"DECODE" LED (Green) - This LED lights to indicate that the Logic has decoded the scanned bar code. (Plus II logic only--when in setup mode, this LED blinks alternately with the IDLE LED on the Plus II.)



Model 30 LED Displays

Operating Procedure

The purpose of this section is to provide a simple description of the scan head operational sequence of events under normal operating conditions.

To power up the Model 30, turn on the connected logic unit. The "**POWER**" and Trigger LEDs on the scan head light. After the motor speeds up, the "**LASER**" LED lights. If it does not, check all external connections. Do this if either no PE is connected, or if the PE is blocked.

You can easily determine normal operation of the Model 30. After the motor speeds up and the Trigger PE is broken, the laser should turn on, and a scan line should exit the laser window. If no beam appears, check the "**LASER**" LED, located on top of the unit, and check the laser flip down lid. Power off the connected logic unit and then power on the unit.

Power is supplied to the scan head only through the connected logic.

The following is a scenario of how the Model 30 LED's work:

1. When power is supplied to the head, the "**POWER**" LED on top of the Model 30 lights.

NOTE: If the PE is not connected, the "**POWER**" and Trigger LEDs light.

2. When a carton "breaks" the photoelectric circuit between the trigger photoeye and reflector (i.e.: blocks the photoeye), a signal is sent to the Model 30 indicating the presence of a carton. The Trigger LED lights when this occurs. The "**LASER**" LED and the laser turn on, and the Model 30 begins searching for a valid bar code.

3. When a carton no longer blocks the beam of the Trigger photoeye, the Trigger LED goes out and the Model 30 stops scanning the product for a valid bar code. The laser turns off and the connected logic proceeds to translate the data into a serial ASCII format for transmission out of the I/O port.

For the exact operating range of the scan head and any custom instructions, refer to the customer information in the back pocket of this manual.

Notes

Chapter

2 What to Do After Receiving Your Model 30

Chapter Contents

Introduction

This chapter describes different types of equipment that may be used in a Model 30 scanning system. Next, some general scanning terms are discussed that may be helpful while mounting your Model 30. Finally, this chapter describes how to mount each piece of equipment within your Model 30 system and how to set up your Model 30.

Some of the equipment described in this chapter might not be used with your system. Skip over sections that do not apply.

Unpacking Instructions

When you unpack your Model 30, you will find your entire scanning system. The placement of the Model 30 accessories inside the box depends on your order.

You should first remove everything from the box and compare the items with your packing list. If any of the parts of the Model 30 or any of the accessories are missing or damaged, contact Accu-Sort immediately. (Refer to the Customer Service section of this manual.)

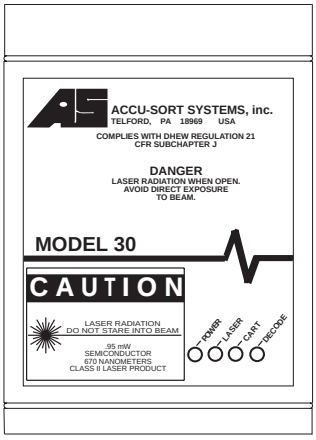
Be sure to check all packing material for parts of the Model 30 (ie.: manuals, cables, etc.) Save the packing material in case you ever need to ship the unit back to Accu-Sort.

Depending on your needs, you may have one, or more, of the following pieces of equipment:

- Model 30 Scan Head
- Trigger Photoeye for Carton Presence Detection with bracket (B-33045)
- Reflector for photoeye (unless otherwise specified)
- Model 30 Bar Code Scan Head Operations Reference Manual
- Scan head to logic interconnect cable

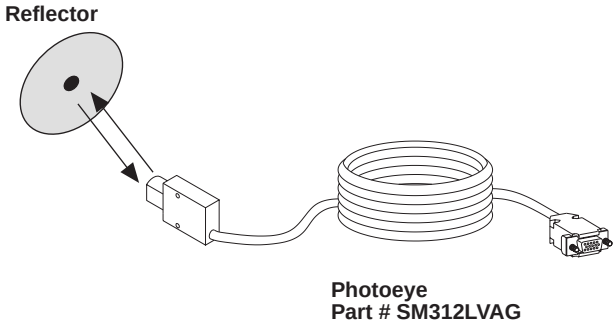
Following is a description of each piece of equipment.

Model 30 Scan Head - This houses the necessary components in which to generate a laser beam, scan a bar code, and send the scanned information to a decoder logic.



Model 30 Scan Head (Top View)

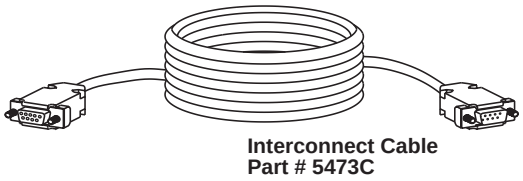
Photoeye - This is a photo-electric eye that sends a signal to the Model 30 when something blocks its path of light. Photoeyes provide one way to trigger the Model 30 when an object arrives and when an object leaves the scanner.



Photoeye

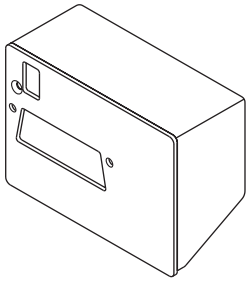
> ⚠ CAUTION
>
> Be careful when making any electrical connections. Electric shock is possible when making any contact with electricity.

Interconnect Cable (Scan head to logic) - This cable connects the Model 30 to a decoder logic, allowing scanned information to be transmitted.



Interconnect Cable

Vibrating Vane (Optional) - Your Model 30 may use a variable raster. With a variable raster, the width of the raster pattern (laser lines) is adjustable through the vibrating vane option. It is a module attachable to the front of the Model 30. If you use a variable raster, you must mount the scanner with the module window facing the bar code to be scanned. The raster width should be centered over the area that the code location varies.



Vibrating Vane

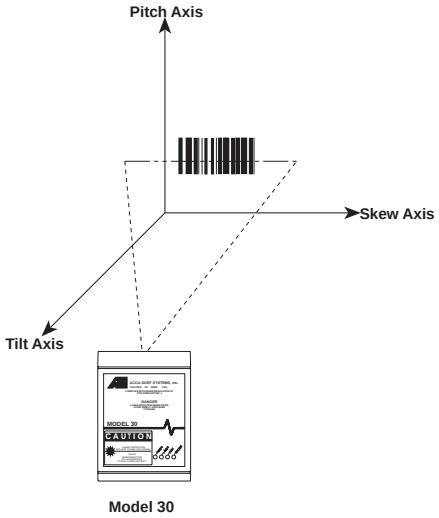
Facts To Know Before Mounting Your Model 30

There are a few common terms in bar code scanning that you need to know before you mount your Model 30. Understanding these terms will help you when you mount your scanner, or if you ever have to move your scanner from its original mounting place.

Ladder orientation refers to a bar code whose bars are parallel to the bar code's direction of travel. **Picket Fence** means that the bars of the bar code are perpendicular to the direction of travel. Regardless of the direction of travel, the scan line *must* be perpendicular to the bars.

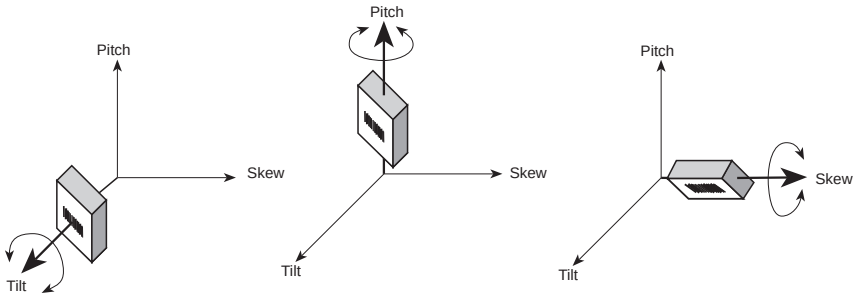
Bar Codes In Ladder (left) And Picket Fence (right) Orientations

Tilt, Pitch, and **Skew** refer to the way the bar code lines up with the scan line. In the drawing below, the bar code is perpendicular to the scan line. The **skew** axis is parallel to the scan line in this position. The **pitch** axis is parallel to the bars in this position. The **tilt** axis is perpendicular to the plane of the scan window.



The Tilt, Pitch, and Skew Axes

Tilt is the way the bar code rotates around the tilt axis. Similarly, pitch and skew occur when the bar code is rotating around those axes.



Tilted, Pitched, and Skewed Bar Codes

The **Exit Window** is where the laser beam exits the scanner. **Near Distance**, also called **Optical Throw**, is the closest the Model 30 can be to the bar code and still read the bar code passing through its scan line. The **Far Distance** is the farthest distance at which the Model 30 can read a bar code. The **Depth of Field** is the range over which the Model 30 can read bar codes. To calculate your Depth of Field, subtract the Near Distance from the Far Distance. The Model 30's **Optimum Distance** is the Center of the Depth of Field. The **Scan Window** is the usable amount of the laser beam at any given depth of field.

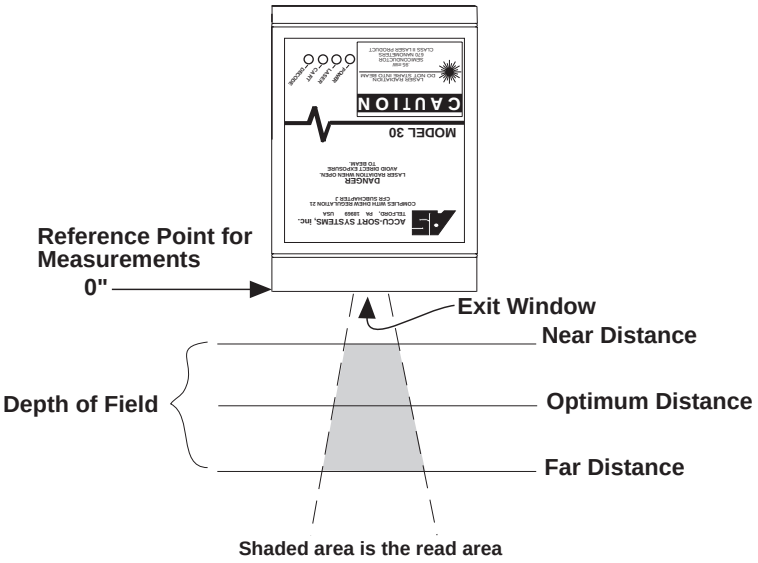


Illustration of Scanning Terms

Mounting Your Model 30

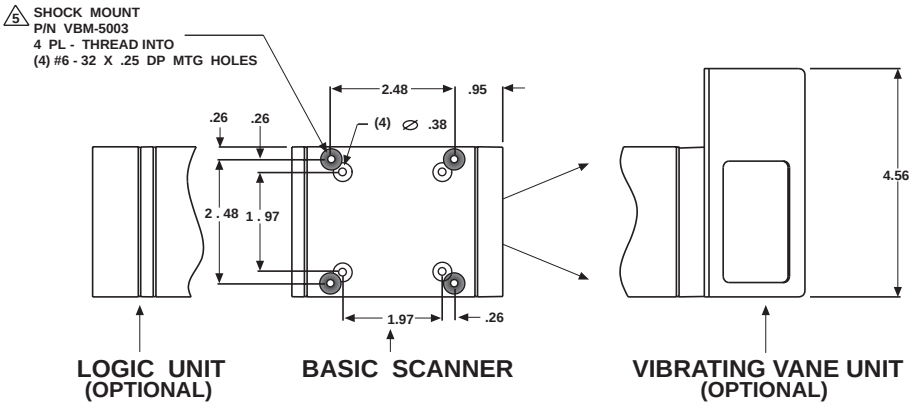
When you mount your Model 30, make sure there is enough space around the unit for the connections to the accessories needed for your application. There must also be enough room to allow the Model 30 and its equipment to stay cool. The minimum space requirements for the Model 30 are as follows:

- Overhead - Leave enough room for air flow
- Back - 2.25" for connections
- Sides - Leave enough room for air flow
- Front - Make sure there are no obstructions between the scanner and the bar code to be scanned during the read cycle

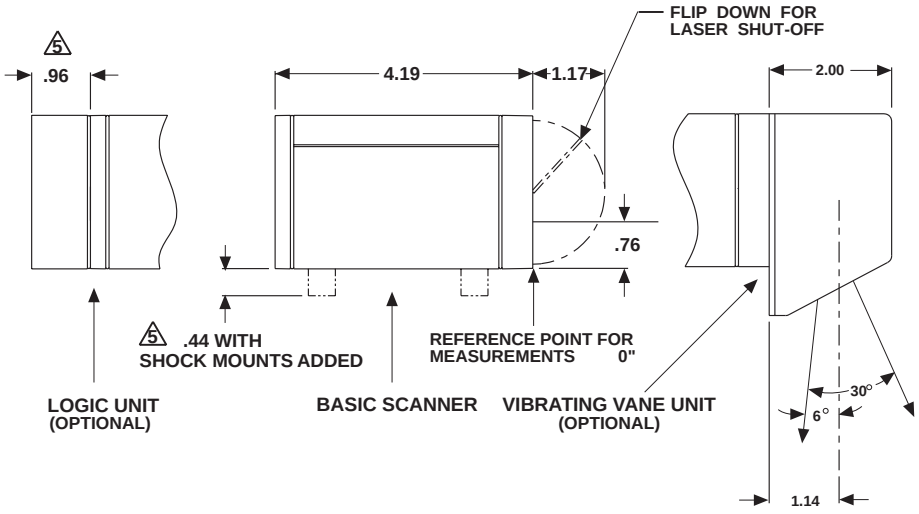
In some applications, codes are printed on glossy paper or covered with a shiny material such as cellophane. When this happens, it is possible that the code surface reflects so much laser light that it is very difficult for the scan head to decode the bar code. This light reflection saturation effect is called 'specular reflection'.

To avoid reflections from the surface of glossy bar codes, do not mount the scan head parallel with the object to be scanned. Mount the scan head at a five to ten degree angle so the laser beam reaches the bar code at a slight angle.

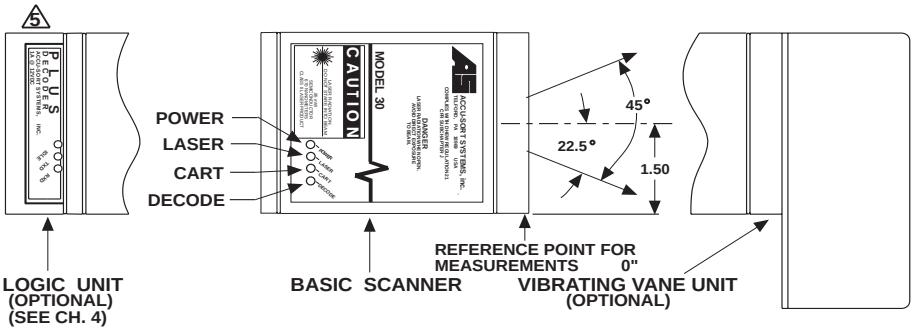
There are many different ways to mount the Model 30. Refer to the following drawings when mounting yours. Use the dimensions to ensure that the above conditions exist in order for your Model 30 to function properly.



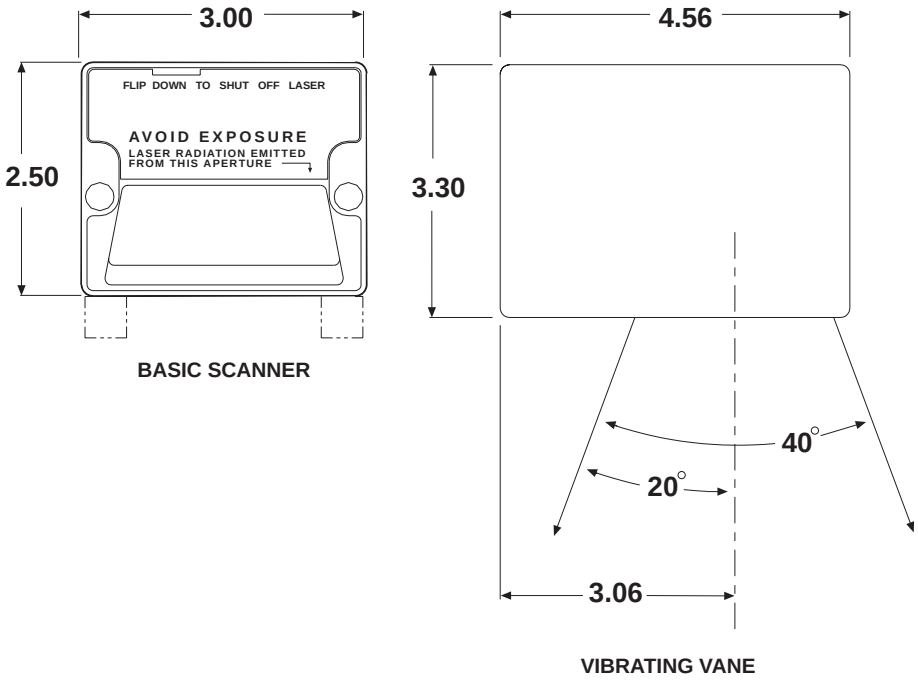
Bottom View



Side View



Top View


3.00
2.50
FLIP DOWN TO SHUT OFF LASER
AVOID EXPOSURE
LASER RADIATION EMITTED FROM THIS APERTURE
BASIC SCANNER
4.56
3.30
40°
20°
3.06
VIBRATING VANE

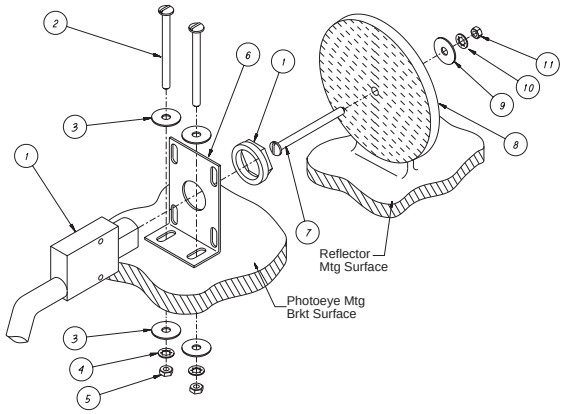
Front Views

Mounting the Photoeye

This section describes how to mount your photoeye to the photoeye mounting bracket. Photoeyes work by bouncing a light beam off a reflector and detecting when something breaks the path of light. In order for your photoeyes to work properly, you must make sure the following things are done:

- The photoeye must have a reflector mounted directly opposite it on the other side of the conveyor.
- The photoeye must be mounted so the light exit window is perpendicular to the conveyor, facing the reflector.
- The reflector must be mounted perpendicular to the conveyor, facing the photoeye.

Use the drawing below to help you mount your photoeye. The table below provides information pertaining to each item number in the drawing.



Photoeye Mounting Diagram

Use the following table to match item numbers with the photoeye mounting diagram above:

Quantity Required	Description	Part Number	Item Number
1	#8-32 Nut	N#8-32	11
1	#8 Internal Tooth Lock Washer	L#8	10
1	#8 Flat Washer	W#8	9
1	3" Reflector	C110MH	8
1	8-32 2" Machined Pan HD	8-32X2MPHZP	7
1	Model 30 P.E. Mtg. Bracket	A-33055	6
2	#6-32 Nut	N#6-32	5
2	#6 Internal Tooth Lock Washer	L#6	4
4	#6 Flat Washer	W#6	3
2	6-32 2" Machined Pan HD	6-32X2MPHZP	2
1	Polorized Photoeye	B-33107	1

Setting Up Your Model 30

The steps below are one recommended way to set up your Model 30 Scanning System:

1. Remove all materials from the box.
2. Check the materials against the packing list and make sure everything is there.
3. Make sure none of the parts are broken.
4. Make all the appropriate connections to your Model 30 as explained in Chapter Three.
5. Mount your Model 30 as described earlier in this chapter.
6. Begin reading your bar codes.

If you have any problems or questions concerning setting up your Model 30, contact Accu-Sort immediately (refer to the Customer Service Section of this manual.)

Chapter

3 Making Model 30 Connections

Chapter Contents

Introduction

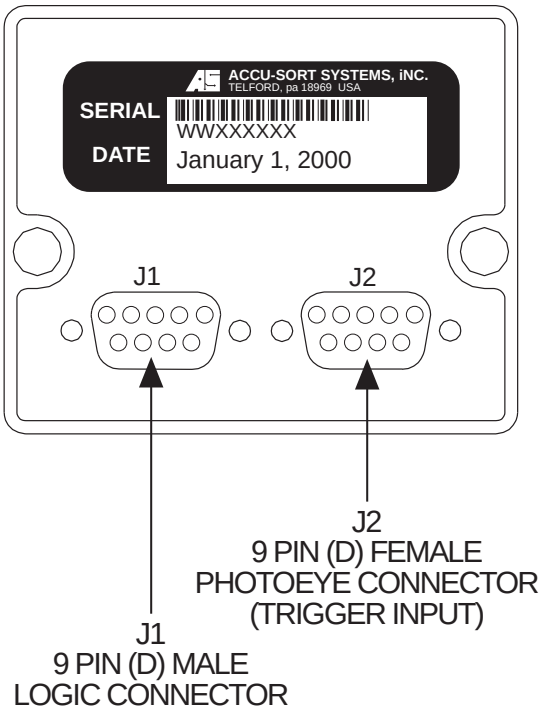
This chapter explains how to supply power to your Model 30, and how to connect your Model 30 to a decoder logic or a trigger input. You must make these connections before you can begin setting up or using your Model 30.

Model 30 External Connections

There are two external connections that can be made to the Model 30:

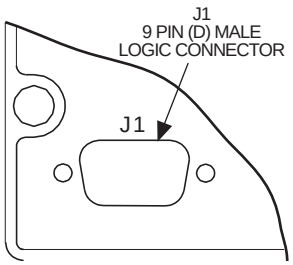
- Logic (J1)
- Photoeye (J2)

These connections are shown below and described in detail on the next few pages:



Model 30 Connector Panel

Providing Power To Your Model 30



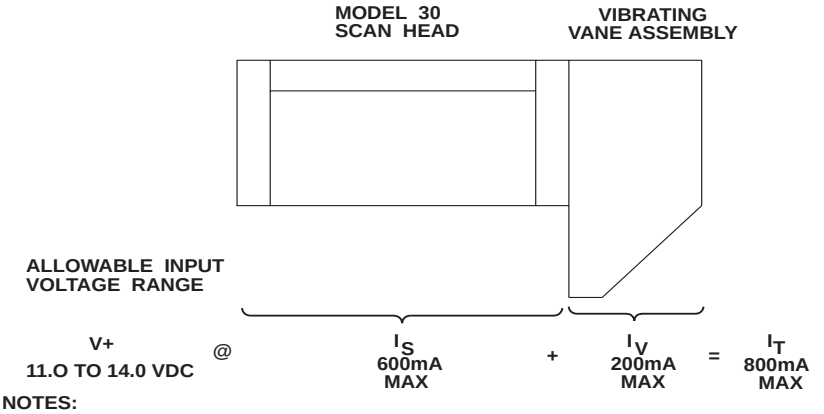
See page 3-2 for a full view of the Model 30 connector panel.

WARNING: Do not make any connections to the Model 30 while the unit is receiving power from the connected logic unit.

The power connector on the Model 30 is port J1, the 9-pin male logic connector, as shown on the connector panel cutout to the left.

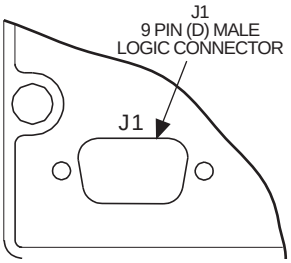
The Model 30 is designed to operate from a power source of +12VDC +/- 1 Volt. (The input current required is less than 0.5 amp.) This power source is provided from the decoder logic. When the logic is powered up, so is the Model 30. The Model 30 then transfers signals to the logic through port J1.

The drawing below shows the power input requirements for the Model 30 and any connecting equipment.



Model 30 Power Input Requirements

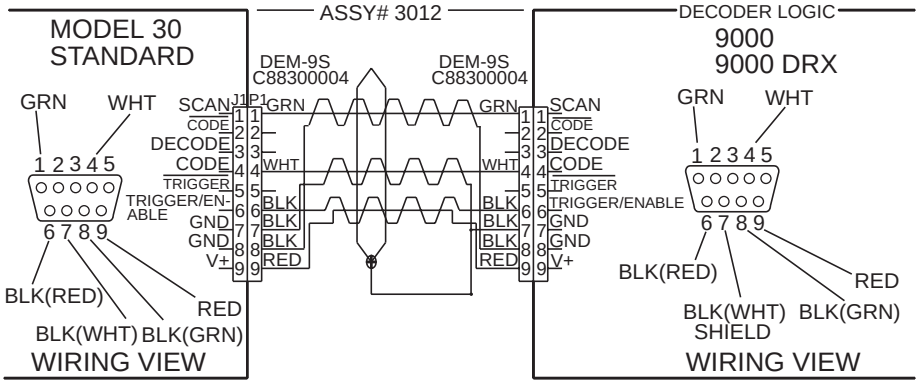
Connecting Your Model 30 To A Decoder Logic



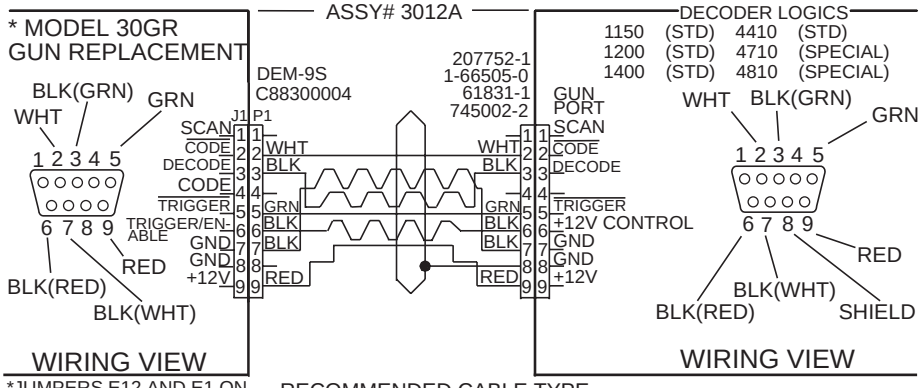
See page 3-2 for a full view of the Model 30 connector panel.

The Logic connector on the interface box is a 9 pin "D" male, labelled LOGIC (J1), as shown on the connector panel cutout to the left.

Use the Accu-Sort Interconnect Cable (part # 5473C) to connect your scanner to the logic. If you do not purchase this cable, you can create your own. The following drawings show the pin connections for the designated LOGIC (J1) connector on the Model 30. Use these drawings to help you make a cable to connect your logic to the Model 30.



RECOMMENDED CABLE TYPE
ALPHA P/N 5473C OR EQUIVALENT
MAXIMUM CABLE LENGTH: 50 FT.

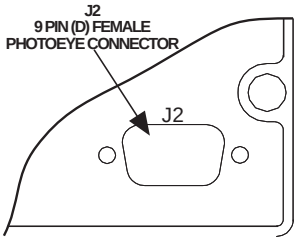


*JUMPERS E12 AND E1 ON A/D BOARD MUST BE IN POSITION 2-3.

RECOMMENDED CABLE TYPE
ALPHA P/N 5473C OR EQUIVALENT
MAXIMUM CABLE LENGTH 20 FT.

Pin Connections for Connecting Your Logic to the Model 30

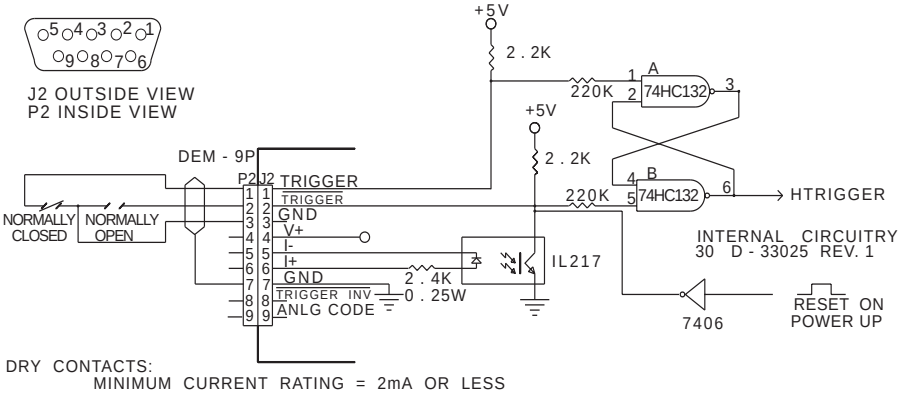
Supplying A Trigger Input To Your Model 30



See page 3-2 for a full view of the Model 30 connector panel.

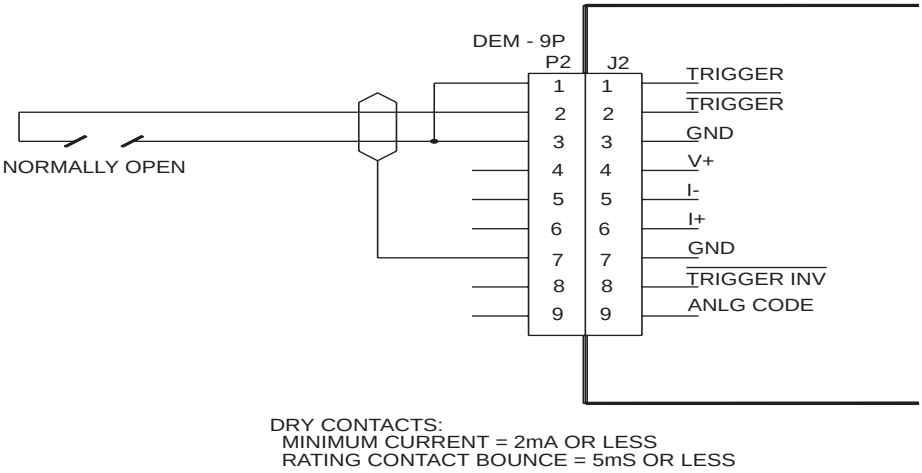
A triggering device can be used to supply an electronic signal or pulse to inform the scanner of the presence of an object within its reading zone. The trigger connector on the Model 30 is a 9 pin "D" female, labelled PHOTOEYE (J2), as shown on the connector panel cutout to the left.

The drawing below shows the internal wiring of the trigger circuit.

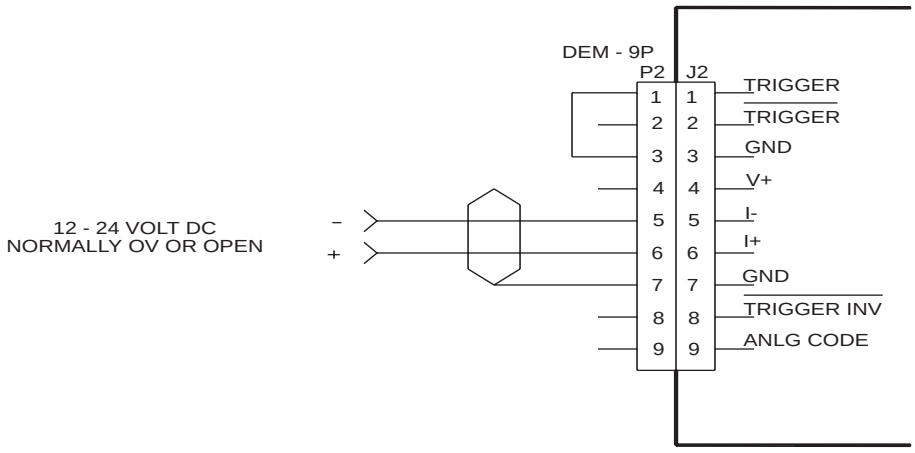


Internal Wiring for Photoeye (J2) Connection

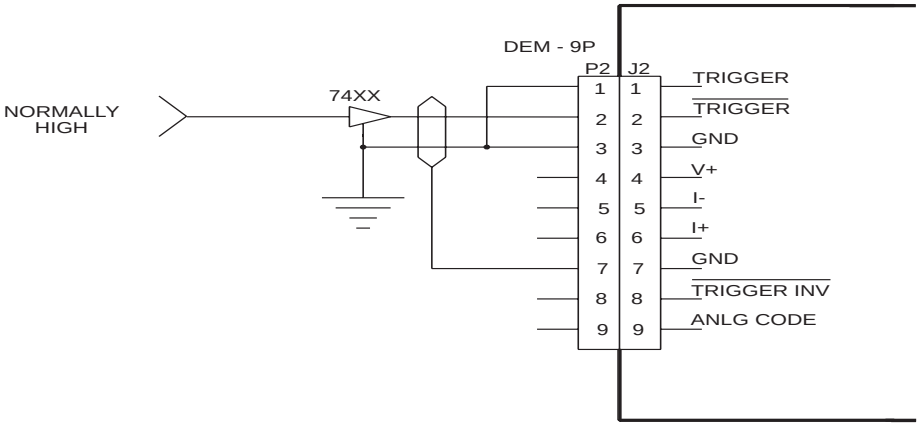
The following drawings represent some common triggering inputs the Model 30 uses.



Wiring Your Model 30 to a (Form A) Triggering Input

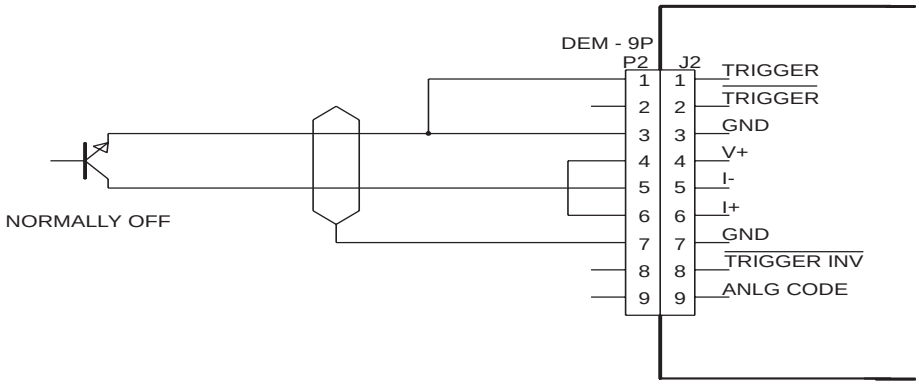


Wiring Your Model 30 to a (12-24 Volt) Triggering Input

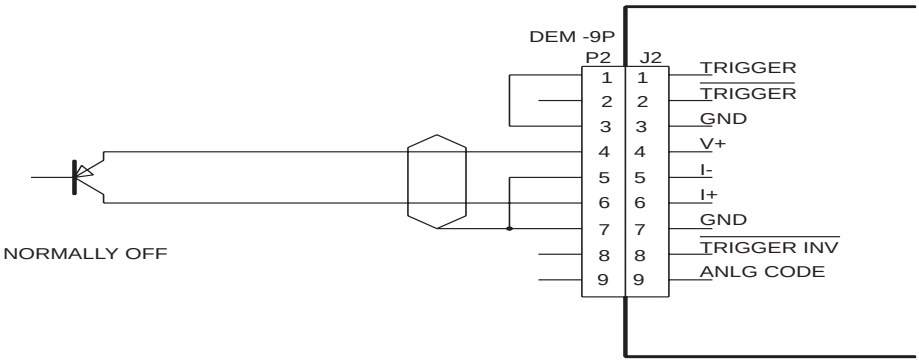


MODEL 30 REPRESENTS APPROXIMATELY 2 TTL LOADS

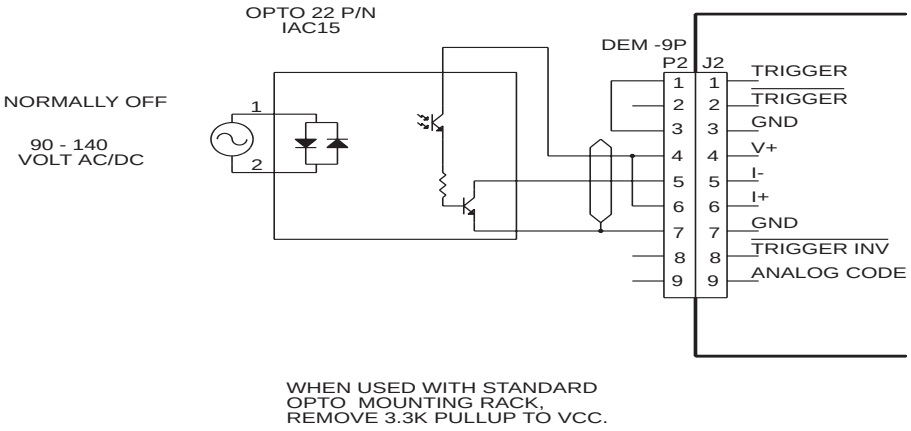
Wiring Your Model 30 to a (TTL) Triggering Input



Wiring Your Model 30 to a NPN Transistor Triggering Input



Wiring Your Model 30 to a PNP Transistor Triggering Input



Wiring Your Model 30 to a (115 Volt) Triggering Input

Chapter

4 Using the Plus II Logic with Your Model 30

Chapter Contents

Introduction

This chapter provides you with detailed information about the AccuSort Plus II Logic. This chapter defines the capabilities of the unit, lists its specifications, and explains how to make connections to it. Refer to your Acusetup programming manual for details on programming your Plus II. Please disregard this section if you do not have a Plus II Logic.

Learning About The Plus II Logic

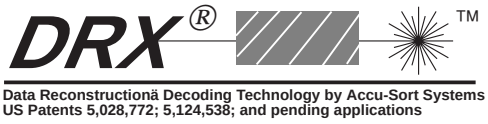
Most bar code scanning and decoding systems use both a decoder logic and a remote scanning head. The Plus II is a decoder logic that can be connected to the Model 30 laser scan head. Together, these two devices make up a complete scanning system, capable of reading bar codes.

The Plus II is an external microcomputer option, that can be connected to the Model 30. The Plus II processes and interprets a bar code signal. It also allows the Model 30 scan head to read the most commonly used bar codes. A decoder logic compares multiple scans of the bar code to ensure the code data has been read reliably. A programmable or defined number of scans must be identified before the decoder logic can accept the data as valid. The decoder logic transmits the valid data to a host computer or similar device. The scan head and the decoder logic work automatically.

The Plus II hardware and software, tailored to meet the customers needs, provide the following capabilities:

- Receive data from external devices
- Receive downloads from a host computer
- Transmit data to the host computer
- Accu-Sort's patented DRX technology

For Accu-Sort's patented DRX technology, the following patent numbers apply:



Specifications of the Plus II

Physical & Environmental:

Size and Weight: 3"W x 2.5"D x .9"H, 3.4 oz.
Power Requirements: 5VDC/12VDC (12VDC for Model 30 scanner)
Power Adapter: 120VAC +/-5% 50-60Hz/220VAC +/-5% 50-60Hz
Power Consumption: 1.5 watts (Plus only)
Enclosure: Dust tight/drip tight for indoors
Connections: DC Input, Serial Communications, Photoeye Input, Open Collector outputs
Operating Temperature: 32-122 degrees F (0-50 degrees C)
Relative Humidity: 20-90% non-condensing

Operational Features:

Programmable Software: Allows you to select code types & lengths, ratio, communications type, noread message, baud rate, number of data bits, parity, start & stop buffers, etc.
Visual Diagnostics: Transmit and Receive LED's (hardware controlled), Idle and Decode LEDs (software controlled)
Microprocessor: Analog Devices ADSP2105
Program Memory: 3KB EEPROM
Memory: 16K x 24 Program Memory, 16K x 16 Data Memory
Configuration Data Storage: 128 x 16 Words EEPROM
Bar Code Types: Code 39, 2 of 5, Interleaved 2 of 5, UPCA, UPCE, EAN-13, EAN-8, Codabar, Code 128 and other industry standards.

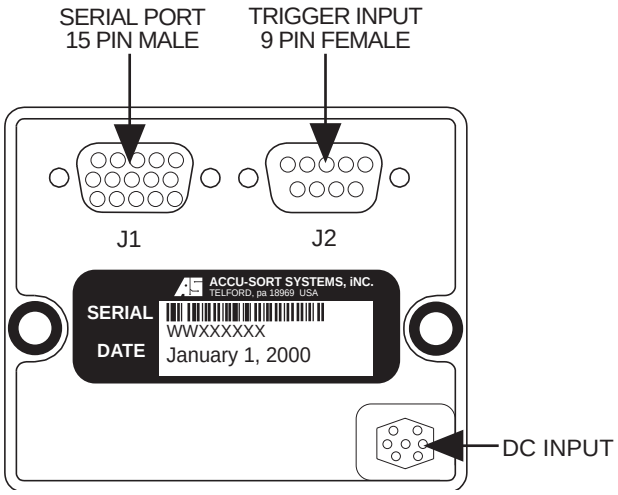
Plus II Connections

CAUTION

Do not make any connections to the Plus II while the unit is plugged in to an electrical source.

Make all connections to the Plus II after the equipment is mounted. The unit should be centrally located so that the cable connections to the serial port are easy to make.

Shown below is a rear view of the Plus II:



Port	Interface Device
J1	Serial I/O Interface (Host Computer, CRT)
J2	Trigger Input (Product detection device)

The following is the pin configuration for the 15-pin connector (J1):

PIN	FUNCTION
1	(GND) Ground)
2	(TXD) Transmit
3	(RXD) Receive
4	$\overline{\text{OUT 0}}$ /(RTS) Request to Send/IN1
5	$\overline{\text{OUT 1}}$/(CTS) Clear to Send
6	SD+
7	RD+
8	SD-
9	RD-
10	T+
11	R+
12	T-
13	R-
14	I+ (TX)
15	I+ (RX)

The following is the pin configuration for the 9-pin connector (J2):

PIN	FUNCTION
1	TRIGGER
2	$\overline{\text{TRIGGER}}$
3	GND
4	V+ (+12)
5	I-
6	I+
7	GND
8	TACH
9	ANALOG CODE (TEST POINT)

Connecting A PC or CRT to your Plus II Logic

The drawing on the next page shows a 25 pin male connector. Use the same assembly procedure for any D connector that you may have.

J1 is a 15 Pin (D) male connector on the Plus II. This is a Serial I/O Interface connector. Use this to connect the Plus II with a Host Computer or a CRT. You must use an interface cable (standard cable assembly # 3030) with the Provided 15 Pin (D) female connector on one end.

Make all pin connections from your interface cable to the connector. These connections are shown on page 4-9. Depending on the type of communication, you must solder the wires to the appropriate pins. Once the pins are properly soldered to the connector, attach the strain relief to the cable and connector to provide support for the electrical connections.

Follow the steps below to assemble the strain relief:

1. Select the strain relief that best fits your interface cable. Be careful not to break the strain relief in half.

2. Holding everything in your hands, place the end of the D connector (pins out if male, holes out if female) behind the front lip of the bottom shelf.

3. Run the cable through the shell and place the bottom half of the strain relief under the cable. The strain relief should fit snug in the cable exit hole of the shell.

4. Close the strain relief, and place the top half of the shell on the bottom half. Make sure the shells make a flush fit. Continue to hold everything together.

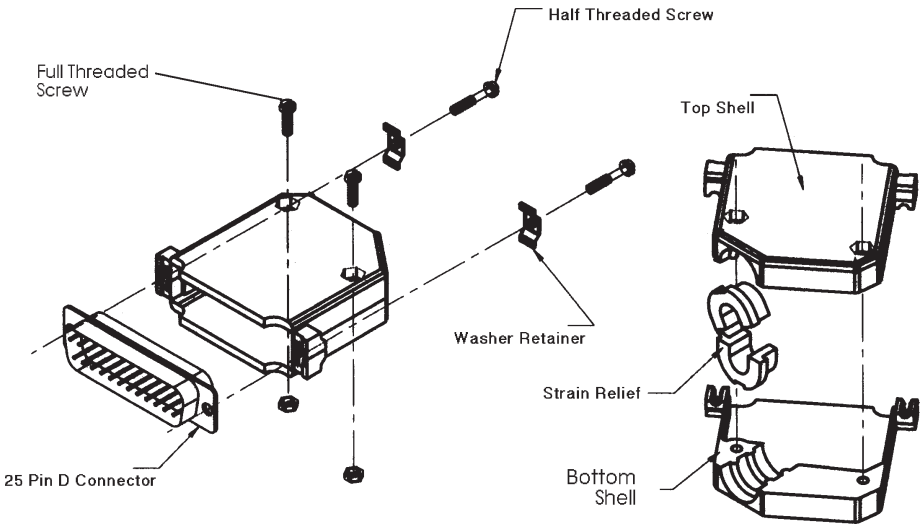
5. While holding the shells together, place one washer retainer on top of each side of the shell assembly and slip a partially threaded screw through each hole in the washer retainer and shell assembly.

6. While still holding the shell assembly together, place one fully threaded screw in each of the holes on top of the shell assembly, and tighten the nut on the bottom.

The strain relief should now be fully assembled. When you connect the cable to a Host or CRT, the other end of the interface cable must have a comparable connector for the Host or CRT.

To connect the Plus II to the interface cable, align the holes on the cable with the pins on connector J1. Insert the pins in the holes, and push until a tight connection is made. Turn the two slotted screws on the cable clockwise until tight. After this connection is properly made, connect the other end of the cable to the Host Computer or CRT.

The drawing to the right shows a 25 pin male connector. Use the same assembly procedure for any D connector that you may have.



Strain Relief Assembly

Connecting to Other Serial Devices

You can connect the Plus II to many other serial devices. The drawings below show all the pin connections for the Plus II when using serial communications. If you need to create your own cables to wire your Plus II to another device, use these drawings as a guide. It is very important that you make the proper pin connections.

Below is a list of terms used in these drawings:

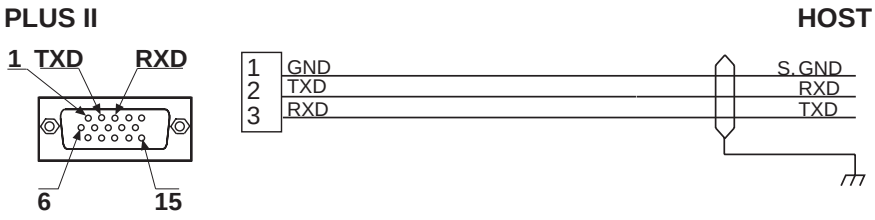
GND-Ground
TXD-Transmit Data (RS232)
CTS-Clear To Send (RS232)
RD-Receive Data (RS422)
SD- -Inverting Line (RS485)
Send Data (RS422)
RXD-Receive Data (RS232)
RTS-Request To Send (RS232)
RD+ -Receive Data (RS422)
SD+ -Non-inverting Line (RS485)
Send Data (RS422)

CAUTION

Be careful when you wire your own cable for the Plus II. You must make sure that the Plus II receives only 5 volts on pins 14 and 15.

RS232 With No Handshaking

Use the following drawing as a guide when you want to connect your Plus II to a device that is using RS232 communication with no handshaking:

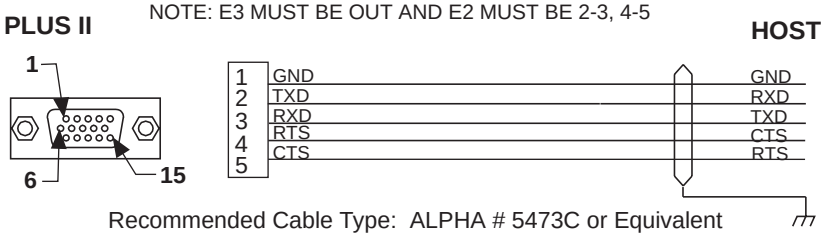


Recommended Cable Type: ALPHA # 5473C or Equivalent
Maximum Cable Length: 50 Feet

You must enable communication types using the software. Refer to your ACUSETUP Manual for more information.

RS232 With RTS/CTS Handshaking

Use the following drawing as a guide when you want to connect your Plus II to a device that is using RS232 communication with RTS/CTS handshaking:

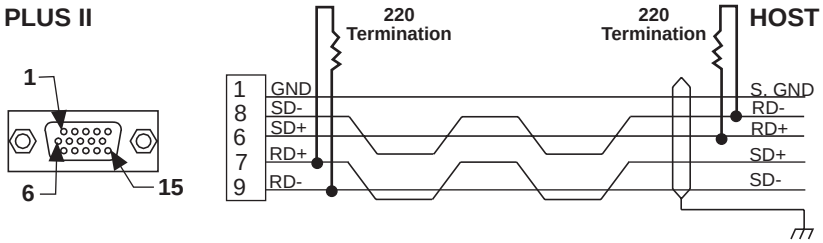


Recommended Cable Type: ALPHA # 5473C or Equivalent
Maximum Cable Length: 50 Feet

You must enable communication types using the software. Refer to your ACUSETUP Manual for more information.

RS422 (point to point)

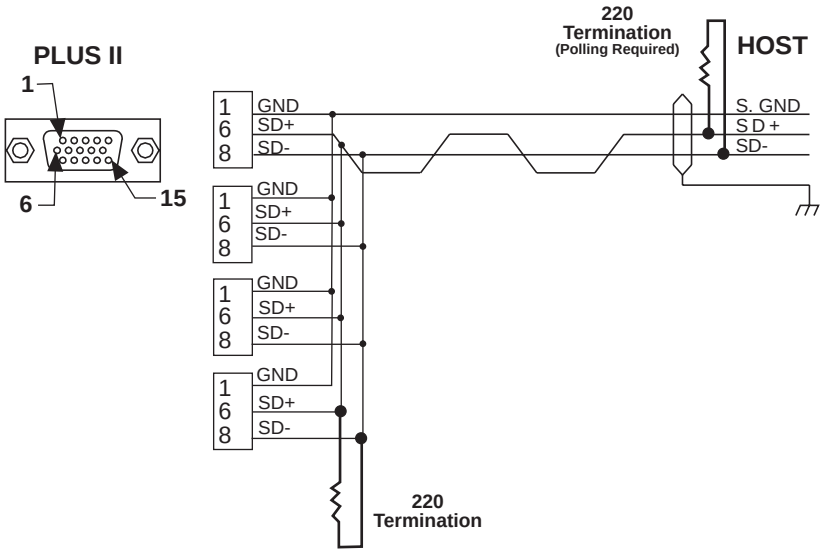
Use the following drawing as a guide when you want to connect your Plus II to a device that is using RS422 serial communication:



NOTE: Termination resistors may be placed in connector shell.
The termination resistor value is 220 OHM 1/4 watt.
With RS-422, the receive lines on both sides must be terminated.
Cable Type: Alpha #5473C (or equivalent).

RS485 Multidrop - Half Duplex

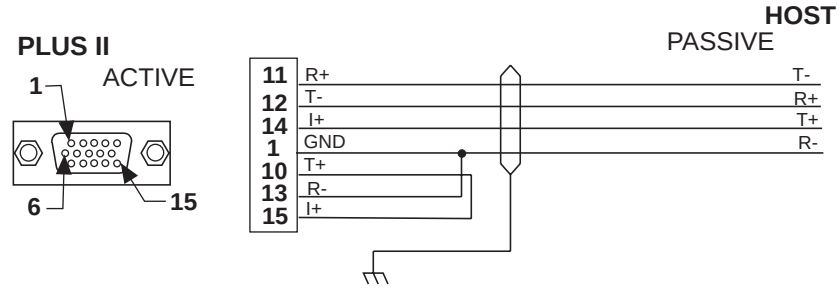
Use the following drawing as a guide when you want to connect your Plus II to a device that is using RS485 Multidrop serial communication:



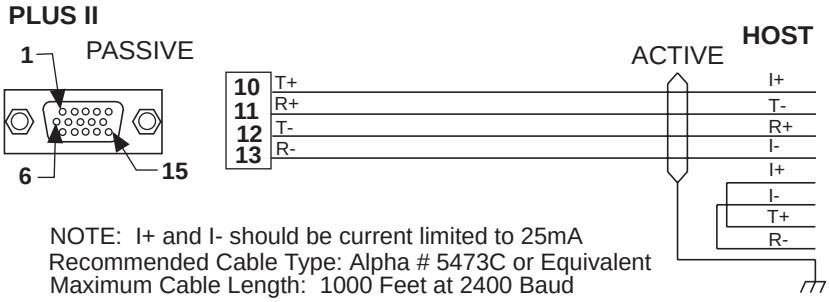
NOTE:
Termination resistors may be placed in connector shell.
The termination resistor value is 220 OHM 1/4 watt.
The transmit-receive lines on both sides must be terminated.
Cable type: Alpha #5473C (or equivalent)

Current Loop

Use the following drawings as guides when you want to connect your Plus II to a device that is using Current Loop serial communication:



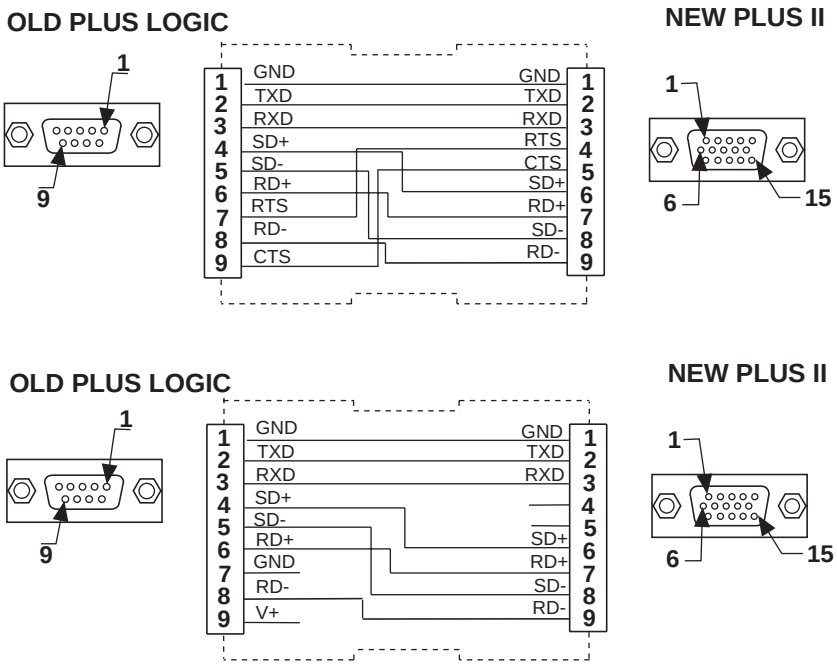
Recommended Cable Type: Alpha # 5473C or Equivalent
Maximum Cable Length: 1000 Feet at 2400 Baud



NOTE: I+ and I- should be current limited to 25mA
Recommended Cable Type: Alpha # 5473C or Equivalent
Maximum Cable Length: 1000 Feet at 2400 Baud

Cable Adapter

Use the following drawings as guides when you want to make a cable adapter between an old plus serial cable and a new Plus II serial cable:



Wiring diagrams for cable adapter between old Plus serial cable and new Plus 2. The adapter shell is DIY9MF. The wire is 22 AWG.

Connecting A Triggering Device to your Plus II Logic

J2 is a nine pin (D) female connector on the Plus II. This connection is for a product detection device. You must use the cables with a nine pin (D) male connector on one end. The other end of the cables must have a comparable connector for the product detection device.

To connect the Plus II to a trigger input cable, align the pins on the cable with the holes on connector J2. Insert the pins in the holes, and push until a tight connection is made. Turn the two slotted screws on each cable clockwise until tight. After these connections are properly made, connect the other end of the cable to the product detection device.

Refer to page 4-4 for the pin configuration of the 9-pin connector (J2).

Providing Power to your Plus II

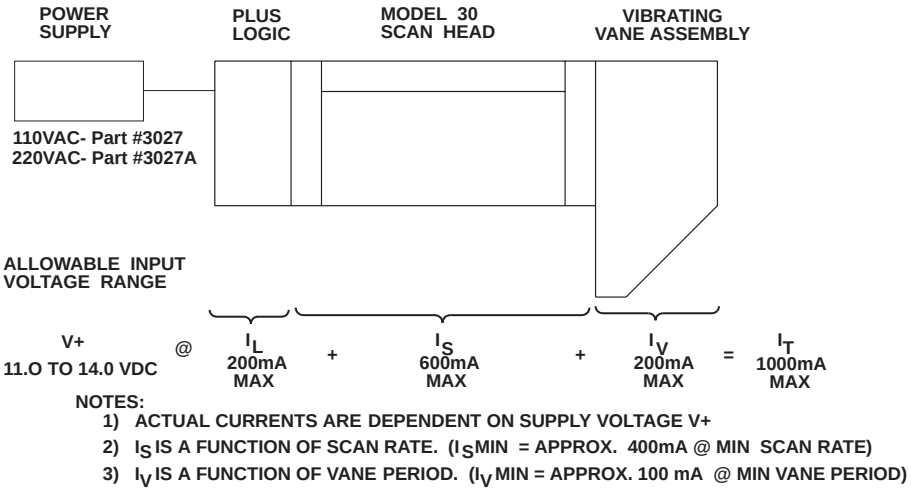
If you are using a Plus Logic unit, issued before January 1, 1993, please make sure that you are using the proper DC Power Adapter and Communications Cable.

The Plus II operates from a power source of +12V, +5V DC. Do not plug the DC Adapter into any power source until the unit is in position and all other connections are made.

Do not use the Plus II power line to operate other equipment. **Do not** place the A.C. line in the same conduit as the serial communications cables. This would cause communication interference.

To connect the power adapter to the Plus II, align the female notches on the power adapter jack with the male pins on the Plus II marked DC Input. When the two components are properly aligned, join the two of them together. After this connection is properly made, connect the other end of the power adapter cord to an AC outlet.

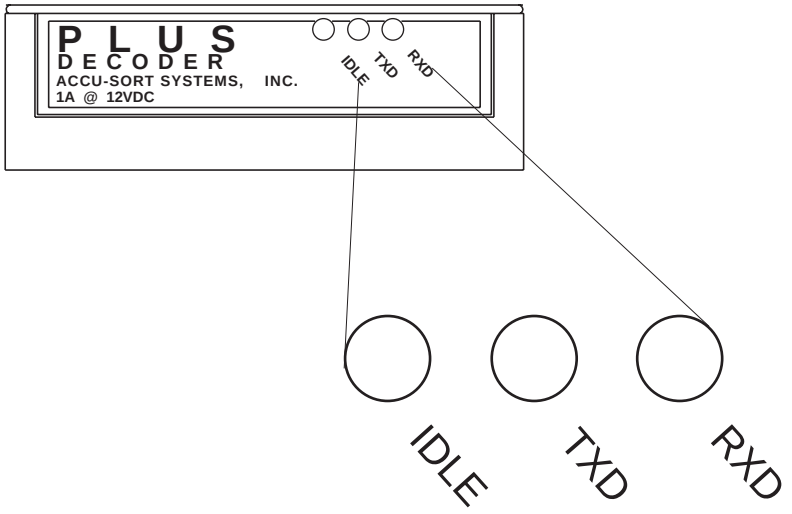
To disconnect the DC input, squeeze the sides of the connector and pull it straight from the unit.



Power Requirements

Plus II Visual Diagnostics

The Plus II has three status LED indicators on the top of the cover panel, as shown below. Use these LED's for diagnosing or trouble-shooting any errors that may occur in your application.



Below is a description of each LED:

IDLE- (Yellow) This LED remains off for a 5 second duration when the unit is turned on, but blinks when the unit is operating. When the unit is in the setup mode, this LED blinks alternately with the DECODE LED on the Model 30.

TRANSMIT- (Green) This LED lights when the unit is transmitting data.

RECEIVE- (Red) This LED lights when the unit is receiving data.

Notes

Chapter

5 Maintaining And Troubleshooting Your Model 30

Chapter Contents

Introduction

The Model 30 hardware was specifically designed for the tough industrial environment. The unit does not need anything more than some basic cleaning and an occasional check-up to insure its best performance. This chapter provides you with a cleaning procedure and some troubleshooting techniques.

The purpose of these procedures is to help prevent the chance of degraded scan head performance. Additionally, these steps help maintenance personnel to locate potential problems that may result in a scan head failure in the future.

General Cleaning and Maintenance

The Model 30 enclosure is tightly sealed to prevent dust or dirt from entering the unit. Nothing inside of the Model 30 needs to be cleaned on a regular basis. If the Model 30 needs to be repaired, do not open the unit. The Model 30 is designed to be shipped back for repair. Refer to the Customer Service Section of this manual.

To insure proper operation and decrease the chance of scan head degradation, follow the procedures defined below:

Warning: Never attempt any procedures that require the removal of the cover from the Scan Head housing.

1. Clean the Model 30 at least once a month. If your work environment is excessively dirty, clean the unit at least once weekly, or more often. Remove dust and dirt accumulations from the Model 30 exterior with a **clean**, soft bristle brush.

2. Use a **clean**, soft cloth dampened slightly with a mild detergent and water solution to remove any dust and dirt that remains on the scan head after using the brush in step 1.

WARNING: Avoid using chemicals that may harm plastic such as those that contain benzene, acetone and similar products.

3. Clean the scan head laser exit window. If the exit window is obstructed in any way, the scan head will not be able to read codes. Lightly brush off particles of dirt using a soft, lint-free lens tissue, or "Dustoff" (compressed air in a can).

CAUTION: Use caution when cleaning the laser scan head. Avoid looking directly into the laser exit window while the laser is on. Do not allow any abrasive material to touch the window. Do not use commercial glass cleaners on the window; these leave a film that accelerates the accumulation of dirt.

4. Check the Trigger Photoeye and reflector. Make sure the photoeye lens and the reflector are clean.

A recommended "One Month Preventive Maintenance Log" is provided on the next page. This log sheet identifies the daily, weekly, and monthly preventive maintenance procedures. Copy this sheet and use it to log the maintenance data for each scan head. If the scan head is located in a **relatively clean environment**, it may be necessary to complete these procedures only **once a month**. However, if the **environment is excessively dirty**, **weekly execution of these procedures** may be the key to reliable operation.

ONE MONTH PREVENTIVE MAINTENANCE LOG

MODEL 30 BAR CODE SCAN HEAD Serial Number: _____

Scan Head Cleaning Procedures	**Week1**	**Week2**	**Week3**	**Week 4**
1. Scan Head Enclosure	_____	_____	_____	_____
2. Laser Exit Window	_____	_____	_____	_____
3. a. Trigger Photoeye	_____	_____	_____	_____
b. Reflector for Photoeye	_____	_____	_____	_____
The above was checked by: (please initial)	_____	_____	_____	_____

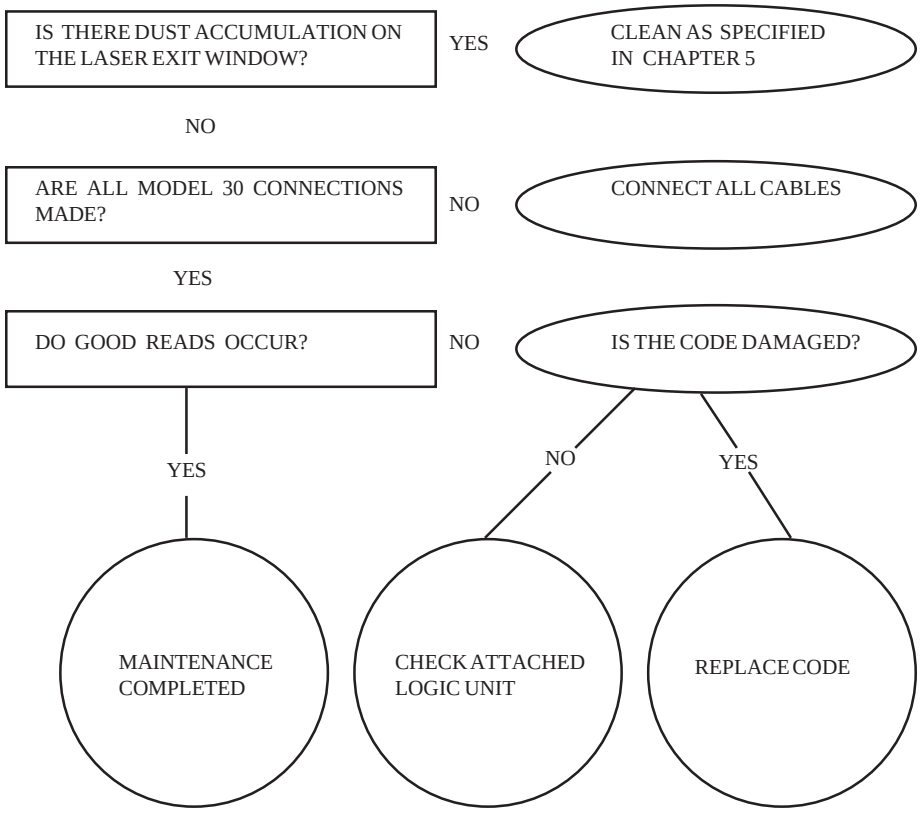
Maintenance Checks	**Week1**	**Week2**	**Week3**	**Week4**
1. a. Scan Head Mounting	_____	_____	_____	_____
b. Trigger Photoeye Mounting	_____	_____	_____	_____
c. Reflector Mounting	_____	_____	_____	_____
2. a. P1 Connections	_____	_____	_____	_____
b. P2 Connections	_____	_____	_____	_____
3. Visible scanning beam	_____	_____	_____	_____
4. Logic is decoding	_____	_____	_____	_____
The above was checked by: (please initial)	_____	_____	_____	_____

Flow Chart of General Maintenance Checks

Use the following chart when performing the general preventive maintenance steps outlined in this Chapter. If these steps are checked on a regular basis (at least once a week depending on the work environment) the Model 30 will continue to provide reliable operation.

If your Model 30 is damaged, please contact our Customer Service Department at 1-800-BAR-CODE. Please refer to the Customer Service Section in the front of this manual for more information about your equipment.

HARDWARE CHECKS



Preventive Maintenance Flow Chart

Basic Trouble Checks

If you have any problems with the Model 30, check the simple possibilities outlined in this section. If performing these checks do not solve the problem, you can request factory service from Accu-Sort. Accu-Sort Field Engineers are fully equipped and prepared to travel to customer sites to provide start-up assistance, training, and repair service. In addition, equipment can be returned to Accu-Sort for repair when necessary.

WARNING: If you must service your own equipment, only a skilled technician who has gone through an Accu-Sort Training program for the Model 30 can perform any detailed troubleshooting. Accu-Sort cannot be held responsible for damages to the Model 30 or any device connected to the Model 30, etc. caused by improperly performed procedures or untrained personnel. (This will void any applicable warranty.)

Successful troubleshooting depends upon knowledge of electronics and the availability of proper test equipment. Experience indicates that the best service comes from qualified Accu-Sort personnel. The Model 30 is designed for most service to be accomplished through the replacement of boards or modules. This increases scan head independence, and reduces the need to rely on outside service organizations.

Be sure to direct any questions concerning the operation and service of the Model 30 to Accu-Sort Systems' Customer Service Department. Before doing so, please refer to the Customer Service Section of this manual.

Checking the Simple Possibilities

Before making these checks, make sure the "**POWER**" LED is illuminated. A scanning beam of light should appear, leaving the exit window. Operate the unit as described in **Chapter One**.

If the Model 30 will not read the bar codes that are properly located within the scan head window, check the following:

- Is the power connection made?
- Is a red beam of light visible in front of the exit window? When the Trigger PE is blocked, a sweeping red laser beam should be visible on an object placed in front of the scan head window. (Be sure the laser flip lid is not covering the laser exit window to block the laser beam!)
- Is the scan head window clean?
- Does the Trigger LED light when the Trigger PE is blocked?
- Does the Trigger PE function properly?
- Are all external connectors making tight connections? Check the connections to the Model 30. Also check the connections at the other end of each cable.

Chapter

6 Appendices

Chapter Contents

Appendix A: ASCII Communications

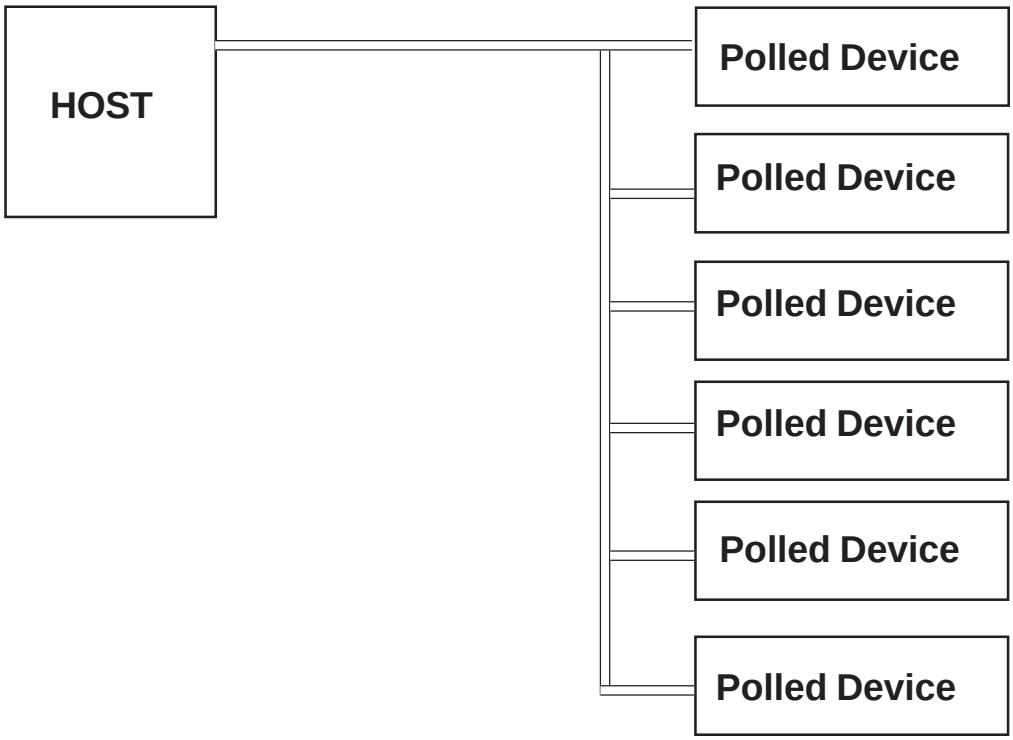
This protocol may not be available for every Accu-Sort device.

Standard RS485 Multidrop Communications

RS485 communication is an Engineering Industries Association standard for the transmitters and receivers of a digital equipment interface. RS485 communication uses differential signal lines and allows for multiple transmitters on one signal pair (although only one transmitter may be enabled at any given time). This is a way of allowing one device to communicate with one or more other devices using a host-to-polled-device method.

The Host-to-polled-device system works as follows:
The host device (usually a decoder logic or computer) originates poll messages. The poll message is from the host to a polled device requesting the polled device to respond with data (if data is available). The polled device is usually a bar code scanner. The polled device responds to the polls from the host. It is not allowed to transmit unless it has been "asked" (polled) by the host. Shown below is a simplified drawing of one way that RS485 communications work:

NOTE: This representation shows one host and six polled devices. You can ultimately have up to 32 polled devices for each serial port on the host (depending on the line length and required response time).



The remainder of this section defines the message formats and timing requirements for the protocol used on RS485 multidrop (2-wire) communications lines. The protocol is defined for both the “master” device and the “slave” devices. This protocol is defined for a one-master system only. The following definitions may help you better understand this protocol.

ASCII digit: This means the ASCII code for a single decimal digit. For example, 30h is the ASCII digit that encodes a zero.

HEX digit: This means the ASCII code for a single hexadecimal digit. Some examples are: 35h is the code for a five, 42h is the code for a "B" (which equals 11 base 10), and the hexadecimal number "5A" would be encoded by the two HEX digits 35h and 41h.

Message Formats

The standard communications parameters are as follows:
Standard asynchronous data frame (least significant bit first)

7 data bits
1 even parity bit
2 stop bits

If the master can only support 8 bit data plus a parity bit, then the format is as follows:

8 data bits
1 odd parity bit
1 stop bit

(Odd parity is required to make sure that the guard character will be all ones with one for parity.)

You can use any baud rate that is supported by both the master and the slaves. System performance is usually best when using the highest baud rate possible.

The following is the framing for all messages sent by any device on the multidrop line:

0FFH STX ID(2) TYPE(2) SEQ DATA LRC(2) CR

(FFhex) = Guard Character
This character is "sacrificed" to the line noise that occurs when the unit transmitter is first turned on. The unit software may (optionally) wait one character time between transmitter enable and transmission of the STX (the next character). This eliminates transmitting the guard character. The receiver ignores this character.

STX(02hex) = Start of text character
This character indicates the start of a message. The receiver should clear any characters in its receive buffer whenever it receives this character.

ID(2 ASCII digits) = The unit ID
This field indicates the unit identification number of the unit to which the message is directed, if the message is coming from the master. This field indicates the unit identification number of the unit transmitting the message, if the message is from a slave.

A message with an ID of "00" from the master is a broadcast message. All slave units should act on the message (display data, reset, etc.), but no slave should respond to the message.

TYPE(2 ASCII digits) = The message type
This field describes the purpose of the message that is sent. There are five message types as shown below:

Message Types

01	Poll	This message type is sent by the master unit to request data from a slave.
02	Data	This message type is sent by either a master to transfer data to a slave or by a slave to transfer data to the master after receiving a poll. The TYPE field will then be followed by a SEQ field and a data field.
03	ACK	This message type is sent by the unit that has just received a valid data message.

04	Wake up	This message type is sent by the master. The slave that receives it should acknowledge the message.
05	No data	This message type may be sent by a slave indicating that the slave has no data to send in response to a poll. This message is optional. If the slave has no data, it may ignore the poll.

SEQ(1 ASCII digit) = The sequence number
This field starts at zero at power up, and is incremented by one for each data message sent. When the sequence number reaches nine, it wraps around to one. This field is only present in a data message.

DATA = The content of the data field
This field contains data, if the message type indicates that data is included. This field may contain no characters (length of zero; poll, acknowledge and wake up messages do not have data fields.)

LRC(2 HEX digits) = The Linear Redundancy Check Sequence
The LRC is computed by exclusive-oring all the characters in the ID, TYPE, SEQ, and data fields, then converting the hex number into two ascii digits. This mathematical process checks to make sure that the message is valid.

CR (0Dh) = Carriage return
This character indicates the end of the message. When this character is received, the unit should check to see that the message started with a STX, and check that the LRC is correct before accepting it as a valid message.

Message Sequencing

The master unit initiates all data transfers by either sending data to a slave or requesting data from a slave. This protocol is strictly half duplex; only one device may be transmitting at any time. A slave device should not transmit unless it receives a valid message that requires a response--when it does receive such a message, it must respond quickly (See Timing). The master unit should respond in a timely manner, but is not under the same constraints as a slave. The following is the example of processing a Master / Slave interaction:

	Master	Slave's response	Master's response
1.	Wake up	ACK	-none-
2.	Poll	Data	ACK
3.	Poll	No data	-none-
4.	Poll	-none-	-none-
5.	Data	ACK	-none-

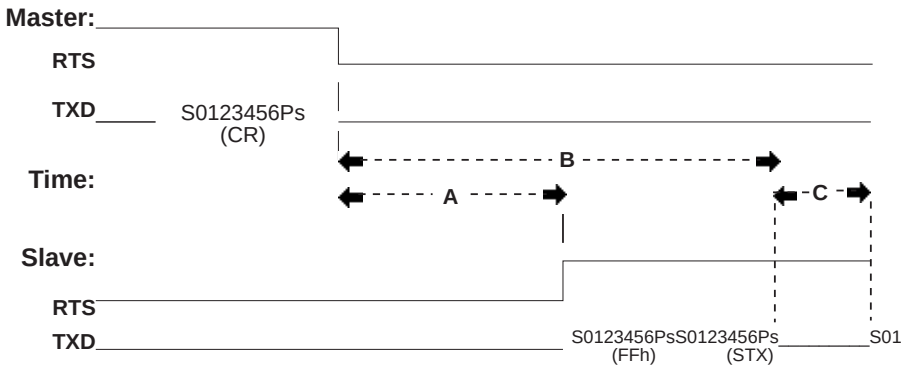
Timing

If a slave unit is going to respond to a poll from the master, it must start its response within two character times of the end of the carriage return at the end of the poll.

NOTE: This makes the response time dependent upon the baud rate.

The slave must turn on its transmitter within two character times after receiving the CR of the master's poll. The slave must place the STX at the beginning of its response, into its serial port no later than three character times after receipt of the master's carriage return.

Once the slave begins transmitting, it must not allow a gap of more than one half a character time between characters. Most transmissions will take place under interrupt, so this should not be a problem; however, it means that serial port interrupts may not be disabled for an extended period of time during data transmission.



"S" is the start bit, "0123456" are the character bits, "P" is the parity bit and "s" is the stop bit.

Typically, the "RTS" line is used to control the transmitter. In this diagram, "RTS" is high when the transmitter is enabled and low when the transmitter is disabled ("tri-stated").

NOTE: The slave's "FF" may be replaced with a 1 character time (10/baud rate) delay between transmitter turn-on and transmission of the STX.

Time Limits:

A	Maximum: 2 character times (20/baud rate). Minimum: 0.
B	Maximum: 4 character times (40/baud rate). Minimum: 2 character times (due to guard character + STX transmission time).
C	Maximum: 1/2 character time (5/baud rate). Minimum: 0.

Both the master and the slave must disable their transmitter as soon as possible after transmitting the carriage return at the end of the message. The transmitter must remain enabled while the carriage return is being sent out, however. This means that the transmitting device must wait for a “transmitter empty” (as opposed to a “transmitter ready”) indication from the serial port before disabling the transmitter.

This protocol has been designed for a "slow" master to communicate with a "fast" slave. The only time-critical item for the master is for the master to release control of the line immediately after sending a message to a slave. While the slave must respond within a very short time window, there are no such constraints on the master. The master may have any amount of time between messages or between characters within its message.

Error Recovery

Error: The slave does not understand a poll message.
Recovery: None. The master will time out, waiting for the slave’s response, then will go on to the next unit.

Error: The slave does not understand a data message from the master.
Recovery: The master will retransmit the data message again after timing out while waiting for the acknowledgement.

Error: The master does not understand the slave’s acknowledgement of a data message.
Recovery: The master will retransmit the data message after timing out while waiting for the acknowledgement. The slave will acknowledge the retransmitted message and discard it, since the message will have the same sequence number as the last message received.

Error: The master does not understand the slave's data message (response to a poll).
Recovery: The master will time out waiting for the slave's response, then continue on to the next poll. Since the slave did not receive an acknowledgement for the data message, it will retransmit the same message in response to the next poll.

Error: The slave does not understand the master's acknowledgement of the slave's data message.
Recovery: The slave will retransmit the same message in response to the next poll. The master will see that it is a duplicate message, acknowledge it, and discard it.

Error: The slave does not understand a broadcast message.
Recovery: None. The message will be lost.

The general rules are as follows:

1. **Each data message will be acknowledged by the recipient**. If a data message is not acknowledged, the transmitter should retransmit it again up to three retries. After the third retry, a communications error message should be displayed and the message discarded (in some systems the message may be recorded in a disk file or on a printer to prevent data loss).

2. **Each new message will have a new sequence number**. If a message is received that has the same message number as the last message received, the recipient should acknowledge the message and then discard it. The sequence number should only be checked for equality to the last sequence number received: there is no requirement that the sequence number must be the next number expected (although in some systems the master will keep track of "out of sequence" errors since they would indicate that messages had been lost).

The sequence number zero is a special case, since it indicates that the data message is the first data message sent since the device sending it has powered up. Messages with a sequence number of zero should always be processed as required, regardless of whether or not they are repeated "back to back".

3. **Any message that contains parity errors, LRC errors or an unrecognized message type should be discarded**. No acknowledgement should be sent. In some systems, the master will keep track of these transmission errors.

4. **Any message that contains a correct LRC, has no errors, is of a correct type, and requires an acknowledgement should be acknowledged even if its sequence number indicates that it is a duplicate message (the sequence number is the same as the last message)**. If it is a duplicate message, it should be acknowledged, then discarded. In some systems, the master will keep track of these duplicate message errors since they would indicate that an acknowledgement had been lost. A broadcast message (one sent to unit "00") must not be acknowledged.

Multidrop Protocol Examples

Message framing:

FFh,	**02h,**	**idhigh,**	**idlow,**	**type,**	**seq no,**	**... data...,**	**lrc0,**	**lrc1,**	**0Dh**
(DEL,	STX,	?,	?,	?,	?,	?,	?,	?,	CR)

NOTE: The DEL character is used as a guard character to make sure that the transmission line is quiet for one character time before the STX is sent. The sequence number only appears on data messages. The LRC stands for "linear redundancy check" and appears on all messages.

Polling sequence:
1. MUX polls slave at address 01 with the following format:

STX, unit id (2 char), 0, 1, lrc (2 char), CR

Example:	**STX**	**0**	**1**	**0**	**1**	**0**	**0**	**CR**
HEX:	02h	30h	31h	30h	31h	30h	30h	0Dh

2. SLAVE answers the poll with the data in the following format:

STX, unit id, 0, 2, seq (1 char), ...data..., lrc, CR

Example:	**STX**	**0**	**1**	**0**	**2**	**1**	**A**	**B**	**C**	**D**	**E**	**7**	**3**	**CR**
HEX:	02h	30h	31h	30h	32h	31h	41h	42h	43h	44h	45h	37h	33h	0Dh

If no data is available:

STX, unit id, 0, 5, lrc, CR

Example:	**STX**	**0**	**1**	**0**	**5**	**0**	**4**	**CR**
HEX:	02h	30h	31h	30h	35h	30h	34h	0Dh

NOTE: It is normally faster to allow the master to time out (which takes three character times) than to use the "no data" response.

3. MUX acknowledges data in the following format:

STX, unit id, 0, 3, lrc, CR

Example:	**STX**	**0**	**1**	**0**	**3**	**0**	**2**	**CR**
HEX:	02h	30h	31h	30h	31h	30h	32h	0Dh

4. MUX polls the next unit . . .

This protocol may not be available for every Accu-Sort device.

Accu-Sort Master/Slave Protocol

Accu-Sort's master / slave protocol is a method of allowing two Accu-Sort scanners to scan during the same trigger cycle and send their data through one unit to a host.

One unit is configured as a master unit. This unit communicates to the host through its primary serial port. It also receives data from the other unit through its secondary serial port.

The other unit is configured as a slave unit. It will send any data received for the current trigger cycle to the master unit. A message is transmitted for each bar code read.

DATA FORMAT
The secondary port of the master and the primary port of the slave are configured the same. They should both be set for RS-232 point-to-point. They communicate at 19200 baud, 7 data bits, even parity, and 2 stop bits. The slave transmits a message for each code enabled using a fixed format. The master is configured to receive this format. (See MESSAGE FORMAT)

TIMING
Non-Tracking:
In non-tracking mode, the slave unit's watch dog timer defaults to 400 ms. The slave unit has 400 ms from the end of the trigger cycle to begin transmission of its bar code data. It can begin transmission of its data anytime from the end of the trigger until the watch dog timer has expired. It is required to have completed all of its transmissions by the expiration of the master's watch dog timer.

The master's watch dog timer will default to 500 ms. The master will be required to wait until the expiration of its watch dog timer before it begins transmitting its data. This will allow the master to receive and process all of the slave unit's data before transmission.

Tracking:
In tracking mode, the master and slave units are configured for the same transmit time. The slave unit is then required to calculate the longest time it needs to send all of its data. To compensate for this value, the slave adjusts its transmit time down. This allows the master to receive and process all of the slave unit's data before transmission.

MESSAGE FORMAT
The transmission of bar code data from the slave unit to the master unit will use the following format:

STX TRIG_ID(1) TYPE (2) CODE(n) QQ(2) CR

STX = Start of text character (02h).

TRIG_ID(1) = Single ascii character representing the ID number for the current trigger cycle. The first trigger cycle will start with an ID of zero (30h). Each consecutive trigger will increment the ID. The ID will increment up to nine (39h), wrap to one (31h), and begin incrementing again. All messages for a trigger cycle will have the same ID.

TYPE (2) = Two ascii characters representing the code type of the data being transmitted.

VALUE	TYPE
00	No-read
01	Straight 2 of 5
02	Interleaved 2 of 5
03	Code 39 (STI option)
04	Code 39
05	Code 128
06	UPC-A (10 characters)
07	UPC-E (6 characters)
08	UPC-A (12 characters)
09	UPC-E (12 characters)
10	EAN-13
11	EAN-8
12	Codabar (start/stop not included)
13	Codabar (start/stop included)
14	AS-10
15	10 Bit Periodic Binary
16	Code 93
17	PharmaCode

CODE(n) = String of ascii characters containing the bar code. This field is not required for a no-read message.

QQ(2) = Two ascii characters representing the quality of code read (01-99). This field is not required for a no-read message.

CR = Carriage return (0Dh).

MESSAGE PROTOCOL
Each device will use ACK/NAK protocol with the other unit. When a message is transmitted, the transmitting unit will expect to receive an ACK (06h) or a NAK (15h) in response. If an ACK is received, this communication sequence is complete. If a NAK is received, the message should be transmitted again. If nothing is received for 250 ms, the transmitting device will treat this as a NAK being received and re-transmit. A message will be re-transmitted a maximum of three times. If a fourth NAK or time out is seen, an error should be logged and the message should not be re-sent. All messages received should be ACK'd by the receiving unit. The NAK response is reserved for use in custom applications.

When each unit powers up, it will send a synchronization character (SYN or 16h) to the other unit. This character will indicate that both units will set their next trigger ID to 0.

The data messages will be sent down from the slave to the master for each trigger cycle. For each trigger cycle, the master will wait for messages from the slave before transmitting to the host. Each message received from the slave should have the same trigger ID that the master is using for that trigger cycle. If an incorrect ID is received, an error should be logged on the master unit and the data should be discarded. The master will place any valid messages into its compare buffer and process them as if they were read by that unit.

Protocols Used With RS232, Current Loop, and 422

RTS/CTS (Used with only RS232)
This protocol stands for "Request To Send" and "Clear To Send". This is a common type of "handshaking" that goes on between two units. When one device wants to transmit to another device, it will drive the RTS line indicating it has data to transmit. When the receiving device is ready to receive, it will drive the CTS line indicating it is ready. When you use RTS/CTS it requires the addition of two more wires on the communication cable. If they are not needed, it is advised not to use any other additional lines in the cable.

ACK/NAK
This is a software protocol. When a unit receives a message, it indicates whether it has received that message correctly. If all information is received, the unit will transmit an "ACK" (acknowledge). The ACK is a signal that more information may be transmitted. If the information is not received correctly, then it will transmit a "NAK" (non-acknowledge). The NAK is a signal requesting a message be retransmitted. Most software has a limit to the number of retransmits. Three NAKS is common.

XON/XOFF
This is a software protocol. XON stands for "transmit on" and XOFF stands for "transmit off." A unit receiving data may signal the unit transmitting that it should stop sending data by transmitting and XOFF (ctrl-S). An XON (ctrl-Q) signals the original unit to begin transmitting again.

Appendix B: ASCII Chart

Hexadecimal & Decimal Character ASCII Table											
DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII	DEC	HEX	ASCII
000	00	^@ NUL	032	20	SPC	064	40	@	096	60	'
001	01	^A SOH	033	21	!	065	41	A	097	61	a
002	02	^B STX	034	22	"	066	42	B	098	62	b
003	03	^C ETX	035	23	#	067	43	C	099	63	c
004	04	^D EOT	036	24	$	068	44	D	100	64	d
005	05	^E ENQ	037	25	%	069	45	E	101	65	e
006	06	^F ACK	038	26	&	070	46	F	102	66	f
007	07	^G BEL	039	27	'	071	47	G	103	67	g
008	08	^H BS	040	28	(	072	48	H	104	68	h
009	09	^I HT	041	29	)	073	49	I	105	69	i
010	0A	^J LF	042	2A	*	074	4A	J	106	6A	j
011	0B	^K VT	043	2B	+	075	4B	K	107	6B	k
012	0C	^L FF	044	2C	,	076	4C	L	108	6C	l
013	0D	^M CR	045	2D	-	077	4D	M	109	6D	m
014	0E	^N SO	046	2E	.	078	4E	N	110	6E	n
015	0F	^O SI	047	2F	/	079	4F	O	111	6F	o
016	10	^P DLE	048	30	0	080	50	P	112	70	p
017	11	^Q DC1 XON	049	31	1	081	51	Q	113	71	q
018	12	^R DC2	050	32	2	082	52	R	114	72	r
019	13	^S DC3 XOFF	051	33	3	083	53	S	115	73	s
020	14	^T DC4	052	34	4	084	54	T	116	74	t
021	15	^U NAK	053	35	5	085	55	U	117	75	u
022	16	^V SYN	054	36	6	086	56	V	118	76	v
023	17	^W ETB	055	37	7	087	57	W	119	77	w
024	18	^X CAN	056	38	8	088	58	X	120	78	x
025	19	^Y EM	057	39	9	089	59	Y	121	79	y
026	1A	^Z SUB	058	3A	:	090	5A	Z	122	7A	z
027	1B	^[ESC	059	3B	;	091	5B	[	123	7B	{
028	1C	^\ FS	060	3C	<	092	5C	\	124	7C	|
029	1D	^] GS	061	3D	=	093	5D	]	125	7D	}
030	1E	^^ RS	062	3E	>	094	5E	^	126	7E	~
031	1F	^_ US	063	3F	?	095	5F	_	127	7F	DEL

Notes

Glossary of Terms

ACK - A control character sent to acknowledge that a transmission block has been received.

Active/Passive Device - In 20mA current loop communications, a device capable of providing the current for the loop (active) and a device that draws the current from the equipment it is connected to (passive).

Address - A unique designation for the location of data or the identity of a smart device; allows each device on a single communications line to respond to its own message.

AEL - (Accessible Emission Limit) The average power limitations of electronic radiation from a laser light source as defined by the CDRH.

AIM - Automatic Identification Manufacturers, Inc.

Alignment - The position of a scanner or light source in relation to the target of a receiving element.

Alphanumeric - The character set which contains letters, digits and other characters such as punctuation marks.

Ambient Light - The lighting conditions in the scanning area. Ambient light can interfere with successful scanning of bar codes.

ANSI (American National Standards Institute) - The principle standards development group in the U.S. A non-profit, non-governmental group supported by over 1000 trade organizations, professional societies, and companies. Member body to the ISO (International Standards Organization).

Aperture - Term used on the required CDRH warning labels to describe the laser exit window.

ASCII(American Standard Code for Information Interchange) - Pronounced asky. A seven bit plus parity code established by ANSI to achieve compatibility between data services.

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

Asynchronous Transmission - Transmission in which the time intervals between transmitted characters may be of unequal length. Transmission is controlled by start and stop bits at the beginning and end of each character.

Autodiscrimination - The ability of bar code reading equipment to recognize and correctly decode more than one bar code symbology.

Autodistinguish - The ability of a scanner to recognize a selectable number of different symbologies and process the data without operator intervention; this is a prerequisite feature of linear bar code scanners employed in open systems.

Bar - The dark elements of a printed bar code symbol.

Bar Code - An array of rectangular bars and spaces that are arranged in a predefined pattern to represent elements of data referred to as characters.

Bar Code Character - A single group of bars and spaces that represent an individual number, letter, or other symbol.

Bar Code Density - The number of characters that can be represented in a linear unit of measure. Bar code density is often referred to in characters per inch (CPI).

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

Bar Code Reader - A device that examines a printed spacial pattern and decodes the encoded data.

Bar Height - The height of the shortest bar in a bar code.

Bar Length - The bar dimension perpendicular to the bar width.

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

Baud Rate - A unit used to measure communications speed or data transfer rate; represents the number of discrete conditions or events per second.

BCC (Block Check Character) - Used to check transmission accuracy, a character transmitted by the sender after each message block and compared with a block check character computed by the receiver.

Bed Width - The width of the conveyor bed measured in inches.

BEL - A control character that is used when there is a need to call for attention; it may control alarm or attention devices.

Belt Width - The width of the conveyor belt measured in inches.

Bidirectional - A bar code symbol capable of being read successfully independent of scanning direction.

Bit (Binary Digit) -The contraction of binary digit, the smallest unit of information in the binary system; a one or zero condition.

Bottom Read - When the scanner is mounted under the conveyor to read codes on the bottom of the boxes or on the front or back of the boxes. If used there is not enough clearance for a standard front or back read.

BPS (Bits per Second) - Unit of data transmission rate. See baud rate.

Buffer - A temporary storage device used to compensate for a difference in data rate and data flow between two devices (typically M).

Byte - A binary element string functioning as a unit, usually shorter than a computer “word”. Eight-bit bytes are most common. Also called a “character”.

CART (Otherwise known as trigger) - A signal, typically provided by a photoeye or proximity switch, that informs the scan head of the presence of an object within its reading zone.

CCD (Charge Coupled Device) - Used in scanners to sense the light and dark areas of a symbol.

CDRH- (National Center for Devices and Radiological Health) This organization (a service of the Food and Drug Administration) is responsible for the safety regulations governing acceptable limitations on electronic radiation from laser devices. Accu-Sort is in compliance with the CDRH regulations.

Character - A single group of bars and spaces in a code that represent an individual number, letter, punctuation mark or other graphic element. Used as part of the organization, control, or representation of data.

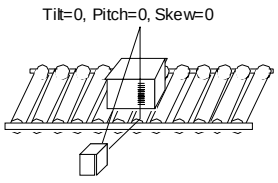
Check Character - A character (usually at the end of the code) that is used to perform a mathematical check to ensure the accuracy of a scan of the bar code.

Code Orientation - The relationship of the bar code with reference to the scan head's reading zone. Typical code orientations are Ladder and Picket Fence.

Code Length - The length of the bar code measured from the start of the first bar to the end of last bar.

Code Placement - Variation in code placement affects the ability of a scanner to read a code. The terms Tilt, Pitch, and Skew deal with the angular variations of code placement in the X, Y and Z axes. Variations in code placement affect the pulse width and therefore the decoding of the code. Pulse width is defined as a change from the leading edge of a bar or space to the trailing edge of a bar or space over time. Pulse width is also referred to as a transition. Tilt, pitch, and skew impact the pulse width of the code.

Changes to this code presentation cause the bar codes to appear smaller to the scanner which results in a smaller pulse width. Each of these variation has a different effect on a scanner reading these codes and the combination of the variations leads to more complicated effects.



Code Quality - The number of scans successfully decoded during a read cycle.

Communications Protocol - The rules governing exchange of information between devices connected together on the same communications line.

Conveyor Speed - The speed that the conveyor is moving measured in feet per minute. Conveyor speed directly impacts the time that the code is in front of the scanner; therefore, it affects the number of reads that are possible.

CR (Carriage Return) - An ASCII or EBCDIC control character that moves the cursor or print mechanism to the left margin.

CTS (Clear to Send) - The Modem interface signal that indicates to the DTE device to begin transmission.

Current Loop - Method of interconnecting terminals and transmitting signals, whereby a mark (binary 1) is represented by current on the line and a space (binary 0) is represented by the absence of current.

Decoder Logic- The electronic package that receives signals from the scan head, interprets the signals into useful data, and provides the interface to other devices.

Depth of Field - The distance between the maximum and minimum plane in which a symbol can be read. This range is from the specified optical throw to the far reading distance.

DIP Switches - Switches that are the approximate size of an integrated circuit.

Dot Matrix Printer - A dot matrix printer is an impact printer that consists of a series of pins arranged in an array. The pins strike an inked ribbon against the label stock to form the bar code and characters. This is the most common type of printer used to print labels on-demand. Some dot matrix printers use a moving print head and stationary stock. The print head moves across the label, printing one dot at a time, to complete one line. The print head then begins printing the next line. Other dot matrix printers use a stationary print head. These printers typically print one line at a time and are therefore much quicker than a printer with a moving print head. **Common Problems with dot matrix printing:** The printed ink (bars) tends to expand or "bleed". This causes the size of the bars of a code to expand while shrinking the spaces. There tends to be small gaps between pins of a dot matrix printed bar. This can lead to problems with scanners because these gaps can appear as spaces. Ribbon wear is a factor when printing dot matrix codes. If a printer uses a circular type ribbon (ribbon is used over and over again) the contrast of the bar code diminishes over time. A bar code printed with an old ribbon can be more difficult to read than one printed with a new ribbon. **Benefits of dot matrix printing:** It is inexpensive to print bar codes using dot matrix printers.

Downloading- The process of sending configuration parameters, operating software or related data from a central source to remote stations.

DSR (Data Set Ready) - An RS232 modem interface control signal which indicates that the terminal is ready for transmission.

DSR (Data Terminal Ready) - Modem interface signal which alerts the modem that the DTE device is ready for transmission.

Duplex Transmission - See Full and Half Duplex.

EDI (Electronic Data Interchange) - A method by which data is electronically transmitted from one point to another.

EIA-232 -Interface between data terminal equipment and data communication equipment employing serial binary data interchange.

EIA-422 -Electrical characteristics of balanced-voltage digital interface circuits.

EIA-485 - The recommended standard of the Electronic Industry Association that specifies the electrical characters of generators and receivers for use in balanced digital multipoint systems.

Element - Dimensionally the narrowest width in a character - bar or space.

ENQ (Enquiry) - A transmission control character used as a request for a response from a remote station. (^E)

ESC (Escape) - A control character which is used to provide additional control functions. It alters the meaning of a limited number of continuously following bit combinations. (^[)

ETX (End of Text) - A transmission control character that terminates a text.

Even Parity - A data verification method in which each character must have an even number of on bits.

Expansion Bus - Allows the microprocessor to communicate with controllers for peripheral devices, such as a network card or an internal modem.

Far Distance - The distance (in inches) from the face of the scanner to the **farthest** point at which a code can be successfully scanned.

Flying Lead - A lead that exits the back of the connector hood on the outside of the cable jacket. It is normally attached to the drain wire or shield and connected to the chassis of the switch, modem, etc. It can also be a hardware control lead.

Front Read - The scanner is mounted to read bar codes on the leading edge of a box as it passes the scanner. In a front read application, the scanner can be mounted above or on the side of the conveyor.

Full Duplex (FDX) - Simultaneous, two-way, independent transmission in both directions.

Half Duplex (HDX) - Transmission in either direction, but not simultaneous.

Handshaking - Exchange of predetermined signals between two devices establishing a connection. Usually part of a communications protocol.

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

Helium Neon Laser - The type of laser most commonly used in bar code scanning. Because the laser beam is bright red, bars must not be printed with red ink since they would be indistinguishable from the code's background.

Ink Jet Printing - Ink jet is a non-contact printer that projects drops of ink at a printing surface. The sprayed drops are controlled electronically to form a bar code.**Common Problems with laser printing:** Its main restriction is that ink jet printing is usually capable of printing only low density codes.**Benefits of laser printing**: Because ink-jet printers are non-contact and non-impact, they can print bar codes on a variety of contoured, rough, and delicate surfaces. Capable of printing random or sequential information on labels. Ink jet printers can print directly on cartons and avoid the cost of label stock.

Input/Output Modules - Since many scanners are operating in environments that have electrical noise problems, it is helpful to have equipment electrically isolated from other equipment. The standard method for isolating inputs and outputs is through the use of OPTICALLY ISOLATED INPUT/OUTPUT MODULES. These flexible modules allow the scanner to control high voltage outputs that are susceptible to noise. Since they are isolated from each other the noise is not picked up in the scanner.

The modules come in both input and output versions. The output versions are controlled by a 5VDC input. The output of the modules can range from 24VAC - 140VAC or 3VDC - 200VDC. Foreign voltage ranges are available. The maximum current that the modules can supply is limited by the output voltage and the module type. The input versions are controlled by either a DC or AC input ranging from 3VDC - 32VDC or 90VAC - 140VAC. Foreign voltage ranges are available. The output of the modules is a 5VDC level. The maximum current is limited by the input modules. These output modules are commonly used to control diverters, alarms, external relays, etc. The input modules can be used for photoeye inputs.

Intercharacter Gap - The space between two adjacent bar code characters in a discrete code.

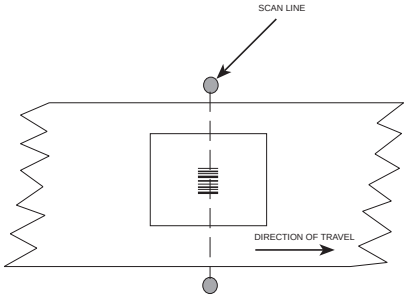
Interface - A shared boundary defined by common physical interconnection characteristics, signal characteristics and meanings of interchanged signals.

Interleaved Bar Code - A bar code in which characters are paired together using bars to represent the first character and spaces to represent the second.

I/O - The abbreviation for input/output. The keyboard and a printer, are examples of I/O devices. I/O activity is different from computational activity. When a program sends a document to the printer, it is engaging in I/O activity; when the program sorts a list of terms, it is engaging in computational activity.

Jumper - A wire that connects a number of pins on one end of a cable only, such as looping back Request to Send from Clear to Send pins 4 and 5.

Ladder Orientation - When the bar code's bars are positioned horizontally on the product, causing them to appear as a ladder. The ends of all bars will enter the scan window first.



LAN - The acronym for local area network. A LAN system is usually confined to the same building or a few nearby buildings, with all equipment linked by wiring dedicated specifically to the LAN.

Laser Gun - A hand-held non-contact laser scanner that is usually activated with a trigger.

Laser Scanner - An optical bar code reading device using a low energy laser light beam as its source of illumination.

Laser Printing - Laser printers use a pulsed or rastered laser light source to positively charge an image on a dielectric cylinder of an electrostatic printing mechanism. Toner used in the laser printing process adheres to the charged portion of the cylinder. This toner is then transferred to paper using heat. **Common Problems with laser printing:** The labels are more expensive than those used in dot matrix printers. **Benefits of laser printing:** Labels can be printed at various speeds. Laser printed bar code labels are high quality and very accurate.

LCD (Liquid Crystal Display) - A low-power display often used for notebook computers. An LCD consists of a liquid crystal solution between two sheets of polarizing material. An electric current causes each crystal to act like a shutter that can open to allow light past or close to block the light.

LED (Light Emitting Diode) - A semiconductor generally made from gallium arsenide, that can serve as a visible or near infrared light source when voltage is applied continuously or in pulses. LEDs have extremely long lifetimes when properly operated.

LF (Line Feed) - An ASCII control character that moves the cursor or print mechanism to the next line. (^J)

mA - The abbreviation for milliampere(s).

Memory - A computer can contain several different forms of memory, such as RAM, ROM, and video memory. The term *memory* is generally used to define RAM. When a computer has 8 MB of memory, it actually has 8 MB of RAM.

Memory Address - A specific location, usually expressed as a hexadecimal number, in the computer's RAM.

MHz - The abbreviation for megahertz.

Microprocessor - The primary computational chip inside the computer, referred to as the "brain". The microprocessor contains an arithmetic processing unit and a control unit. Software written for one microprocessor must usually be revised to run on another microprocessor.

Mil - One thousandth of an inch (0.001 inch). Bars and spaces of codes are commonly referred to as being a certain number of mils wide.

Misread - The scanner incorrectly decodes a bar code as it passes through the scan zone.

Mouse - A pointing device that controls the movement of the cursor on a screen. Mouse-aware software allows the user to activate commands by clicking a mouse button while pointing at objects displayed on the screen.

Moving-Beam - Rather than using a stationary laser beam and relying on product movement for a single scan, a multi-facet mirror wheel and motor is used to 'move' the beam across the code several times while in motion itself.

Moving-Beam Bar Code Scanner - A device that dynamically searches for a bar code symbol by sweeping a moving optical beam through a field of view called the scanning zone. Automatic bar code reader that reads codes by sweeping a moving optical beam through a field of view. Moving-beam scanners are usually mounted in a fixed position and read codes as they pass by.

MTBF - The abbreviation for mean time between failures.

Multidrop Line - A single communications circuit that interconnects many stations, each of which contains terminal devices. See EIA-485.

NAK (Negative Acknowledgment) - A control character used to indicate that the previous transmission block was in error and the receiver is ready to accept retransmissions.

Narrow Bar (NB)/Narrow Space (NS) - Smallest code element, bar or space, in the bar code symbol. Also known as the X dimension.

NCDRH - (National Center for Devices and Radiological Health) This organization (a service of the Food and Drug Administration) is responsible for the safety regulations governing acceptable limitations on electronic radiation from laser devices. Accu-Sort is in compliance with the NCDRH regulations.

Near Distance - The distance (in inches) from the face of the scanner to the **closest** point at which a code can be successfully scanned.

NEMA - In order to rate the quality of an enclosure the National Electrical Manufacturers Association (NEMA) has developed a system for rating all enclosures. A partial list of the NEMA enclosures is shown below along with what particles it is designed to restrict.

RATINGS

3 Enclosures are intended for indoor or outdoor use primarily to provide protection against windblown dust, rain, and sleet, and is undamaged by the formation of ice on the enclosure.

4 Enclosures are intended for indoor or outdoor use primarily to provide protection against windblown dust and rain, splashing water, and hose-directed water; undamaged by the formation of ice on the enclosure.

4X Enclosures are intended for indoor or outdoor use primarily to provide protection against corrosion windblown dust and rain, splashing water, and hose directed water; undamaged by the formation of ice on the enclosure.

6 Enclosures are intended for use indoors or outdoors where occasional submersion is encountered.

12 Enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping noncorrosive liquids.

13 Enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, noncorrosive coolant.

NVC - The acronym for non-valid code. Defines the condition that occurs when an object has been scanned and no bar code could be decoded. Usually, this indicates that either no code was on the object or the code was badly damaged and could not be decoded.

No-Read - When the scanner is unable to decode a bar code as it passes through the scan zone.

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

Odd Parity - A data verification method in which each character must have an odd number of on bits.

Omnidirectional - Orientation is unpredictable and can be ladder, picket fence, or any angle in between. A single scan line is not sufficient to scan bar codes oriented omnidirectionally.

Operating Range - The sum of the scanner's optical throw and depth-of-field.

Optical Throw - Measured distance from the scanner's window to the near reading distance of the depth of field. Typically, this is the closest a bar code can be to the scanner's window and still be properly decoded.

Optimum Reading Distance - Typically, the center of the depth of field.

OCR - Optical Character Recognition.

Orientation - The alignment of the code's bars and spaces to the scan head. Often referred to as vertical (picket fence) and horizontal (ladder).

Oversquare - Used to describe bar codes that are taller (from top to bottom of the bars) than they are wide (from first to last bar).

Package Detection
Trigger or Cart - The standard abbreviation for a signal indicating that an object is passing by the scanner is called Cart. This signal indicates to the scanner to start or stop reading.

Trigger or Cart Cycle - The time during which the scanner is attempting to read the bar code.

Hardware Cart - This is an electrical signal from a relay, photoeye, or proximity switch indicating that an object is passing by the scanner.

Start and End of Cart Photoeyes - The cart cycle begins when the start of cart photoeye is blocked and continues until the end of cart photoeye is unblocked. Relay decisions and data communication take place after the end of cart photoeye is unbroken. The diagram below shows start and end of cart photoeye placement.

Induct Photoeyes - The cart cycle begins when the start of cart photoeye is blocked and continues until the cart photoeye is unblocked. Blocking the INDUCT photoeye causes relay decisions and data communication. For this placement the distance between the CART and INDUCT photoeyes must be less than the minimum box size plus the minimum box spacing.

Software Cart - A serial message from an external device that controls the cart cycle.

Self Cart - This form of cart requires no input signal. The scanner is continuously attempting to decode bar codes. When a scanner is in self cart, there is no way of determining if there is a package present or a NO-READ.

Flip Lens - A moveable lens inside a scanner that increases Depth of Field.

Package Spacing - This is the spacing between items on a conveyor. Package spacing is measured one of two ways: Leading edge of one box to leading edge of the next or trailing edge of one box to trailing edge of the next. Package spacing is critical to system operations.

Parameter - A value or opinion that you specify to a program. A parameter is sometimes called a *switch* or an *argument*.

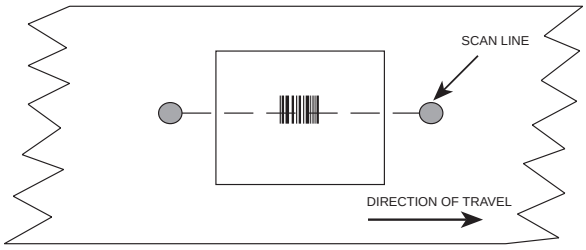
Parity Bit - A bit that is set at "0" or "1" in a character to ensure that the total number of 1 bits in the data field is even or odd.

Pen Scanner - A pen-like device either connected by wire to a device, or self-contained, used to read bar codes. Requires direct contact with the symbol.

Peripheral Device - An internal or external device, such as a printer, a disk drive, or a keyboard, connected to a computer.

Photoeye - Used as a presence detector to identify objects in the scanner's reading zone. The photoeye emits a beam and is used with a reflector to create a photoelectric circuit. When the beam is blocked by an object, breaking the circuit, a signal called CART is sent to the scanner.

Picket Fence Orientation - When the bar code's bars are positioned vertically on the product, causing them to appear as a picket fence. The first bar will enter the scan window first.



Pitch - Rotation of a code pattern about the X-axis. The normal distance between center line or adjacent characters.

Polarized Laser - A specialized laser source used in high glare environments.

Polling - A means of controlling devices on a multipoint line.

Protocol - A formal set of conventions governing the formatting and relative timing of message exchange between two communicating systems.

Pulse Width - A change from the leading edge of a bar or space to the trailing edge of a bar or space over time. Pulse width is also referred to as a transition.

Queue - A buffer used to hold data in order until it is used or transmitted.

Quiet Zone - Required distance before the first bar and after the last bar of the code that must be free of marks or printing.

Radio Frequency - Non-optical automatic dientification devices that use radio waves to transmit data.

Raster - The process of projecting the laser beam at varied angles spaced evenly from each other. Typically, the mirror wheel surfaces are angled to create multiple scan lines instead of a single beam.

Raster Mirror Wheel - The standard mirror wheel forms the laser line that is projected from the scanner. Although the mirror wheel projects 8 separate lines (for an 8-sided mirror wheel), the speed of the sweep makes it appear that it is actually one line. This type of mirror wheel is adequate for a **ladder** orientation because the laser line will pass from the bottom to the top of the code. For a **picket fence** orientation the standard mirror wheel is not always adequate. One problem facing the **picket fence** orientation is that the same portion of the code is being repeatedly scanned. If the printing quality at this point is not good the label may not be scanned even though other parts of the label are good. Another problem for a **picket fence** orientation is the placement of the label. If the placement is off enough a single scan line will not read all the bar codes presented to the scanner.
Read-only - A read-only file is one that you are prohibited from editing or deleting. A file can have read-only status if:

- Its read-only attribute is enabled.
- It resides on a physically write-protected diskette.
- It is located on a network in a directory to which the system administrator has assigned read-only rights to you.

Read Zone - Area in front of the scanner's window in which the bar code should appear for scanning. This zone consists of the scan window and the raster width (if used).

Reflectance - The amount of light returned from an illuminated surface.

Relay - Relays are simply electrical switches that are typically used to control external diverts, alarms, etc. Relay types available are FORM A and FORM C. FORM C type relays have both normally open and normally closed contacts available while FORM A type relays have only normally open contacts available.

Relay Output Duration - This is the time (in seconds) after the relay is energized that it should be turned off.

Relay Output Delay - The time lapse between an event and the energizing of the relay.

Request To Send (RTS) - An RS232 modem interface signal which indicates that the DTE has data to transmit.

Resolution - The narrowest element dimension which can be distinguished by a particular reading device or printed with a particular device or method.

Response Time - The elapsed time between the generation of the last character of a message at a terminal and the receipt of the first character of the reply. It includes terminal delay and network delay.

ROM - The acronym for read-only memory. The computer contains programs essential to its operation in ROM. A ROM chip retains its contents even after you turn off your computer.

RPM - The abbreviation for revolutions per minute.

RS232 - Interface between data terminal equipment and data communication equipment employing serial binary data interchange.

RS422 - The Electronic Industries Association standard that specifies the electrical characteristics of balanced voltage digital interface circuits.

RS485 - The Electronic Industries Association standard that specifies the electrical characters of generators and receivers for use in balanced digital multipoint systems.

Scan - A single pass of the laser beam over the code or a portion of the code. The search for a bar code symbol that is to be optically recognized.

Scan Area - The area intended to contain a symbol.

Scan Window - The usable length of the scanning beam that may detect the bar codes. The scan window is perpendicular to the depth of field.

Scanner - An electronic device that optically converts printed information into electrical signals. These signals are sent to the decoder logic.

Scanner Orientation - Relationship of the scan head with reference to the bar code's location on products. The scan head must be set up to insure that all code bars and spaces are bisected at the same time. Typically, either side read or top read is used for picket fence or ladder code orientations.

SCSI - The acronym for small computer system interface. An I/O but interface with faster data transmission rates than standard ports. The user can connect up to seven devices to one SCSI interface.

Self-checking - A bar code or symbol using a checking algorithm which can be independently applied to each character to guard against undetected errors.

Serial Port - An I/O port used most often to connect a modem or a mouse to your computer, identifiable by its 9-pin connector.

Serial Transmission - The most common transmission mode; serial, information bits are sent sequentially on a single data channel.

SERIAL ASYNCHRONOUS TRANSMISSION OF DATA: The 6000 Decoder Logic is capable of communicating the following communications interfaces: RS232, RS422, RS485, 20mA current loop and RS423.

When data is transmitted serially from a communications port, the information is transferred between the two devices one data bit at a time. The data flow can follow one of three different communications modes: simplex, half duplex, or full duplex.
Each character of data within the data flow is transported in a binary bit frame called the asynchronous data frame.

The start bit begins each frame. A low voltage signal on the data communications line marks the beginning of the start bit, at which point the receiving device begins looking for binary zeros and ones (0's and 1's).
The following five to eight data bits (the number depends on the format used) comprise the binary character.
For error detection, an optional parity bit can define whether the total number of zeros or ones was even or odd. There are five different parity selections as shown below:

ODD - last data bit is a logical 0 if the total number of logical 1's in the first seven data bits is odd.

EVEN - last data bit is a logical 0 if the total number of logical 1's in the first seven data bits is even.

MARK - last data bit is always a logical 1 (i.e.: high/mark).

SPACE - last data bit is always a logical 0 (i.e.: low/space).

OFF (NONE) - last data bit is not present.

The method used to catch errors by using parity bits is as follows: When the transmitter frames a character, it tallies the number of 0's and 1's within the frame and attaches a parity bit. (The parity bit varies according to whether the total is even or odd.) The receiving end then counts the 0's and 1's and compares the total to the odd or even recorded by the parity bit. If a discrepancy is noticed by the receiving end, it can flag the error and request a retransmission of the data.

A stop bit is used to signal the end of the character. (Stop bits are typically one or two bits in length. The slower the transmission speed, the more stop bits required for recognition of the end of the data frame.)

In addition to the direction of data flow and the data framing, there are other considerations to insure uniform transmissions. Certain operating parameters must be followed to prevent the loss of valuable data.

The first consideration is the speed of transmission, known as baud rate. Serial data transmission is measured in bits per second (BPS). The baud rate selections available for the 6000 are: 110, 300, 1200, 2400, 4800, 9600 and 19200. To enable two devices to interact, they must both be transmitting/receiving data at the same baud rate. If it is not possible to do this, there must be a buffer (typically additional storage memory) that accommodates the differences in communications speed.

Many serial communications links also use a flow control system to handle data transmission in addition to memory buffers.

X-ON/X-OFF Protocol
A common type of flow control is the X-ON/X-OFF protocol. When a receive buffer nears its memory capacity, the receiving device sends an ASCII X-OFF signal to the transmitting device, telling it to stop sending data. When the memory buffer has enough space to handle more data, the X-ON signal is sent to the transmitting device, telling it to start sending data again.

ACK/NAK Protocol
Another common protocol is ACK/NAK protocol. When the device transmits a message to the host, the host responds with either an ACK (06H) or a NAK (15H). If the host transmits an ACK to the device, the device deletes its transmit message and the communication sequence is complete. If the host transmits a NAK, the device will retransmit. The device resends data a maximum of three times. Optionally this may be changed to 1, 2, 3, or infinite retransmits by the user. If the device receives a fourth NAK, it will delete the data in its transmit buffer and display "MAX REXMITS". A transmitting device ignores ACK and NAK characters received during data transmission. If, for example, a device receives a NAK during a data transmission, it will not resend the data at the completion of the transmission.

The device also has a retransmit timer. This timer is activated each time the device transmits data to the host. If the timer runs for two seconds (this is also changeable) and the device does not receive an ACK or NAK from the host, a timeout occurs and the device retransmits its data. Each time the device retransmits because of a timeout, it treats the timeout the same as receiving a NAK from the host computer. If the device does not receive an ACK before the end of the fourth timeout, it will delete the data in its transmit buffer and display "MAX REXMITS". The device deletes data in its transmit buffer and displays the error message when any combination of four timeouts and NAKs from the host occurs.

When the device receives a message from the host, it calculates the BCC for the message and compares the calculated BCC to the received BCC. If the two values match, the device transmits an ACK, ending the communication. If the values do not match, the device transmits a NAK to the host and waits for the host to retransmit the message. The host, like the device, should retransmit a maximum of three times.

The sequence number starts at zero (30H) and is incremented each time a device transmits a new message. When the sequence number reaches nine (39H), it wraps around to one (31H). If the sequence number skips a number, the receiving device knows that a message was lost. If the same sequence number is received on two sequential messages, the second message is responded to with an ACK or NAK (as appropriate) and ignored.

Shielding- Protective covering that eliminates electromagnetic and radio frequency interference.

Side Read - The scanner is mounted to read the side of a box as it passes by the head.

Signal - An impulse or fluctuating electrical quantity (i.e.: a voltage or current) the variations of which represent changes in information.

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

Space - The lighter elements of a bar code symbol formed by the background between bars.

Specular Reflections - A condition when the laser light is reflected back from the code's surface at an angle equal, or nearly equal, to the angle of incidence of the laser light. This condition makes it difficult for the scan head to detect the differences in light variation caused by the code's bars and spaces.

Stacked Codes - 16K and Code 49 are examples where a long symbol is broken into sections and "stacked" one upon another similar to sentences in a paragraph. Extremely compact codes.

Start Bit - In asynchronous transmission, the first bit or element in each character, normally a space, that prepares the receiving equipment for the reception and registration of the character.

Stop Bit - The last bit in an asynchronous transmission, used to indicate the end of a character, normally a mark condition, that serves to return the line to its idle or rest state.

STX (Start of Text) - A transmission control character that precedes a text and is used to terminate a heading. (^B)

Symbol - A combination of characters including start/stop and checksum characters, as required, that form a complete scannable bar code.

Symbologies
Code 39 - A bar code with a full alphanumeric character set, a unique start and stop character, and three other characters. The name is derived from its code structure, which is 3 wide elements out of a total of 9 elements. The nine elements consist of five bars and four spaces.
Code 128 - A bar code symbology capable of encoding the full ASCII 128 character set. It encodes these characters using fewer code elements per character resulting in a more compact code. It features a unique start and stop character for bidirectional and variable length decoding, both bar and space character parity for character integrity, a check character for symbol integrity, a function character for symbol linking, and spare function characters for unique application definition and/or future expansion.
Interleaved 2 of 5 (I 2of5) - A bar code with a numeric character set with different start and stop characters. The name is derived from the method used to encode two characters. In the symbol, two characters are paired together using bars to represent the first character and the spaces to represent the second. This interleaved structure allows information to be encoded in both the bars and the spaces. A start character, bar and space arrangement, at one end, and a different stop character bar and space arrangement at the other end, provide for bidirectional decoding of this symbol.

Syntax - The rules that dictate how you must type a command or instruction so that the computer will understand it.

System.ini **file** - When you start Windows, it consults the system.ini file to determine a variety of options for the Windows operating environment. Among other things, the system.ini file records which video, mouse, and keyboard drivers are installed for Windows. Running the Control Panel or Windows Setup program may change options in the system.ini file.

Thermal Printing - Thermal printers use heated print heads and special heat activated paper. There are two types of thermal printers. One uses a method similar to the dot matrix printer where an array of heated dots move along the paper and form the character or bar code. The other method uses a heated bar and the paper moves across the bar. Another type of thermal printer is called a Thermal Transfer printer. The main difference between this type of printer and a thermal printer is the use of heat sensitive ribbons as opposed to heat sensitive paper. This type of printing is permanent on label stock. **Common Problems with thermal printing:** Since the paper used is heat activated the labels will deteriorate over time in a warm environment. Infrared scanners cannot detect the bar codes and consequently a visible red light laser must be used to scan these codes. **Benefits of thermal printing:** Thermal printers are quiet and inexpensive.

Thermal Transfer - A printing system like thermal except a one-time ribbon is used and common paper is used as a substrate. Eliminates the problems of fading or changing color inherent in thermal printing.

Tilt - Rotation around the Z axis. Used to describe the position of the bar code with respect to the laser scan line.

Trigger - (Otherwise known as cart) - A signal, typically provided by a photoeye or proximity switch, that informs the scan head of the presence of an object within its reading zone.

UCC (Uniform Code Council) - The organization which administers the UPC and other retail standards.

Undersquare - Used to describe bar codes that are longer (from the first to last bar) than they are high (from the top to bottom of the bars).

UPS - The abbreviation for uninterruptible power supply. A battery-powered unit that automatically supplies power to your computer in the event of an electrical failure.

Utility - A program used to manage system resources including memory, disk drives, and printers.

Vane Raster - Decreases the amount of scans possible due to a smaller percentage of scans bisecting the code.

Verifier - A device that makes measurements of the bars, spaces, quiet zones and optical characteristics of a symbol to determine if the symbol meets the requirements of a specification or standard.

Vibrating Vane - A variable raster that can have an unlimited number of raster lines. It covers a larger area and is adjustable.

Wand Scanner - A hand-held contact laser scanner that an operator guides across the bar code.

Wedge - A device that plugs in between a keyboard and a terminal. It allows data to be entered either by keyboard or by various types of scanners.

Wide Bar (WB)/Wide Space (WS) - Widest code element, bar or space, in the bar code symbol.

Wide to Narrow Ratio - Dividing the size of the wide elements by the size of the narrow elements of a bar code yields the bar and space ratios. Bar and space ratios can differ. **NOTE:** If the narrow bar and narrow space are equal and the wide bar and wide space are equal then you calculate only one ratio.

Write-protected - Read-only files are said to be *write-protected*. You can write-protect a 3.5-inch diskette by sliding its write-protect tab to the open position and a 5.25-inch diskette by placing an adhesive label over its write-protect notch.

"X" Dimension - The dimension of the narrowest bar and narrowest space in a bar code.

XON - A control character sent by the receiving device to signal the transmitting device to begin sending data.

XOFF - A control character sent by the receiving device to signal the transmitting device to stop sending data.

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