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MHI-2000 Technical Reference Manual

Rev A, January 2002

EM-63555-1A

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MHI-2000 Technical
Reference Manual
Rev A, January 2002

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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.

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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.

There are no operator serviceable parts/controls in the 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.

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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.

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PREFACE *Welcome*

Congratulations on your purchase of the MHI-2000 Programmable Interface. 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.

How To Use This Manual

The purpose of this manual is to ensure that your MHI-2000 system becomes operational quickly and reliably. This manual covers installation, basic operations, including instructions to operate the MHI-2000 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.

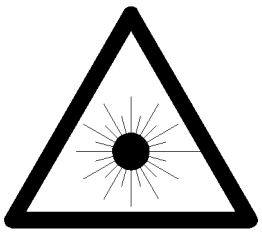
Note: Provides useful information about the current topic.

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.

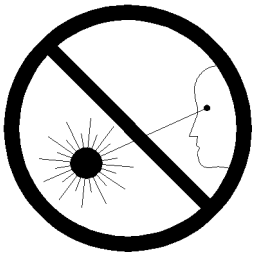
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Warning Symbols

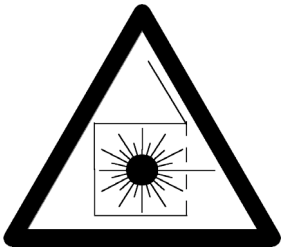


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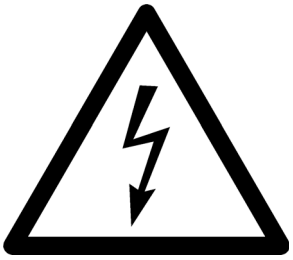
Class 2 Laser Product
Laser Classe 2
Klasse 2 laserscanner
Laser Klasse 2 Produkt
Producto Láser Clase 2
Luokan 2 laserlaite
Apparecchiatura laser di classe 2



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
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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 MHI-2000 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 an MHI-2000 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

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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 MHI-2000 on hand for immediate replacement. Alternatively, you can select a support plan that specifies a quick response time or a MHI-2000 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 MHI-2000 will be returned after inspection and repair. However, upon return, the MHI-2000 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.'s 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.

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CHAPTER 1 Overview & Maintenance

This chapter provides you with an overview of, and specifications and maintenance for, the MHI-2000.

Overview

Typical Physical Setup

The MHI-2000 may be used with other equipment, such as photoeyes and a tachometer.

Keysheet

The Keysheet specifies the details of your MHI-2000 setup. It is based on information you provided to SICK Auto Ident, Inc. about your MHI-2000 application.

The information in the Keysheet customizes the MHI-2000 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
- Code for Gap Tracking
- Network
- File Memory
- C code

SICK Auto Ident, Inc. will provide software to you, as your application requires. These updates can be uploaded into your MHI-2000 from your PC, with the software available from SICK Auto Ident, Inc. on a diskette. The MHI-2000 uses flash memory to allow complete re-programming in the field.

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Specifications

MHI-2000

Configuration

Memory

- 2M (approx. 800K for user C programs and data)

Network

- Starnode
- Ethernet 10 base T
- Additional Ethernet 10 base T (optional)

Optional Solid-State Input/Output Modules

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

- IDC15 Type-DC Input (10-32 VDC)
- ODC15 Type-DC Output (5-60 VDC)
- IAC15 Type-AC Input (90-140 VAC)
- OAC15 Type-AC Output (90-140 VAC)
- IAC15A Type-AC Input (180-280 VAC)
- OAC15A Type-AC Output (180-280 VAC)

Optional Programmable Interface Controller

For some special applications, an additional PIC board may be installed.

Physical

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

MHI-2000

- 10.75 x 6.5 x 5 inches (273 x 165.1 x 127 mm)
- 5.5 pounds (2.5 kilograms)

Power

- *Input*—115/230 +/-10% VAC @ 2.0/1.0 A, 50/60 Hz
- *Output - DC power*—+12 VDC, 750 mA to photocells, tachometer, etc. +5 VDC, 375 mA to tachometer

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Construction

A single integrated package consisting of an aluminum enclosure, fully gasketed, and mounted on a 1/2 inch (12.7 mm) aluminum base plate.

Environmental

- Dust-tight and drip-proof
- *Operating Temperature*—32° to 122° F (0° to 50° C)
- *Humidity*—5% to 95% non-condensing

LED Status Indicators

Ten LEDs on a single display monitor operations and communications.

Communications

There are six independent communications ports:

- 1 asynchronous serial Host port (RS-232) I/O connector
- 1 asynchronous serial Terminal/Slave port (RS-232)
- 1 asynchronous serial Setup port (RS-232)
- 1 asynchronous serial D-port (RS-232)
- 1 RS-485 LAN port with Starnode protocol
- 1 Ethernet port (10 base T)

Inputs

Eight total, active low when <1.0 VDC.

- Maximum input 30 VDC intermittent, 27 VDC continuous

Outputs

Eight total, open collector solid state—30 VDC at 150 mA, max.

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Maintenance

The MHI-2000 requires no special maintenance when operated in an environment free from extremes of temperature, humidity, shock, and vibration. Perform the following tasks once a month to keep the MHI-2000 clean and to inspect it for mechanical damage.

1. Switch MHI-2000 main power OFF before cleaning it.
2. Clean dirt and dust from the MHI-2000's 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.

Caution: The MHI-2000's internal components do NOT require maintenance. Opening the MHI-2000 with power applied can expose you to electrical and mechanical hazards, which can cause bodily injury.

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CHAPTER 2 *Installation & Setup*

This chapter provides you with an overview of the MHI-2000 hardware installation and setup. It also describes interconnections for the interface terminal board.

Unpacking & Inspection

Unpack the MHI-2000 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 list.

Inspect the equipment for shipping damage and, if any exists, 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 MHI-2000 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:
  - 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.

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Site Preparation

Refer to the Keysheet.

- AC power to MHI-2000. 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.
- Setup/Diagnostic Terminal—Local CRT, or PC running serial communications software program, i.e., Microsoft Windows HyperTerminal, ProComm, or Telix.

Electrical Connections

To MHI-2000

- Grounded, AC power
- Network (if used)
- 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

Site Preparation

Power

115/230 VAC line power must be brought to the MHI-2000. You should also provide additional 115 VAC outlets for setup and diagnostic test equipment.

Setup

You should have one of the following:

- PC 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.

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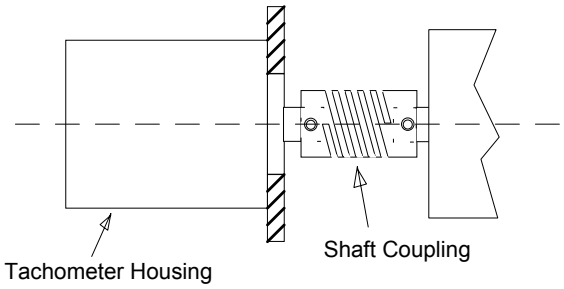
Installing the Tachometer

A tachometer, which measures conveyor movement, is required for gap tracking. 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 MHI-2000 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.

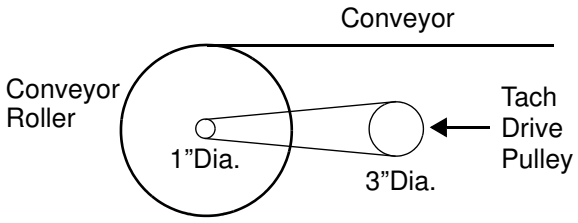
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TABLE 2–1. Conveyor Travel per Pulse

Roller diameter:	2 inches	3 inches	4 inches
Resolution:	0.021 inches	0.031 inches	0.042 inches
Conveyer Speed:	21 inches/sec 105 ft/min	31 inches/sec 157 ft/min	42 inches/sec 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. Pully 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-3.

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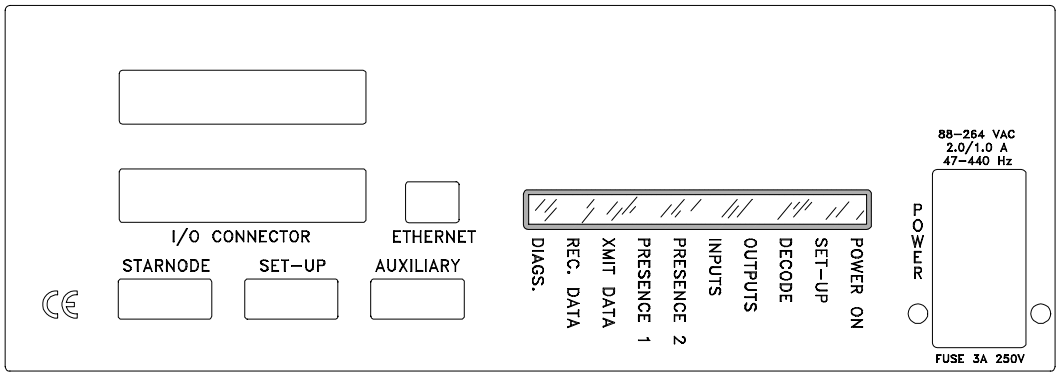
CHAPTER 3 Controls, Connectors, & Indicators

This chapter describes the physical layout, controls, connectors and indicators on the MHI-2000.

MHI-2000 I/O Panel

The I/O panel on the MHI-2000 contains all indicators, controls, and connectors, as shown in Figure 3–1.

FIGURE 3–1. I/O Panel



Power Input/ON-OFF Switch/Fuse Unit

Connect a standard power cord to the AC input connector. The power supply accepts either 115 or 230 VAC, with internal automatic selection. The input cable should be clamped to the connector for maximum security.

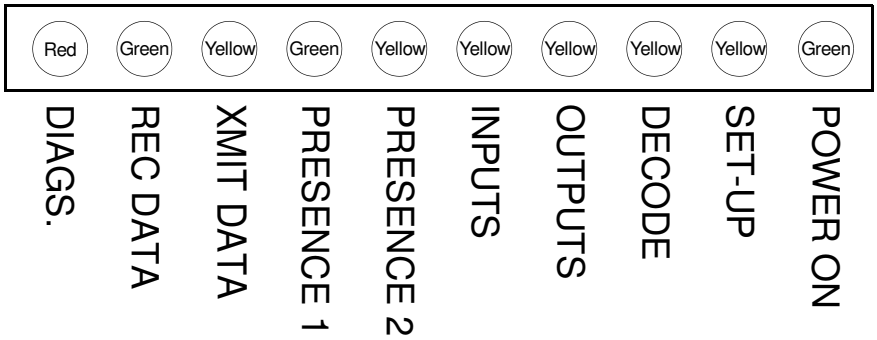
The power ON/OFF (I/0) rocker switch is located above the AC input connector. Press **I** to turn the MHI-2000 ON; press **0** to turn the MHI-2000 OFF. The fuse compartment is located above the Power Switch. The fuse is a 3A, 250 VAC, 3AG type. To verify the fuse type, carefully open the fuse compartment with a small screwdriver.

Status Indicators

There are 10 LED status indicators on the I/O panel of the MHI-2000. The LED colors and function names are shown in Figure 3–2.

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FIGURE 3–2. LED Display



LEDs

Diags

The DIAGS. LED lights whenever one or more of the following conditions occur in the MHI-2000:

- A serious problem with the computer system memory has occurred.
- Other types of *fatal* errors have occurred that are detectable by the software.

Because the diagnostics indicator is shared, you may have to run the diagnostics software to determine the precise reason that the LED is ON.

Rec Data

The REC DATA LED blinks whenever the MHI-2000 receives characters from the Host, Terminal, Setup and Starnode ports. The Ethernet port is not monitored. This LED helps to verify wiring and assure that those communication signals are reaching the MHI-2000.

Xmit Data

The XMIT DATA LED blinks whenever the MHI-2000 transmits characters to the Host, Terminal, Setup, and Starnode ports. The Ethernet port is not monitored. This LED indicates that the MHI-2000 is sending data from a communication port.

Presence 1

The PRESENCE 1 LED displays the status of the signal from the INZONE photoeye. The PRESENCE 1 LED monitors INPUT 1 of the MHI-2000.

Presence 2

The PRESENCE 2 LED displays the status of the signal from the OUTZONE photoeye. The PRESENCE 2 LED monitors INPUT 2 of the MHI-2000.

Inputs

The INPUTS LED displays the state of all standard inputs (1 - 8) combined. When any of the inputs is enabled, the LED will light. To determine the status of each input individually, you must run the INPUTS test of the diagnostics program.

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When OPTO-22 relays are installed in the Interface Board, you can determine which input relays are active by observing the LED associated with each relay.

The inputs on the optional Programmable Interface Controller are not monitored.

Outputs

The OUTPUTS LED displays the state of all outputs (1 - 8) combined. When any of the outputs is enabled, the LED will light. To determine the status of each output individually, you must run the OUTPUTS test of the diagnostics program.

When output relays are installed in the Interface Board, you can determine which output relays are active by observing the LED associated with each relay.

Decode

The DECODE LED has no function currently.

Set-Up

The SET-UP LED indicates that the MHI-2000 is in either the Setup or Diagnostics mode. Therefore, it is not running your custom application software.

Power On

The POWER ON LED indicates that MHI-2000 power is ON. When power is applied, the computer performs internal diagnostic tests.

Interface Board Connections

The Interface Board is accessible by removing the MHI-2000 cover. The MHI-2000 Command and Control Board provides 12VDC and 5VDC power to operate the Interface Board.

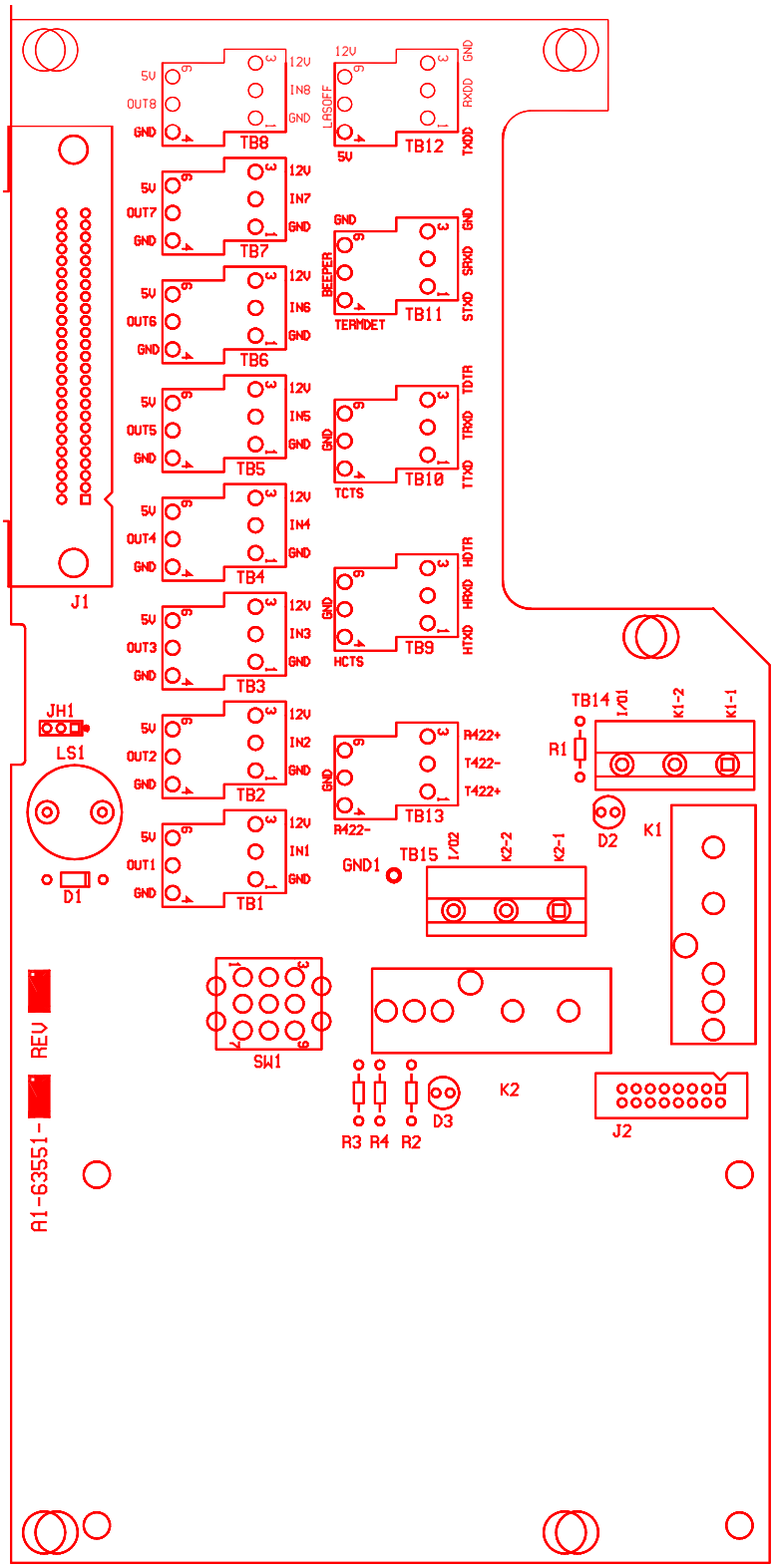
There are two jumpers, internal to the MHI-2000, to connect DC output power to the interface board. This is done by moving shunts of JH10 (1-2) and JH11 (1-2) on the Command and Control Board. This is the default setting.

All control and communication I/O connections, except to networks, should be made at the Interface Board.

Connect network cables, if used, directly to the MHI-2000. You can also connect a terminal to the SETUP connector on the front panel of the MHI-2000, although, normally, it will be more convenient to make the connection at the Interface Board.

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FIGURE 3–3. Standard Interface Unit Circuit Board



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TABLE 3–1. Interface Board I/O Connections

TB1-1	GND	GROUND
TB1-2	IN1	INPUT 1
TB1-3	+12V	+12V POWER
TB1-4	GND	GROUND
TB1-5	OUT1	OUTPUT 1
TB1-6	+5V	+5V POWER
TB2-1	GND	GROUND
TB2-2	IN2	INPUT 2
TB2-3	+12V	+12V POWER
TB2-4	GND	GROUND
TB2-5	OUT2	OUTPUT 2
TB2-6	+5V	+5V POWER
TB3-1	GND	GROUND
TB3-2	IN3	INPUT 3
TB3-3	+12V	+12V POWER
TB3-4	GND	GROUND
TB3-5	OUT3	OUTPUT 3
TB3-6	+5V	+5V POWER
TB4-1	GND	GROUND
TB4-2	IN4	INPUT 4
TB4-3	+12V	+12V POWER
TB4-4	GND	GROUND
TB4-5	OUT4	OUTPUT 4
TB4-6	+5V	+5V POWER
TB5-1	GND	GROUND
TB5-2	IN5	INPUT 5
TB5-3	+12V	+12V POWER
TB5-4	GND	GROUND
TB5-5	OUT5	OUTPUT 5
TB5-6	+5V	+5V POWER
TB6-1	GND	GROUND
TB6-2	IN6	INPUT 6
TB6-3	+12V	+12V POWER

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TABLE 3–1. Interface Board I/O Connections (Continued)

TB6-4	GND	GROUND
TB6-5	OUT6	OUTPUT 6
TB6-6	+5V	+5V POWER
TB7-1	GND	GROUND
TB7-2	IN7	INPUT 7
TB7-3	+12V	+12V POWER
TB7-4	GND	GROUND
TB7-5	OUT7	OUTPUT 7
TB7-6	+5V	+5V POWER
TB8-1	GND	GROUND
TB8-2	IN8	INPUT 8
TB8-3	+12V	+12V POWER
TB8-4	GND	GROUND
TB8-5	OUT8	OUTPUT 8
TB8-6	+5V	+5V POWER
TB14-1	K1-1	K1 OPTO-22 PIN 1
TB14-2	K1-2	K1 OPTO-22 PIN 2
TB14-3	I/O1	K1 OPTO-22 INPUT or OUTPUT
TB15-1	K2-1	K2 OPTO-22 PIN 1
TB15-2	K2-2	K2 OPTO-22 PIN 2
TB15-3	I/O2	K2 OPTO-22 INPUT or OUTPUT

Control Input Connections

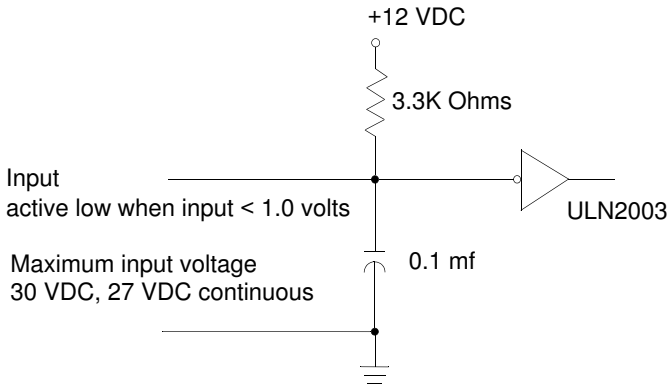
Interface Unit Inputs

All eight standard solid-state control input connections to the Interface Board are available at terminal block TB1 through TB8, as shown in Figure 3–3, “Standard Interface Unit Circuit Board” on page 3-4.

Connector assignments are listed in Table 3–1, “Interface Board I/O Connections” on page 3-5.

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FIGURE 3–4. Typical Solid-State Input Circuit

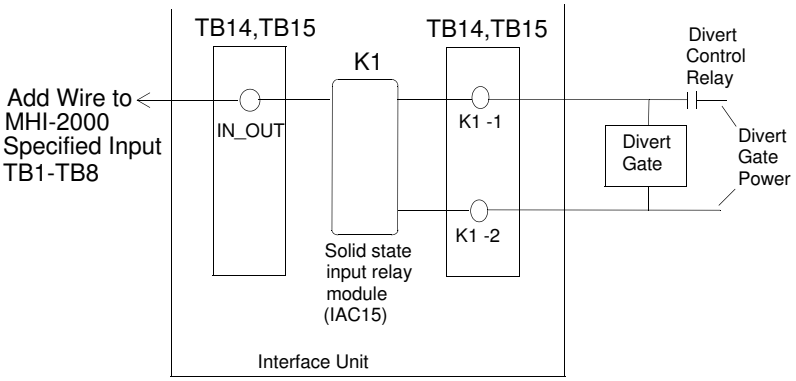


Optional Input Relay Modules

Two optional solid-state input relay modules (OPTO22) may be used to accommodate AC/DC input and output signals.

Input relay modules can be plugged into locations K1 or K2. Relay modules with several different AC and DC voltage and power ratings can be provided to fit your application. External wiring should be connected to TB14/15 pins 1/2 respectively, as shown in Figure 3–5. An additional 22 AWG is required to complete the connection to the specific input you require. Connect this wire from TB14/15 pin3 to required input TB1-8 pin2.

FIGURE 3–5. Solid-State Input Relay Module



Control Output Connections

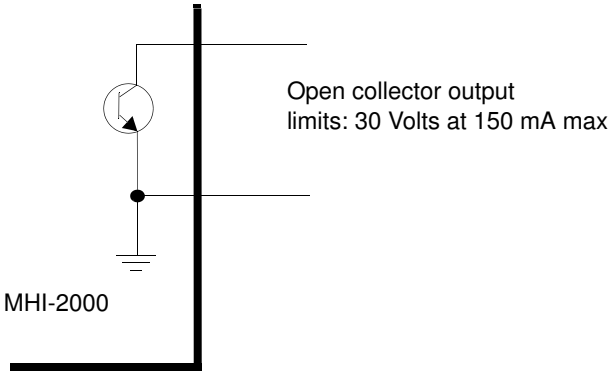
Interface Unit Outputs

All eight standard solid-state control output connections to the Interface Board are available at terminal block TB1 through TB8, as shown in Figure 3–3, “Standard Interface Unit Circuit Board” on page 3-4.

Connector assignments are listed in Table 3–1, “Interface Board I/O Connections” on page 3-5.

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FIGURE 3–6. Typical Solid-State Output Circuit

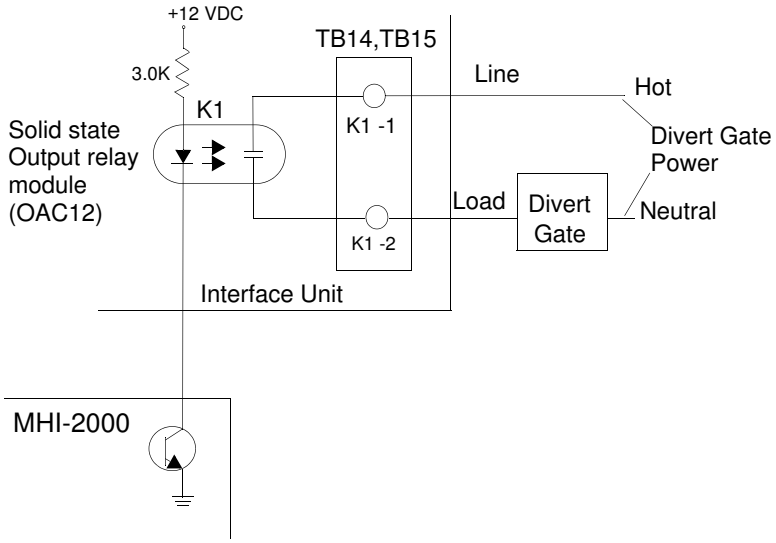


Optional Output Relay Modules

Two optional solid-state output relay modules (OPTO22) may be used to accommodate AC/DC input and output signals.

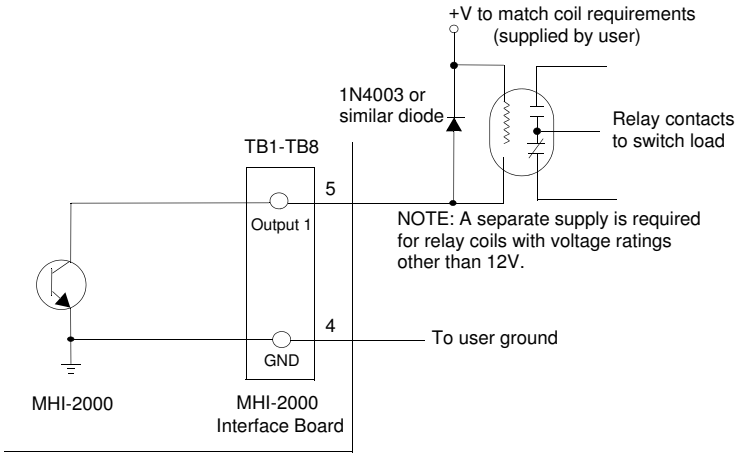
Output relay modules can be plugged into locations K1 or K2. Relay modules with several different AC and DC voltage and power ratings can be provided to fit your application. External wiring should be connected to TB14/15 pins 1/2 respectively, as shown in Figure 3–7. An additional 22 AWG is required to complete the connection to the specific output you require. Connect this wire from TB14/15 pin3 to required output TB1-8 pin5.

FIGURE 3–7. Solid-State Output Relay



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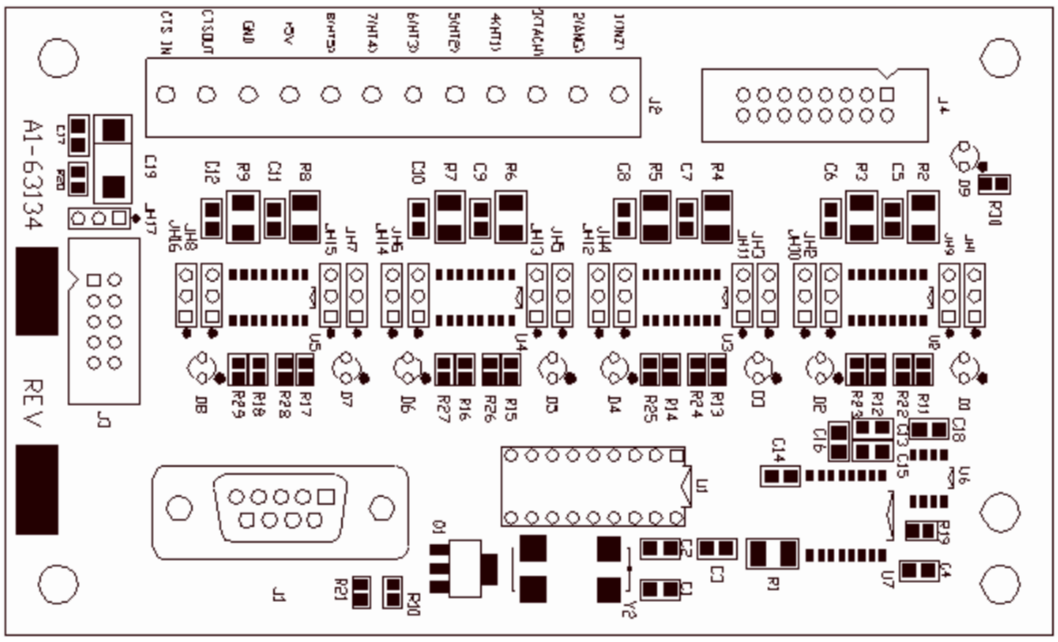
FIGURE 3–8. Open Collector Output Operating an External Relay



Programmable Interface Controller

Up to seven additional low-voltage DC input or outputs are available at terminal block J2 on an optional Programmable Interface Controller, as shown in Figure 3–9. Use of the PIC board is application specific. Definition of input and output pins requires knowledge of PIC function. All input and output pins are similar to the ones shown in Figure 3–4 and Figure 3–6.

FIGURE 3–9. Programmable Interface Controller Board



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TABLE 3–2. 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)

Special Inputs & Outputs

Beep

Beep is a solid-state, open-collector output that normally activates an audio tone to signal the operator.

By default JH1 shunt is positioned from 2-3. This allows the beeper signal to be sent to the on board transducer. If you wish to send this signal to an external device use TB11 and set the JH1 shunt to positions 1-2.

Interface Board I/O Connections

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

TABLE 3–3. Interface Board Comm Connections

TB9-1	HTXD	HOST TRANSMIT DATA
TB9-2	HRXD	HOST RECEIVE DATA
TB9-3	HDTR	HOST DATA TERMINAL READY
TB9-4	HCTS	HOST CLEAR TO SEND
TB9-5	GND	GROUND
TB9-6		
TB10-1	TTXD	TERMINAL TRANSMIT DATA
TB10-2	TRXD	TERMINAL RECEIVE DATA
TB10-3	TDTR	TERMINAL DATA TERMINAL READY

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TABLE 3–3. Interface Board Comm Connections (Continued)

TB10-4	TCTS	TERMINAL CLEAR TO SEND
TB10-5	GND	GROUND
TB10-6		
TB11-1	STXD	SETUP TRANSMIT DATA
TB11-2	SRXD	SETUP RECEIVE DATA
TB11-3	GND	GROUND
TB11-4	TERMDET	TERMINAL DETECT
TB11-5	BEEPER	BEEPER
TB11-6	GND	GROUND
TB12-1	TXDD	TRANSMIT DATA D-PORT
TB12-2	RXDD	RECEIVE DATA D-PORT
TB12-3	GND	GROUND
TB12-4	+5V	+5V POWER
TB12-5	EXLASOFF	EXTERNAL LASER OFF
TB12-6	+12V	+12V POWER
TB13-1	T422+	RS-422 TRANSMIT (+)
TB13-2	T422-	RS-422 TRANSMIT (-)
TB13-3	R422+	RS-422 RECEIVE (+)
TB13-4	R422-	RS-422 RECEIVE (-)
TB13-5	GND	GROUND
TB13-6		

Expansion Board Input Connections

Table 3–4 shows the Expansion Board Input Connection at Terminal Block J2.

TABLE 3–4. 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)

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TABLE 3–4. Expansion Board Input Connections

J2 Marked	Assignment
9 +5V	+5V
10 GND	GND
11 CTSOUT	CTSOUT (RS-232)
12 CTSIN	CTSIN (TTL)

Connectors on Front Panel

Refer to Table 3–5 and Table 3–6, "I/O Connector" on page 3-13 for connector and signal specification for the MHI-2000 Front Panel.

TABLE 3–5. Front Panel Connections

Pin	AUXILIARY	STARNODE	SETUP	(SETUP/1400)
1		LAN+ (blue wire)		
2	Host RXD	TERM DETECT	Setup TXD	
3	Host TXD	LAN- (white wire)	Setup RXD	
4	Host DTR	Ground		Ground
5	Ground	Frame Ground (cable shield)	Ground	
6		Ground		Ground
7		TERM RXD		Setup RXD
8	Host CTS	TERM TXD		Setup TXD
9		+5 VDC, 350 mA max		+5 VDC, 350 mA max

FIGURE 3–10. Front Panel Connectors



Female — Setup & Starnode

Male — Auxiliary

Auxiliary Connector

Auxiliary Connections are also available on TB9 on the Interface Board. The Auxiliary 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., is determined by parameters you can set. Refer to Appendix E, "Parameters," for more information. This port can use RS-232 or full modem protocols. RS-422 communication is available with the interface box only.

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

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Starnode Connector

The Starnode Connector allows the MHI-2000 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 front panel of the MHI-2000. Refer to Table 3–5, “Front Panel Connections” on page 3-12.

Terminal Port Functionality on Starnode Connector

The Starnode Connector can also be used to access the Terminal port so it can be used as a Setup Port. Terminal Port uses RS-232 conventions. Refer to Table 3–5, “Front Panel Connections” on page 3-12. CiMAX 1400 is powered by pins 6 and 9. Pin 2 is a terminal detect pin used by the MHI-2000 to detect CiMAX 1400 presence.

Setup Connector

The SETUP connector is provided as an input port for a local terminal. You can connect 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 3–5, “Front Panel Connections” on page 3-12.

Setup connections are also available on TB11 on the Interface Board.

A terminal can be used to display and change parameters values and run diagnostic tests. Most terminals only require connection to pins 2, 3 and 5.

You can configure the setup port to use a CiMAX 1400 Hand-Held Terminal by changing the default cable from J10 to J8 on the Command and Control Board, internal to the MHI-2000.

Ethernet Connector

An RJ-45 connector for 10baseT twisted pair is provided. No Ethernet connections are available in the Standard or Hex Interface Units. You must attach your network cable directly to the RJ-45 connector on the front panel of the MHI-2000.

I/O Connector

The cable connecting the Command and Control PCB to the Interface PCB is plugged into the I/O Connector, as shown in Table 3–6.

TABLE 3–6. I/O Connector

Signal	Pin #
Output 1	38
Input 1	8
Output 2	14
Input 2	33
Output 3	39
Input 3	9
Output 4	15
Input 4	34
Output 5	40
Input 5	10

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TABLE 3–6. I/O Connector (Continued)

Signal	Pin #
Output 6	16
Input 6	35
Output 7	41
Input 7	11
Output 8	17
Input 8	36
RXDD	24
Beep	23
+12V	21
Ground	45
+5V	43
N/C	22
Ground	37
+12V	44
TXDD	25
Host TXD	1
Host RXD	26
Host DTR	2
Host CTS	27
TERM TXD	3
TERM RXD	28
TERM DTR	4
TERM CTS	29
T422+	6
T422-	31
R422+	7
R422-	32
TERM DET	50
Setup TXD	5
Setup RXD	30
+5V	49
Laser Control	47
+5V	48
Ground	20
+5V	18
+12V	46

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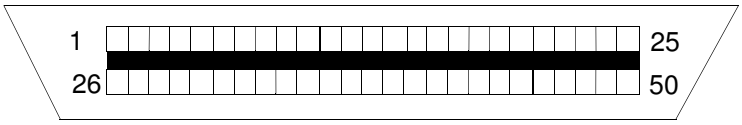
TABLE 3–6. I/O Connector (Continued)

Signal	Pin #
Ground	12
Ground	13
+12V	19
Frame Ground	42

50-Pin Cable Connector

This connector plugs into the I/O Connections jack on the MHI-2000 front panel, and is shown in Figure 3–11.

FIGURE 3–11. 50 Pin Centronics Connector



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CHAPTER 4 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 MHI-2000 has a separate, dedicated Setup Port. Figure 3–1, “I/O Panel” on page 3-1 shows the location of the Setup Port. Refer to “Setup Connector” on page 3-13 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 or PC running terminal software can be connected to the Setup port. When connected, the terminal becomes the display and keypad for the MHI-2000. The Starnode port supports a CiMAX 1400 Hand-Held Terminal.

The Host and Terminal ports can also be used to send commands directly to the MHI-2000’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 6, “Diagnostics”.

The Starnode port allows the MHI-2000 to be connected to an EIA-485 Starnode Local Area Network. Most functions that can be performed through the serial ports can also be performed through the Starnode port.

The MHI-2000 has an Ethernet 10 base T port. Most functions that can be performed through the serial ports can also be performed through the Ethernet port.

Power Up

When you power up or reset the MHI-2000, the SET-UP LED will flash for a short time. During this time, the MHI-2000 will send several status messages to the Setup port.

```
CiMatrix Omni-2000 Bootrom Version x.x
Creation Date: mm dd yyyy, hh:mm:ss
```

The lines above display the product name, and the Command boot block version and date.

```
Type '!' to stop auto-boot ...
0
Auto-Booting ...
```


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The section above provides a 5 second delay to allow you to change the basic boot parameters. This is further described after the standard status messages.

```
--------------------------------------------------
* Current Boot Parameters:                  *
--------------------------------------------------
Boot Device                        : xxxxx
Network Device                     : xxxxx
Network Device Unit Number         : 0
Network Name                       : xxxxx
IP Address With Subnet Mask        : x.x.x.x:ffffff00
Gateway IP Address                 : x.x.x.x
Boot Option Flags (In Hex)         : 0x0
FTP Server Name                    : xxxxxxx
FTP Server IP Address              : x.x.x.x
FTP File Name                      : xxxxxx
FTP Login Password                 : xxxxxx
FTP Login User Name                : xxxxxx
```

The lines above display all of the current boot parameter of the MHI-2000.

```
Loading OS from Flash ... sectors 7-13
Uncompressing xxxxxx bytes ...
Checksum OK.
Starting at address 0x8002000 ...
```

The section above displays while the Command OS is being copied from flash and run.

```
(C) 2001 Sick Auto Ident, Inc. ALL RIGHTS RESERVED
MHI-2000 Ver. x.x Build Date: mmm dd yyy, hh:mm:ss
User Program: None (Waiting For Download)
Scanner Setup
  On-Board Ethernet: 10.6.1.210
     Add-on Ethernet: Not Installed
     Operation Mode: Idle
                Tracking: Disabled
              Host Port: No Protocol
              Term Port: No Protocol
             Setup Port: No Protocol
                 D Port: No Protocol
          Starnode Port: No Protocol
              Tcp Port 1: No Protocol
              Tcp Port 2: No Protocol
              Tcp Port 3: No Protocol
Ethernet Link(s) Active
```

If parameter 401 TERM. NUMBER and parameter 402 TERM. TYPE are not equal to 0, one of the following messages will be displayed, depending on Starnode status:

```
No Starnode
Starnode is Active, Terminal # xxxx
```


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MHI-2000 Setup is also displayed. These refer to parameters 641, 651, 002, 700, 111, 131, 151, 171, 400, 673, 683, and 693 respectively.

If while countdown is running for auto boot, a <!> is received the following message will be sent.

```
[Omni2000 Boot]:
```

If you enter a ?. the list of commands will be displayed.

```
[Omni2000 Boot]: ?

Commands:
? or help       - help
@ or go         - start operating system
change          - change boot parameters
display         - display boot parameters
reboot          - reboot system
toggle          - toggle to debug boot mode
updateos        - download and update OS image in Flash
```

Available Boot Devices (Names Are Case Sensitive):

```
xxxxxx unit 0
slip
flash
```


User Interface—Parameters & Diagnostics

The MHI-2000 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 6, “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 6, “Diagnostics” for more information.

Operating Modes

The MHI-2000 operates in three modes:

- Normal — In this mode, you can monitor information about the MHI-2000’s operation, including the barcode read, input and output status, and barcode quality.
- Setup — In this mode, you can set parameters to program the MHI-2000 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.
- Diagnostics — In this mode, you can test the hardware and software to check the MHI-2000 performance.

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Normal Mode

In the Normal mode, you can program the MHI-2000 to send information such as label placement, box size, or bin information.

Refer to parameter 006 DEBUG DATA for a description of the various debug reports available.

Setup & Diagnostic Modes

Special Host commands, ?S and ?D, are used to place the MHI-2000 into the Setup or Diagnostic mode. These commands are only recognized when received at the Setup Port. Refer to Chapter 6, "Diagnostics" for more information. Parameter 007 DEBUG DATA PORT defines the ports that receive setup data (Terminal, Host, Ethernet, Setup).

A beginning and ending message character must frame the command. If parameter 403 MSG CHAR PREFIX and 404 MSG CHAR SUFFIX have not been changed from their 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, send the command as ~?R~ (assuming MSGCHAR is a ~), or ?R over a Starnode network, to restore default parameters.

WARNING! YOUR MHI-2000 MAY USE NON-DEFAULT PARAMETERS CUSTOMIZED FOR YOUR APPLICATION. THESE PARAMETERS ARE DETAILED IN YOUR KEYSHEET. RESETTING THE MHI-2000 TO USE DEFAULT PARAMETERS WILL CAUSE YOUR CUSTOMIZED PARAMETERS TO BE LOST. THEY WILL NEED TO BE RESTORED.

Non-Intelligent ASCII Terminal

Upon receiving a ~?S~ or ~?D~ command, the MHI-2000 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.

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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 Appendix E, “Parameters”.

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 002 OPERATION MODE 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 four times after the Setup mode is entered, the display will appear as:

```
SETUP - (P)REVIOUS, (G)OTO, (T)OGGLE, (E)XIT
002 OPERATION MODE    0
003 IO MODE           0000
006 DEBUG DATA        00000
007 DEBUG DATA PORT   0000
```

  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 G00608 will display parameter 006 DEBUG DATA and enter a value of 08. The change will only become effective when you EXIT the menu.

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- *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.

Note: When exiting the setup/diagnostic menu, if parameter values have been changed, then the MHI-2000 prompts whether these changes should be saved. Responding yes (Y) will save the changes.

Data Entry Through Setup Menu on the ASCII Terminal

Enter new values 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. Press Enter to enter the value.
   - If you entered a **valid value**, the beeper will sound once and the terminal will show the parameter again, with the new value replacing the old one.
   - If you entered an **invalid value**, three short beeps will be sounded. 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 6, “Diagnostics”.
- *T*—TOGGLE between the Diagnostics and Setup menus.
- *E*—EXIT the Diagnostics menu and return to Normal mode.

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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, IO PORTS, you will display the last test SYSTEM STATS on the last line. If SYSTEM STATS is already displayed when you advance forward, you will see IO PORTS 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
IO PORTS
TACHOMETER TEST
TACHOMETER CAL.
KEYSHEETS
OS UPDATE
NETWORK PING
NETWORK STATS
PORT TEST
REAL TIME CLOCK
STARNODE MONITOR
SYSTEM STATS
```

Refer to Chapter 6, “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). Because the CiMAX 1400 has a 4 by 20 display, some of the parameters are displayed on two lines. Function keys are programmed to provide entry to the Setup mode (~?S~) and the Diagnostic mode (~?D~).

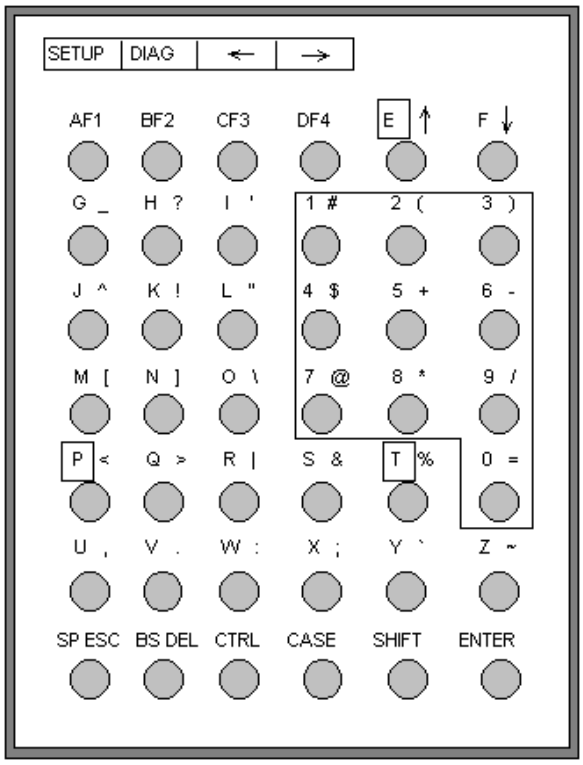
The CiMAX 1400 requires +5 VDC and Ground. This is supplied by the MHI-2000 when the CiMAX 1400 is connected to the Starnode port at the MHI-2000.

When the CiMAX 1400 is connected to the Starnode port, it pulls the TERMinal DETect pin on the port low, to indicate to the MHI-2000 that the CiMAX 1400 is connected.

Disconnecting the CiMAX 1400 reboots the MHI-2000 and restores the system to the master-slave configuration. The keyboard of the CiMAX 1400 is shown in Figure 4–1.

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FIGURE 4–1. 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.

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 Guide* for more information.

User Programmable—Press SHIFT- F4. Refer to the *CiMAX 1400 User Guide* for more information.

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

Exits Setup or *Diagnostic Mode*—Press E. This returns the MHI-2000 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.

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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 MHI-2000s to display information about barcodes read, I/O status, and other data, all in real time.

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5

CHAPTER 5 *Host Commands & Downloads*

This chapter describes how to use a Starnode network, Ethernet network, and the serial ports to connect the MHI-2000 to a host computer to communicate with, control, and download C programs.

Introduction

You can connect the MHI-2000 to a host PC by a Starnode network via the STARNODE port, Ethernet network via 10 base T port, or through a serial port. Once communication with the host or network has been established, you can command the MHI-2000 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, Ethernet or Starnode port. This chapter will describe in detail:

- How to control the MHI-2000 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 MHI-2000 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 MHI-2000 through a:

- Host or Terminal/Setup port, a framing character, normally a tilde (~), must be sent before and after each command.
- 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 will 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 5–1. The commands are listed numerically, by decimal value, in ascending order. Commands with a decimal value 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 MHI-2000.

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TABLE 5–1. Terminal Control Commands

Message Type	Command (Dec/Hex)	(Serial)	(Network)
Request Diagnostic String	52/34	~4~	4
Request Status Information	53/35	~5~	5
Reset	59/3B	~;~	;
Clear Diagnostic Count	60/3C	~<~	<
Enable Digital Output	61/3D	~=x~	=x
Turn Relay Off	62/3E	~>x~	>x
Setup Command	63/3F	~?x~	?x
Upload Parameter	37/25	~%x~	%x
Program Message	65/41 (or greater)	A (or greater)	A (or greater)
Display Box/No Read Count		~TOTAL~	/TOTAL
Outzone Deviation Statistics		~TOLER~	/TOLER
Start Presence		~!~	/!
Stop Presence		~$~	/$
Clear Box/No Read Registers		~TOT00~	/TOT00

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ASCII 4 Command—Requesting a Diagnostic String

When sent over STARNODE or TCP/IP, use this format 4.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~4~.

Upon receiving an ASCII 4 command (decimal 52; hexadecimal 34), the MHI-2000 will send the following string back to the controller:

MHI #NNNNN

Where:

NNNNN is the message count for this MHI-2000. This value will be 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 MHI-2000 is rebooted by turning it *Off* and then *On* again.

Message Format—None

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ASCII 5 Command—Requesting Status Information

When sent over STARNODE or TCP/IP, use this format 5.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~5~.

When the MHI-2000 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:

MHI VV ABCDEFGHIJKLMNOPQRSTUV

Where:

VV—The version number of the software used in the MHI-2000

ABCDEFGHIJKLMNOPQRSTUV—The 22-character diagnostic string

The diagnostic status string reflects the current status of the MHI-2000, as shown in Table 5–2.

TABLE 5–2. Status String Interpretation

Position	Meaning When 1
A	Inzone Status
B	Outzone Status
C	Zone Error Status
D	Decode Status
E	BTL Status
F	Scan Speed Status
G	Transmit Data Status
H	NAK Status
I	Receive Data Status
J	Receive Error Status
K	NO READ Status
L	MATCH Status
M	NO MATCH Status
N	Setup Status
O	Program Status
P	Default Status
Q	Fault Status
R	Conveyor Stalled Status
S	Reverse Tach Status
T	Ethernet Fail Status
U	Starnode Fail Status
V	Slave Offline Status

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Status String Digit Explanations

A—Inzone Status

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

B—Outzone Status

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 Error Status

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 Status

1 indicates that the decoder is processing data.

E—BTL Status

1 indicates that the MHI-2000 is falling behind in analyzing data stored in the bar timing logic (BTL) buffer. This digit may be 1 if large amounts of barcoded data are being scanned.

F—Scan Speed Status

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

G—Transmit Data Status

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

H—NAK Status

1 indicates that the MHI-2000 does not perceive the Starnode network as operational, i.e., the network has not polled the MHI-2000 recently. It may also indicate an error in data received from the Starnode Controller.

I—Receive Data Status

1 indicates that the MHI-2000 is currently receiving data through the Host, Setup, or Starnode Ports.

J—Receive Error Status

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

K—NO READ Status

1 indicates a NO READ output energized.

L—MATCH Status

1 indicates a MATCH output energized.

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M—NO MATCH Status

1 indicates a NO MATCH output energized.

N—Setup Status

1 indicates that the unit is operating in the Diagnostics mode or the Setup mode. Refer to “Setup & Diagnostic Modes” on page 4-4 for more information.

O—Program Status

1 indicates that the MHI-2000 is currently executing a user program.

P—Default Status

1 indicates that the MHI-2000 is in the Default Setup mode.

Q—Fault Status

1 indicates that there is a hardware error fault somewhere in the system (FAULT LED).

R—Conveyor Stalled Status

1 indicates that the conveyor has stalled.

S—Reverse Tach Status

1 indicates that reverse conveyor movement has been detected.

T—Ethernet Fail Status

1 indicates that the MHI-2000’s network connections are set up and the Ethernet link(s) are broken.

Note: The entire network must be disabled if the link on just a single controller is broken.

U—Starnode Fail Status

1 indicates that the MHI-2000 is configured for Starnode but there is no Starnode communication with Starnode Controller.

V—Slave Offline Status

1 indicates that the slave device is offline.

Example

If the default MESSAGE CHARACTER value is not changed, downloading the string `~5~` over the Host or Setup ports will cause the MHI-2000 to return a diagnostic string.

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ASCII ; Command—Rebooting MHI-2000

When sent over STARNODE or TCP/IP, use this format ;.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~;~.

Upon receiving an ASCII **;** (semicolon) command (decimal 59; hexadecimal 3B), the MHI-2000 will reboot as if it had been turned *Off* and then *On* again. The MHI-2000's parameter values will be safely stored in memory after startup.

Message Format—None

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ASCII < Command—Clearing Diagnostic Count

When sent over STARNODE or TCP/IP, use this format **<**.

When sent serially and the default MESSAGE CHARACTER is **~**, use this format **~<~**.

The ASCII **<** (less than sign) command (decimal 60; hexadecimal 3C) is used to clear the message count from a MHI-2000 without having to restart it. Refer to “ASCII 4 Command—Requesting a Diagnostic String” on page 5-3 for details regarding the message count.

This count may also be reset by sending an ASCII **;** command that resets the MHI-2000 to its default values.

Message Format—None

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ASCII = Command—Enabling Relay Control Outputs

When sent over STARNODE or TCP/IP, use this format =NNN.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~=NNN~.

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.

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

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

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

Downloading the string ~=004~ over the Host or Setup port will enable output 3.

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ASCII > Command—De-Energizing Relay Control Outputs

When sent over STARNODE or TCP/IP, use this format >NNN.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~>NNN~.

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.

By sending a single *0* as the parameter *NNN*, 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.

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

Downloading the string ~>004~ over the Host or Setup port will disable output 3.

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ASCII ? Command—Setup

When sent over STARNODE or TCP/IP, use this format ?x, ?99y, or ?9z.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~?x~, ~?99y~, or ~?9z~.

The ASCII ? (question mark; decimal 63; hexadecimal 3F) command tells the MHI-2000 that this is a Setup command. These allow the network or application running at the host to change or read the MHI-2000's parameters, as well as to control the execution of any resident C program running on the MHI-2000.

Message Format— ?x or
?99y or
?9z

Where:

?—The ASCII character that indicates a setup command.

Specific Control Commands

These are basic commands to perform specific tasks. They follow the format ?x, where x is S, D, R, or THH:MM:SS,mm-dd-yy.

TABLE 5–3. Special Control Commands

?S	This command causes the MHI-2000 to enter the Setup Menu. In this menu, you can view and change any of the MHI-2000 parameters. For more information, see Chapter 4, "Startup & Operation".
?D	This command causes the MHI-2000 to enter the Diagnostics Menu. In this menu, you can run a variety of useful diagnostic tests for alignment and troubleshooting requirements. For more information, see Chapter 4, "Startup & Operation" and Chapter 6, "Diagnostics".
?R	This command causes all of the MHI-2000's parameters to be set to default values. Care should be taken when using this command, because there are a few parameters that are used for hardware and communication requirements. Prior to the use of this command, you should have stored the keysheet parameters or upload all group strings to an ASCII file.
?THH:MM:SS,mm-dd-yy	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. The RTC is backed up by a battery, and it continues to keep time when the MHI-2000 power is Off. The command can be used over any serial port. All parameters must be entered as two-digit numbers, using leading zeros where necessary. HH = hours, 24-hour format (00 to 23) MM = minutes SS = seconds mm = month dd = day yy = year

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Uploading Multiple Group Commands

These are your basic group upload commands that will send information to whichever communication port requested the information. This may be useful for saving specific MHI-2000 parameters to a file, or just to review the MHI-2000 current settings. Appended to the end of this transmission is ~;~, used to perform a restart of the MHI-2000 if these groups were back downloaded.

This may be useful when configuring multiple MHI-2000s or transferring one MHI-2000's setup configuration to another.

They follow the format ?99y, where y is 7, 8, or 9.

TABLE 5–4. Multiple Group Commands

?997	This is similar to a setting of 9, with the exception of groups 45, 46, and 47, which are missing. In the MHI-2000, groups 45, 46, and 47 do not exist. This is the same as a setting of 9. Each group setup string is uploaded with a ~% prefix for later downloading use.
?998	This command causes the MHI-2000 to upload current endpoint table. This selection is not applicable with MHI-2000 devices. ~%890 +000 +000 +000 +000 +000 +000 +000 +000~ ~%891 +000 +000 +000 +000 +000 +000 +000 +000~ ~%892 +000 +000 +000 +000 +000 +000 +000 +000~ ~%893 +000 +000 +000 +000 +000 +000 +000 +000~ ~%894 +000 +000 +000 +000 +000 +000 +000 +000~ ~%895 -+000 +000 +000 +000 +000 +000 +000 +000~ ~%896 200 500~ ~;~
?999	This command causes the MHI-2000 to upload all group setup strings. Each group setup string is uploaded with a ~% prefix for later downloading use. The first group is shown below. As you can see, each parameter is separated by a <space>. Refer to Chapter A, "Group Setup Strings" for a description of each group setup string. ~%800 0 0000 00 0500 00000 0000 0000~

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User Program Control Commands

If there is a user program installed in the MHI-2000, these commands may override the execution of that program. They follow the format ?9z, where z is 1, 2, 3, 4, or 5.

TABLE 5–5. User Program Control Commands

?91	This command extracts or uploads a user C program from the MHI-2000. 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 MHI-2000 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 .s2k file by a terminal emulation or other program, so that file can be downloaded to the MHI-2000 later. Similarly, S-records sent to the Starnode or Ethernet port are framed in the .l2k file format. This feature is useful for extracting a user program from a MHI-2000 when the original .s2k or .l2k file is not available, for use in a replacement MHI-2000, or to save the program before a new version of the operating system is downloaded. 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 MHI-2000 serial ports. *Only the program's code and constant data segments are sent.*
?92	This command causes the MHI-2000 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 MHI-2000 would then erase its C program from NOVRAM. The MHI-2000 must then be reset by downloading the RESET command: ~;~
?93	This command stops the program running (it remains in NOVRAM). The program will start again following the next MHI-2000 reset.
?94	This command suspends the program.
?95	This command resumes the program.

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ASCII % Command-Parameters

When sent over STARNODE or TCP/IP, use this format %8pppvvv, %8xy, or %9xy.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~%8pppvvv~, ~%8xy~, or ~%9xy ~.

The ASCII % (percent sign; decimal 37; hexadecimal 25) command tells the MHI-2000 that this is a Parameter command. These allow the network or application running at the host to change or read the MHI-2000's parameters.

Message Format— %8pppvvv or
%8xy or
%9xy

Where:

%—The ASCII character that indicates a parameter command.

Variable	Description
xy	These two numbers refer to which group string is to be uploaded (%9xy), or downloaded (%8xy).
ppp	This is the individual parameter number to change.
vvv	This is the individual parameter value to change.

Individual Group String Commands

These are basic commands used to perform both upload and download of individual group setup string. When downloading a string, you should follow this command with a ; command. This will cause the MHI-2000 to reboot with the new parameters applied. These commands follow the format:

xy: Is the specific group setup string. Refer to Appendix A, "Group Setup Strings" for more detail.

%9xy Is the command to upload a specific group setup string.

%8xy Is the command to download a specific group setup string. All individual parameters within the string should be separated by a <space>. Group strings may be truncated, if later parameters within that string do not have to be modified. If the string is accepted, you will get the following response:

Group 8xy Loaded

Individual Parameter Command

This is your basic command to change an individual parameter only. After downloading a string, you should send a ; command. This will cause the MHI-2000 to reboot with the new parameters applied. These commands follow the format:

ppp: Is the specific parameter number.

vvv: Is the specific parameter value.

%pppvvv Is the command to change parameter ppp to a value of vvv.

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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 MHI-2000 for execution.

Message Format—A<MESSAGE>

Where:

A (or any greater ASCII character)—Informs the operating system to pass this message to the C program running the MHI-2000.

<*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 *SH3 C Programmer's Platform User Manual* for more information.

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TOTAL Command

When sent over STARNODE or TCP/IP, use this format /TOTAL.

When sent serially, use this format ~TOTAL~.

The TOTAL command is used to display a report such as:

```
0 boxes, 0 no reads
0 unassigned, 0 on multiple boxes, 0 no line on box
```

Where:

boxes—Total box count

no-reads—No-read count

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

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TOLER Command

When sent over STARNODE or TCP/IP, use this format /TOLER.

When sent serially, use this format ~TOLER~.

The TOLER command is used to return outzone deviation statistics for the last 11 boxes. It will display a report such as:

```
Object 0 outzone deviation = 0 *
Object 1 outzone deviation = 0
Object 2 outzone deviation = 0
Object 3 outzone deviation = 0
Object 4 outzone deviation = 0
Object 5 outzone deviation = 0
Object 6 outzone deviation = 0
Object 7 outzone deviation = 0
Object 8 outzone deviation = 0
Object 9 outzone deviation = 0
Object 10 outzone deviation = 0
Object 11 outzone deviation = 0
OUTZONES: Late=0 Early=0 Unexpected=0 Missing=0 On time=0
```


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TOT00 Command

When sent over STARNODE or TCP/IP, use this format /TOT00.

When sent serially, use this format ~TOT00~.

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

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~!~ & ~$~ 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 ~$~ permit an external system to send Presence signals to the MHI-2000. ~!~ replaces the inzone photoeye signal, and ~$~ replaces the outzone photoeye signal.

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

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

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VER Commands

When sent over STARNODE or TCP/IP, use this format /VER.

When sent serially and the default MESSAGE CHARACTER is ~, use this format ~VER~.

This command will return the version of all installed software modules currently operating within the MHI-2000. The user program currently stored in the MHI-2000 will be displayed. If there is no user program, the user program line will not be displayed. The following information will be returned:

```
MHI-2000 Ver. x.x Build Date: mmm dd yyyy, hh:mm:ss
User Program: None (Waiting For Download)
```


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C Programming Considerations

The SICK Auto Ident, Inc. SH3 C Programmer's Platform provides the ability to develop customized application programs on a PC and then download them to the target controller. The SH3 C Programmer's Platform also provides functions well suited to formatting scanned label data, providing I/O control and other important functions that typically arise in industrial bar code scanning applications.

The C programming language provides a robust set of instructions that utilize advanced data structures and operators, economical syntax, and advanced flow control capabilities.

C programs written for the SICK Auto Ident, Inc. family of controller products use the GNU gcc SH3 cross compiler. You should become familiar with the *GNU Toolkit User Manual*.

To compile, link, and locate a user program:

1. Create a C program.
2. Compile the program.
3. Link/locate the program.
4. Create formatted output files:
   a. Map output file - ***.map***
   b. Object file, for symbolic debugging - ***.o***
   c. LAN transfer file, ***.l2k, for Starnode or Ethernet***
   d. Host/Term transfer file, ***.s2k, serial downloads***

LAN transfer files and Host/Term transfer files can be treated exclusively of one another. They are output files for Starnode, .l2k, or serial downloads.

Developing User Programs

You can develop and compile C programs on any PC equipped with an RS-232 serial port, a Starnode PC Interface Board, or an Ethernet board using TCP/IP. To download through Starnode network (LAN), the target controller must include the Starnode option. You load the C program into the target controller through any RS232 serial port or over the Starnode network.

The result of the compilation process produces a .l2k download file, for Starnode environments, and an .s2k file, for RS-232 serial downloading.

Installing C Programming Platform

The SH3 C Programmer's Toolkit is distributed as a CD, with the setup utility "install.exe" located in the root directory. Use the following steps to install the compiler:

1. Insert the CD into the drive.
2. Execute \install.exe.
3. Select Next to proceed past the initial copyright screen.

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4. If the default installation directory of `c:\cisoft\csh3` is not acceptable, edit the path in the space provided.
5. Select Finish to proceed with the installation.
6. Modify your autoexec.bat to include the following path declaration:

   C:\CISOFT\CSH3\BIN

Note: The installation requires 30 Mb of hard disk space and takes approximately five minutes to complete.

If your system is not equipped with a CD drive, you may install the compiler by transferring only install.exe from a system that is equipped with a CD drive over to the target system. The remaining files on this CD are provided for convenient reference and to make the GNU sources available to you as required under the GNU GPL license.

The distribution CD will create all required compiler utilities and include files on your system. The CD also includes .PDFs of the GNU manuals and the GNU source used in building the compiler, assembler, and binary utilities. The installation software does not install these to your system.

Overview of Development Steps

This section explains creating programs for downloading to a target MHI-2000.

1. Modify or create a C source file with an ASCII text editor. For example, create a C program using a text editor that creates ASCII files as follows:

```
#include <stdio.h>
#include <stdlib.h>
/* User must define "program_name"*/
char *program_name = "HELLO";
void main(void)
{
   printf("Hello World");
   sleep(5000L);
   stop();
}
```

   a. Save the program with a name extension of .c (e.g., HELLO.c). The `cisoft\csh3\example` directory, created by the INSTALL Program on your SH3 C Programmer's Platform CD, contains the HELLO.c program.

   Note: The utility sh3build.exe*, included in the directory C:\CISOFT\CSH3\BIN, automates Step 2 through Step 5.*

   ---

   b. You have the option to execute automatically or continue manually. For manual instructions, refer to Step 2 through Step 5.

      To execute automated steps, enter:

```
\CISOFT\CSH3\BIN\SH3BUILD HELLO
```


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2. Make sure your working directory is `c:\cisoft\csh3\example`. Compile the source file to create an object file by typing:

```
C:\CISOFT\CSH3\BIN\gcc -m3 -Wa,-dsp -ansi -nostdinc -O
-fvolatile -fno-builtin -Wall -IC:\CISOFT\CSH3\include\
-BC:\CISOFT\CSH3\BIN\ -DCPU=SH7729 -c hello.c
```

3. Link the object file and the libraries by typing:

```
C:\CISOFT\CSH3\BIN\ld -o appl.o -E -r -dc -Map appl.map hello.o
```

4. Format the linked output into a .l2k file by typing:

```
\CISOFT\CSH3\BIN\COFF2LAN -ohello.l2k appl.o
```

5. Format the linked output into a .s2k file by typing:

```
 \CISOFT\CSH3\BIN\COFF2SEF -ohello.s2k appl.o
```

6. Configure the target device for accepting downloads.

7. Download the compiled user program.

Creating a Program

The following code fragment demonstrates some of the requirements for the user program. These requirements include:

- Providing a main() routine
  Upon startup of the user program, this routine executes first
- Supplying a global variable, char *program_name
  The string pointed to by program_name momentarily displays at boot time
- Including function prototypes for the SICK Auto Ident, Inc. library - ciprot.h

Example

```
#include <stdio.h>
#include "ciprot.h"
/* Example user task WORLD.C   */
char *program_name = "test"; /* Displayed at boot */
void main(void)
{
   setscreen("Hello World!");
   while(TRUE);
}
```

The `(drive):\cisoft\csh3\example\*` directories contain a build utility, *sh3build.exe*, that automates the compiling, linking, and formatting process. It is worthwhile to go through the steps this utility performs.

Compiling a Program

The remaining steps assume that you have modified your path to include the directory containing the GNU Compiler & binary utilities. By default, these are installed to `\cisoft\csh3\bin`. Alternatively, you may explicitly supply filename paths when executing the compiler and utilities.

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The source file is compiled using the GNU cross-compiler for the Hitachi SH3 processor, using the following command:

```
gcc -m3 -Wa,-dsp -ansi -nostdinc -O -fvolatile -fno-builtin -Wall -
IC:\CISOFT\CSH3\include\ -BC:\CISOFT\CSH3\BIN\ -DCPU=SH7729
-c hello.c
```

Where:

`-c hello.c`	Tells the C compiler to compile hello.c
`-m3`	Tells the C compiler to generate SH3 assembler
`-Wa,-dsp`	Passes option to the assembler
`-ansi`	Specifies ANSI C compatibility
`-nostdinc`	Search only the current and specified directories for include files
`-O`	Optimizes code for size and execution speed
`-fvolatile`	Considers all references using pointers as volatile memory
`-no-builtin`	Excludes the use of compiler built-in functions
`-Wall`	Selects all recommended gcc compiler warning level options
`-IC:\CISOFT\CSH3\include\`	Specifies the path for include files
`-BC:\CISOFT\CSH3\BIN\`	Specifies the path for the gcc executables
`-DCPU=SH7729`	Specifies target processor

You can find these and additional compiler switches described in the GNU C Compiler section of the *GNU Toolkit Reference Manual*.

Link & Locate a Program

After compiling all the code modules, link/locate the object files to create a single COFF object module.

To link and locate the example program, enter the command:

```
ld -o appl.o -E -r -dc -Map appl.map hello.o
```

Where:

`-o`	Creates an output file named appl.o
`-E`	Adds all symbols to the dynamically linked symbol table
`-r`	Generates relocatable output
`-dc`	Assigns space for common symbols
`-Map appl.map`	Outputs a symbol table map
`hello.o`	Space delimited list of file names to be linked

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You can find these and additional compiler switches described in the “Using ld, The GNU Linker” section of the *GNU Toolkit Reference Manual*.

Formatting for Downloads

Once the relocatable object file `appl.o` has been created, you must run a formatter, COFF2SEF, to create a file for serial downloads.

The format for this command is:

```
COFF2SEF -ohello.s2k appl.o
```

Where:

`-ohello.s2k`	Specifies the name of the output file
`appl.o`	Specifies the name of the input file for formatting

Then, you can serially download hello.s2k to the target. If you use block mode for download, use COFF2SEF command line switches to specify the prefix and suffix characters to match the target setup parameters for block mode.

If you are using Starnode or Ethernet, you must run a formatter, COFF2LAN, to create a file for lan downloads.

The format for this command is:

```
COFF2LAN -ohello.l2k appl.o
```

Where:

`-ohello.l2k`	Specifies the name of the output file
`appl.o`	Specifies the name of the input file for formatting

Configuring the Target Device

The target device that will execute your new application may communicate using RS-232, Starnode RS-485, Ethernet TCP/IP, or some combination of all three. Refer to the manual that came with your target device for instructions on setting configuration parameters. Initially, these devices will only be able to communicate serially, typically at 9600 baud, no parity, and 8 data bits. Run setup and configure the appropriate parameters.

Starnode Parameters

- 401 TERM. NUMBER — Assign each device a unique number between 1 and 4095.
- 402 TERM. TYPE — Assign each device a number between 1 and 127. Devices that are expected to receive the same download application should be assigned the same value for Terminal Type.

Ethernet Parameters

- 641 IP ADDRESS 1 — Request a unique IP address for each device from the network administrator.

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- 670 NET 1 DEST IP — This should match the IP address of the host that will be used to download to the device.

These are the minimum setup requirements for the Ethernet devices. You may also need to configure parameter 642 if the default subnet mask is not acceptable, and parameter 643 if the device needs to be accessed through a gateway. Refer to the operators guide supplied with the device for more information.

Serial Parameters

Downloads are sent to the Host port of a scanning device. The default settings on the device are usually 9600 baud, no parity, 8 data bits, 1 stop bit, and XON/XOFF protocol. Refer to the operators guide supplied with the device for more information. Parameters that may need to be changed range from parameter 100 BAUD RATE HOST through parameter 106 IN SUF. HOST.

Loading Programs via RS-232

1. Using Hyperterminal or any other terminal emulator, download the .s2k file created by the COFF2SEF utility to the target equipment. You must first establish communications between your PC and the target controller.

2. Enter ~5~.
   This generates a reply similar to the following:

   ```
   MHI          1.0 00000001000000000000
   (Model) (Version) (Dots/Status)
   ```

   Model refers to the name of your SICK Auto Ident, Inc. device.

3. When your PC and the target controller are communicating successfully, download the program to the target controller. If no reply is generated, re-check the cable and the settings for your communications program and try again. The target controller displays:

   ```
   LOADING: XXXXXX,
   ```

   Where:

   XXXXXX is the current program load address.

   Units that have no display will send decimal points out the SETUP serial port as the download progresses. Since STDOUT for these units is the SETUP serial port, the following message will be displayed from that port.

   The program name HELLO displays for 5 seconds, and then the program executes.

   The HELLO.c example program will display:

   ```
   HELLO WORLD
   ```

It will display this for 5 seconds and stop the target controller. The unit awaits further command input or another program download.

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Loading Programs on Starnode via Starndem

Depending on what O/S you use on your development platform and which software products you have installed, you may have either a console based or Windows GUI based version of Starndem. A console based version is supplied on the Starnode Developers disk, and on the Starnode SCO Unix Driver disk. A Windows GUI version is supplied with recent versions of the Starnode Developers Disk and with the Starnode NT driver. Detailed usage instructions for STARNDEM are available in the appropriate manual for your software product.

Run the Starnode demonstration program, STARNDEM.

The Starnode demo program will allow you to download the executable file to the MHI-2000. *STARNDEM.EXE* is described in the *Starnode PC Data Collection Network Operator's Manual.*

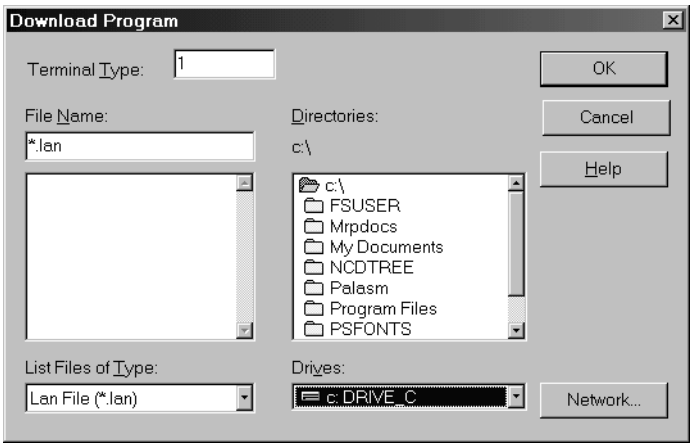
A detailed description of the PC board's operation during downloads can be found in the *Starnode Data Collection Network Operators Manual*. The interface routines (STBLC, STBLN, STBLB, and SINIT) are involved in the process of downloading .l2k files.

Download Program—Allows you to transmit a compiled *.l2k 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 5–1.

FIGURE 5–1. 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 127.

3. Specify the *.l2k 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 *.l2k files shown, select a different path from the File Name list box.

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

4. After selecting a *.l2k 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.

Using Multidem to Load Programs

Multidem can be used to load programs on Ethernet, Starnode or RS-232.

Overview

Multidem is the GUI that demonstrates the functionality of the OLE Servers, and provides limited data collection capabilities. Multidem collects data from one or more SICK Auto Ident, Inc. OLE Servers. It stores the data to a text file, and converts it to a standard database via a utility called DBConvrt, which is also configured with the OLE Servers. Multidem may also be used to download compiled programs to MHI-2000s, send messages to MHI-2000s, and monitor the raw receive data being processed by a second application.

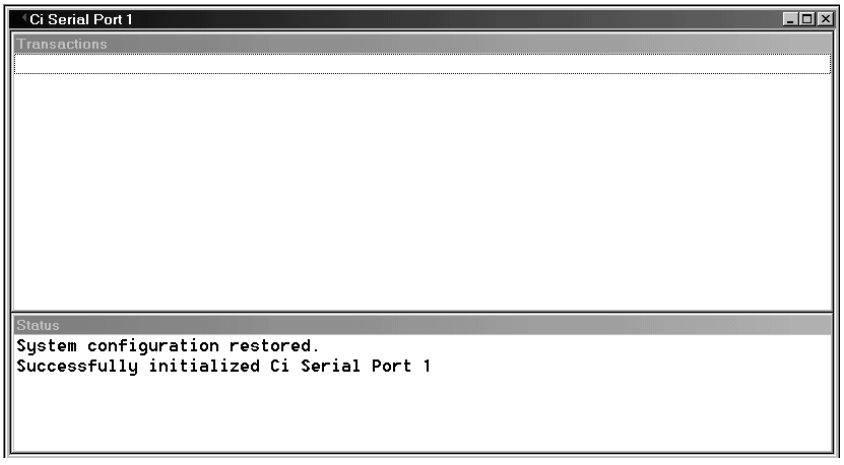
A configuration file was included at the time of the Multidem installation. This configuration file automatically accesses the system-configured OLE Server, initializes communications, and begins collecting data to a specific text file. Data in this text file will periodically be archived to another text file, and the archive is then converted to a standard database.

Send Program

Before selecting this menu option, perform the following steps:

1. Click on the document window associated with the connected OLE Server to bring it to the foreground. An example of a document window is shown in Figure 5–2.

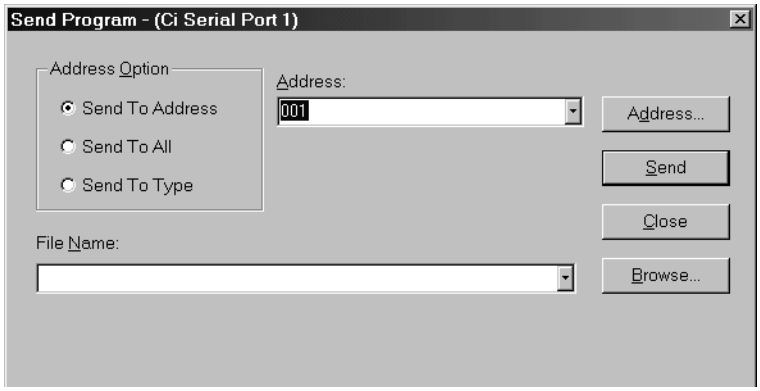
FIGURE 5–2. Example Document Window



2. Open the File menu and select Send Program. This displays the Send Program dialog box, as shown in Figure 5–3.

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FIGURE 5–3. Send Program Dialog Box



In the example in Figure 5–2, the Ci Serial document window was previously selected, which means that a program could be sent/downloaded across the Serial network.

This dialog box allows pre-compiled programs to be downloaded to MHI-2000s. Typically, program suffixes are .l2k for Starnode or TCP/IP, and .s2k files for Serial. Programs are used to customize the behavior of a MHI-2000, and may be written in C or T.A.L.L programming languages. These programs are then compiled and framed for download.

To populate the address list, you can either click Address to browse, or directly type the address value into the Address drop-down list.

The address value will depend on which address option has been selected. The options, as provided in the Address Option box, may be used to send the defined program as follows:

- Send to Address — Specifies one Station ID. When this option is selected, the download is sent directly to the one Station ID bypassing the controller.
- Send to All — Specifies all Station IDs.
- Send to Type — Specifies all Station IDs configured for a specific server type.

The following describes typical usage, depending on the connected server.

Starnode

1. Send programs by Starnode type.
2. The program will then be stored on the controller for both immediate download, as well as download when the MHI-2000 is next powered up.
3. Select Send to Address to download directly to the one Station ID bypassing the controller.

Note: When Send to All is selected, the program is broadcast to all MHI-2000s on the Starnode network.

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TCP/IP

1. Power up all MHI-2000s.
2. Select Send To Address.
3. Select the appropriate IP address from the Address drop-down list.
4. When the MHI-2000s have been configured with a Starnode Type, the TCP/IP server will determine which MHI-2000s have been configured with this Starnode Type and will download accordingly.

Note: Selecting Send To All will cause the download program to be read in record by record and to be sent to each currently connected IP address.

Serial

1. Select Send To Address.
2. Select the appropriate communications port from the Address drop-down list.

Note: Send To Type is not supported for the Serial Server. Selecting Send to All will cause the download program to be read in record by record and send each record to all configured serial ports.

3. Click Browse to display the Download Program dialog box. Use this to select the specific download program name and click Open to continue.
4. Click Send to download the program.
5. Click Close when you are finished downloading the required programs.

Downloading .l2k Files—Starnode Asynchronous Cntlr 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, invoke the program 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 .l2k files in RAM, it will

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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 MHI-2000.

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 (barcode 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:

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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. *SH3 C Programmer's Platform User Manual* for complete information on the use of these routines.

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CHAPTER 6 Diagnostics

This chapter describes the diagnostic programs that test the MHI-2000's inputs, outputs, memory, and the procedures that update the operating system and restore default parameter settings.

Introduction

The MHI-2000's Operating System (OS) contains a series of diagnostic programs that can test the inputs and outputs, tachometer calibration, and memory operation.

Initiating Diagnostics Tests from a Terminal

You can switch the MHI-2000 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 Starnode port. Refer to "Non-Intelligent ASCII Terminal" on page 4-4 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 4-7 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 MSG CHAR PREFIX

? — The command character

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

Send the command to the MHI-2000 by pressing Enter or CR.

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

You may want to program various function keys on the terminal to generate and download strings to the MHI-2000.

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For example, the string `~?S~`, when sent to the MHI-2000, 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 MHI-2000 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 QUALITY, you will see the last test name (SYSTEM STATS). If SYSTEM STATS is already displayed when you move forward, you see the first test name (READ QUALITY) 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, if 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 - 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. 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 6–1. The remainder of this chapter provides complete descriptions of the tests and procedures.

TABLE 6–1. Diagnostic Tests

Test Name	Display
Input/Output	IO PORTS
Tachometer Test	TACHOMETER TEST
Tachometer Calibration	TACHOMETER CAL.
Restore Settings	KEYSHEETS
Update Operating System	OS UPDATE

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TABLE 6–1. Diagnostic Tests (Continued)

Test Name	Display
Network Ping	NETWORK PING
Network Statistics	NETWORK STATS
Communication Ports Test	PORT TEST
Real Time Clock	REAL TIME CLOCK
Starnode Network Monitor	STARNODE MONITOR
System Statistics	SYSTEM STATS

The Diagnostics menu and all diagnostic outputs will only be sent to the Terminal and Setup 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 140-153, except that no prefix character will be sent and the suffix characters `CARRIAGE RETURN` and `LINE FEED` will be sent. Refer to parameters 147, 148, and 149 in Appendix E for more information.

Stopping Diagnostic Tests

Any test can be terminated at any time by pressing Enter.

Input/Output (IO PORTS) Test

The Inputs/Outputs test tests the eight control inputs and outputs.

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, followed by pressing A. 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.

Tachometer Test

If your installation includes a tachometer, this test is useful for troubleshooting and for verifying the accuracy of parameter 702 FIXED CONV SPEED.

Running the Test

1. Select and run the test. When this test is run, you will see a result similar to the following:

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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 FIXED CONV SPEED. The number of digits reported may vary among MHI-2000 types

pppp—The calculated conveyor speed in feet per minute

If parameter 702 FIXED CONV SPEED 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 FIXED CONV SPEED. 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 MHI-2000 is configured to read.
2. Ensure that the conveyor is running at normal speed and that the tachometer is functioning and connected correctly.
3. Ensure that the following parameters are set to appropriate values.
   a. Enter a preliminary value for parameter 702 FIXED CONV SPEED. A best guess or a value of 50 is appropriate.
   b. Set parameter 510 INZONE DEBOUNCE to the appropriate presence and tachometer input debouncing times.
   c. Enter accurate values for parameters 705 INZONE TO DATA and 706 OUTZONE TO DATA, the distances between the inzone and the outzone photoeyes and the centerline of the scan zone.
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 box to break 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 of boxes... 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 tach counts tttt m/s mmm mils/tic ppp ft/min ht zone: q

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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.

Example

Box2: 960 tach counts 1090m/s 37mils/tic 172 ft/min

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 FIXED CONV SPEED.

Keysheets

The Keysheets procedure allows you to save, delete, or load the customized Keysheet parameters that were saved in FLASH memory. Because you cannot overwrite the FLASH memory, these parameters provide a reliable backup of the original settings.

Running the Procedure

1. Select KEYSHEETS by entering <R> while KEYSHEETS is shown. The Keysheet File List will be displayed. To exit from keysheet diagnostics, enter <E>.

```
Keysheet File list
1: FACTORY DEFAULT KEYSHEET
2: KEY1
3: KEY2
4: <EMPTY>
5: <EMPTY>

Would you like to (S)ave/(D)elete/(L)oad or (E)xit? L
```

To load a currently stored keysheet, enter <L>. The following will be displayed:

```
Select job number (1-5) to Load from. Hit <Enter> to exit. X

KEYSHEET LOADED

Would you like to (S)ave/(D)elete/(L)oad or (E)xit? D
```

To delete or empty a saved keysheet from flash, enter D. The following will be displayed:

```
Select job number (1-5) to Load from. Hit <Enter> to exit. X

KEYSHEET DELETED

Would you like to (S)ave/(D)elete/(L)oad or (E)xit? S
```


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To save current working parameters to flash, enter S. The following will be displayed:

```
Select job number (1-5) to Load from. Hit <Enter> to exit. X

Please type a description or hit <enter> to use
the current description. You MUST enter a description
if none exists.
```

At this point, you should enter a keysheet name <KEY2>. The following will be displayed:

```
SAVING KEYSHEET.....KEYSHEET SAVED.
```

You must reboot the MHI-2000 for the restored parameters to take effect.

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. makes every effort to be backward compatible, and will try to warn you when new parameter values will need to be entered by hand.

Operating System Update

In order to update the Command Board OS, you may have to change some of your download parameters, depending on your specific system setup. When you access the test, the following should be displayed:

```
NOTE: Scanner Operation Will Stop For The Update Process
To Continue With Command OS Update, Type 'UPDATE'
To Change The Download Parameters, Type 'CHANGE'
To Display List Of Command OS Files On The FTP Server, Type '?'
To Display List Of All Files On The FTP Server, Type 'LIST'
```

To display a list of command OS Files located at the FTP Server address, type <?>.

```
xxxxxxxxx.os
yyyyyyyyy.os
```

To display a list of all files located at the FTP Server address, type LIST.

```
-rwxrwxrwx   1 noone    nogroup   497197 Sep 11 14:53 xxxxxxxxx.os
```

To display and/or change your current download parameters, type CHANGE.

```
Current Download Parameters:
1. FTP Server Address:x.x.x.x
2. Login Name:       xxxxxxxx
3. Password:         xxxxxxx
Enter Parameter number or <Enter> to Exit
```

If download parameters are set correctly, press <Enter> to exit. Type UPDATE to continue with OS Update. The following should be displayed:

```
MHI-2000 will reset after update.
Enter name of file to download or ? for OS file list
```


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Enter the correct file name for the command board operating system. If you enter an incorrect file name, an error will be reported and the MHI-2000 will reset. If file name is correct, the following should be displayed:

```
Getting File from FTP Server
Shutting down scanner operation...
Writing to Flash sector 7
Writing to Flash sector 8
Writing to Flash sector 9
Writing to Flash sector 10
Writing to Flash sector 11
Writing to Flash sector 12
Writing to Flash sector 13
Writing to Flash sector 14
OS update complete. xxxxxx bytes written.
```

After completion of the update, the MHI-2000 should reset.

Network Ping

Use this test to show other active network devices by referencing their IP address. This is similar to the DOS Ping command. When you run this test, the following will be displayed:

```
Enter IP Address To Ping
```

If you enter an active device, the following would be displayed:

```
PING x.x.x.x: 56 data bytes
64 bytes from 10.6.1.13: icmp_seq=0. time=0. ms
64 bytes from 10.6.1.13: icmp_seq=1. time=0. ms
64 bytes from 10.6.1.13: icmp_seq=2. time=0. ms
64 bytes from 10.6.1.13: icmp_seq=3. time=0. ms
64 bytes from 10.6.1.13: icmp_seq=4. time=0. ms
----x.x.x.x PING Statistics----
5 packets transmitted, 5 packets received, 0% packet loss
round-trip (ms) min/avg/max = 0/0/0
```

If you enter an inactive device, the following would be displayed:

```
PING x.x.x.x: 56 data bytes
no answer from x.x.x.x
```

Network Stats

Use this test to show a number of statistical reports about the Ethernet network and the individual adapters. When you run this test, the following will be displayed:

```
Networking Statistics - Select Number:

  1. Adapter Statistics
  2. ARP Table
  3. SICK Auto Ident Networked Devices
  4. Connections
  5. Host Table
  6. ICMP Statistics
```


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7. IP Statistics
8. MBuf Statistics
9. Routing Statistics
10. Routing Table
11. UDP Statistics
12. TCP Debug Socket Statistics
13. TCP Statistics

Individual Adapter Statistics

14. On-board Controller Bound Protocols
15. On-board Controller Low Level Statistics
16. On-board Controller MBuf Statistics
17. On-board Controller Packet Statistics
18. On-board Controller Register Values
19. Add-on Controller 1 Bound Protocols
20. Add-on Controller 1 Low Level Statistics
21. Add-on Controller 1 MBuf Statistics
22. Add-on Controller 1 Packet Statistics
23. Add-on Controller 1 Register Values

To display statistics of items listed above, type the report number, and specific information will be displayed.

Port Test

Use this test to test the communication ports of the MHI-2000. When you run this test, the following will be displayed:

```
Select Test Parameter To Change,
R To Run Test, Or Any Other Key To End Diagnostic.

1. Include Message Count = YES
2. Number Test Messages = CONTINUOUS
3. Test Message = Test
4. Test Port(s) = Host Port
```

Selecting 1 will toggle the Include Message Count YES/NO. Selecting Yes will append a test number after the test message.

Selecting 2 will allow you to select the number of test messages you wish to send. 1-998 are numeric specific. 999 will continuously send messages. 0 will set you in interactive mode where what you send will be re-transmitted out the port or ports selected as test port. When you select 2, the following will be displayed:

```
Enter Number Of Messages (1- 998), 0 For Interactive Output,
or 999 For Continuous Output:
```

Selecting 3 will allow you to enter your own test message. The following will be displayed:

```
Enter Test Message:
```

Selecting 4 will allow you to select the port you wish to send the test message. The following will be displayed:

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```
Select Port(s) To Test:
1.  D Port (I/O Box)
2.  Host Port
3.  Net Port 1
4.  Net Port 2
5.  Net Port 3
6.  Setup Port
7.  Starnode Port
8.  Telnet Port
9.  Terminal Port
10. All Net Ports
11. All Ports
```

Once you have defined selections 1-4, pressing R will begin the ports test. To stop the test, press any key.

Real Time Clock

Use this test to display and set the MHI-2000's internal Real time clock. When you run this test, the following will be displayed:

```
Select Command:
1. Display Time
2. Change Time
```

Selecting 1 will display current time and date. Selecting 2 will set the time and date, as shown below.

```
Enter Time/Date In The Format hh:mm:ss mm/dd/yy
```

Starnode Monitor

Use this test to show Starnode Network traffic and messages. You may use various filters to obtain required results. This test will not display this individual MHI-2000's messages. Each can be terminated by pressing any key. When you run this test, the following will be displayed:

```
Warning - This Device Will Be Offline While Running The Monitor

Select Monitor Filter Mode:
1. All Messages (ASCII Data Format)
2. All Messages Except Date/Time (ASCII Data Format)
3. All Messages Except Date/Time (Hex Data Format)
4. Raw Data (Non-Message Hex Format)
```

Filter setting 1 will assign a message number, show the type, source, destination, length, message status, and the message, as shown below. In this example, you see the master Starnode controller broadcasting to all devices the time and date message.

```
Press Any Key To End Monitoring ...

MSG#    TYPE   SRC  DEST LEN STATE DATA
000000> DATTIM MAST ALL  007   OK      02/27/01 13:45:29
000001> DATTIM MAST ALL  007   OK      02/27/01 13:45:30
000002> DATTIM MAST ALL  007   OK      02/27/01 13:45:30
```


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Filter setting 2 will assign a message number, show the type, source, destination, length, message status, and the ASCII message as shown below. In this example, you see the master Starnode controller broadcasting a send status string message.

```
MSG#    TYPE   SRC  DEST LEN STATE DATA
000000> BRDCST MAST ALL  001 OK    5
```

Filter setting 3 will assign a message number, show the type, source, destination, length, message status, and the hex message, as shown below. In this example, you see the master Starnode controller broadcasting a send status string message.

```
MSG#    TYPE   SRC  DEST LEN STATE DATA
000000> BRDCST MAST ALL  001 OK    35
```

Filter setting 4 will assign a byte number, show the hex data, and ASCII data of all Starnode traffic. This test accumulates a large amount of data. An abbreviated portion showing broadcasted date and time message is displayed:

```
BYTE#  HEX DATA                                  ASCII DATA
.
.
00480> 04 .. 05 .. 06 .. 07 .. 04 .. 05 .. 06 .. 07 ..    ................
00490> 04 .. 05 .. 06 .. 07 .. 04 .. 05 .. 06 .. 07 ..    ................
004a0> 04 .. 05 .. 06 .. 07 .. 0c 16 60 0b 37 19 53 ..    .........`.7.S.
004b0> 04 .. 05 .. 06 .. 07 .. 04 .. 05 .. 06 .. 07 ..    ................
.
.
```

System Stats

Use this test to show a number of specific areas of the MHI-2000 operation. It will display statistics of the following tests. To run a specific test, enter the test number. When you run the test, the following will be displayed:

```
System Information, Statistics, Debug Configuration - Select Number:
1.  Debug Data Setup
2.  D Port Statistics
3.  Exception Log
4.  Exception Log Reset
5.  Fault Conditions (DIAGS LED)
6.  Focusing Statistics
7.  FPGA Load Log
8.  Host Port Statistics
9.  Memory Usage
10. MPB Statistics
11. PC Tunnel Statistics
12. Read Statistics
13. Starnode Statistics
14. System Devices
15. System Drivers
16. System Files
17. Task CPU Utilization
18. Task Error Number List
19. Task Error Number Reset
```


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20. Task Information Details
21. Task Information Summary
22. Terminal Port Statistics

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APPENDIX A Group Setup Strings

This appendix defines the group setup strings that are used to set up the MHI-2000 from a host computer. Each string is diagrammed to identify the parameters in the string by their positions.

Group Setup String Definitions

TABLE A–1. Group Setup String Definitions

Region X	Group Y	Parameter	Parameters in Setup String
0	0	MHI-2000 OPERATION	002 - 007
0	1	MHI-2000 OUTPUT	011 - 013
0	2	MULTIREADS	027
1	0	HOST SERIAL PORT	100 - 113
1	2	TERM SERIAL PORT	120 - 133
1	4	SETUP SERIAL PORT	140 - 150
1	6	D-PORT SERIAL PORT	160 - 173
2	0	DECODE BIN 1	200 - 204
2	2	DECODE BIN 2	210 - 214
2	4	DECODE BIN 3	220 - 224
2	6	DECODE BIN 4	230 - 234
2	8	DECODE BIN 5	240 - 244
3	0	DECODE BIN 6	250 - 254
3	2	DECODE BIN 7	260 - 264
3	4	DECODE BIN 8	270 - 274
4	0	LAN PORT COMMS and MSGS	401 - 404
5	1	PRESENCE INPUTS, RELAY TYPES	501 - 524
5	5	RELAY HOLD TIMES	553 - 560

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TABLE A–1. Group Setup String Definitions (Continued)

Region X	Group Y	Parameter	Parameters in Setup String
6	0	USER PROGRAM	600 - 602
6	1	USER VARIABLES	610 - 625
6	3	USER STRINGS 1 - 5	630 - 634
6	4	USER STRINGS 6 - 10	635 - 639
6	5	ETHERNET CARD 1	640 - 647
6	6	ETHERNET CARD 2	650 - 657
6	7	FTP/NETWORK OPTIONS	660 - 668
6	8	TCP/IP PORT 1 PORT 2	670 - 687
6	9	TCP/IP PORT 3	690 - 697
7	0	TRACKING	700 - 706

The region and group number make up the two digit number used in the upload and download commands. 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 you want to download a group of parameters for review, use the command %9XY, 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 you want to upload many parameters at once to set or modify their values, as when loading values according to a Keysheet, use the command %8XY, where:

8 = set parameters

X = 0 through 8 for the general region

Y = 0 through 9 for the particular string.

When you want to set an individual parameter, use the command %PPPVVV, where:

PPP = the three-digit parameter number
VVV = the parameter value

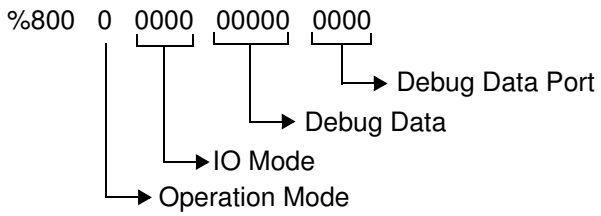
Group Setup Parameter String Formats

The default values for parameters are shown in these strings. Your application may require other parameter values.

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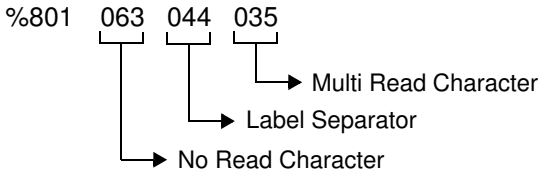
MHI-2000 Operation

Parameters 002-007 (%800)



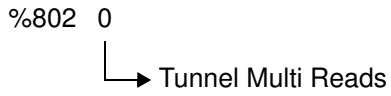
MHI-2000 Output

Parameters 011-013 (%801)



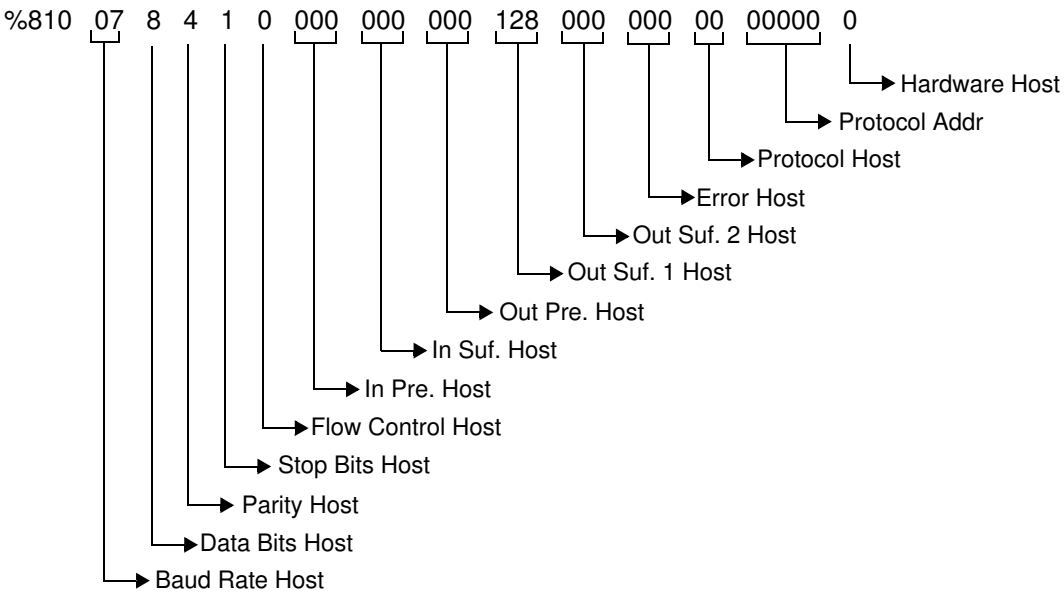
Multireads

Parameters 027 (%802)



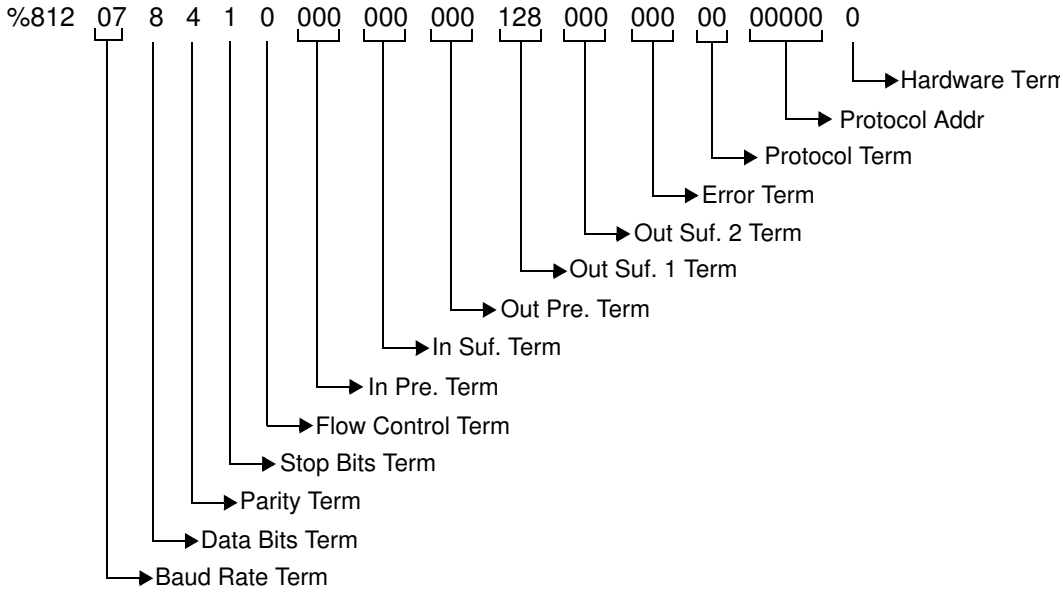
Host, Terminal, Setup, D-Port Serial Communications

Parameters 100-113 (%810)

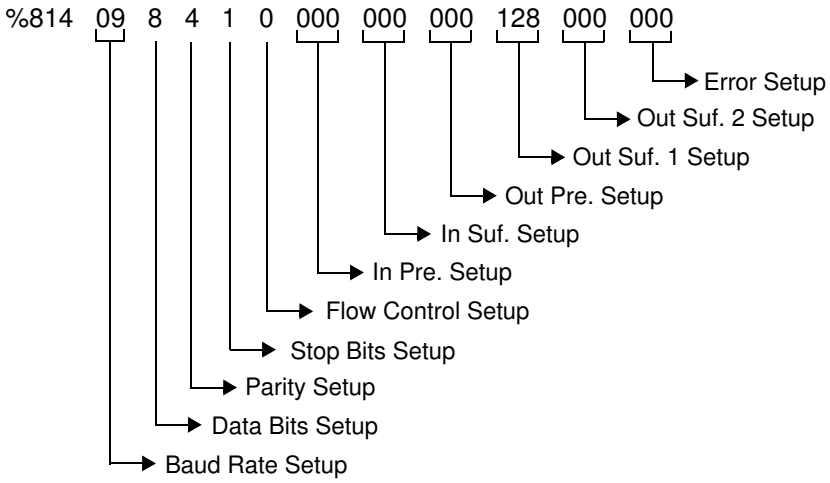


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Parameters 120-133 (%812)

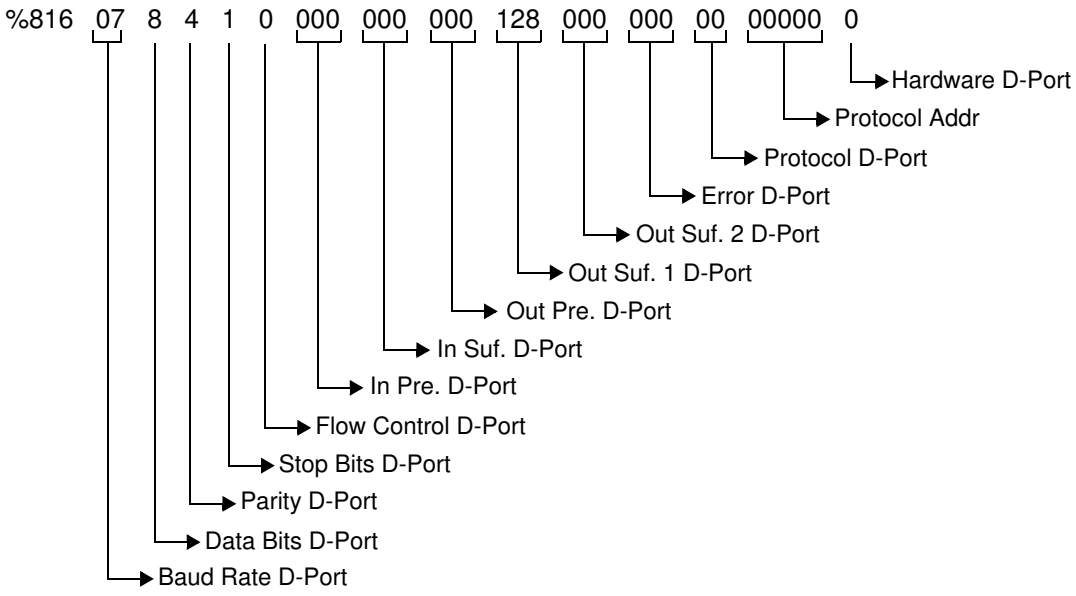


Parameters 140-150 (%814)



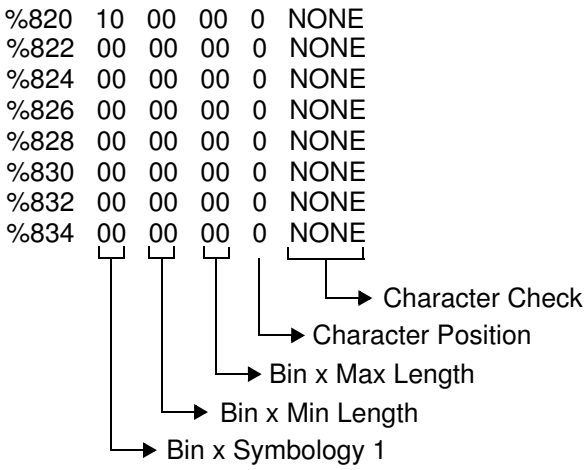
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Parameters 160-173 (%816)



Decode Bins

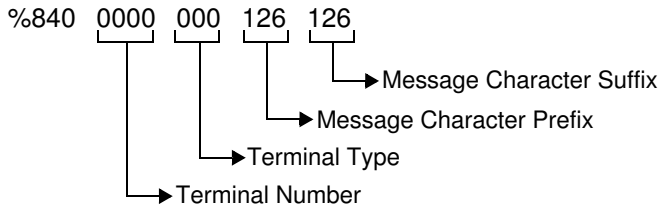
Parameters 200-204 (%820)
Parameters 210-214 (%821)
Parameters 220-224 (%822)
Parameters 230-234 (%823)
Parameters 240-244 (%824)
Parameters 250-254 (%825)
Parameters 260-264 (%826)
Parameters 270-274 (%827)



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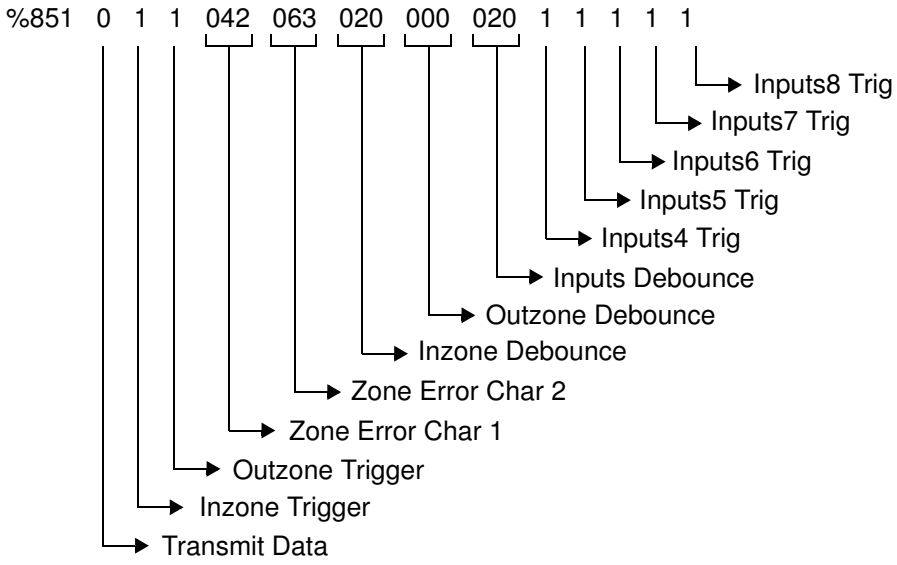
Lan Port Comms and Messages

Parameters 401-404 (%840)



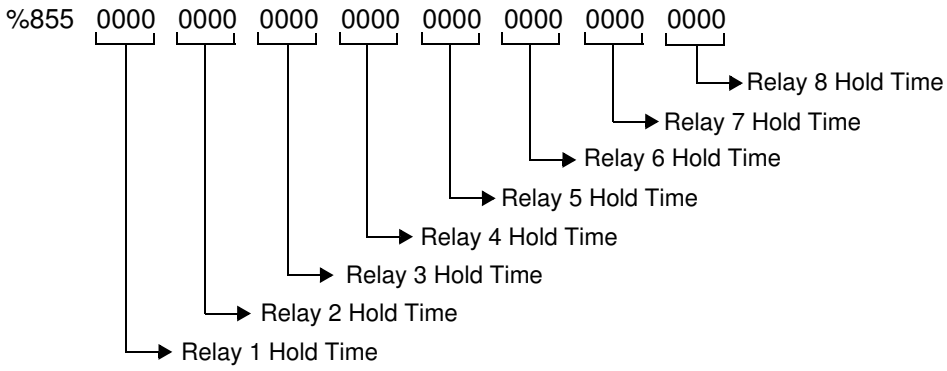
Presence Inputs & Relay Types

Parameters 501-524 (%851)



Relay Hold Times

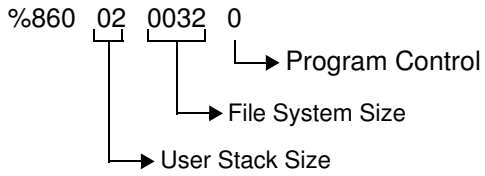
Parameters 553-560 (%855)



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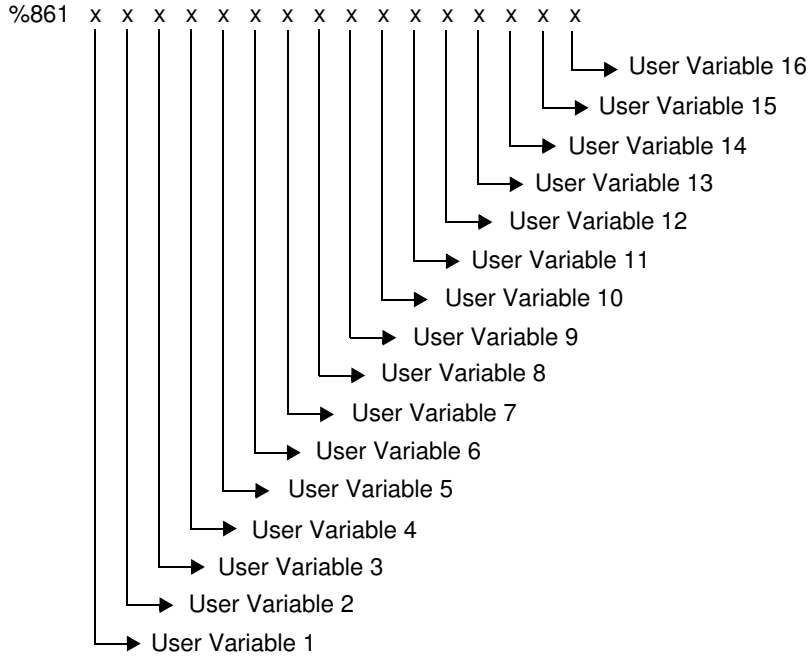
User Program

Parameters 600-602 (%860)



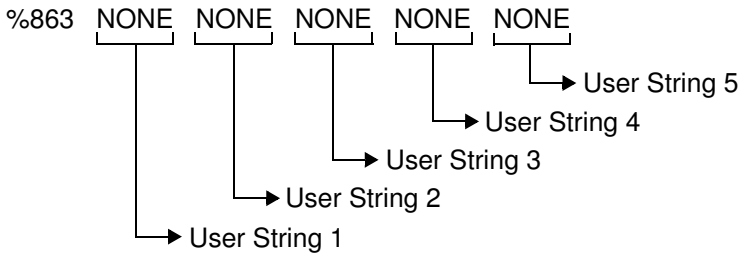
User Variables

Parameters 610-625 (%861)



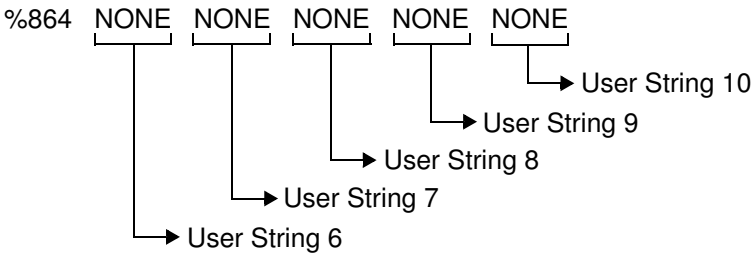
User Strings

Parameters 630-634 (%863)



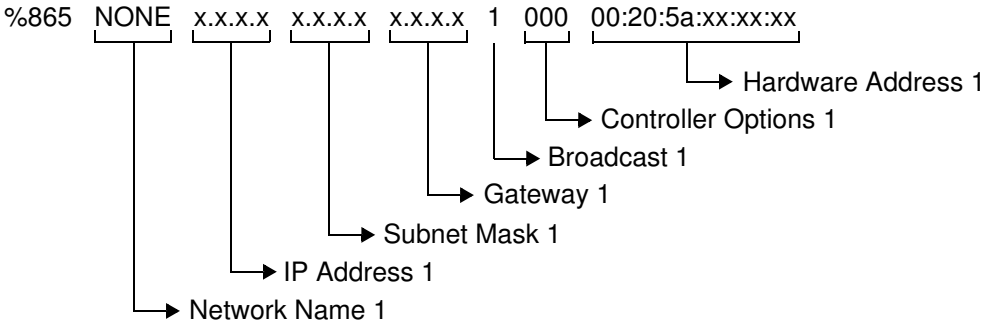
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Parameters 635-639 (%864)

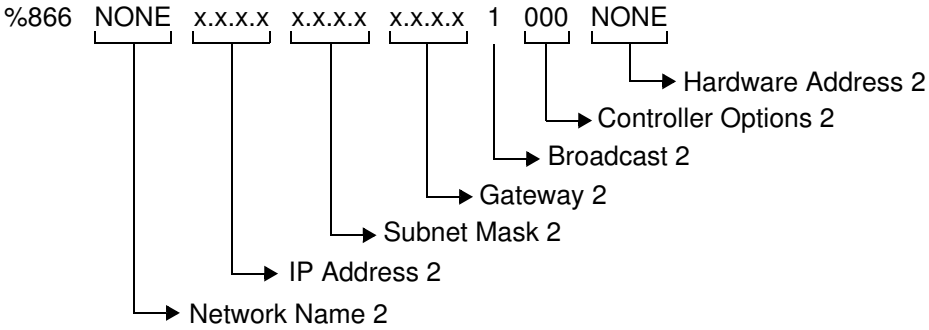


Ethernet Card Parameters

Parameters 640-647 (%865)



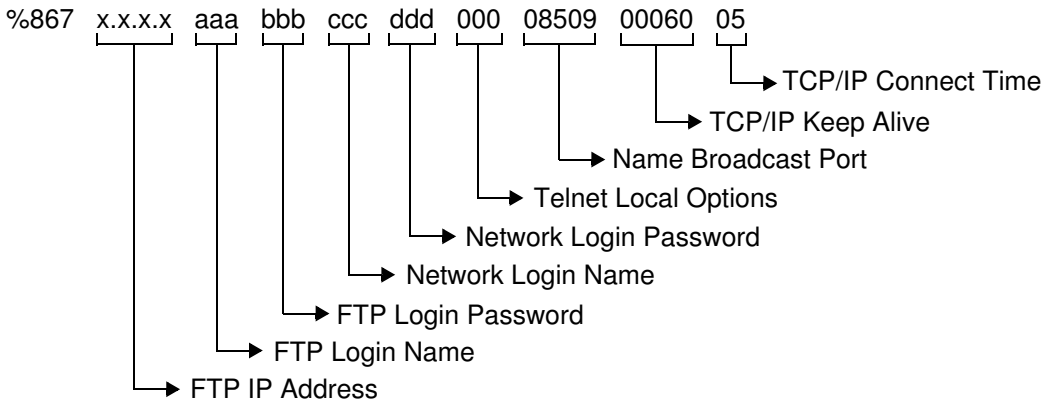
Parameters 650-657 (%866)



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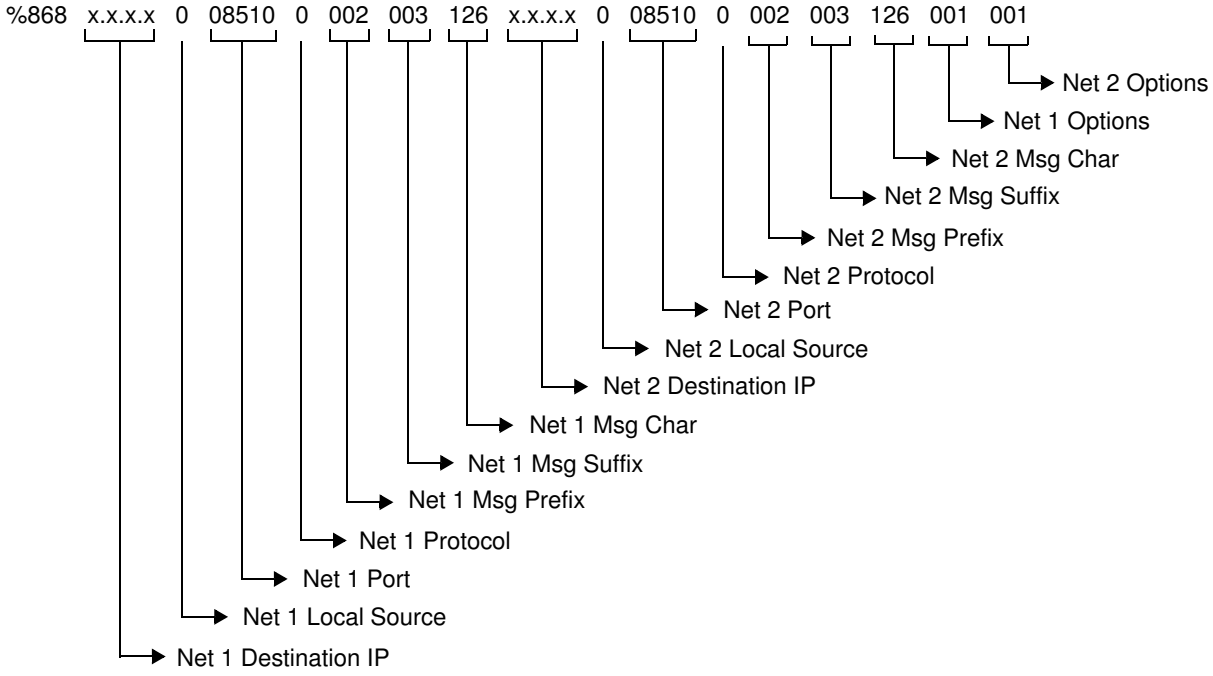
FTP/Network Options

Parameters 660-668 (%867)



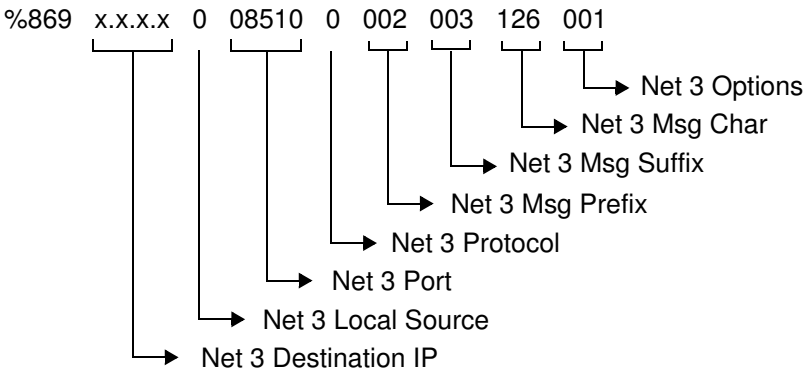
TCP/IP Ports

Parameters 670-687 (%868)



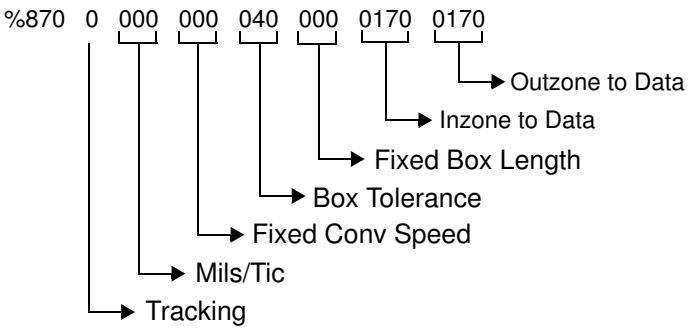
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Parameters 690-697 (%869)



Tracking

Parameter 700-706 (%870)



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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

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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	

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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	

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TABLE B–1. ASCII Equivalence Table (Continued)

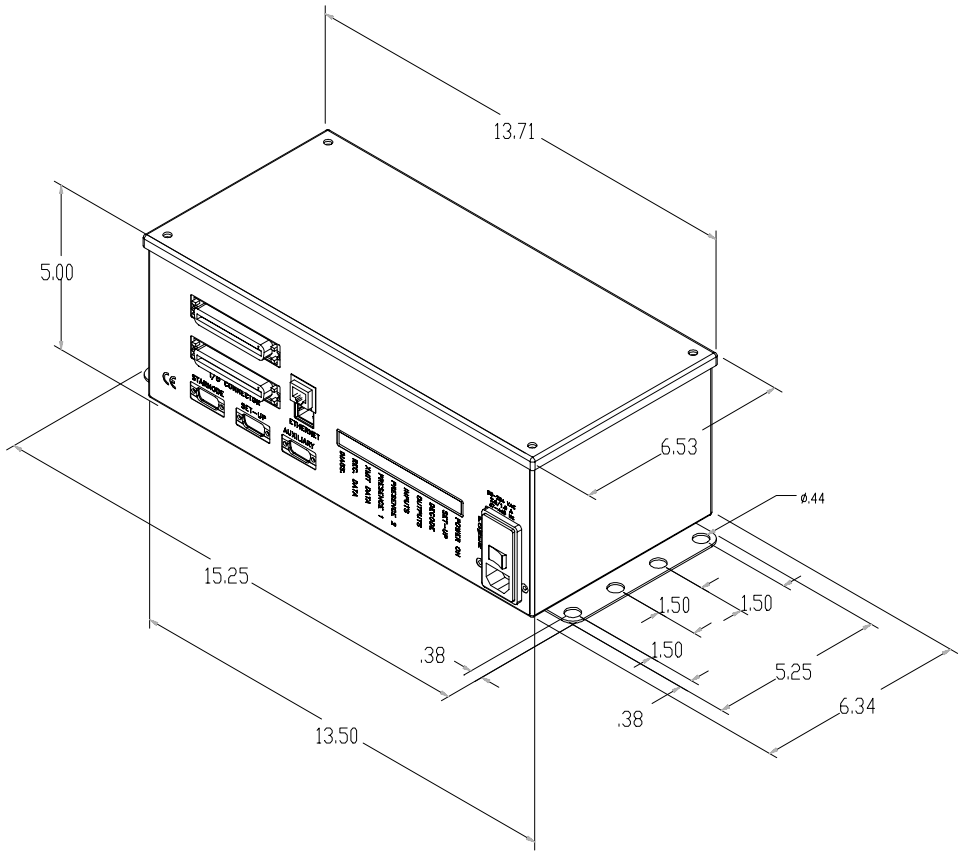
ASCII Character	Decimal	Hex	Keyboard
d	100	64	
e	101	65	
f	102	66	
g	104	67	
h	104	68	
i	105	69	
j	106	6A	
k	107	6B	
l	108	6C	
m	109	6D	
n	110	6E	
o	111	6F	
p	112	70	
q	113	71	
r	114	72	
s	115	73	
t	116	74	
u	117	75	
v	118	76	
w	119	77	
x	120	78	
y	121	79	
z	122	7A	
{	123	7B	
| (VERTICAL BAR)	124	7C	
}	125	7D	
~ (TILDE)	126	7E	
DEL (DELETE)	127	7F	

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APPENDIX C *Dimension Diagrams*

MHI-2000

FIGURE C–1. MHI-2000 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.

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The retro-reflective target is a polarized sensor. The photoeye will not receive a false signal from an object or background that 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–2. End Views of Photoeye

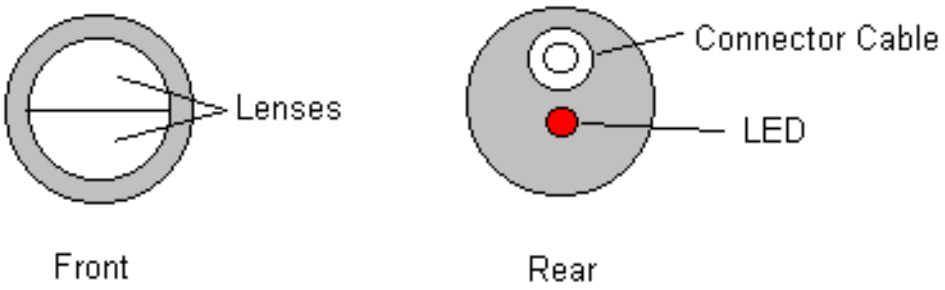
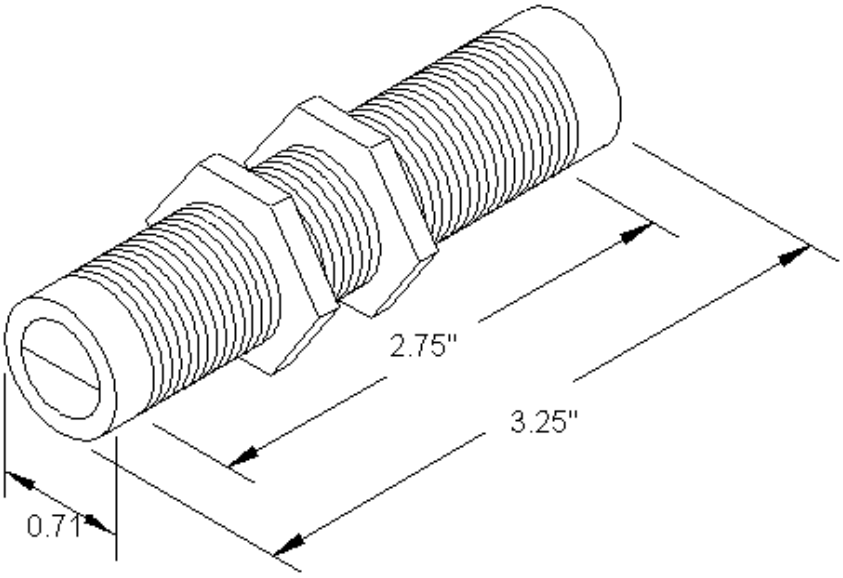


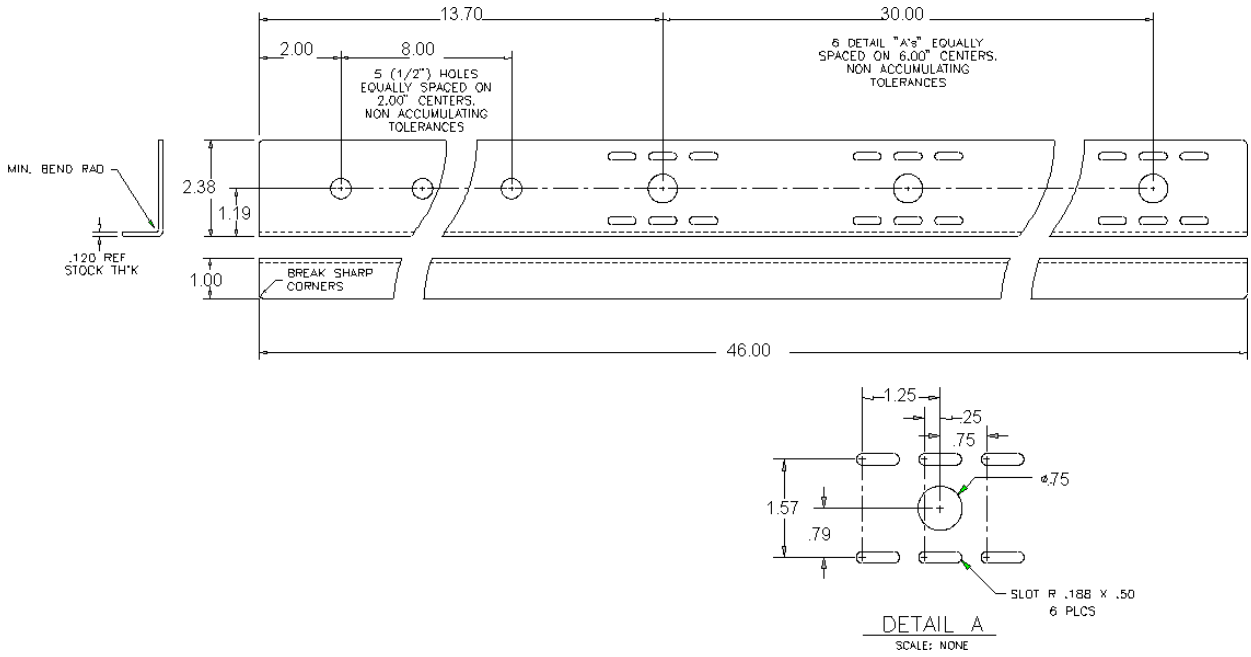
FIGURE C–3. Photoeye Dimensions



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Photoeye Tree Bracket

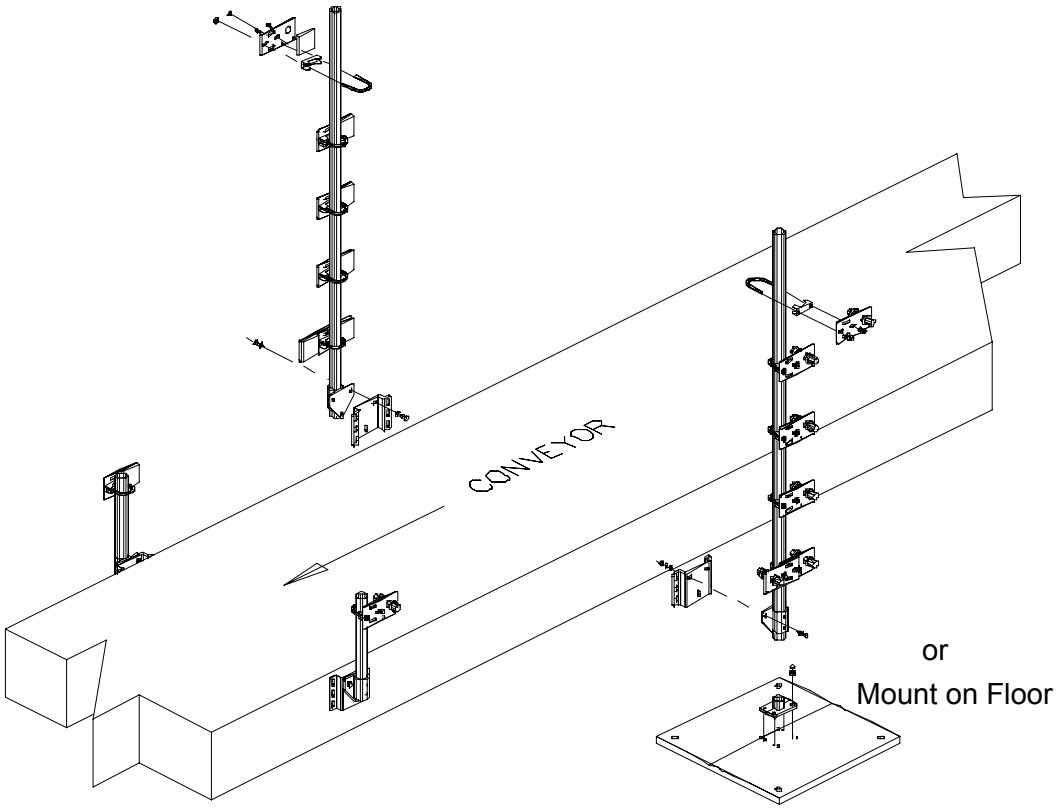
FIGURE C–4. Photoeye Tree Bracket & Dimensions

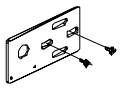


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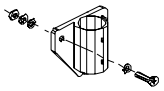
Photoeye Tree Hardware

FIGURE C–5. Photoeye Tree Hardware and Part Numbers





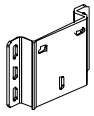
A1-62887
Photoeye Bracket
with 8-32 Hardware



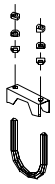
A1-62876
Pipe Flange Assembly
with 1/4-2D Hardware



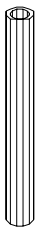
922-0014-1
Pipe Fitting



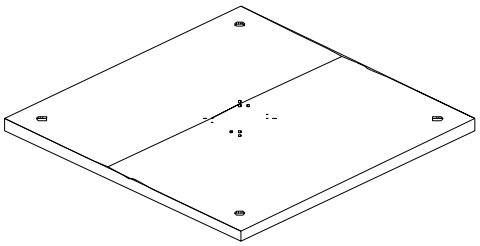
A4-62874
Pipe Flange
Mounting Bracket



A1-62886
U-Bolt Assembly



A4-62059-1 (short)
A4-62059-4 (long)
Mounting Pipe



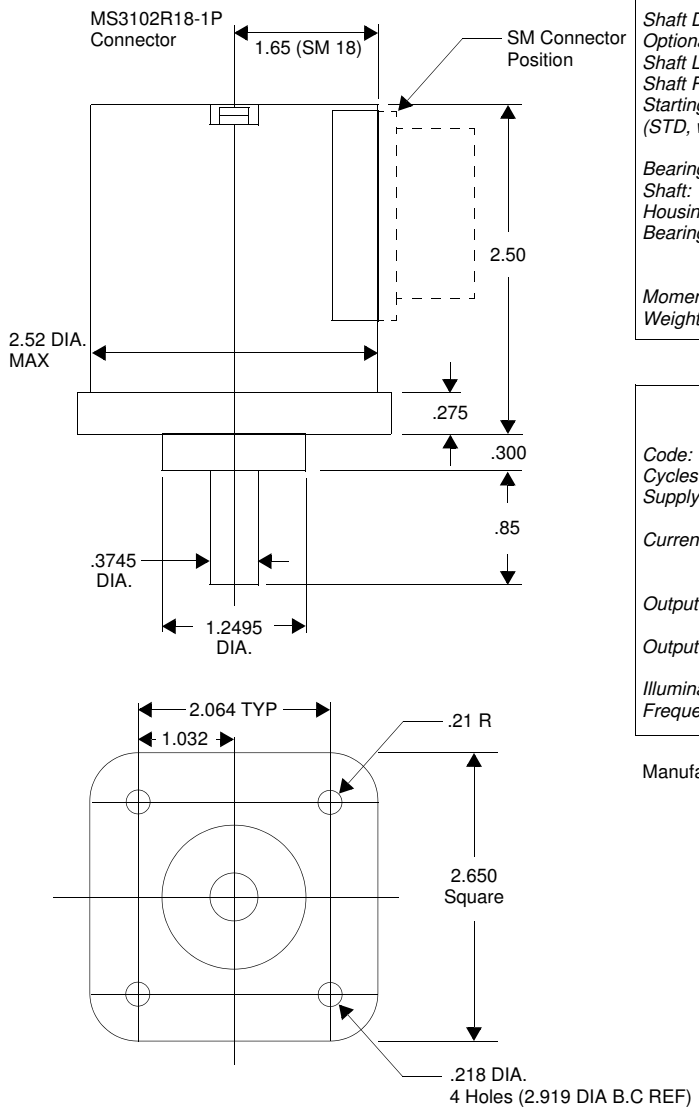
A4-60888
Floor Plate

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Tachometer Assembly

FIGURE C–6. Tachometer Assembly & Dimensions

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 Responce:	100kHz

Manufacturer: BEI

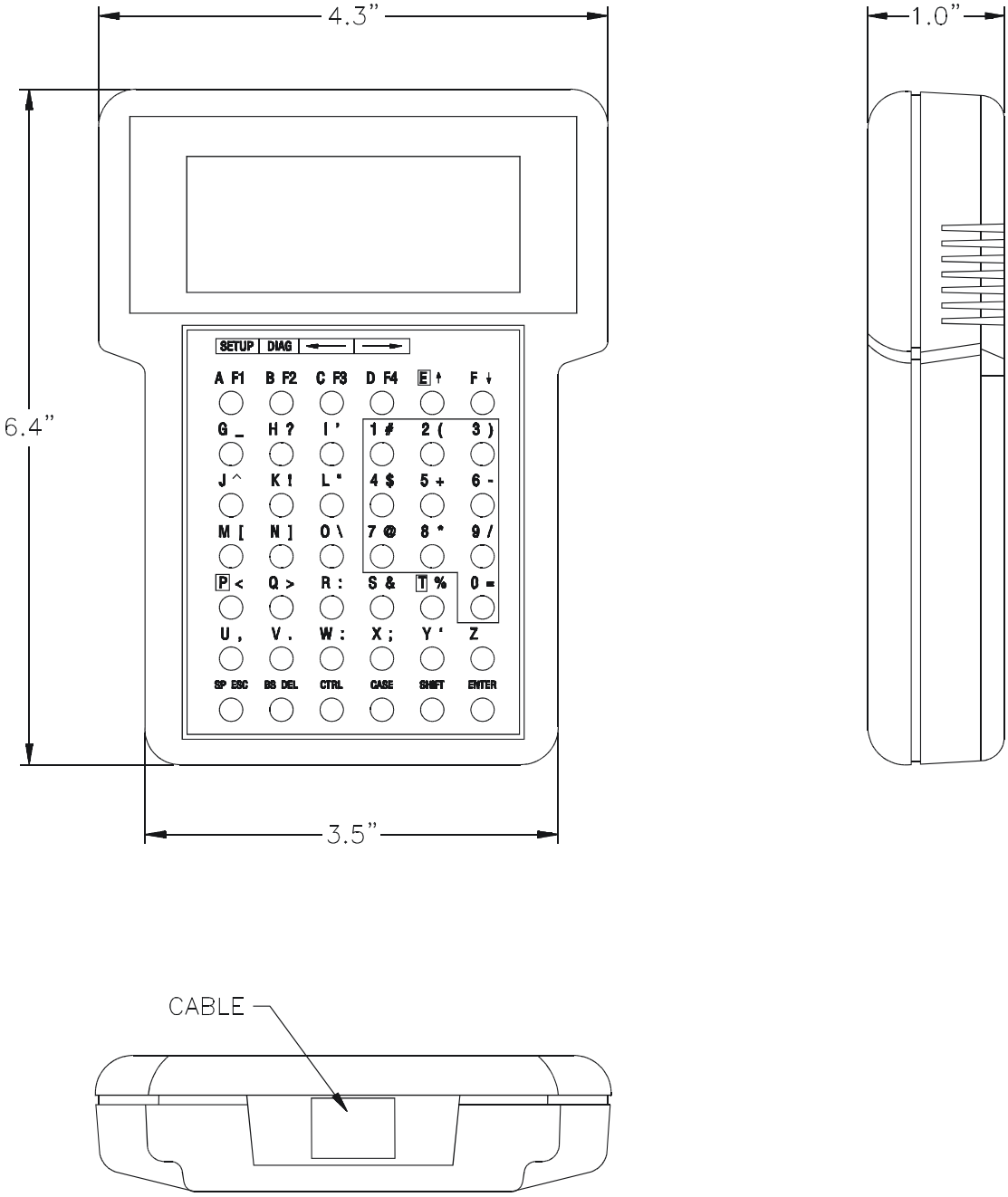
MODEL NUMBER:

H25D-(blank)-(blank)-300-ABZ C-7406R-LED-S-M18

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CiMAX 1400 Hand-Held Terminal

FIGURE C–7. CiMAX Hand-Held Terminal



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D

APPENDIX D Modem Installation

Introduction

For diagnostic and troubleshooting help, you can connect your scanner to a modem through the Setup port. This modem connection allows remote site analysis via telephone lines. Also, you can use the modem to transmit the scanner data output directly to customer support personnel at SICK Auto Ident, Inc.

Parts List

Verify the contents of your modem with the parts list in Table D–1.

TABLE D–1. Modem Parts List

Quantity	Description	Part Number
1	56k Data/Fax Modem	Part # 971-0165-1
1	Scanner - Modem Interface Cable (9 to 25 pin)	Part # A1-62785-4
2	Locking fastener pad (Velcro Tape) for vertical mounting	Part # A4-66312-2

Site Preparation

SICK Auto Ident, Inc. requests the customer to provide the following:

1. Provide and set up a dedicated analog (conventional) telephone line.
2. Provide a standard 120 VAC outlet.
3. Provide a location to mount the modem within 25 feet of the scanner.
4. Mount the modem in an easily accessible location to provide access for troubleshooting.

Locating & Mounting Modem

You must locate the modem within five feet of a 120VAC power outlet and an appropriate telephone wall outlet, and within 25 feet of the scanner.

The modem is designed for horizontal mounting. If you need to mount the modem vertically, a Locking Fastener Pad (Velcro tape) is provided.

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Installation

The SETUP Port on the scanner, the SICK Auto Ident, Inc.-supplied cable, and the serial port on the modem must use the same three communication lines: transmit, receive, and ground. Refer to Figure D–1 and Figure D–2.

FIGURE D–1. Cabling Diagram

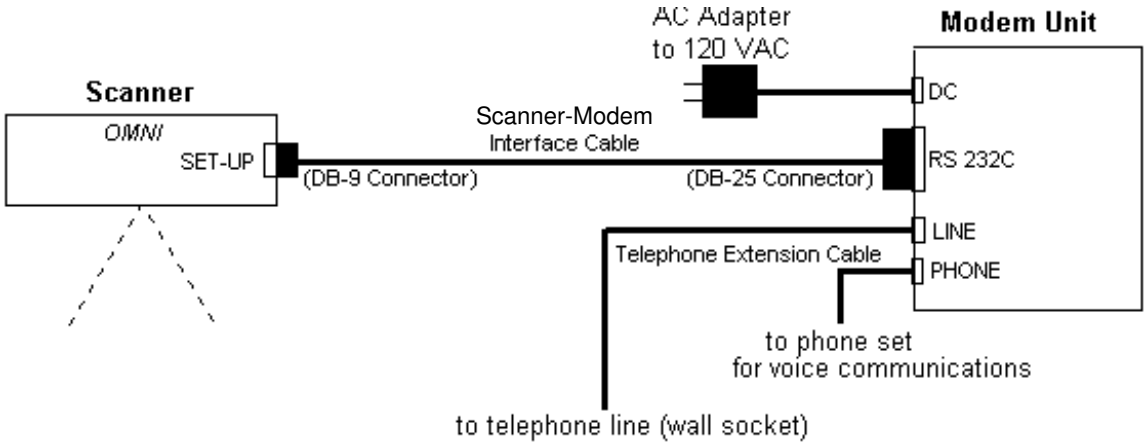
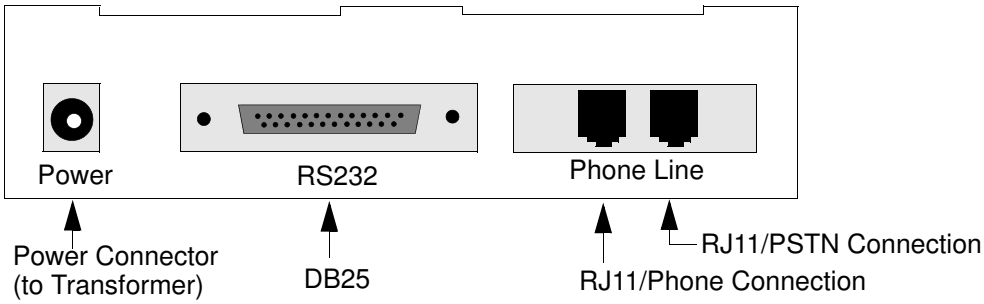


FIGURE D–2. Modem Unit Connections



1. Ensure that all power is *Off* to the scanner and modem.
2. Connect all cabling as shown in Figure D–1, Figure D–2, and as follows:
   a. Connect the *DB-25 Connector* of the Scanner-Modem Interface Cable to the Modem Unit connector, *RS-232C*. Connect the *DB-9Connector* to the Setup Port on the scanner.
   b. Connect the wire from the AC Adapter to *DC* connector on the Modem Unit.
   c. Plug the AC adapter/power supply into a 120 VAC wall outlet.

      Note: The primary AC power for the modem and scanner must not be on the same circuit as heavy transient loads, such as motors or heavy machinery.

   d. Connect one end of the Telephone Extension Cable to *LINE* on the Modem Unit.

      WARNING! DO NOT CONNECT THE TELEPHONE LINE FROM THE WALL SOCKET TO THE MODEM CONNECTOR MARKED PHONE. THIS CAN PERMANENTLY DAMAGE THE MODEM.

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e. Connect the other end of the Telephone Extension Cable to your wall phone outlet.

f. Connect the cable from your phone set to *PHONE* on the Modem Unit.

3. Power *On* the scanner and modem individually.

Modem Operation

The Modem Units front panel LEDs indicate readiness for communication and data flow. The fourth LED (56) from the left should remain *On* after power-up.

Final Testing

Final testing of the modem installation is to be performed by SICK Auto Ident, Inc. Technical Support personnel. Contact SICK Auto Ident, Inc. Technical Support.

Note: Please have the following information before calling SICK Auto Ident, Inc. Customer Support.

- Your company's name and address.
- A contact name and phone number.
- The scanner's serial number (located on the connector panel).
- The scanner modem phone number.

Configuring Modem

The Modem Unit is configured at the factory for your application. To reconfigure the modem, ensure you have a 9 or 25 pin serial RS-232 shielded modem cable. The baud rate of the PC should be 38.4k baud.

Note: This cable is NOT supplied by SICK Auto Ident, Inc.

To reset the configuration, follow the procedure below:

1. Apply power to the Modem.
2. Type *ATZ* and press Enter to check communication between the modem and scanner.
3. Type *AT&F0* and press Enter to restore the modem's factory defaults.
4. Type *AT&K*4 and press Enter to enable *XON/XOFF* flow control.

   Note: It is not possible to send commands to the scanner through the modem without performing Step 4. The scanner does not set the appropriate control signals.

5. Type *AT&D3* and press Enter to enable DTR.
6. Type *AT$SB38400* and press Enter to change the baud rate of the RS-232 port to 38.4k baud.

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7. Type *ATS0=1* and press Enter to set the modem to auto answer after 1 ring.
8. Type *AT&W0* and press Enter to save the current configuration in memory (non-volatile RAM). This configuration will be used on subsequent power-ups.
9. Cycle power to the modem *Off* and *On*. LED (56) should remain *On*.

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E

APPENDIX E *Parameters*

The MHI-2000 reads stored parameter values from its internal memory in order to determine how it should operate. These values define most aspects of MHI-2000 operation, from the range of barcode symbologies that will be decoded, to what parity and checking schemes will be used to verify the integrity of received data.

Parameters are combined into group setup strings, defined in Appendix A, “Group Setup Strings,” such that they can be conveniently uploaded and downloaded to and from the MHI-2000, using the Starnode, Host or Terminal ports.

Parameter Regions

Parameters are organized into logical groups of closely related functions, called regions, as follows:

002 - 027 — Operation Group

100 - 113 — Host Port Group

120 - 133 — Terminal Port Group

140 - 150 — Setup Port Group

160 - 173 — Port D Group

200 - 204 — BIN 1 Decoding Group

210 - 214 — BIN 2 Decoding Group

220 - 224 — BIN 3 Decoding Group

230 - 234 — BIN 4 Decoding Group

240 - 244 — BIN 5 Decoding Group

250 - 254 — BIN 6 Decoding Group

260 - 264 — BIN 7 Decoding Group

270 - 274 — BIN 8 Decoding Group

400 - 404 — Starnode Setup Group

501 - 524 — Inputs/Outputs Group

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553 - 560 — Relay Hold Time Group

600 - 602 — User Program Group

610 - 625 — User Variable Group

630 - 639 — User String Groups

640 - 647 — Ethernet Card 1 Group

650 - 657 — Ethernet Card 2 Group

660 - 668 — TCP/Networking Group

670 - 687 — TCP/Network 1 and TCP/Network 2 Group

690 - 697 — TCP/Network 3 Group

700 - 706 — Tracking

Quick Reference List of Parameters by Region

002-027—Operation Parameters

TABLE E–1. Operations Parameters

Param	Function	Valid Values	Default Value
002	OPERATION MODE	0 - 4	0
003	IO MODE	0 - 4095	0000
006	DEBUG DATA	0 - 32767	00000
007	DEBUG DATA PORT	0 - 4095	0000
011	NO READ CHAR	001 - 122	063 (?)
012	LABEL SEPARATOR	001 - 122	044 (,)
013	MULTI READ CHAR	001 - 122	035 (#)
027	TUNNEL MULTI READS	0 or 1	0

100-173—1xx Serial Communication Parameters

TABLE E–2. 1xx Serial Communication Parameters

Param	Function	Valid Values	Default Value
100	BAUD RATE HOST	0 - 11	07 (9600 bps)
101	DATA BITS HOST	7 or 8	8
102	PARITY HOST	2 - 4	4
103	STOP BITS HOST	1 or 2	1
104	FLOW CONTROL HOST	0 - 3	0
105	IN PRE. HOST	000 - 255	000

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TABLE E–2. 1xx Serial Communication Parameters (Continued)

106	IN SUF. HOST	000 - 255	000
107	OUT PRE. HOST	000 - 255	000
108	OUT SUF. 1 HOST	000 - 255	128 (CR-LF)
109	OUT SUF. 2 HOST	000 - 255	000
110	ERROR HOST	000 - 255	000
111	PROTOCOL HOST	0 - 10	00
112	PROTOCOL ADDR HOST	0 - 65536	00000
113	HARDWARE OPTS HOST	0 or 1	0
120	BAUD RATE TERM	0 - 11	07 (9600 bps)
121	DATA BITS TERM	7 or 8	8
122	PARITY TERM	2 - 4	4
123	STOP BITS TERM	1 or 2	1
124	FLOW CONTROL TERM	0 - 3	0
125	IN PRE. TERM	000 - 255	000
126	IN SUF. TERM	000 - 255	000
127	OUT PRE. TERM	000 - 255	000
128	OUT SUF. 1 TERM	000 - 255	128 (CR-LF)
129	OUT SUF. 2 TERM	000 - 255	000
130	ERROR TERM	000 - 255	000
131	PROTOCOL TERM	0 - 10	00
132	PROTOCOL ADDR TERM	0 - 65536	00000
133	HARDWARE OPTS TERM	0	0
140	BAUD RATE SETUP	0 - 11	09
141	DATA BITS SETUP	7 or 8	8
142	PARITY SETUP	2 - 4	4
143	STOP BITS SETUP	1 or 2	1
144	FLOW CONTROL SETUP	0 - 3	0
145	IN PRE. SETUP	000 - 255	000
146	IN SUF. SETUP	000 - 255	000
147	OUT PRE. SETUP	000 - 255	000
148	OUT SUF. 1 SETUP	000 - 255	128 (CR-LF)
149	OUT SUF. 2 SETUP	000 - 255	000
150	ERROR SETUP	000 - 255	000
160	BAUD RATE D-PORT	0 - 11	07
161	DATA BITS D-PORT	7 or 8	8
162	PARITY D-PORT	2 - 4	4
163	STOP BITS D-PORT	1 or 2	1
164	FLOW CONTROL D-PORT	0 - 3	0
165	IN PRE. D-PORT	000 - 255	000
166	IN SUF. D-PORT	000 - 255	000

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TABLE E–2. 1xx Serial Communication Parameters (Continued)

167	OUT PRE. D-PORT	000 - 255	000
168	OUT SUF. 1 D-PORT	000 - 255	128 (CR-LF)
169	OUT SUF. 2 D-PORT	000 - 255	000
170	ERROR D-PORT	000 - 255	000
171	PROTOCOL DPORT	0 - 10	00
172	PROTOCOL ADDR DPORT	0 - 65536	00000
173	HARDWARE OPTS DPORT	0	0

200-273—BIN x Decoding Group Parameters

TABLE E–3. BIN x Decoding Group Parameters

Param	Function	Valid Values	Default Value
200	BIN 1 SYMBOLOGY	00, 10, 20 or 50	10
201	BIN 1 MIN LENGTH	0 - 64	00
202	BIN 1 MAX LENGTH	0 - 64	00
203	BIN 1 CHAR POS	0 or 1	0
204	BIN 1 CHAR CHECK	ASCII string	NONE
210	BIN 2 SYMBOLOGY	00, 10, 20 or 50	00
211	BIN 2 MIN LENGTH	0 - 64	00
212	BIN 2 MAX LENGTH	0 - 64	00
213	BIN 2 CHAR POS	0 or 1	0
214	BIN 2 CHAR CHECK	ASCII string	NONE
220	BIN 3 SYMBOLOGY	00, 10, 20 or 50	00
221	BIN 3 MIN LENGTH	0 - 64	00
222	BIN 3 MAX LENGTH	0 - 64	00
223	BIN 3 CHAR POS	0 or 1	0
224	BIN 3 CHAR CHECK	ASCII string	NONE
230	BIN 4 SYMBOLOGY	00, 10, 20 or 50	00
231	BIN 4 MIN LENGTH	0 - 64	00
232	BIN 4 MAX LENGTH	0 - 64	00
233	BIN 4 CHAR POS	0 or 1	0
234	BIN 4 CHAR CHECK	ASCII string	NONE
240	BIN 5 SYMBOLOGY	00, 10, 20 or 50	00
241	BIN 5 MIN LENGTH	0 - 64	00
242	BIN 5 MAX LENGTH	0 - 64	00
243	BIN 5 CHAR POS	0 or 1	0
244	BIN 5 CHAR CHECK	ASCII string	NONE
250	BIN 6 SYMBOLOGY	00, 10, 20 or 50	00
251	BIN 6 MIN LENGTH	0 - 64	00

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TABLE E–3. BIN x Decoding Group Parameters (Continued)

252	BIN 6 MAX LENGTH	0 - 64	00
253	BIN 6 CHAR POS	0 or 1	0
254	BIN 6 CHAR CHECK	ASCII string	NONE
260	BIN 7 SYMBOLOGY	00, 10, 20 or 50	00
261	BIN 7 MIN LENGTH	0 - 64	00
262	BIN 7 MAX LENGTH	0 - 64	00
263	BIN 7 CHAR POS	0 or 1	0
264	BIN 7 CHAR CHECK	ASCII string	NONE
270	BIN 8 SYMBOLOGY	00, 10, 20 or 50	00
271	BIN 8 MIN LENGTH	0 - 64	00
272	BIN 8 MAX LENGTH	0 - 64	00
273	BIN 8 CHAR POS	0 or 1	0
274	BIN 8 CHAR CHECK	ASCII string	NONE

400-404—Starnode Setup Parameters

TABLE E–4. Starnode Setup Parameters

Param	Function	Valid Values	Default Value
400	STARNODE PROTOCOL	0 or 7	0
401	TERM. NUMBER	0 - 4095	0000 (none)
402	TERM. TYPE	0 - 126	000 (none)
403	MSG CHAR PREFIX	032 - 126	126 (~)
404	MSG CHAR SUFFIX	032 - 126	126 (~)

501-560—Inputs/Outputs Parameters

TABLE E–5. Inputs/Outputs Parameters

Param	Function	Valid Values	Default Value
501	TRANSMIT DATA	0 or 1	0
503	INZONE TRIGGER	0 or 1	1
504	OUTZONE TRIGGER	0 or 1	1
505	ZONE ERROR CHAR 1	000 - 255	042 (*)
506	ZONE ERROR CHAR 2	000 - 255	063 (?)
510	INZONE DEBOUNCE	0 - 255	020 ms
511	OUTZONE DEBOUNCE	0 - 255	000 ms
512	INPUTS DEBOUNCE	0 - 255	020 ms
520	INPUT 4 TRIGGER	0 or 1	1
521	INPUT 5 TRIGGER	0 or 1	1
522	INPUT 6 TRIGGER	0 or 1	1

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TABLE E–5. Inputs/Outputs Parameters (Continued)

523	INPUT 7 TRIGGER	0 or 1	1
524	INPUT 8 TRIGGER	0 or 1	1
553	RELAY 1 HOLD TIME	0 - 9999	0000
554	RELAY 2 HOLD TIME	0 - 9999	0000
555	RELAY 3 HOLD TIME	0 - 9999	0000
556	RELAY 4 HOLD TIME	0 - 9999	0000
557	RELAY 5 HOLD TIME	0 - 9999	0000
558	RELAY 6 HOLD TIME	0 - 9999	0000
559	RELAY 7 HOLD TIME	0 - 9999	0000
560	RELAY 8 HOLD TIME	0 - 9999	0000

600-639—User Program Parameters

TABLE E–6. User Program Parameters

Param	Function	Valid Values	Default Value
600	USER STACK SIZE	2 - 32	02 (2 KB)
601	FILE SYSTEM SIZE	0 - 2560	0032
602	PROGRAM CONTROL	0 - 4	0
610	USER VARIABLE 1	0 - 65535	00000
“	“	“	“
625	USER VARIABLE 16	0 - 65535	00000
630	USER STRING 1	ASCII string	NONE
.	“	“	“
639	USER STRING 10	ASCII string	NONE

640-668—Ethernet Parameters

TABLE E–7. Ethernet Parameters

Param	Function	Valid Values	Default Value
640	NETWORK NAME 1	ASCII string	NONE
641	IP ADDRESS 1	X.X.X.X	10.6.1.210
642	SUBNET MASK 1	X.X.X.X	255.255.255.000
643	GATEWAY 1	X.X.X.X	10.6.1.1
645	BROADCAST 1	0 or 1	1
646	CONTROLLER OPTS 1	0 - 255	000
647	HARDWARE ADDRESS 1	Read Only	00:20:5a:xx:xx:xx
650	NETWORK NAME 2	ASCII string	NONE
651	IP ADDRESS 2	X.X.X.X	000.000.000.000
652	SUBNET MASK 2	X.X.X.X	255.255.255.000

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TABLE E–7. Ethernet Parameters (Continued)

653	GATEWAY 2	X.X.X.X	000.000.000.000
655	BROADCAST 2	0 or 1	1
656	CONTROLLER OPTS 2	0 - 255	000
657	HARDWARE ADDRESS 2	Read Only	NONE
660	FTP IP ADDRESS	X.X.X.X	10.6.1.16
661	FTP LOGIN NAME	ASCII string	operations
662	FTP LOGIN PASSWORD	ASCII string	cimatrix
663	NETWORK LOGIN NAME	ASCII string	cimatrix
664	NETWORK LOGIN PASS	ASCII string	cimatrix
665	TELNET LOCAL OPTS	0 - 007	000
666	NAME BROADCAST PORT	0 - 65535	08509
667	TCP/IP KEEP ALIVE	5 - 20000	00060
668	TCP/IP CONNECT TIME	1 - 99	05

670-697—TCP/IP Port Parameters

TABLE E–8. TCP/IP Port Parameters

Param	Function	Valid Values	Default Value
670, 680, 690	NET x DEST IP	X.X.X.X	000.000.000.000
671, 681, 691	NET x LOCAL SOURCE	0 - 2	0
672, 682, 692	NET x PORT	0 - 65535	08510
673, 683, 693	NET x PROTOCOL	0 or 7	0
674, 684, 694	NET x MSG PREFIX	000 - 255	002 (STX)
675, 685, 695	NET x MSG SUFFIX	000 - 255	003 (ETX)
676, 686, 696	NET x MSG CHAR	000 - 255	126 (~)
677, 687, 697	NET x OPTIONS	0 - 63	001

700-706—Tracking Parameters

TABLE E–9. Tracking Parameters

Param	Function	Valid Values	Default Value
700	TRACKING	0 or 1	0 (disabled)
701	MILS/TIC	0 - 999 (x 0.001")	000 (disabled)
702	FIXED CONV SPEED	0 - 999 (feet per minute)	000 (off)
703	BOX TOLERANCE	0 - 999 (tenths of an inch)	040 (4.0")
704	FIXED BOX LENGTH	0 - 999 (tenths of an inch)	000 (off)
705	INZONE TO DATA	0 - 9999 (tenths of an inch)	0170 (17.0")
706	OUTZONE TO DATA	0 - 9999 (tenths of an inch)	0170 (17.0")

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002 - 027 Decoding & Operation Parameters

002 OPERATION MODE

MODE OF OPERATION

Valid Values 0 - 4

0 — HOT READ MODE (default)
Reports label when label threshold is met. Labels are binned and like labels are grouped together. When a bin count exceeds the label threshold, it is reported.

1 — OUTZONE
Reports label when triggered by an outzone event. All bins are analyzed with respect to the histogram parameters and a label or no read is reported for each bin.

2 — INZONE/OUTZONE
Reports label when triggered by an outzone event as in Outzone mode. Without gap tracking enabled, labels are not binned until an Inzone event occurs. In Gap Tracking, labels are placed on objects being tracked through the zone.

3 — VIRTUAL OUTZONE
Reports label when package tracking moves an object outside of the scan zone. Labels are placed on objects being tracked through the zone.

4 — TIMEOUT
Reports label at periodic intervals.

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003 IO MODE

INPUT/OUTPUT MODE

Valid Values 0 - 4095

To select a mode of operation, sum the following option codes:

Add 1 — Disable barcode data sent to TERMINAL port

Add 2 — Disable barcode data sent to HOST port

Add 16 — Disable beeper

Add 64 — Disable barcode data sent to STARNODE port

Add 128 — Disable barcode data sent to SETUP port

Add 256 — Disable barcode data sent to TCP1 port

Add 512 — Disable barcode data sent to TCP2 port

Add 1024 — Disable barcode data sent to TCP3 port

Add 2048 — Disable barcode data sent to TELNET port

Default Value 0000 (all normal I/O enabled)

Description Disabling ports that are not needed can increase the rate at which barcode data can be processed. In high-speed scanning applications, some I/O functions are not needed. Therefore, the ability to enable/disable specific I/O functions is desirable. If a user C program is running, it can control all communication ports.

You can disable sign-on and other unsolicited messages that would normally be sent from the SETUP port in the Setup/Diagnostics mode. These messages could confuse a host computer or another device if it is connected to this serial port instead of to the HOST serial port. You can **disable** these messages by adding +128. This will not disable the automatic sending of decoded barcodes to the port in normal operation (i.e., not running a C program and not in the Setup/Diagnostic menu).

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006 DEBUG DATA

DEBUG DATA

Valid Values 0 - 32767

To display other types of debug data, sum the following option codes:

Add 1 — Add label placement information

Add 2 — Add tracking zone errors

Add 4 — Add box length

Add 8 — Add box height

Add 16 — Add label replacement

Add 32 — Add label reading

Add 64 — Add bin dump

Add 128 — Add bin reject

Add 256 — Add tunnel master

Add 512 — Add tracking data

Add 1024 — Add Crisplant data

Add 2048 — Add PC tunnel data

Add 4096 — Add focusing data

Add 8192 — Add time stamp data

Add 16384 — Add TCP/IP data

Default Value 00000 (No debug data enabled)

Description This parameter is used to select formatted diagnostic information for display.

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007 DEBUG DATA PORT

DEBUG DATA PORT

Valid Values 0 - 4095

Add 1 — Enable sending debug data out Terminal Port

Add 2 — Enable sending debug data out Host Port

Add 64 — Enable sending debug data out Starnode Port

Add 128 — Enable sending debug data out Setup Port

Add 256 — Enable sending debug data out TCP1 Port

Add 512 — Enable sending debug data out TCP2 Port

Add 1024 — Enable sending debug data out TCP3 Port

Add 2048 — Enable sending debug data out Telnet Port

Default Value 0000 (Disable reporting of debug data)

Description This parameter allows you to select which port should receive special debugging information (as defined in Parameter 006 DEBUG DATA). By setting this parameter accordingly, debug data can be sent out any combination of communication ports. This is useful when debugging a working system that may, for example, be communicating to a host system via the Terminal port. Debug data won't be sent out the Terminal port if this port is not enabled. If, however, a computer is connected to the Setup port, then entering 128 would enable any debug reporting to be seen on this port.

For example, a setting of 385 sends debug data to the TCP1 Port (256), the setup port (128), and the Terminal port (1). Notice that 256 + 128 + 1 = 385.

007 DEBUG DATA PORT uses the same format as 003 IO MODE, except that:

TABLE E–10. TUNNEL MULTI READS Valid Values and Descriptions

For Parameter...	You set a bit to...
0007 DEBUG DATA PORT	Enable the data output.
0003 IO MODE	Disable the data output.

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011 NO READ CHAR

NO READ CHARACTER

Valid Values Decimal 001 - 122

Default Value Decimal 063 (ASCII ?)

Description The NO READ CHAR is sent in the data field of the device's output message in place of barcode data characters if no barcode was read during a Presence cycle (a box entered and exited the scan zone).

The default no read character *?* can be replaced by any other ASCII character by changing the value of this parameter. The "ASCII Equivalence Table" in your device's *Technical Reference Manual* contains an ASCII - decimal conversion table.

Enter a value of 000 to **disable** this parameter.

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012 LABEL SEPARATOR

LABEL SEPARATOR

Valid Values Decimal 001 - 122

Default Value Decimal 044 (ASCII ,)

Description The separator character is used to separate multiple barcodes sent by the device to the host in a single, formatted string when multiple barcodes have been read on one scanned object.

Any other ASCII character can replace the default separator character, by changing the value of this parameter. The “ASCII Equivalence Table” in your device’s *Technical Reference Manual* contains an ASCII - decimal conversion table.

Enter a value of 000 to **disable** this parameter.

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013 MULTI READ CHAR

MULTIPLE READ CHARACTER

Valid Values Decimal 001 - 122

Default Value Decimal 035 (ASCII #)

Description The scanner can be programmed to detect multiple unique and non-unique barcodes on one object, and to report an error if one or the other or both are detected. If so programmed, the scanner will present multiple read characters instead of barcode characters.

The multiple read character is sent in the data field of the scanner's output message in place of barcode data characters if multiple unique barcodes were read during the Presence cycle.

The default multiple read character # can be replaced by any other ASCII character by changing the value of this parameter. The "ASCII Equivalence Table" in your scanner's *Technical Reference Manual* contains an ASCII - decimal conversion table.

Enter a value of 000 to **disable** this parameter.

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027 TUNNEL MULTI READS

TUNNEL MULTI READS

Valid Values 0 or 1

Default Value 0

Description Table E–11 lists the TUNNEL MULTI READS valid values and their descriptions.

TABLE E–11. TUNNEL MULTI READS Valid Values and Descriptions

Value	Description
0	Disables the reporting of multireads in the Tunnel Master Application Mode.
1	Enables the reporting of multireads in the Tunnel Master Application Mode.

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100-173 Serial Communications Parameters

These parameters set the operating characteristics of the HOST, TERMINAL, SETUP and D-Port ports, such as baud rate, parity and stop bits, transmit protocol, and input or output prefixes and suffixes.

100 BAUD RATE HOST
120 BAUD RATE TERM
140 BAUD RATE SETUP
160 BAUD RATE D-PORT

Valid Values 0 - 11

0—14.4K bps
1—28.8K bps
2—300 bps
3—600 bps
4—1200 bps
5—2400 bps
6—4800 bps
7—9600 bps
8—19.2K bps
9—38.4K bps
10—57.6K bps
11—115.2K bps

Default Value BAUD RATE HOST — 07 (9600 baud)
BAUD RATE TERM — 07
BAUD RATE SETUP — 09
BAUD RATE D-PORT — 07

Description The BAUD RATE parameters select the speed, in bits per second (bps), that data is transmitted through the port.

The baud rate of a port should be set to match that of the device with which the port is communicating. For instance, if a port is connected to a non-intelligent terminal operating at 9600 baud, the port must be configured for 9600 baud.

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101 DATA BITS HOST
121 DATA BITS TERM
141 DATA BITS SETUP
161 DATA BITS D-PORT

DATA BITS

Valid Values 7 or 8

Default Value DATA BITS HOST — 8
DATA BITS TERM — 8
DATA BITS SETUP — 8
DATA BITS D-PORT — 8

Description The DATA BITS parameters set the number of data bits in the transmitted field. It is permissible to use eight data bits plus a parity bit.

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102 PARITY HOST
122 PARITY TERM
142 PARITY SETUP
162 PARITY D-PORT

PARITY

Valid Values 2 - 4

2 — EVEN parity (sum of 1's to be even)
3 — ODD parity (sum of 1's to be odd)
4 — No parity

Default Value PARITY HOST — 4 (No parity)
PARITY TERM — 4
PARITY SETUP — 4
PARITY D-PORT — 4

Description The PARITY parameters configure the device to be compatible with the parity-checking scheme used by the devices connected to a port. Parity is used to help detect errors in data transmission.

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103 STOP BITS HOST
123 STOP BITS TERM
143 STOP BITS SETUP
163 STOP BITS D-PORT

STOP BITS

Valid Values 1 or 2

Default Value 1

Description The STOP BITS parameters set the number of stop bits in the data field.

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104 FLOW CONTROL HOST
124 FLOW CONTROL TERM
144 FLOW CONTROL SETUP
164 FLOW CONTROL D-PORT

FLOW CONTROL

Valid Values 0 - 3

The following values can be summed when entering a value for this parameter.

0 — None
Add 1 — XON/XOFF
Add 2 — RTS/CTS

Default Value FLOW CONTROL HOST — 0
FLOW CONTROL TERM — 0
FLOW CONTROL SETUP — 0
FLOW CONTROL D-PORT — 0

Description The FLOW CONTROL parameters allow you to select the flow and control protocols to be used when the device transmits/receives data through the HOST, TERMINAL and SETUP ports. There are four options available.

XON/XOFF (1)

This is a bi-directional control protocol. The device will send data through the selected port until it receives an XOFF (<DC3> character) from the receiving device, at which time it will stop transmitting. The device will resume transmission when it receives an XON (<DC1> character).

The device will send an XOFF character when its Receive buffer has reached its full capacity of 256 characters. It will send an XON when its buffer empties to 224 characters.

RTS/CTS (2)

This is a bi-directional control protocol. The device will assert Clear To Send (CTS) at the selected port whenever it is prepared to receive data. It will drop CTS when its Receive buffer reaches its maximum capacity of 256 characters. It will assert CTS again when its Receive buffer empties to 32 characters.

The device will send data from the selected port until the receiving device drops DTR (Data Terminal Ready). The device will resume data transmission when the receiving device asserts DTR again.

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105 IN PRE. HOST
125 IN PRE. TERM
145 IN PRE. SETUP
165 IN PRE. D-PORT

INPUT PREFIX CHARACTER

Valid Values 000 - 255

Default Value 000

Description The INPUT PREFIX parameters select the ASCII prefix character. If set to non-zero, this character must be received by the device before any data will be accepted. The prefix character is stripped from the data prior to its use.

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106 IN SUF. HOST
126 IN SUF. TERM
146 IN SUF. SETUP
166 IN SUF. D-PORT

INPUT SUFFIX CHARACTER

Valid Values 000 - 255

Default Value 000

Description The INPUT SUFFIX parameters select an ASCII suffix character. When set to non-zero, it is used as a terminator for data being received by the device. Serial data received through the selected port will be accumulated from the time that an input prefix character is received until the time that the suffix character is received.

If the Serial Input Buffer reaches its capacity before the suffix character is received, the data will be presented as though it were a complete block. This prevents the Serial Input Buffer from overflowing and losing data.

The suffix character may or may not be presented with the data, depending upon the value of the parameter.

- If the suffix should not be presented with the data, select an ASCII character and enter its decimal value (000 - 127).
- If the suffix should be presented with the data, select an ASCII character, add 128 to its decimal value, and enter the summed value.

Example

To present a block of data with a <CARRIAGE RETURN> as the suffix character, enter the value 141 (013, the decimal value for <CARRIAGE RETURN>, plus 128).

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107 OUT PRE. HOST
127 OUT PRE. TERM
147 OUT PRE. SETUP
167 OUT PRE. D-PORT

OUTPUT PREFIX CHARACTER

Valid Values 000 - 255

Default Value 000

Description The OUTPUT PREFIX parameters select an ASCII prefix character. When set to non-zero, it will precede all data transmitted from the device.

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108 OUT SUF. 1 HOST
128 OUT SUF. 1 TERM
148 OUT SUF. 1 SETUP
168 OUT SUF. 1 D-PORT

OUTPUT SUFFIX 1 CHARACTER

Valid Values 000 - 255

Default Value Decimal 128 (CR - LF) (this is a non-standard ASCII decimal code)

000 (Parameter 168 only)

Description The OUTPUT SUFFIX 1 parameters select a first ASCII suffix character.

When set to non-zero, the suffix character will be appended to the end of each data block transmitted through the selected port of a device.

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109 OUT SUF. 2 HOST
129 OUT SUF. 2 TERM
149 OUT SUF. 2 SETUP
169 OUT SUF. 2 D-PORT

OUTPUT SUFFIX 2 CHARACTER

Valid Values 000 - 255

Default Value 000

Description The OUTPUT SUFFIX 2 parameters select a second ASCII suffix character. With Block Mode Output enabled, it will be appended after the first suffix character (if one is selected), to the end of each block of data transmitted.

If an OUTPUT SUFFIX 2 character is specified, only the selected SUFFIX ONE character immediately followed by the selected SUFFIX TWO character will be recognized as a data terminator.

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110 ERROR HOST
130 ERROR TERM
150 ERROR SETUP
170 ERROR D-PORT

ERROR CHARACTER

Valid Values 000 - 255

Default Value 000

Description The ERROR CHARACTER parameters select an ASCII character that will be substituted for any character that is received through the selected port with a parity or framing error.

If the Serial Input buffer reaches capacity, the error character will be stored as the last character in the buffer. This allows the calling routine to trap serial errors. Assigning a value greater than decimal 127 **disables** this feature, and all data will be presented as received.

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111 PROTOCOL HOST
131 PROTOCOL TERM
171 PROTOCOL DPORT

PROTOCOL HOST, PROTOCOL TERMINAL, PROTOCOL DPORT

Valid Values 00 - 10 (Parameters 111, 131, 171)

Valid Values 00 — Normal communications mode

01 — Polling Mode D (Master)

02 — Polling Mode D (Slave)

03 — Crisplant Sorter

04 — Serial Master

05 — Serial Slave (TX/RX Same Port)

06 — Serial Slave (TX/RX Different Port)

08 — Height Input

09 — External Data Input

10 — Telnet Redirect

Default Value 00

Description The PROTOCOL parameters select special communications protocols. For Polling Mode D, refer to *Intermec Data Communications Reference Manual*, Intermec P/N 044737-001.

- 00 — No additional serial communication protocols are selected.
- 01 — Identifies the given port to be the Master in a Polling Mode D scanner network. This is an RS485 communication protocol. Refer to *Intermec Data Communications Reference Manual*, Intermec P/N 044737-001, for specific details on this protocol.
- 02 — Identifies the given port as a slave in a Polling Mode D scanner network. Note that a protocol address (112, 132, 172) is required for proper operation.
- 03 — The Crisplant SC2000 controller-scanner interface is implemented on this serial port. This is an RS422 based interface. This protocol is used when interfacing to a Crisplant sorter.
- 04 — Serial Master identifies the port to serve as the Master in a serial Master/Slave network. The function of the Master is to collect the barcode data from all of the slaves and it's own data and compile the decode format result for presentation to the Host system. This protocol requires that block

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mode be used by defining a message prefix and suffix for this input port. The block mode characters must match those set on the Slave output port.

- 05 — Identifies Serial Slave where only one serial port is used for transmit and receive of slave data. In this scheme, if, for example, the Terminal port is used for slave data, then the first slave transmits out of its Terminal port to the Master. The next slave transmits out its Terminal port to the first slave's Terminal port. This chain continues for the number of slaves in the network. Each slave passes along any data that it receives in its Terminal port (from another slave in the chain) ultimately up to the Master.
- 06 — In this method of Serial Slave protocol, both the Terminal and Host serial ports are required (when there is more than one slave). Either the Terminal or Host port is defined as the Serial Slave In port (the port in which additional slave data is routed). Then, the alternate port is used to send data up the chain ultimately to the Master.
- 07 — This is not a valid serial protocol setting. This is used to define a PC based Tunnel interface that is only available on the Starnode or Ethernet (TCP) ports.
- 08 — The Height Input protocol is used when an external serial height sensor is used. For example, a height tree provides serial height information. This protocol enables these devices to be easily integrated with the scanner.
- 09 — The External Data protocol is a specialized Master protocol for use when interfacing with an MHV Camera. This is most often done with an MHI-2000.
- 10 — The Telnet redirect protocol is used to redirect serial data from any of the four serial ports (Host, Terminal, Setup, or D port) to a Telnet port (Ethernet). The Protocol Address parameter defines the Telnet port address.

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112 PROTOCOL ADDR HOST
132 PROTOCOL ADDR TERM
172 PROTOCOL ADDR DPORT

PROTOCOL ADDRESS

Valid Values 0 - 65536

Default Value 00000

Description The scanner address for serial protocols. This parameter is closely associated with the serial Protocol parameter. It has the following meaning, based on the defined Protocol:

Polling Mode D Master	When a port is defined as the Polling mode D Master port, the Protocol Address defines the number of slaves in the network.
Polling Mode D Slave	When a port is defined as a Polling Mode D Slave port, the Protocol Address defines the slave's unique Slave address.
Telnet Redirect	When a port is defined as a Telnet redirect port, the Protocol Address defines the Telnet port address.
Other Protocols	For all other serial protocols, the Protocol Address is undefined.

For Serial Master, the Protocol Address is a bitmap setting of the devices it is connected to.

For Serial Slave, the Protocol Address is the address of the slave.

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113 HARDWARE OPTS HOST
133 HARDWARE OPTS TERM
173 HARDWARE OPTS DPORT

HARDWARE OPTS

Valid Values 0 or 1 (Parameter 113)

0 (Parameters 133, 173)

Default Value 0

Description A 1 turns on RS422. This is only supported on the Host port.

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200-274 BIN x Decoding Group Parameters

These parameters set the decoding characteristics of the MHI-2000.

200 BIN 1 SYMBOLOGY
210 BIN 2 SYMBOLOGY
220 BIN 3 SYMBOLOGY
230 BIN 4 SYMBOLOGY
240 BIN 5 SYMBOLOGY
250 BIN 6 SYMBOLOGY
260 BIN 7 SYMBOLOGY
270 BIN 8 SYMBOLOGY

Valid Value 00, 10, 20, 50

Default Value
BIN 1 SYMBOLOGY — 10
BIN 2 SYMBOLOGY — 00
BIN 3 SYMBOLOGY — 00
BIN 4 SYMBOLOGY — 00
BIN 5 SYMBOLOGY — 00
BIN 6 SYMBOLOGY — 00
BIN 7 SYMBOLOGY — 00
BIN 8 SYMBOLOGY — 00

Description The mandatory SYMBOLOGY parameter is a two-digit value that tells the scanner which symbology to decode.

210 BIN 2 SYMBOLOGY sets the symbology for the sub bin. The implemented symbologies are:

- Code 128 (10)
- Code 39 (20)
- Interleaved 2 of 5 (50)

A zero setting **disables** the symbology for the bin.

The scanner decodes the symbologies listed in Table E–12.

TABLE E–12. Scanner Decodes and Symbologies

Values	Valid Barcode Symbologies
10	Code 128*
20	Code 39
50	Interleaved 2-of-5

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201 BIN 1 MIN LENGTH
211 BIN 2 MIN LENGTH
221 BIN 3 MIN LENGTH
231 BIN 4 MIN LENGTH
241 BIN 5 MIN LENGTH
251 BIN 6 MIN LENGTH
261 BIN 7 MIN LENGTH
271 BIN 8 MIN LENGTH

Valid Values 0 - 64

Default Value
BIN 1 MIN LENGTH — 0
BIN 2 MIN LENGTH — 0
BIN 3 MIN LENGTH — 0
BIN 4 MIN LENGTH — 0
BIN 5 MIN LENGTH — 0
BIN 6 MIN LENGTH — 0
BIN 7 MIN LENGTH — 0
BIN 8 MIN LENGTH — 0

Description Defines the minimum expected barcode length.

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202 BIN 1 MAX LENGTH
212 BIN 2 MAX LENGTH
222 BIN 3 MAX LENGTH
232 BIN 4 MAX LENGTH
242 BIN 5 MAX LENGTH
252 BIN 6 MAX LENGTH
262 BIN 7 MAX LENGTH
272 BIN 8 MAX LENGTH

Valid Values 0 - 64

Default Value
BIN 1 MAX LENGTH — 0
BIN 2 MAX LENGTH — 0
BIN 3 MAX LENGTH — 0
BIN 4 MAX LENGTH — 0
BIN 5 MAX LENGTH — 0
BIN 6 MAX LENGTH — 0
BIN 7 MAX LENGTH — 0
BIN 8 MAX LENGTH — 0

Description Defines the maximum expected barcode length.

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203 BIN 1 CHAR POS
213 BIN 2 CHAR POS
223 BIN 3 CHAR POS
233 BIN 4 CHAR POS
243 BIN 5 CHAR POS
253 BIN 6 CHAR POS
263 BIN 7 CHAR POS
273 BIN 8 CHAR POS

Valid Values 0 or 1

Default Value 0

Description This parameter indicates whether the CHAR CHECK characters will be at the start or the end of the label. Table E–13 lists the BIN x CHAR POS valid values and their descriptions.

TABLE E–13. BIN x CHAR POS Valid Values and Descriptions

Values	Description
0	The start of a label.
1	The end of a label.

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204 BIN 1 CHAR CHECK
214 BIN 2 CHAR CHECK
224 BIN 3 CHAR CHECK
234 BIN 4 CHAR CHECK
244 BIN 5 CHAR CHECK
254 BIN 6 CHAR CHECK
264 BIN 7 CHAR CHECK
274 BIN 8 CHAR CHECK

Valid Value One, two, or no ASCII characters.
Both printable and non-printable characters can be entered in the same string.

Default Value NONE

Description These parameters consist of one or two ASCII characters that are used to only select barcodes that begin or end (as defined by parameter CHAR POS) with these characters, screening out barcodes that do not begin with these characters.

Enter a printing character just as it would be printed.

Enter a non-printing character in the format `\xnn`, where nn are the two hexadecimal characters that define the non-printing character. The "ASCII Equivalence Table" in your device's *Technical Reference Manual* lists the hex equivalents of all ASCII non-printing characters.

For example, the ASCII non-printing GS (group separator) characters found in UCC/EAN-128 and UCC-128 SSCC (serial shipping container code) formatted Code -128 bar codes can be entered as \x1D.

The 230 BIN 4 SYMBOLOGY string contains up to two characters to use in screening labels for a bin.

Default If no characters are entered for this element, then no barcode ID character screening will be done.

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400 - 404 Starnode Setup Parameters

Two parameters, 401 TERM. NUMBER and 402 TERM. TYPE, are provided for STARNODE operations. If STARNODE operations will be invoked, both parameters should have their values set appropriately.

400 STARNODE PROTOCOL

STARNODE PROTOCOL

Valid Values 0 or 7

Default Value 0

Description This parameter indicates the protocol used for reporting data over Starnode. When set to 0, normal Starnode communication is used, if a valid Terminal # (parameter 401) and Terminal Type (parameter 402) have been set. Additional Tunnel protocol is achieved when this parameter is set to 7.

0 — Starnode Protocol.

7 — PC-Based Tunnel Protocol over Starnode. This protocol is used when interfacing a device in a Starnode based PC Tunnel network. The PC runs our Tunnel application, which coordinates the communication of an array of devices and provides extensive system capabilities. Please consult the factory for detailed information on the Tunnel application.

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401 TERM. NUMBER

STARNODE TERMINAL NUMBER

Valid Values 0 - 4095

Default Value 0000 (None)

Description Each device connected to the STARNODE network must be assigned a unique terminal number that identifies that device to the STARNODE network. A valid terminal type (parameter 402) must also be entered.

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402 TERM. TYPE

TERMINAL TYPE

Valid Values 0 - 126

Default Value 000 (None)

Description If C programs are to be automatically downloaded to devices through a network, all devices on the network must be assigned a terminal type. These type numbers determine which C programs are downloaded to each device.

For example, if device terminal numbers 0001, 0004, and 0007 are all designated as Type 004, and if the program SHIP.l2k is assigned to all Type 004 terminals, then the STARNODE controller will automatically download SHIP.l2k to all three devices upon network startup.

Terminal type may also be used for Ethernet networks; however, it is not required.

Note: No program can be downloaded over a Starnode network to a device designated as type 000.

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403 MSG CHAR PREFIX
404 MSG CHAR SUFFIX

MESSAGE CHARACTER PREFIX/SUFFIX

Valid Values Decimal 032 - 126

Default Value Decimal 126 = ~ (tilde)

Description These characters must frame all command messages sent to the device.

For example, to get the status string of the devices (command='5'), you would have to enter "~5~" to get the string.

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501 - 560 Inputs/Outputs Parameters

501 TRANSMIT DATA

TRANSMIT DATA

Valid Values 0 or 1

Default Value 0

Description This parameter defines when to report barcode data during Presence. Table E–14 lists the TRANSMIT DATA valid values and their descriptions.

TABLE E–14. TRANSMIT DATA Valid Values and Descriptions

Value	Description
0	Data is reported when the trailing edge of a box reaches the outzone
1	Data is presented with the leading edge of the box

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503 INZONE TRIGGER
504 OUTZONE TRIGGER

INZONE TRIGGER, OUTZONE TRIGGER

Valid Values 0 or 1

Default Value 1

Description The default inputs for the inzone and outzone Presence functions are input 1 and input 2, respectively. You can change the polarity of the signal's inzone and outzone using these parameters. Table E–15 lists the INZONE/OUTZONE TRIGGER valid values and their descriptions.

TABLE E–15. INZONE/OUTZONE TRIGGER Valid Values and Descriptions

Value	Description
0	Input must be active, or true.
1	Input must be inactive, or false.

The device digital inputs are active, or true, when they are pulled low. They are usually connected to normally open relays or open collector photoeyes, which effectively close a switch to ground when the photoeye is blocked.

Entering a zero for that input may use the inverse polarity.

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505 ZONE ERROR CHAR 1
506 ZONE ERROR CHAR 2

ZONE ERROR CHARACTER 1 and 2

Valid Values Decimal 000 - 255

Default Value ZONE ERROR CHAR 1 — Decimal 042 (*)

ZONE ERROR CHAR 2 — Decimal 063 (?)

Description The device allows the designation of two ASCII characters as zone error characters. Both characters are appended to the end-of-barcode or NO READ data to alert the host or controller that zone synchronization errors are occurring.

There are two zone errors that may occur:

- The inzone Presence detection device may signal a second time before the outzone device has signaled once. In this case, the error characters will be appended in the order of the two parameters (defaults: *?).
- The outzone device may signal prior to an inzone signal. In this case, the characters will be appended in reverse order (?*).

This scheme indicates which error condition was detected.

Example

Assuming that the ZONE ERROR CHARACTER ONE and TWO parameters are left at their default values (decimal 042 and 063, respectively), an inzone error will be reported as:

```
...<DATA>...*?
```

and an outzone error will be reported as:

```
...<DATA>. .?*
```

Note: Zone errors have a different meaning when you are using gap tracking with a tachometer, since there may be multiple packages in the scan zone at the same time. The zone error characters described above will not be sent in this situation.

There are some zone error situations that can be recognized when using gap tracking. A message of ****** (six asterisks) is sent as an indicator that a box was tracked through the zone, but did not arrive at the outzone within the parameter 703 BOX TOLERANCE value of distance traveled as determined by the tachometer count. In other words, the box was early or late at the outzone photoeye. This could happen if an inzone signal occurred but an outzone signal did not because, for example, a box did not travel all the way through the zone. This error message does not get sent by default. To enable it, set parameter 505 to 255, with gap tracking enabled.

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510 INZONE DEBOUNCE (Input 1)
511 OUTZONE DEBOUNCE (Input 2)
512 INPUTS DEBOUNCE (Inputs 3 - 8)

INZONE DEBOUNCE, OUTZONE DEBOUNCE, INPUTS DEBOUNCE

Valid Values 0 - 255

Default Value 020 (milliseconds) (parameters 510, 512)

000 (milliseconds) (parameter 511)

Description These parameters are the debounce times for their respective inputs. Debouncing allows you to eliminate multiple edges from a noisy input source that may take some time to settle to its final value. Separate times are allowed to cover situations where some inputs might need to have the minimum response time and others need longer debouncing (push buttons and lever-type divert verify switches, for instance).

000 = no debounce time, respond immediately to any input change

Debounce times help the device deal with the problem of detecting multiple transitions of contact closure inputs, or photoeyes that do not give a logic low level of less than 0.7 V. A larger debounce time helps filter out this noise, but will not always solve the problem. We recommend using only the photoeyes that SICK Auto Ident, Inc. provides, or using solid state input modules instead of relays.

This problem can also occur at the tachometer input. Use the tachometer/encoder provided by SICK Auto Ident, Inc., or make sure that the signal swings below 0.7 V and above 2.5 V.

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520-524 INPUT (4-8) TRIGGER

INPUT X TRIGGER

Valid Values 0 or 1

Default Value 1

Description You can change the polarity of the signals input 4 through input 8 using these parameters. Table E–16 lists the valid values and their descriptions.

TABLE E–16. INPUT 4-8 TRIGGER Valid Values and Descriptions

Value	Description
0	Input must be active, or true.
1	Input must be inactive, or false.

The device digital inputs are active, or true, when they are pulled low. They are usually connected to normally open relays or open collector photoeyes, which effectively close a switch to ground when the photoeye is blocked.

Entering a zero for that input may use the inverse polarity.

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553-560 RELAY X HOLD TIME

RELAY TIMES

Valid Values 0 - 9999 milliseconds

Default Value 0000 (Relay Disabled)

Description This parameter specifies the length of time (in milliseconds) for which the seven device solid-state circuits, and the relays driven by them, will remain energized after they have been energized.

For mechanical relays to operate, a hold time of at least 12 milliseconds is necessary. A RELAY HOLD TIME value of not less than 15 milliseconds is recommended.

Setting the parameter to 0000 will **disable** an output. Even if an output activation signal is generated, the corresponding output will not activate because it is being told to remain unenergized.

Conversely, if a RELAY HOLD TIME value is set to 9999, the corresponding output (and relay) will remain energized until the next output activation decision is made.

A user C program can use the operating system's relay hold feature by turning on an output that has a non-zero relay hold time. The OS will automatically turn it off at the end of the hold time. Setting the hold time to either 0 or 9999 will stop the OS from automatically turning it on or off.

If a relay hold time is set to 9999, the output will stay in the last driven state until the next decision point changes it.

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600 - 639 User Program Parameters

600 USER STACK SIZE

STACK SIZE IN KILOBYTES

Valid Values 2 - 32

Default Value 02 (2 KB)

Description This parameter sets the stack size available to the user program. Refer to the *SH3 C Programmer's Platform User's Manual* for more detailed information.

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601 FILE SYSTEM SIZE

FILE SYSTEM SIZE IN KILOBYTES

Valid Values 0 - 2560

Default Value 0032 Kb (set to 0000 to disable file system)

Description This parameter sets the RAM size available to the user program for C file system operations. The largest size is determined by the amount of RAM in the device.

Refer to SICK Auto Ident, Inc. *SH3 C Programmer's Platform* documentation for complete information.

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602 PROGRAM CONTROL

PROGRAM CONTROL

Valid Values 0 - 4

Default Value 0

Description This parameter allows skipping the waiting for download… time, and automatically restores the program from Flash on reboot. Table E–17 lists the PROGRAM CONTROL valid values and their descriptions.

TABLE E–17. PROGRAM CONTROL Valid Values and Descriptions

Value	Description
0	Normal operation.
1	Causes the device to wait for a download from the host. If the user program exists in FLASH after a ten second delay, run the user program.
2	Causes the device to load and run the user program from flash.
3	TBD (do not use)
4	TBD (do not use)

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610-625 USER VARIABLE x

USER VARIABLE x

Valid Values 0 - 65535

Default Value 00000

Description User definable parameters can be read and written by the user C program and accessed through the OS Setup menu. These parameters save you from writing a setup menu, and provide locations that are secure from power-down to power-up.

These parameters are accessed from the User Variable library C program routine.

These parameters are used to save up to 16 integer values in non-volatile RAM that can be used as a simple method to save values from power-up to power-up. Since these locations are not cleared when a program is downloaded, they may be used to communicate between different programs as well.

Note: Using files is a logical way to save values from power-up to power-up or between programs. Another method is to declare a block of uninitialized static variables and use the fact that these variables are non-volatile and not zeroed by the loader when the program starts up. These variables cannot be shared by different programs, however, since their locations are not (in general) known. In this case, these 16 locations are accessed using USER VARIABLE x.

Refer to SICK Auto Ident, Inc. *SH3 C Programmer's Platform* for additional information.

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630-639 USER STRING x

USER STRING x

Valid Values ASCII string up to 20 characters

Default Value None

Description User definable parameters can be read and written by the user C program and accessed through the OS Setup menu. These parameters are saved and restored from power-down to power-up.

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640 - 697 Ethernet Network Parameters

640 NETWORK NAME 1
650 NETWORK NAME 2

NETWORK NAME x

Valid Values ASCII string up to 20 characters

Default Value None

Description This string parameter is provided so that a character based network name can be associated with a given Ethernet connection.

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641 IP ADDRESS 1
651 IP ADDRESS 2

IP ADDRESS x

Valid Values X.X.X.X (where X = 0 - 255)

Default Value IP ADDRESS 1 — 10.6.1.210

IP ADDRESS 2 — 000.000.000.000

Description The device provides for up to two Ethernet hardware connections. Network 1 is the on board Ethernet connection and Network 2 is the optional add on Ethernet card. The IP Address parameters define the desired TCP/IP address for each connection.

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642 SUBNET MASK 1
652 SUBNET MASK 2

SUBNET MASK x

Valid Values X.X.X.X (where X = 0 - 255)

Default Value 255.255.255.000

Description If a device system is connected to a network that is already using a subnet mask, all of the devices in the system should use the same subnet mask. Otherwise, the subnet mask should match the default for the class of network address being used. The string nosubnet can be used to specify no subnetting.

The default of 255.255.255.000 is for a class C network address.

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643 GATEWAY 1
653 GATEWAY 2

GATEWAY x

Valid Values X.X.X.X (where X = 0 - 255)

Default Value GATEWAY 1 — 10.6.1.1

GATEWAY 2 — 000.000.000.000

Description If routing is not used, the default gateway address 000.000.000.000 should be used, otherwise, the desired Gateway address is defined here.

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645 BROADCAST 1
655 BROADCAST 2

BROADCAST x

Valid Values 0 or 1

Default Value 1

Description Under the BSD 4.2 release of TCP/IP, a destination address of all zeros was used as a broadcast address. Under the BSD 4.3 release, this was changed to all ones. Either can be used.

0 invokes BSD 4.2

1 invokes BSD 4.3

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646 CONTROLLER OPTS 1
656 CONTROLLER OPTS 2

CONTROLLER OPTS x

Valid Values 0 - 255

Default Value 000

Description This parameter is a bitmap of the following selections.

TABLE E–18. Values and Descriptions

Value	Description
000	10 Base 2
001	Use twisted pair
002	Set squelch level to 240mV (default of 400 mV is recommended)
004	Full step mode for BNC (1/2 step is recommended)
008	Disable link testing for twisted pair (Enabled is recommended)
255	Use the Ethernet adaptor jumper settings.

Note: The device supports RJ-45 twisted pair (10 Base T) cabling as options for the add on Ethernet card only.

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647 HARDWARE ADDRESS 1
657 HARDWARE ADDRESS 2

ETHERNET ADAPTER ADDRESS x

Valid Values 00:20:5a:xx:xx:xx (where xx = hardware address)

Default Value 00:20:5a:xx:xx:xx

Description This parameter is read only. The Ethernet address assigned to the device will be displayed.

If no Ethernet controller is found by the device, or if an error occurs retrieving the Ethernet address, then NONE will be displayed.

A typical Ethernet address is 00:20:5a, where 00:20:5a is the SICK Auto Ident, Inc. address. This address is assigned by IEEE to adapters that are manufactured by SICK Auto Ident, Inc.

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660 FTP IP ADDRESS

FTP IP ADDRESS

Valid Values X.X.X.X (where X = 0 - 255)

Default Value 10.6.1.16

Description This string provides the TCP/IP address assigned to an FTP server that may be used to transfer a new O/S to the MHI-2000. To initiate the O/S transfer, run diagnostics and select the O/S upgrade menu option. The FTP connection is associated with the on-board Ethernet circuit.

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661 FTP LOGIN NAME
662 FTP LOGIN PASSWORD

FTP LOGIN NAME and PASSWORD

Valid Values ASCII string up to 15 characters

Default Value FTP LOGIN NAME — operations

FTP LOGIN PASSWORD — cimatrix

Description These strings provide the login name and login password to be used when logging into an FTP server. An FTP server may be used to transfer a new O/S to the MHI-2000. To initiate the O/S transfer, run diagnostics and select the O/S upgrade menu option.

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663 NETWORK LOGIN NAME
664 NETWORK LOGIN PASSWORD

NETWORK LOGIN NAME and PASSWORD

Valid Values ASCII string up to 15 characters

Default Value NETWORK LOGIN NAME — cimatrix

NETWORK LOGIN PASSWORD — cimatrix

Description These strings provide a login name and password for the on-board Ethernet connection. They provide a string-based method of identifying various scanners when multiple scanners are located on a network.

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665 TELNET LOCAL OPTS

TELNET LOCAL OPTS

Valid Values 000 - 007

Default Value 000

Description There are three bit settable Telnet Local Options.

TABLE E–19. Values and Descriptions

Value	Description
001	Disable inactivity timeout. By default, the Telnet connection will be closed if there is no activity for 10 minutes. This feature can be disabled by setting this option.
002	Change CR to CR LF on input.
004	Change CR to CR LF on output.

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666 NAME BROADCAST PORT

NAME BROADCAST PORT

Valid Values 0 - 65535

Default Value 08509

Description This parameter defines the broadcast port address for a UDP name message. In general, the factory default setting of 08509 should be unchanged. This feature can be disabled by entering an address of 0.

This feature provides a method for our service technicians to make an Ethernet connection when the IP address of the device is not known (without having to make a serial connection).

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667 TCP/IP KEEP ALIVE

TCP/IP KEEP ALIVE

Valid Values 5 - 20000

Default Value 00060

Description This parameter defines the number of seconds the TCP/IP stack uses to determine if a connection is lost.

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668 TCP/IP CONNECT TIME

TCP/IP CONNECT TIME

Valid Values 1- 99

Default Value 05

Description This parameter defines the number of seconds before a timeout occurs when attempting to open a new socket.

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670 NET 1 DEST IP
680 NET 2 DEST IP
690 NET 3 DEST IP

NETWORK x DESTINATION IP

Valid Values X.X.X.X (where X = 0 - 255)

Default Value 000.000.000.000

Description This string provides the TCP/IP address assigned to the server.

When the MHI-2000 boots, it will attempt to establish a TCP connection with the server assigned this address. Up to 3 TCP/IP sockets are provided through these parameter settings. Additional sockets can be created with a user program.

With the default setting of 000.000.000.000, no socket connection is attempted.

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671 NET 1 LOCAL SOURCE
681 NET 2 LOCAL SOURCE
691 NET 3 LOCAL SOURCE

NETWORK x LOCAL SOURCE

Valid Values 0 - 2

Default Value 0

Description This setting is used to select the Ethernet controller that will be used for establishing this connection. If you want the operating system to determine which controller to use, select the default setting of 0.

TABLE E–20. Values and Descriptions

Value	Description
0	Determine controller to use in the O/S.
1	Use the on-board (built-in) Ethernet controller.
2	Use the optional add-on Ethernet controller.

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672 NET 1 PORT
682 NET 2 PORT
692 NET 3 PORT

NETWORK x PORT

Valid Values 0 - 65535

Default Value 08510

Description The device expects to establish a TCP (Ethernet) connection with a server using this well-known port value and the IP address of the server.

The default port value of 08510 can be used, providing the server uses the same port value.

The port value must not conflict with port values used by existing server applications such as FTP or Telnet, or use port numbers reserved for applications having root privileges.

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673 NET 1 PROTOCOL
683 NET 2 PROTOCOL
693 NET 3 PROTOCOL

NETWORK x PROTOCOL

Valid Values 0 or 7

Default Value 0

Description This parameter indicates the protocol used for reporting data over Ethernet.

TABLE E–21. Values and Descriptions

Value	Description
0	Default Ethernet protocol (TCP)
7	PC-based Tunnel Protocol over Ethernet (TCP)

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674 NET 1 MSG PREFIX
675 NET 1 MSG SUFFIX
684 NET 2 MSG PREFIX
685 NET 2 MSG SUFFIX
694 NET 3 MSG PREFIX
695 NET 3 MSG SUFFIX

NETWORK x MESSAGE PREFIX and SUFFIX

Valid Values Decimal 000 - 255

Default Value PREFIX Decimal 002 (STX)

SUFFIX Decimal 003 (ETX)

Description All command and data messages sent over the TCP (Ethernet) client connection must begin with the prefix character and end with the suffix character.

The default ASCII value of 002 (STX) can be used, providing the server also uses this PREFIX default.

The default ASCII value of 003 (ETX) can be used, providing the server also uses this SUFFIX default.

Setting the message prefix and suffix to 0 disables block mode communication.

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676 NET 1 MSG CHAR
686 NET 2 MSG CHAR
696 NET 3 MSG CHAR

NETWORK x MESSAGE CHARACTER

Valid Values Decimal 000 - 255

Default Value Decimal 126 (~)

Description All command messages sent to the device must be framed with this character. The default ASCII character 126 can be used, providing the server application also uses 126. The message character is always required and cannot be disabled by setting it to 255.

For example, "~?S~ instructs the device to enter the Setup menu. In this example, the '~' characters are command prefix and suffix indicators (the prefix and suffix are always the same character).

It is important to understand that the message character should only appear in a data stream when it is intended to be part of a command.

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677 NET 1 OPTIONS
687 NET 2 OPTIONS
697 NET 3 OPTIONS

NETWORK x OPTIONS

Valid Values Decimal 0 - 063

Default Value 001

Description These parameters for each network connection (1,2,3) are bit mappable settings with the following meanings:

TABLE E–22. Values and Descriptions

Value	Description
Keep Alive (0x01)	Setting this option to a 1 enables the keep alive for this socket.
Large Buffers (0x02)	Setting this option to a 1 doubles the sockets send and receive buffer size.
Don't Route (0x04)	Enabling this option allows outgoing messages to bypass the standard routing.
Linger (0x08)	Enabling this option allows any buffered data to be transmitted (if possible) prior to closing the socket. If Linger is disabled, buffered data may not be transmitted when a socket close request is issued.
No Delay (0x10)	This option is used to prevent data transmissions from being delayed by the TCP/IP stack.
Debug (0x20)	This option enables various debug features. It is intended for use by our Engineers and should not be enabled.

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700 - 706 Tracking Parameters

TRACKING PARAMETERS

With information provided by the Setup parameters, and inputs from such external devices as photoeyes and a tachometer, the lengths and y-axis positions of all boxes in the scan zone will be known by the device.

When detected by a scan, the y-axis positions of all barcodes in the scan zone will also be known by the scanner.

With this information, the scanner can correctly associate barcodes with their corresponding boxes.

The parameters in this section define the following:

1. The scanner's position relative to the conveyor.
2. The width of the conveyor.
3. The maximum and minimum heights of boxes on the conveyor.
4. Whether only one or multiple boxes at a time must be tracked through the scan zone.
5. The positions of the photoeyes that sense boxes entering and leaving the scan zone.
6. The number of height-sensing photoeyes.
7. The positions of the height-sensing photoeyes.
8. The distance per tachometer pulse that the conveyor and boxes move.
9. The tolerances to be applied to allow for expected inaccuracies in measurements.
10. The rotation angle of the scanner with respect to the conveyor.
11. The laser X-pattern in use.
12. The alternate CIX parameters in use.
13. The length of boxes, if fixed.
14. The conveyor speed, if fixed and a tachometer is not used.

The scan zone is normally defined by the positions of inzone and outzone photoeyes. These photoeyes will normally be positioned just outside of the boundaries within which the scanning beam can read barcodes on boxes as they pass by. In some applications, a single inzone photoeye and a tachometer can be used to define the scan zone.

The minimum distance between inzone and outzone photoeyes must be increased as conveyor width increases, to compensate for the increased height-of-scan with increased reading range. Your keysheet will specify the minimum distances between these photoeyes for your application.

The distance between zone-defining photoeyes may also be increased, if necessary, to accommodate conveyor physical positioning limitations or the special requirements of your application. For example, because data transmission of the barcode of a box normally occurs after the box has passed the outzone photoeye, moving the outzone photoeye farther downstream from

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the scanner will cause a corresponding delay in data transmission. Such a data transmission delay may be needed by some sorting systems.

If there will never be more than one box at a time in the scan zone, gap tracking need not be used, and no additional inputs other than the inzone and outzone photoeyes will be needed.

If gap tracking is not used, and if multiple boxes enter the scan zone, the scanner may associate a barcode with the wrong box. However, the scanner can usually detect multiple boxes in the scan zone because inputs from the inzone and outzone photoeyes will occur out of their normal sequence. If this should occur, the scanner can append specific error characters to the data transmitted when a box passes the outzone photoeye.

These extra characters can alert the host computer or tracking system to the possible error. The characters indicate whether multiple inzone inputs have occurred without the expected corresponding outzone inputs, or the reverse. Parameters 505 and 506 are used to select the characters. They will be sent only if gap tracking is disabled.

When more than one box may be in the scan zone at one time, a tachometer is usually used to track box position through the zone, although tachometer-less tracking can also be implemented in some applications. In either case, the scanner must know how far the box will move for each pulse received from the tachometer or from the system clock if tachometer-less tracking is implemented.

You must enter the distances from the scanner's center line (projected on to the plane of the conveyor) to the inzone and outzone photoeyes. After the distances are entered, the TACH CALIBRATION diagnostic test can be run to derive and enter the distance-per-pulse value automatically, if a tachometer is being used. Otherwise, a fixed conveyor speed must be entered.

Tolerances must be entered to allow for expected variations in box movement between the inzone to the outzone photoeyes. If actual box movement falls outside of these expected tolerances, the boxes will be considered false or phantom, and any barcode data read from these boxes will be discarded. Usually, these phantom boxes are not caused by real boxes but by unexpected occurrences, such as a maintenance person unintentionally blocking a photoeye.

A maximum of eight boxes can be tracked between the inzone and outzone photoeyes. Be sure to check that the total number of small boxes and expected gaps between them, when placed end to end between these photoeyes, will not exceed this limit.

With gap tracking invoked, you must enter parameters for conveyor width, the installed scanner height above the conveyor, and the heights of the shortest and tallest boxes.

If the gap between boxes may be less than the difference in heights of the shortest and tallest boxes, height-sensing photoeyes must be used to provide box height information to the scanner. The scanner must know the height of the box being scanned to know whether the barcode being read is near an edge of a tall box or on a leading or trailing short box. The photoeyes are placed in a vertical array just before the inzone photoeye. The spacing between these height-sensing photoeyes must be less than the smallest inter-box gap.

The height of each photoeye above the conveyor must be entered into the Setup parameters. This information, with the minimum and maximum box heights, provides the information needed to properly associate barcodes with closely spaced boxes of differing heights.

When it is necessary to have very accurate barcode location information - for instance, because of short gaps between boxes - or when reading multiple closely spaced barcodes per box, using the maximum possible number of closely spaced height-sensing photoeyes is advisable.

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The same parameters that determine the minimum gap between boxes also determine the minimum gap between barcodes. The two dimensions are similar and the calculations are equally affected by the number of height-sensing photoeyes, the tachometer resolution and the care with which all measurements of the gap tracking parameters are made and entered. The minimum spacing between barcodes is typically eight inches, but smaller spacing may be possible, depending on the application.

Because the positions and heights provided by the photoeyes will not be exact, boxes may appear to be taller or shorter than their actual heights. Using smaller numbers of widely spaced height-sensing photoeyes increases the uncertainty. Because of the uncertainty, barcodes positioned near the leading or trailing edges of boxes may appear to be off the box when read, and would normally be discarded, except that a box tolerance parameter is provided.

The box tolerance parameter makes each box appear longer by the amount of the tolerance, allowing the scanner to compensate for the inexact input data. When short gaps between boxes are expected, this tolerance must be chosen carefully such that box lengths are not increased so much that the gap between boxes effectively disappears. If this happens, barcodes that could be associated with two boxes will be associated with the first box.

When using large box tolerance values, the inzone and outzone photoeyes may also have to be moved away from the scanner by a corresponding amount. This will allow the scanner to make use of the selected tolerance for barcodes at the edges of boxes as the boxes enter or exit the scan zone.

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700 TRACKING

TRACKING

Valid Values 0 or 1

0 — Disabled

1 — Enabled

Default Value 0

Description This parameter indicates the tracking function.

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701 MILS/TIC

TRACKING, IN MILS

Valid Values 0 - 999

Default Value 000 (Gap Tracking disabled)

Description This parameter specifies the tachometer resolution expressed in distance traveled by the conveyor per one encoder pulse.

The value of this parameter can be easily and accurately measured by running the TACH CALIBRATION routine included in the device diagnostic menu described in “Diagnostic Tests & Procedures” in your device’s *Technical Reference Manual*. An initial estimate of the value must be entered before running the TACH CALIBRATION routine. A value of 050 is typical.

The value of this parameter can also be calculated by analyzing the conveyor drive system from the point where the tachometer is coupled to it to the conveyor belt or rollers in through the scan zone. The tachometer typically outputs 300 pulses per revolution.

Some applications don’t need to use gap tracking, but do need to perform actions in a user program according to distance traveled. The tachometer may be used by a user program if parameter 702 FIXED CONV SPEED is non-zero, even if gap tracking is disabled by setting parameter 700 TRACKING to 0.

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702 FIXED CONV SPEED

FIXED CONVEYOR SPEED

Valid Values 000 - 999 (feet per minute)

Default Value 000 (Disabled)

Description Normally, a tachometer is used to measure the movement of the conveyor during gap tracking operations. If this parameter has a non-zero value entered, the value will be used as the assumed conveyor speed, to provide tachometer-less gap tracking.

Conveyor starts and stops cannot be recognized when using this technique. The device will assume that the conveyor is always running. For this reason, use of an actual tachometer is recommended.

When invoking tachometer-less gap tracking, set this parameter to 001.

When a fixed conveyor speed is being used, scanner input 3, normally reserved for the tachometer, is available for general purpose use.

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703 BOX TOLERANCE

BOX TOLERANCE

Valid Values 0 - 999 (tenths of an inch)

Default Value 040 (4.0")

Description Box tolerance is a dimensional tolerance applied to a box to increase its length to allow for measuring uncertainty. This parameter is useful when close tolerances are required for small gaps. A loose tolerance is required to eliminate false multi-reads.

If the position of a barcode is calculated to be within the increased length, the barcode will be associated with the box.

The default value of 040 provides a 4.0” area before and after each box within which a barcode will be considered to be *on* the box. This tolerance value requires that there be a minimum gap of 4.0” (2 x 4”) between boxes.

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704 FIXED BOX LENGTH

FIXED BOX LENGTH

Valid Values 0 - 999 (tenths of an inch)

Default Value 000 (Disabled)

Description Normally, the length of a box is determined by measuring the distance that it travels while blocking the inzone photoeye.

This parameter can be used to define a fixed box length for use in gap tracking in applications where the inzone signal durations generated are not proportional to the lengths of the boxes. In tilt-tray applications, for example, the inzone may be detected by a photoeye mounted underneath the trays, blocked by the car or other mechanism, which gives a short pulse. If this parameter is non-zero, that value will be used for the box length instead of the duration of the inzone signal.

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705 INZONE TO DATA
706 OUTZONE TO DATA

INZONE TO DATA, OUTZONE TO DATA

Valid Values 0 - 9999 (tenths of an inch)

Default Value 0170 (17.0")

Description These parameters specify the distance between the inzone and outzone Presence photoeyes and the centerline of the scan zone drawn perpendicular to conveyor motion on the plane of the conveyor.

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