CiMAX 75xxA/76xx Scanner Technical Reference Manual

Rev F, February 2002

EM-63165-1F

CiMAX 75xxA/76xx Scanner
Technical Reference Manual
Rev F, February 2002

Factory Authorized Training

SICK Auto Ident, Inc. provides comprehensive product training. Contact the SICK Auto Ident, Inc. Training Coordinator at 1-888-264-4641 for in-house and on-site class schedules and rates.

Getting Assistance

If you have questions or comments, please contact SICK Auto Ident, Inc. at 1-888-264-4641. For additional assistance, contact:

- Order Processing (Option #1)
- Technical Support (Option #2)
- Field Service Contracts (Option #3)
- Customer Service Fax (781) 828-3150

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5 Shawmut Road
Canton, MA 02021 USA
(781) 302-2500
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Printed in the United States of America.

Warning!

WARNING! THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THIS USER MANUAL, MAY CAUSE INTERFERENCE TO RADIO COMMUNICATIONS. IT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR CLASS A COMPUTING DEVICES PURSUANT TO SUBPART J OF PART 15 OF FCC RULES, WHICH ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST SUCH INTERFERENCE WHEN OPERATED IN A COMMERCIAL ENVIRONMENT. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE INTERFERENCE, IN WHICH CASE THE USER, AT HIS OWN EXPENSE, MUST TAKE NECESSARY MEASURES TO CORRECT THE INTERFERENCE.

THIS PRODUCT DOES NOT EXCEED THE CLASS A LIMITS FOR RADIO NOISE EMISSIONS FROM DIGITAL APPARATUS SET FORTH IN THE RADIO INTERFERENCE REGULATIONS OF THE CANADIAN DEPARTMENT OF COMMUNICATIONS. (LE PRÉSENT APPAREIL NUMÉRIQUE N'ÉMET PAS DE BRUITS RADIOÉLECTRIQUES DÉPASSANT LES LIMITES APPLICABLES AUX APPAREILS NUMÉRIQUES DE LA CLASS A PRESCRITES DANS LE RÈGLEMENT SUR LE BROUILLAGE RADIOÉLECTRIQUE ÉDICTÉ PAR LE MINISTÈRE DES COMMUNICATIONS DU CANADA.)

Caution - Use of controls or adjustments or performance of procedures other than those specified in this manual may result in hazardous exposure.

Attention - l'utilisation de procédures de contrôle, de reglage ou d'utilisation autres que celles specifiées dans ce manuel peut entrainer une exposition dangereuse à la lumière du laser.

Peligro - El uso de controles, ajustes o funcionamiento diferentes a los especificados en este manual pueden resultar en exposición a el rayo laser.

Waarschuwing - Afwijkend gedrag op de in net handboek beschreven procedure kan schok - en/of bestralingsgevaar teweegbrengen.

Vorsicht: Veränderungen der Justierungen oder Einstellungen, sowie sonstige Veränderungen die nicht in diesem Manual beschrieben sind, können zu gefährlichen Ausstrahlungen führen.

Varoitus - Kaikki muut huolto ja säätötoimenpiteet, joita ei ole tässa ohjeessa määritelty tai maimittu, voivat aiheuttaa vaaratilanteen.

Attenzione - L'uso di controlli o tarature o l'asecuzione di procedure diverse da quelle specificate in questo manuale possono causare pericolose esposizioni.

No operator serviceable part/controls in scanner. Refer service to factory authorized dealer.

Ne pas ouvrir - toute réparation effectuée par une personne non qualifiée peut entrainer la violation des règles de securité relatives au laser.

Partes y/o controles del scanner que no se pueden manipular por el usuario. Contactar a el distribuidor autorizado. Reparable sólo en fábrica.

Gelieve neit te openen - eigen veiligheid kan hierdoor in gevaar gebracht worden.

Versuchen Sie nich selbst irgendwelche Reparaturen oder Einstellungen im Innern des Gerätes vorzunehmen. Da es innen kane vom Benutzer zu bedienenden Teile gibt, gefährdet an öffnen des Gehäuses nur Ihre Sicherheit. Raparaturen nur durch eine autorisierte Fachwerkstatt.

Lukijan saa avata ja huoltaa vain maahantuojan valtuuttama korjaaja.

L'utente finale non può effettuare interventi di riparazione sugli scanner. Rivolgersi esclusivamente al rivenditori autorizzati. I servizi di riparazione del produttore sono in USA.

Caution - Danger of explosion if lithium battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of the used batteries according to the manufacturer's instructions.

Attention danger d'explosion si pile lithium mal branchée - remplacer par pièce d'origine contrôlée - suivre les instructions du fabricant pour le recyclage des piles lithium usagées.

Peligro - Peligro de explosión si la batería de litio no se coloca correctamente. Reemplazaría únicamente con el mismo tipo o equivalente recomendado por el fabricante. Utilizar las baterías según las instrucciones del fabricante.

Waarschuwing - Ontploffingsgevarr bij foutieve vervanging batterij. Omwisseling uitsluitend door analoog en door de fabrikant goedgekeurd type. Teruggave batterijen volgens instructies de fabrikant.

Vorsicht- Explosionsgefahr bei fehlerhaftem Austausch der Lithiumbatterie. Eventuellen Austausch nur mit gleichem oder kompatiblen, vom Hersteller empfohlenen Typ. Gebrauchte Batterien nur bei entsprechenden Sammelstellen entsorgen.

Varoitus - Räjähdysvaara jos litiumparisto asennataan väärin. Vaihda vain valmistajan suosittelemaan samaan tai vastaavaan paristotyyppiin. Hävitä paristo valmistajan ohjeiden mukaisesti.

Attenzione - Può esservi pericolo di esplosioni se le batterie al litio vengono sostituite in modo non corretto. Tali batterie devono essere sostituite unicamente con lo stesso tipo di batterie raccomandato dal produttore oppure con batterie di tipo equivalente. Le batterie usate devono essere smaltite seguendo le modalità raccomandate dal produttore.

Contents

PREFACE *Welcome*

Congratulations on your purchase of the CiMAX 75xxA/76xx Scanner. Our goal at SICK Auto Ident, Inc. is to provide you with a reader/control system of the highest quality that is both powerful and easy to use. We are also committed to providing you with excellent technical and customer support services necessary to meet your business needs. We're glad to have you as a customer and we're sure you'll be pleased with your purchase.

The CiMAX 75xxA/76xx Scanner uses advanced laser technology to locate and read 1-D symbologies, linear barcodes and to automatically decode in any orientation. It provides high-speed accuracy reading of coded information to meet your real-time requirements.

How To Use This Manual

The purpose of this manual is to ensure that your CiMAX 75xxA/76xx Scanner system becomes operational quickly and reliably. This manual covers installation, basic operations, including detailed step-by-step instructions to operate the CiMAX 75xxA/76xx Scanner system, and supporting information.

Guide Conventions

The following typographical conventions are used throughout this manual.

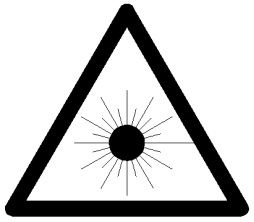
- Items emphasizing important information are *italicized* or **bolded**.
- Keyboard entries are indicated as an *italic.*
- Menu selections, menu items, tab selections, and entries in screen image windows are indicated as such: File, Data Matrix, Options.

Note: Provides useful information about the current topic.

Caution: Provides information for the prevention of damage to the product.

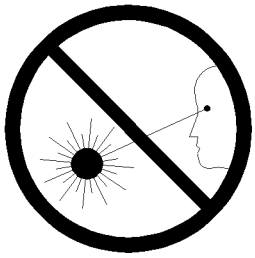
WARNING! PROVIDES INFORMATION FOR THE PREVENTION OF PERSONAL INJURY OR DAMAGE TO THE PRODUCT.

Warning Symbols

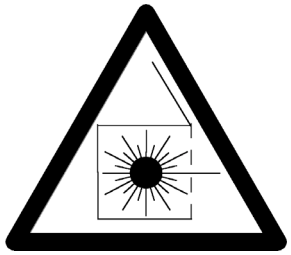


2

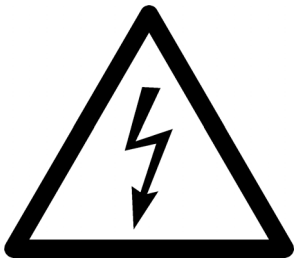
Class 2 Laser Product
Laser Classe 2
Klasse 2 laserscanner
Laser Klasse 2 Produkt
Producto Láser Clase 2
Luokan 2 laserlaite
Apparecchiatura laser di classe 2



Laser Radiation - Do not stare into Beam.
Rayonnement Laser - Ne pas s'exposer.
Radiación Láser - No mirar fijamente a el rayo.
Laser straling - Niet in straal kijken.
Laserstrahlung - Nicht in den Strahl blicken, auch nicht mit optischen Instrumenten.
Lasersäde - Alä katso valolähteeseen.
Radiazioni laser - Non rivolgere lo sguardo direttamente al raggio laser.



Caution - Laser radiation when open and interlock defeated. AVOID EXPOSURE TO BEAM.
Attention - En cas d'ouverture, risque de rayonnement laser. NE PAS S'EXPOSER.
Peligro - Radiación Láser al abrir. EVITAR LA EXPOSICIÓN DEL RAYO.
Waarschuwing - Bestraling mogelijk bij geopend en ontgrendeld toestel. BLOOTSTELLING AAN LASERSTRAAL VERMIJDEN!
Vorsicht! Laserstrahlung wenn Abdeckung geöffnet oder Sicherheitsschalter überbrückt. NICHT IN DEN STRAHL BLICKEN.
Varoitus - Lasersäteilyä saattaa esiintyä avattaessa kotelo ja ohitettaassa suojakytkimet. VÄLTÄ ALTISTUMISTA LASERSÄTEILYYN.
Attenzione - Radiazioni laser in caso di apparecchiatura aperta e dispositivo di protezione difettoso. EVITARE OGNI ESPOSIZIONE AL RAGGIO LASER.



Warning - Shock hazard
Danger - Haute tension
Atención - Peligro de descarge
Waarschuwing - Schokgevaar
Warnung! Vorsicht Hochspannung
Sähköiskun vaara
Attenzione - Pericolo di scossa elettrica

Caution
Attention
Peligro
Waarschuwing
Vorsicht
Varoitus
Attenzione

Warning Labels

This scanner is labeled in accordance with Federal regulations. If any label is removed, lost, or becomes illegible, order a replacement from SICK Auto Ident, Inc. Figure 1, Figure 2, and Figure 3 show the labels and their locations on the scanner.

FIGURE 1. Warning Label Location

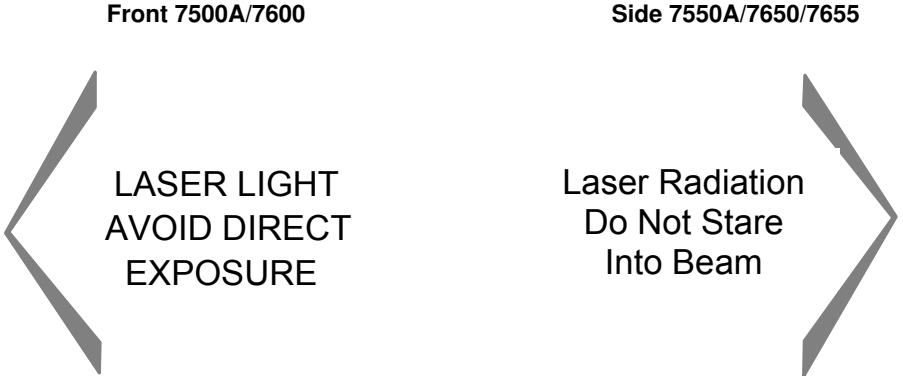


FIGURE 2. Warning Label Location—Rear

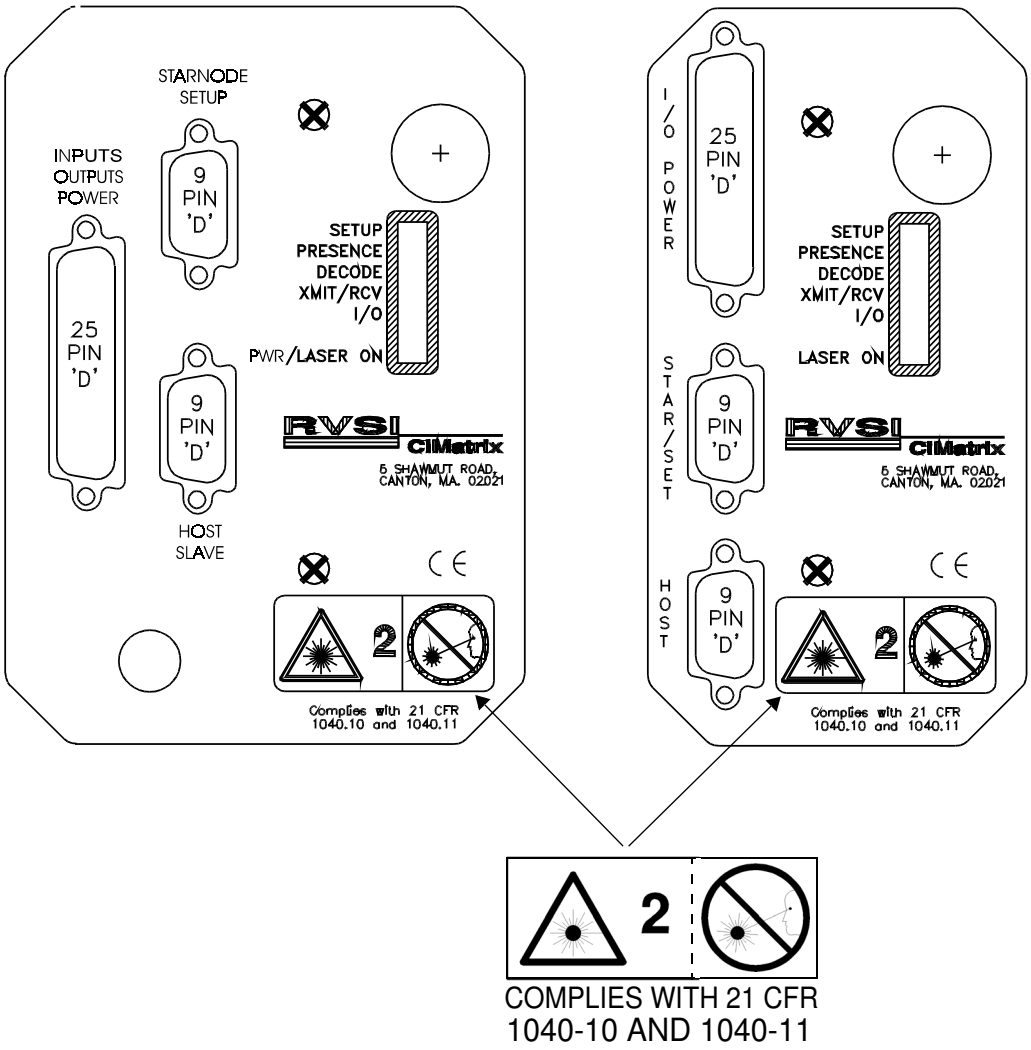
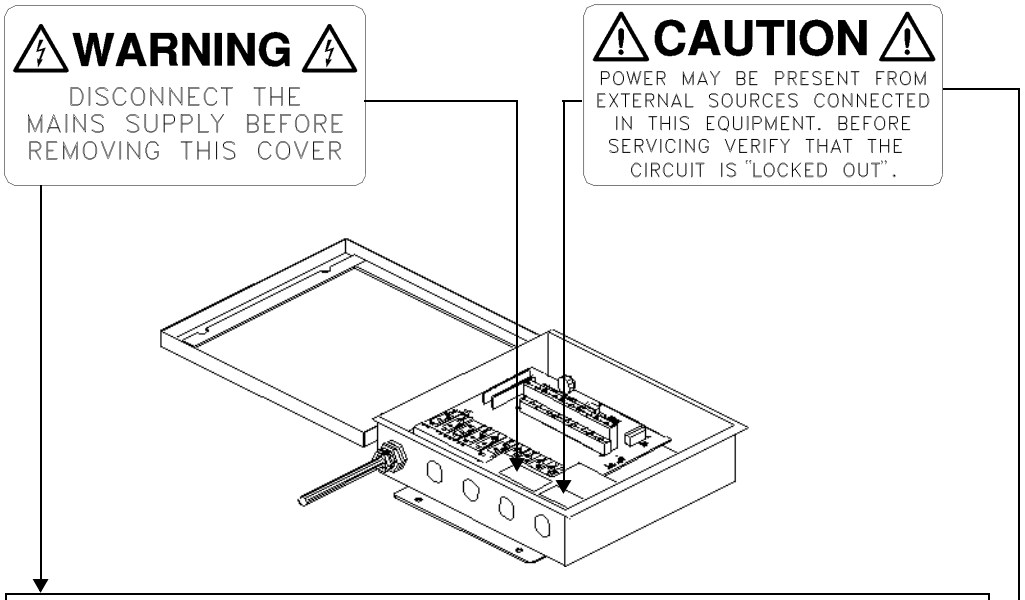


FIGURE 3. Warning Labels—Inside Interface Unit



Attention - déconnecter l'alimentation principale avant d'ouvrir le couvercle.

Atención - Desconectar la alimentación de corriente antes de retirar esta cubierta.

Waarschuwing - Netspanning uitschakelen vooraleer de behuizing te openen.

Warnung! Vor dem Öffnen des Gehäuses Netestecker ziehen.

Varoitus - Kytke jännite pois ennen tämän kannen poistamista.

Attenzione - Scollegare le principale alimentazione prima de rimiovere questo coperchio.

Attention - une alimentation peut être présente en provenance d'une source externe connectée à cet equipement. Avant intervention, verifier que l'alimentation est débranchée.

Peligro - Equipo con tensión. Verificar que esté desconectado antes de manipularlo.

Waarschuwing - Mogelijke stroomtoevoer teweeggebracht door externe aansluiting(en). Uitschakeling netspanning nakijken vóór ingebruikname.

Vorsicht! Spannung kann von extern angeschlossenen Geräten zu diesem Gerät übertragen werden. Vor dem Service auf Spannungsfreiheit prüfen.

Varoitus - Laitteeseen saattaa tulla jännite ulkopuolisista lähteistä. Ennen huoltoa tarkista, että laite on kytketty irti muista laitteista.

Attenzione - In questa apparecchiatura può esservi corrente proveniente dall'esterno. Prima di effettuare qualsiasi riparazione verificare che i circuiti siano prima stati esclusi.

CDRH Requirements

The following CDRH Requirements must be met.

Levels of Accessible Laser Radiation
670 nm, 2.0 mw peak, 0.21 mw average, 36 msec pulse, .10 micro sec. rise/fall
3.3 ms rate, 0.55 micro joule pulse radiation.

Getting Assistance

We hope this manual will be helpful. If you have questions or comments, please don't hesitate to contact SICK Auto Ident, Inc. For additional assistance, please refer to the following information.

SICK Auto Ident, Inc. Customer Service Policy

We care about your productivity and will go to great lengths to ensure that you have maximum up-time. Whether you call for a site survey, place an order, or request technical support, you are assured of prompt, courteous, and personalized attention.

Our state-of-the-art accounting and computer management systems permit us to instantly access customer order information. A trained staff member is available to assist you with:

- Order entry assistance
- Product information and application answers
- Product delivery status
- Technical support
- One-on-one problem resolution

Contact your sales representative. Or, to reach SICK Auto Ident, Inc. Customer Service directly, call 1-888-264-4641. The fax number is (781) 828-3150.

Return-to-Factory Instructions

Should your CiMAX 75xxA/76xx Scanner system fail to operate correctly, verify the following:

- Confirm that it has been properly configured with the proper setup parameters, as ordered.
- Inspect and verify all cable connections.

If a problem persists, contact your sales representative or SICK Auto Ident, Inc. Customer Service by calling the numbers provided in "SICK Auto Ident, Inc. Customer Service Policy".

Please call SICK Auto Ident, Inc. at 1-888-264-4641 to return a CiMAX 75xxA/76xx Scanner for repair. Request the Return Authorization (R.A.) Department. Please be prepared to furnish the following information:

- Company name, address, and telephone number
- Contact name

- Return address (if different) and other pertinent shipping information
- Catalog number and serial number
- Description of the problem
- Purchase order and other invoicing information relative to the repair

SICK Auto Ident, Inc. will provide you an R.A. number. Please include this R.A. number on the shipping label and any correspondence concerning the return. Please include several sample barcode labels, a listing of setup parameters, and a detailed description of the problem. Repair or upgrade estimates shall be furnished upon request.

Upon receiving a defective product with a valid Return Authorization number, SICK Auto Ident, Inc. will attempt to return the repaired or replacement equipment on a best-effort basis within five working days. You may have a different support plan specifying other terms.

For critical applications, SICK Auto Ident, Inc. recommends you keep a spare scanner on hand for immediate replacement. Alternatively, you can select a support plan, which specifies a quick response time or a scanner swap.

SICK Auto Ident, Inc. shall pay surface transportation charges for the return shipment if the address is within the 48 contiguous states or the District of Columbia. Customers outside this area shall pay shipping costs, customs clearance, and any other related charges.

Your scanner will be returned after inspection and repair. However, upon return, the scanner may require re-configuration to the setup parameter values you were using.

Product Warranty

SICK Auto Ident, Inc. guarantees that its products are free from defects in materials or workmanship (under proper and normal use and maintenance) in accordance with SICK Auto Ident, Inc.' operating instructions for a period of one year from the shipping date.

This warranty shall be null and void if equipment is modified, if it is improperly installed or used, if it is damaged by accident or neglect, or if components are improperly installed or replaced by the buyer.

Under no circumstances shall SICK Auto Ident, Inc. be liable to the buyer or any other party for lost profits, diminution of good will, or other special or consequential damages whatsoever.

The warranty appearing here supersedes all other warranties, express or implied, statutory or otherwise, including any implied warranty of merchantability or fitness for a particular purpose.

CHAPTER 1

Overview & Maintenance

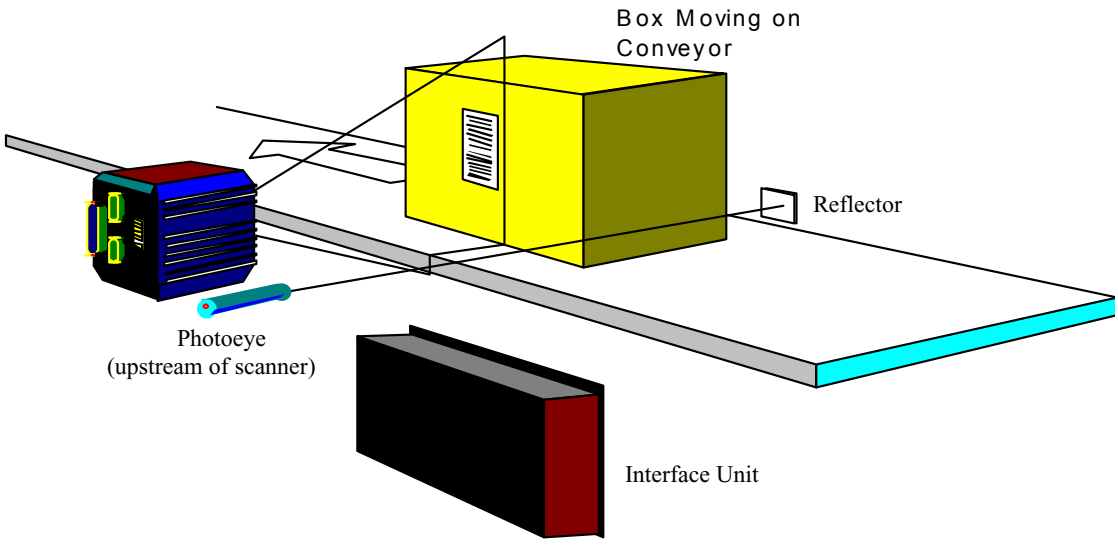
This chapter provides you with an overview of a typical CiMAX 75xxA/76xx scanner application product specifications.

Overview

Typical Physical Setup

CiMAX 75xxA/76xx scanners may be used with other equipment including photoeyes, tachometer, Standard Interface Unit, and a Hex Interface Unit. Figure 1–1 shows the CiMAX 7500A scanner in a typical scan tunnel configuration with accessory components. However, your application may not have the same requirements. Specific cable connections, pinouts and wiring diagrams are provided in Chapter 3, “Controls, Connectors, & Indicators”.

FIGURE 1–1. Typical Configuration—CiMAX 7500A/7600



CiMAX 7500A/7600 Laser Scanner

The 75xxA/76xx scanners are intelligent fixed-position laser scanners designed for high reading rates, local or network processing and control and user C programmability. Optionally, it can be configured with SICK Auto Ident, Inc. CIX (Code Information eXtraction) technology to permit barcodes rotated as much as 60° from the scan beam to be read. A network option (Ethernet, SDS, or DeviceNet) is also available with 75xxA scanners.

The dual processor architecture uses an independent Digital Signal Processor (DSP), to translate barcode data for the 32-bit main processor. The CiMAX 75xxA/76xx scanners can be configured with up to 1MB of non-volatile program and data memory.

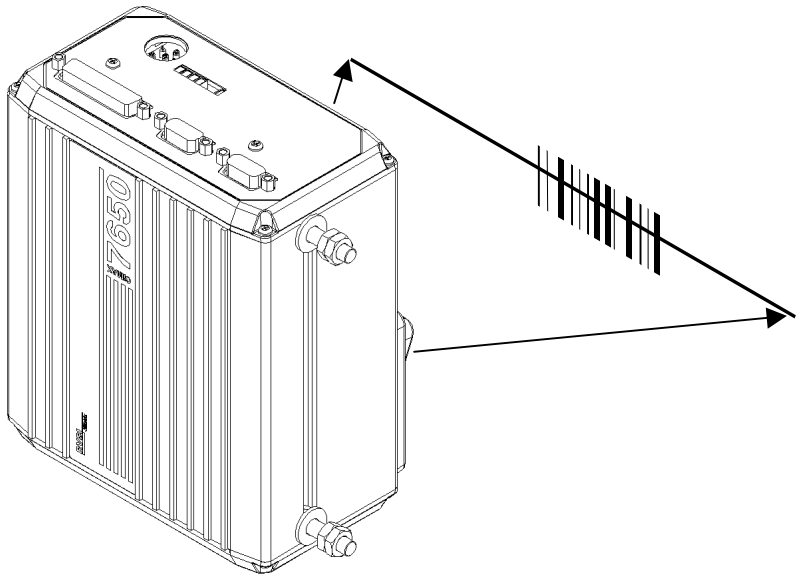
The CiMAX 75xxA/76xx scanners have eight inputs and eight outputs for use in box presence and height detection, timing, diverter control, and alarming. The Standard Interface Unit provides power for one scanner; or two, when operated in Master/Slave mode. The Basic Interface Unit only provides power for one CiMAX 76xx, or one CiMAX 75xxA without the Ethernet option installed.

The CiMAX 7600 scanner is operationally identical to the 7500A except that the network option is not available. The CiMAX 7600 case is an inch narrower (3.32" vs. 4.33") than that of the CiMAX 7500A, so the CiMAX 7600 can be mounted in more physically restricted spaces.

CiMAX 7550A/7650 Laser Scanner

The CiMAX 7550A/7650 scanners are electrically and operationally identical to the CiMAX 7500A/7600. The housing of the CiMAX 7550A/7650 is physically longer than the CiMAX 7500A to accommodate a 90° deflection mirror, which permits the laser beam to output from the side instead of the front of the case, as shown in Figure 1–2.

FIGURE 1–2. CiMAX 7650 Scan Sweep

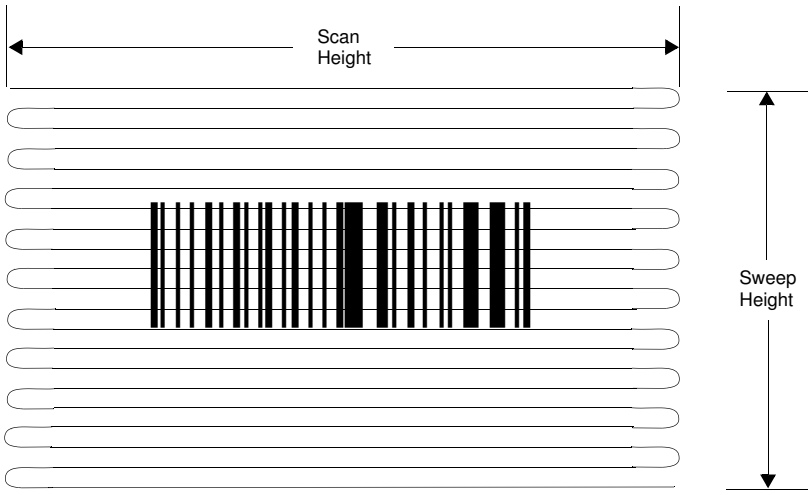


This design allows for a flatter installation. For example, it can be installed under a conveyor to scan labels on the bottom of a box. It is sometimes used to scan picket-fence orientation barcodes or the bottom of boxes as they pass over a break in the conveyor. The cable connectors may be positioned to face up or down, and the mounting screws are located on the side of the unit.

CiMAX 7555A/7655 Laser Scanner

The CiMAX 7555A/7655 emits a horizontal beam that is swept back and forth in a sweep raster scanning pattern as shown in Figure 1–3.

FIGURE 1–3. Sweep Raster Scan Pattern of the CiMAX 7555A/7655



The CiMAX 7555A/7655 sweep raster scanner provides a moving, visible red laser beam that sweeps repeatedly across a barcode in a regular sinusoidal wave pattern. The CiMAX 7555A/7655 has the same housing as the CiMAX 7550A/7650, but the laser beam is deflected in a sweep raster pattern for increased coverage.

Refer to Appendix C, “Dimension Diagrams” for mechanical drawings of the CiMAX 7500A, the CiMAX 7550A, the CiMAX 7600, and the CiMAX 7650/7655.

Except where specifically noted, all information in this manual applies to the CiMAX 7500A/7550A/7555A/7600/7650/7655 Scanners.

Keysheet

The Keysheet specifies the details of your scanner setup. It is based on information you provided to SICK Auto Ident, Inc. about your scanner application. The keysheet has been carefully developed from the results of a questionnaire you filled out about your conveyor system.

The information in the keysheet customizes the CiMAX 75xxA/76xx scanner hardware and software setup for your site. Do not deviate from the keysheet or otherwise change the configuration without consulting SICK Auto Ident, Inc.

Software Updates

Software updates from SICK Auto Ident, Inc. can include changes and improvements in the following:

- Operating System

- CIX Technology
- Network
- File Memory
- C code
- Decoded Symbologies

Software updates will be provided to you by SICK Auto Ident, Inc. as your application requires. These updates can be uploaded into your scanner from your PC, with the software available from SICK Auto Ident, Inc. on a diskette. The scanner uses flash memory to allow complete re-programming in the field.

Specifications

Scanner

Configuration

Depth of Field (DOF)/Diodes

- Fixed focus: 4”, 8”, 14”, 18”, 26.5”, 28”, 36”

Memory

- 256K (approx. 100K for user C programs and data)
- 1M (approx. 800K for user C programs and data)

Network—75xxA only

- Without
- Ethernet 10 base 2
- Ethernet 10 base T
- SDS
- DeviceNet

Physical

For mechanical drawings with dimensions, refer to Appendix C, “Dimension Diagrams”.

CiMAX 7500A

- 5.71 x 4.33 x 4.55 inches (145 x 110 x 115 mm)
- 3.5 pounds (1.6 kilograms)

CiMAX 7550A/7555A

- 5.70 x 4.78 x 6.85 inches (145 x 121 x 174 mm)
- 4.0 pounds (1.8 kilograms)

CiMAX 7600

- 5.71 x 3.32 x 4.55 inches (145 x 85 x 115 mm)
- 3.0 pounds (1.4 kilograms)

CiMAX 7650/7655

- 5.71 x 3.32 x 6.08 inches (145 x 85 x 155 mm)
- 3.5 pounds (1.6 kilograms)

Method of Illumination

Laser diodes, wavelength 670 nanometers (visible red light)

Scan Rates

- Application dependent—Refer to your keysheet
- 400-1200 scans per second @ 60^{o} scan angle

Power

- *Input*
  - Power required from external Basic Interface Unit. Regulated +12 VDC, 1.2A max.
  - Power required from Standard/Hex Interface Unit. +12 VDC, 1.0A, +5 VDC, 250 mA., max.

Construction

Single integrated package consisting of aluminum enclosure fully gasketed and mounted on 1/2-inch (12.7 mm) aluminum base plate.

Environmental

- NEMA 12 (IP 65) dust-tight and drip-proof
- *Operating Temperature*—32° to 122° F. (0^{o} to 50^{o} C)
- *Humidity*—5% to 95% non-condensing

LED Status Indicators

Six LEDs on a single display monitor operations and communications

Communications

Four independent communications ports

- 1 asynchronous serial Host port (RS-232 or RS-422)
- 1 asynchronous serial Terminal port (RS-232)
- 1 RS-485 LAN port with Starnode protocol
- 1 Network port (optional) - *CiMAX* 75xxA *only*

Inputs

- Fifteen total, active low when <1.0 VDC
  - Maximum input 30 VDC intermittent, 27 VDC continuous
- Eight standard inputs
  - Normal default input assignments
    - Two presence (Inzone, Outzone)
    - One tachometer—0.2 inches per pulse minimum resolution at up to 1000 pulses per second, max
    - Up to five height-sensing inputs
  - Inputs not used for presence, tachometer and height-sensing are available for general purpose use under user C program control
- Seven optional inputs—For use only for height-sensing with Programmable Interface Controller

Outputs

- Eight total, open collector solid state—30 VDC at 150 mA, max
- Normal default output assignments
  - Output 1—No Read
  - Output 2—Match
  - Output 3—No Match

Basic Interface Unit

Physical

Refer to Appendix C, “Dimension Diagrams” for more information.

- 3.64 H x 4.13 W x 1.39 D inches (93 x 105 x 35 mm)
- 1.6 lbs (0.73 kg) with attached cable

- Scanner-interface cable length—6.5 feet (2 meters)
- Power cord length—15 feet (4.6 meters)

AC Power

115/230 ±10% VAC @ 0.4/0.2A, 50/60 Hz.

Inputs

Basic—One solid state, active low when <1.0 VDC, 30 VDC max, 27 VDC continuous
(This input is an extension of scanner input 1, default INZONE PRESENCE signal)

Outputs

- *Basic*—One open collector solid state, 30 VDC at 150 mA, max. (This output is an extension of scanner output 1, default NO READ signal)
- +12 VDC and ground to operate external photoeye
- RS-232 serial communications link to host computer

Standard Interface Unit

Physical

Refer to Appendix C, “Dimension Diagrams” for more information.

- 13.25 H x 13.00 W x 2.98 D inches (337 x 330 x 76 mm)
- 13.5 lbs (6.1 kg) with attached cable
- Scanner-interface cable length—6.5 feet (2 meters)

AC Power

115/230 ±10% VAC @ 0.8/0.4A, 50/60 Hz.

Inputs

Standard—Eight solid state, active low when <1.0 VDC, 30 VDC max, 27 VDC continuous
(These inputs are extensions of the eight solid state scanner inputs)

Outputs

Standard—Eight open collector solid state, 30 VDC at 150 mA, max. (These outputs are extensions of the eight solid-state scanner outputs)

Optional Solid-State Input/Output Modules

Optically isolated Opto–22 style modules may be installed as inputs or outputs. They are controlled by standard input/output signals.

- Input Modules
  - *Type*—AC Input

  - *Voltage Range*—90-140 VAC
    - 6 mA at minimum voltage
    - 10 mA at max. voltage
- Output Modules
  - *Type*—AC Output
  - *Load Current Over Load Voltage Range*—0.02 - 3 A at 24 - 140 VAC

Electro-Mechanical Output Relay

One Form C (SPDT) relay operated by scanner output eight.

Hex Interface Unit

Physical

For dimensions, refer to Appendix C, “Dimension Diagrams”.

- 21 H x 18.5 W x 4.25 D inches (533 x 470 x 108 mm)
- 50.5 lbs (22.9 kg) with attached cable
- Scanner-interface cable length—6.5 feet (2 meters)

AC Power

115/230 VAC +10% @ 3.0/1.5A, 50/60 Hz.

Inputs

Standard—Eight solid state, active low when <1.0 VDC, 30 VDC max, 27 VDC continuous (These inputs are extensions of the eight solid state scanner inputs)

Outputs

- *Standard*—Eight open collector solid state, 30 VDC at 150 mA, max. (These outputs are extensions of the eight solid-state scanner outputs).

Optional Solid-State Input/Output Modules

Optically isolated Opto–22 style modules may be installed as inputs or outputs. They are controlled by standard input/output signals.

- Input Modules
  - *Type*—AC Input
  - *Voltage Range*—90-140 VAC
    - 6 mA at minimum voltage
    - 10 mA at max. voltage

- Output Modules
  - *Type*—AC Output
  - *Load Current Over Load Voltage Range*—0.02 - 3 A at 24 - 140 VAC

Electro-Mechanical Output Relay

One Form C (SPDT) relay operated by scanner output eight.

Maintenance

The scanner requires no special preventive maintenance when operated in an environment free from extremes of temperature, humidity, shock, and vibration.

The following tasks should be performed once a month to keep the scanner clean and to inspect it for mechanical damage.

1. Remove DC power and disconnect all cables before cleaning.
2. Clean dirt and dust from the scanner's window and from the LED display, using a soft, lint-free cloth and a non-abrasive liquid cleaner. DO NOT use an abrasive cleaner.
3. Check all cables for signs of abrasion.
4. Check that all cable connections are secure after maintenance.

Caution: The scanner's internal components do NOT require preventive maintenance. Opening the scanner with power applied can expose the operator to electrical and mechanical hazards, which can cause bodily injury. If internal maintenance is required, return the scanner to SICK Auto Ident, Inc. for service.

CHAPTER 2 *Installation & Setup*

This chapter provides you with an overview of the CiMAX 75xxA/76xx scanner hardware installation and setup. It also describes the procedure for mounting the scanner and interconnections to the interface unit, photoeyes and tachometer.

Unpacking & Inspection

Unpack the scanner and any accessories ordered. Depending on what you ordered, the equipment may have been shipped in more than one carton.

Remove the packing list from the pocket on each carton. Verify that you have received all of the items shown on the packing lists.

Inspect the equipment for shipping damage and, if you see any damage, notify both the carrier and SICK Auto Ident, Inc. immediately.

Store the original packing material inside each carton, and store the cartons in a safe place. If the scanner or any accessories need to be repaired, upgraded or modified in the future, return them to SICK Auto Ident, Inc. in the original cartons with the original packing material.

Refer to “Product Warranty” on page xix and “Return-to-Factory Instructions” on page xviii for more information.

Installation Checklist

- Plan and schedule complete installation
- Identify and include personnel responsible for:
  - Scanning system
  - Data system
  - Control or conveyor system
  - Maintenance
  - Installation
- Review plan with SICK Auto Ident, Inc. Field Service Engineer—Confirm schedule two weeks prior to engineer arriving on site for functional checkout

Site Preparation

Refer to the keysheet.

- Scanner
- AC power to Interface Unit. Ensure AC power is connected to an earth ground.
- AC power (convenience outlets) for local PC, CRT, modem, oscilloscope. Ensure AC power is connected to an earth ground.
- Structure for mechanically installing scanner
- Interface unit
- Tachometer, if used, including custom mounting brackets and flexible shaft coupling for required mechanical isolation
- Photoeyes
  - Presence
  - Height-sensing, if used, including mounting brackets
- Setup/Diagnostic Terminal—CiMAX 1400, local CRT, or PC running serial communications software program, i.e., Microsoft Windows Terminal, ProComm or Telix.
- Telephone for support
- Telephone line for support modem
- Verify conveyor speeds and width
- Verify box height variations
- Verify label symbology, dimensions and quality
- Verify all parts, mounting brackets, cables, connectors, and personnel available

Physical Installation

- Supporting structure for scanner with provisions for exact positioning
- Interface Unit
- Hex Interface Unit, if installed
- Tachometer. brackets and shaft isolation, provided by installer, are important.
- Photoeyes—*Exact Positioning Is Critical!*
  - Presence
  - Height-sensing
- Modem

Electrical Connections

- To Scanner
  - Network (if used)
  - I/O cable to interface unit (DC power)
- To Interface Unit
  - Grounded AC power
  - I/O cable to scanner
  - Presence photoeyes
  - Tachometer (installer provides cable)
  - Height-sensing photoeyes
  - Communication cable(s) provided by installer
  - Any special digital I/O connections
  - Modem and cables, provided by installer

On Site Testing

On site testing with SICK Auto Ident, Inc. Field Service Engineer or SICK Auto Ident, Inc.-Certified Installer. Plan for one day per scanner plus 1/2 day for training.

- Review operational requirements
- Review mechanical and electrical installation
- Functional Reading Tests
  - Diagnostics
  - Read Labels
    - Known good from SICK Auto Ident, Inc.
    - Customer labels
    - Field Service Diagnostic Test Kit
    - Basic Tests
    - Over extremes of label placement
- Set or verify photoeye placement parameters
- Run Tachometer Diagnostic—automatically sets some setup parameters
- Verify communications and special I/O circuits
  - To customer device

  - If necessary, transmit to known good device (PC running communications software program)
  - Through modem to remote site for support
  - Ethernet, if used, directly to scanner connector
- Test application
- Repeat with spare equipment

Operation Instruction

Instruct user personnel in operation of product.

- Manual with keysheet
- LED Displays
- Operation
- Setup parameters
- Diagnostics
- Troubleshooting
- Label quality
- Communications and special I/O circuits
- Modem
- Selected support plan
- Other support alternatives

Final Approval

- User/customer sign-off on installation checklist. Copy and file.
- Update keysheet or other documentation as necessary for future reference

Site Preparation

Power

When installed, the Interface Unit will require a dedicated AC outlet. You should provide additional 115 VAC outlets near the Interface Unit for setup and diagnostic test equipment.

+12VDC and +5VDC regulated DC power is provided by the Standard/Hex Interface Unit.

+12VDC regulated DC power is provided by the Basic Interface Unit.

Setup

In addition to the components illustrated in Figure 1–1, “Typical Configuration—CiMAX 7500A/7600” on page 1-1, you should have one of the following:

- CiMAX 1400 hand-held terminal
- PC computer with terminal emulation software and cable
- RS-232 ASCII terminal

Communications wiring to the host is necessary.

Photoeyes & Tachometer Installation

Follow the installation directions only if your system requires presence photoeyes, height-detecting photoeyes and a tachometer.

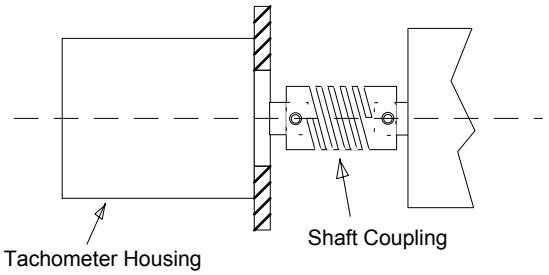
Installing the Tachometer

A tachometer is required to measure conveyor movement for gap tracking. Refer to “Gap Tracking” on page 4-11 for more information. Gap tracking is required when there is the possibility that more than one box may be in the scanning zone at the same time.

You must provide a custom bracket to mount the tachometer securely to your conveyor.

Connect the tachometer to a driven roller or other driven rotational part of your conveyor using a flexible shaft coupling or a belt and pulley drive as shown in Figure 2–1.

FIGURE 2–1. Tachometer Driver by Flexible Shaft Coupling



Note: You must use an appropriate flexible shaft coupling or belt and pulley drive to provide mechanical isolation of the tachometer from your conveyor. Without such isolation, the tachometer is subject to misalignment, roller shaft wobble and consequent wear to the tachometer's precision bearings.

Alternatively, a friction wheel can be used, to couple the tachometer to the surface of a belted conveyor. Friction drives have the potential to slip and cause tracking errors over time, but may be suitable for your application.

A suitable measuring wheel (P/N 16002070215) with a 12" circumference, a white rubber surface and an inside diameter compatible with the standard SICK Auto Ident, Inc. tachometer, and a universal tracking mounting base (P/N 14005750000), can be purchased from:

Danaher Controls
1675 Delany Road
Gurnee, IL 60031

The CiMAX 75xxA/76xx scanner requires inputs from a tachometer that produces a conveyor travel resolution finer than 0.20 inches per pulse with a pulse rate of no more than 1 kHz. Lower resolution will affect position accuracy but may provide enough accuracy for your application.

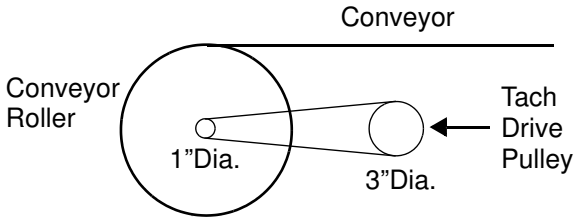
The examples in Table 2–1 display conveyor travel per pulse if a 300-pulses/revolution tachometer is driven directly from conveyor rollers of the diameters indicated. The speeds listed produce 1 kHz pulse rates.

TABLE 2–1. Conveyor Travel per Pulse

Roller diameter:	2 inches	3 inches	4 inches
Resolution:	0.021 inches	0.031 inches	0.042 inches
Conveyer Speed:	21 inches/sec	31 inches/sec	42 inches/sec
	105 ft/min.	157.5 ft/min.	210 ft/min.

If you use higher conveyor speeds, connect the tachometer directly to a larger diameter driven roller or use a belt and pulley system to achieve slower tachometer rotation, as shown in Figure 2–2. Optionally, use a tachometer that generates fewer pulses per revolution. Figure 2–2 displays a pulley arrangement providing a speed reduction of 3 to 1 and a 33% decrease in tachometer resolution.

FIGURE 2–2. Pulley Arrangement



The speed reduction will be proportional to the ratio of the pulley diameters, with the tachometer connected to the larger diameter pulley. The resolution will decrease in inverse proportion to the ratio of the diameters.

Mounting Presence Photoeyes

The photoeye positions for your application are specified on your keysheet.

Mounting Photoeye Tree Bracket

The bracket supports the height-detecting photoeyes on one side of the conveyor. A second bracket supports reflectors for each photoeye on the other side of the conveyor.

Mount the height-detecting photoeyes immediately upstream of the inzone photoeye.

Dimensions of the bracket available from SICK Auto Ident, Inc. are listed in “Photoeye Tree Bracket” on page C-9.

Scanner Installation

Mount the scanner on a supporting structure next to the conveyor such that it can be exactly positioned as detailed on your keysheet. The scanner should not be subject to shock or vibration from the conveyor.

Connecting CiMAX Scanner & Basic/Standard/Hex Interface Unit

1. Remove AC power at the circuit breaker.
2. Connect the AC power cord to line power from the Basic/Standard/Hex Interface Unit.
3. Connect the 25-pin connector to In/Out PWR and secure it.
4. Connect the 9-pin female connector to the Host and secure it.
5. Verify that the Interface Unit power switch is in the *Off* position.

It is preferable but not necessary to use the SICK Auto Ident, Inc. Basic/Standard/Hex Interface Unit(s) with the scanner. When you use an Interface Unit, you will obtain all I/O connections, except Ethernet, at the Interface Unit. Do not attempt to connect directly to the scanner without contacting SICK Auto Ident, Inc.

Inside the Standard/Hex Interface Unit, use terminal block 1 (TB1) to make low power I/O connections. Use terminal block 2 (TB2) to make connections to relays. Refer to Chapter 3, “Controls, Connectors, & Indicators” for connection information.

WARNING! IF YOU ARE USING OPTO-22 MODULES FOR INPUTS AND OUTPUTS, AC VOLTAGES MAY BE PRESENT IN THE INTERFACE UNIT. YOU SHOULD MAKE SURE THAT ALL EXTERNAL POWER IS REMOVED FROM THE INTERFACE UNIT’S INPUTS AND OUTPUTS BEFORE PERFORMING ANY MAINTENANCE. THE ON-OFF SWITCH ON THE SCANNER DOES NOT CONTROL THESE VOLTAGES.

On-Off Switch

SICK Auto Ident, Inc. recommends that you supply AC power, with a ground wire, to either the Interface Unit or to user-supplied DC power supplies through an external, fused control switch meeting all local electrical codes.

CHAPTER 3 *Controls, Connectors, & Indicators*

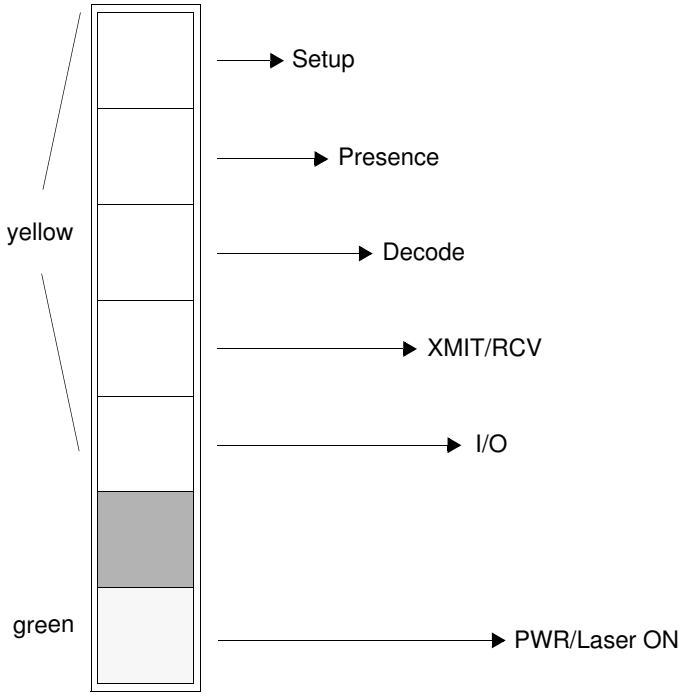
This chapter describes the physical layout, controls, connectors and indicators on the CiMAX 75xxA/76xx Scanner, the Basic Interface Unit, Standard Interface Unit, and the Hex Interface Unit.

Scanner

LED Display

There are six status indicators on the rear panel of the CiMAX 75xxA/76xx Scanner, as shown in Figure 3–1.

FIGURE 3–1. LED Display



Setup

The SETUP LED indicates that the scanner is in either the Setup or Diagnostics mode rather than in the normal operating mode. When this LED is *On*, the CiMAX 75xxA/76xx Scanner is not running application software.

Presence

The PRESENCE LED shows the status of the scan zone presence detect photoeyes. If the scanner is configured to use presence, the LED lights when an object is in the scan zone.

Decode

The DECODE LED lights when the scanner is decoding a barcode.

Xmit/Rcv

The XMIT/RCV LED will blink whenever the scanner is sending or receiving data. This includes messages to and from all sources that are sent via the Host, Setup and Starnode ports. The Ethernet port is not monitored. This LED helps to verify correct wiring and confirms that the scanner is receiving communications from any source.

I/O

The I/O LED shows the state of all inputs and outputs (1 through 8) combined. That is, if any of the inputs or outputs are activated, this LED will be on. To view the status of each input or output, the user must run the Inputs/Outputs test of the Diagnostics Program. The user may also observe which relays are active in the Interface Unit.

Pwr/Laser On (green)

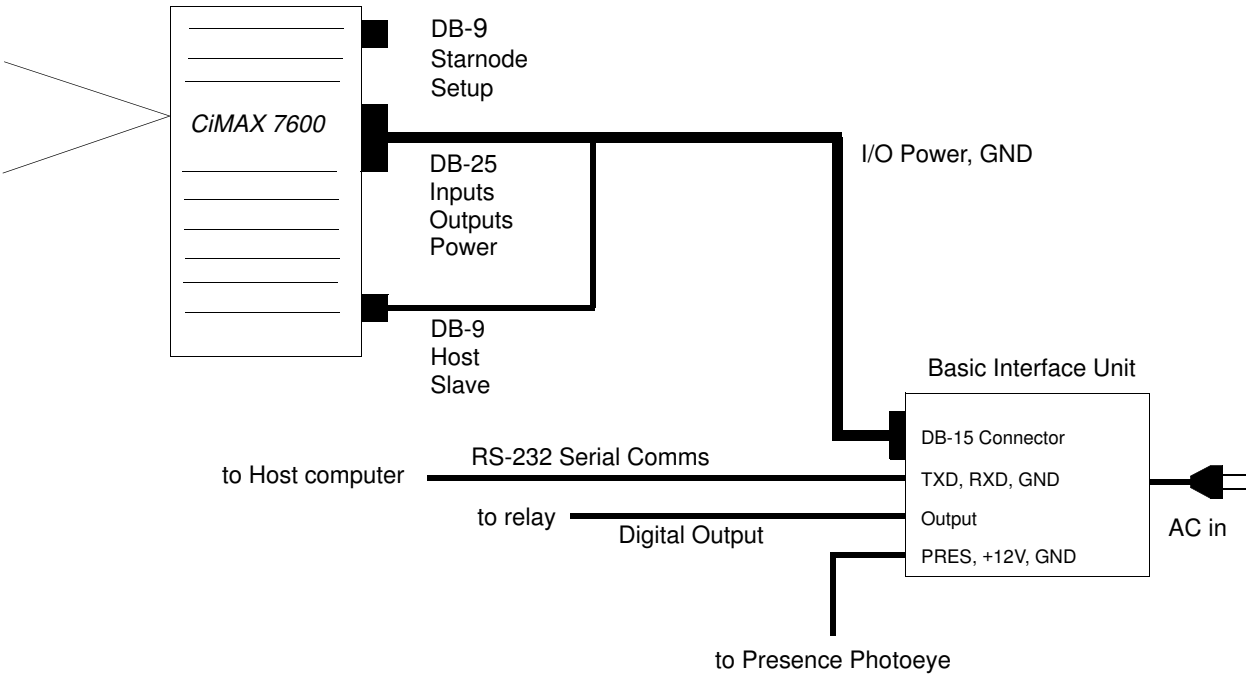
This LED indicates that power to the scanner is *On*. When power is first applied to the scanner, the scanning motor starts and the on-board computer performs internal diagnostics. After the diagnostics tests are completed, the laser is turned on and normal operation begins.

Interface Units

Basic Interface Unit

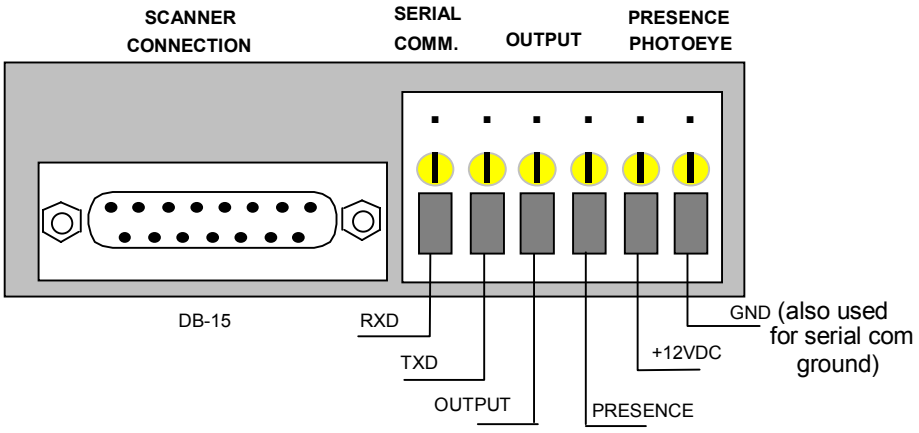
The Basic Interface Unit allows you to make I/O and relay connections at a more convenient location than at the scanner itself. The scanner is connected directly to the 15-pin D-type connector on the Basic Interface Unit, as shown in Figure 3–2. A two-meter cable is provided with the interface for this purpose.

FIGURE 3–2. Basic Interface Unit—Block Diagram



The basic interface provides six screw-down I/O connections, identified by silk-screened labels on the outside of the case. The DB-15 and screw-down connectors are shown in Figure 3–3.

FIGURE 3–3. Basic Interface Unit—I/O Panel



Note: The Basic Interface Unit provides +12VDC ±5% only and is designed for use with the optionally configured CiMAX 75xxA/76xx Scanner, without Ethernet option.

I/O Panel Inputs & Outputs

RXD

Terminal connector for RXD signal on an RS-232 communications link with Host computer.

TXD

Terminal connector for TXD signal on an RS-232 communications link with Host computer.

Output

Terminal connection for scanner's solid state Output 1, by default, the NO READ signal.

Presence

Terminal connector for presence signal from an inzone detecting photoeye.

+12VDC

Terminal connector for +12 VDC power for an inzone detecting photoeye (50 mA maximum).

GND

Terminal connector for common grounds for a photoeye and the RS-232 communications link.

Scanner Connection

D-type connector for scanner power, serial communications, inputs and outputs, as shown in Figure 3–4. The pins assignments of the DB-15 connector are shown in Table 3–1.

FIGURE 3–4. DB-15 Connector

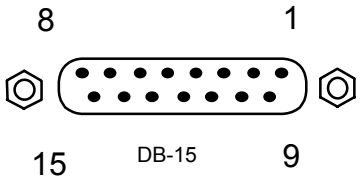


TABLE 3–1. DB-15 Pin Assignments

Pin	Description
1	Not used
2	Host RXD (data from Host)
3	Host TXD (data to Host)
4	Output 1
5	Not Used
6	Presence Input
7	Signal Ground
8	Frame Ground
9	+12 VDC ±5%, 1.2A
10-15	Not Used

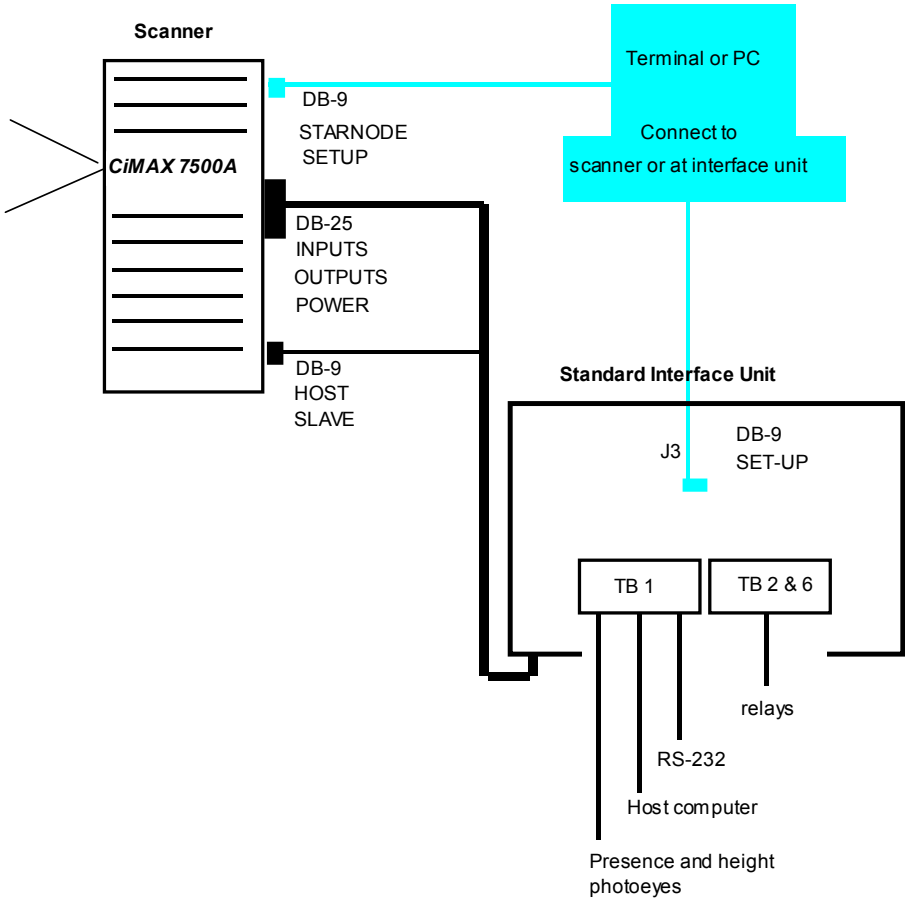
Connection to a Host

You can connect the Basic Interface Unit to a PC that will act as a Host. This is a three-wire connection (RXD, TXD, and GND). On a typical 25-pin RS-232 connector on a host computer, RXD is pin 2, TXD is pin 3, and GND is pin 7.

Standard Interface Unit

The Standard Interface Unit allows you to make most CiMAX 75xxA/76xx Scanner connections at a more convenient location than at the scanner itself, which may be mounted where it is not easily accessible. The Standard Interface Unit can usually be mounted at the side of the conveyor, allowing easy access from the floor. Figure 3–5 illustrates how the scanner and the Standard Interface Unit are interconnected.

FIGURE 3–5. Standard Interface Unit—Interconnection Block Diagram



Hex Interface Unit

The Hex Interface Unit is a special box that allows more than one scanner to be used in a tunnel type application. You can have up to six scanners attached to one interface unit. This allows most of the common signals to be connected to more than one scanner without additional wiring. It also allows for a quicker and more reliable installation. Because of the specialized nature of these applications, this box must be specific to the application.

Starnode drop cables can be directly connected to TB7 and TB8. These terminal blocks can be an extension of any Starnode network branch. All Starnode rules still apply in the layout of Starnode network (refer to the *Starnode Installation & Site Planning Guide)*. This allows a common connect for the Starnode drop cables and eliminates the need for individual T-TAP boxes.

Standard Interface Connections

The Standard Interface Unit is connected to the scanner by the cables provided with the system. The cables connect DC power to the scanner and all of the scanner input, output and communications signals, to the interface unit. You *must* connect the network cables directly to the scanner.

You can connect a PC, running terminal software, to the SETUP port in the SET/STAR connector on the scanner. However, it may be more convenient to connect it to the SETUP connector inside the Standard Interface Unit.

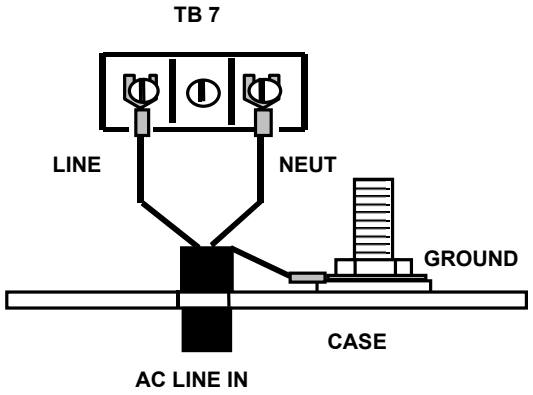
The SETUP connector in the Standard Interface Unit does not support the CiMAX 1400 Hand-Held terminal.

AC Power

115/230 VAC (auto selected) ±15%, 50/60 Hz, 40 W max power is required by the Standard Interface Unit. This supplies DC power to itself, to the scanner, and provides AC voltage for relays controlling AC-operated devices.

The AC Power Cable is fed into the interface through a punch-out hole in the case. The AC line connections are made at TB7, using the screws labeled NEUT and LINE. The ground wire must be connected directly to the case, as shown Figure 3–6.

FIGURE 3–6. AC Power Connection



Toggle switch S1 on the circuit board is an AC ON/OFF switch. Because the cover of the interface will normally be closed, AC power should be supplied to the interface through an external, fused switch.

Hex Interface Connections

The Hex Interface Unit requires its own AC power. There is a 4 A 250 VAC, 3AG fuse located in the fuse compartment above the power switch. To access the fuse, open the fuse compartment with a small screwdriver.

If you position the Hex Interface Unit with the scanner cables exiting on your left side, scanner A is the cable closest to the slide Starnode door. The scanners are labeled A through F, with scanner F located closest to the corner of the box.

The Hex Interface Unit provides six setup connectors, one for each scanner.

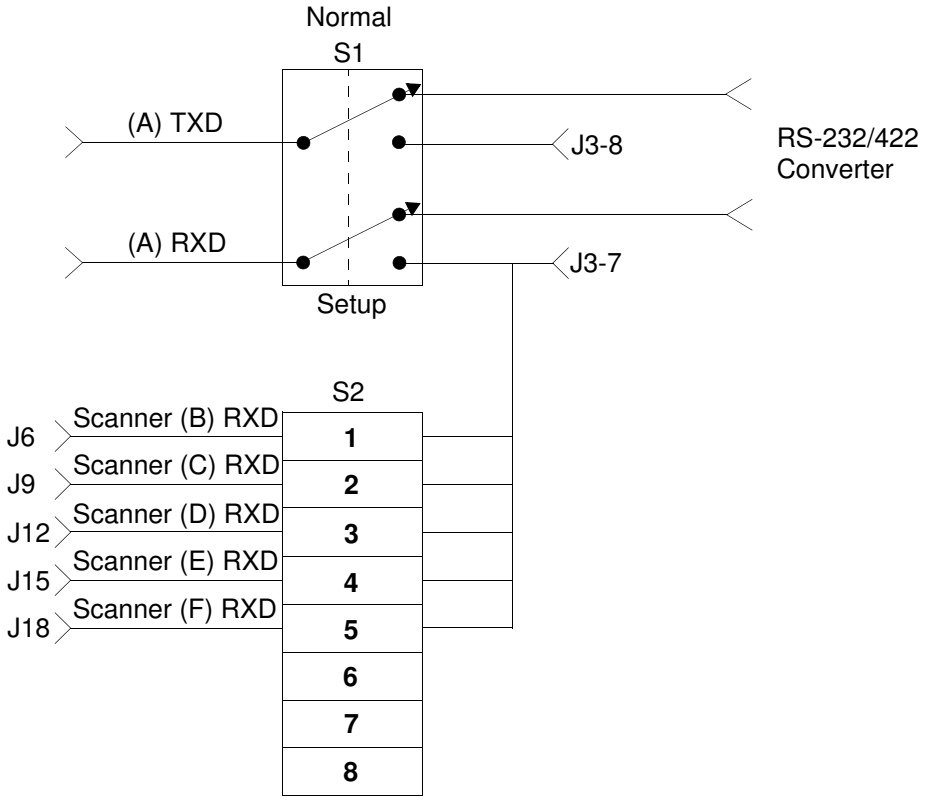
In some applications, scanner A is acting as a master scanner using its host port to communicate over a sub-system RS422 multi drop connection to other scanners in the system. This master's setup port is used to communicate to a host computer using RS-232 on TB1 pins 39 and 40. If Switch 1 (S1) is in the normal position, scanner A setup port is also connected to a RS-232 to RS-422 converter. The RS-422 host connection will be made on TB9 pins 1 - 4.

Switch 2 is a dipswitch that may be used to connect a number of scanners setup port receive data lines together. This may be used when data from the Programmable Interface Controller must be sent to all of the scanners. SICK Auto Ident, Inc. cable (A1-63397-1) will be connected between Programmable Interface Controller J1 and Hex Interface Box J18. Make sure that the cable end with pin 8 is connected to the Programmable Interface Controller. Switch 2 positions are as follows:

- If all scanners are to receive the same data on the Setup Port, S2 should be set (11111xxx), where:
  - 1=On
  - 0=Off
  - x= don’t care
- Position 5—F (BCDEFxxx) Position 5 must be set to *On* to connect data to any other scanners. Scanner F gets data directly from J18.
- Scanner A requires that S1 be in the setup position to receive data.

When the CiMAX 75xxA/76xx Scanner is connected to the Hex Interface Unit, ensure the correct switch is *On* for that scanner. Those scanners must use the SETUP port to receive data from the Programmable Interface Controller. If you wish to use this port for setup or diagnostics, set the applicable switch to *Off* temporarily, during testing.

FIGURE 3–7. S1 & S2 Connection Diagram



Another use of these switches is when you wish to update the operating system of more than one scanner at the same time. If you wish to upgrade the OS, communication to a scanner must be made to that scanner's setup port through one of the six connectors in the Hex Interface Unit. Each connector is used for each individual scanner. For example, if you have two CiMAX 75xxA Scanners or two CiMAX 76xx Scanners attached to positions C and D, connect the computer to J9 or J12. Set S1 to normal and S2 to 01100000 (0=off, 1=on).

Control Input Connections

Interface Unit Inputs

All standard solid state control input connections to the Interface Unit(s) are available at terminal block TB1, as shown in Figure 3–10, "Standard Interface Unit Circuit Board" on page 3-12, and Figure 3–11, "Hex Interface Unit Circuit Board" on page 3-13.

Connector assignments are listed in Table 3–2, "Interface Unit I/O Connections—TB1," on page 3-17.

Eight low-voltage DC solid state control inputs are provided and are, by default, assigned to accept inzone and outzone presence, tachometer and five height sensor signals, as specified in Table 3–2, "Interface Unit I/O Connections—TB1," on page 3-17. The assignments are shown in parentheses in the table. A custom C program or the Setup parameters may be used to override the default assignments.

An optional DC-to-DC converter provides isolated DC power for photoeyes and a tachometer. Isolated +12 and +5 volts DC and ground terminals are available on terminal block TB5. Using these voltages and the opto-isolated inputs will provide total isolation.

Programmable Interface Controller Inputs

Standard inputs 4-8 are used for height sensing. When used, the least significant height is connected to input 4 of the Interface Unit(s).

Up to seven additional low-voltage DC inputs are available at terminal block J2 on an optional Programmable Interface Controller, as shown in Figure 3–12, "Programmable Interface Controller Board" on page 3-14. The inzone photoeye is connected to input 8 of the Programmable Interface Controller. The extra height photoeyes are connected to inputs 1 - 7 of the Programmable Interface Controller, with lowest input connected to input 1 of the Programmable Interface Controller. On the leading edge of inzone, the peak-detected state of the 7 inputs, the highest number of photoeyes blocked since the last inzone, are sent serially to the scanner. They permit additional height sensing, for better resolution of height and corresponding better accuracy for x, y positioning to allow smaller gaps between boxes.

Optional Input Relay Modules

As many as eight optional solid-state input relay modules can be used to accommodate AC input signals. Refer to "Relays in the Interface Units" on page 3-14 for more information.

Control Output Connections

Eight solid-state open-collector control outputs are available at terminal block TB1 on the main printed circuit board, to operate relays, alarms, diverters, etc. Connector assignments are listed in Table 3–2, "Interface Unit I/O Connections—TB1," on page 3-17. Refer to Figure 3–8, "Typical Solid State Output Circuit" on page 3-10.

By default, three of the outputs are assigned to output NO READ, MATCH and NO MATCH signals, as specified Table 3–2, "Interface Unit I/O Connections—TB1," on page 3-17. The assignments are shown in parentheses in the table. A custom C program or the Setup parameters may be used to override the default assignments.

As many as seven optional solid-state output relay modules, and one form C (SPDT) electro-mechanical relay, are available to switch AC voltages. Refer to "Relays in the Interface Units" on page 3-14 for more information.

Special Inputs & Outputs

Laser Control

A digital low or switch closure to ground on this input will turn the laser *On* or *Off*, depending upon how a jumper inside the scanner was configured at the factory. The default position of jumper JH2 is between pins 1 and 2. This is referred to as a normal laser control. With no connection, or logical high on the input laser control, the laser will be *On*. A ground or logical low on laser control input causes the laser to turn *Off*. Moving the jumper to position 2 to 3 causes this function to be reversed and referred to as an inverted laser control.

Beeper

The Beeper output is an open collector output providing an audio tone to signal the operator each time that the scanner has read a label.

By default, Output 4 is used to drive the beeper. Jumper JH6 in the Standard Interface Unit is used to connect Output 4 to the beeper. For beeper operation, position JH6 across pins 2 and 3.

Refer to Figure 3–10, “Standard Interface Unit Circuit Board” on page 3-12 which shows the location of JH6.

To use Output 4 as a general purpose output:

1. Place the JH6 jumper across pins 1 and 2.
2. Set parameter 003 IOMODE to +16 to disable the beeper. Refer to the *Scanner Parameters Reference Guide* for more information.

Communications Inputs & Outputs

Host and SETUP port connections are available on terminal block TB1. Terminal assignments for these ports are shown in Table 3–2, “Interface Unit I/O Connections—TB1,” on page 3-17.

DC Power Outputs

Terminal block TB1 also provides several non-isolated low voltage DC outputs for powering external sensors, as well as associated ground connections. The ratings of the DC outputs are shown in Table 3–2, “Interface Unit I/O Connections—TB1,” on page 3-17.

Solid State Input & Output Circuits

Figure 3–8 and Figure 3–9 show typical Solid State Input and Output Circuits.

FIGURE 3–8. Typical Solid State Output Circuit

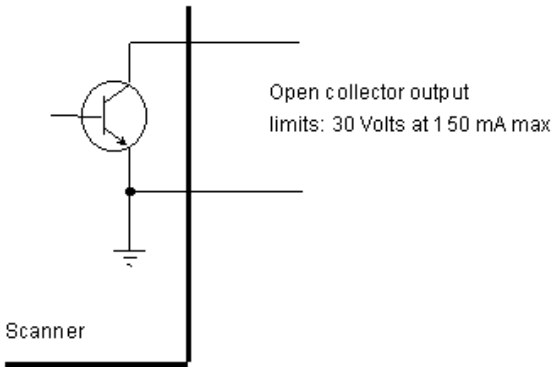
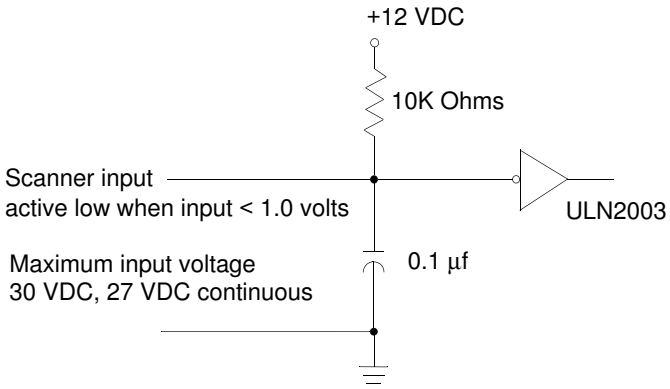
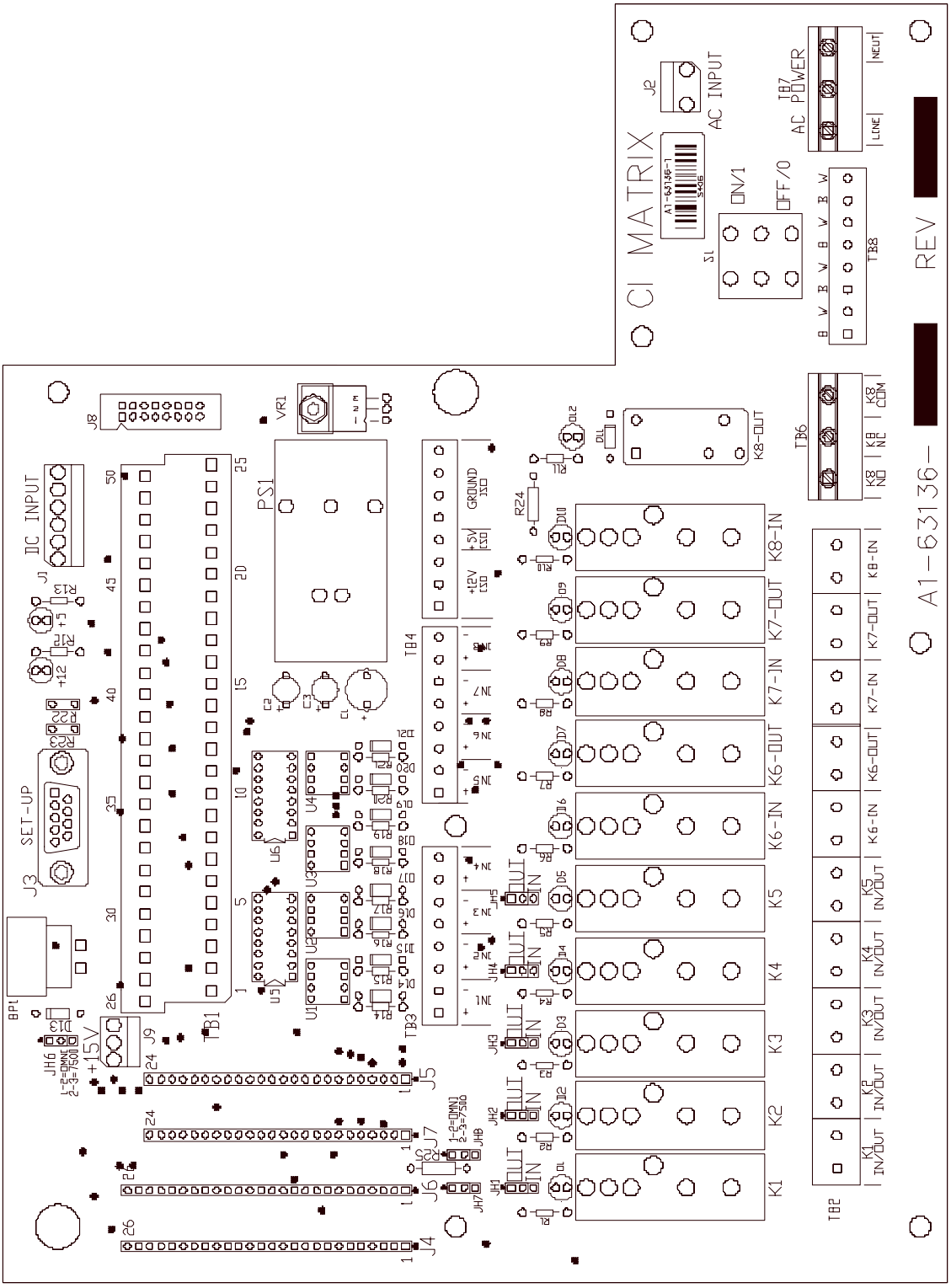


FIGURE 3–9. Typical Solid State Input Circuit



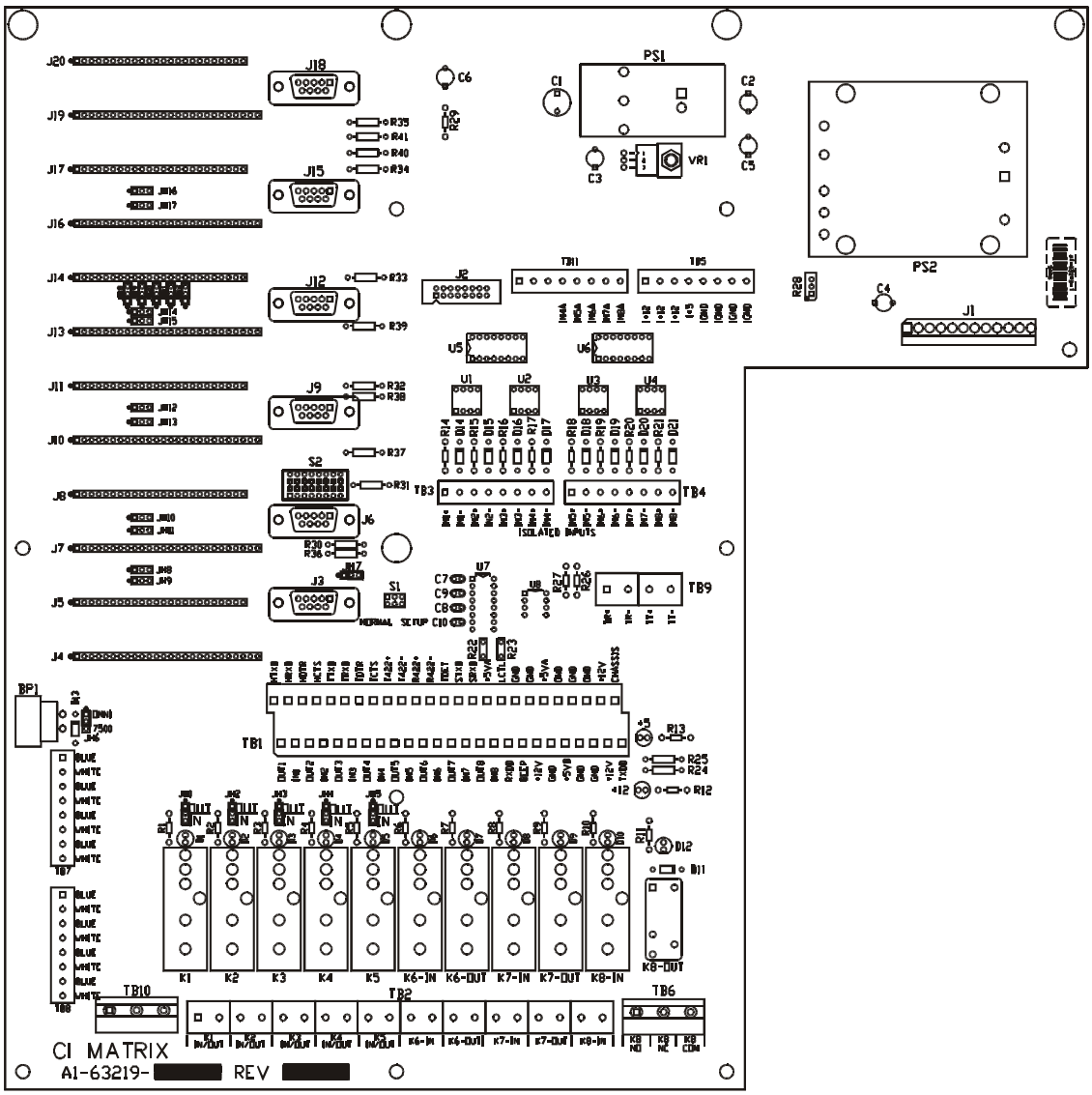
Standard Interface Unit Circuit Board

FIGURE 3–10. Standard Interface Unit Circuit Board



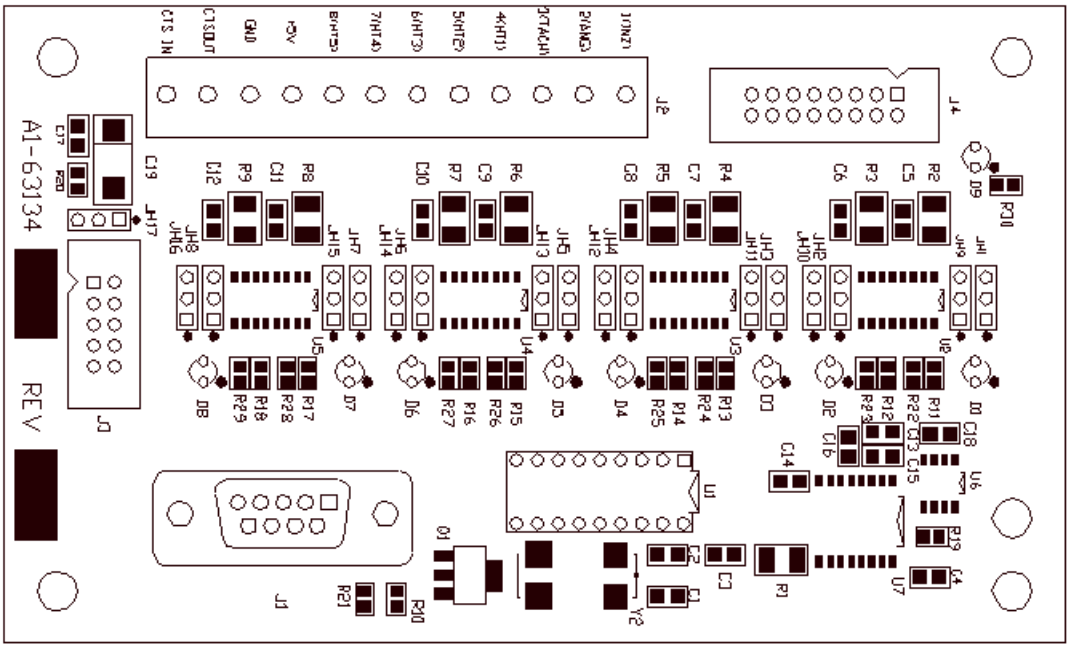
Hex Interface Unit Circuit Board

FIGURE 3–11. Hex Interface Unit Circuit Board



Programmable Interface Controller Board

FIGURE 3–12. Programmable Interface Controller Board



Relays in the Interface Units

Standard Interface Unit

Optional output relay modules can be plugged into locations K1 through K7. Standard Opto-22 style solid state output relay modules with several different AC and DC voltage and power ratings can be provided to fit your application. You can use these relays to operate divert gates, for example.

Optional input relay modules can be plugged in to locations K1 through K5. Relay modules with several different AC and DC voltage and power ratings can be provided to fit your application.

Position the jumpers associated with relay modules JH1-JH5 to:

- *IN* when an input relay is used, as shown in Figure 3–13
- *OUT* when an output relay is used, as shown in Figure 3–14
- *OUT* when no module is used

FIGURE 3–13. JH1-5 Jumper Setting for Input Relays

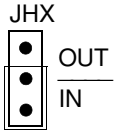
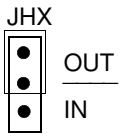


FIGURE 3–14. JH1-5 Jumper Setting for Output Relays



K8 is an electro-mechanical relay containing one set of normally open (NO) and normally closed (NC) contacts. You can use K8 to accomplish logic functions with AC line voltage. For example, relays in series can be used to implement the AND logic function. This relay provides contacts that remain open, and contacts that remain closed, when the power is OFF.

Hex Interface Unit

JH18 through JH22 are used to isolate inputs 4 - 8 from the three scanners attached to the top three positions (D-F) of the Hex Interface Unit. Normal operation requires that these shunts be installed in the 1-2 position. This will insure that these inputs are connected to all six scanners the same way. If this interface box is used side scanning, then the inputs 4 - 8 will be connected to proximity sensors that detect which side of the conveyor a box may be positioned. Three scanners will be connected to the lower three positions (A - C) and the scanners on the other side of the conveyor will be connected to the top three positions (D - F). The proximity information should be in reverse order from the lower three scanners. This is accomplished by moving shunts JH18 through JH22 to the 2 - 3 position. For example, if five proximity sensors are used, install 22 AWG wire between TB1 AND TB11 (IN4-IN8A, IN5-IN7A, IN6-IN6A, IN7-IN5A, IN8-IN4A).

Typical Relay Wiring Examples

FIGURE 3–15. Open Collector Output Operating an External Relay

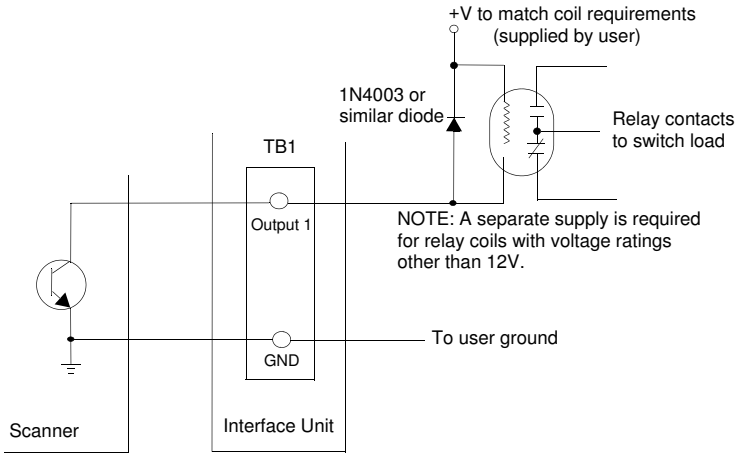


FIGURE 3–16. Solid State Output Relay

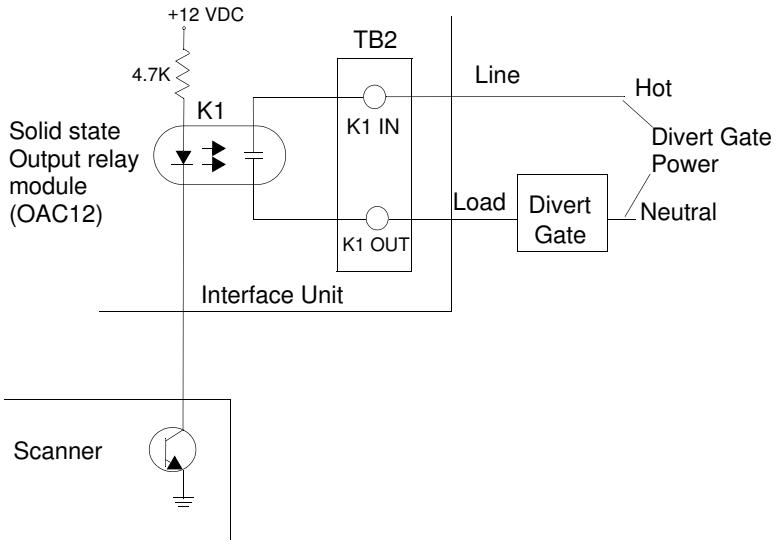


FIGURE 3–17. K-8 Electro-Mechanical Relay Connection

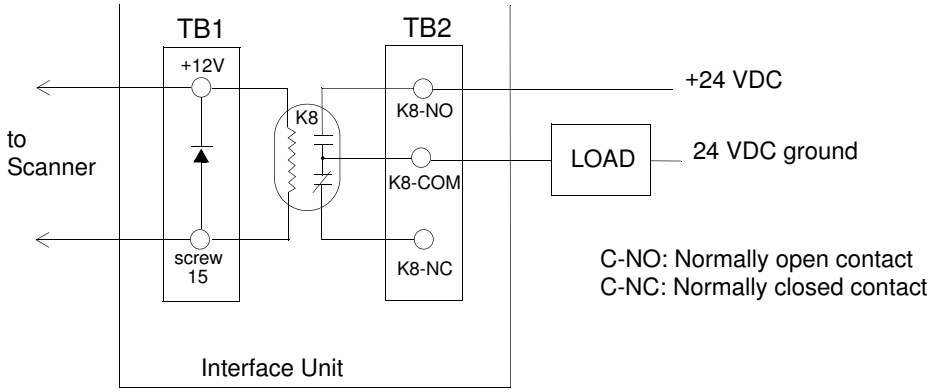
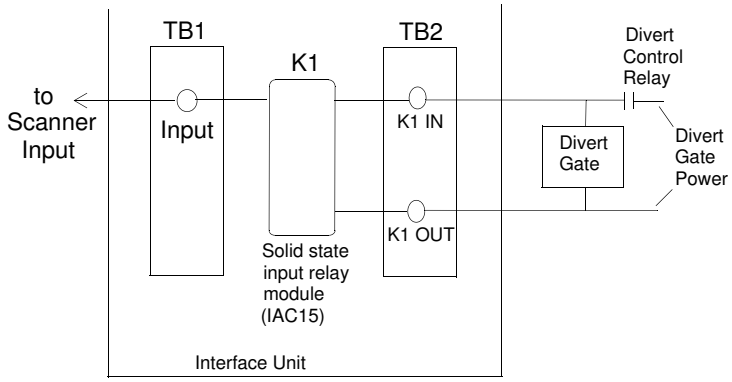


FIGURE 3–18. Solid State Input Relay Module



Interface Unit I/O Connections

Table 3–2 shows the Interface Unit I/O connections at Terminal Block TB1. Default assignments are indicated in parentheses.

TABLE 3–2. Interface Unit I/O Connections—TB1

TB1	Signal	In/Out Pwr DB-25	Host DB-9
1	Output 1 (NO READ)	9	
2	Input 1 (INZONE PRESENCE)	1	
3	Output 2 (MATCH)	10	
4	Input 2 (OUTZONE PRESENCE)	2	
5	Output 3 (NO MATCH)	11	
6	Input 3 (TACHOMETER)	3	
7	Output 4 (BEEPER)	12	
8	Input 4 (HEIGHT SENSOR 1)	4	
9	Output 5	13	
10	Input 5 (HEIGHT SENSOR 2)	5	
11	Output 6	14	
12	Input 6 (HEIGHT SENSOR 3)	6	
13	Output 7	15	
14	Input 7 (HEIGHT SENSOR 4)	7	
15	Output 8	16	
16	Input 8 (HEIGHT SENSOR 5)	8	
17			
18	Beep	12	
19	+12 VDC	19	
20	Ground		
21	+5 VDC	24	
22	Ground		
23	Ground		5
24	+12 VDC	20	
25			
26	Host TXD		3
27	Host RXD		2
28			
29			
30			
31			
32			
33			
34	Host T422+		1

TABLE 3–2. Interface Unit I/O Connections—TB1 (continued)

TB1	Signal	In/Out Pwr DB-25	Host DB-9
35	Host T422-		6
36	Host R422+		7
37	Host R422-		9
38			
39	Setup TXD		8
40	Setup RXD		4
41	+5 VDC	25	
42	Laser control	17	
43			
44			
45			
46	Ground	21	
47	Ground	22	
48	Ground	23	
49			
50	Frame Ground	18	

Expansion Board Input Connections

Table 3–3 shows the Expansion Board Input connection at Terminal Block J2.

TABLE 3–3. Expansion Board Input Connections

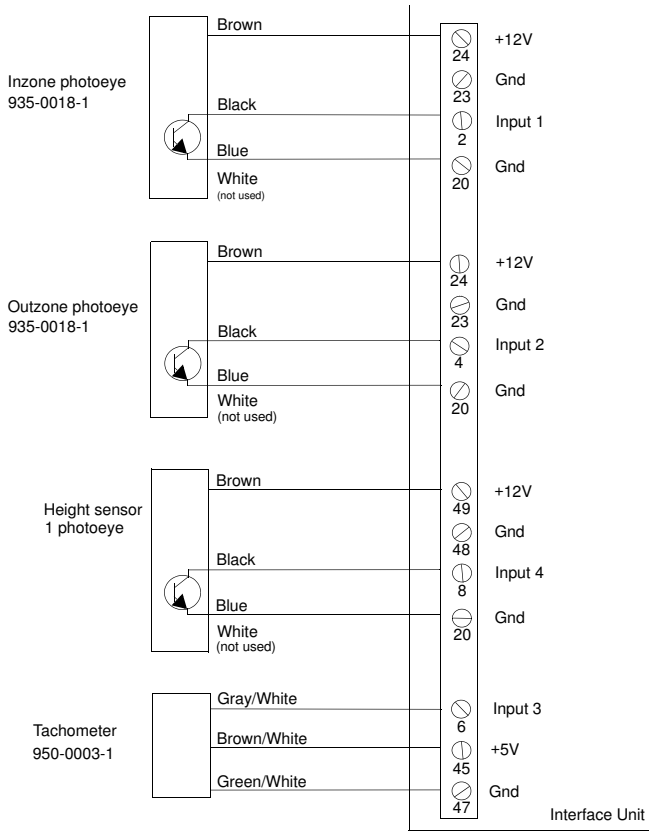
J2 Marked	Assignment
1 (INZ)	Height Input 1
2 (ANG)	Height Input 2
3 (TACH)	Height Input 3
4 (HT1)	Height Input 4
5 (HT2)	Height Input 5
6 (HT3)	Height Input 6
7 (HT4)	Height Input 7
8 (HT5)	Inzone Presence (connect to TB1-2)
9 +5V	+5V
10 GND	GND
11 CTSOUT	CTSOUT (RS-232)
12 CTSIN	CTSIN (TTL)

Photoeye & Tachometer Connections

Note: Connections shown here are for SICK Auto Ident, Inc. parts only.

Use TB3, TB4 and TB5 instead of TB1 for complete opto-isolation. Refer to Table 3–2, "Interface Unit I/O Connections—TB1," on page 3-17 for TB1 assignments.

FIGURE 3–19. Photoeye & Tachometer Connections



Connectors on Scanner I/O Connector Panel

Refer to Table 3–2, Table 3–3, and Table 3–4 for connector and signal specification for the Scanner I/O connector.

TABLE 3–4. I/O Connections

Pin	Host	Set/Star
1	Host T422+	LAN+ (blue wire)
2	Host RXD	TERM DETECT
3	Host TXD	LAN- (white wire)
4	Host DTR	Ground
5	Ground	Frame Ground (cable shield)

TABLE 3–4. I/O Connections (continued)

Pin	Host	Set/Star
6	Host T422-	Ground
7	Host R422+	TERM RXD
8	Host CTS	TERM TXD
9	Host R422-	+5 VDC, 500 mA max

I/O Connector Panel

FIGURE 3–20. I/O Connector Panel—CiMAX 75xxA

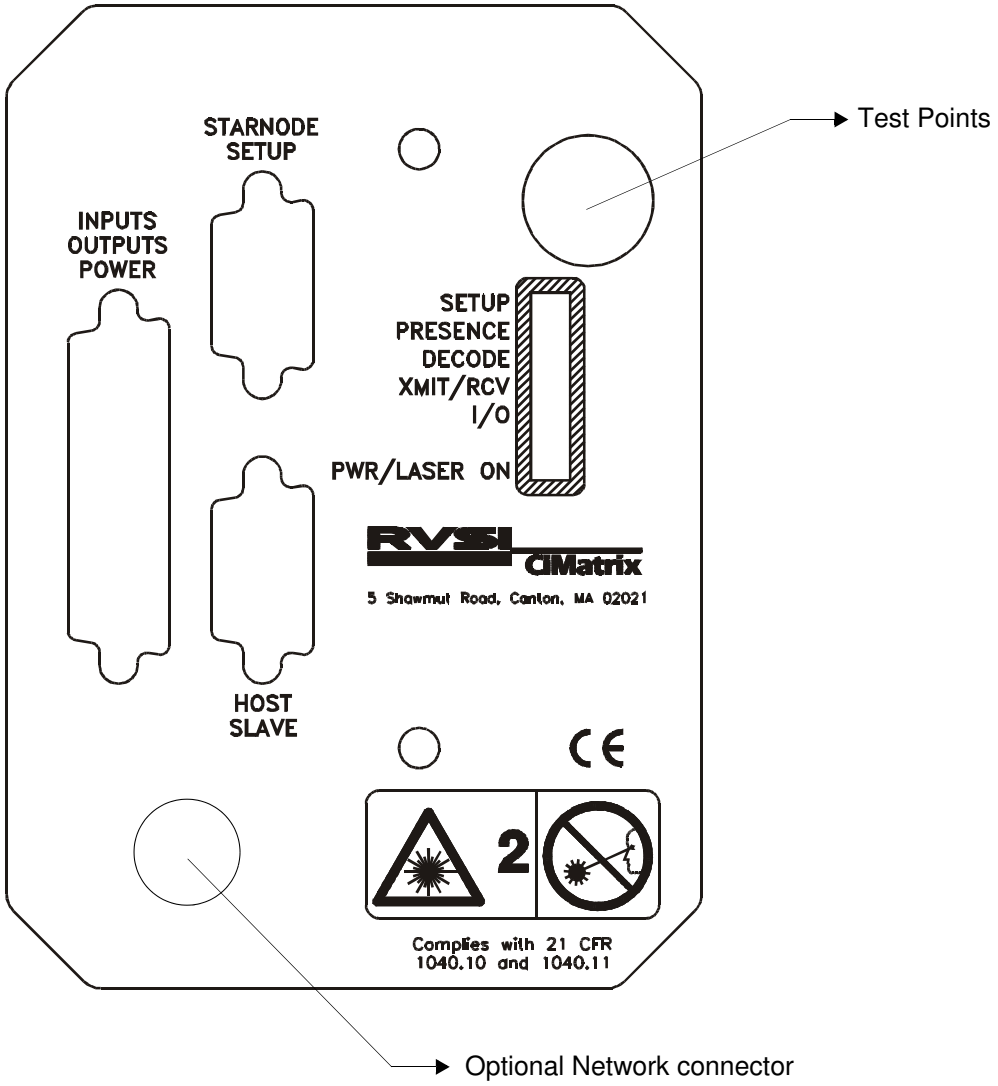
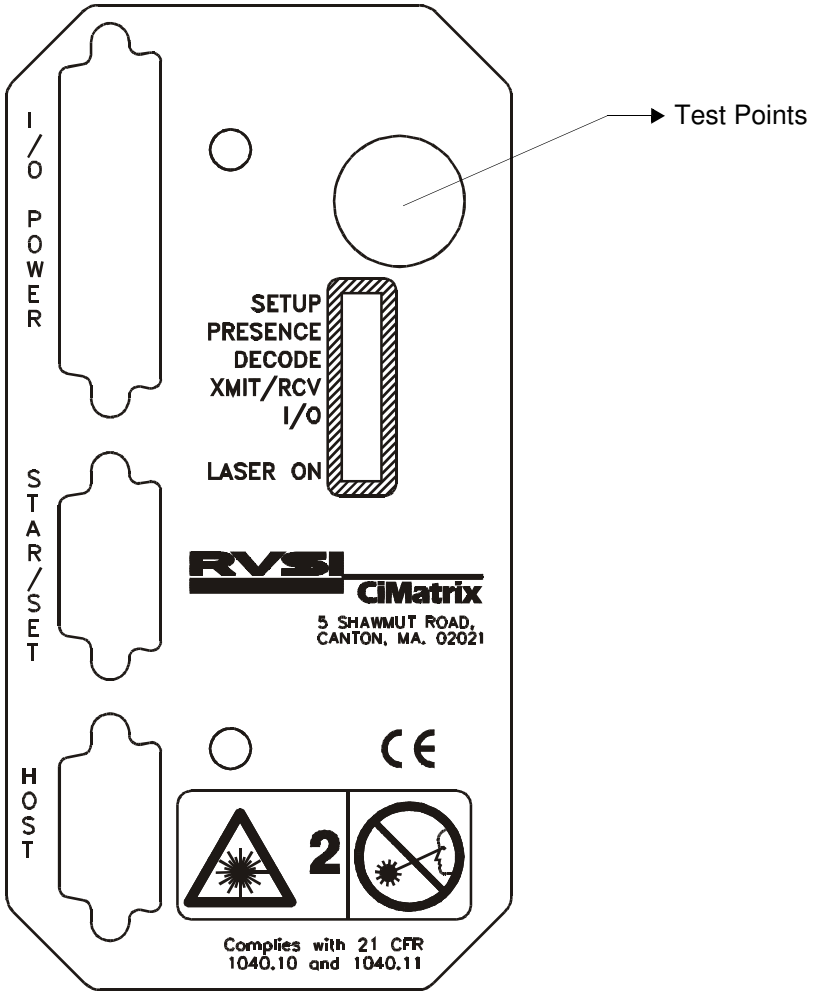


FIGURE 3–21. I/O Connector Panel—CiMAX 7600/7650/7655



Host Connector

Host Connections are also available on TB1 in the Standard and Hex Interface Unit and are brought to the scanner through the I/O Connections connector. The Host Connector provides an asynchronous serial I/O port that can be used to connect to a host computer or to other serial, ASCII devices (such as printer, display terminals, external keyboards, etc.). Control of data flow, baud rates, etc., are determined by parameters you can set. Refer to the *Scanner Parameters Reference Guide* for more information. This port can use RS-232, RS-422 or full modem protocols.

Pins 2, 3, and 5 are always used for RS-232 communication. Pins 1, 5, 6, 7, and 9 are used for RS-422 communication. Your host may require using other pins or making other connections in order to send and receive data.

The Host Connector contains two asynchronous serial I/O communication ports, Host and Terminal.

The Host Port is used to connect the CiMAX 75xxA/76xx Scanner to a host computer or controller to transfer barcode data for processing.

The SETUP Port is used to connect the scanner to another scanner or to a printer, display terminal or computer.

Control of data flow, baud rates, communications protocols, etc., from both ports can be set by means of parameters and software jumpers (parameters 100-199, 200-299, and 495). Refer to the *Scanner Parameters Reference Guide* for more information.

The Host port can be programmed to use either RS-232 or RS-422 conventions, or both. The SETUP port uses only RS-232.

Starnode Setup Connector

The Starnode Connector allows the CiMAX 75xxA/76xx Scanner to be connected to an EIA-485 Starnode local area network (LAN). This network connection is not implemented in the Interface Unit. You must attach your network cable directly to the connector on the rear panel of the scanner. Refer to Table 3–4, “I/O Connections,” on page 3-19.

Setup Port Functionality on Starnode Connector

The SETUP connector is provided as an input port for a local terminal. You can connect a CiMAX 1400 hand-held terminal, an ASCII terminal or a PC running a terminal emulation program. This port uses RS-232 conventions and runs at 9600 baud. Refer to Table 3–4, “I/O Connections,” on page 3-19.

Setup connections are also available on TB1 in the Standard and Hex Interface Units and are connected to the scanner through the I/O Connections connector.

A terminal can be used to display and change parameters values and run diagnostic tests. These functions are described in other chapters in this manual. Most terminals only require connection to pins 6, 7 and 8.

The CiMAX 1400 terminal also uses pins 2 and 9. A cable with the necessary connections is provided with the terminal. Some terminals may require connecting to or jumpering other pins.

Optional Network Connectors—CiMAX 75xxA only

A BNC coaxial connector (standard) for 10 Base 2 thinnet or an RJ-45 connector for 10 base T twisted pair is provided with an Ethernet option. A 4-pin SDS or 5-pin DeviceNet connector is provided with a CAN option. No network connections are available in the Standard or Hex Interface Units. If your scanner has the network option installed, you must attach your network cable directly to the connector on the I/O Connector panel of the scanner.

Electrical Test Points

Six electrical test points, mounted on the printed circuit board, can be accessed by removing the round plug located in the upper right corner of the scanner I/O panel.

Test point information is included in this manual for completeness. The test points are for use by factory personnel during setup and adjustment. The test point signals are:

MOD1—Laser Modulation

An analog input signal that can be used to compensate for the lower laser power at the beginning and end of each scan line.

LSR1—Laser Current

A voltage which, when divided by the laser diode resistance, provides an estimate of the diode current.

ANA1—Analog Signal

The analog voltage from the detector before it is digitized. This signal is used to adjust the polarizing filter in the scanner.

BAR1—Barcode Signal

Digitized bar code signals used to adjust the phase and mechanical position of the polygon mirror.

SOS1—Start Of Scan

A sync signal used when viewing waveforms on an oscilloscope.

GND1—Ground

A ground connection for equipment connected to the test points.

4

CHAPTER 4 *Introduction to Scanning*

This chapter describes the basics of laser barcode scanning, the operation of single line scanners and scan tunnel applications.

Introduction

The laser diode used in a barcode scanner generates a low-power beam of (670 nm) red laser light. Rotating flat mirrors reflect this beam such that it sweeps rapidly across the scanning zone. The light you see looks like a long, thin red line.

Barcode labels scanned by the laser beam reflect varying amounts of the laser's light back to the scanner where the rotating mirrors direct the reflected light to the scanner's receiver optics.

A photo diode in the receiver generates an electrical signal that varies in proportion to the intensity of light reflected by the barcode as it is scanned. Other circuits amplify the signal.

The black-colored bars of a barcode reflect much less light than the light-colored spaces between the bars. Light of lower intensity is reflected from a bar than from a space. As the beam sweeps over the barcode, a pattern of analog signal levels is created in the scanner, which duplicates the pattern of bars and spaces. The timing relationship between this analog waveform and the widths of the bars and spaces depends on the rotation speed of the mirrors and the distance from the scanner to the barcode.

The receiver circuitry converts the analog waveform to a digital waveform consisting of a series of uniformly high and low signal levels. This digital waveform is passed, along with a start-of-scan signal, to the scanner's decode circuitry.

Reading Barcodes

Successful barcode reading requires printing labels with precise, crisp, clearly defined high-contrast bars and spaces.

The X Dimension

The scanner analyzes the digital waveform and determines the width of the narrowest bars and spaces. This width is referred to as the X dimension.

On the printed barcode, the X dimension is the width of the smallest space or bar, traditionally measured in thousandths of an inch, or mils. Figure 4–1 shows the X dimension of bars and spaces in a typical barcode.

FIGURE 4–1. X-Dimension

The size of the narrowest bar must equal the size of the narrowest space

In the scanner, the widths of all other bars and spaces are measured and expressed as multiples of X. For example, symbologies such as Code 39 and Interleaved or Straight 2-of-5 use only two widths, X and 2X (wide and narrow). Other symbologies, such as Code 128 and UPC/EAN, use up to four element widths, with bars and spaces ranging from X to 4X.

Measuring Barcodes

The X dimension of a barcode is traditionally measured in thousands of an inch (mils), using an optical comparator. This is available from SICK Auto Ident, Inc. or optical suppliers. Ideally, the width of the narrowest space should equal the width of the narrowest bar.

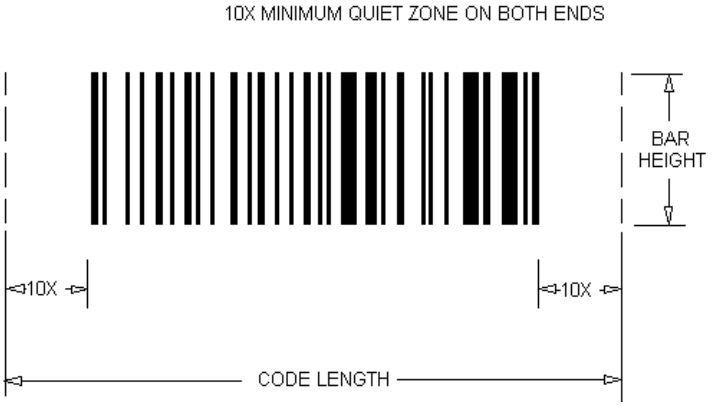
Your scanner has been set up to read the minimum X dimension specified on the Keysheet. For best scanner performance, the actual X dimension of your barcodes should be no smaller than the specified dimension. If your barcodes have too narrow an X dimension, your scanner may not be able to read codes over its entire reading range.

Quiet Zone

There must be a Quiet Zone of at least ten times the X dimension on both ends of the barcode. The color and surface of the label material in the Quiet Zone and in the spaces must be the same.

After the scanner has determined a barcode's X dimension, it interprets all spaces of 10X or greater as quiet zones, and all bars and spaces between the quiet zones as barcode data. Figure 4–2 illustrates spaces, bars and quiet zones. The sizes of the quiet zones have been exaggerated for clarity.

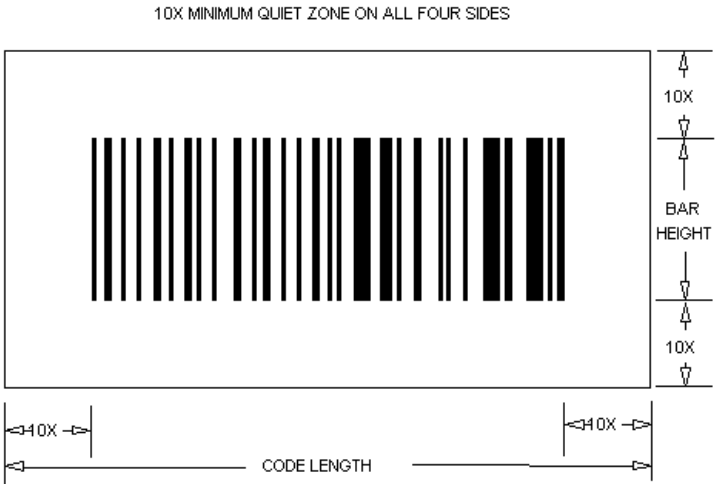
FIGURE 4–2. Barcode—Quiet Zone



Quiet Zones for Stitching

If your scanner is equipped with SICK Auto Ident, Inc. CIX technology, your barcodes must have a 10X minimum quiet zone on all four sides of the barcode. This will allow for stitching, which is the connecting of segments of barcode. Figure 4–3 illustrates the ideal barcode label for scanning operations that include stitching. The sizes of all four quiet zones have been exaggerated for clarity.

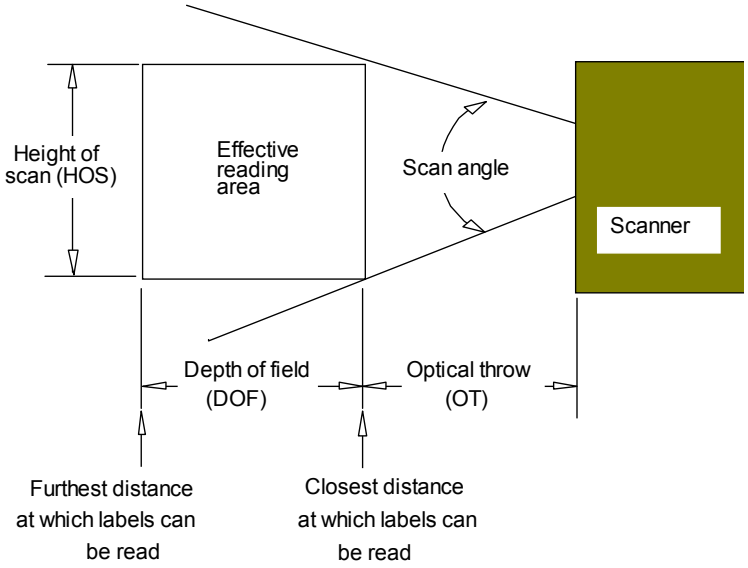
FIGURE 4–3. Barcode—Stitching



Optical Considerations

After barcode printing quality, the next most important factor in scanner operation is maintaining the correct distance between the scanner and the barcodes being scanned. The barcodes must pass through the effective reading area, illustrated in Figure 4–4.

FIGURE 4–4. Effective Reading Area



Your Keysheet specifies the maximum and minimum distances allowed between barcode labels and the scanner. You must install the scanner such that the labels will pass within these limits.

Depth of Field

The *depth of field* is the difference between the maximum and minimum distances at which barcodes can be read.

In general, depth of field will be equal to about 50 percent of the reading range for barcodes with small X dimensions, and up to about 70 percent for barcodes with large X dimensions.

Optical Throw

The *optical throw* is the distance from the scanner's window or, on some scanners, from a datum line on the side of the scanner, to the beginning of the depth of field. Optical throw is the distance from the scanner to the closest point at which a barcode can be read.

Reading Range

The *reading range* is the maximum distance from the scanner at which barcodes can be read. The reading range is equal to the sum of the optical throw and the depth of field.

Height of Scan

The *height of scan* is the length of the laser scan line at the minimum reading distance. SICK Auto Ident, Inc. scanners support a constant height of scan, as listed on your Keysheet and illustrated in Figure 4–4.

Scan Angle

The *scan angle* is the maximum angle generated by the laser beam during scanning, as illustrated in Figure 4–4.

Barcode Orientation

Barcodes can pass a scanner in one of two possible orientations:

- Ladder
- Picket Fence

Ladder

In *Ladder* orientation, the bars and spaces are parallel to the direction of travel of a box on a conveyor, making the bars in the code resemble the rungs of a ladder as shown in Figure 4–5. When the scanner is installed such that the laser beam scans in the vertical direction, it can read ladder-oriented barcodes.

FIGURE 4–5. Ladder Orientation

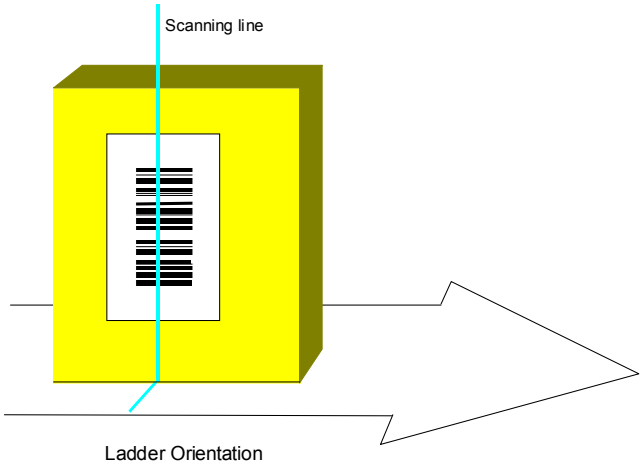
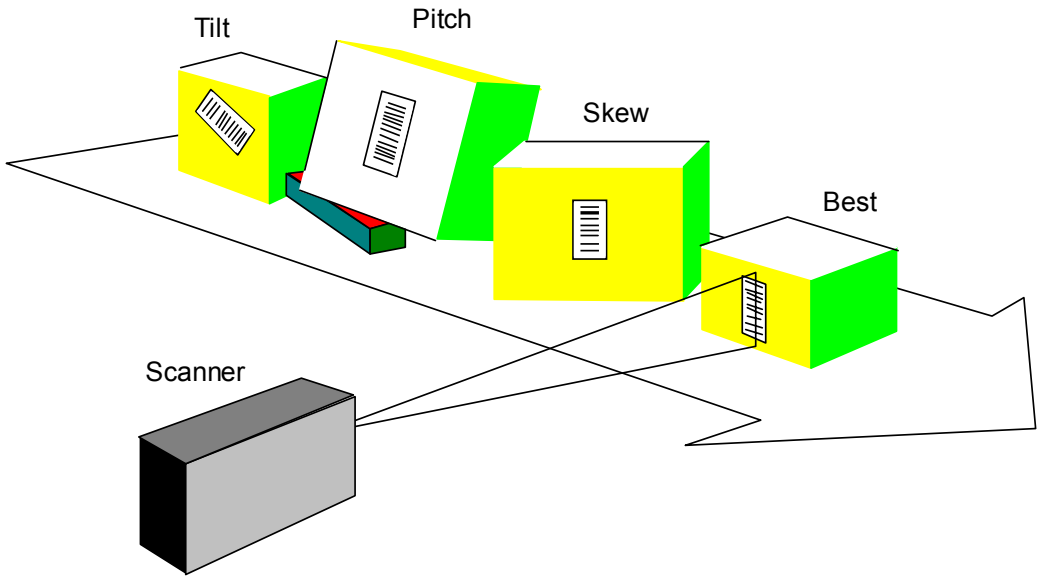


Figure 4–6 displays a conveyor that carries boxes containing ladder-oriented barcodes that exhibit tilt, pitch and skew. The first three boxes from left to right are incorrectly positioned for optimal barcode reading.

It is rare when a barcode is aligned exactly perpendicular to the scanning beam. Accordingly, three barcode orientations must be handled, all of which can reduce the quality of barcode reading.

FIGURE 4–6. Ladder Orientation Displaying Tilt, Pitch, Skew, and Best



Picket Fence

In *picket fence* orientation, the bars and spaces are perpendicular to the direction of travel of a box on a conveyor, making the bars in the code resemble the pickets of a fence as shown in Figure 4–7. When the scanner is installed such that the laser beam scans in the horizontal direction, it can read picket fence-oriented barcodes.

FIGURE 4–7. Picket Fence Orientation

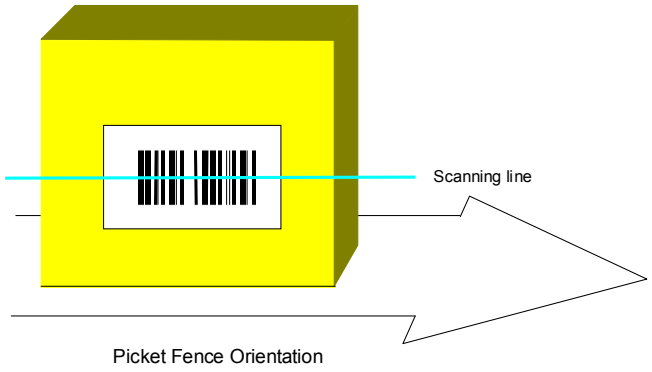
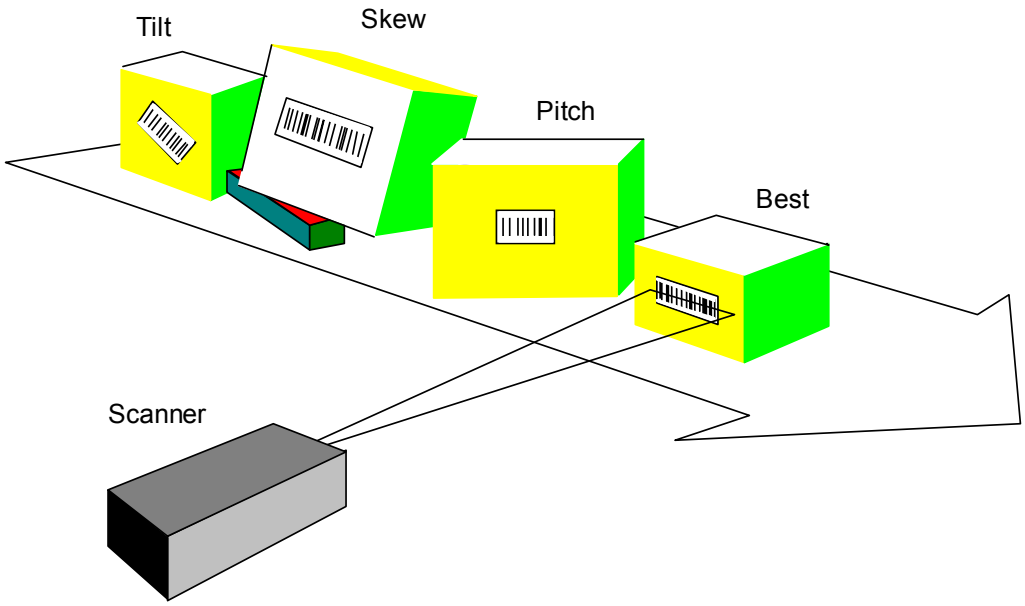


Figure 4–8 displays a conveyor that carries boxes containing picket fence-oriented barcodes that exhibit tilt, pitch and skew. The first three boxes from left to right are incorrectly positioned for optimal barcode reading.

It is rare when a barcode is aligned exactly perpendicular to the scanning beam. Accordingly, three barcode orientations must be handled, all of which can reduce the quality of barcode reading.

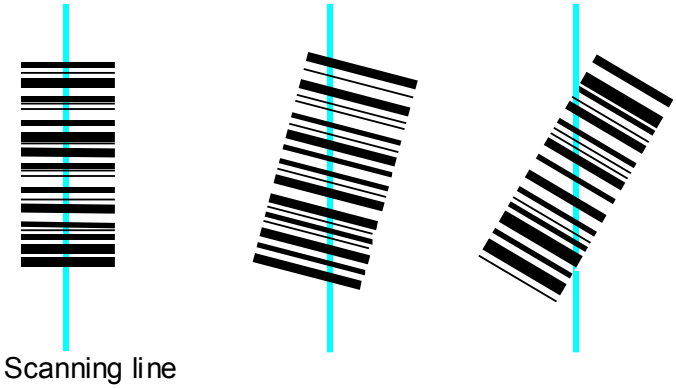
FIGURE 4–8. Picket Fence Orientation Displaying Tilt, Skew, Pitch, and Best



Tilt

Tilt is the rotation of a barcode about an axis that passes through the barcode perpendicular to its plane. As shown in Figure 4–9, the barcode cannot be read by a single laser scan when the tilt becomes so great that the beam does not cut across all of the bars and spaces during one sweep.

FIGURE 4–9. Varying Degrees of Tilt



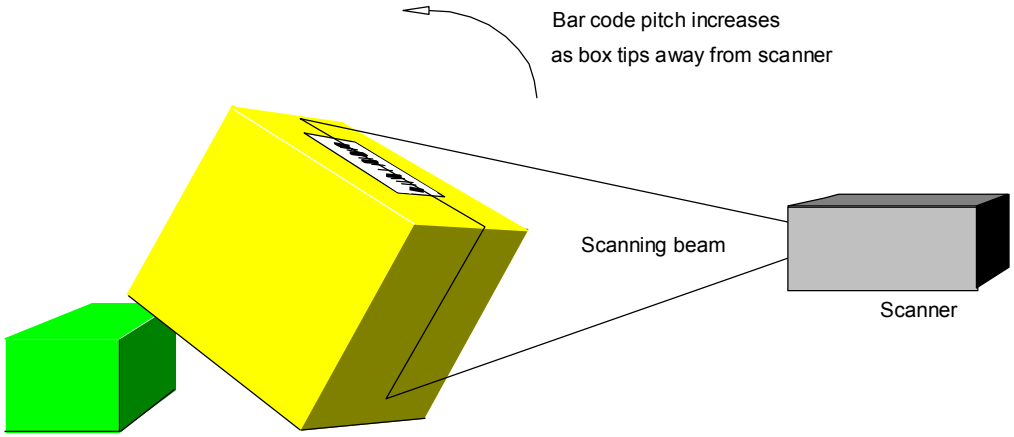
If your scanner is equipped with optional CIX technology, then greater tilt can be handled. As long as the scanner beam passes through at least one complete character in the barcode on each scan, the scanner can stitch the pieces of code obtained from multiple scans together until a complete decode is obtained.

If your scanner is not equipped with CIX technology, then a successful read and decode of a barcode can only be obtained if the scanning beam crosses every bar and space in the barcode in a single sweep. If even one bar or space is missed, a No Read will result. Figure 4–9 shows the barcode on that the right is tilted so far that CIX technology is required to read it.

Pitch

Pitch is the rotation of the barcode about an axis parallel to and in the plane of the bars and spaces, as shown in Figure 4–10. The greater the barcode pitch, the thinner the bars and spaces will appear to the scanner. In addition, the length of the barcode will appear to grow shorter. At some angle, the scanner will no longer be able to measure the widths of the bars and spaces in the code.

FIGURE 4–10. Pitch Orientation



Skew

Skew is the rotation of the barcode about an axis perpendicular to the bars and spaces and in the plane of the code. The greater the skew, the less height the barcode appears to have to the scanner. At some angle, the height will become too small for the scanner to read.

Number of Scans per Barcode

Regardless of which orientation barcodes are in when they pass the scanner, the scanning application should be constructed such that the scanner makes some minimum number of successful scans while the barcode is within the reading area. For example, the application might be constructed such that a barcode will be scanned not less than five times before it passes out of the scanning zone.

Ladder and *Picket Fence* codes have different number-of-scans equations, as shown in Figure 4–11 and Figure 4–12.

FIGURE 4–11. Ladder Equation

$$\text{Scans/Barcode} = \text{Scan Rate} \times \frac{\text{Bar Height}}{\text{Conveyor Speed}}$$

FIGURE 4–12. Picket Fence Equation

$$\text{Scans/Barcode} = \text{Scan Rate} \times \frac{\text{Height of Scan} - \text{Length of Code}}{\text{Conveyor Speed}}$$

These equations assume that the barcode is not tilted and that the units of measurement are consistent.

Presence Detection

Presence Detection is the method normally used to tell the scanner when to read a barcode. This is usually implemented by a using a photoeye to sense the light returned by a reflector mounted on the opposite side of the conveyor. When an object on the conveyor blocks the light, a signal from the photoeye instructs the scanner to begin reading. When the object no longer blocks the light, a signal from the photoeye instructs the scanner to stop reading and to transmit the barcode data. Ideally, the presence signal will be on from just before the barcode passes in front of the scanner beam until just after it passes. If no barcode is read during the presence cycle, a No Read message is usually sent to the host computer or controller.

Presence Detection can sometimes be implemented with a single photoeye. It is often possible when the scanner is reading ladder-oriented codes with a vertical scanner beam and sometimes possible when reading picket fence oriented codes with a horizontal scanner beam.

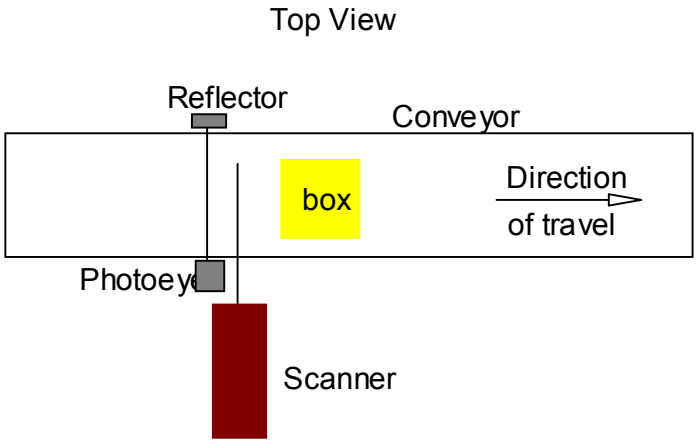
When reading picket fence codes, two photoeyes in a zone presence configuration should be used if the usable scan zone (the scanner's height of scan) is longer than the boxes to be scanned. In this configuration, a photoeye is typically located at each end of the scan zone. The presence cycle begins when a box first blocks the inzone photoeye and ends when the box no longer blocks the outzone photoeye.

This configuration makes the scan zone longer than is possible using a single photoeye, and it takes advantage of the increased reading area made possible by the horizontal scanning line. When using zone presence detection, it is imperative that only one box be in the scanning zone at a time so that a barcode will always be associated with its corresponding box.

Single Presence

In the *Single Presence* configuration, one photoeye detects each box and signals the scanner to begin reading. The scanner is normally set to transmit the decoded barcode data, if any, when the photoeye signals that the box is no longer detectable. Figure 4–13 shows the scanner mounted such that the laser beam scans vertically, and the barcodes have a ladder orientation.

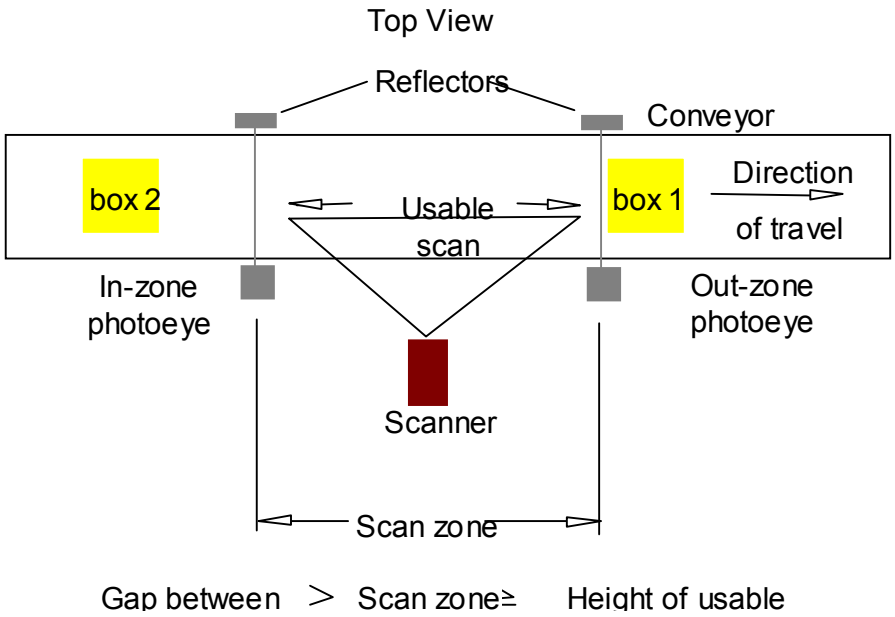
FIGURE 4–13. Single Presence Detection



Zone Presence

In the *Zone Presence* configuration, an inzone photoeye signals the scanner that a box has entered the scan zone and an outzone photoeye signals that the box has left. The scanner is normally set to transmit its decoded barcode data after the box has left the zone. Figure 4–14 shows the scanner mounted such that the laser beam scans horizontally and the barcodes have a picket fence orientation.

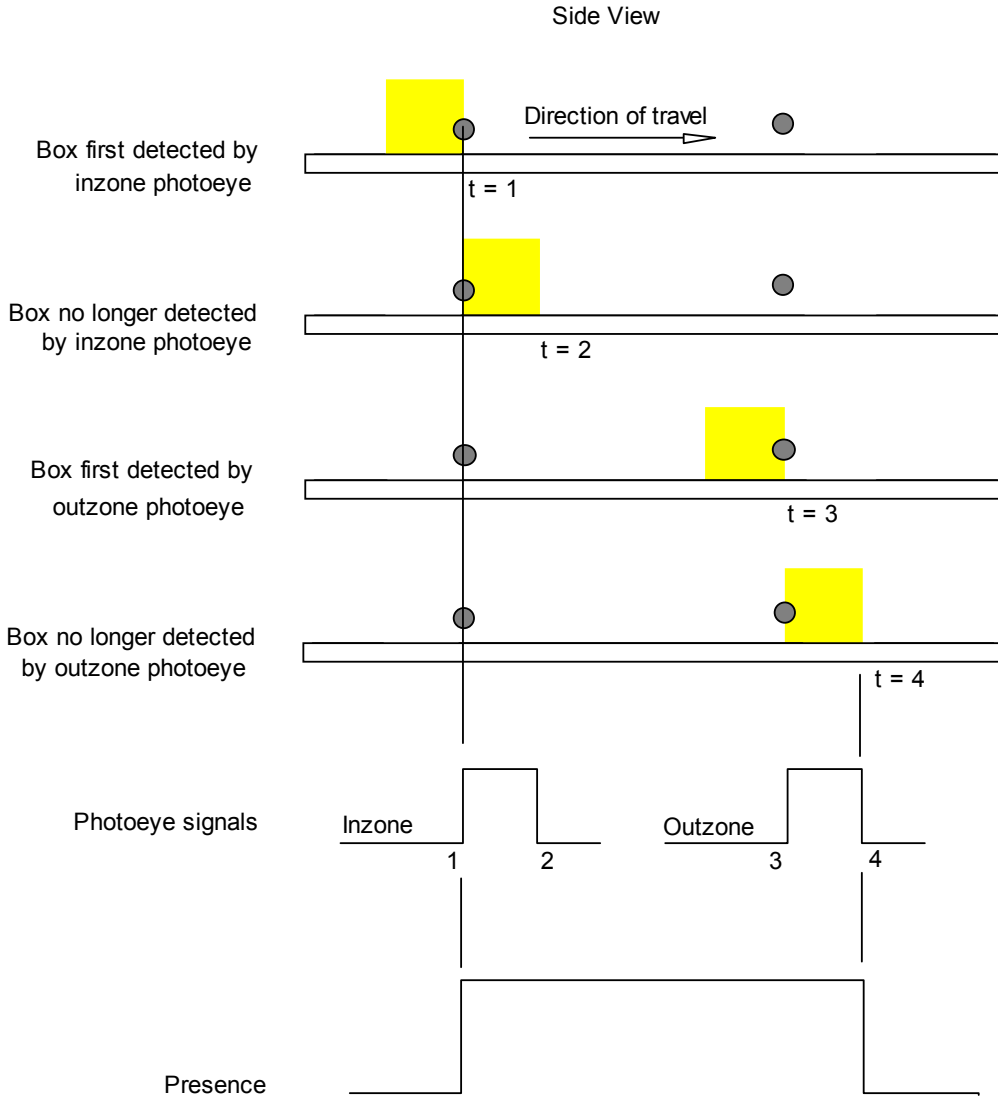
FIGURE 4–14. Zone Presence Detection



Zone Presence is useful in scanning applications where picket fence codes are affixed to boxes whose length is less than the scanner's height of scan. *Zone Presence* allows the scanner to read the barcode throughout the entire height of scan.

Figure 4–15 shows a scanner attempting to read a barcode from the time that the box is first detected by the inzone photoeye until the time that it is no longer detected by the outzone photoeye. The timing diagram illustrates how zone presence extends the time that the scanner has to read barcodes.

FIGURE 4–15. Zone Presence and Extended Read Time

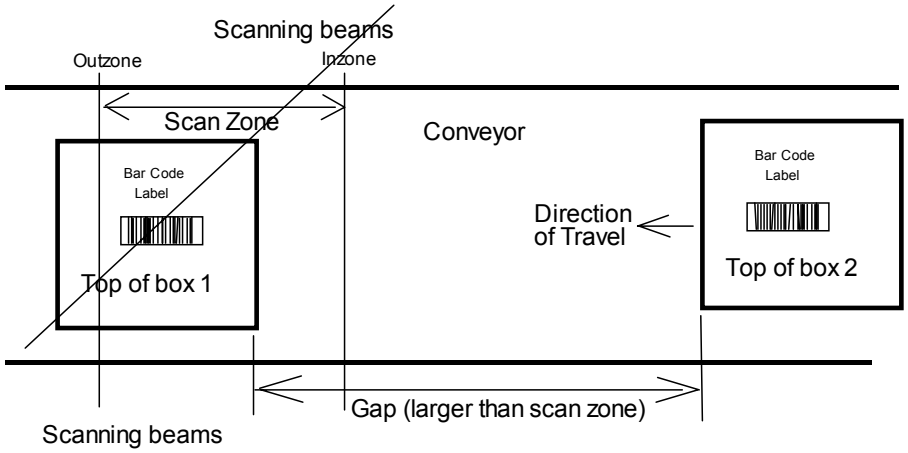


Gap Tracking

Gap Tracking, also called box or package tracking, is a technique that allows a scanner to keep track of the locations of up to eight boxes while they are in the scan zone. It allows the scanner to correctly associate each barcode with its box, even if a scan line sweeps across more than one box and barcode. Gap tracking is required whenever there may be more than one box at a time in the scan zone.

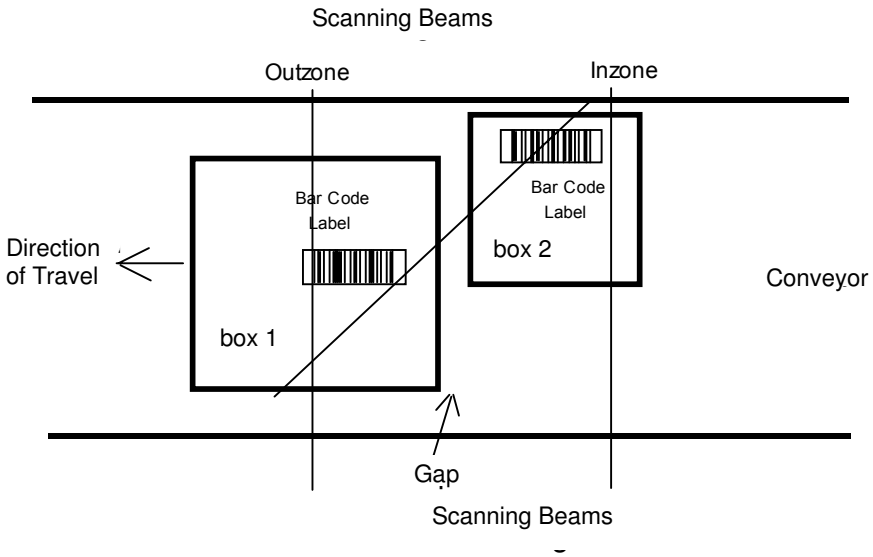
In Figure 4–16, the gap is larger than the scan zone. Box 1 will leave the scan zone before box 2 enters the zone. In this situation, gap tracking is not needed.

FIGURE 4–16. Gap Tracking—Not Required



In Figure 4–17, gap tracking is required because two boxes and their barcode labels are in the scan zone at the same time. If gap tracking is not implemented, the scanner may assign the barcode to the wrong box.

FIGURE 4–17. Gap Tracking—Required



The minimum expected gap between boxes has been specified by the requirements of your application. Refer to your Keysheet.

To avoid problems created by insufficient gaps between barcodes or boxes, you may have to install additional sensors and devices. Refer to your Keysheet to determine if your application requires this additional equipment.

For more information about gap tracking, refer to parameters 700-725 in the *Scanner Parameters Reference Guide* and to “Gap Tracking Diagnostics” on page 8-22.

Additional Inputs

The scanning beams cover an area that extends along the direction of travel of the conveyor as well as across the conveyor. Because of this extended area, several additional inputs to the scanner may be necessary for it to read every barcode and to associate the correct barcode with each box. With additional inputs, the scanner may be able to read labels on up to eight boxes in the scan zone simultaneously. The additional inputs are tachometer and height-detecting photoeyes.

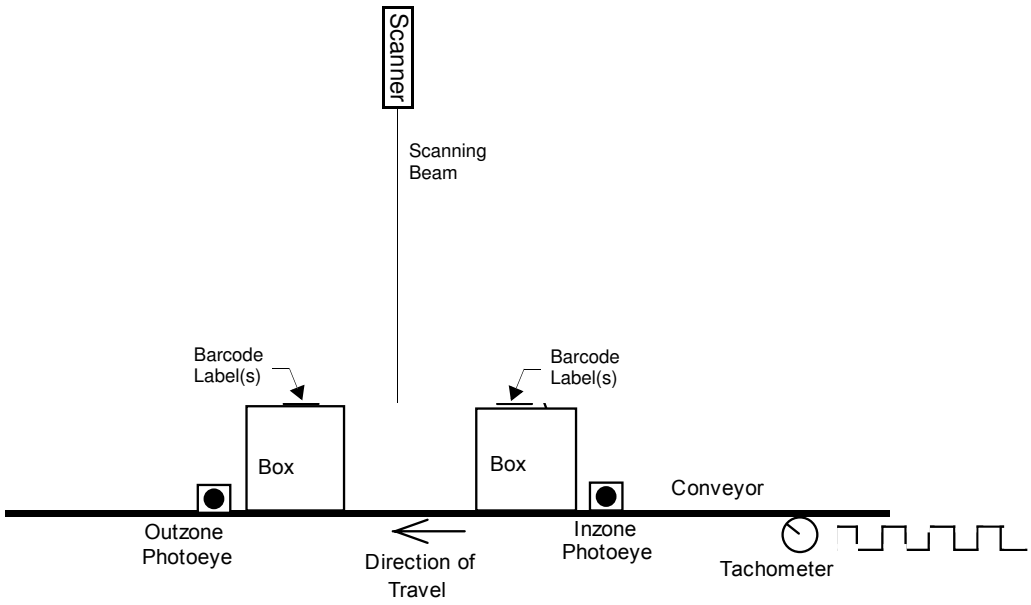
These additional inputs may not be needed for every application. Your application has been carefully analyzed from the data you provided on a technical questionnaire for your application. SICK Auto Ident, Inc. has defined the scanner configuration and input requirements from that data. You can find the resulting input requirements for your application on the Keysheet inside the front cover of this manual.

Tachometer Input

A tachometer is a pulse generator attached to some driven part of the conveyor such as a roller shaft. Pulses from the tachometer measure conveyor movement. The tachometer should output to the scanner one pulse for each 0.2 inches or less of movement at a rate no greater than 1000 pulses per second.

As illustrated in Figure 4–18, the tachometer is used to measure the distance that each box travels. The scanner uses this information, in conjunction with the inzone and outzone photoeye signals, to keep track of the exact position of each box while it is in the scan zone.

FIGURE 4–18. Gap Tracking—Tachometer Used



In some applications that use a fixed conveyor speed, gap tracking can be implemented without the use of a tachometer. Refer to parameters 718 FIXED BOX LEN and 719 FIXED CONV SPD in the *Scanner Parameters Reference Guide* for more information.

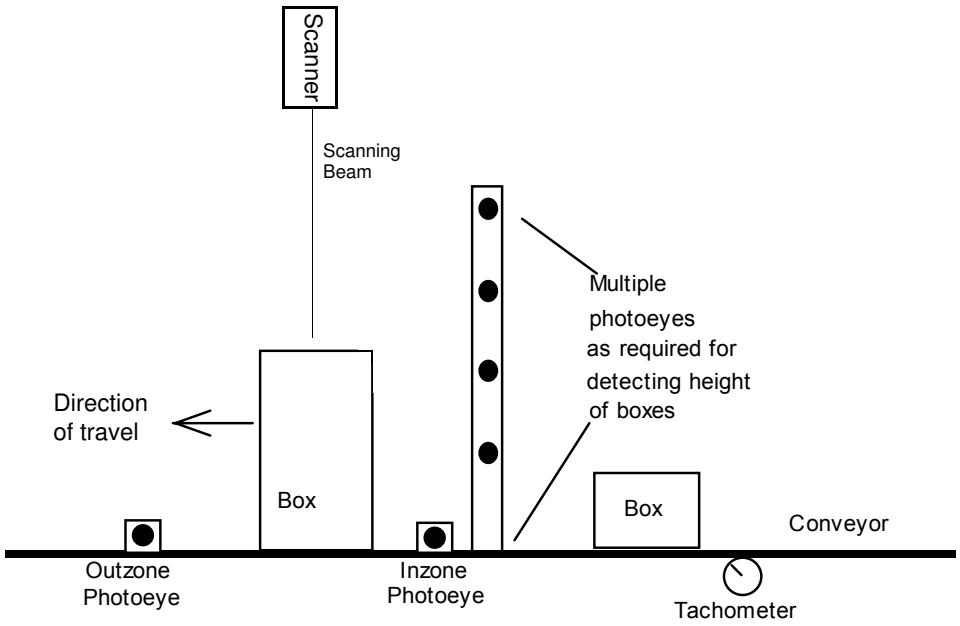
Height Sensing Photoeye Inputs

Additional inputs to the scanner may be necessary to allow the scanner to distinguish barcodes on tall boxes from barcodes on preceding or following short boxes.

If the scanner is provided with height sensing photoeye information as boxes enter the scan zone, the scanner can distinguish between barcodes on adjacent boxes of different heights. Height sensing tells the scanner where to look for a barcode in the vertical dimension. Using height sensing and the tachometer, the scanner can correctly associate each barcode with its corresponding box.

Figure 4–19 illustrates the use of height-sensing photoeyes. The number of height-sensing photoeyes and their spacing above the conveyor depends on the minimum gap between boxes, the height variations between boxes, and the distance from the scanner to these boxes. Height-sensing photoeyes are specified on the Keysheet for your application.

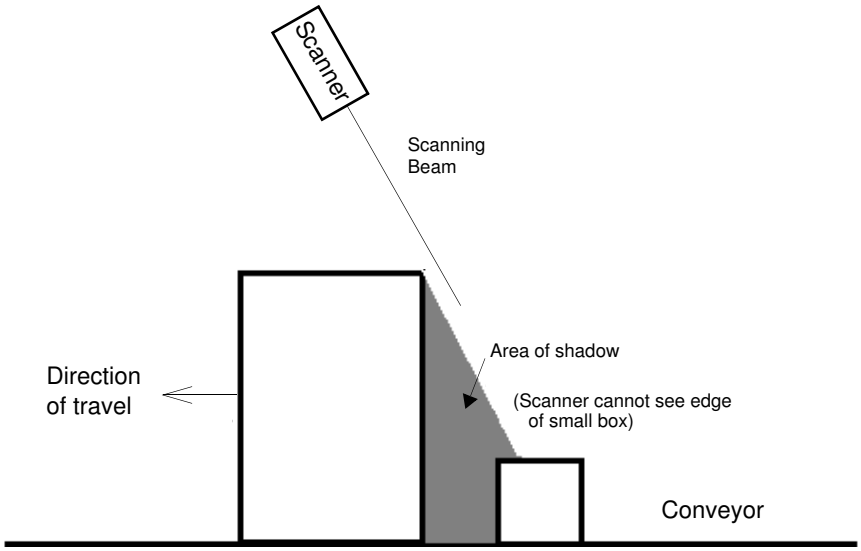
FIGURE 4–19. Height Detection Photoeyes



Some conveyor systems may carry a mix of tall boxes and short boxes. If more than one box may be in the scanning zone at the same time, you should design your conveyor system to avoid small gaps between boxes. The minimum gap is specified on the Keysheet of your application.

Small gaps may cause a tall box to block or shadow the scanning beam from reading a barcoded label on the preceding or following short box as shown in Figure 4–20. If gaps allow this shadowing effect, place your label at the center of the top of the box to minimize this problem.

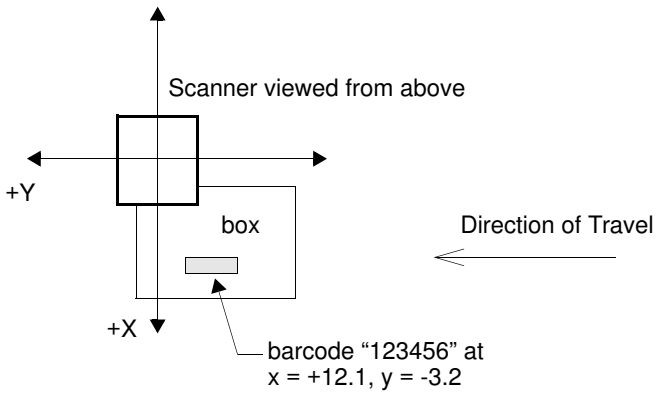
FIGURE 4–20. Tall Box Shadowing a Short Box



X & Y Coordinates

The scan zone is mapped from above by an x-axis and a y-axis. The origin is the center of the scanner. Box and barcode movements are always in the +y direction. The +x axis is in the direction shown in Figure 4–21.

FIGURE 4–21. +X Axis Direction



A box is always considered to be as wide as the conveyor because the presence photoeyes can detect the leading and trailing edges of a box but not determine its width. The coordinate system does not change if the scanner is rotated over the conveyor.

Each barcode read has an x, y position in this coordinate system at all times. When gap tracking is in use, this position is continually compared with the positions of the leading and trailing edges of each box currently in the scan zone. If the barcode’s y-coordinate falls between the edges of a box, the barcode read will be associated with that box.

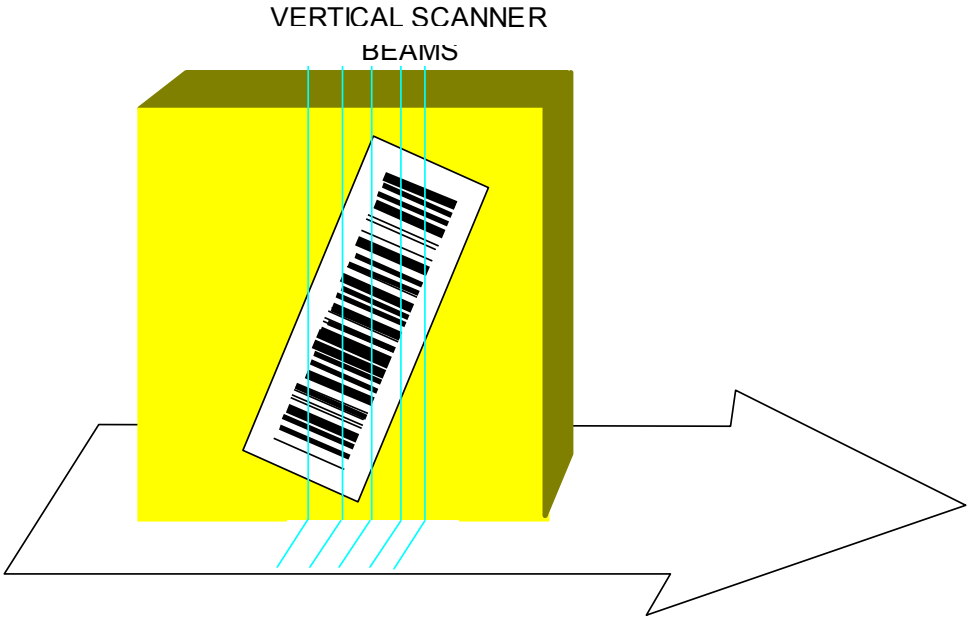
The x, y position of a barcode may also be used to tell it apart from another barcode that is otherwise non-unique, i.e., cannot be distinguished by its symbology, length or its first one or two characters. If two barcodes are at two different positions on the same box, then the scanner can read them as different barcodes.

CIX Technology & Barcode Requirements

If a scanner has been factory-configured to incorporate optional Code Information eXtraction (CIX) technology, it can read barcodes tilted at extreme angles. CIX technology enables the scanner to read segments (pieces) of barcode on successive scans and then *stitch* the segments together to form the entire code.

Figure 4–22 illustrates multiple scans reading different pieces of the barcode. The barcode is moving past a single repeating scan beam.

FIGURE 4–22. Multiple Scans of a Moving Barcode

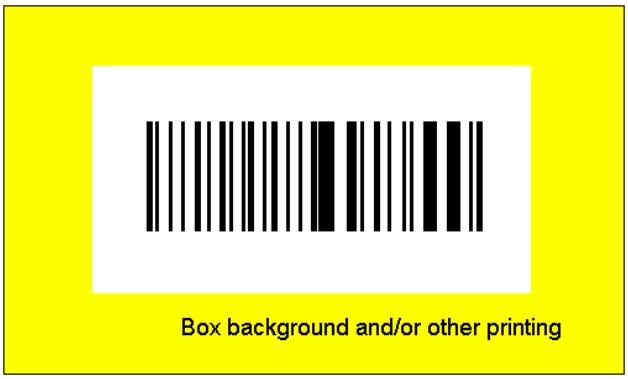


CIX decoding requires complex analysis and testing of the data found between quiet zones. Pieces of the code from every scan must be stored and analyzed, and the complete barcode cannot be decoded until the data from all of the several scans is *stitched* together and tested to see whether or not the resulting code passes all of the specified decoding requirements.

Unfortunately, barcode label standards do not yet specify a quiet zone all around the code. The standards specify quiet zones only at the ends of the code, since the technology for scanning and decoding a code in segments had not been developed at the time that the standards were adopted. Therefore, some barcode labels are unsuitable for use in CIX applications.

When using CIX technology, a 10X quiet zone on all four sides of the barcode is desirable. Codes tested without a quiet zone surrounding the entire code have demonstrated reduced readability compared to codes with the quiet zone. The best example of a barcode with an adequate quiet zone is shown Figure 4–23.

FIGURE 4–23. 10X Quiet Zones on All Sides



In some cases, codes include *human readable* alphanumeric text next to the code. This text allows people to manually read the barcode. When this human-readable text is necessary, it is better to have the quiet zone between the barcode and the human readable text as shown in Figure 4–24.

FIGURE 4–24. With Human Readable Text Outside of 10X Quiet Zone

If this spacing is not possible, then the quiet zone should be located outside of this text data, with the text limited to only one line, as shown in Figure 4–25. The scanner can usually accommodate this extraneous text if it has been programmed to expect such a pattern, and if the amount of such text is minimal. The amount of this text must be relatively small when compared to the real barcode scanned in any given scan.

FIGURE 4–25. One Line of Human Readable Text Within 10X Quiet Zone

Other printing along the edge of a code, such as the bearer bars used with codes printed on corrugated boxes in the UPC Shipping Container Code, for instance, may also be accommodated.

To accommodate these bearer bars, there must be a quiet zone outside of the printing. The printed area should also be relatively small when compared to the code area scanned in the same scan as the printing. Other human-readable printing or identifying marks on the label should be printed outside of the quiet zone surrounding the barcode, as shown in Figure 4–26.

FIGURE 4–26. With Small Bearer Bars Within 10X Quiet Zone

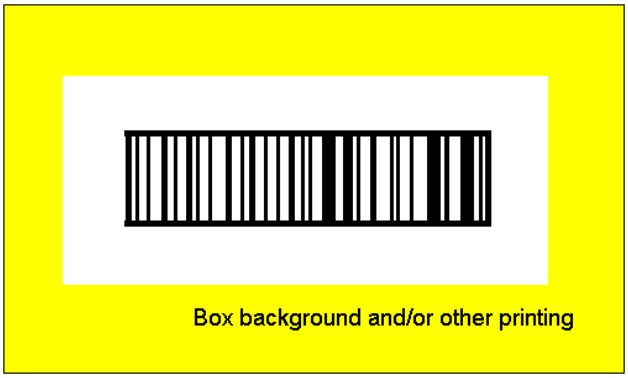


Figure 4–27, Figure 4–28, and Figure 4–29 are examples of barcodes that may not read reliably.

FIGURE 4–27. Reduced Performance Barcode—Example 1

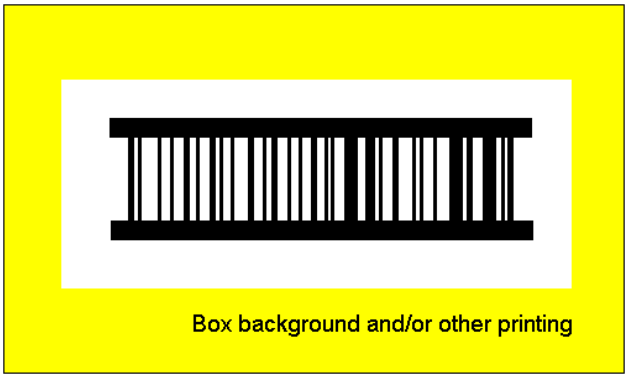


FIGURE 4–28. Reduced Performance Barcode—Example 2

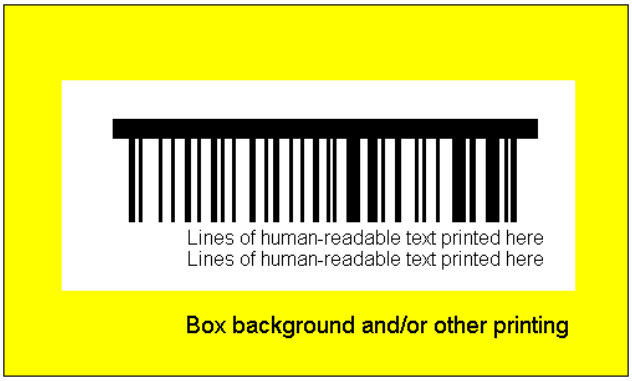
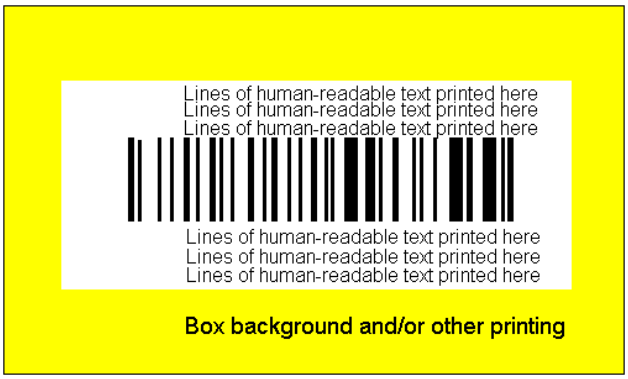


FIGURE 4–29. Reduced Performance Barcode—Example 3



Processing Barcode Data

After potential barcode data has been framed between leading and trailing quiet zones, it is exported to the selected decode software routines in the scanner for further analysis and possible decoding. The scanner then attempts to match the data with one of the user-defined *decode format strings*.

For maximum decoding efficiency, the *decode format string* should contain only the symbologies and label lengths you want to decode.

In scanning applications where a variable number of ASCII characters are encoded in each barcode, the Minimum Label Length and Maximum Label Length parameters should be set.

Pre-sorting of fixed-length barcodes occurs in much the same way. Any barcode that does not meet the length restrictions will be rejected before decoding is attempted.

Data Transmission

Decoded barcode data is transmitted to the host computer or to C program control in a standard format or presentation.

The output message sent from the scanner has the following format:

prefix DATA suffix 1 suffix 2

The prefix, suffix 1 and suffix 2 characters are optional. They may be selected by setup parameters to be any ASCII characters.

A typical message might look like this:

123456CRLF

where:

123456—Decoded data from a six-digit barcode (no prefix character has been selected)

CR—The single ASCII character for Carriage Return (suffix 1)

LF—The single ASCII character for Line Feed (suffix 2).

The scanner's reading can be controlled by a presence signal from a photocell or other control device. If presence control has been selected and no barcode was read during the presence cycle, then the output message will be sent with a single ASCII *?* character as the data field. (*?* means no label.) A no label and a no read message (variable length codes) for the above example would be:

?CRLF

If you have selected reading fixed length codes, then the number of *?* will equal the number of characters you selected to read. For example, if you selected six characters, then the no read message will be:

??????CRLF

The default no-read character *?* can be changed to any other ASCII character, using parameter 056. Refer to the *Scanner Parameters Reference Guide* for more information.

When Output Message is Sent

You can select setup parameters to send the output message at any one of three times in the reading cycle.

1. If the scanner's reading is controlled by a presence signal from a photocell or other control device, the output message can be sent at the end of the presence cycle.

   This is the normal and preferred method. It has the advantages of control of the reading cycle, scanning of the entire labeled object before output message transmission and transmitting only one message per box for synchronization and counting by the receiving device.

2. If presence control is not possible, the output message can be sent after the barcode is no longer under the scanning beam, allowing it to be scanned and decoded as many times as possible, to provide reading redundancy and reliability. This method may cause problems with multiple transmissions per label.

3. The output message can be sent after a selectable minimum number, or threshold, of decodes have occurred.

   This technique is least preferred because it forces transmission prior to decoding all possible scans of the label. It should only be used when an immediate response is required. For example, it allows an operator holding a box such that its barcode is under the scanner to move the box and set it down as soon as the barcode is decoded.

Introduction to Scan Tunnel Applications

A scan tunnel consists of a group of barcode scanners arranged in an array around a conveyor such that a barcode located on any surface of a box moving on the conveyor can be read.

In this explanation, we call the objects moving on the conveyor boxes, but they could just as well be suitcases, parcels, trays or other objects with barcode labels on them or on attached tags.

Some of the variables which must be considered when designing a scan tunnel are: size and shape of boxes; speed of conveyor; number of box sides to be scanned; barcode characteristics; and distance limitations, if any, on scanner placement.

CiMAX 7800 scanners with auto-focusing capability can be used to read barcodes on the ends of boxes as the boxes approach and leave the scan zone. Both vertical and horizontal scanning is implemented such that, with CIX technology enabled, barcodes oriented in any direction on the ends of the boxes can be read.

Either CiMAX 7800 scanner, with CIX technology enabled, can be used to read barcodes located on the tops and sides of the boxes, depending upon the requirements of the specific application.

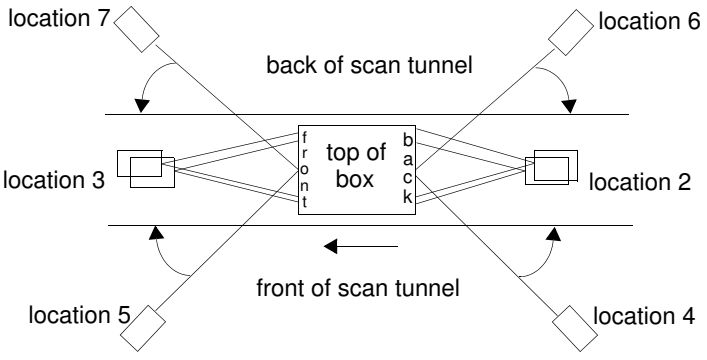
CiMAX 7850 scanners, usually installed at the main conveyor's induction lanes, and with CIX technology enabled, can be used to read barcodes located on the bottoms of boxes. The scanners are mounted below the induction lane conveyors and scan the bottoms of the boxes as the boxes move across the gap between conveyors.

In the following sections, two uses of the CiMAX 7800 and one use of the CiMAX 7850 are illustrated. The illustrations are provided as examples only - each scan tunnel must be individually designed after evaluating the user's specific requirements.

CiMAX 7800 Scanning Front/Back Boxes

Figure 4–30 illustrates how CiMAX 7800 scanners can be mounted. It shows the areas each can scan when used to read barcodes in a scan tunnel.

FIGURE 4–30. Scanning Front & Back of Box



The conveyor moves from right to left when viewed from the front of the scan tunnel.

Locations 2 and 3 may have two scanners, mounted one above the other. The upper scanner in location 3 scans the upper area of the front of the box. The lower scanner in location 3 scans the lower area of the front of the box.

Locations 5 and 7 are also divided. The scanner in location 5 scans the right-hand area of the front of the box. The scanner in location 7 scans the left-hand area of the front of the box. The horizontal laser beams overlap the vertical beams.

Figure 4–31 shows the sections of the box fronts covered by scanners 7, 3 and 5. Scanners 6, 2 and 4 cover the box backs in the same way. All mounting angles are shown as 45° skew, 0° pitch and 0° tilt. Other skew angles are possible, with appropriate adjustments of parameter 727 TUNNEL MTG ANGLE.

FIGURE 4–31. Scanner Coverage Identification

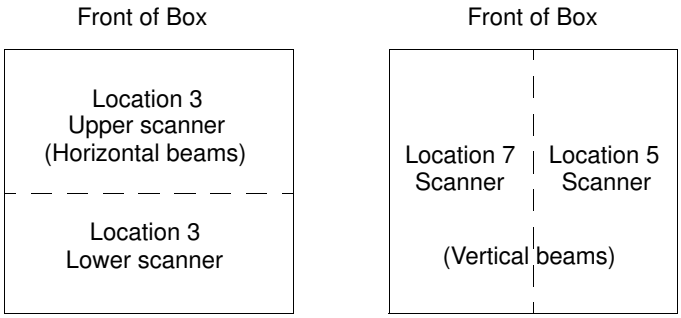
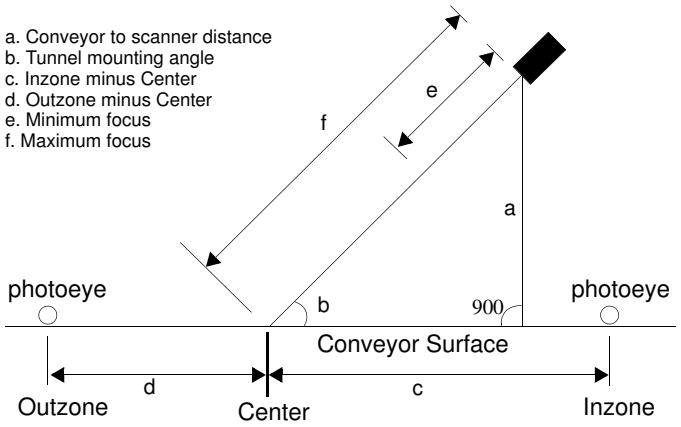


Figure 4–32 shows, in more detail, the mounting geometry of a typical scanner relative to the conveyor.

FIGURE 4–32. Mounting Geometry of Typical Scanner



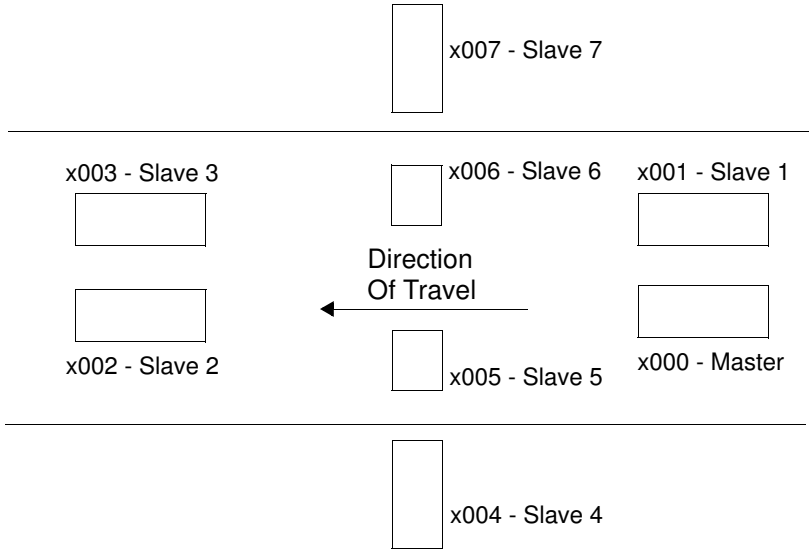
Whenever a scanner is mounted to read at other than 90°, as illustrated in Figure 4–32, it must have parameter 700 TRACKING set correctly to see barcodes. Refer to parameter 700 TRACKING in the *Scanner Parameters Reference Guide* for more information.

Parameter 728 FRONT/BACK ONLY can be set such that scanners setup to read barcodes on the fronts and backs of boxes will reject barcodes read on the top and sides.

CiMAX 7800 Scanning Front, Back, Top & Side Boxes

Figure 4–33 illustrates how CiMAX 7800 scanners can be mounted to read barcodes on the tops and sides, as well as the fronts and backs, of boxes in a scan tunnel. Slaves 004 and 007 are set up to read the sides, slaves 005 and 006 to read the tops, slaves 002 and 003 to read the fronts and slave 001 and master 000 to read the backs.

FIGURE 4–33. Scanning Front, Back, Top and Side of Box

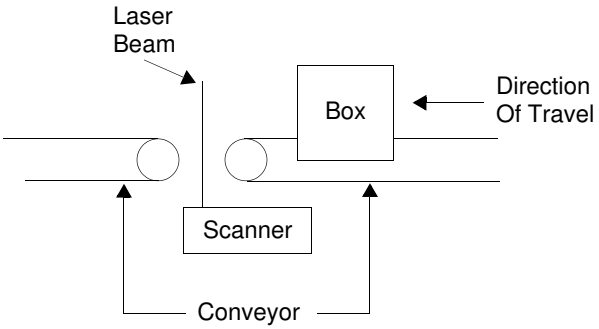


CiMAX 7850 Scanning Bottoms of Boxes

Figure 4–34 illustrates how a CiMAX 7850 scanner can be mounted to scan the bottom of boxes as they move across an induction line conveyor gap. The gap is shown oversize for clarity.

If the orientation of the barcodes on the boxes can not be controlled, the same barcode must be printed both vertically and horizontally on each label (and on both sides, if a baggage tag) such that, with CIX technology enabled, barcodes oriented in any direction on the bottoms of the boxes can be read by the scanner.

FIGURE 4–34. Scanner Viewing Bottom of Box



Scan Tunnel Control

The scan tunnel software runs in a PC under Windows NT, for its real-time processing speed. It coordinates communication among all of the scanners, collects the transmissions from the group and transmits the data associated with each specific box to a host computer.

The data is transmitted to the host at a time determined by an input signal from the scanner system, to allow the host to associate each data transmission with a specific box located at a specific position on the moving conveyor.

The tunnel software also provides diagnostic capability for the scanners and real-time monitoring of scanner performance.

Interface Units

Interface Units, which provide power and interface connections for up to six scanners, are available, to reduce the amount of system wiring required.

Additional Information

For additional information about specific scan tunnel applications, consult your Keysheet or contact SICK Auto Ident, Inc. directly.

5

CHAPTER 5 *Startup & Operation*

This chapter describes how to power-up, how to use the Setup port and a terminal to monitor operation, how to enter the Setup and Diagnostic modes and how to change parameters.

Serial Communications Ports

The CiMAX 75xxA/76xx Scanner has a Terminal port that can also be used as the Setup port. Refer to "Communications Inputs & Outputs" on page 3-10 for connector and pin assignment information.

The port designated for Setup can be used to monitor operation, to change parameters and to perform diagnostic tests. Any RS-232 ASCII terminal, a PC running terminal software or a CiMAX 1400 Hand-Held terminal, can be connected to the Setup port. When connected, the terminal becomes the display and keypad for the scanner.

It is necessary, in some master-slave configurations, to take extra steps to tell the scanner that a setup terminal is connected to the Terminal port, in order to enter the Setup/Diagnostics mode. These extra steps are detailed in parameter 002 OPMODE in the *Scanner Parameters Reference Guide* for more information and in Chapter 8, "Diagnostics".

The Host and Terminal ports can also be used to send commands directly to the scanner's operating system. This direct transmission bypasses the menu-driven user interface associated with the Setup port. Direct transmission is useful for remote setup from a host computer. The commands are described in Chapter 7, "Communication Modes".

The Starnode port allows the scanner to be connected to an EIA-485 Starnode Local Area Network. This port may be used with the CiMAX 1400 Hand-Held terminal.

The CiMAX 75xxA also has an optional Ethernet connector and port. Most functions that can be performed through the serial ports can also be performed through the Ethernet and Starnode ports.

Power Up

When you power up or reset the scanner, the SETUP LED will flash for a short time. During this time, the scanner will send several status messages to the Setup port.

Status Messages

If you have a terminal connected to the port, you will be able to read the messages. The first message displayed is

WAITING FOR STABLE MOTOR SPEED...

From a stop, the motor may take as much as 10 seconds to come to its set speed and stabilize. If the scanner is reset when the motor is already up to speed, motor stabilization may take as little as three seconds.

The laser control software prevents the laser from turning on until the motor speed stabilizes above a minimum speed of 100 s/s (scans/second), and will turn the laser off if the motor speed drops below that minimum speed. The motor speed must then re-stabilize above the minimum speed before the laser will turn on again.

The laser will not turn on until the motor speed has stabilized. If the motor does not stabilize within one minute, the software will turn on without turning on the laser. During the one minute waiting period, the software will display the WAITING FOR STABLE MOTOR SPEED... message.

Table 5–1 shows the minimum acceptable scan (motor) speeds associated with each of the DSP clock rates described in 009 CLOCK RATES in the *Scanner Parameters Reference Guide*.

TABLE 5–1. Minimum Acceptable Scan Speeds

DSP Clock Rate, MHz	Motor Speed, scans/second *
	75A, 76, 78
40	610
32	488
25	380
20	305

* Motor speed settings below these thresholds will result in the DSP bar timing being reduced.

You will then see a startup message similar to the following:

```
CIDSP Download Complete
No network card detected
PREBOOT VX.X FLASH ROM
BOOT MONITOR VX.X
CIDSP-Non-Stitching Auto-distinguish (5 symbologies) for Scanner: Ver X.X
TPU Functions Ver X.X
CiMAX 7500 Ver. X.X
***Warning: Checksum 0, NV RAM Defaults Restored***
(C) 1994-2000 CiMATRIX CANTON, MA. ALL RIGHTS RESERVED
256K RAM
Main uP:25MHz,DSP:40MHz (bar timing:20MHz)
NEW ROM -- RAM CLEARED
INITIALIZING FILE SYSTEM
        32 Kb File System
        32 Kb available to User Program
GAP TRACKING DISABLED
NEED TERMINAL #
```

The lines in the message have the following meanings:

- The first line indicates booting is complete.

- The network card detection line indicates that the hardware has detected a specific network card installed. This will be displayed by the following responses:
  - No network card detected
  - Ethernet card detected
  - DeviceNet/SDS card detected

Note: Note: This line is displayed in CiMAX 75xxA scanners only.

- The PREBOOT and BOOT lines contain the version number of the FLASH download program. You can determine the software versions installed without rebooting. Refer to Chapter 7, “Communication Modes” for more information.
- The CIDSP line provides the DSP barcode decoding description and gives the version of the digital signal processor (DSP) code currently being used.
- The TPU line gives the version of the internal processor code currently being used.
- The CiMAX 7500 line gives the version number of the operating system (OS) software.
- The copyright line will only be displayed during the first power-up/re-boot after a memory clear command or, if the RAM has failed, as described in “Power-Up With Customized Values” on page 5-5 and in Chapter 7, “Communication Modes”.
- The RAM line indicates how much RAM memory is installed.
- The Main uP line indicates the processor speeds, determined by the setting of parameter 009 CLOCK RATES.

  The lines NEW ROM -- RAM CLEARED and INITIALIZING FILE SYSTEM will occur if this is the first reboot since downloading a new FLASH OS, if the structure is corrupt or if you have changed parameter 601 FILESYS. If you have changed the file system size by changing parameter 601 FILESYS, the following warning message will be displayed and a beep, followed by a delay before re-initializing begins:

  ```
  FILESYS ABOUT TO RE-INITIALIZE
  ```

  When the file system is re-initialized, all previous data will be lost. This is equivalent to reformatting a diskette. Refer to the *Scanner Parameters Reference Guide* for more information about the file system and parameter 601 FILESYS.

- The sign-on message lines, which follow the INITIALIZE message lines, will appear in the format:

  ```
  32Kb File System
  32Kb available to User Program
  ```

Parameter 601 FILESYS sets the file system size in Kb. The default is the minimum size, 32Kb. The largest size is determined by the amount of RAM installed, in either 256Kb or 1Mb blocks.

- The GAP TRACKING line indicates the setting of parameter 700 TRACKING. The default is DISABLED.

- The line NEED TERMINAL # will be displayed if a Starnode network terminal ID number (parameter 401 STARNODE TERMINAL NUMBER) has not been entered. If you are not using a Starnode network (LAN), you may ignore this message. If you are using a Starnode network, you must assign an ID number before the scanner can connect to the network.

If an ID number has been assigned, and the network connection is made, the following message will be displayed:

WAITING FOR STARNODE...
STARNODE ACTIVE

If the network connection is not made, the following message will be displayed:

WAITING FOR STARNODE...
NO STARNODE

Note: There is no corresponding message sent from the Setup port to indicate whether or not an Ethernet server has been connected. Successful connection can only be determined by the host program at the remote computer.

Power-Up With Factory Default Values

If this is the first power up or reset following a memory clear command, or if the battery-backed RAM is not holding the memory, you will see an additional copyright message:

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In addition, you will hear three ascending tones, followed by three descending tones, from the beeper (if you have connected a beeper to the I/O CONNECTOR or are using a SICK Auto Ident, Inc. Standard Interface Unit). The three descending tones are an indication that default values have been loaded.

Power-Up After Memory Failure

If you see the copyright message, it may mean that the battery-backed RAM has failed. To check the battery, restart the scanner by turning the power off, waiting a few seconds and then turning the power on again. If the scanner is still sends this copyright message, contact SICK Auto Ident, Inc. for information regarding service.

Memory Error Detection, Response & Reporting

If the checksum for the parameter area of RAM is found to be invalid after a power-down/power-up cycle, the parameters are checked for validity against their maximum and minimum values. The Decode Format Strings are also checked for valid settings.

If the checksum is incorrect but no parameter is found to be outside of its allowed range, the parameters will NOT be restored to their default values and the following message will be displayed among the sign-on messages at power-up:

Warning: Checksum Bad, Params Within Range

If any parameter is found to be outside of its allowed range, all parameters will be reset to their default values, and the following message will be displayed among the sign-on messages at power-up:

Warning: Checksum Bad, NV Ram Defaults Restored

If the memory has never been initialized, or if the default parameter values have been restored, the following message will be displayed among the sign-on messages at power-up:

Warning: Checksum 0, NV Ram Defaults Restored

Information about checksum errors can be reviewed from the host computer by invoking the ~DATA~ command. Refer to Chapter 7, "Communication Modes" for more information on this command.

Power-Up With Customized Values

If customized parameter values have been entered, or during subsequent power-ups after loading defaults, the copyright message and descending tones will not be sent. Instead, you will hear three ascending tones and the scanner will begin to operate normally.

Power-Up After Automatic Reboot

The processor frequently checks the operation of the DSPs used for barcode decoding and automatically reboots the scanner if the DSP is found not to be decoding (*sleeping*). If this happens, the following message is sent to the Setup port:

Reboot: DSP 0 found sleeping

User Interface—Parameters & Diagnostics

The CiMAX 75xxA/76xx Scanner user interface is accessed using a terminal connected to the Setup port. This allows you to change parameters and run diagnostics and calibration procedures. Refer to Chapter 8, "Diagnostics" for more information.

You can also change parameters without going through the user interface by using Host Commands. These commands can be sent over any of the communication ports, Host, Terminal or Starnode. Refer to Chapter 7, "Communication Modes" for more information.

Operating Modes

The scanner operates in three modes:

- Normal
- Setup
- Diagnostic

In the *Normal* mode, you can monitor information about the scanner's operation, including the barcode read, input and output status, and barcode quality.

In the *Setup* mode, you can set parameters to program the scanner for differing applications, including the type of terminal you are using, the barcode symbology on your labels, presence configuration, use of output relays, height of boxes and serial communications.

In the *Diagnostic* mode, you can run tests of the hardware and software to check the scanner's performance.

Normal Mode

In the Normal mode, you can program the scanner to send information such as the barcode read, the input and output status, and barcode quality, to the Host computer using a Normal mode report format. Refer to the following example showing one of the formats:

normmd_rpt =1

```
01234567890123456789
line 1   <--- label data ---> label data
line 2   (blank)
line 3   ST:01234567890123456 status
line 4   IO:87654321-87654321 inputs-outputs
```

Refer to parameter 012 NORMMD RPT in the *Scanner Parameters Reference Guide* for a description of the Normal Mode Report display.

Setup & Diagnostic Modes

Special Host commands, ?S and ?D, are used to place the scanner into the Setup or Diagnostic mode. These commands are only recognized when received at the Setup port. Refer to Chapter 7, "Communication Modes" for more information.

A beginning and ending message character must frame the command. If parameter 403 MSGCHAR has not been changed from its default value of ~, type the commands:

~?S~ (tilde, question mark, S, tilde) to enter the Setup mode.

~?D~ (tilde, question mark, D, tilde) to enter the Diagnostic mode.

You can also enter the Setup and Diagnostic modes over the Starnode network. The Starndem program can be used in a rudimentary fashion by manually sending the appropriate messages. To enter Setup or Diagnostics from Starndem, or any program controlling the Starnode network, send a *?S* or a *?D* message to the terminal. It will respond with the first line in the menu.

Use a command of *none* and begin each message with */M*. To exit the menu, send */ME*, with the *E* indicating Exit.

You have exited the Setup/Diagnostic mode on the Starnode network when the message EXIT SETUP or EXIT DIAGNOSTICS is sent from the Starnode port when *E* is received.

Resetting to Default Parameters

You can return to SICK Auto Ident, Inc. default parameter values at any time by entering the *?R* command through any communication port. If sent through a Host or Terminal port, the command must be sent as ~?R~ (assuming MSGCHAR is a ~), or ?R over a Starnode network, to restore default parameters.

WARNING! YOUR SCANNER MAY USE NON-DEFAULT PARAMETERS CUSTOMIZED FOR YOUR APPLICATION. THESE PARAMETERS ARE DETAILED IN YOUR KEYSHEET. RESETTING THE SCANNER TO USE DEFAULT PARAMETERS WILL CAUSE YOUR CUSTOMIZED PARAMETERS TO BE LOST AND WILL NEED TO BE RESTORED.

Refer to "Restore Keysheet" on page 8-17 for more information on restoring Keysheet parameters.

Terminal Types

There are two terminal types supported:

Non-intelligent ASCII

CiMAX 1400 Hand-Held

A PC running terminal emulation software can be used instead of the ASCII terminal.

The scanner can be configured to use one or the other by setting parameter 000 TERM DEVICE to the appropriate value. The default value selects the ASCII terminal. A simple keystroke sequence can be used to switch between configurations.

This is useful if you accidentally configure the scanner for use with an ASCII terminal and then connect the hand-held terminal. The hand-held terminal will display unusable information. To change the configuration when you cannot see the menus, type the following sequence:

<SHIFT> <SETUP> <ENTER> <SPACE> <ENTER> <EXIT>

Non-Intelligent ASCII Terminal

Upon receiving a ~?S~ or ~?D~ command, the scanner will enter the Setup or Diagnostic mode and display a corresponding menu on the ASCII terminal The Setup menu offers a quick, easy way of viewing and, if necessary, changing parameter values. The Diagnostic menu offers a simple way to run diagnostic tests.

Setup Menu on the ASCII Terminal

The Setup menu displays parameter number, parameter name (in abbreviated form) and current value. All parameter abbreviations are listed in the *Scanner Parameters Reference Guide*.

The parameter display format is:

III NNNNNN VVVVVV

where:

III —The three-digit parameter number.

NNNNNN—The abbreviated parameter name.

VVVVVV—The value currently stored in memory.

When you first enter the Setup menu, the following line will be displayed:

SETUP - (P)REVIOUS, (G)OTO, (T)OGGLE, (E)XIT

This line lists all but one of the scrolling options that allow you to view parameters or leave the Setup menu.

The scrolling options function as follows:

Enter—Display the NEXT parameter. To view the parameter after the parameter displayed on the last line of the screen, if one is currently shown (or parameter 000 if none are shown), press *Enter*. The next parameter will appear on the next line. If the screen is full, it will scroll up and delete the top line to make room for the new line.

For example, when *Enter* is pressed seven times after the Setup mode is entered, the display will appear as:

```
SETUP - (P)REVIOUS, (G)OTO, (T)OGGLE, (E)XIT
        000 TERM DEVICE          2
        002 OPMODE               0
        003 IOMODE               000
        004 MINLEN               04
        005 MAXLEN               32
        006 THRHLD               01
        007 NLLSCN               04
```

Continuing to press *Enter* after the screen is filled will cause succeeding parameters to be displayed at the bottom of the list, with preceding parameters deleted from the top.

P—Display the PREVIOUS parameter. To view the parameter previous to the parameter displayed on the last line of the screen, if one is currently shown, press *P* followed by *Enter*. The previous parameter will appear on the next line. If the screen is full, it will scroll up and delete the top line to make room for the new line.

G—GOTO a specific parameter. To GOTO a specific parameter, press *G* followed by the three-digit parameter number followed by *Enter*. The parameter and its current value will be displayed on the next line of the display. If the display is full, it will scroll up to make room for the new line. When both a parameter number and a valid value are entered, that parameter's old value will be replaced by the newly entered value. For example, entering G00605 will display parameter 006 THRHLD (VALIDATION THRESHOLD) and enter a value of 05. The change will only become effective when you EXIT the menu.

T—TOGGLE between Diagnostic and Setup menus, without changing parameter position. That is, if you TOGGLE to the Diagnostic menu and then TOGGLE back to the Setup menu, you will return to the same parameter that you were viewing before you toggled. To toggle, press *T* followed by *Enter*.

E—EXIT the Setup/Diagnostic menu and resume operation. All changes made to parameter values prior to the EXIT command will become effective upon exiting. To EXIT, press *E* followed by *Enter*.

Data Entry through Setup Menu on the ASCII Terminal

New values can be entered as follows.

1. Move through the Setup menu to display the desired parameter on the last line of the list.
2. Type in a new value, being careful to enter the required number of digits for the parameter. Press *Enter* to enter the value.

   If a valid value (correct number of digits and value within the range for the parameter) was entered, the beeper will sound once and the terminal will show the parameter again, with the new value replacing the old one.

   If an invalid value was entered, three short beeps will sound. The previous value for the parameter will remain displayed and unchanged.
3. Exit the Setup menu to accept the changed value or move to the next parameter to be changed.

Diagnostics Menu Display on the ASCII Terminal

The Diagnostics menu lists all of the diagnostic tests that are available. Operation is similar to Setup menu operation. When you enter the menu from the Normal mode, the following will be displayed:

DIAGNOSTICS - (P)REVIOUS, (R)UN, (T)OGGLE, (E)XIT

If you toggle from the Setup menu to the Diagnostic menu, you will see the above line plus all of the Diagnostic menu lines you have previously displayed.

While in the Diagnostics menu, your choices are:

Enter—Display NEXT test on the last line.

P—Display the PREVIOUS test on the last line.

R—RUN the diagnostic test currently displayed on the last line. Refer to the individual test descriptions described in Chapter 8, “Diagnostics”.

T—TOGGLE between the Diagnostics and Setup menus.

E—EXIT the Diagnostics menu and return to Normal mode.

Since parameter changes do not take effect until you EXIT the Setup menu, you cannot change a parameter in the Setup menu and then toggle to the Diagnostic menu to observe the effect. Instead, you must exit the Setup menu and then reenter the Diagnostic menu.

The Diagnostic menu *wraps around*. If you back up through the menu from the first test, READ SPEED, you will display the last test SET CLOCK on the last line. If SET CLOCK is already displayed when you advance forward, you will see READ SPEED again on the last line.

If you have been working with both the Setup menu and the Diagnostic menu, and have changed parameter values, these changes will become effective upon exiting either the Diagnostic or the Setup menu.

The following shows how the Diagnostic menu will look after entering the Diagnostic mode from the Normal mode and pressing *Enter* repeatedly.

DIAGNOSTICS - (P)REVIOUS, (R)UN, (T)OGGLE, (E)XIT
- READ SPEED
- READ QUALITY
- READ EFFICIENCY
- MIN MAX BAR
- MOTOR SPEED
- IOPRTS
- LABEL POSTION
- TACH STATUS
- TACH CALIBRATION
- SET DIGITAL POTS
- CIDSP DIAGS
- CAN DIAGS (75xxA only)
- EXHAUSTIVE RAM
- FLASH UPDATE
- RESTORE KEYSHEET

RESTORE PROGRAM
SET CLOCK

Refer to Chapter 8, “Diagnostics” for complete information about the diagnostic tests and how to run them.

CiMAX 1400 Hand-Held Terminal

The CiMAX 1400 Hand-Held terminal is a full ASCII terminal with a 4 line by 20-character liquid crystal display. It has a non-volatile memory for custom function key assignments. It accepts control characters and some (non-ANSI) escape sequences for cursor positioning and other host-controlled functions.

The same menu that is used for the ASCII terminal is used for the hand-held terminal (HHT). The only difference is, because the CiMAX 1400 has a 4 by 20 display and some parameters are displayed on two lines. Function keys are programmed to provide entry to the Setup mode (~?S~) and the Diagnostic mode (~?D~).

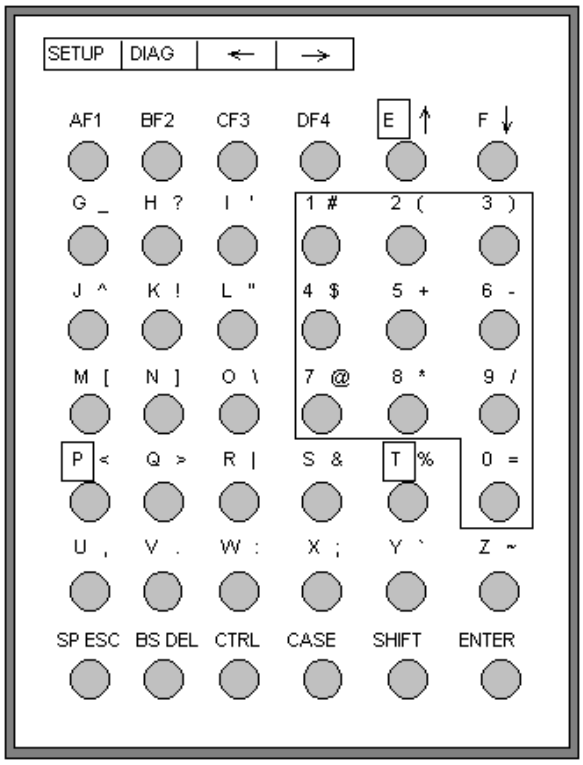
The CiMAX 1400 requires +5 VDC and Ground. The scanner supplies this, when the CiMAX 1400 is connected to the Setup port at the scanner.

When the CiMAX 1400 is connected to the Setup port, it pulls the TERMinal DETect pin on the port low, to indicate to the scanner that the CiMAX 1400 is connected.

In applications where scanners are set up in a master-slave configuration, pulling TERMinal DETect low suspends master-slave operation and allows the scanner to be put into the Setup/Diagnostics mode.

Disconnecting the CiMAX 1400 reboots the scanner and restores the system to the master-slave configuration. The keyboard of the CiMAX 1400 is shown in Figure 5–1.

FIGURE 5–1. CiMax 1400 Keyboard



CiMAX 1400 Hand-Held Terminal Function Keys

Two function keys, F1 and F2, on your keyboard are programmed to provide entry to Setup mode or Diagnostic mode.

Note: You must press SHIFT and release it, and then press the Function Key to enter Setup or Diagnostic mode.

Setup Mode—Press SHIFT - F1. Sends ~?S~ (tilde, question mark, capital S, tilde).

Diagnostic Mode—Press SHIFT - F2. Sends ~?D~ (tilde, question mark, capital D, tilde).

User Programmable—Press SHIFT- F3. Refer to the *CiMAX 1400 User's Guide* for details.

User Programmable—Press SHIFT- F4. Refer to the *CiMAX 1400 User's Guide* for details.

Special-Use Alpha Keys on the CiMAX 1400 Hand-Held Terminal

Exits Setup or *Diagnostic Mode*—Press E. This returns the scanner to normal operation.

Displays the Previous Menu— Press P. This returns you to the previous menu, or leaves the Setup/Diagnostic Mode if you are in the topmost menu.

Toggles Between Diagnostic Mode and *Setup Mode*—Pointers are kept to remember the current position in each menu. The toggle function is available at any point in the menu, except during actual parameter entry.

Runs a Diagnostic Test—Press *R*. Pressing *Enter* will stop the diagnostic test.

Using the Hand-Held Terminal as a Real Time Display

Because the CiMAX 1400 terminal supports cursor positioning, it can be used with scanners to display information about barcodes read, I/O status and other data, all in real time. Refer to parameter 012 NORMMD RPT in the *Scanner Parameters Reference Guide* for more information.

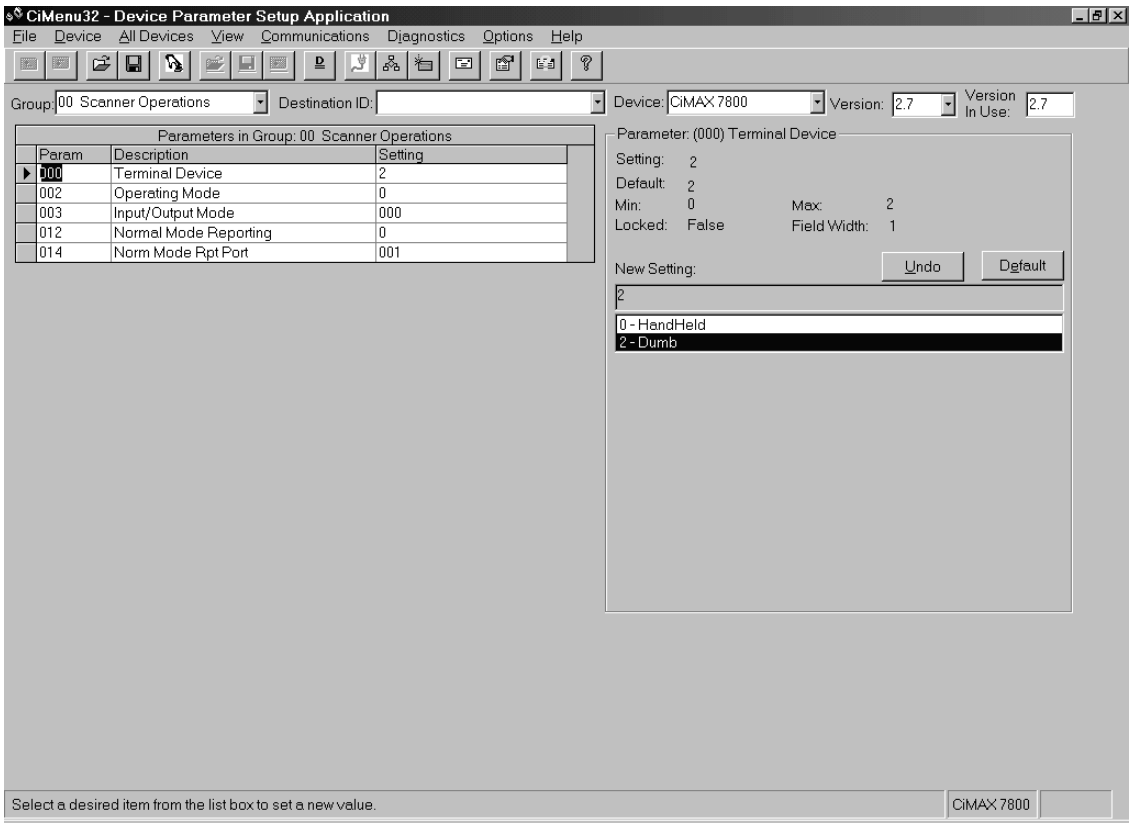
CiMenu32 for Windows Utility (Optional)

CiMenu32 is an easy-to-use 32-bit Windows application that makes it convenient to review, set, modify and save parameter values in most SICK Auto Ident, Inc. one-dimensional scanners and terminals. Refer to the *CiMenu32 User Manual* for complete operating instructions.

All parameter values are stored in the CiMenu32 database (CiMenu.mdb) such that you can run the application even when no scanner is connected, to set values now and download later.

Parameters are arranged by device and by groups in a device.

FIGURE 5–2. CiMenu32 - Device Parameter Setup Application—Main Window



CiMenu32 Features

- Parameters and operations are presented graphically.
- Default values for all parameters are immediately available.
- Parameter values can be range-checked.
- Current parameter settings can be quickly reviewed and modified.
- Parameters can be downloaded by device or by a group in a device.
- Parameter can be set offline and then downloaded to the scanner later.
- Serial, Starnode and Ethernet communications are supported, and communications parameters are easily set.
- Parameters can be saved and loaded to/from a text file.
- A status bar shows the state of program execution and Help messages and indicates the scanner and communications protocol selected.
- Supports on-line help. You can press the F1 key any time during a session to view a Help page for the selected parameter.

System Requirements

CiMenu32 is designed to run on a PC using Windows 95 or later, or Windows NT 4.0 or later. It will not run on a 16-bit Windows operating system.

The PC can be connected to the SICK Auto Ident, Inc. scanner or terminal through a Terminal/Setup serial port or over a Starnode or Ethernet TCP/IP network.

To run CiMenu32 over a Starnode network, you must install a SICK Auto Ident, Inc. Starnode OLE server for Windows NT or for Windows 95 in your PC.

To run CiMenu32 over an Ethernet network, you must install a SICK Auto Ident, Inc. TCP OLE server in your PC. Refer to *OLE Server User Manual* for more information.

6

CHAPTER 6 *Host Commands & Downloads*

This chapter describes how to use a Starnode network and the serial ports to connect the scanner to a host computer to communicate with, control and download C programs.

Introduction

The scanner can be connected to a host PC computer by a Starnode network via the STARNODE port, or through a serial port. Once communication with the host or network has been established, the scanner can be commanded to perform many functions and to provide requested information. The commands can be sent to the Setup port but are most commonly sent to the Host or Starnode port. This chapter will describe in detail:

- How to control the scanner or solicit information from it using commands downloaded from a host computer or Starnode controller
- How to change parameters using commands from a host computer
- How to develop C programs for a scanner and download them to it.

Before beginning Starnode operations, you should know the network protocols and messages.

Control Commands from the Host

When sending commands to the scanner through a Host or Terminal/Setup port, a framing character, normally, a tilde (~), must be sent before and after each command.

When sending commands to the scanner through a Starnode or Ethernet port, a forward slash (/) must precede each command. Otherwise, all strings that begin with an ASCII A or greater will be interpreted as data and be sent to the user program.

In Starnode environments, command values are passed via the SSEND, SBRDC, or SBRDT operations.

A description of each command is described in Table 6–1. The commands are listed numerically, by decimal value, in ascending order. Commands with a decimal value of less than 65 are processed at the operating system level. Commands with a decimal value of 65 or greater are interpreted as data to be passed to a user C program running on the scanner.

TABLE 6–1. Terminal Control Commands

Message Type	Command (Decimal)	(Hex)	(ASCII)
Request Diagnostic String	52	34	4
Request Status Information	53	35	5
Reset	59	3B	;
Clear Diagnostic Count	60	3C	<
Enable Digital Output	61	3D	=
Turn Relay Off	62	3E	>
Setup Command	63	3F	?
Program Message	65 (or greater)	41 (or greater)	A
Display Box/No Read Count *			~TOTAL~
Debugging Information *			~DATA~
Start Presence			~!~
Stop Presence			~$~
Clear Box/No Read Registers *			~TOT00~
Turn Laser On/Off *			~LASxx~
Request Status from Slaves *			~QSNDx~
Query Slave for Data *			~QGETx~
Flush All Slave Data *			~QFLS~

Note: Additional commands are available to implement "Gap Tracking Diagnostics" on page 8-22, "Recording" on page 8-34, and "Playback" on page 8-35.

** Commands sent over STARNODE or TCP/IP must be prefixed with a / .*

ASCII 4 Command—Requesting a Diagnostic String

Upon receiving an ASCII 4 command (decimal 52; hexadecimal 34), the scanner will send the following string back to the controller:

```
7500 #NNNNN
```

Where *NNNNN* is the message count for this scanner. This will be a value between *00000* and *65535*.

This string can be used for diagnostic purposes. The message count is incremented each time this message is requested. The count is reset to zero when the unit receives an ASCII `<` command (decimal 60; hexadecimal 3C), an ASCII `;` command (decimal 59; hexadecimal 3B); or when the scanner is rebooted by turning it *Off* and then *On* again.

Message Format—None

Example

In Starnode environments, downloading only the ASCII 4 will result in the scanner returning a message count.

ASCII 5 Command—Requesting Status Information

When the scanner receives an ASCII 5 command (decimal 53; hexadecimal 35), it responds by sending a string representing its current status. The information returned can be useful for troubleshooting malfunctions. The returned string has the format:

```
7500 V.V ABCDEFGHIJKLMNOPQ
```

where:

V.V—The version number of the software used in the scanner

ABCDEFGHIJKLMNOPQ—The 17-character diagnostic string

The diagnostic status string reflects the current status of the scanner as shown in Table 6–2.

TABLE 6–2. Status String Interpretation

Position	Meaning when 1
A	Inzone presence on
B	Outzone presence on
C	Zone synchronization error
D	Decode Flag
E	Bar timing overflow
F	Scan speed off ±12%
G	Sending data
H	Timeout on last Starnode download
I	Receiving data
J	Receive error has occurred
K	*Relay 1 (NO READ) energized
L	*Relay 2 (MATCH) energized
M	*Relay 3 (NO MATCH) energized
N	Scanner is in Setup menu or diagnostic mode
O	Scanner is operating under user program control
P	Scanner is configured with default parameter values
Q	Laser diode failure detected

* NO READ, MATCH, and NO MATCH are assigned to Relays 1, 2, and 3 respectively by the scanner control program. These assignments can be changed by setup parameters 541, 542 and 543 using the Setup menu or by a C program.

Status String Digit Explanations

A—Inzone Presence

1 indicates that the presence photoeye or Microswitch™ has detected an object entering the scanning zone.

B—Outzone Presence

1 indicates that the outzone presence photoeye or Microswitch™ has been triggered. This indicates that the box or object is leaving the scanning zone.

C—Zone Sync Error

1 indicates that a zone synchronization error has occurred. When not using gap tracking, this error occurs when either the inzone presence detecting device signals a second time before the outzone detector has signaled once, or the outzone device signals prior to an inzone signal.

D—Decode Flag

1 indicates that the decoder is processing data.

E—Bar Timing Overflow

1 indicates that the scanner is falling behind in analyzing data stored in the bar timing logic buffer. This digit may be *1* if large amounts of barcoded data are being scanned.

F—Scan Rate

1 indicates that the scanning mirror is not running within the normal operating range.

G—Sending Data

1 indicates that data is currently being sent through the Host, Terminal or Starnode ports.

H—Timeout

In Starnode environments, *1* indicates that the scanner does not perceive the network as operational (i.e., the scanner has not been polled recently by the network).

I—Receiving Data

1 indicates that the scanner is currently receiving data through the Host, Setup or Starnode ports.

J—Receive Error

1 indicates that received data contained a parity or framing error.

K—NO READ Energized

1 indicates a NO READ energized. This assignment can be changed through a C application or by changing parameters.

L—MATCH Energized

1 indicates a MATCH energized. This assignment can be changed through a C application or by changing parameters.

M—NO MATCH Energized

1 indicates a NO MATCH energized. This assignment can be changed through a C application or by changing parameters.

N—Setup/Diagnostic Mode

1 indicates that the unit is operating in the Diagnostics mode or the Setup mode. Refer to "Setup & Diagnostic Modes" on page 5-6 for more information.

O—User Program

1 indicates that the scanner is currently executing a user program.

P—Default Setup

1 indicates that the scanner is in the Default Setup mode. If SICK Auto Ident, Inc. configured your scanner, this digit will be a 1. If this digit is a 0, at least one of the scanner's parameter values was changed. Refer to 000-099 Decoding & Scanner Operation Parameters in the *Scanner Parameters Reference Guide* for more information.

Q—Laser Diode Fault

1 indicates that the scanner's laser diode may have failed, or is beginning to fail. Contact SICK Auto Ident, Inc. Customer Service.

Message Format—None

Example

If the default MESSAGE CHARACTER value is not changed, downloading the string ~5~ over the Host or Setup ports will cause the scanner to return a diagnostic string.

ASCII ; Command—Rebooting Scanner

Upon receiving an ASCII `;` (semicolon) command (decimal 59; hexadecimal 3B), the scanner will reboot as if it had been turned *Off* and then *On* again. The scanner's parameter values will be safely stored in memory after startup.

Message Format—None

Example

If the default MESSAGE CHARACTER value is not changed, downloading the string `~;~` over the Host or Setup port will cause the scanner to reboot.

ASCII < Command—Clearing Diagnostic Count

The ASCII < (less than sign) command (decimal 60; hexadecimal 3C) is used in Starnode environments to clear the message count from a scanner without having to restart it. Refer to "ASCII 4 Command—Requesting a Diagnostic String" on page 6-3 for details regarding the message count.

This count may also be reset by sending an ASCII ; command that resets the scanner to its default values.

Message Format—None

Example

If the default MESSAGE CHARACTER value is not changed, downloading the string ~<~ over the Host or Setup port will cause the scanner to reset its diagnostic count.

ASCII = Command—Enabling Relay Control Outputs

The solid-state control outputs can be enabled by downloading the ASCII **=** (equal sign; decimal 61; hexadecimal 3D) command.

Message Format— **=NNN**

where:

- *NNN*—The output to enable in accordance with the following:
  - *001* for output 1
  - *002* for output 2
  - *004* for output 3
  - *008* for output 4
  - *016* for output 5
  - *032* for output 6
  - *064* for output 7
  - *128* for output 8

To enable outputs in combination, enter the sum of the individual output values.

For example, entering *007* will enable the first three outputs. Entering *255* will enable all eight outputs.

If the RLYHLD (relay hold) time for an output is non-zero, then that output will automatically disable at the end of the hold time. If the RLYHLD is zero, the output will remain enabled.

It is possible to suspend all relay hold countdowns, so that the outputs will not switch back to their disabled state) by sending a *0* as the parameter *NNN*.

Example

~=0~ Suspend Relay Hold Countdowns

The current states of the outputs (enabled or disabled) will not be directly affected by sending a *0*.

Example

If the default MESSAGE CHARACTER value is not changed, downloading the string **~=2~** over the Host or Setup port will enable output 2.

ASCII > Command—De-Energizing Relay Control Outputs

The solid-state control outputs can be de-energized by downloading the ASCII **>** (greater-than sign; decimal 62; hexadecimal 3E) command.

Message Format—**>NNN**

where:

- *NNN*—The output to disable in accordance with the following:
  - *001* for output 1
  - *002* for output 2
  - *004* for output 3
  - *008* for output 4
  - *016* for output 5
  - *032* for output 6
  - *064* for output 7
  - *128* for output 8

To disable outputs in combination, enter the sum of the individual output values.

It is possible to resume all relay hold countdowns so that the outputs will switch back to their disabled states at the end of their Relay Hold Countdowns by sending a single *0* as the parameter *NNN*.

Example

~>0~ Resume Relay Hold Countdowns

The current states of the outputs, enabled or disabled, will not be directly affected by sending a *0*.

Example

If the default MESSAGE CHARACTER value is not changed, downloading the string **~>2~** over the Host or Setup port will disable output 2.

ASCII ? Command—Setup

The ASCII **?** (question mark; decimal 63; hexadecimal 3F) command tells the scanner that this is a Setup command. These allow the network or application running at the host to change or read the scanner's parameters, as well as to control the execution of any resident C program running on the scanner.

Message Format—**?NNN<new parameter value>** *or*

?8NN<new group parameter values> *or*

?9NN *or*

?9N

where:

?—The ASCII character that indicates a setup command

NNN—A parameter number, which must be followed by the new parameter value, with the appropriate number of characters.

When the first digit of the parameter number is an *8*, then the next two digits *NN* is the parameter group number to be downloaded to set parameters to new values. The rest of the string contains the new parameter values for that group.

When the first digit is a *9*, then the next two digits *NN* is the parameter group number to be uploaded from the scanner to permit their values to be reviewed.

When the first digit is a *9*, and there is only a single following digit *N*, one of five C program control commands:

– Upload C program to host computer

– The Erase C program command

– The Stop (but not erase) C program command

– The Suspend C program command

– The Resume C program command

Downloading Individual Parameters

To download an individual parameter to change it, you use the command **?NNN**, where *NNN* equals the parameter number, followed by the parameter value. The number of digits and valid range for the parameter value must be correct. Refer to the *Scanner Parameters Reference Guide* for more information.

Example

To change parameter 007 NULL SCAN COUNT to a new value of 33, using the Host or Setup port, send:

```
~?00733~
```

Note: You must follow all parameter changes with a ; command to reboot the scanner, in order for the changes to take effect.

Downloading Groups of Parameters

The command **?8XY** is used to change many parameters at once

where

X = 0 through 8 for the general region

Y = 0 through 9 for the particular group string in that region

Refer to the *Scanner Parameters Reference Guide* and Appendix A, “Group Setup Strings” for a description of group setup strings and their uses. The group setup strings are useful when configuring multiple units or transferring one unit’s setup configuration to another.

The number of digits, order, and valid ranges for the parameter values must be correct.

Example

To change parameter 007 NULL SCAN COUNT to *33*, and to set all other parameters in that group to their default values, using the Host or Setup port, send:

```
~?801 043201330000000100000~
```

Refer to Appendix A, “Group Setup Strings” for more information.

Note: You must follow all parameter changes with a ; command to reboot the scanner, in order for the changes to take effect.

Uploading Groups of Parameters

When you want the scanner to send a group setup string to a Host or Setup terminal to review the current settings of the parameters, use the command **?9XY**

where:

X = 0 through 9 for the general region

Y = 0 through 9 to select the particular group string in that region

Refer to Appendix A, “Group Setup Strings” for more information.

These commands allow an operator at the host or network to determine how a scanner is currently configured. This is useful when configuring multiple scanners or transferring one scanner's setup configuration to another.

Because the setup string returned will be framed by the currently set MESSAGE CHARACTER (by default, a ~), the string can be downloaded to another scanner without any changes.

When a group setup string is returned to a terminal, the flow control protocol and all other communication characteristics currently configured for the port will be observed.

You can communicate through the Host or Setup ports or through the Ethernet or Starnode ports.

Example

To solicit a scanner's region/group 01 group setup string, send:

```
~?901~
```

The scanner will then return its entire region/group 01 group setup string, framed by ~ (tilde) characters.

Uploading All Group Setup Strings at Once

All of the scanner group setup strings can be uploaded for review at one time by using the **~?999~** command. If you wish to upload all parameter settings, with the exception of digital pot settings, use the ~?997~ command. Refer to Appendix A, "Group Setup Strings" for more information.

Since these strings are primarily used to download parameters to another scanner, they will be sent framed by MSGCHARs. The list of group setup strings downloaded must be followed by a **~;~** (reboot) command to instruct the scanner to use the new parameter values.

Command **~?997~** is used to extract all parameters except digital pot settings. This is useful when copying parameters from one scanner to another without overwriting the digital pot settings that are unique to each scanner.

Command ~?998~ can be used to extract all endpoint group setup strings.

Set Time & Date Command

This command is used to set the on-board real-time clock (RTC). If Starnode is connected, the RTC will be set to the Starnode time, and this command need not be used. A battery backs up the RTC, and it continues to keep time when the scanner power is *Off*. The command can be used over any serial port.

The command is— **~?THH:MM:SS,mm-dd-yy~**

where:

HH—hours, 24-hour format (00 to 23)

MM—minutes

SS—seconds

mm—month

dd—day

yy—year

All parameters must be entered as two-digit numbers, using leading zeros where necessary.

The clock time and date can be read and used for any purpose by a user C program.

ASCII A or Greater Command—User Program Data

Any value greater than an ASCII **A** (decimal 65; hexadecimal 41) will be forwarded to the C program running the scanner for execution.

Message Format—**A<MESSAGE>**

Where:

A (or any greater ASCII character) tells the operating system to pass this message to the C program running the scanner.

<*MESSAGE*> is the remainder of the string of up to 126 ASCII characters that will be passed to the C program. This will be stored in the buffer for the receiving port, and can be retrieved using a **dta_get()** call. Refer to the *C Programmer's Platform Users Manual* for more information.

~TOTAL~ Command

When sent over STARNODE or TCP/IP, this command must be prefixed with / . The ~TOTAL~ command is used to display a report such as:

0 boxes, 0 no reads

where:

boxes—Total box count

no-reads—No-read count

You can view a running display of boxes and no reads in the status line by setting parameter 012 NORMMD RPT = 2, 3, 4 or 5.

The totals in the first line will not be cleared (even if the power is cycled *Off* and *On*) until **`~TOT00~`** is sent.

~DATA~ Command

3 bad checksums, 3 restored defaults, 0 last bad param
Max Scan Delay 55374, Min Scan Delay 0, Unassigned Label 0, Overlapping 0
DSP Buffer Overflows [0-7] 0, 0, 0, 0, 0, 0, 0, 0

where:

bad checksums—Number of bad checksums detected

restored defaults—Number of restored default parameters

last bad param—Number (in the Setup menu) of the last parameter that was found to be outside its range

Max Scan Delay—Number of scans barcode data processing is lagging

Min Scan Delay—Number of scans barcode data processing is lagging

Unassigned Label—Number of unassigned labels to no box

Overlapping—Number of overlapping labels to more than one box

DSP Buffer Overflows—Number of buffer overflows per DSP

Refer to “Memory Error Detection, Response & Reporting” on page 5-4 for bad checksums, restored defaults and bad last parameter.

When parameter 002 OPMODE is set to *7*, Polling Mode D information will also be reported, as shown below:

Polling Mode D Communication Stats

Slave	Request	Response	Consecutive No Responses
1	3	3	0
2	3	3	0
3	3	0	3

- *Slave*—Polling Mode D slave number
- *Request*—Number of times that data was solicited from a slave
- *Response*—Number of times that the slave responded
- *Consecutive No Responses*—Current number of times that the slave did not respond

The Polling Mode D totals can be cleared by sending **`~TOT00~`** and will also be cleared when the power is cycled *Off* and *On*.

~TOT00~ Command

The ~TOT00~ command (T, alpha-O, T, numeric zero, zero) clears all of the totals reported in response to the ~TOTAL~ command and generates the message:

Clearing box count

~!~ & ~$~ Commands

In some installations, an external system may be used to detect when boxes have entered and exited the scan zone, replacing the inzone and outzone photoeyes normally used.

The serial commands `~!~` and `~$~` are provided to permit an external system to send Presence signals to the scanner. `~!~` replaces the inzone photoeye signal, `~$~` replaces the outzone photoeye signal.

Parameter 501 PRESENCE ENABLE must be on (set to 1) when using these serial commands.

These commands will produce zone errors if two `~!~` are received before a `~$~` is received.

These commands are not compatible with gap tracking, because no box length timing information is available. Therefore, parameter 700 TRACKING should be disabled (set to 0).

~LASxx~ Command

This command, when sent over STARNODE or TCP/IP, must be prefixed with / . On power-up, all laser diodes are turned *On*.

This command can be used to turn the laser diode *On* and *Off*. This command is useful when measuring the inzone-center / outzone-center parameters in a Tunnel configuration. It is also used for isolating the performance of a single scanner.

The value of *xx* in the command determines which diodes are turned on and which are turned off each time the command is sent.

xx is a summed value of:

- +01—turn on laser 1

If a bit is not set, the associated diode will be turned *Off*; if it is set, the laser diode will be turned *On*. For example:

- To turn the laser diode *Off*, send **`~LAS00~`**
- To turn the laser diode *On*, send **`~LAS01~`**

~QSNDx~, ~QGETx~ & ~QFLS~ Commands

This command, when sent over STARNODE or TCP/IP, must be prefixed with / . These commands are provided for debugging when parameter 002 OPMODE is set to 7 or 8 to enable the RS-422 multi-drop/ Intermec Polling Mode D protocol, which allows the use of Host ports to communicate among scanners.

Information about the Intermec Polling Mode D protocol is provided in the descriptions of parameters 002 OPMODE, 111 SCANNER ADDR and 112 SLAVE NO/ADDR. For a complete description of the protocol and the communications system, refer to *Intermec Data Communications Reference Manual*.

Sending **`~QSNDx~`** will send the **`~5~`** command (Request Status Information) to slave *x*. Setting *x* to *0* will send the **`~5~`** command to all slaves.

Sending **`~QGETx~`** will query slave x for bar code data. Setting *x* to *0* will query all slaves.

Sending **`~QFLS~`** will send a Flush Data command to all slaves.

~VER~ Command

This command, when sent over STARNODE or TCP/IP, must be prefixed with / . This command will return the version of all installed software modules currently operating within the scanner. The user program currently stored in the scanner will be displayed. If there is no user program, the user program line will not be displayed. The following information will be returned:

PREBOOT VX.X FLASH ROM
BOOT MONITOR VX.X
CIDSP-Non-Stitching Auto-distinguish (5 symbologies) for Scanner: Ver X.X
TPU Functions Ver X.X
User Program: xxxxx
CiMAX 7500 Ver. X.X
or
CiMAX 7600 Ver. X.X

Gap Tracking Diagnostic Commands

You can request the software version and all of the Gap Tracking diagnostic data from any port.

Note: The tildes (~) are required through the Host and Setup ports, but are not used through the Starnode and Ethernet ports. Over the Starnode and Ethernet ports, you must precede each command with a forward slash (/), to indicate that it is a command. Otherwise, all strings that begin with an ASCII A or greater will be sent to the user program as data. The format of the data returned from the scanner is described in "Gap Tracking Diagnostics" on page 8-22.

These commands are:

- **~TRACK~**—Returns beam coordinates
- **~TIMES~**—Returns beam timestamp limits
- **~TOLER~**—Returns outzone deviation statistics for last eight boxes

The following commands can only be used when parameter 012 NORMMD RPT = 4

- **~TRAKS~**—Returns most recent collected tracking information of barcodes that fit on a box
- **~TRAKN~**—Returns most recent collected tracking information of barcodes that did not fit on a box
- **~TRUNC~**—Returns most recent collected truncation information

C Program Control Commands

Upload C Programs to the Host Computer (ASCII 91) Command

The host command **?91** is used to extract or upload a user C program from the scanner. The program is sent as ASCII Motorola S-records, framed appropriately for the port that sent the command. For example, if a **~?91~** is sent to the scanner over the Host or Setup port, the S-records are framed with a tilde (**~**). This framing is necessary in case the S-records are saved to a *.sef* file by a terminal emulation or other program, so that file can be downloaded to the scanner later. Similarly, S-records sent to the Starnode or Ethernet port are framed in the *.lan* file format.

This feature is useful for extracting a user program from a scanner when the original *.sef* or *.lan* file is not available, for use in a replacement scanner, or to save the program before a new version of the operating system is downloaded. This is especially useful when the program cannot be saved in FLASH memory because it is larger than 8Kbytes.

Note: Only the program's code and constant data segments are sent.

It is important that the host program that is saving the S-records to a file does not drop any characters as the data is received. XON/XOFF protocol is supported by the scanner if required over the serial ports.

Erase C Program (ASCII 92) Command

This command causes the scanner to erase the C program currently stored in NOVRAM. This allows the program to be erased without affecting current parameter values or any data stored in NOVRAM. This does not remove the user program from Flash. You must store another user program to flash.

Example

If the default MESSAGE CHARACTER value is not changed, an Erase C Program command would be downloaded as:

```
~?92~
```

The scanner would then erase its C program from NOVRAM. The scanner must then be reset by downloading the RESET command

```
~;~
```

Stop C Program (ASCII 93) Command

The program will stop running but will still be in NOVRAM if **~?93~** is downloaded. The program start again following the next scanner reset.

Suspend C Program (ASCII 94) Command

The program will be suspended if **~?94~** is downloaded.

Resume C Program (ASCII 95) Command

The program will be resumed by downloading `~?95~`

C Programming Considerations

C programming allows customized application programs to be developed on an ordinary PC and then downloaded to the scanner. The C programming language provides a robust platform with advanced data structures and operators, economical syntax, and advanced flow control capability. The SICK Auto Ident, Inc. User Library provides functions well suited to formatting scanned label data, providing special relay control, and other important functions that typically arise in industrial bar code scanning applications.

Compiling C Programs for Download

C programs can be developed and compiled on any PC-compatible computer equipped with either an RS-232 serial port or a Starnode PC Interface Board. The C program can then be loaded into the scanner through any RS-232 serial port or it can be loaded over the Starnode network.

The C compiler can be configured to produce a *.LAN* download file (for Starnode environments) or a *.SEF* file (for RS-232 serial downloading). Any terminal emulation program, for example, ProComm or Windows Terminal can be used to download the program.

Consult the *C Programming Platform User Manual* for complete information on C programming.

Installing C Programming Platform

To install the C programming platform on your hard disk, perform the following steps:

1. Insert the diskette labeled *C Programming Platform Disk 1* in your floppy disk drive.
2. Type:

   A (or B):INSTALL
3. Follow the screen prompts. The installation requires about 4Mb of hard disk space.
4. Modify your *AUTOEXEC.BAT* file to add the line:

   SET INCLUDE=c:\CISOFT\C68K\INC
5. Modify your *AUTOEXEC.BAT* file so that your path declaration includes the following line:

   C:\CISOFT\C68K\BIN

Downloading C Programs (.sef)

To download a C program to the scanner, follow the steps below:

1. Modify or create a C source file with an ASCII text editor.
2. Compile the source file to create an object file.
3. Link the object file and the libraries into an executable file.
4. Format the executable file into Motorola hex format.

5. Frame the executable file so that it can be downloaded to the scanner.

6. Download the framed file to the scanner.

Note: A complete discussion of C programming is beyond the scope of this manual. However, a simple example is given below to illustrate how to run a custom program on the scanner.

Example

1. Using a text editor which creates flat ASCII files (such as DOS Edit or Windows Notepad), create a C program. Here is a simple example that you can enter:

```
#include <stdio.h>
#include <stdlib.h>

/* User must define "program_name"*/

char *program_name = "HELLO";

void main(void)
{
print("Hello World");
sleep(5000L);
stop();

}
```

   Save the program with a name extension of *.c* This program is contained in the *CISOFT\C68K\EXAMPLE\HELLO* directory created by the INSTALL Program on your C programming language diskette.

   Note: Steps 2 through 5 have been automated via a batch file, C68K.BAT, included in the directory C:\CISOFT\C68K\EXAMPLE/HELLO.

   If you wish, type **`C68K HELLO`** to execute these steps automatically.

2. From the directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, to compile the program, type:

```
..\..\bin\c68332 hello.c -sd -L -I..\..\inc -o hello.o1 -1 hello.lst
```

   For more information on the use of the C Compiler, refer to the SICK Auto Ident, Inc. *C Programming Platform Users Manual* that accompanies your C programming platform.

3. From the directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, to link the program to your program object module, type:

```
..\..\bin\LLINK hello.o1 -L ..\..\LIB\rtlib.1 -c
..\..loc\ssCiMAX7500.loc -o hello.rmp -b _S_data -rs sdata -rc isep stsep
```

4. From the directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, to convert the object file to Motorola hex format, type:

   ```
   ..\..\bin\FORM hello.rmp -ec usep
   ```

5. From the directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, to frame Motorola S-records for serial block download by CICOMM, type:

   ```
   ..\..\bin\exec\ciframe hello.hex
   ```

6. Start up your terminal emulation program, and verify communication by typing:

   ```
   ~5~
   ```

   You should receive a reply similar to the following:

   ```
   7800 X.X 00000010100000000
   ```

   If you receive no reply, there is a problem with your connections or serial communication parameters, or both.

   When you are assured that your PC and the scanner are communicating, you can download the program. Using the terminal emulation program, send the serial-framed program (hello.sef) to the scanner by using straight ASCII file transfer (usually called UPLOAD). As the program is being downloaded, you will see a line of periods (.) sent from the SetupP port, indicating each line being sent. When the download is complete, the scanner will reboot and then send the name of your program HELLO to the Setup port before running the program.

Downloading C Programs via Starnode (.LAN)

The following steps outline the procedure for loading a C application program into a scanner connected to the Starnode data collection network.

1. Ensure that the Starnode network is fully operational.

   If you need to install and check your Starnode network, read the *Starnode Data Collection Network Site Planning and Installation Guide*, and the *Starnode PC Data Collection Network Operator's Manual*.

2. Configure the scanner for Starnode communications.

   Two parameters of the scanner's operating system must be set prior to Starnode communications. You cannot use the parameter defaults. You must set #401, Terminal ID number, and #402, Terminal Type number.

   Refer to the *Scanner Parameters Reference Guide* to change parameter values. After you set the two parameters, exit the Setup menu and look for the message WAITING FOR STARNODE on the hand-held or other terminal connected to the Setup port of the scanner. (If you kept the default parameter values, the scanner will ignore the Starnode network, emit three descending tones followed by three ascending tones and then turn on the laser beam.)

   The Terminal Type number is used in Step 8.

3. Modify or create a C source file with an ASCII text editor.

   Using a text editor which creates ASCII files, such as DOS Edit or Windows Notepad, create a C program. An example you can enter is shown below:

```
#include <stdio.h>
#include <stdlib.h>

/* User must define "program_name"*/

char *program_name = "HELLO";
void main(void)
{
printf("Hello World");
sleep(5000L);
stop();
}
```

   Be sure to save the program with a name extension of *.c*.

   Compile the source file to create an executable file.

   From directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, compile the program by typing:

```
..\..\bin\c68332 hello.c -sd -L -I..\..\inc -o hello.o1 -1
      hello.lst
```

   For more information on the use of the C Compiler, refer to the SICK Auto Ident, Inc. *C Programming Platform User's Manual* that accompanies your C programming platform.

4. Link the object file and the libraries into an executable file.

   From *the* directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, link the program to your program object module by typing:

```
..\..\bin\LLINK hello.o1 -L ..\..\LIB\rtlib.1 -c
..\..loc\ssCiMAX7500.loc -o hello.rmp -b _S_data -rs sdata -rc isep stsep
```

   Format the executable file in Motorola hex format.

   From the directory C:\CISOFT\C68K\EXAMPLE\HELLO, convert the object file to Motorola hex format by typing:

```
..\..\bin\FORM hello.rmp -ec usep
```

5. Format the executable file into Starnode format.

   From directory *C:\CISOFT\C68K\EXAMPLE\HELLO*, format Motorola S-records to Starnode LAN format by typing:

   ```
   ..\..\bin\lanremap hello.hex hello.lan
   ```

   Run the Starnode demonstration program, STARNDEM.

   The Starnode demo program will allow you to download the executable file to the scanner. *STARNDEM.EXE* is described in the *Starnode PC Data Collection Network Operator's Manual.*

   A detailed description of the PC board's operation during downloads can be found in the *Starnode Data Collection Network Operators Manual*. The interface routines (STBLC, STBLN, STBLB, and SINIT) that are involved in the process of downloading .LAN files.

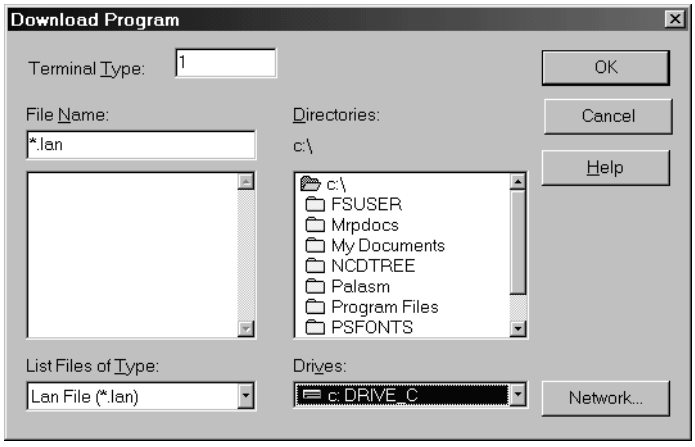
Download Program—Allows you to transmit a compiled **.LAN* program to all terminals in the network of a specified type. Such downloads might be used for testing or demonstration of the network's capabilities.

Note: If you specified Y (Yes) to the Full Initialization prompt and STARNDEM.CNF file was found, programs have already been downloaded.

---

1. Opening the Transmit menu and selecting Download Program displays the Download Program dialog box as shown in Figure 6–1.

FIGURE 6–1. Download Program Dialog Box



2. Determine the terminal type that you want to download to. Click on Terminal Type field and enter the terminal type. Valid types are 001 to 128.

3. Specify the **.LAN* file to be downloaded by typing a complete path and program name in the File Name field or by clicking on the program name. To change the list of **.LAN* files shown, select on a different path from the File Name list box.

If a different program was downloaded to the target terminals during a previous session, the later download takes the place of the previous one.

After selecting a **.LAN* file, click OK. The hourglass is displayed while the download is in progress, and then disappears when the download is complete. You may then select a new file name and/or terminal type and download to the next group of terminals.

Downloading .LAN Files—Starnode Asynchronous Controller MUX Interface

C programs can be downloaded from a Starnode AC/CICALP using a host-based program or the SICK Auto Ident, Inc. SACDEM program running on a PC.

If SACDEM is used, the program is invoked by typing **`SACDEM CR`** at the DOS prompt. When the Main Menu is shown, press *F6* to initiate the download. SACDEM prompts for the name of the program to be downloaded, followed by the terminal type (valid values: 001 to 127) to receive this program. After a terminal type has been specified, the Starnode AC/CICALP initiates the download.

The operation of the Starnode AC/MUX at power-up is determined by the values of the CLEAR PROGRAMS and AUTO INITIALIZE parameters of the MUX Interface Handler. Upon power-up, the Starnode AC/MUX will re-initialize the network; part of this process is downloading C programs stored in the controller's RAM. If no programs are found, the controller will send nothing.

If desired, a download can be initiated at any time if the host sends a Full Initialization (decimal 20, hex 32) command to the Starnode AC/MUX. Upon receiving the command, the Starnode AC/MUX will re-initialize the entire Starnode network; if the MUX has any .lan files in RAM, it will download them based upon terminal type. The controller will send an <ACK> or <NAK> back to the host, indicating the success or failure of the initialization.

A detailed description of Starnode AC/MUX operation during downloads can be found in the *Starnode AC/MUX Operator's Manual*.

Data Detection by C

The following illustrates the programming features of the scanner.

A C program normally waits for barcode data in one of two modes:

- Polling
- Event Manager.

Polling

1. Loop on system status using the function, **`get_dstatus(1, &dstatus)`** until **`dstruc.item1`** is not zero.
2. Loop on system status using the function, **`get_ustatus()`** until bit 1 (bar data pending) is **`ONE (TRUE)`**. Bit 0 is the low order bit.
3. Loop on data available by using the function:

```
ret = dta_get(1, len, &str)
```

Where:

len>0

str is allocated len characters until a non-zero value is returned to ret.

Event Manager

Event Manager creates a data event using the function:

```
data_event(1, TimeOut, &user_func, &parameter_list)
```

This method causes a data event to occur when information on port 1 (bar code data) is buffered to the user program. When this buffer occurs, the event triggers shortly thereafter. If there is no data buffered by the time **Timeout** expires, the event still triggers the user function.

Once the user function triggers, the function takes **cState** as a parameter. The value in cState indicates how the event was triggered. Additionally, the information in the user buffer can be retrieved by using the Polling mode above Step(3), from the user function **dta_get**.

There may be occasions where reading the state of the inzone and outzone presence inputs would be of interest. The inzone and outzone presence inputs are normally assigned as input 1 and input 2, respectively, and can be sensed by a user program in one of two ways:

1. By polling input 1 and/or 2 using the function **d_inp(),** until it returns the desired level in bit 7 or bit 6 for inzone and outzone, respectively.
2. By creating an input event using the function:

   ```
   dinput(1, 1, TimeOut, &user_function, &parameter_list)
   ```

   This method senses a zero to one transition of the inzone presence input and then executes user_function with the parameters in parameter_list.

The presence inputs can be remapped by a C program if desired.

Refer to the SICK Auto Ident, Inc. *C Programmer's Platform Users Manual* for complete information on the use of these routines.

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CHAPTER 7 *Communication Modes*

This chapter introduces the OPMODE parameter and describes Scale mode, Starnode usage, and RS-422 mode.

OPMODE Parameter

Refer to the *Scanner Parameters Reference Guide* for a complete description OPMODE. The parameter 002 OPMODE has nine modes, as summarized in Table 7–1.

TABLE 7–1. 002 OPMODE Modes

Mode	Mode Description	Usage Description
0	NORMAL	Used when the scanner is used by itself, connected to the host computer but with no direct connection to other SICK Auto Ident, Inc. scanners.
1	NOT USED	
2	MASTER, SERIAL DAISY CHAIN	Used to connect multiple scanners together to allow multiple coverage areas (top and sides of boxes, for example) to be combined into one transmission to the host computer.
3	SLAVE, SERIAL DAISY CHAIN	Same as MASTER, SERIAL DAISY CHAIN.
4	SERIAL PASS-THROUGH	Used to program a scanner that receives data at its Terminal port to echo the data out of its Host port, without modification.
5	MASTER, MULTIPLE BIN	Use the same serial daisy-chain methods as modes 2 and 3, but support the use of multiple decode format bins.
6	SLAVE, MULTIPLE BIN	Same as MASTER, MULTIPLE BIN
7	MASTER, RS-422 MULTI-DROP	Use the RS-422 MULTI-DROP/Polling Mode D protocol.
8	SLAVE, RS-422 MULTI-DROP	Same as MASTER, RS-422 MULTI-DROP.
9	PC based STARNODE TUNNEL	This mode provides built-in support for PC-based Starnode tunnel.

Scale Mode

The Scale Mode allows serial data from a scale, terminal or another device to be added to the barcode data transmitted at the end of presence. To enable scale data, add a decode format bin with SS=89, MM=02. LL and CC can be set to further qualify the incoming string. The ASC fields are not used; set them to 00 or leave them blank.

The scanner must use presence. You must configure the Terminal port to use Block Mode Input. A prefix is optional; a suffix is mandatory.

The serial data is read at the end of presence, and fitted into the decode format bin at that time. Only the most recent block of data received is used, and earlier ones are discarded.

Scale data may also be inputted in master/slave mode provided the scanners are setup as follows: The master must use Opmode=2, and have a decode format bin "8902". As before, you can also add a specific length to qualify it. The last slave unit in the chain will also have an '8900' decode format bin, and the scale data should be input to its Terminal port. Note the MM field is set to '00' to allow the scale data to transmit on nullscan (i.e. as soon as it is received) if the slaves are using presence. If the slaves are not using presence, then you could set it either to '8900' or '8902', as an MM field of 02 defaults to nullscan presentation if presence is disabled. The slaves in between this last slave unit and the master should not have an '89' bin.

Starnode Usage

The scanner may be used on the STARNODE network. Note that you must assign a terminal number and a type to each scanner.

Valid terminal numbers range from 1 to 4095. This number must be unique for each scanner. The terminal numbers can be consecutive, for example 1, 2, 3, or spaced apart 100, 200, 300.

A single, standard STARNODE stub cable makes connection to the scanner from a SICK Auto Ident, Inc. T-TAP box. The maximum length of a stub cable, from the main cable, is 25 feet.

RS-422 Mode

You can configure the Host port of the scanner for RS-422 communications. The Setup port is permanently configured for RS-232 only. To select RS-422 at the Host port, set parameter 495 JUMPER SETTINGS listed in 490-495 Software Jumpers & Miscellaneous in the *Scanner Parameters Reference Guide* for more information.

SICK Auto Ident, Inc. suggests that you connect your host transmit lines to the scanner even though you do not wish to send data to the scanner. This will prevent noise from being received at the scanner.

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CHAPTER 8 *Diagnostics*

This chapter describes the diagnostic programs that test the scanner's reading capability, inputs, outputs, memory and DSP operation, and the procedures that update the operating system and restore default parameter settings.

Introduction

The scanner's Operating System (OS) contains a series of diagnostic programs, which can test the scanner's barcode reading capabilities, the inputs and outputs, tachometer calibration, and memory operation.

The barcode scanning tests help to determine that parameter values have been entered correctly. The input and output tests help to verify wiring and connections. Other tests can help isolate malfunctions in the scanner if they should occur.

Note: If your scanner has been configured for presence detection, a presence signal is still not required to read barcodes or perform diagnostics functions.

Initiating Diagnostics Tests from a Terminal

You can switch the scanner to the Diagnostics mode from an ASCII terminal, a PC operating in terminal emulation mode or a CiMAX 1400 Hand-Held terminal connected to the Setup port. Refer to "Non-Intelligent ASCII Terminal" on page 5-7 for more information.

The CiMAX 1400 Hand-Held terminal has been factory-programmed to enter the Diagnostics mode when you press *Shift*, release it and press *F2*. Refer to "CiMAX 1400 Hand-Held Terminal" on page 5-10 for more information.

To enter the Diagnostics mode from an ASCII terminal, type the command

~?D~

where:

~ (tilde)—The default or other message character that you can select using parameter 403 MESSAGE CHARACTER

?—The command character

D—Used to enter the Diagnostics mode and display the Diagnostics menu. Type upper case characters

Send the command to the scanner by pressing *Enter* or *CR*.

Note: When sending data through the serial ports, you must type all commands from the terminal using UPPER CASE characters.

You may want to program various function keys on the terminal to generate and download strings to the scanner.

For example, the string `~?S~`, when sent to the scanner, causes the Setup menu to be displayed on the terminal. Thus, you might want to configure one of the user-definable keys on your terminal to generate the `~?S~` string when pressed. You could label this key *SETUP*.

Diagnostics Menu

When the scanner first enters the Diagnostics mode, the following line will appear on the terminal display:

DIAGNOSTICS (P)REVIOUS, (R)UN, (T)OGGLE, (E)XIT

The Diagnostics menu will list all of the diagnostic tests that are available to you as you press *Enter*.

This menu wraps around. If you back up through the menu from READ SPEED, you will see the last test name (SET CLOCK). If SET CLOCK is already displayed when you move forward, you see the first test name (READ SPEED) again.

While in the Diagnostics menu, your choices are:

- *Enter*—Display the NEXT test. To view the test after the test displayed on the last line of the screen, if one is currently shown (or the first test, in none are shown), press *Enter*. The next test will be displayed on the next line. If the screen is full, it will scroll up and delete the top line to make room for the new line.
- *P*—Display the PREVIOUS test. To view the test previous to the test displayed on the last line of the screen, if one is currently shown, press *P* followed by *Enter*. The previous test will be displayed on the next line. If the screen is full, it will scroll up and delete the top line to make room for the new line.
- *T*—TOGGLE between Diagnostic and Setup menus without changing parameter/test position. When you *Toggle* to the Setup menu and then *Toggle* back to the Diagnostic menu, you will return to the same test that you were viewing before you toggled. To toggle, press *T* - *Enter*.
- *R*—RUN the diagnostic test currently displayed on the last line. With the exception of the “Exhaustive RAM Test” on page 8-13, any test can be stopped by typing *Enter*.

E—EXIT the Diagnostic/Setup menu and resume operation. To exit, press *E* - *Enter*.

Diagnostic Tests & Procedures

The diagnostic tests are listed in Table 8–1. The remainder of this chapter provides complete descriptions of the tests and procedures.

TABLE 8–1. Diagnostic Tests

Test Name	Display
Read Speed	READ SPEED
Read Quality	READ QUALITY
Read Efficiency	READ EFFICIENCY
Min/Max Bar	MIN MAX BAR
Motor Speed	MOTOR SPEED
Input/Output	IOPRTS
Label Position	LABEL POSITION
Tachometer Status	TACH STATUS
Tachometer Calibration	TACH CALIBRATION
Set Digital Potentiometers	SET DIGITAL POTS
Decoder Processor	CIDSP DIAGS
SDS/DeviceNet Diagnostics	CAN DIAGS (75xxA only)
Exhaustive RAM	EXHAUSTIVE RAM
FLASH O.S. Download	FLASH UPDATE
Restore Default Settings	RESTORE KEYSHEET
Restore C Program	RESTORE PROGRAM
Set Clock	SET CLOCK

The Diagnostics menu and all diagnostic outputs will only be sent to the Terminal port and not to the Host port, regardless of whether a terminal is attached to the port.

The Terminal port will respond as it has been configured by Setup parameters 200-210, except that no prefix character will be sent and the suffix characters `CARRIAGE RETURN` and `LINE FEED` will be sent. Refer to parameters 207, 208 and 209 in the *Scanner Parameters Reference Guide* for more information.

Stopping Diagnostic Tests

With the exception of the "Exhaustive RAM Test" on page 8-13, any test can be terminated at any time by pressing *Enter*.

Read Speed Test

During the *Read Speed Test*, the scanner will continuously scan and decode all barcodes placed in front of it. When a barcode has been scanned the number of times specified by parameter 006 VALIDATION THRESHOLD, the beeper will sound and the barcode data will be sent to the Terminal port for display on the ASCII terminal, PC or CiMAX 1400.

Conducting the Test

1. Determine the barcodes and X dimensions for which your scanner is configured. Your scanner may have been custom-configured by SICK Auto Ident, Inc. This information can be found on your keysheet.
2. Select a barcode that will be scanned during normal operation.
3. Determine the optimum distance between the barcode labels and the scanner during normal operation. For example, if your scanner will be mounted 20 inches from the barcoded objects, hold the selected barcode 20 inches from the scanner to simulate actual operation.
4. Orient the label such that a laser line sweeps across the barcode from quiet zone to quiet zone.
5. Select and run the test.

Note: The scanner's depth of field affects the read speed. The fastest read speeds occur at the optimum decode positions. As you move the barcode label closer to or farther away from the scanner, it will beep faster (if a beeper is connected) as the label approaches the optimum reading distance.

---

6. End the test by typing *Enter*.

Read Quality Test

The *Read Quality Test* shows how accurately a specific barcode is being decoded. Groups of 100 potentially decodable scans are examined and the number of successful decodes is displayed.

Test results are displayed in the following format:

LLLLLLLLL QQ NNN

where:

LLLLLLLLL—The first nine characters of the barcode successfully decoded.

QQ—A number from 00 to 99, representing the quality of the barcode in percent, determined by comparing how closely the bar/space width ratios match the ideal case for that symbology.

NNN—The number of successful decodes, in percent.

Conducting the Test

1. Determine the barcodes and X dimensions for which your scanner is configured. Your scanner may have been custom-configured by SICK Auto Ident, Inc. This information can be found on your keysheet.
2. Select a barcode typical of one that will be scanned during normal operation.
3. Determine the distance between the barcode labels and the scanner during normal operations.
4. Hold the barcode label at that distance to simulate actual operation.
5. Select and run the test.

6. Allow the beam to scan across the barcode and wait for approximately 3 seconds.

7. Observe the test results on the screen. If, after a few seconds, there is no displayed result, check the distance between the scanner and barcode label, and also verify that your scanner can decode the barcode symbology being scanned as it is currently configured.

Example

This example is displayed on the screen with the result:

123456789 79 99

This indicates that a single barcode consisting of the digits 123456789 was successfully decoded 99 out of 100 scans, and that its quality score was 79 out of a possible 99.

The message NO LABEL will occur as a timeout indication if there are no barcodes found within the last 100 scans.

Barcodes with a quality of less than 40 may be poorly printed or be positioned outside the depth of field of the scanner, or both. The lower quality may also mean that the scanner is out of adjustment.

The symbologies to be auto-distinguished are automatically set up according to the symbologies specified in the decode format strings.

Read Efficiency Test

The *Read Efficiency Test* shows how efficiently barcodes are being located and decoded. The scanner will continuously decode groups of 100 sequential scans of multiple barcodes and display the number of successful decodes from each group of scans. When you set Parameter 012 NORMMD RPT to 1, the beeper output frequency will increase as *Read Efficiency* increases.

The output displayed on the terminal will be:

LLLLLLLLL MM NNN, PPPPPPP NNN

where:

LLLLLLLLL—The first nine characters of the barcode sample read with the highest efficiency.

MM—The number of different barcode samples read.

NNN—The Read Efficiency for each barcode, i.e., the number of decodes in 00 scans of the barcode sample read.

PPPPPPP—The first nine characters of each of the other barcodes read, repeated as needed to report all of the barcodes read during the 100-scan test.

Conducting the Test

1. Determine the barcodes and X dimensions for which your scanner is configured. Your scanner may have been custom-configured by SICK Auto Ident, Inc. This information can be found on your keysheet.

2. Select one or more barcodes, each with different characters in the first nine digits and of the same or differing symbologies, which will be scanned during normal operations. For example, if Code 128 is one of the symbologies your scanner is configured to decode, you can select Code 128 labels.

3. Select and run the test.
4. Allow a beam to sweep across the one or more barcodes from quiet zones to quiet zones. Wait a few seconds.
5. Observe the test results displayed on the terminal. If, after a few seconds, there are no results displayed, check the distance between the scanner and barcode labels. Verify that the barcodes chosen have symbologies that can be decoded by your scanner as it is currently configured.
6. Press *Enter* to stop the test.

The message NO LABEL will occur as a timeout indication if there were no barcodes found within the last 100 scans.

The symbologies to be auto-distinguished are automatically set up according to the symbologies specified in the decode format strings.

Example

This example is displayed on one line of the terminal screen with the result:

100000009 03 100, 100000008 097, 100000007 092

The line reports that three different barcode samples were detected and read during a 100-scan test. The most successfully decoded barcode sample contained the first nine characters 100000009 and the Read Efficiency was 100%. The barcode was successfully read 100 out of 100 scans.

The first nine characters of the other two barcodes read, and their Read Efficiencies (97% and 92%), were also reported.

Minimum/Maximum Bar Test

This test shows the ratio of the narrowest and widest bar widths encountered during cycles of 100 scans.

The display format is:

Min bar: *bbb*, Maxbar: *BBB*, Min space: *sss*, Max space: *SSS*, Max Data: *DDD*, Lbl: *aaaaa*

where:

bbb—The *Narrowest Bar*, in width counts.

BBB—The *Widest Bar*, in width counts.

sss—The *Narrowest Space*, in width counts.

SSS—The *Widest Space*, in width counts.

DDD—The *Depth Bar Buffer* full (non-stitching only)

aaaaa—The complete barcode read.

Conducting the Test

1. Determine the barcodes and X dimensions for which your scanner is configured. Your scanner may have been custom-configured by SICK Auto Ident, Inc. This information can be found on your keysheet.
2. Select a barcode that will be scanned during normal operations.
3. Select and run the test.
4. Allow the beam to scan across the barcode at the correct distance from the scanner. Wait a few seconds.
5. Observe the test results on the display. If, after a few seconds, there is no displayed result, check the distance between the scanner and barcode level, and verify that your scanner can decode the barcode as it is currently configured.

   The results should show approximately equal bar and space ratios, as in the following example.

Example

Assume that a barcode is scanned and that the display reports the following:

020 059 019 061 005 1234567890

Observe that the ratios of largest to smallest bars and spaces are both near 3 to 1. Therefore, these results are suitable for barcodes with 3:1 wide-to-narrow ratio.

Note: If the Min/Max Bar Test does not indicate a clear ratio between the widest and narrowest bars and spaces, the fault probably does not lie in the scanner. The barcode may be poorly printed or not printed to specification, or positioned outside of the depth of field of the scanner.

Motor Speed Test

The scanner uses a motor spinning a multi-sided polygon mirror to generate laser scan lines. The speed of the motor was determined for your application and was entered on your keysheet. This test measures the speed of the motor and can be used to verify that the motor is running at the specified speed.

Test results are shown in the following format:

SSS SS RRRR RPM

where:

SSS—The number of scans per second (SS)

RRRR—The mirror speed in Revolutions per Minute (RPM)

Conducting the Test

1. Select and run the test.
2. Wait a few seconds until the test results are displayed on the terminal. For example:

For example:

300 SS 1800 RPM

Input/Output (IOPRTS) Test

This tests the eight control inputs and outputs. During normal scanner operation, Inputs 1 and 2 accept the inzone and outzone signals. Outputs 1, 2, and 3 output the NO READ, MATCH, and NO MATCH outputs.

You can re-map these functions to any input or output under program control by using:

– a user C program, *or*

– parameters 503 INZONE, 504 OUTZONE, 541 NO READ OUTPUTS, 542 MATCH OUTPUTS, and 543 NO MATCH OUTPUTS.

Note: By default, OUTPUT 4 controls the BEEPER. To re-assign this output from a user C program, you must first disable the BEEPER function with an appropriate call to the SYS_PORTS library routine. For complete information about the BEEPER function, refer to the C Programmer's Platform User's Manual.

Conducting the Test

1. Select and run the test.
2. When the test is run, the eight inputs will be sampled repeatedly and their states reported as follows:

   INPUTS=XXXXXXXX

   where:

   X—0 or 1 depending on the input state.

3. While running the test, you can turn on any output by entering the output number (*1 through 8*), or all outputs at once by entering *A*, for All outputs. The selected outputs will turn on for approximately one second.

   Each output must be observed manually to determine that it is operating. If the Standard Interface Unit is in use, the LED indicators associated with each output relay can be observed to determine if the relays are being energized.

Label Position Test

When there is the possibility of more than one box being in the scan zone at a time, the gap-tracking program uses the barcode position within the scan zone to determine the box with which the barcode should be associated.

This test checks position calculation and the validity of parameters 705 CONV WIDTH, 706 INZONE-CENTER and 707 OUTZONE- CENTER. These define the size of the scan zone. Position is calculated for only one box in the scan zone at a time.

The test is normally only useful to SICK Auto Ident, Inc. service personnel.

Conducting the Test

1. Select and run the test.
2. Select a barcode that the scanner is configured to read. Orient the label so the beam sweeps across the barcode from quiet zone to quiet zone.

   Every 100 scans, you should see a result similar to the following:

   LLLLLLL x=nnnnn y=mmmm t=pppp dsp=q height=r

where:

LLLLLLL—The first seven characters of the barcode read and nnnnn, mmmmm, pppp, q and r are numbers.

x & *y*—Represent the barcode position actually, the first edge of the barcode detected by the scanning beam in a coordinate system centered under the scanner, in mils (0.001" units).

t—The time from the start of the scan when the barcode was first detected.

r—The height zone above the conveyor in which the barcode is being read.

If your installation includes height-sensing photoeyes, you must block all of the photoeyes that would be blocked by a box corresponding to the height of the label in order for the label position determination to be accurate.

q—The decoding (DSP) processor that detected the barcode by its associated laser beam. Single line scanners use only one DSP.

Tachometer Status Test

If your installation includes a tachometer, this test is useful for troubleshooting and for verifying the accuracy of parameter 702 MILS/TIC.

Conducting the Test

Select and run the test. When this test is run, you will see a result similar to the following:

nnnn COUNTS mmmm MILS pppp FT/MIN

where:

nnnn—The number of tachometer pulses received in one second.

mmmm—The distance in mils that this corresponds to, as determined by parameter 702 MILS/TIC. The number of digits reported may vary among scanner types.

pppp—The calculated conveyor speed in feet per minute.

If parameter 702 MILS/TIC is set to zero, gap tracking will be disabled. If the value is not accurate, the distance and speed calculations will be incorrect.

Tachometer Calibration Procedure

If your installation includes a tachometer, this procedure may be used to set parameter 702 MILS/TIC. This will be useful when the parameter cannot be derived from other known values,

such as the number of pulses/revolution and the gearing ratio between the driven shaft and actual conveyor movement.

To Run Calibration

1. Select a box or article with a barcode that the scanner is configured to read.
2. Make sure that the conveyor is running at normal speed and that the tachometer is functioning and connected correctly.
3. Make sure that the following parameters are set to appropriate values.

   Parameter 702 MILS/TIC must have a preliminary value entered. A best guess or a value of 50 is appropriate.

   Parameters 510-517 INPUT1-8 TIME and parameter 518 INPUT DBNC TYPES must be set to the appropriate presence and tachometer input debouncing times and types.

   Parameters 706 INZONE-CENTER and 707 OUTZONE-CENTER, the distances between the inzone and the outzone photoeyes and the centerline of the scan zone, must have accurate values entered.
4. Select and run the test.
5. When the test is started, the scan zone between the inzone and outzone photoeyes should be empty. The message Waiting for inzone... will be displayed on the terminal.

   If there are boxes in the zone when the test is started, you may see the message Waiting for zone to clear... until the boxes exit from the scan zone.
6. Pass several boxes through the scan zone on the conveyor, one box at a time. As each box blocks the inzone photoeye, the message Inzone will be displayed.

   When the leading edge of the box blocks the outzone photoeye, a message similar to the following will be displayed:

   Box *x*: nnn counts mmm mils/tic ppp ft/min ht zone: q

   where:

   x—The number of the box passed through the zone

   nnn—The number of encoder pulses recorded

   mmm—The calculated distance traveled per pulse

   ppp—The resulting conveyor speed

   q—The height zone indicated by the height-sensing photoeye tree, if your application requires this.

   As subsequent boxes are passed through the zone, the mils/tic values will be averaged.

   Ending the test will cause this average to be entered into parameter 702 MILS/TIC.

Set Digital Potentiometers

The scanner has 11 digital pots. The pots are 100-position digital potentiometers with non-volatile memory. Refer to parameters 444-459 in the *Scanner Parameters Reference Guide* for more information.

The pots cannot be set to an absolute position using the Diagnostics menu. They must be incremented or decremented to their top or bottom end by incrementing or decrementing 100 times, if you don't know where they are positioned initially, increment or decrement them to the desired position. The pots can also be set by entering numerical positions using the Setup menu as described in "Non-Intelligent ASCII Terminal" on page 5-7.

You can observe pot settings and also adjust them, with the exceptions noted below, through the Diagnostics menu. This will allow you to increment or decrement pot settings while watching the results on a scope, or while running a diagnostics test such as Read Efficiency.

- To protect the laser diode, the scanner has a jumper that must be re-positioned before their LSR PWR LIMIT pots can be adjusted. The jumper should be returned to their Safe positions after adjustment.

When you access the Set Digital Potentiometers test, you will see the following (your parameter values may be different):

Current settings: (select # to change)

1 MOTOR SPEED = 50
2 LSR PWR (FINE) = 0
3 LSR PWR (COARSE) = 0
4 LSR PWR LIMIT = 0
5 PHASE = 99
6 RASTER FREQUENCY = 0
7 RASTER AMPLITUDE = 0
8 OPT RCVR LIMIT = 99
9 OPT RCVR THRESH = 72
10 OPT RCVR SHIFT = 20
11 OPT RCVR GAIN = 0

Note: Potentiometers #6 and #7 are only used in a CiMAX 7555A/7655 with the programmable raster option. In older scanners, these pots were used for laser modulation. Using the default values without programmable raster option may cause loss of laser power. To prevent this, set pots #6 and #7 to a value of 99.

Once you have selected a pot by entering its number followed by *Enter*, the following will then be displayed:

U to increment, D to decrement, T for max, B for min
E to run Read Efficiency, X to stop Read Efficiency

To change the pot settings, press the keys listed below.

U—Moves the pot up one increment.

D—Moves the pot down one increment.

T—Moves the pot to its maximum position

B—Moves the pot to its minimum position

Pressing *E* while a pot is selected will run the Read Efficiency test. Refer to "Control Commands from the Host" on page 6-1 for more information.

Pressing *X* will stop the test. It can be useful to monitor read efficiency while adjusting certain pots by pressing *U* and *D* to increment or decrement them.

Decoder Processor Test (CIDSP DIAGS)

Decoder Processor Test displays the current software version and program being used by the decoding processor, also referred to as the DSP. The processor decodes the bars and spaces of barcodes into ASCII data that is presented to the host.

Conducting the Test

1. Select and run the test. If CIX (stitching) is not enabled, the two lines below will be sent to the terminal when the test is run:

   CIDSP-Non-Stitching Auto-distinguish (5 symbologies) for Scanner: Ver X.X

   CONFIRM

   If CIX (stitching) is enabled, the two lines below will be sent to the terminal when the test is run:

   CIDSP- Stitching Auto-distinguish (C128, I25, C39, UPC, C93) for Scanner: Ver X.X

   CONFIRM

   The first line reports the program type (Stitching or Non-Stitching), the version of the scanner software in use and, if CIX is enabled, the five symbologies that can be read, but have not necessarily been selected to be read.

   The second line asks if you want to run an extensive decoding processor (DSP) communication and RAM test.

2. When you enter *Y*, the test will cause the scanner to reboot. This test is no longer available with version 2.0 or later (76xx), or version 3.0 or later (75xx).

   Earlier versions will display the @ character at regular intervals on the terminal. Each @ indicates that a group of tests have been successfully run. If you see the message DSP FAIL while running the test, there may be a problem with the scanner. Contact SICK Auto Ident, Inc. Customer Service for assistance. Press any key to end the test.

Can Diagnostics (75xxA Only)

CAN DIAGS allows some limited diagnostics for the DeviceNet/SDS board. When this diagnostic is run, you may see:

Can Device is Offline

This indicates that the network cable is not connected, or the DeviceNet or SDS master is not running, and the diagnostic will return to the menu.

Otherwise, you will see the following prompt:

```
Network Type: DeviceNet, Software Version: X.X,  Device State: Online
Enter 8 digits (hex format) to drive outputs
Input = 00000000 00000000 00000000 00000000
```

You will see 'SDS' in place of DeviceNet if an SDS board is installed.

For 'Device State', you may see other messages besides 'Online'.

```
Initialize
No Can Power
Autobaud
Can Bus Off
Online
Offline
```

The last line will be repeated every one second, reflecting the current state of the expansion inputs according to any DeviceNet or SDS messages that are received. You will see either a '1' or a '0' in each of the 32 bits.

You can force outputs from the diagnostic by typing in an 8-digit hex format number. For example, typing in '80000001' will cause outputs 1 and 32 to be forced on. In this example, the message:

```
Output= 10000000 00000000 00000000 00000001
```

will then be displayed.

Reading the inputs and setting the outputs from within this diagnostic can be very helpful in testing PLC ladder logic or PC flowchart logic in the field.

Exhaustive RAM Test

The *Exhaustive RAM Test* completely tests the microprocessor and non-volatile memory. When this test is performed, all downloaded C programs and parameter values stored in memory will be *permanently erased*.

Once started, the test *cannot be aborted* except by turning the scanner off, which causes it to reset to its default (factory-set) parameter values.

Conducting the Test

1. Select EXHAUSTIVE RAM test by typing *R* - *Enter* while EXHAUSTIVE RAM is shown. The following confirmation message will be displayed:

   ```
   WARNING!  ALL PARAMETER SETTINGS WILL BE ERASED.

   WARNING!  DO YOU WISH TO PROCEED? (Y/N)
   ```

2. Type *Y* - *Enter*. Entering any other response will abort the test. A second confirmation message will be displayed:

   ```
   YOU ANSWERED "Y".  TO PROCEED WITH RAM TEST/CLEAR,

   NOW TYPE 'CLEAR'
   ```

3. To perform the test, type *CLEAR* or *clear* as a security check. Any other response will abort the test.

   Observe the display. If there is a memory failure, the terminal will display the message:

   MEM FAILED AAAA

   where:

   AAAA—The failed memory address.

4. Allow the test to run through several displays of @ before terminating it.

Exiting the Test

To end the test, turn the scanner off.

Failures in the scanner's memory mean that it must be serviced. Contact your SICK Auto Ident, Inc. representative immediately.

Flash Operating System Download

This procedure should only be used by SICK Auto Ident, Inc. Service Personnel.

Note: All parameters will be reset to defaults after this procedure. Parameters should be uploaded to a file for future reference. All setup parameters will be set to default following new OS download. Verify that you have all group setup strings to a file allowing you to properly restore setup parameters.

The scanner Operating System (O.S.) software is stored in FLASH read only memory (ROM). This technology allows the scanner to be reprogrammed in the field. The scanner may be upgraded with new releases of the operating system using this procedure.

Performing the Download

1. Select FLASH O.S. Download by typing *R* - *Enter*. The following message will be displayed:

   WARNING! OPERATING SYSTEM WILL BE ERASED.
   NEW OPERATING SYSTEM CODE MUST THEN BE DOWNLOADED,
   USING TERMINAL PORT SET 9600,N,8,1, XON/XOFF
   WARNING! DO YOU WISH TO PROCEED? (Y/N)

Note: Since the operating system will be erased, you must be absolutely sure you have the necessary new release from SICK Auto Ident, Inc. You also must be sure that you are connected to a computer with a terminal emulation program that can perform either a straight ASCII download without any outgoing character translations, or an Xmodem file transfer.

---

2. Press *Y* or *y* - *Enter* to proceed. Press any other key(s) to cancel the procedure. The following will be displayed:

   YOU ANSWERED 'Y' TO PROCEED WITH ERASING
   OPERATING SYSTEM, NOW TYPE 'FLASH'

3. Type *FLASH* or *flash* - *Enter* to start the procedure. The following message will be displayed:

```
Please Cycle power (turn OFF, then ON)
To Start FLASH Download Procedure
```

4. Cycle power to the scanner. The following will be displayed.

```
RVSI CiMatrix FLASH programming monitor
BOOT MONITOR V X.X
Operating System must be reprogrammed.
Code checksum:
XXXXXXXX
Actual checksum:
XXXXXXXX
Erasing main block 1...
erase OK
Erasing main block 2...
erase OK
Erasing main block 3
erase OK
Erasing main block 4
erase OK
Waiting for download of new system code....
or start of Xmodem/Xmodem1K transfer.....
```

5. At the PC, load and run a terminal emulation program such as ProComm for Windows or DOS, or Windows Terminal.

Note: After the old O.S. is erased, the Setup/Terminal/Slave port will revert to default serial port parameter values; 9600 baud, 7 data bits, space parity (equivalent to 8 data bits, no parity). Because O.S. downloads using 38.4K baud are 4x faster than at 9600 baud, you may want to speed up the download process by changing the default values.

6. (Optional) Change the default serial port parameters. To change the baud rate, enter the following command:

   ~?x00n~

   where:

   x—1 or 2, for Host or Terminal ports, respectively

   n—The values of *n* are shown in Table 8–2.

TABLE 8–2. *n* Values

n	Values
0	14.4k
1	28.8k
7	9600
8	19.2k
9	38.4k

To change the parity and number of stop bits, enter:

~?x02nn~

where:

x—1 or 2 for Host or Terminal ports respectively

nn—the values for *nn* are shown in Table 8–3.

TABLE 8–3. *nn* Values

nn	Parity	Stop Bit(s)
0	space	1
1	mark	1
2	even	1
3	odd	1
4	none	1
8	space	2
9	mark	2
10	even	2
11	odd	2
12	none	2

The new OS can be downloaded over the Host or Terminal ports using ASCII, Xmodem or Xmodem1K protocols. Under ideal conditions of no noise and a relatively short RS-232 cable, you can use the straight ASCII download. This method is almost twice as fast as either of the Xmodem protocols, but it does not allow error correction.

If you use a modem or if your on-site communications are noisy, you should use either the Xmodem or Xmodem1K protocol. Every data packet sent using these protocols is tested for errors by a checksum comparison. Xmodem1K is slightly faster than Xmodem, but it is not universally supported.

7. If you are making an Xmodem transfer, configure the scanner as an Xmodem receiver by sending it the following command:

   ~X~

   The following message will be sent in response:

   READY TO RECEIVE FILE FOR XMODEM DOWNLOAD

   The scanner will then poll the PC or host computer, and wait to begin the file transfer process. It will expect to receive data through the same port that received the **~X~** command.

8. If you have changed the baud rate, you should change the associated baud rate on the terminal at this time. Start downloading the new Operating System *.sef* file from the PC to the scanner. If you are using straight ASCII protocol, the scanner will sends a line of periods (.) to the terminal to indicate each line being sent. The process takes about 15 minutes at 9600 baud. If you are using Xmodem or Xmodem1K protocol, the scanner will not send the periods.

9. When the transfer is complete, the checksum will be displayed and the system will automatically reboot. You should see the message:

   Download complete.

   Code checksum:
   XXXXXXXX
   Actual checksum:
   XXXXXXXX
   Checksums match, download successful.

   Starting up new operating system code.

   The scanner will reboot and display the sign-on messages for the new version, on your terminal.

Note: When the new O.S. starts up, default serial port parameters will again be used. If you changed the baud rate or parity on the PC, you must set it back to 9600 baud, 7 data bits, space parity (equivalent to 8 data bits, no parity).

If there is a problem during the download, the resulting checksum may be incorrect. If this is the case, the procedure will start over, and you must download the code again.

Restore Keysheet

The *Restore Keysheet* procedure allows you to restore the customized keysheet parameters that were saved in FLASH memory at the factory. Because the user cannot overwrite the FLASH memory, these parameters provide a reliable backup of the original settings.

Running the Procedure

1. 1. Select RESTORE KEYSHEET by typing *R - Enter* while RESTORE KEYSHEET is shown. The comment block from the last keysheet that was saved will be displayed. If no keysheet was saved, the following message will be displayed:

   NO KEYSHEET SAVED

   WARNING: Restoring keysheet parameters will overwrite current settings.

   Do you wish to proceed? (Y/N)

2. Type *Y* or *y -Enter* to restore to RAM the previously saved keysheet parameters.

   Entering any other response will abort the procedure. If no parameters were saved, you will see the message:

   NO KEYSHEET SAVED

   Otherwise, the following message will be displayed:

   Keysheet parameters restored, press any key to reboot

3. You must reboot the scanner for the restored parameters to take effect.

The power to the laser diode will be turned *Off* during restoration to avoid spikes that could shorten diode life.

Note: The keysheet area in FLASH memory is not erased when a new OS version is downloaded. Therefore, you can restore the keysheet settings easily after updating the OS. However, if the new OS introduces any new or changed parameters, they may not be set correctly by the saved keysheet. SICK Auto Ident, Inc. make every effort to be backward compatible, and will try to warn you when new parameter values will need to be entered by hand.

Restore C Program

RESTORE PROGRAM is used to either save the currently loaded C program into non-volatile FLASH memory, or restore the program from FLASH into RAM memory. This allows restoring a user program in the event of memory loss of the battery-backed SRAM, and after downloading a new version of the operating system. This gives a measure of security to installations where the user program source code and download file may not be given to a customer by the system integrator, or gets lost over time. This also allows scanners that are returned to the factory for service to be shipped back to the customer with their program intact.

Procedure for Restoring a User Program

The RESTORE PROGRAM procedure works in a similar fashion to the RESTORE KEYSHEET procedure. When you run the procedure by entering an *R* from the Diagnostic menu, you will be prompted with messages similar to the following:

Currently stored User Program information:

Program checksum, start, end, & comment block:

ec 130000 130810 1302fc Program XYZ for Company ABC, written 9/9/99

WARNING: Restoring user program will overwrite current program

Do you wish to proceed? (Y/N)

In this example, the comment block saved with the program is *Program XYZ for Company ABC, written 9/9/99*. You may type any information in this block when the program is saved.

If there is no program stored in FLASH memory, the following will be displayed:

NO USER PROGRAM STORED

If you answer the prompt with a *Y* or *y*, a second prompt will be displayed to confirm:

WARNING: Restoring user program will overwrite current program

Do you wish to proceed? (Y/N)

If you answer this prompt with a *Y* or *y*, the program will be restored into memory, and another prompt will be sent:

User program restored, press any key to reboot

After you press any key, the scanner will reboot and run the user C program.

Saving a User Program

The user program to be saved in memory must have a code and constant segment size of less than 8Kbytes. Refer to the following paragraphs to determine the size of your program. The method used to save a program is hidden from a user in that there is no prompt telling you how to do it. To save a program to FLASH memory, run the RESTORE PROGRAM procedure by typing *R* in the Diagnostic menu, and then typing PROGRAM in response to the prompt:

Do you wish to proceed? (Y/N).

You will be prompted with:

Enter comment block for new user program:

Type your desired comment block to be saved with the program. You may type any number of characters, ending it with a *CR*. The number of characters you enter is included in the size of the program when the test is made to see if it will fit in the available 8Kbytes of space. After the comment block is entered, a final prompt will appear:

User program saved, press any key to reboot.

Pressing any key will reboot the scanner.

The user program to be saved in memory must have a code and constant segment size of less than 8Kbytes. 8Kbytes may seem small, but most programs will fit in this size. As an example, the Crisplant program is just under 8K. This is CODE size only, including constants and initialized data. It does not include the dynamic data usage by the program, global, local or local static.

You may find the size of your program by one of two methods. The direct method is to load the program into the scanner and then try to save it to FLASH memory. If the program is too large, the following message will appear:

User Program is too large to fit in Flash memory

The quantitative method is to look at the map file generated after the linking phase of the program build.

You must add the following line to your make file or batch file (e.g. c68k.bat) to generate this map file:

```
..\..\bin\GSMAP %1.rmp -n -o
```

or:

```
c:\cisoft\c68k\bin\GSMAP %1.rmp -n -o
```

depending on the paths to the C Programming Platform executable files.

At the bottom of the *.map* file generated by the *GSMAP.EXE* program, there will be a list of all the segment sizes. Scroll up from the bottom of the file, until you find the notation *end_constant*. Subtract the address of this segment from the address of the *S__main* segment. The difference will be the size of the code and constant segments. For example, you will see something like the following:

...

TABLE 8–4.

Segment	Address	Length	Class	Align	Combine
S__main	00130000 (1245184)	000028 (40)	code	hword	private
S_main	00130028 (1245224)	000ed4 (3796)	code	hword	private
_S_data	00130efc (1249020)	0005da (1498)	constant	hword	private
sdata	001314d6 (1250518)	0000d9 (217)	constant	hword	private
end_constant	001315b0 (1250736)	000001 (1)	separate	hword	private

..

In this example, the end_constant address minus the S__main address is 1315B0 - 130000 = 15B0(hex) or 1250736 - 1245184 = 5552(decimal). This program is less than 8Kbytes, since 8K = 2000 (hex) or 8*1024 = 8192 (decimal).

The data segments of the user program, i.e. the local, global or static variables are not saved with the program.

The program variables may also be corrupted by the action of saving a program in FLASH memory. This is consistent with normal operation of the user program in that the RAM is battery backed and is not cleared after each power-up. Un-initialized data will therefore not be automatically cleared to zero.

Any program that depends on this technique to save data as static variables instead of using the ANSI-compatible file system, must check the integrity of the data with a checksum scheme, or other technique.

Any files in use by a program using the ANSI-compatible file system will be lost when a program is restored.

Set Clock Procedure

This diagnostic allows you to set the time and date of the on-board battery-backed real-time clock. The clock may be read and used by a user C program. When you run this entry by pressing *R*, the following example message will be displayed:

> Present time/date is:
>
> 12:00:00
>
> 08-04-95
>
> Enter new time (hh:mm:ss):

The clock will continue to keep time and date while you are observing the display. Press *Enter* to exit the routine without making any changes to the clock.

To change the time, type a new time, in 24-hour notation, followed by *Enter*. The clock will be reset at the instant that *Enter* is pressed, so you must compensate for the delay between typing the time and pressing *Enter*.

No line editing is allowed, so you must enter the time correctly. If you enter an incorrectly formatted time string, but not an incorrect time, the message, Incorrect format, will be displayed, and you will be prompted to re-enter the time.

You will be prompted to enter the date by the message:

Enter new date (mm-dd-yy):

Type the date in the correct format, followed by *Enter*, to enter the new date and end the procedure.

You can run Set Clock again by pressing *R* to ensure the correct values were entered. The time displayed will be the time at which you press *R*. Press *Enter* to exit the procedure without changing the clock.

7555A/7655 Frequency Adjustment

This adjustment refers only to scanners with the programmable sweep option. Although parameters 454 RASTER FREQUENCY and 455 RASTER AMPLITUDE are listed on all scanners, they are only used with the programmable sweep function. To prevent the loss of laser power in earlier models of all scanners, set these two parameters to 99. The parameters range is 000 (default) to 099.

These parameters may be set from the Setup menu by entering in values directly, or through the SET DIGITAL POTS diagnostic. New features have been added to the diagnostic to allow displaying the sweep frequency while you set the pots. This is valuable when setting up the proper sweep height and frequency in the field, since without this feature you would have to open up a unit and measure the frequency with a meter.

When running the SET DIGITAL POTS diagnostic, the menu of choices is now:

Current settings: (select # to change)

1 MOTOR SPEED = 50
2 LSR PWR (FINE) = 0
3 LSR PWR (COARSE) = 0
4 LSR PWR LIMIT = 0
5 PHASE = 99
6 RASTER FREQUENCY = 0
7 RASTER AMPLITUDE = 0
8 OPT RCVR LIMIT = 99
9 OPT RCVR THRESH = 72
10 OPT RCVR SHIFT = 20
11 OPT RCVR GAIN = 0

Selecting 6 to adjust the raster frequency will bring up the following prompt. A similar prompt is given if 7 is selected.

Mode will reliably work if reading efficiency is 100!
U to increment, D to decrement
T for max, B for min, F to display Frequency
6 RASTER FREQUENCY = 00

The current sweep frequency measurement is displayed by typing 'F'. You will then get either the message:

No measurements made

Or a message like:

Frequency: 9 Hz

It is important to understand how the measurement is made to understand the cases where you get the message "No measurement made". The diagnostic assumes a label is placed in the middle of the sweep height and that the sweep height relative to the bar height is such that the raster pattern extends beyond the label on both sides. The diagnostic times how long it takes to move off of the label, then return to the same point. This is then converted to the sweep frequency.

If there is no label being scanned, or the sweep height is not big enough to move off of the label (so a label is always being scanned), then the message "No measurements made" will be displayed.

The proper method to use this feature is to first set the sweep frequency and amplitude to zero (making a single line), and then place a label with small bar height relative to the desired sweep height in the middle of the scan line. Run the Read Efficiency diagnostic and position the label so it reads 100% or as close as you can get it to 100%.

Then, increase the amplitude and frequency to approximate the desired sweep height. The actual starting frequency is not important except to get some oscillation so you can measure the frequency. The combination of sweep height and bar height should result in a raster pattern that extends beyond the label on both sides. At this point you can type 'F' to make a frequency measurement. Adjust the frequency setting to the desired value. Note that there is an interaction between the frequency and amplitude settings. As you change the frequency, the sweep height (amplitude) will also change as you drive the oscillation relative to the resonance of the motor/mirror assembly. You will have to iterate between setting the amplitude pot then the frequency pot to arrive at your desired sweep height and frequency.

Gap Tracking Diagnostics

Adjusting Gap Tracking parameters and diagnosing problems during the installation of your scanner can be made easier by using the following built-in diagnostic features.

Scanner Model Notification

Parameters are included that are not used in all scanner models, or that may be used only when certain options are installed.

Gap Tracking Parameters

The gap tracking-related parameters, with their default values are shown in Table 8–5.

TABLE 8–5. Gap Tracking Parameters

Parameter	Description	Default Value
700	TRACKING	0 (disabled)
701	ENC UPDATE RATE	4 ms
702	MILS/TIC	000 (disabled)
703	OUTZN TOLR	040 (4.0")

TABLE 8–5. Gap Tracking Parameters (Continued)

Parameter	Description	Default Value
704	BOX TOLR	020 (2.0")
705	CONV WIDTH	240 (24.0")
706	INZONE-CENTER	0170 (17.0")
707	OUTZONE-CENTER	0170 (17.0")
708	ENDPOINT TBL	0
709	ROTATION ANGLE	000 (degrees)
710	HEIGHT1	030 (3.0")
711	HEIGHT2	090 (9.0")
712	HEIGHT3	150 (15.0")
713	HEIGHT4	210 (21.0")
714	HEIGHT5	000 (not installed)
715	CONV TO SCANNER	180 (18.0")
716	MIN HEIGHT	000 (000")
717	MAX HEIGHT	180 (18.0")
718	FIXED BOX LEN	000 (off)
719	FIXED CONV SPD	000 (off)
725	PIC PHOTO EYES	0
726	SCAN DELAY COMP	0 (disabled)
727	TUNNEL MTG ANGLE	45
728	BOX FACES	0
729	LABEL TOLR	020
730	SCAN ZONE IZ-CTR	0170
731	SCAN ZONE OZ-CTR	0170
732	PIC SERIAL PORT	1
733	PIC POSITION	1
743	NUM HT ARRAY SENSORS	096
744	BOX TOLR SIGN	+

Setting Up for Gap Tracking Diagnostics

To set up for diagnostic testing:

1. Connect a PC running terminal emulation software (not a CiMAX 1400) to the scanner's Setup port.
2. Be sure that the scanner is running in the Normal mode.
3. Set parameter 012 NORMMD RPT only as indicated in the following paragraphs.

Unsolicited Messages Sent to the Setup Port

If gap tracking is disabled (parameters 501 PRESENCE ENABLE and 702 MILS/TICK both zero), you will see the following message after reboot:

GAP TRACKING DISABLED

If gap tracking is enabled (501 PRESENCE ENABLE and 702 MILS/TIC both non-zero), you will see a message similar to the following after reboot:

GAP TRACKING ENABLED: Res:33mils/tic Tolr:3993mils

where:

Res is the value of parameter 702 MILS/TIC

Tolr is the value of parameter 703 OUTZN TOLER

The following three messages are related to the tachometer:

If the tachometer signal drops below 5 ft/min:

STALLED CONVEYOR SLOW MOVEMENT

If there are no recorded tach ticks in 500 ms:

STALLED CONVEYOR NO MOVEMENT

When ticks above 5 ft/min are detected (but after a possible 500 ms delay):

UNSTALLED CONVEYOR

Host Commands

Host Commands request data from the scanner that can help in diagnosing gap-tracking problems. They are not meant to be used to routinely monitor operation.

To routinely monitor scanner operation, use a CiMAX 1400 terminal as described in 012 NORMMD RPT in the *Scanner Parameters Reference Guide*.

Note: DSP 0 is installed in all scanners. DSPs 1 through 7 are only used in OMNI scanners. In the examples which follow, information about all possible DSPs are included to maintain software conformity among products.

~TRACK~

These are the endpoints for the lines that have been calculated according to the known endpoints at 13" and 60" at all of the possible heights. The heights are in turn calculated from the height parameters:

TABLE 8–6. Send Beam Coordinates

Parameter	Description	Value
710	HEIGHT1	030
711	HEIGHT2	090
712	HEIGHT3	150
713	HEIGHT4	210
714	HEIGHT5	000

TABLE 8–6. Send Beam Coordinates

Parameter	Description	Value
715	CONV TO SCANNER	180
716	MIN HEIGHT	000
717	MAX HEIGHT	180
725	PIC PHOTOEYES	0
732	PIC SERIAL PORT	1
733	PIC POSITION	1

Example

Using the above defaults.

---Tracking Debug Data---
Line endpoints at height 0
DSP 0: 0,-12986 to 0,12986, length = 25973,height = 17875
DSP 1: 0,0 to 0,0, length = 0,height = 17875
DSP 2: 0,0 to 0,0, length = 0,height = 17875
DSP 3: 0,0 to 0,0, length = 0,height = 17875
DSP 4: 0,0 to 0,0, length = 0,height = 17875
DSP 5: 0,0 to 0,0, length = 0,height = 17875
DSP 6: 0,0 to 0,0, length = 0,height = 17875
DSP 7: 0,0 to 0,0, length = 0,height = 17875

Line endpoints at height 1
DSP 0: 0,-9717 to 0,9717, length = 19435,height = 13375
DSP 1: 0,0 to 0,0, length = 0,height = 13375
DSP 2: 0,0 to 0,0, length = 0,height = 13375
DSP 3: 0,0 to 0,0, length = 0,height = 13375
DSP 4: 0,0 to 0,0, length = 0,height = 13375
DSP 5: 0,0 to 0,0, length = 0,height = 13375
DSP 6: 0,0 to 0,0, length = 0,height = 13375
DSP 7: 0,0 to 0,0, length = 0,height = 13375

Line endpoints at height 2
DSP 0: 0,-5358 to 0,5358, length = 10716,height = 7375
DSP 1: 0,0 to 0,0, length = 0,height = 7375
DSP 2: 0,0 to 0,0, length = 0,height = 7375
DSP 3: 0,0 to 0,0, length = 0,height = 7375
DSP 4: 0,0 to 0,0, length = 0,height = 7375
DSP 5: 0,0 to 0,0, length = 0,height = 7375
DSP 6: 0,0 to 0,0, length = 0,height = 7375
DSP 7: 0,0 to 0,0, length = 0,height = 7375

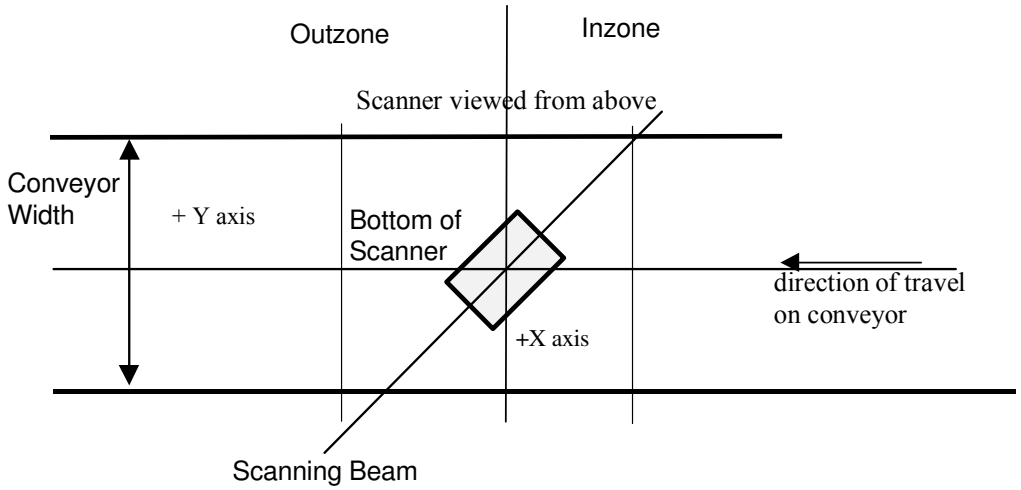
Line endpoints at height 3
DSP 0: 0,-998 to 0,998, length = 1997,height = 1375
DSP 1: 0,0 to 0,0, length = 0,height = 1375
DSP 2: 0,0 to 0,0, length = 0,height = 1375
DSP 3: 0,0 to 0,0, length = 0,height = 1375
DSP 4: 0,0 to 0,0, length = 0,height = 1375
DSP 5: 0,0 to 0,0, length = 0,height = 1375

DSP 6: 0,0 to 0,0, length = 0,height = 1375
DSP 7: 0,0 to 0,0, length = 0,height = 1375

Line endpoints at height 4
DSP 0: 0,90 to 0,-90, length = -181,height = -125
DSP 1: 0,0 to 0,0, length = 0,height = -125
DSP 2: 0,0 to 0,0, length = 0,height = -125
DSP 3: 0,0 to 0,0, length = 0,height = -125
DSP 4: 0,0 to 0,0, length = 0,height = -125
DSP 5: 0,0 to 0,0, length = 0,height = -125
DSP 6: 0,0 to 0,0, length = 0,height = -125
DSP 7: 0,0 to 0,0, length = 0,height = -125

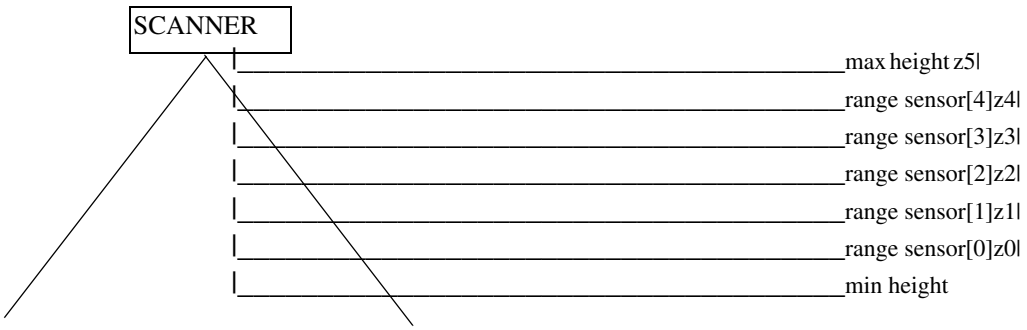
The coordinate system illustrated in Figure 8–1 shows the orientation of the x-y axis. The points recorded in the Cartesian system are with respect to the direction of travel along the Y-axis, as shown in Figure 8–1.

FIGURE 8–1. Orientation of X-Y Axis



The height listed is actually the range from the scanner, and includes the internal optical path length. The heights are calculated as the midpoint between each height parameter according to Figure 8–2.

FIGURE 8–2. Calculated Heights



Parameter 709 ROTATION ANGLE affects the line endpoints. ROTATION ANGLE allows the scanner to be rotated with respect to the conveyor. This is done internally by converting the end point table in use to new coordinates according to this angle.

Note: The next three commands can only be used when parameter 012 NORMMD RPT is set to 4.

~TRAKS~

This command gathers data about barcode positions. The TRAKS data describes the encoder count, the x-y position of the barcode, and the position of the box in the zone at the time the bar code was read. Only bar codes that were found to belong to a box because their y-axis value is within the bounds of the box leading edge and trailing edge (plus the BOX TOLR value) are saved in this array.

The data is cleared at the next inzone signal.

Example

---Tracking Debug Data---
Dsp:0 Enc:43234 X:-316 Y:-8295 Lead:3394 Trail:-17000 IZ:42612 Label:25
Dsp:0 Enc:47908 X:2589 Y:-11712 Lead:-12776 Trail:-17000 IZ:47776 Label:76
Dsp:0 Enc:48532 X:-2785 Y:-5423 Lead:-6110 Trail:-10928 IZ:48198 Label:B0B
Dsp:0 Enc:56454 X:688 Y:-9432 Lead:-7034 Trail:-17000 IZ:56146 Label:91
Dsp:0 Enc:61484 X:137 Y:-8940 Lead:-9938 Trail:-14162 IZ:61266 Label:570324
Dsp:0 Enc:62048 X:-2860 Y:-5338 Lead:-5054 Trail:-9938 IZ:61686 Label:09
Dsp:0 Enc:34458 X:-235 Y:-8520 Lead:-9608 Trail:-13898 IZ:34232 Label:88

~TRAKN~

This command is just like ~TRAKS~, except that the data describes barcodes that did not fit onto any box.

~TRUNC~

Available but not applicable.

~TIMES~

Available but not applicable.

~TOLER~

This command is useful to check the accuracy of the MILS/TIC, INZONE-CENTER and OUTZONE-CENTER parameters. It displays the outzone deviation, in number of tachometer ticks, of when the box actually reached the outzone photoeye, compared to its position calculated from the number of tach ticks recorded multiplied by the dist/tick value. If a box is early or late by more than the OUTZN TOLR parameter, it is considered a phantom box.

Example

---Tracking Debug Data---
OUTZONE Tolerance =121 tics (3993 mils)
* = last object
Object 0 outzone deviation = 12
Object 1 outzone deviation = 10

Object 2 outzone deviation = -30
Object 3 outzone deviation = 10
Object 4 outzone deviation = 6
Object 5 outzone deviation = 0 *
Object 6 outzone deviation = 10
Object 7 outzone deviation = -30
OUTZONES: Delayed=5 Early=4 Unexpected=0 Missing=4 On time=0

~TOTAL~

When sent over STARNODE or TCP/IP, this command must be prefixed with / . The ~TOTAL~ command is used to display a report such as:

0 boxes, 0 no reads

where:

boxes—Total box count

no-reads—No-read count

You can view a running display of boxes and no reads in the status line by setting parameter 012 NORMMD RPT = 2, 3, 4 or 5.

The totals in the first line will not be cleared (even if the power is cycled *Off* and *On*) until **`~TOT00~`** is sent.

~DATA~

3 bad checksums, 3 restored defaults, 0 last bad param
Max Scan Delay 55374, Min Scan Delay 0, Unassigned Label 0, Overlapping 0
DSP Buffer Overflows [0-7] 0, 0, 0, 0, 0, 0, 0, 0

where:

bad checksums—Number of bad checksums detected

restored defaults—Number of restored default parameters

last bad param—Number (in the Setup menu) of the last parameter that was found to be outside its range

Max Scan Delay—Number of scans barcode data processing is lagging

Min Scan Delay—Number of scans barcode data processing is lagging

Unassigned Label—Number of unassigned labels to no box

Overlapping—Number of overlapping labels to more than one box

DSP Buffer Overflows—Number of buffer overflows per DSP

Refer to “Memory Error Detection, Response & Reporting” on page 5-4 for bad checksums, restored defaults and bad last parameter.

When parameter 002 OPMODE is set to *7*, Polling Mode D information will also be reported, as shown below:

Polling Mode D Communication Stats

Slave	Request	Response	Consecutive No Responses
1	3	3	0
2	3	3	0
3	3	0	3

- *Slave*—Polling Mode D slave number
- *Request*—Number of times that data was solicited from a slave
- *Response*—Number of times that the slave responded
- *Consecutive No Responses*—Current number of times that the slave did not respond

The Polling Mode D totals can be cleared by sending **`~TOT00~`** and will also be cleared when the power is cycled *Off* and *On*.

~TOT00~

Clear totals of boxes and no-reads

Example

Clearing Box Count

NORMMD_RPT Data Reports & Formats

When a PC running terminal emulation software is connected to the scanner's Setup port with the scanner in Normal mode, gap-tracking information will be sent to the Setup port with the bar code at the end of presence. The information sent, and the format, depends on the value of parameter 012 NORMMD RPT, as illustrated below.

NORMMD_RPT = 0

Bar code data will be sent just as it is from the Host port.

NORMMD_RPT = 1

When set to 1, and if the hand-held terminal is selected via the 000 TERM DEVICE parameter, then cursor positioning is used to place the label on the first line, nothing on the second line, current inputs and outputs on the third line, and the status flags, equivalent to the status decimal points in the 242i, on the fourth line. This aids the hand-held unit become the *display* for the CiMAX 7800.

NORMMD_RPT = 2

With presence and gap tracking enabled, the barcode will be sent on line 1, the total box count and no read count will be sent on line 2 and the length and height will be sent on line 3.

Example

151F0286706E
9 BOXES, 4 NO READS, 1 IN ZONE
LEN 694,HT 2

NORMMD_RPT = 3

With gap tracking enabled, gap tracking-related data will be sent on the two lines following the barcode.

where:

pcnt—Number of objects in zone

phead—Pointer to a look-up table (SICK Auto Ident, Inc. use)

ptail—Pointer to a look-up table (SICK Auto Ident, Inc. use)

dsp—Number of the DSP that read bar code

rel—Release coordinate (SICK Auto Ident, Inc. use)

len—Length of the box (x 0.001")

ht—Number of height sensors blocked

delta iz—Time in zone, in mils/tic

gap—Distance between this box and the last (x 0.001").

Example

151F0286706E

pcnt:1,phead:3,ptail:3,dsp:0,rel:3796749

len:22770,ht:2,delta iz:176814,gap:176814

151F0286708Q

pcnt:2,phead:5,ptail:4,dsp:0,rel:3974817

len:4290,ht:0,delta iz:196548,gap:173778

Missing Outzone

pcnt:1,phead:5,ptail:5,dsp:0,rel:3989205

len:4752,ht:3,delta iz:13926,gap:9636

You may also see the message:

MISSING OUTZONE

This message reports that a phantom box has been detected. A missing outzone message will be generated when there is an inzone signal without a corresponding outzone signal. The message is sent after enough tachometer ticks have occurred for the box to have moved 1 ½ times the length of the zone. This is a timeout length for each box.

An unexpected outzone transition message will be sent as soon as an outzone signal occurs without a corresponding inzone, as:

UNEXPECTED OUTZONE TRANSITION

NORMMD_RPT = 4

If gap tracking is enabled, gap tracking/barcode reading data will be sent and will include the following:

- *Object*—Cumulative number of objects detected
- *Trakcnt*—Number of barcodes that fit onto this box
- *No Tracks*—Number of barcodes that were off of this box but might still be on another box
- *Truncations*—Number of barcodes that were outside of the scan zone.

Example

151F0286706E

Object: 0 Trakcnt:27 NoTracks:15 Truncations :1

151F0286708Q

Object: 1 Trakcnt:11 NoTracks:33 Truncations :29

151F0286706E

Object: 3 Trakcnt:34 NoTracks:13 Truncations :4

151F0286708Q

Object: 4 Trakcnt:12 NoTracks:24 Truncations :29

Sources of Error in Gap Tracking

Under control of application engineer/installer/owner:

1. Large mils/tic settings.
2. Inadequate resolution of box height (number of height sensors).
3. Accuracy of all user-entered parameters.

Normal Mode Reporting 7

With Normal Mode Reporting set to 7 (and 700 TRACKING set to 2 through 7), the 7800 reports each time a label is read and attempted to be put on a box. There are several uses for this test. The first thing that it does is provide a way of knowing when a label is read, but determined to not belong on a box (an indication that the box is not where the 7800 thinks it is). Some sample reports are shown below.

OMNI

Box 0, X -4443, Y -3640, Z1 -4067, Age 0 1 32453, Label 777779
Box -8, X -6447, Y 1779, Z1 -4067, Age 0 1 35591, Label 2222224444440000

The box index is shown first. A negative box value indicates the label does not fit on a box (a value of -8 is used to reflect -0). The X and Y coordinates are shown next. The zone 1 value indicates the leading edge distance from the center of the scan zone. The age of the label, DSP (mask) and DSP timestamp are shown next. Finally, the label is shown.

7800

Box 1 1, Face 20000, Z1 4910, Z2 870, Foc 650, Th 81, Lbl 1Z0123456789123456

There are two values shown for Box. Normally they are the same, as in the example above. These indicate the box index. If the box value is negative, this indicates that the label did not fit on any box. The second number in this case would be either a -1 or -2. A value of -2 indicates that the label overlapped two boxes, unable to determine which box the label belongs on. A value of -1 indicates the label does not fit on any box.

The next field reports the box face (10,000 = front, 20,000 = top, 30,000 = back, 40,000 = near side, 50,000 = far side). The zone 1 and zone 2 values are given next. These are the leading and trailing edge distance from the center of the zone when the label was read (this gives the relative box position). The focus distance and threshold setting are given next. Finally the label in question is shown.

Using NMR 7 with a fixed focus setting and then again with a dynamic focus setting provides an indication of how well the 7800 is tracking boxes.

Note: Do not use NMR 7 when statically reading a box. The I/O system will be swamped with report entries.

When box is -1 (label does not fit on a box) the face and zone2 values have no meaning.

Position Accuracy Factors

There are several factors that influence the accurate tracking of position of a box. These are tabulated below.

Inzone Debounce Time

The distance that the box travels in the debounce time skews the location of the box accordingly. This becomes a greater factor at higher conveyor speeds. For example, a 20-millisecond debounce time on a conveyor moving at 500 feet per second results in a 2-inch lag before recognizing the input. This error alone would affect the ability of the 7800 to properly focus when scanning down the rear of a box. The software compensates for this time lag and adjusts the focus point accordingly.

Photoeye Height Tree

The spacing of photoeyes on the height tree greatly influence the effective depth of field for a 7800. The box height and thus the 7800 focal distance is estimated to be the halfway point between two photoeyes. True box heights may be above or below this point by ½ distance between the photoeyes. As this distance approaches the 7800 depth of field, the effective DOF is reduced accordingly. For example say the 7800 has a depth of field of approximately 4 inches at any given focal distance. If photoeyes are placed 2 inches apart, then the maximum error in height is 1 inch. The 7800 DOF then becomes 3 inches. As you can see a photoeye separation of say 6 inches would reduce the DOF to only 1 inch. This becomes even more critical when attempting to read down the face of a box.

Tachometer Resolution

The 7800 focal distance is checked on each tachometer pulse. An adjustment to the focal distance may not be made on each pulse but certainly cannot be made more frequently. When scanning down the face of a box many focal distance adjustments are required in a short time. It is important

that the frequency of tachometer pulses be sufficient to result in a smooth adjustment of the focal distance.

Conveyor Speed Accuracy

It is important that the 7800's estimate of the conveyor distance traveled with each tach pulse. The position of the box is determined by updating it according to the calculated speed. Any error in this speed thus results in a corresponding error in location. Often the conveyor speed is determined by using the TACH CALIBRATION procedure. This procedure determines the mils/tic of the tachometer signal. This calculation relies on the inzone to outzone distance being accurate. Any error in this measurement results in an inaccurate speed calculation.

7800 Scan Line Angle Accuracy

It is important that the 7800 mounting be such that the scan line is at the indicated angle. This wording may sound odd, however it is intended to indicate that the mounting angle of the 7800 case does not necessarily correspond to the scan line angle. It is possible that the scan line is not exactly parallel to the 7800 case. The best way to ensure the proper scan line angle is to measure from where the scan line exits the 7800 window to the conveyor. Often a protractor is used to reference the 7800 case to the mounting frame. This is not the preferred method.

Inzone To Center Measurement

The distance from the inzone to the center of the scan zone (the point where the scan line intersects the conveyor) is critical to determining the accurate position of a box. Any error in this measurement affects the focus distance when scanning down the face of a box.

Multiple Labels Per Box

It is possible to have a 7800 read two faces of a box and be able to differentiate labels according to the face of the box. For example a 7800 mounted above the conveyor scanning toward the back of a box can read labels on the top and back of a box. It can then put these labels in separate bins according the X, Y position. Remember that with tracking set to 2 through 7 the X dimension indicates the face of the box. By setting the MM fields of the decode format bins to use X, Y position (settings 4 or 8) and the label tolerance to less than 10 inches, labels on different faces are put in separate bins.

Each face of the box is at least 10 inches apart according to the definition of the face stored in the X dimension. Even labels physically located very close together, but on different faces, are easily separated according to this method. Notice that the setting for label tolerance must be less than 10 inches in order for this approach to work.

To determine the location of the top and bottom edge of a box, the highest and lowest photoeyes that are blocked will be used. If for some reason (odd shaped box, etc.) there is a photoeye between the highest/lowest photoeyes that is not blocked, this will not affect the determination of the top and bottom of the box. If the PIC board is being used to incorporate additional height sensors into the system, parameter 733 (PIC POSITION) will be used to determine if these height sensors are located above or below the normal I/O sensors. If PIC POSITION is set to 1, the PIC board sensors will be considered to be above the normal I/O sensors. If PIC POSITION is set to 0, they will be below the normal I/O height tree. If a box blocks only one height sensor, the bottom of the box will be considered to be the height zone associated with the next lowest height sensor to the one that is presently blocked.

CIX Troubleshooting

DSP debugging tools (playback, record, dumping of CIX memory) allow capturing of static data (both stitching and non-stitching), and dynamic stitching data for later playback and analysis.

For example, if you were having trouble stitching a label (and you've investigated all other problem possibilities, such as analog and optical settings, and CIX parameters), you could record a stitching pass through the label. You could save the recorded data to a file for later analysis by engineering. You could also play back the recorded data, while changing CIX parameters, to observe the effects, using identical data each time. Using the segment buffer usage dump, and general knowledge of how stitching works, you could analyze what's happening and change parameters to make it work better.

These debugging tools are used with several products and the nomenclature is generic, not customized for a scanner, and contains references that do not necessarily apply to all scanners. In particular, single-line scanners use only one DSP numbered 0. X-pattern scanners may use two to eight DSPs numbered 0-7.

Host Commands

Host commands are provided to perform the record, playback and data display operations, as outlined in Table 8–7.

TABLE 8–7. Host Commands

Command	Parameters	Description
~CIXn~	n = DSP number	Displays DSP current snapshot of segment buffer usage.
~RECn xx~	n = DSP numberxx = minimum number of features (bars and spaces) in each scan	Tells DSP to record data. The recorded data is then copied to the 68332 processor using DMA (direct memory access), and stored in a buffer.
~RECS~		Sends the data in the 68332 buffer to a port. The data is formatted as commands for downloading later.
~RBUF …~	… = offset into buffer and 16 words of data.	Fills the buffer in the 68332 with the data (...) in the command string. This command is meant to be generated by the RECS command.
~PLAYR~		Resets the buffer pointers to the start of the buffer.
~PLAYn xx~	n = DSP numberxx = number of scans	The 68332 direct memory accesses xx scans to the DSP. If xx is 00, the 68332 direct memory accesses the entire buffer.
~PDMPxxxx~	xxxx = scan number	Dumps the scan number, xxxx, to the port.

Recording

To use the record function, set parameter 079 CIX ENABLE to 3, and exit the setup menu. The scanner will reboot and display the DSP code version (CIDSP-2181 Stitching Recorder Ver X.X). The scanner will no longer decode bar codes. Instead, it will wait for a `~RECn xx~` command to begin recording

where:

n is the DSP number

xx is the minimum number of features (bars and spaces) in each scan

---

Note: The recording process uses a large block of memory to save the DSP data. This data will overwrite any user C program that has been loaded.

If there are fewer features than xx, no data will be recorded for that scan. This allows filtering out scans that have some stray data but no actual bar code segment. A typical value for xx may be 10. Parameters 076 and 077 (min/max X ticks) are also used to filter the data. The other DSP parameters are NOT used during the record process, including 073 DISCARD RATE.

In practice, you will want to start recording just before the label of interest passes through the particular DSP's scan line. Recording will continue until the DSP's memory is filled.

When recording, decimal points will be output to indicate that recording is in progress.

There is room for 16K of features (bars and spaces). Depending on the scan rate, conveyor speed and noise level, this may take several seconds or only a fraction of a second.

For example, if a `~REC0 10~` is sent, DSP 0 will start to record data for scans in which there are at least 10 edges. The message Warning: User program will be overwritten. is sent out of the Setup port, and recording begins. When the DSP's memory is filled, the message Recorder Done is sent. You will want to be sure that a complete pass through the label has been recorded, by observing how fast the memory is filled. Typically, several seconds of data will be recorded.

You may now play back the data (until the data is cleared), or you can extract the data and save it to a file. Extracting the data is done by sending a `~RECS~` command. The data sent will look approximately like the following:

~RBUF 0000 - 0000 0057 002F 000E 006B 0027 0059 002B 0018 0029 005F 0027 001A 0067 0027 001A ~
~RBUF 0001 - 0030 0011 0063 0029 001E 0022 005E 0068 0065 0024 001D 0025 001D 0027 0061 0027 ~

… etc.

In practice, you will log this to file using a terminal emulation program running in a PC. It is a large amount of data, and will take some time to upload. The data is in a format that can be directly used to download into a scanner to set up a playback.

Playback

The *Playback* program works in conjunction with the recorder to provide a means for stepping through (playing back) stitched labels. It uses all of the same parameters as the normal stitching program. In fact, it works basically the same as the normal stitching program except that it can process (play) segments one at a time. This allows inspecting the segment usage while stepping through a label. Parameters can be changed and the label can then be played again to see if there is an improvement.

In the current version, you must set parameter 073 DISCARD RATE to 0 before playing back.

To play back data, first change parameter 079 CIX ENABLE to 4, and exit the setup menu. The scanner will reboot, disable all presence options and display:

CIDSP-Playback for stitched labels. Ver: X.X

If you have just recorded data on this scanner, the data will still be in memory, and you may play back this data into a DSP. You may also, at this point, download previously recorded data, using the `~RBUF...~` strings that were extracted and saved to a file in a PC. Send the file from the PC using the terminal emulation program.

As listed in Table 8–7, host commands are used to control the playback. Sending `~playn 00~`, where *n* is the DSP number, will play to the end of the recorded data. If the DSP decodes the data, it will be sent to the 68332 processor and presented as usual.

Sending `~playr~` will reset the playback to the start of the data.

Sending `~pdmpxxxx~` will dump the scan indicated by xxxx to the Setup port for display. This is a display of the actual bars and spaces in the scan. This might be useful to look at how noisy the bardata is, bar/space ratios, min/max bardata, etc.

Sample data dumped in response to a `~pdmp0003~` command may display:

Data for Segment - 3
1708 0090 002F 0055 0044 0007 001C 00AD 00E0 009C
008F 008E 008D 0045 00D5 0008 0013 0037 008F 0056
0043 0096 0130 004E 004D 004C 004F 0131 00E9 0044
3D50 01F0 0C24 0180

The first number is the duration of the first space, in number of clock ticks (in hex). The second number is the duration of the first bar, followed by the next bar, etc. In practice, you can scan the data and easily find the bardata surrounded by quiet zones.

You can play just a portion of the data by sending `~playn xx~`

where:

n is the DSP

xx is the number of scans to play back.

Following this by another `~playn xx~` will play the next xx scans. In this way, you can progress through the data, observing the decoding process as you go.

For example, sending a `~play0 10~` command will cause the following response:

Playback Start
Number of Segments Processed:10, Buffer Segment Position:10

To display a snapshot of the segment usage at any point, use the `~CIXn~` command, where n is the DSP number. This will dump the current segment buffers (i.e., saved pieces of barcode) in an easily readable format.

Sg Va Strt End 1st Last Fami
0 0 13D2 0B81 0000 0000 3E5A
Data - 37 39 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

1 1 92BA 8886 0001 0001 3E5E
Data - 37 39 35 00 00 00 00 00 00 00 00 00 00 00 00 00 00

Up to the number of segment buffers as set by parameter 065.

The columns are interpreted as:

- *Sg*—The segment number, in decimal notation
- *Va*—The segment valid value, in decimal notation. A new segment starts with a value equal to the segment_life. It decrements each scan.
- *Strt*—The starting location of the label (the time from the start of the scan in hex notation)
- *End*—The end position of the label data for this segment, in hex notation.
- *1st*—The scan number of the first data segment in this segment, in decimal notation
- *Last*—The scan number of the last data segment in this segment, in decimal notation.
- *Fami*—A pointer to the family record for this segment, in hex notation.

The remainder of the data is the decoded segment data, in hex notation. It may be filled from the front or from the rear. This is an indication of the direction in which the label is being decoded. For example, the first three characters of a label *795…* (37h = ASCII 7, 39h = ASCII 9, 35h = ASCII 5). Refer to Table B–1, “ASCII Equivalence Table,” on page B-1.

Code 128 can be more difficult to interpret when subset C is used.

If a user program is inadvertently loaded during playback, playback will be disabled and an error message will be displayed.

A

APPENDIX A *Group Setup Strings*

This appendix defines the group setup strings that are used to set up the scanner from a host computer. Each string is diagrammed to identify the parameters in the string by their positions. Not all strings apply to all scanners.

Group Setup String Definitions

TABLE A–1. Group Setup String Definitions

Region X	Group Y	Parameter	Parameters in Setup String
0	0	SCANNER OPERATION	000-003, 012, 014
0	1	GENERAL DECODING	004-010, 015
0	2	HISTOGRAM	016-018, 056-059
0	3	DECODE FORMAT	020-027
0	4	DECODE FORMAT	028-035
0	5	MATCH STRINGS	040-047
0	6	MATCH STRINGS	048-055
0	7	DSP PARAMETERS	060-069
0	8	DSP PARAMETERS	070-079
0	9	AUTO SETUP	080-095
1	0	HOST SERIAL PORT	100-114
2	0	TERM SERIAL PORT	200-210
4	0	LAN PORT COMMS and MSGS	400-403
4	1	ETHERNET PARAMETERS	405-408,413-414 (75A only)
4	2	ETHERNET PARAMETERS	409-412, 415 (75A only)
4	4	MOTOR SPEED	444
4	5	LASER 1 PROGRAMMABLE POTS	450-459
4	9	JUMPER SETTINGS	495

TABLE A–1. Group Setup String Definitions (continued)

Region X	Group Y	Parameter	Parameters in Setup String
5	0	PRESENCE INPUTS, RELAY TYPES	501,503-506,510-518
5	2	RELAY OUTPUTS	541-543, 553-560
6	0	USER PROGRAM	600-601
6	1	USER VARIABLES	610-625
7	0	GAP TRACKING and TACH	700-709, 726-731
7	1	HEIGHT DETECT	710-719, 725, 732, 733, 743, 744

The region and group number make up the two digit number used in the upload and download commands, as illustrated in Table A–1. A leading 8 invokes an upload command, to set (change) one or more parameter values. A leading 9 invokes a download command, to permit parameter values to be reviewed.

When the user wants to download a group of parameters for review, the command `?9XY` should be used, where:

`9` = get parameters

`X` = *0* through *8* for the general region

`Y` = *0* through *9* for the particular group string in that region.

When the user wants to upload many parameters at once to set or modify their values, as when loading values according to a keysheet, the command `?8XY` should be used, where:

`8` = set parameters

`X` = *0* through *8* for the general region

`Y` = *0* through *9* for the particular string.

When the user wants to set an individual parameter, the command`?XXX` should be used, where:

`XXX` = the three-digit parameter number.

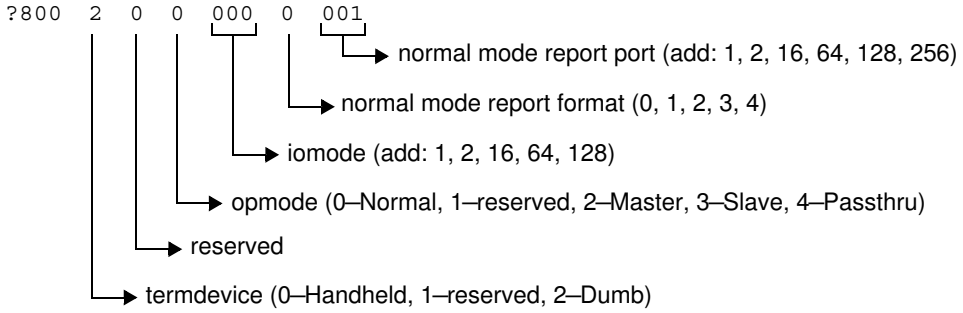
Group Setup Parameter String Formats

Spaces between characters are for illustration only. Spaces are not used in actual strings, except for the space after the ?nnn number or where otherwise indicated. The default values for parameters are shown in these strings. Your application may require other parameter values.

Note: The scanner will reboot automatically when you exit the Setup menu so the newly entered values will take effect.

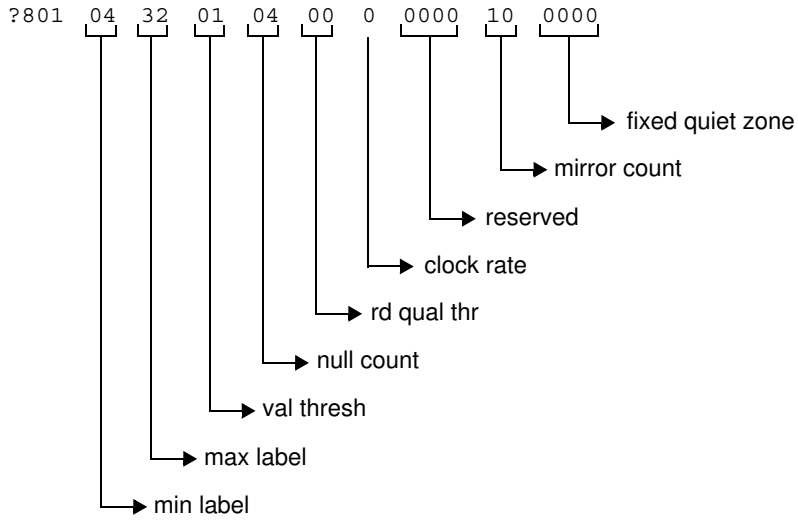
Scanner Operation Parameters

Parameters 000-003, 012, 014 (?800)



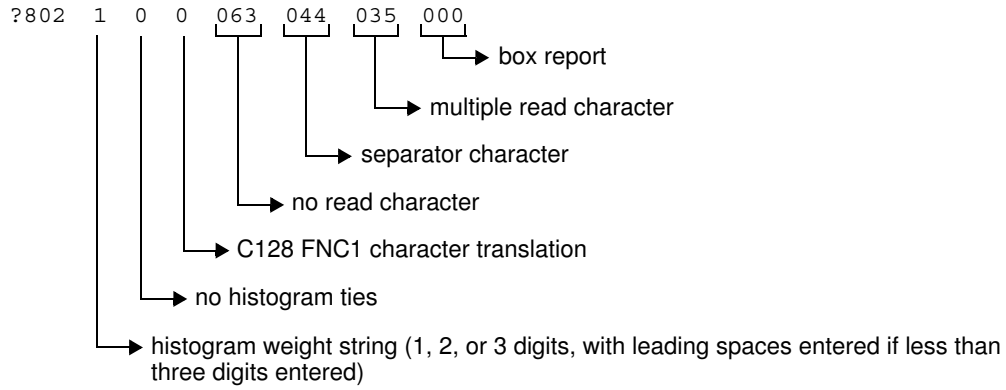
General Decoding Parameters

Parameters 004-010, 015 (?801)



Histogram Parameters

Parameters 016-018, 056-059 (?802)



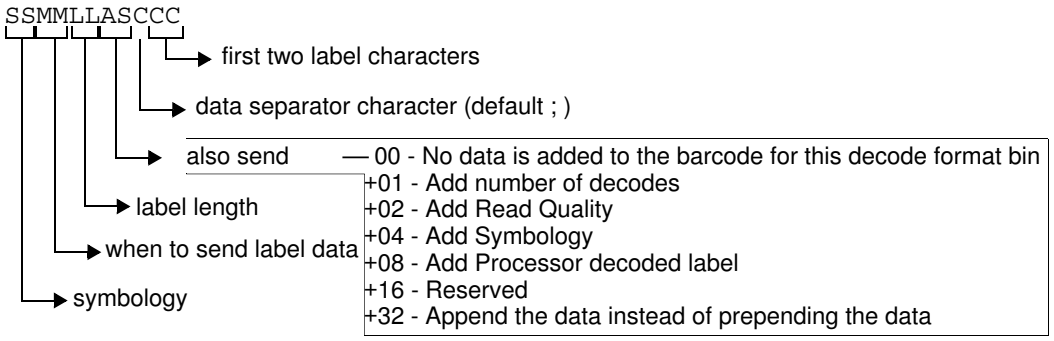
Decode Format Parameters

Parameters 020-027 (?803)

?803 SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC
SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC

Parameters 028-035 (?804)

?804 SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC
SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC SSMMLLASCCC



Note: The spaces are used as delimiters between the decode formats.

Example

The default settings are:

```
?803 10020000; 20020000; 50020600; 00000000; 00000000;
     00000000; 00000000; 00000000;

?804 00000000; 00000000; 00000000; 00000000; 00000000;
     00000000; 00000000; 00000000;
```

Note: CC field values are not entered in the default settings.

Match Strings Parameters

Parameters 040-047 (?805)

?805 each string of eight parameters may have a maximum of *60* alphanumeric characters. The total string must be less than *255* characters (127 over Starnode). If a match string is not being used, a NONE should be entered in the string, as illustrated below.

NONE NONE NONE NONE NONE NONE NONE NONE

Parameters 048-055 (?806)

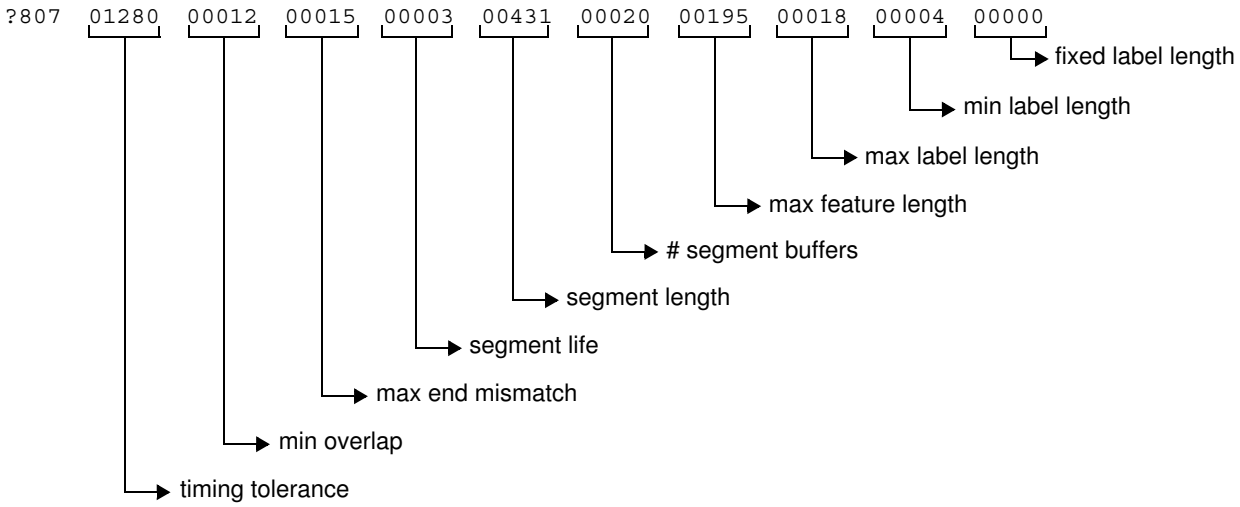
?806 each string of eight parameters may have a maximum of *60* alphanumeric characters. The total string must be less than *255* characters (127 over Starnode). If a match string is not being used, a NONE should be entered in the string, as illustrated below.

NONE NONE NONE NONE NONE NONE NONE NONE

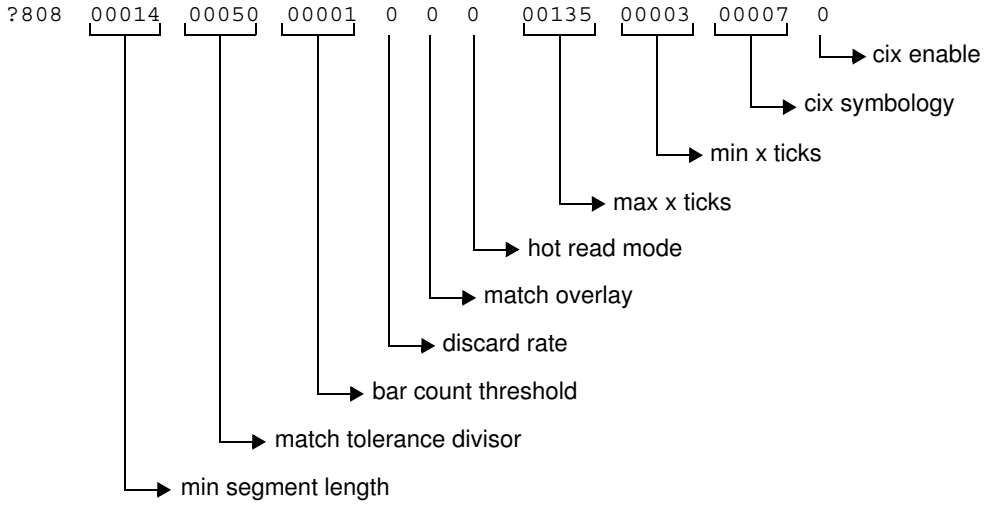
Note: The spaces are used as delimiters between the match strings.

Decoding Processor (DSP) Parameters

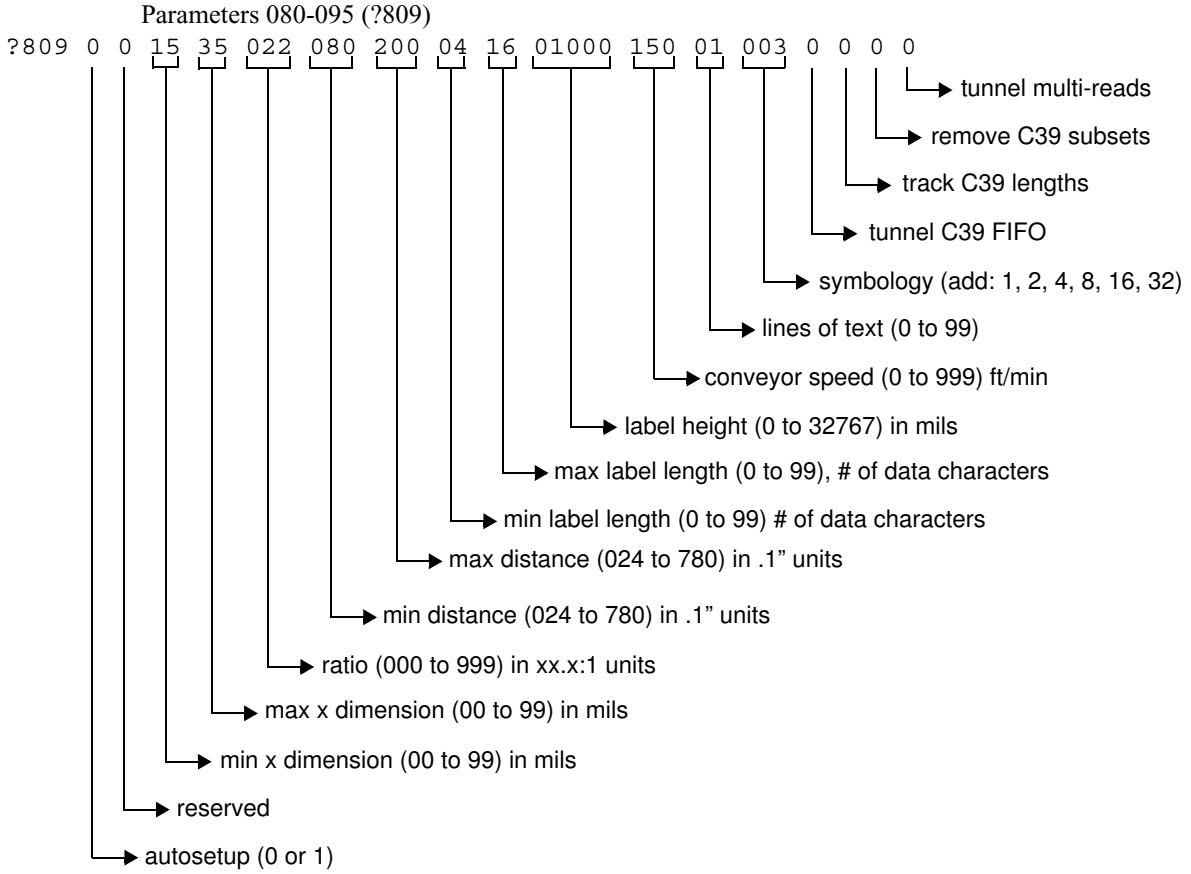
Parameters 060-069 (?807)



Parameters 070-079 (?808)

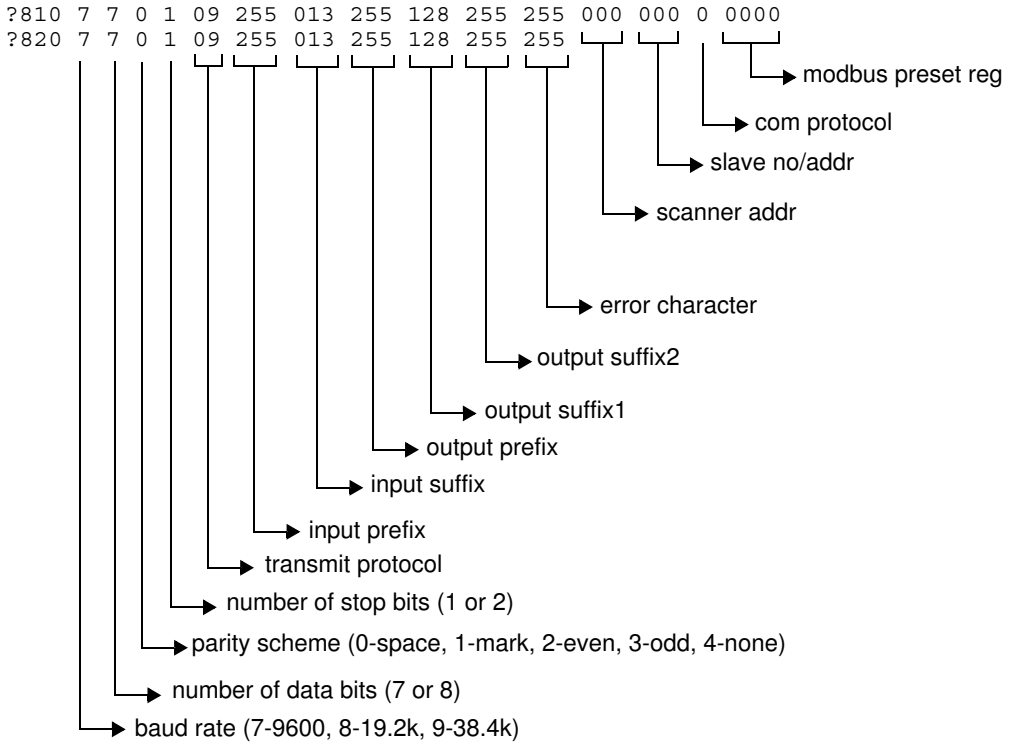


DSP Autosetup Parameters



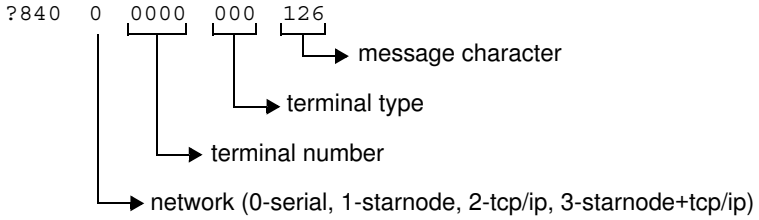
Host & Terminal Port Serial Communications Parameters

Parameters 100-114 (?810), 200-210 (?820)

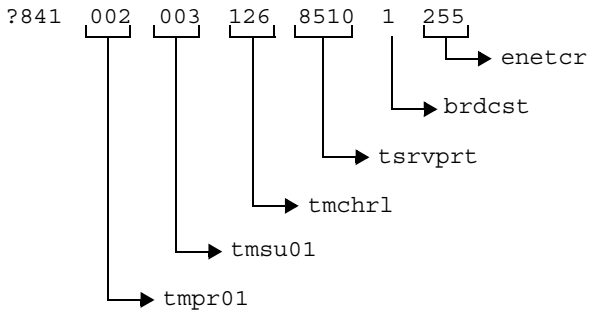


Lan Port Comms & Messages Parameters

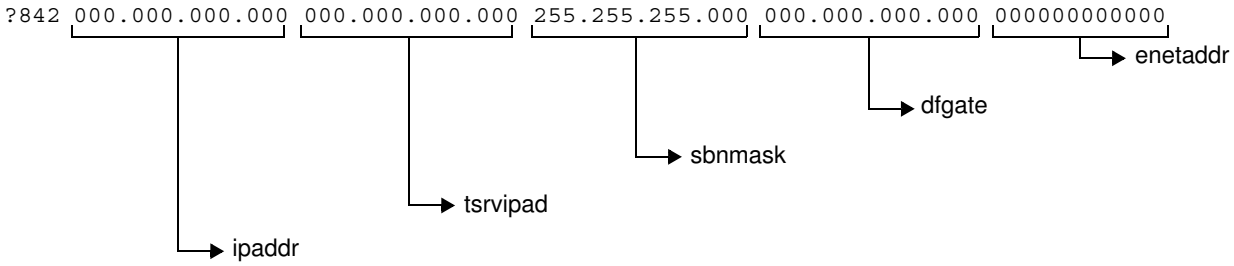
Parameters 400-403 (?840) and 405-408, 413, 414 (?841)



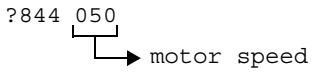
The following parameter applies to CiMAX 7500A only



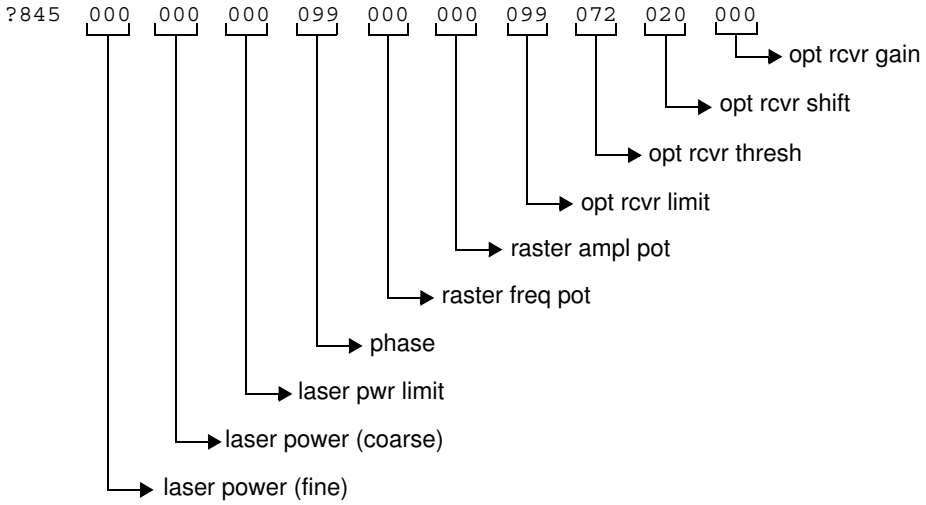
Parameters 409-412, 415 (?842) - CiMAX 75xxA only



Digital Potentiometers (Parameters 444-459)



The scanner temporarily turns off the power to all laser diodes when any digital potentiometer string is loaded, to prevent current spikes from shortening diode life.



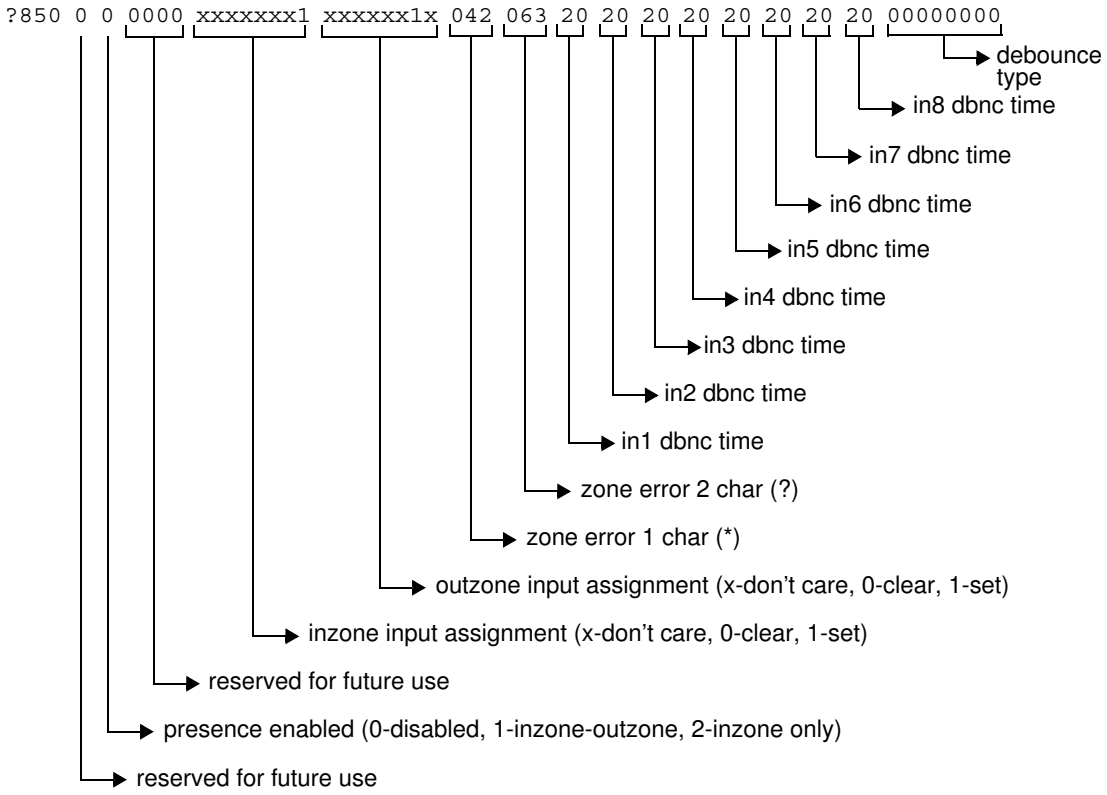
Digital Jumpers Parameters

Parameter 495 (?849)

~?849 00010011~

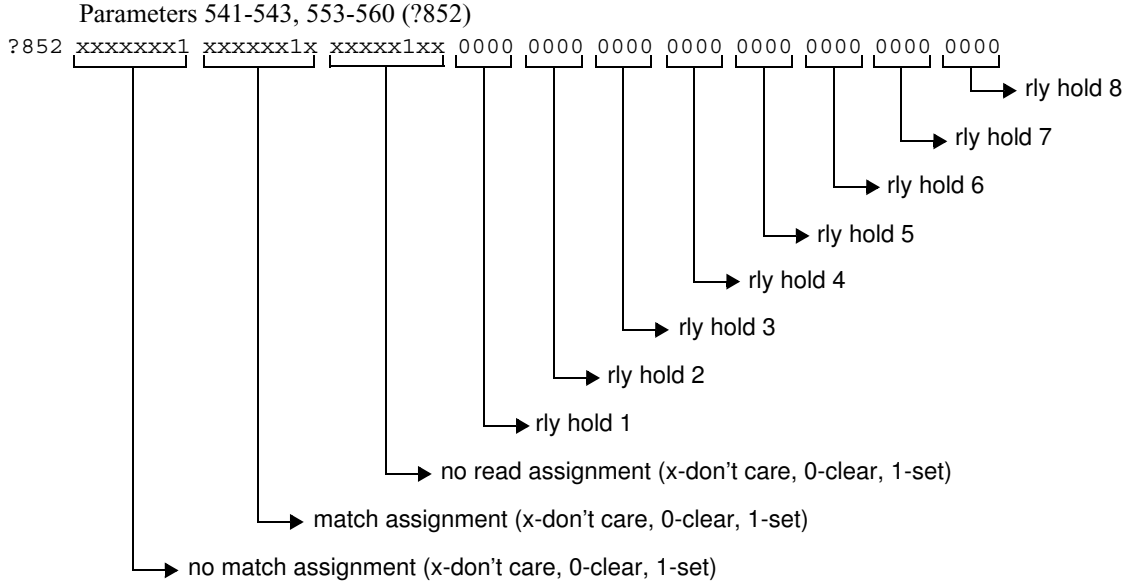
Presence Inputs, Relay Types & Debounce Times Parameters

Parameters 501, 503-506, 510-518 (?850)



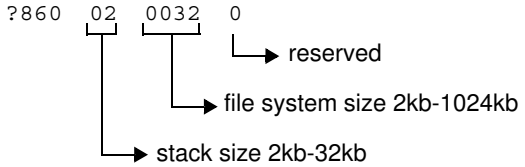
Relay Outputs Parameters

Parameters 541-543, 553-560 (?852)



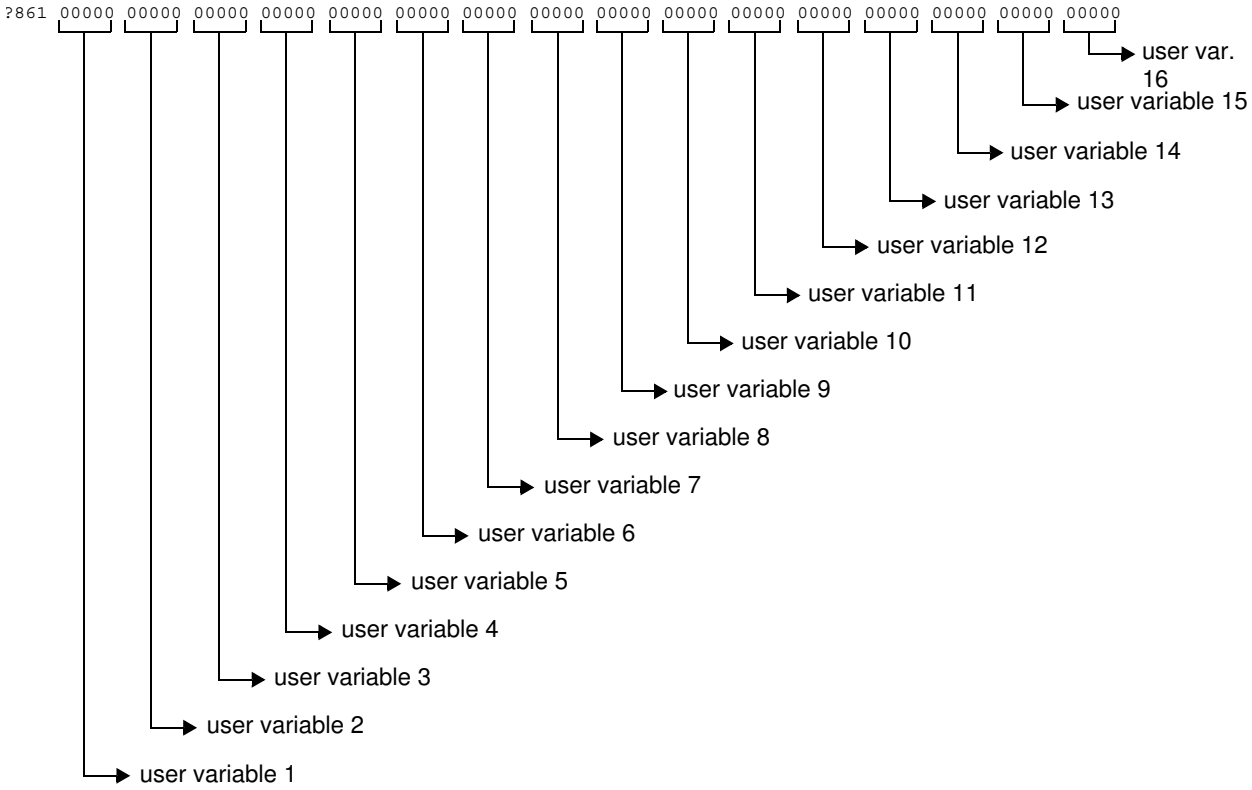
User Program Parameters

Parameters 600-601 (?860)



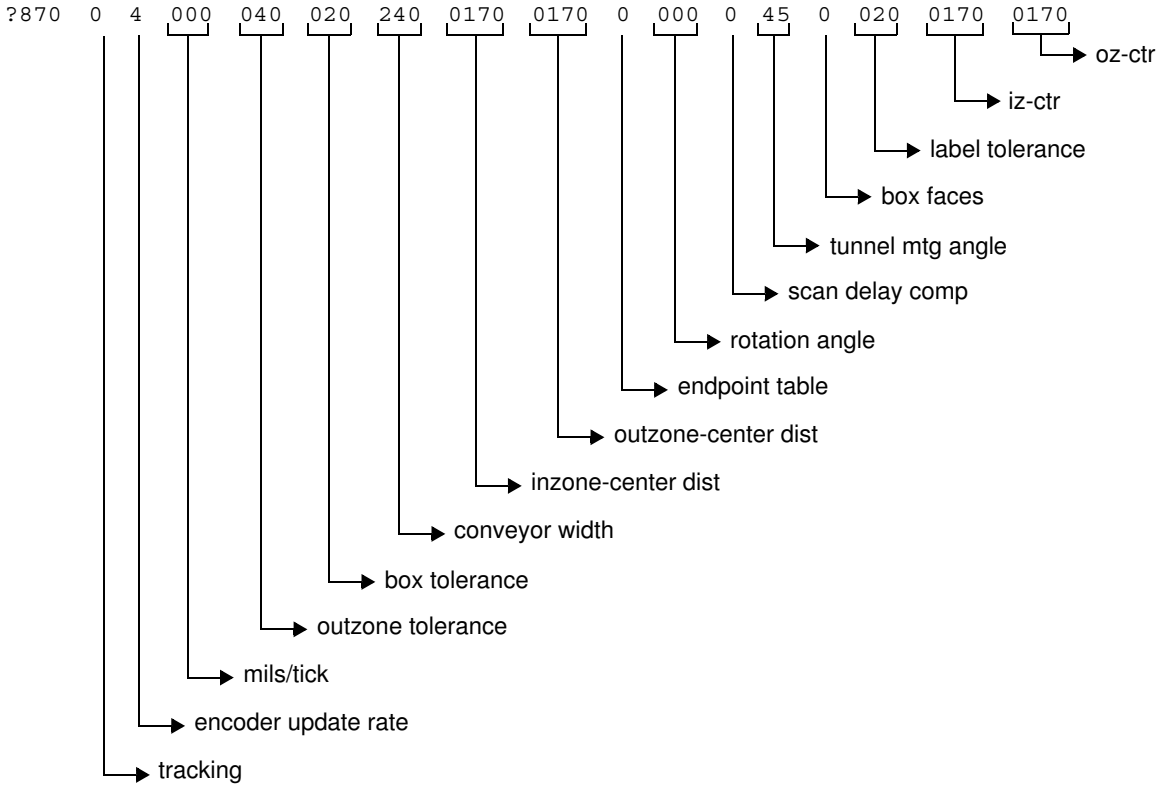
User Variables Parameters

Parameters 610-625 (?861)



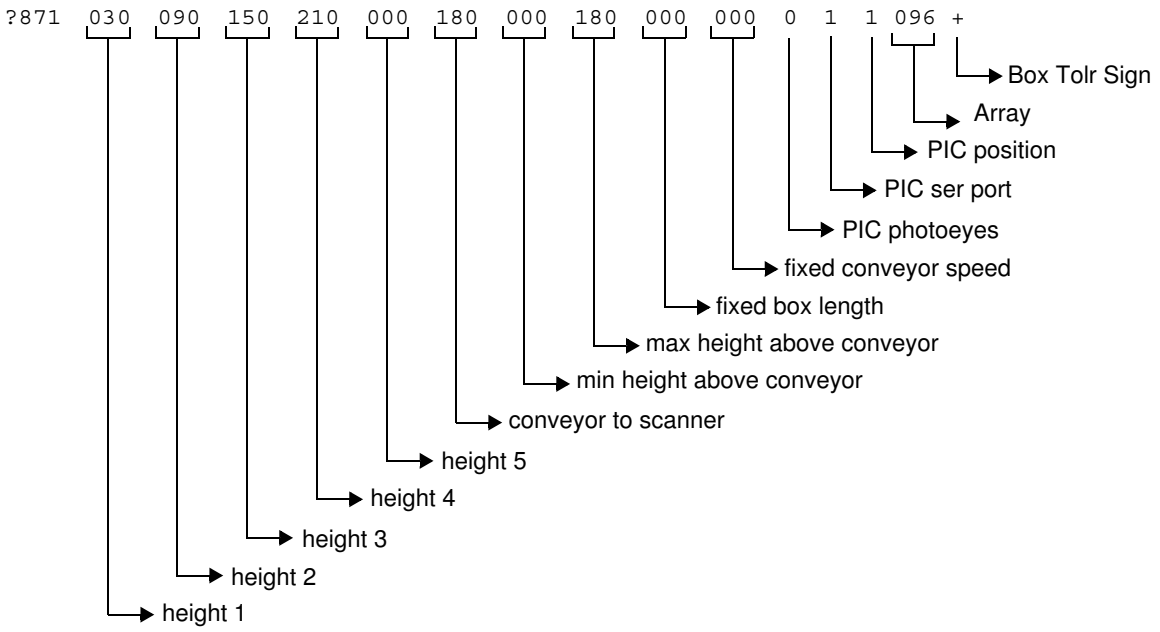
Gap Tracking & Tachometer Input Parameters

Parameters 700-709, 726-731 (?870)



Height Detect Parameters

Parameters 710-719, 725, 732, 733, 743, 744 (?871)



Label Tracking

Ten parameters can be adjusted to increase the label-tracking accuracy of each scanner installation. These parameters adjust internally calculated label positions such that they more closely approximate actual label positions.

Unlike other parameters, these ten parameters are un-numbered and can only be uploaded and downloaded by means of group setup string ?X89, illustrated below with default values. Non-default values should only be used when the alternate endpoint table is selected (by setting parameter 708 ENDPOINT TBL = 1). The group setup strings have the following format:

?889 +36 -36 +03750 +03750 +03750 +03750 +03750 +03750 +03750 +03750

- The first parameter (default = +36 = +36°) is the maximum scan beam angle. This is the angle between a perpendicular drawn from the scan zone origin to the scan beam and a line drawn from the origin to the end of the scan line that is farthest away from the origin, with both lines in the plane of the conveyor.
- The second parameter (default = -36 = -36°) is the minimum scan beam angle. This is the angle between a perpendicular drawn from the scan zone origin to the scan beam and a line drawn from the origin to the end of the scan line that is nearest to the origin, with both lines in the plane of the conveyor.
- Parameters 3, 5, 7 and 9 (default = +03750 = +3.75%) are the percentages of scan line offset subtracted from the inward scanning beams. This offset compensates for the error in the actual start-of-scan point caused by the gap between the down mirrors.

- Parameters 4, 6, 8 and 10 (default = +03750 = +3.75%) are the percentages of scan line offset added to the outward scanning beams This offset compensates for the error in the actual end-of-scan point caused by the apex of the spinning polygon mirror.

APPENDIX B *ASCII Equivalence*

This appendix contains the ASCII character set with decimal and hex equivalents for each character, and the keyboard strokes required to generate ASCII control characters.

ASCII Equivalence Table

TABLE B–1. ASCII Equivalence Table

ASCII CHARACTER	DECIMAL	HEX	KEYBOARD
NULL	000	00	CTRL @
SOH (START OF HEADING)	001	01	CTRL A
STX (START OF TEXT)	002	02	CTRL B
ETX (END OF TEXT	003	03	CTRL C
EOT (END OF TRANSMISSION)	004	04	CTRL D
ENQ (ENQUIRY)	005	05	CTRL E
ACK (ACKNOWLEDGE)	006	06	CTRL F
BEL (BELL)	007	07	CTRL G
BS (BACKSPACE)	008	08	CTRL H
HT (HORIZONTAL TAB)	009	09	CTRL I
LF (LINE FEED)	010	0A	CTRL J
VT (VERTICAL TAB)	011	0B	CTRL K
FF (FORM FEED)	012	0C	CTRL L
CR (CARRIAGE RETURN)	013	0D	CTRL M
SO (SHIFT OUT)	014	0E	CTRL N
SI (SHIFT IN)	015	0F	CTRL O
DLE (DATA LINK ESC)	016	10	CTRL P
DC1 (DATA CONTROL 1)	017	11	CTRL Q
DC2 (DATA CONTROL 2)	018	12	CTRL R
DC3 (DATA CONTROL 3)	019	13	CTRL S
DC4 (DATA CONTROL 4)	020	14	CTRL T
NAK (N0 ACKNOWLEDGE)	021	15	CTRL U
SYN (SYNCHRONOUS IDLE)	022	16	CTRL V
ETB (END OF TRANS. BLOCK)	023	17	CTRL W

TABLE B–1. ASCII Equivalence Table (continued)

ASCII CHARACTER	DECIMAL	HEX	KEYBOARD
CAN (CANCEL)	024	18	CTRL X
EM (END OF MEDIUM)	025	19	CTRL Y
SUB (SUBSTITUTE)	026	1A	CTRL Z
ESC (ESCAPE)	027	1B	CTRL [
FS (FILE SEPARATOR)	028	1C	CTRL \
GS (GROUP SEPARATOR)	029	1D	CTRL]
RS (RECORD SEPARATOR)	030	1E	CTRL ^
US (UNIT SEPARATOR)	031	1F	CTRL _
SP (SPACE)	032	20	
! (EXCLAMATION POINT)	033	21	
" (QUOTE MARK)	034	22	
# (POUND SIGN)	035	23	
$ (DOLLAR SIGN)	036	24	
% (PERCENT SIGN)	037	25	
& (AMPERSAND)	038	26	
' (APOSTROPHE)	039	27	
((LEFT PAREN)	040	28	
) (RIGHT PAREN)	041	29	
* (ASTERISK)	042	2A	
+ (PLUS SIGN)	043	2B	
, (COMMA)	044	2C	
- (MINUS SIGN)	045	2D	
. (PERIOD)	046	2E	
/ (SLASH)	047	2F	
0	048	30	
1	049	31	
2	050	32	
3	051	33	
4	052	34	
5	053	35	
6	054	36	
7	055	37	
8	056	38	
9	057	39	
: (COLON)	058	3A	
; (SEMI-COLON)	059	3B	
<	060	3C	
=	061	3D	

TABLE B–1. ASCII Equivalence Table (continued)

ASCII CHARACTER	DECIMAL	HEX	KEYBOARD
>	062	3E	
?	063	3F	
@	064	40	
A	065	41	
B	066	42	
C	067	43	
D	068	44	
E	069	45	
F	070	46	
G	071	47	
H	072	48	
I	073	49	
J	074	4A	
K	075	4B	
L	076	4C	
M	077	4D	
N	078	4E	
O	079	4F	
P	080	50	
Q	081	51	
R	082	52	
S	083	53	
T	084	54	
U	085	55	
V	086	56	
W	087	57	
X	088	58	
Y	089	59	
Z	090	5A	
[(LEFT BRACKET)	091	5B	
\ (BACKSLASH)	092	5C	
] (RIGHT BRACKET)	093	5D	
^ (UP ARROW)	094	5E	
_ (UNDERLINE)	095	5F	
' (ACCENT,GRAVE)	096	60	
a	097	61	
b	098	62	
c	099	63	

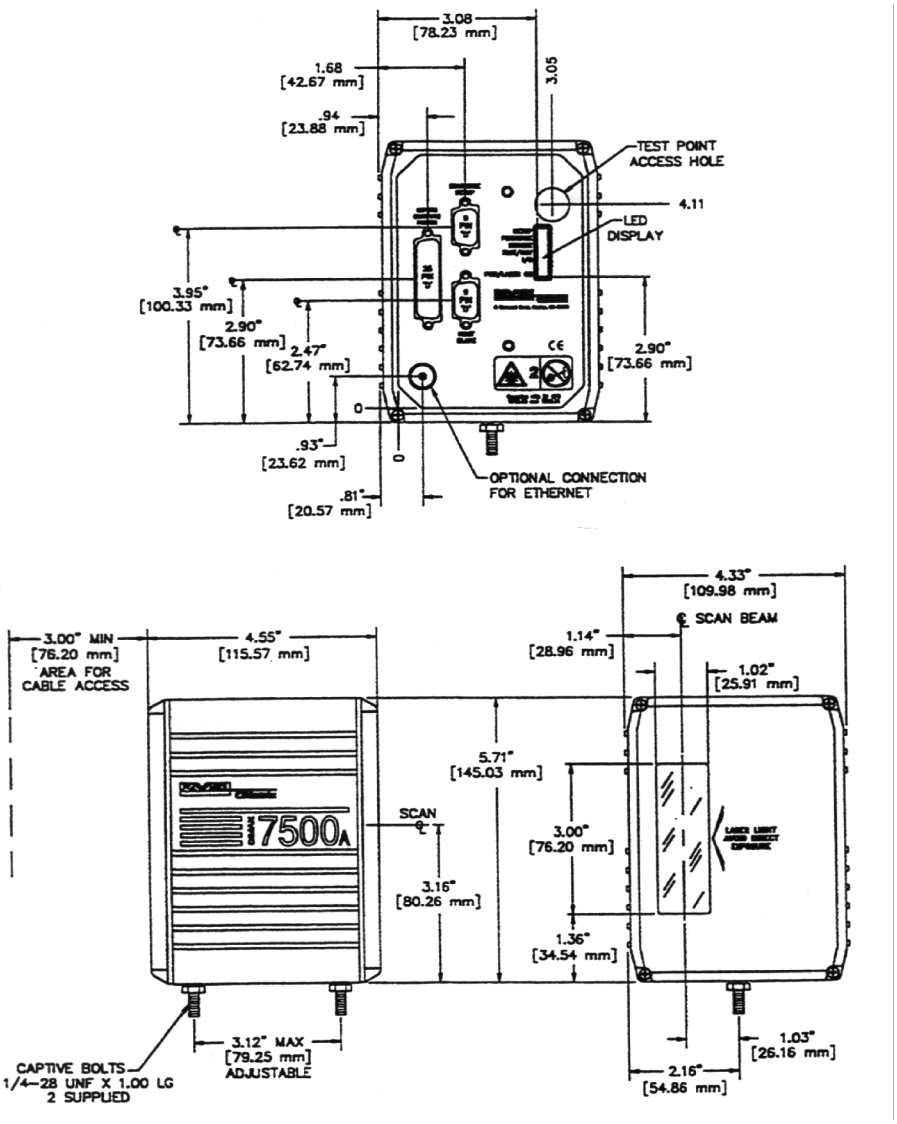
TABLE B–1. ASCII Equivalence Table (continued)

ASCII CHARACTER	DECIMAL	HEX	KEYBOARD
d	100	64	
e	101	65	
f	102	66	
g	104	67	
h	104	68	
i	105	69	
j	106	6A	
k	107	6B	
l	108	6C	
m	109	6D	
n	110	6E	
o	111	6F	
p	112	70	
q	113	71	
r	114	72	
s	115	73	
t	116	74	
u	117	75	
v	118	76	
w	119	77	
x	120	78	
y	121	79	
z	122	7A	
{	123	7B	
| (VERTICAL BAR)	124	7C	
}	125	7D	
~ (TILDE)	126	7E	
DEL (DELETE)	127	7F	

APPENDIX C *Dimension Diagrams*

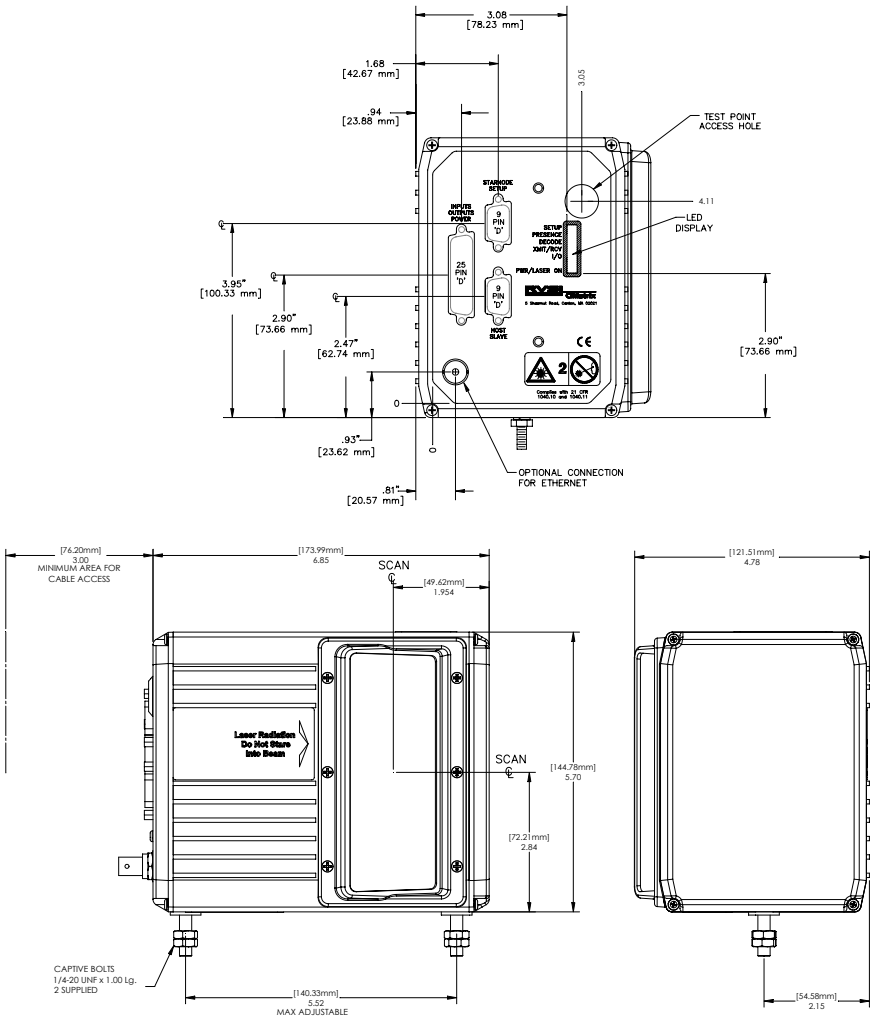
CiMAX 7500A Scanner

FIGURE C–1. CiMAX 7500A Scanner



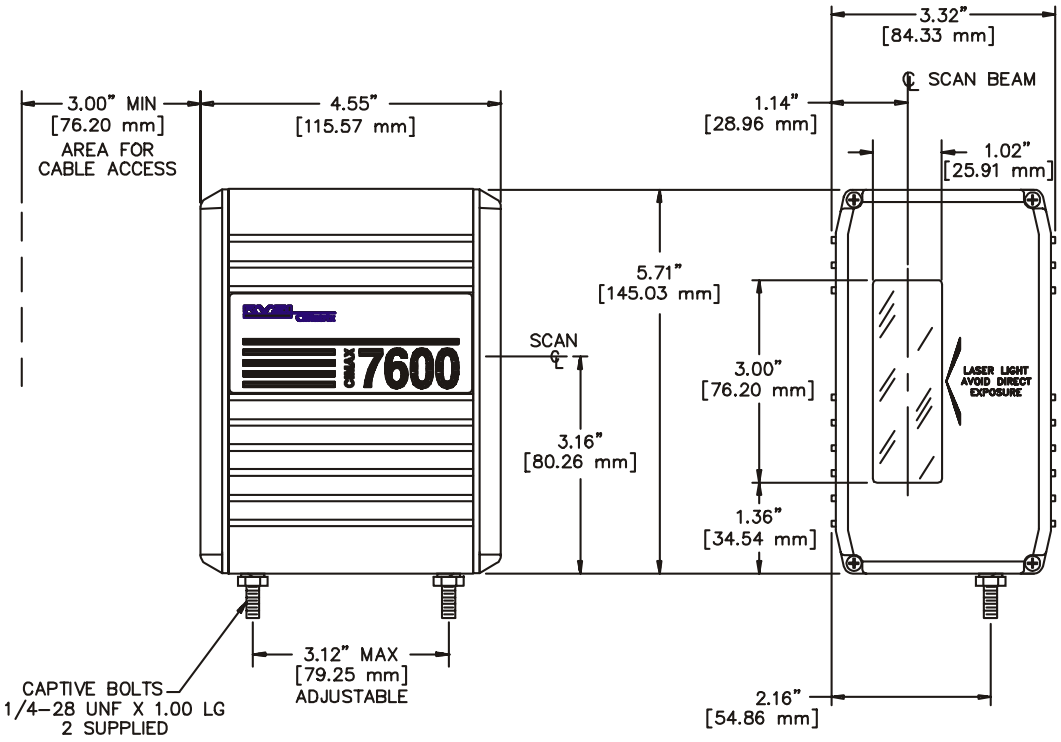
CiMAX 7555A Scanner

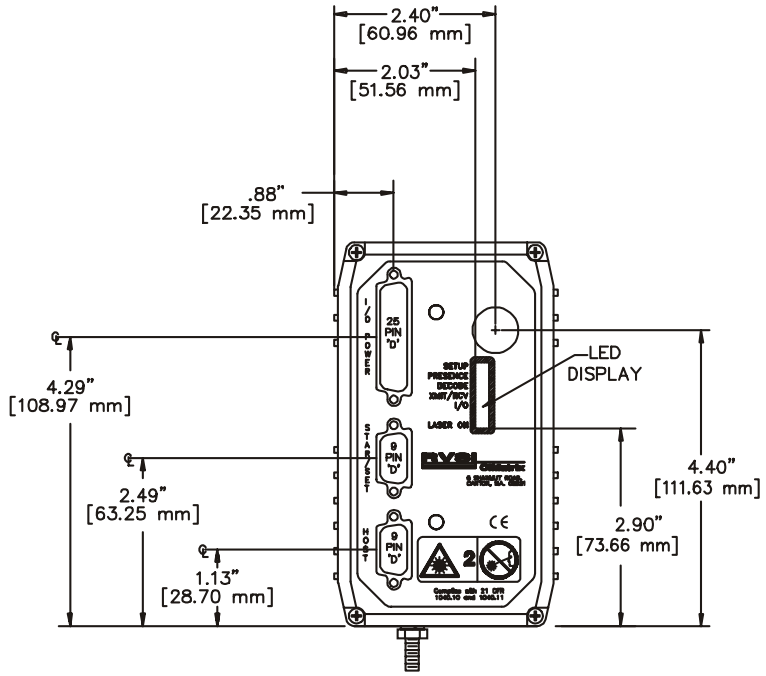
FIGURE C–2. CiMAX 7555A Scanner



CiMAX 7600 Scanner

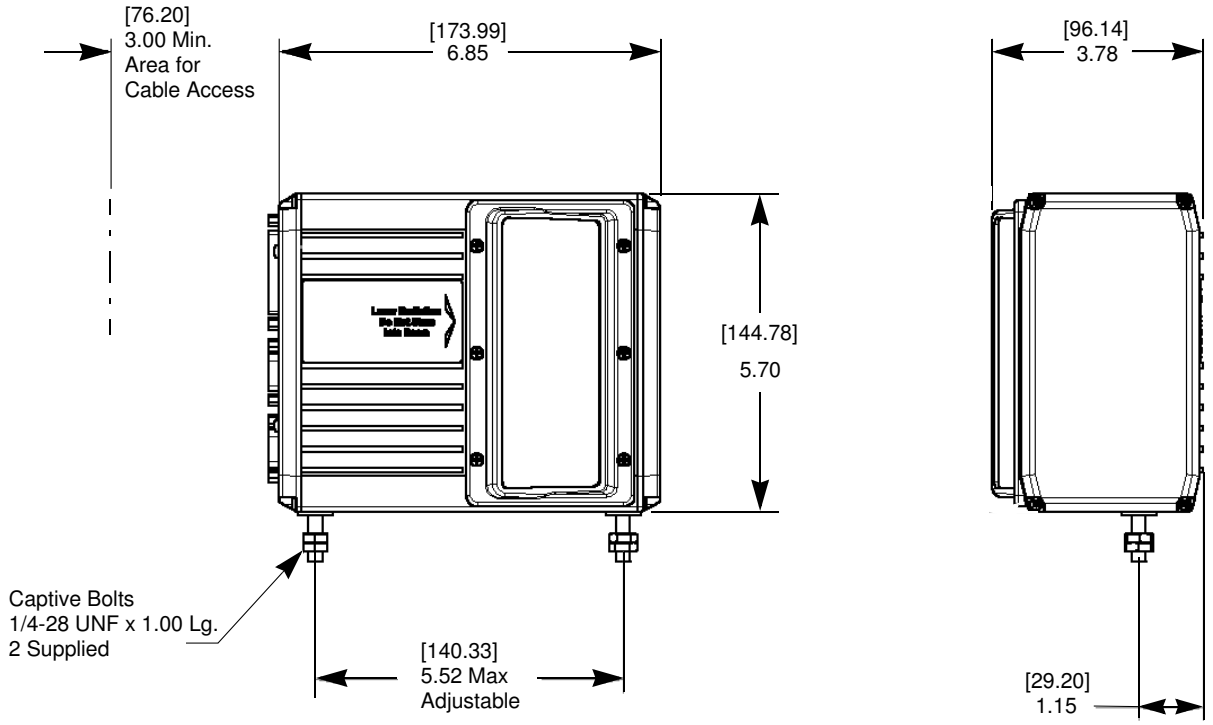
FIGURE C–3. CiMAX 7600 Scanner





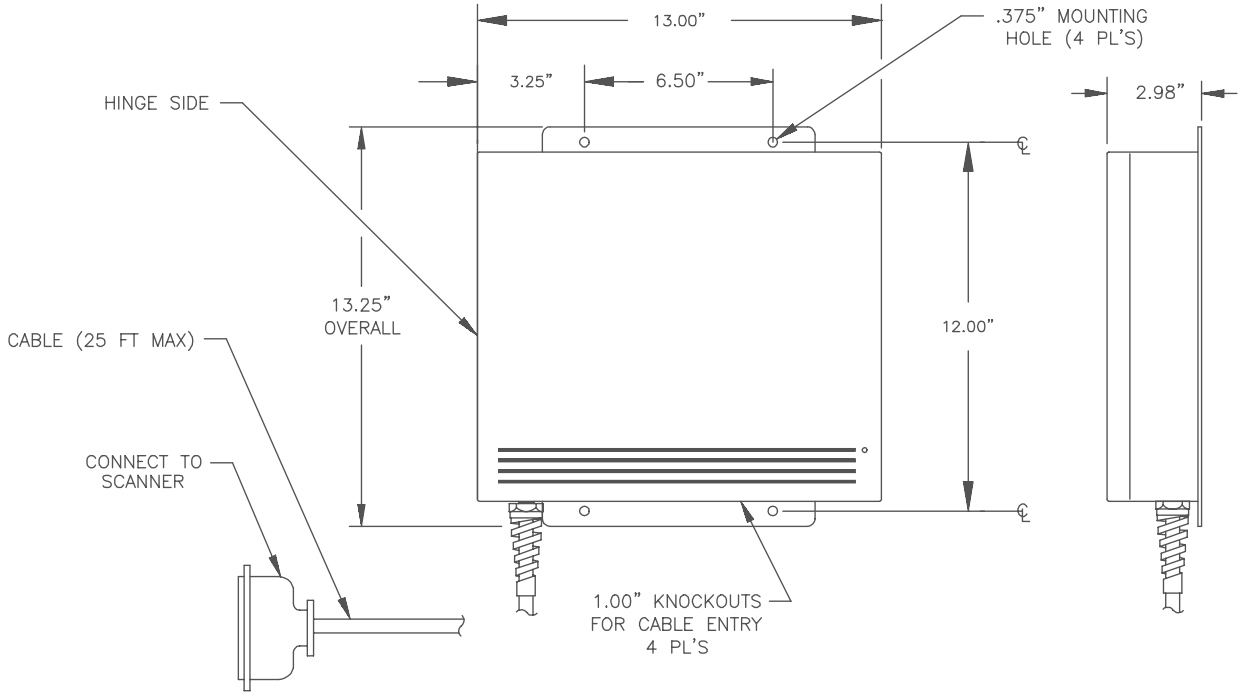
CiMAX 7650/7655 Scanner

FIGURE C–4. CiMAX 7650/7655 Scanner



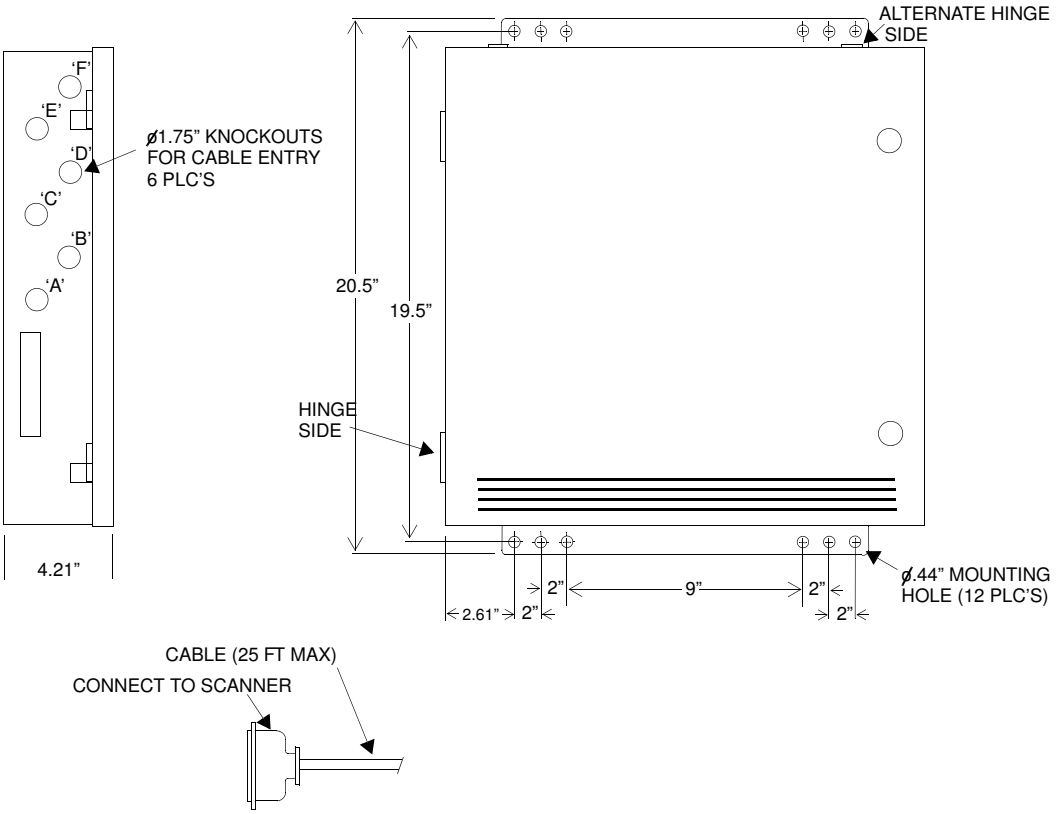
Standard Interface Unit

FIGURE C–5. Standard Interface Unit Dimensions



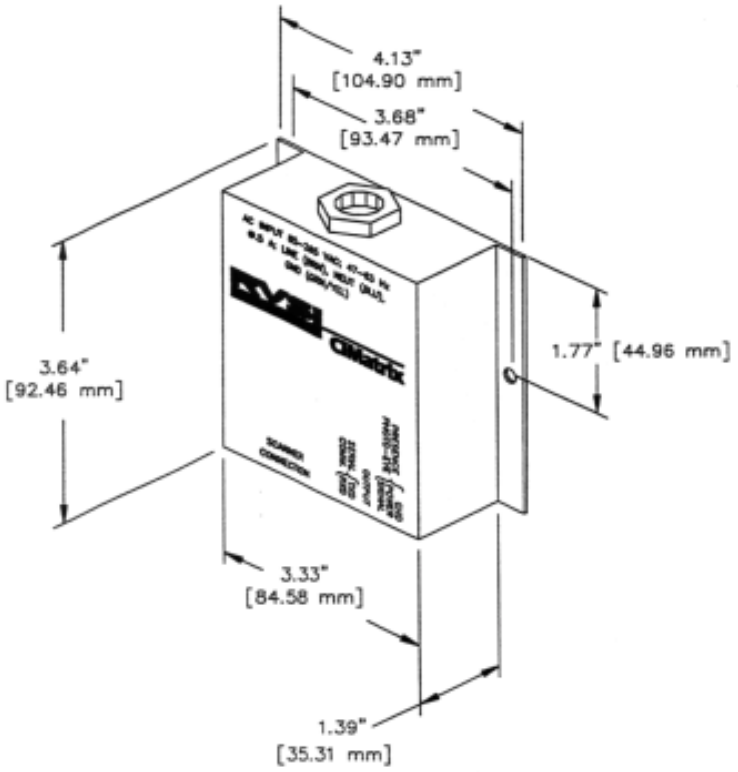
Hex Interface Unit

FIGURE C–6. Hex Interface Unit Dimensions



Basic Interface Unit

FIGURE C–7. Basic Interface Unit Dimensions



Photoeye

The 935-0018-1 photoeye is a compact, self contained photo-electric sensor. The photoeye unit includes a control system, a power supply, an optical emitter, a receiver, and a cable for input/output connections.

The retro-reflective target is a polarized sensor. The photoeye will not receive a false signal from an object or background which is highly reflective but will only read a light beam reflected by the target.

A rear-mounted LED close to the connector cable lights when the photoeye does not receive the reflected beam, indicating that an object has been detected.

FIGURE C–8. End views of Photoeye

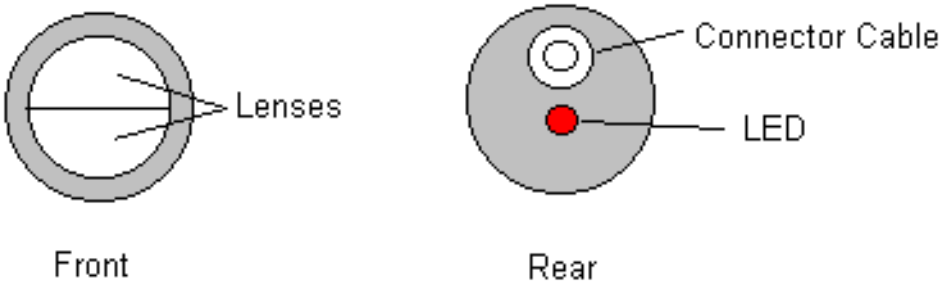
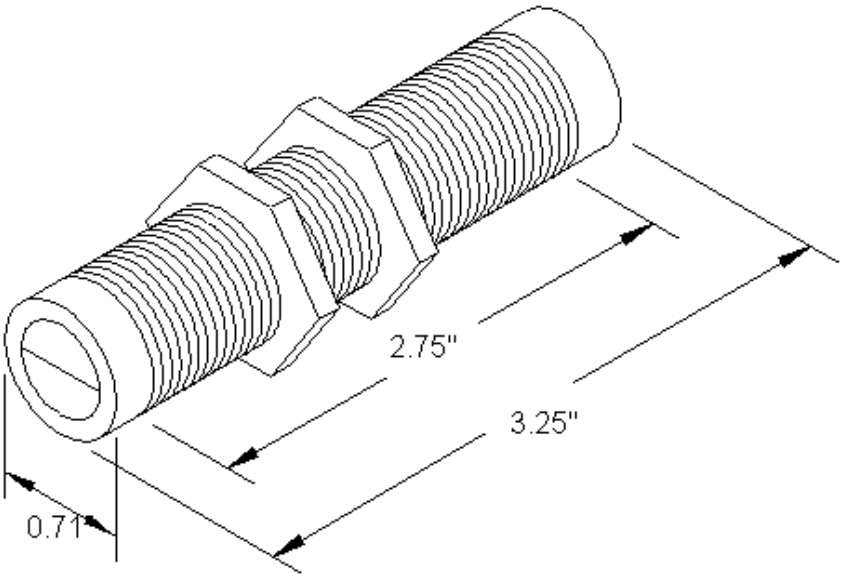
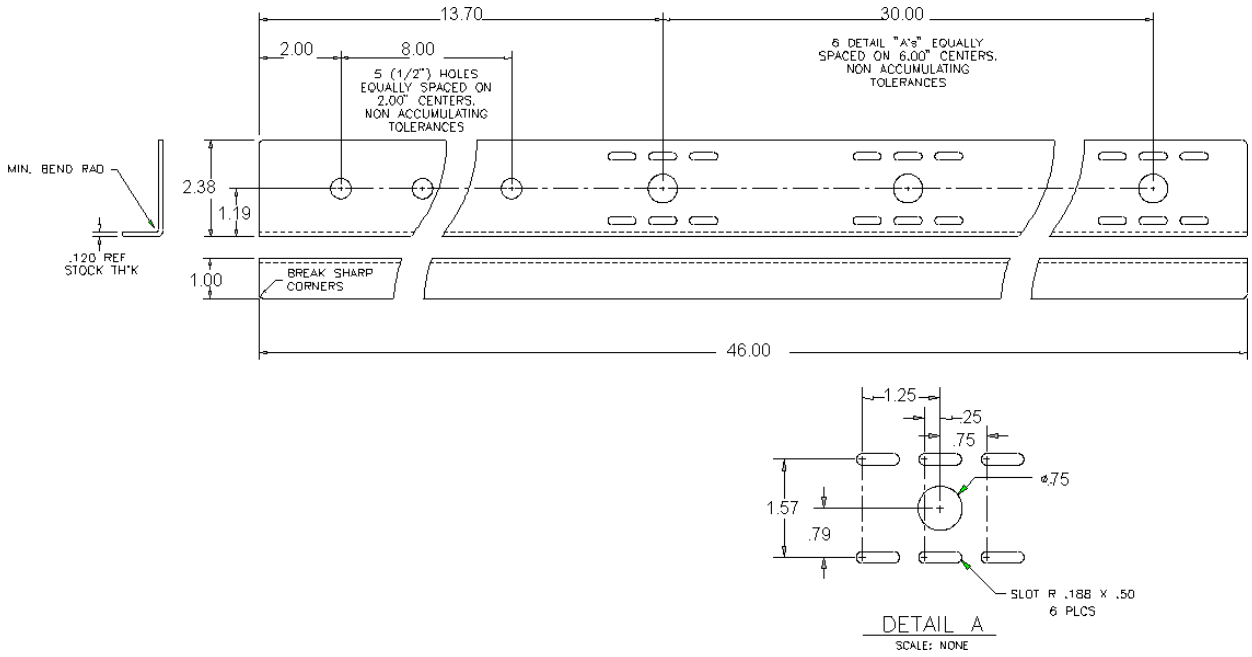


FIGURE C–9. Photoeye Dimensions



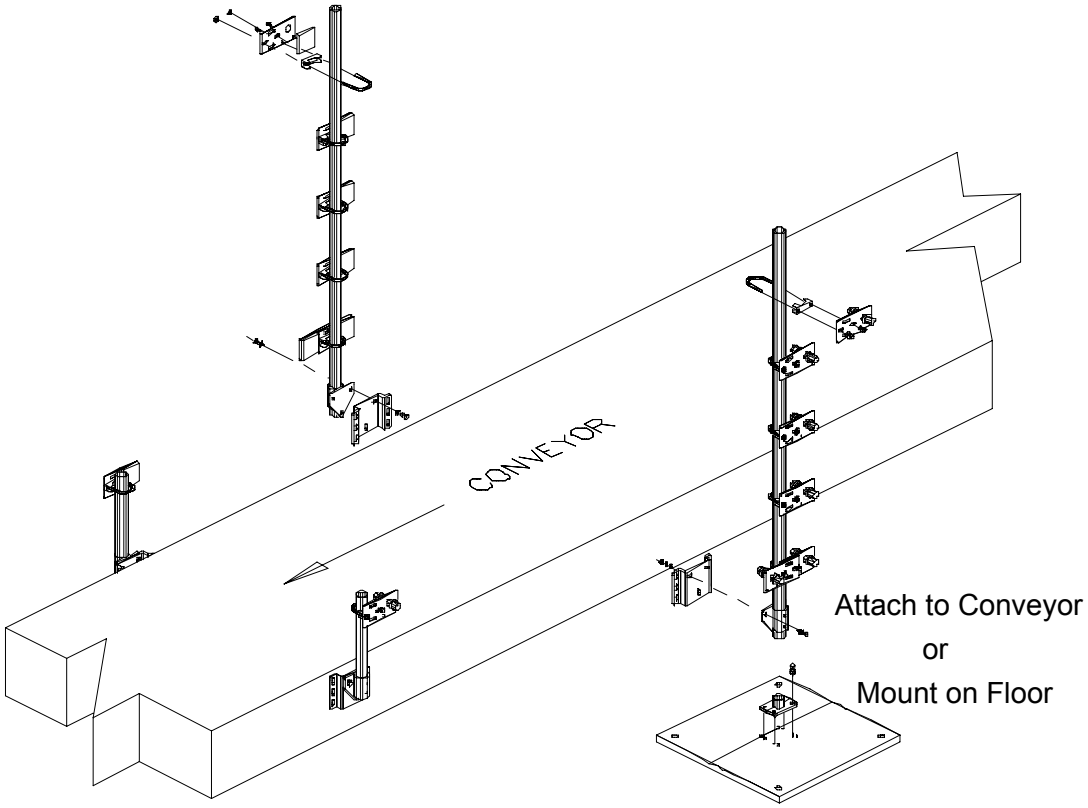
Photoeye Tree Bracket

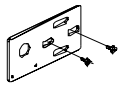
FIGURE C–10. Photoeye Tree Bracket & Dimensions



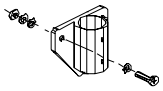
Photoeye Tree Hardware

FIGURE C–11. Photoeye Tree Hardware and Part Numbers



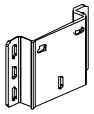


A1-62887
Photoeye Bracket
with 8-32 Hardware

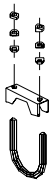


A1-62876
Pipe Flange Assembly
with 1/4-2D Hardware

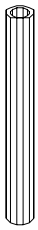
922-0014-1
Pipe Fitting



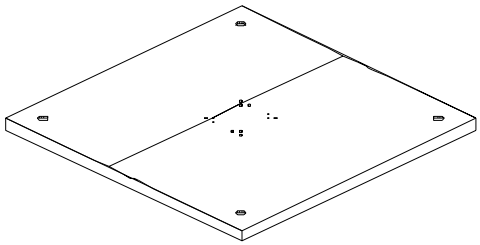
A4-62874
Pipe Flange
Mounting Bracket



A1-62886
U-Bolt Assembly



A4-62059-1 (short)
A4-62059-4 (long)
Mounting Pipe

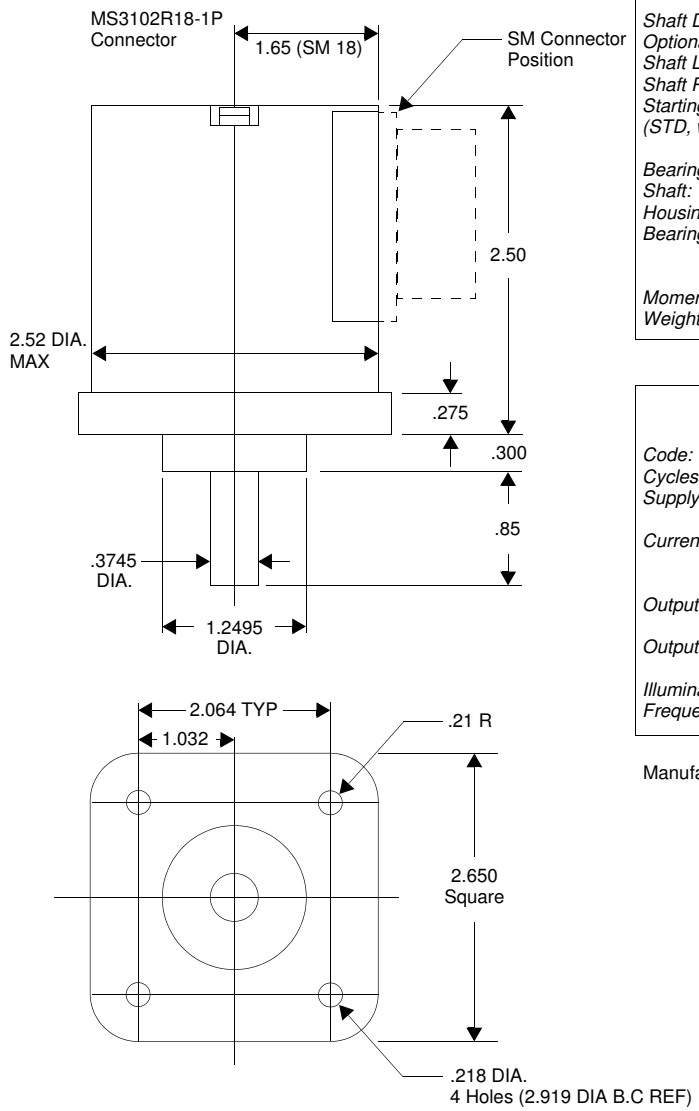


A4-60888
Floor Plate

Tachometer Assembly

FIGURE C–12. Tachometer Assembly

H25 D
Square Flange



MECHANICAL

Shaft Diameter:	.3745 in. diameter standard
Optional Flat On Shaft:	.80 long x .03 deep
Shaft Loading:	up to 40 lbs. axial & 35 lbs. radial
Shaft Runout:	.0005 T.I.R. at midpoint
Starting Torque & 25°C (STD, without shaft seal):	1.0 in-oz. maximum
Bearings:	Class ABEC 7
Shaft:	416 Stainless Steel
Housing & Cover:	Die cast aluminum
Bearing Life:	$2x10^8$ revs at rated shaft loading. $10x10^9$ revs at 10% of rated shaft loading. (Mfr's Specs)
Moment of Inertia:	4.1×10^{-4} oz-in-sec^2
Weight:	13 oz. typical

ELECTRICAL

Code:	Incremental
Cycles Per Shaft Turn:	1 to 2540 on code disc
Supply Voltage:	+5Vdc ±5% standard, optional higher voltages available
Current Requirements:	
TTL:	175mA max. 125mA typical
CMOS:	120mA max. 100mA typical
Output Format:	2 channels (A & B) in quadrature $\pm 27^0$ electrical
Output Format Options:	Index & complementary outputs are available
Illumination:	LED
Frequency Response:	100kHz

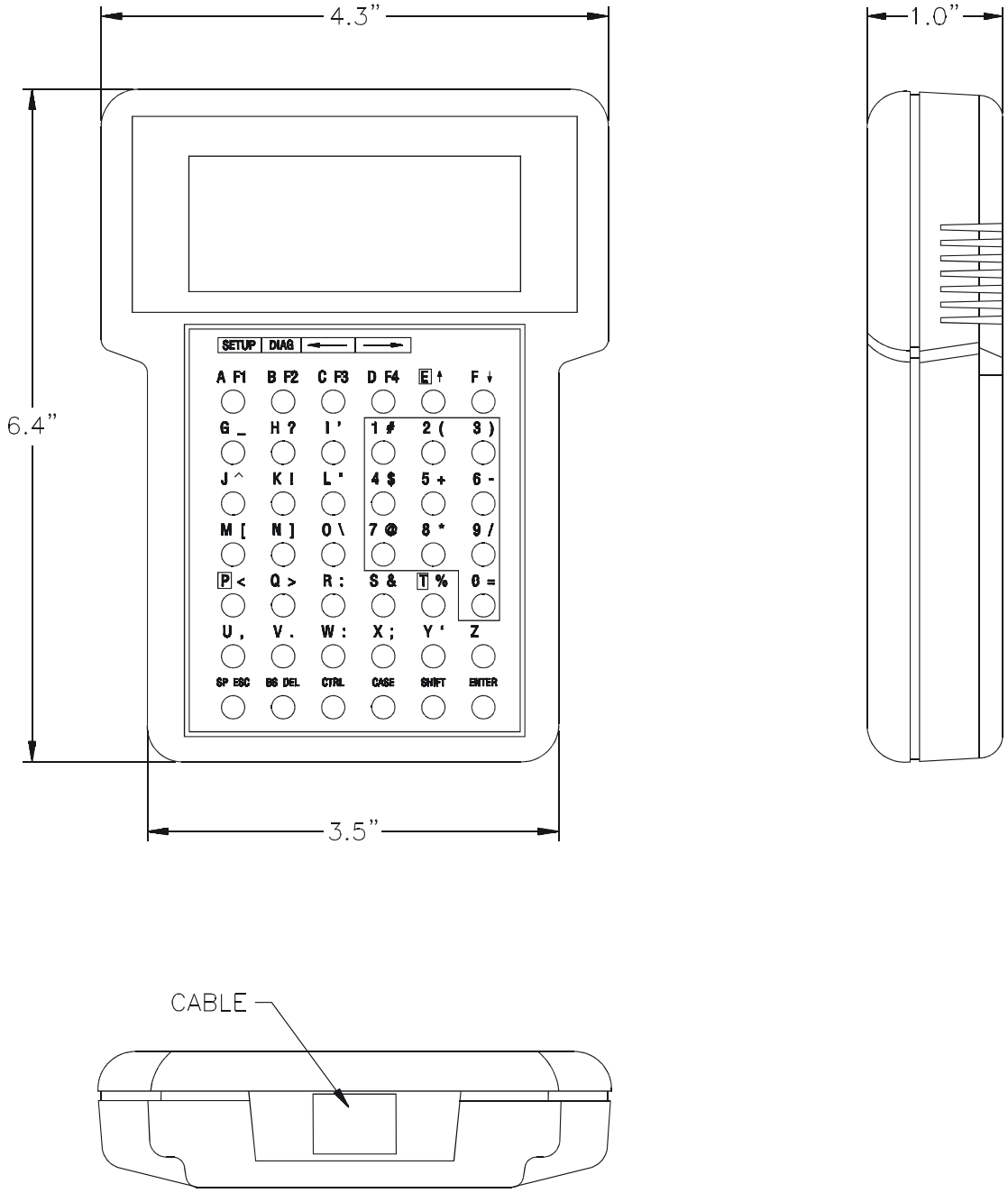
Manufacturer: BEI

MODEL NUMBER:

H25D-(blank)-(blank)-300-ABZ C-7406R-LED-S-M18

CiMAX 1400 Hand-Held Terminal

FIGURE C–13. CiMAX 1400 Hand-Held Terminal



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