Encompass® Multiprotocol Reader System Guide

Do not distribute this document outside of TransCore.

Distribution to external parties is governed by TransCore non-disclosure agreement.

TransCore
8600 Jefferson Street NE
Albuquerque, New Mexico 87113

January 2023
P/N 412067-011A

For further information, contact:

TransCore
8600 Jefferson Street NE
Albuquerque, NM 87113 USA

TransCore Sales Support:

(800) 923-4824

Technical Support

Phone: (505) 856-8007

Web: www.transcore.com

WARNING TO USERS IN THE UNITED STATES AND CANADA

FEDERAL COMMUNICATIONS COMMISSION (FCC) LOCATION AND MONITORING SERVICE STATEMENT 47 CFR §90.351

NOTE: The user is required to obtain a Part 90 site license from the Federal Communications Commission (FCC), or an equivalent delivered by Industry Canada (IC), to operate this radio frequency identification (RFID) device in the United States or Canada. FCC ID number is FIHE6PT90V2. The IC ID number is 1584A-E6RSS137V2. Access the FCC website at www.fcc.gov/Forms/Form601/601.html or at http://wireless.fcc.gov/index.htm?job=online_filing or at the IC website at http://www.ic.gc.ca/eic/site/sd-sd.nsf/eng/h_00023.html to obtain additional information concerning licensing requirements.

NOTE: Users in all countries should check with the appropriate local authorities for licensing requirements.

FCC RADIO FREQUENCY INTERFERENCE STATEMENT 47 CFR §15.105(a)

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate RF energy and may cause harmful interference to radio communications if not installed and used in accordance with the instruction manual. Operating this equipment in a residential area is likely to cause harmful interference, in which case, depending on the regulations in effect, the user may be required to correct the interference at their own expense.

NO UNAUTHORIZED MODIFICATIONS 47 CFR §15.21

CAUTION: This equipment may not be modified, altered, or changed in any way without permission from TransCore, LP. Unauthorized modification may void the equipment authorization from the FCC and will void the TransCore warranty.

USE OF SHIELDED CABLES AND GROUNDING 47 CFR §15.27(a)

NOTE: Shielded cables and Earth Grounding the unit is recommended for this equipment to comply with FCC regulations.

TransCore, LP

AVERTISSEMENT POUR LES UTILISATEURS DES ÉTATS-UNIS ET DU CANADA

DÉCLARATION SUR L’UTILISATION ET L’EMPLACEMENT DES APPAREILS, CONFORMÉMENT AUX EXIGENCES DE LA FCC (COMMISSION FÉDÉRALE DES COMMUNICATIONS DES ÉTATS-UNIS)
47 CFR §90.351

NOTE : L’utilisateur est tenu d’obtenir une licence de site de la FCC aux termes de la partie 90 du Code des règlements fédéraux des États-Unis (CFR), ou un équivalent délivré par Industrie Canada (IC), pour pouvoir se servir de ce dispositif d’identification par radiofréquence (RFID) aux États-Unis et au Canada. Le numéro d’identification pour la FCC est FIHE6PT90V2. Le numéro d’identification pour IC est 1584A-E6RSS137V2. Prière de consulter le site Web de la FCC au www.fcc.gov/Forms/Form601/601.html ou au http://wireless.fcc.gov/index.htm?job=online_filing, ou encore le site Web d’IC à http://www.ic.gc.ca/eic/site/sd-sd.nsf/fra/h_00023.html?Open&src=mm1, pour obtenir des renseignements supplémentaires sur les exigences en matière de licence.

NOTE : Les utilisateurs de tous les pays sont priés de vérifier, auprès des autorités concernées, les exigences locales en matière de licence.

DÉCLARATION SUR LE BROUILLAGE RADIOÉLECTRIQUE, CONFORMÉMENT AUX EXIGENCES DE LA FCC
47 CFR §15.105(a)

NOTE : Cet appareil a été testé et jugé conforme aux limites établies pour un dispositif numérique de classe A, selon la partie 15 des règlements de la FCC. Ces limites visent à assurer un degré raisonnable de protection contre le brouillage préjudiciable lorsque l’appareil est utilisé dans un environnement commercial. Cet appareil génère, utilise et peut diffuser de l’énergie sous forme de radiofréquences (RF) et peut causer un brouillage préjudiciable aux communications radio s’il n’est pas installé conformément au mode d’emploi. L’utilisation de cet appareil en zone résidentielle est susceptible de causer un brouillage préjudiciable, auquel cas, selon la réglementation applicable, l’utilisateur pourrait être tenu d'éliminer le signal parasite à ses propres frais.

AUCUNE MODIFICATION SANS AUTORISATION
47 CFR §15.21

MISE EN GARDE

MISE EN GARDE : Cet appareil ne peut en aucune façon être modifié, altéré ou transformé sans l’autorisation de TransCore, LP. Toute modification non autorisée pourrait invalider l’autorisation de la FCC au regard de l’appareil et annulera la garantie de TransCore.

UTILISATION DE CÂBLES BLINDÉS ET MISE À LA TERRE
47 CFR §15.27(a)

NOTE : Il est recommandé d’utiliser des câbles blindés et de mettre l’appareil à la terre pour assurer la conformité aux règlements de la FCC.

TransCore, LP
États-Unis

Health Limits for Encompass® Multiprotocol Reader Using External Antenna (902 to 921.5 MHz)

Within the United States, environmental guidelines regulating safe exposure levels are issued by the Occupational Safety and Health Administration (OSHA).

Section 1910.97 of OSHA Safety and Health Standards 2206 legislates a maximum safe exposure limit of 10 milliwatts per square centimeter (mW/cm^2) averaged over 6 minutes at 902 MHz.

Although not binding, other organizations such as the American National Standards Institute (ANSI) have issued similar guidelines that are more restrictive than the OSHA limits (ANSI C95.1). ANSI guidelines recommend a maximum safe power density in mW/cm^2 of:

$$\frac{\text{Frequency (in MHz)}}{1500} = \frac{902}{1500} = 0.60 \text{ mW/cm}^2$$

Thus, the maximum permissible exposure for general population/uncontrolled exposure at 902 MHz is 0.60 mW/cm^2. The average time is thirty minutes.

The maximum permissible exposure for occupational/controlled exposures is 3.0 mW/cm^2. The average time is 6 minutes.

The RF power density generated by the Encompass Multiprotocol Reader was calculated using a maximum antenna gain of 14.0 dBi, equivalent to the antenna gain of the external AA3152 Universal Toll Antenna (UTA).

Warning

WARNING

At 2 W transmitted power, 0 dB transmit attenuation, and a distance of 33 inches (82 cm) from the antenna, the maximum power density calculated was less than 0.60 mW/cm^2. Install the antenna at least 33 inches (82 cm) from the general public. Maintenance personnel must remain at least 15 inches (37 cm) from the antenna when the system is operating.

The data confirms that when the UTA, or equivalent antenna, is used with the TransCore Encompass Multiprotocol Reader, the antenna effectively meets OSHA requirements and thus does not represent an operating hazard to either the general public or maintenance personnel.

Limites d’innocuité du lecteur multiprotocole Encompass^{MD} utilisé avec une antenne externe (902 à 921,5 MHz)

Aux États-Unis, les directives environnementales concernant les niveaux d’exposition acceptables sont émises par l’OSHA (Occupational Safety and Health Administration).

L’article 1910.97 de la norme de santé et de sécurité 2206 de l’OSHA fixe la limite d’exposition acceptable à une moyenne de 10 milliwatts par centimètre carré (mW/cm^2) sur une période de 6 minutes à 902 MHz.

D’autres organismes de normalisation tels que l’ANSI (American National Standards Institute) ont émis des directives similaires, mais non obligatoires, qui fixent des limites plus restrictives que celles de l’OSHA (notamment la norme ANSI C95.1). Les normes de l’ANSI recommandent de ne pas dépasser la densité de puissance suivante, exprimée en mW/cm^2 :

$$\frac{\text{Fréquence (en MHz)}}{1500} = \frac{902}{1500} = 0{,}60 \text{ mW/cm}^2$$

Ainsi, le niveau maximal d’exposition permis pour la population générale et les situations d’exposition non contrôlée à 902 MHz est de 0,60 mW/cm^2 en moyenne sur une période de 30 minutes.

Le niveau maximal d’exposition permis dans un cadre professionnel ou contrôlé est de 3,0 mW/cm^2 en moyenne sur une période de 6 minutes.

La densité de puissance des RF générées par le lecteur multiprotocole Encompass a été calculée pour un gain d’antenne maximal de 14,0 dBi, soit l’équivalent du gain de l’antenne de péage universelle (UTA) AA3152.

Mise en garde

MISE EN GARDE

Avec une puissance transmise de 2 W et une atténuation de transmission de 0 dB, la densité de puissance maximale calculée à 33 pouces (82 cm) de l’antenne était inférieure à 0,60 mW/cm^2. Par mesure de précaution, installer l’antenne à au moins 33 pouces (82 cm) de la population générale. Le personnel d’entretien doit se tenir à au moins 15 pouces (37 cm) de l’antenne lorsque le système est en cours d’utilisation.

Les données confirment que l’utilisation de l’UTA ou d’une antenne équivalente avec le lecteur multiprotocole Encompass répond aux exigences de l’OSHA et ne présente pas de danger lié à son utilisation, que ce soit pour la population générale ou le personnel d’entretien.

Summary of Revisions to Encompass Multiprotocol Reader System Guide

Version Number	Date Revised	Summary of Changes
N/A	07/08	Entry for baseline
-002	12/08	Internal update, guide not formally released
-003	01/09	Updated TDM configuration graphics and Belden cable references in Chapter 3. Corrected GPS graphic in Appendix D. Updated cover and copyright date.
-004	08/09	Revised FCC contact information to include wireless Web link, in addition to the forms Web link, for online filing. Revised the TDM wiring description to include information on using resistors at either end of the TDM reader chain to maintain optimum signal fidelity and grounding the TDM Master's TDM cable shield to reduce the risk of electromagnetic interference disrupting or damaging the TDM circuitry in the Encompass reader. Deleted Set/Get SeGo SGSPR Data commands. Set/Get SeGo/eGo Configuration Data commands already provide this function. Added default time-out of 30 ms for setting data acknowledge time-out period. Added Reserved field to Set/Get Uplink Source Control, Set/Get Protocol, and Set/Get Seen Count, commands Added Reserved field to parameter and response lists Revised description for #94PS Set Uplink Source Control command and added Reserved field. Added Table D-5, which explains troubleshooting procedure for unacceptable RF attenuation statistics using check tag Added Caution statement explaining that the digital input/output port is not surge protected and that TransCore strongly recommends that an OPTO 22 module be used to control any input or output device that is connected to the Encompass reader. Expanded the Required Components/Tools section. Revised Figure D-12 to call out the TransCore part number for the socket connector Revised TDM section in Appendix D to match changes made in Chapter 3.
-005	01/10	Updated cover and front matter.
-006	06/10	Updated copyright and patent boilerplate in front matter.
-007	08/10	Updated GPS information; added note to load default operating parameters commands
-008	01/11	Expanded listing of modulated and continuous wave authorized frequency bands in the U.S. in Chapter 1.
-009	03/12	Updated Tech Support phone number, replaced Figure D-13 and added new Figure D-14.
-010	08/12	Corrected baud rate setting table for command #100N. Added command #103N End of Line Delay to Chapter 7 and Appendix E. Updated pre- and post-condition table in Appendix E.

Version Number	Date Revised	Summary of Changes
-010	06/12	Added further explanation of connecting Encompass reader to host PC as point-to-point connection or when multiple readers are used, employing a local area network. Corrected #100N SET BAUD RATE command settings. Listed E -- enable all protocols (periodic) Listed F -- enable all protocols (manual) in the check tag set commands Updated Appendix E listing of command-based conditions
-011	2/14	Updated FCC information, health limits, and licensing requirements. Added French translations for FCC and health limits information. Added new command to table 6-172. Added two new tables, Chapter 6-93.

Contents

Contents

4 General Software Information

5 Communication Protocols

6 Configuring and Operating the Encompass Reader Using UDP Commands

7 Configuring and Operating the Encompass Reader Using AI1200-Emulation Commands

8 Tag Responses

9 Configuring the Lane

10 System Diagnostics and Preventive Maintenance

11 Remote Hardware Reset

A Acronyms and Glossary

B Hardware Interfaces

C System Technical Specifications

D Encompass Reader Options

E Command-Based Pre- and Post-Conditions

Index

List of Figures

List of Tables

1

Before You Begin

Chapter 1

Before You Begin

This chapter provides an overview of the Encompass® Multiprotocol Reader System Guide.

Purpose of the Guide

This *Encompass® Multiprotocol Reader System Guide* provides detailed information about the multiprotocol reader system, including site installation and planning, troubleshooting, and preventive maintenance tasks, as well as a detailed list of the reader software commands and diagnostic and hardware interface information for developing your customized application software. Also included is an appendix that describes the optional assemblies available with the Encompass system.

Intended Audience

The intended audience for this guide is those personnel responsible for installing, configuring, operating, and maintaining the Encompass Multiprotocol Reader.

Guide Topics

This system guide presents the following information.

Chapter 1 – **Before You Begin**	This chapter provides an overview of the system guide as well as related documents, typographical conventions, and licensing requirements.
Chapter 2 – **Developing the Encompass Reader System Site Plan**	This chapter discusses factors to be considered when developing the site plan in preparation for installing the Encompass Reader system equipment.
Chapter 3 – **Installing the Encompass Reader**	This chapter describes the Encompass Reader and instructs the user in installing the Encompass Reader system.
Chapter 4 – **Software Information**	This chapter provides user datagram protocol (UDP) and AI1200-emulation software-related information for the Encompass Reader.
Chapter 5 – **Communications Protocols**	This chapter describes the UDP communication via Ethernet and AI1200-emulation protocol communication via RS-232 for the Encompass Reader.

Chapter 6 – **Configuring and Operating the Encompass Reader Using UDP Commands**	This chapter describes the Encompass Reader mode and UDP commands that are used to configure and operate the reader. This chapter also contains system commands and responses that are needed to develop host software for the UDP command set.
Chapter 7 – **Configuring and Operating the Encompass Reader Using AI1200-Emulation Commands**	This chapter describes the Encompass Reader mode and AI1200-emulation commands that are used to configure and operate the reader. This chapter also contains commands and responses that are useful in developing host software for the AI1200 command set.
Chapter 8 – **Tag Responses**	This chapter provides tag responses to both UDP and AI1200-emulation tag requests.
Chapter 9 – **Configuring the Lane**	This chapter provides information on the importance of lane tuning for optimum automatic vehicle identification (AVI) system performance. This chapter also describes the Encompass Reader functions and features that can assist you in tuning an AVI lane.
Chapter 10 – **System Diagnostics and Preventive Maintenance**	This chapter provides information on error messages, troubleshooting, preventive maintenance schedule, visual inspection, Encompass Reader repair, removal and replacement procedures, and technical support.
Chapter 11 – **Remote Hardware Reset**	This chapter provides information on resetting the Encompass Reader remotely.
Appendix A – **Acronyms and Glossary**	This appendix defines the acronyms and terms used in this system guide.
Appendix B – **Hardware Interfaces**	This appendix describes the physical interconnections within an Encompass Reader system.
Appendix C – **System Technical Specifications**	This appendix provides reference specifications for the Encompass Reader system components.
Appendix D – **Reader System Options**	This appendix describes the options available with the Encompass Reader system.
Appendix E – **Command-Based Pre- and Post Conditions**	This appendix lists the pre- and post-conditions for both UDP and AI1200-emulation commands.
Index	This index provides an alphabetical listing of the system guide topics.

Typographical Conventions Used in this Manual

Table 1-1 lists the typographical conventions that may be used in this manual. Not all of the conventions are used in this version.

Table 1-1 Typographical Conventions

Convention	Indication
WARNING	This procedure might cause harm to the equipment and/or the user.
CAUTION	A caution sign indicates concerns about a procedure.
`Code`	Code, including keywords and variables within text and as separate paragraphs, and user-defined program elements within text appear in courier typeface.
Dialog Box Title	Title of a dialog box as it appears on screen.
Screen Title	Title of a screen as it appears on screen.
Menu Item	Appears on a menu.
Note	Additional information that further clarifies the current discussion. These important points require the user's attention. The paragraph is in italics and the word Note is bold.
Cancel button	Bold text identifies the labeling of items as they actually appear on the keyboard, on a button, as a menu item, and so forth.
Ctrl-**Esc**	A hyphen indicates actions you should perform simultaneously. For example, Ctrl-Esc means to press the **Ctrl** and **Esc** keys at the same time.
5 Return	A space indicates that you should press the specified keys in the sequence listed, not at the same time.
before	Text in italics indicates emphasis.
Customer > **Find**	Bold text followed by a > and more bold text indicates the order of command selections to reach a specific function.
click	Click means that you should press and release the left mouse button.
cursor	The cursor is the flashing vertical line that appears in a selected edit box.
pointer	The pointer is the arrow in the window that shows the movement of the mouse.

2

Developing the Installation Site Plan

Chapter 2

Developing the Installation Site Plan

This chapter provides guidelines for the following tasks:

- ***Assessing and formulating the site plan***
- ***Preparing the site***
- ***Choosing locations to mount the system components***
- ***Determining electrical and communications requirements***

Assessing and Formulating a Site Plan

You will need to perform a general geographic RF site survey to check for RF noise sources near the automatic vehicle identification (AVI) installation.

You will need to formulate a frequency plan for each plaza. Each reader has two frequencies: downlink (reader-to-tag communications) and uplink (tag-to-reader responses). An Encompass Reader deployed for use in the U.S. uses the following frequency ranges:

- **Downlink**: 911.75 to 919.75 MHz, adjustable in 0.25 MHz steps
- **Uplink**: 902.25 to 903.75 MHz and 910.00 to 921.50 MHz, adjustable in 0.25 MHz steps. Actual frequency range is protocol dependent.[1]

Consult with the TransCore systems engineer or other systems integrator assisting with the installation of the Encompass Readers.

Preparing the Installation Site

Prepare the site according to the design parameters determined by your system integrator.

Site Preparation Checklist

Complete the following tasks, depending on the individual site.

❑	Acquire a construction license.
❑	Acquire a Federal Communications Commission (FCC) license.

1. The above frequency ranges are in the location monitoring service band.

❑	Acquire an environmental assessment permit.
❑	Ensure that you have assembled all the lights, buzzers, and vehicle detectors that will interface with the Encompass Reader system.
❑	Ensure that you have software for a desktop or laptop computer to interface with the Encompass Reader firmware.
❑	Pull communications, coaxial, and power cables through outdoor-grade conduit.
❑	Ensure that construction work required for mounting the equipment is completed.
❑	Ensure that 120V AC service is available.

You will need to determine if TDM is required in your installation. If TDM is required, then you may need to wire the installation for TDM configuration. Chapter 9 contains detailed TDM information. You can also use a GPS option if hardwiring is not an option. See Appendix D for more information on the GPS timing assembly option.

Components Checklist

Ensure you have the following components available for the installation:

❑	Encompass Reader(s)
❑	One AA3152 Universal Toll Antenna (UTA) for each lane
❑	All optional equipment to the basic Encompass Reader. Appendix D lists the optional equipment that can be used with the Encompass Reader.

Task Checklist

The following checklist summarizes the installation procedure. Instructions for each task are provided in the “Mounting the Encompass Reader” section in Chapter 3.

❑	Install Encompass Reader (and any options).
❑	Connect power cable from power supply to Encompass Reader.
❑	Install UTA(s) and connect them to Encompass Reader.

Where to Mount the Components

The location for mounting the components is designated in the site installation plan. Many AVI site layouts are similar.

The Encompass Reader can be installed in a housing along with the host computer or lane controller, or the Encompass Reader can be installed in an optional NEMA enclosure.

Overhead Gantry Mount

For an overhead gantry mount, the Encompass Reader is installed with the host computer or lane controller, or the Encompass Reader can be installed in an optional NEMA enclosure. The UTA may be attached to a 2- to 3-inch (5.0- to 7.6-cm) diameter pipe that is supported from a gantry that spans the lanes. These components are mounted approximately 15 to 18 feet (4.5 to 5.5 m) above the road surface. Figure 2-1 illustrates a typical overhead gantry mount.

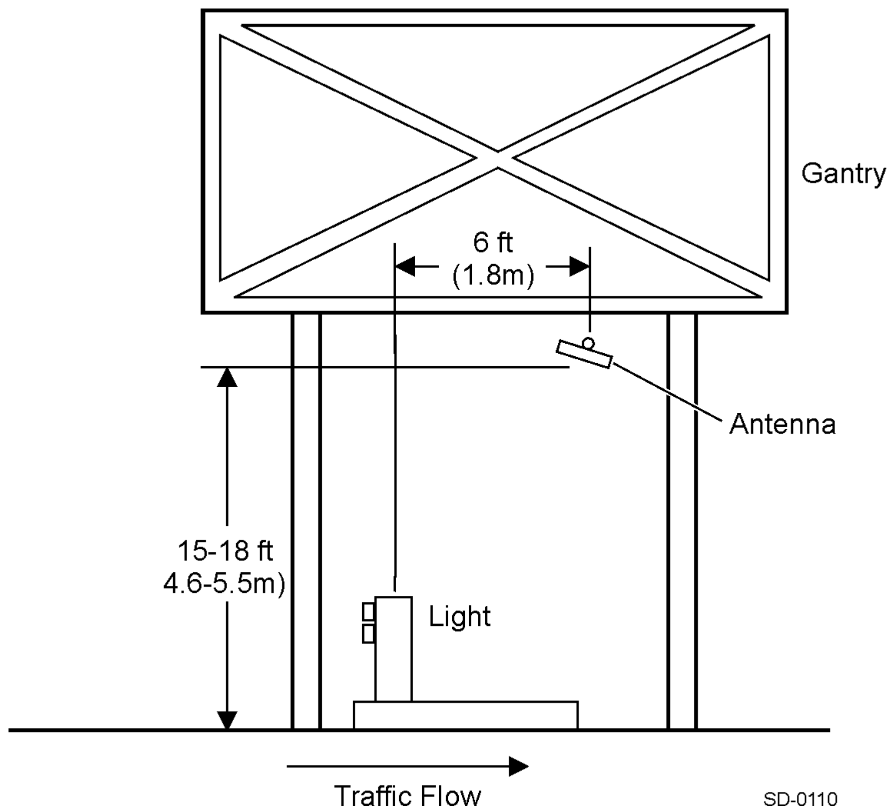

Figure 2-1 Overhead Gantry Mount

Overpass Mount

For the overpass mount, the Encompass Reader is installed with the host computer or lane controller, or the Encompass Reader can be installed in an optional NEMA enclosure. The UTA is attached to a 2- to 3-inch (5.0- to 7.6-cm) diameter pipe that is supported from an overpass. The UTA is centered over the traffic lane and is mounted approximately 15 to 18 feet (4.5 to 5.5 m) above the road surface. Figure 2-2 illustrates a typical overpass mount.

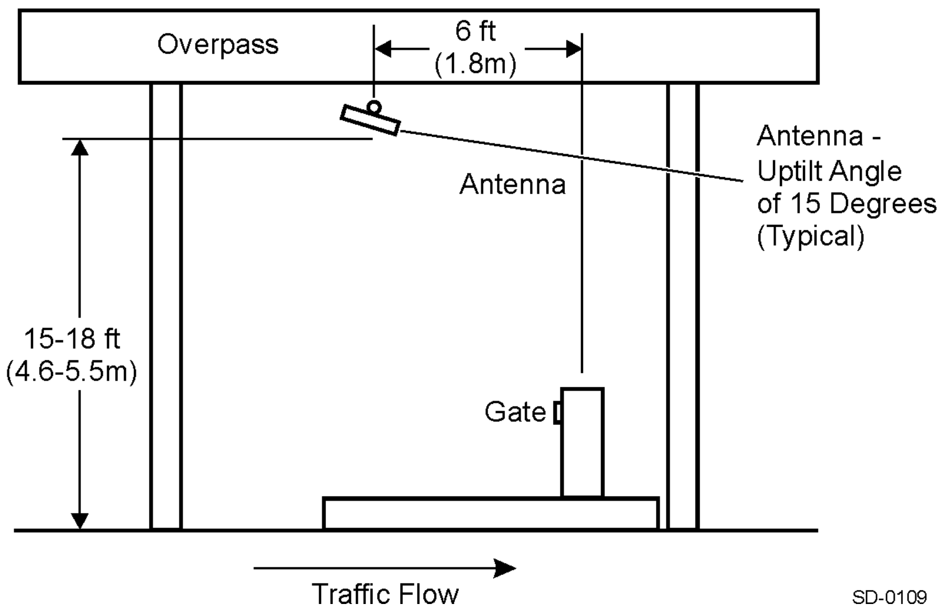

Figure 2-2 Overpass Mount

Cantilever Arm Mount

For the cantilever arm mount, the Encompass Reader is installed with the host computer or lane controller, or the Encompass Reader can be installed in an optional NEMA enclosure. The UTA is attached to a 2- to 3-inch (5.0- to 7.6-cm) diameter pipe at the end of the cantilever arm. The UTA is centered over the traffic lane and is mounted approximately 15 to 18 feet (4.5 to 5.5 m) above the road surface. Figure 2-3 illustrates a typical laneside cantilever arm mount with an antenna.

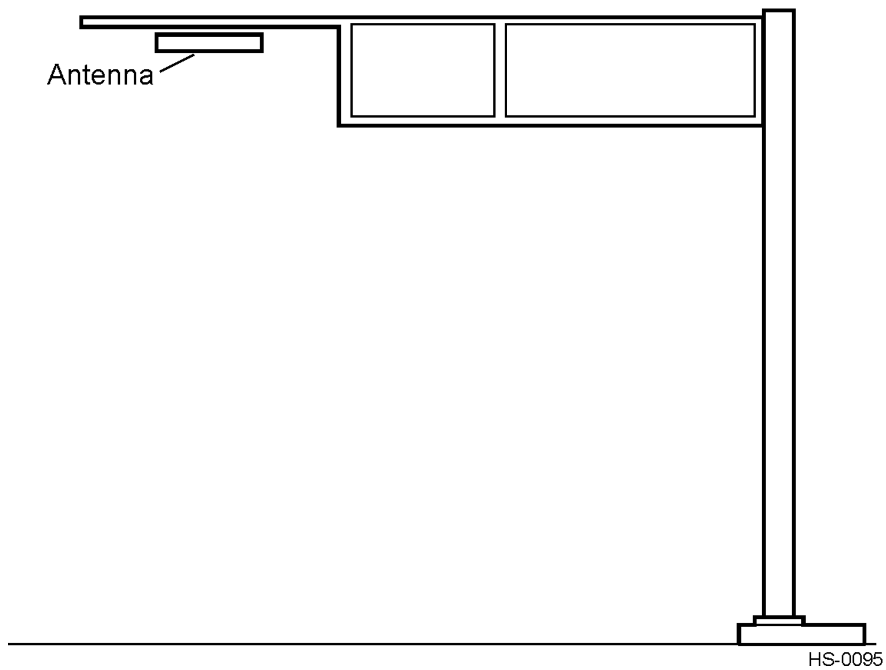

Figure 2-3 Cantilever Arm Mount

Open Road Tolling Gantry

For typical ORT gantry installations, the Encompass Reader may be installed in a laneside equipment cabinet, with the lane controller or in an optional NEMA enclosure. The UTA is attached to a 2- to 3-inch (5.0- to 7.6-cm) diameter pipe mounted approximately 15 to 18 feet (4.5 to 5.5 m) above the road surface. For ORT applications, one set of UTAs may be centered over the lane and a second set of UTAs may be centered over the stripes dividing the lanes (Figure 2-4). This configuration ensures that vehicle traffic, traveling inside and outside the lanes, is covered by the UTAs.

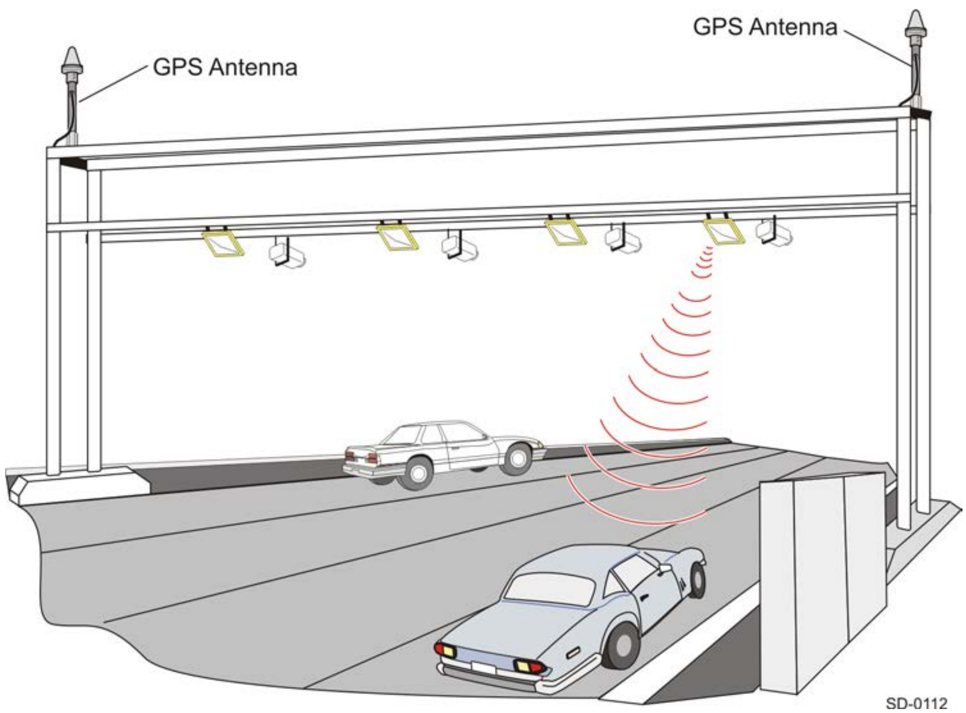

Figure 2-4 ORT Gantry Mount

3

Installing the Encompass Reader

Chapter 3

Installing the Encompass Reader

This chapter describes the Encompass® Reader system and provides instructions for installing the Encompass Reader system.

Encompass Reader Components

TransCore's Encompass Reader is an integrated, multiprotocol 915-MHz radio frequency identification (RFID) reader system that includes an RF transceiver board and processor in a single assembly.

The Encompass Reader is suitable for a wide variety of automatic vehicle identification applications, including airport ground transportation management systems, parking, secure access, and rail applications.

The Encompass Reader can be installed in a cabinet with a host computer or onsite lane controller, or alone in a NEMA enclosure.

The Encompass Reader transmits and receives signals through a single antenna.

The Encompass Reader is capable of reading tags of any of the following protocols in a given installation:

- Super eGo®[1] (SeGo)
- eGo
- TransCore IT2200
- California Title 21
- American Trucking Associations (ATA), full-frame and half-frame
- Interagency Group (IAG)
- ASTM Version 6 (CVISN application)

Caution

Where multiple tag protocols are used in the same installation, an Encompass Reader operating in Mode 88 is capable of reading any combination of the protocols; however, to read more than two protocols ensure that you are using an Encompass 6 Reader platform.

---

1. eGo tags are fully compliant with ANSI INCITS 256:2001 and ISO 18000-6 standards. SeGo is a superset of the eGo protocol.

Encompass Reader Features

The following sections describe the Encompass Reader features and list the specifications for the external connections and performance indicators located in the Encompass Reader housing.

External Device Connectors

This section lists the Encompass Reader connectors. Figure 3-1 shows the Encompass Reader connector and indicator locations.

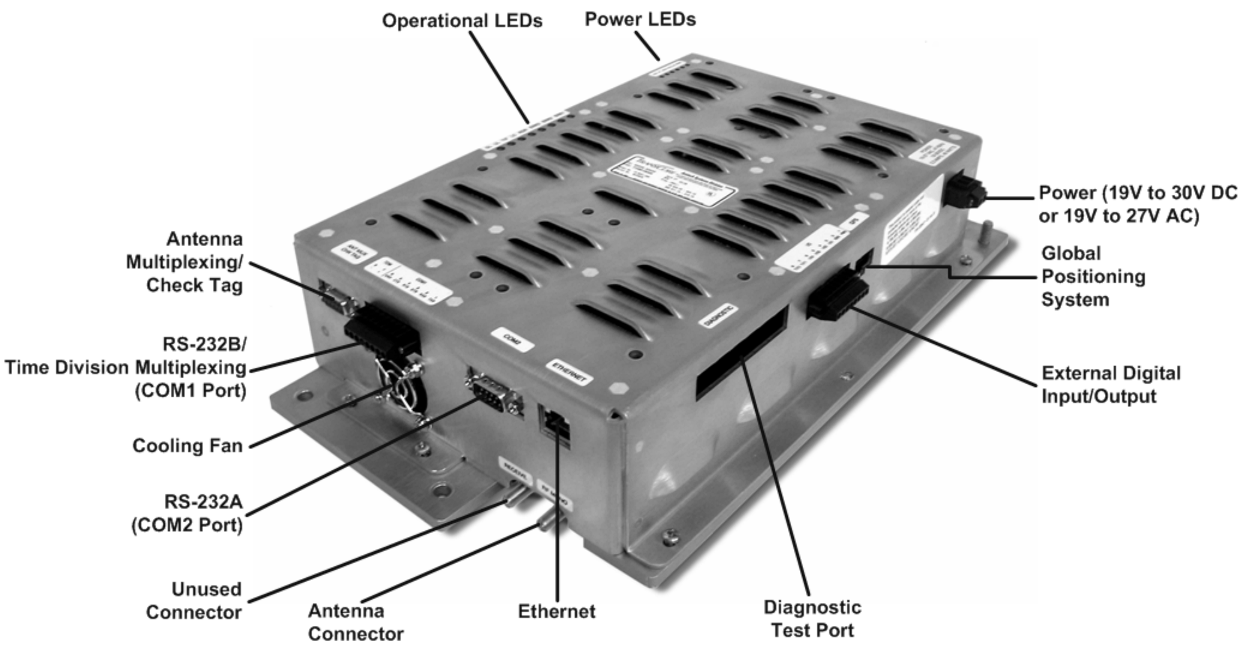

Figure 3-1 Connector and LED Locations on the Encompass Reader

Power Supply

The Encompass Reader requires 19V DC to 30V DC or 19V AC to 27V AC RMS power supply. Table 3-1 lists the external power connector specifications.TransCore offers a Class B transformer accessory kit (part number 76-6000-001) for sites where either 110V AC or 220V AC is available. Accessory kit information is shown in Table 3-2

Table 3-1 Encompass Reader External Power Connector Specifications

Connector Type	Two-Pin Terminal Block TransCore P/N 33356-01 (1 each) and P/N 33358-01 (2 each)

Table 3-1 Encompass Reader External Power Connector Specifications

Wire Gauge	12 – 22 AWG **Note** Installer must consider the wire resistance versus overall length with respect to the Encompass Reader's specified voltage range
Input Supply Voltage	19V to 30V DC 19V to 27V AC RMS **Note** See Figure 3-2 for AC power source wiring and Figure 3-3 for DC power source wiring.
Input Power	DC or AC: 40 watts maximum
In-Rush Current	8 amps maximum, ≤25 milliseconds
Polarity	Power supply is polarity independent

Selecting a Power Supply

You should consider the following factors when selecting a power supply.

- Input voltage: 19V to 30V DC, or 19V to 27V AC RMS @47 to 63 Hz (see Table 3-1 for additional power requirements.)
- Operating temperature of the power supply and the power cable
- Power cord gauge and length. TransCore recommends that you use 12 to 22 AWG cable for the power cord.

Table 3-2 Encompass 5 Power Supply Accessory Kit

Part Number	Description
76-6000-001	**110V AC or 220V AC to 24 V AC Class B transformer**

CAUTION

CAUTION

Wire gauge depends on wire resistance versus overall wire length with respect to the Encompass Reader's specified voltage range and power rating.

Connecting the Encompass Reader to Power Supply

TransCore strongly recommends that you connect the Encompass reader to the power supply as shown in Figure 3-2 and Figure 3-3.

CAUTION

Caution

Loosen mounting screws on power supply connector before removing plug.

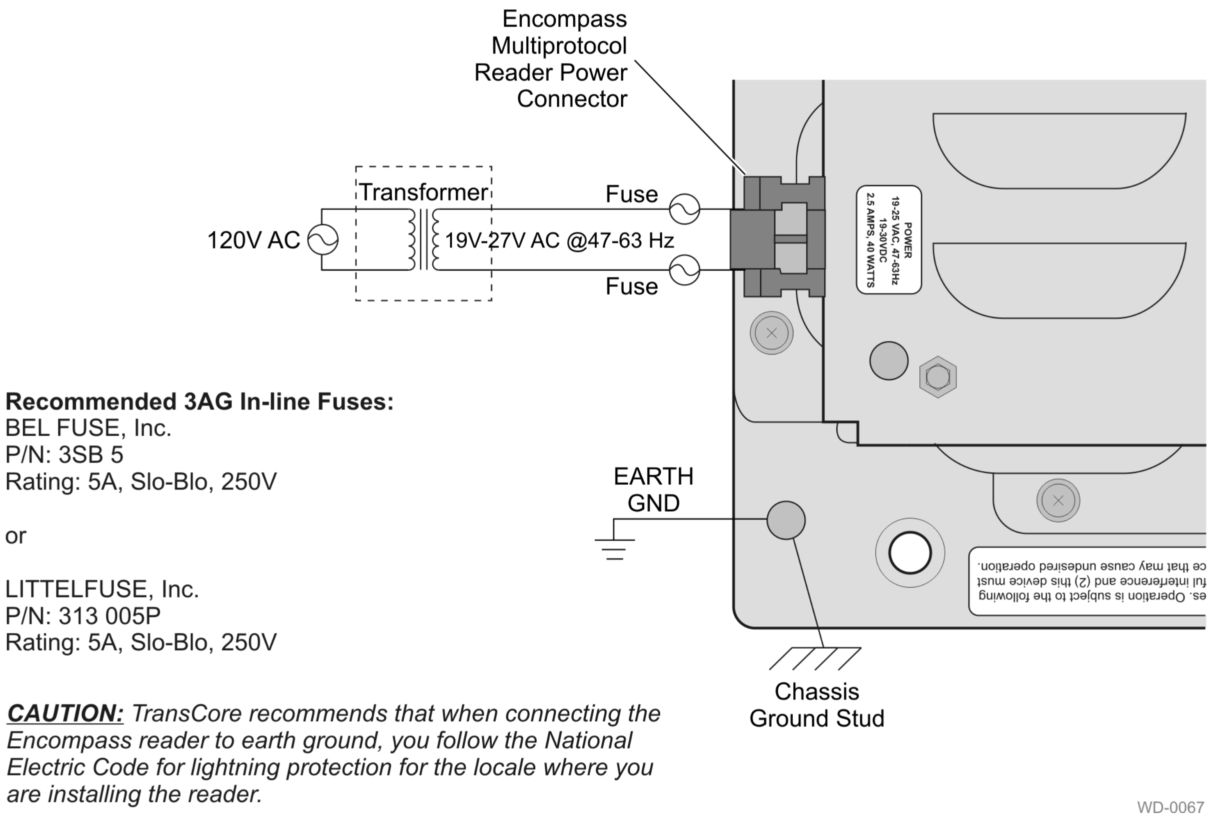

Figure 3-2 Encompass Reader Power Supply Wiring Using AC Power

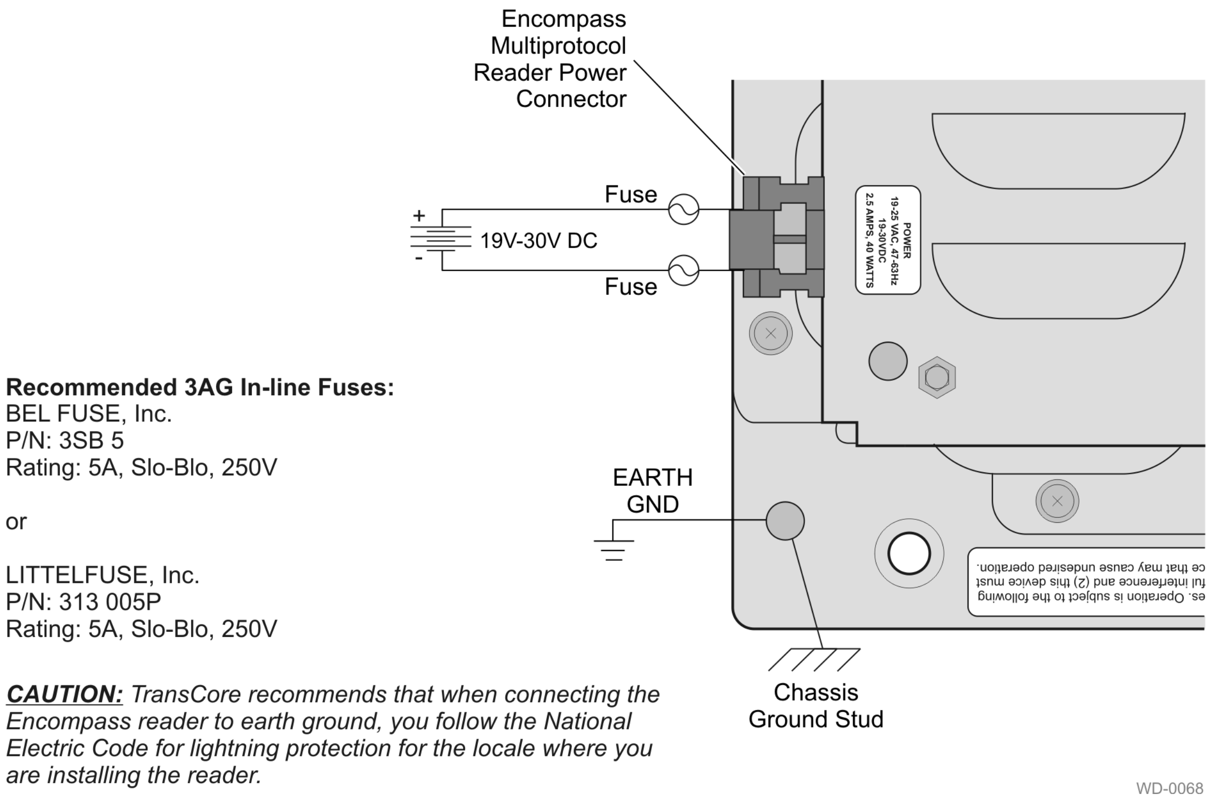

Figure 3-3 Encompass Reader Power Supply Wiring Using DC Power

Power Indicators

Once the Encompass Reader has been powered up, the Power Supply LEDs light. Figure 3-4 shows the Power LEDs.

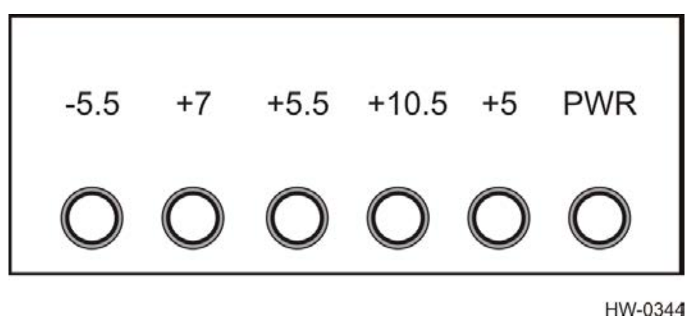

Figure 3-4 Power LEDs

Table 3-3 lists the Power LED information.

Table 3-3 Power LED Descriptions

LED	Indicator
PWR	19V to 27V AC RMS, 47 to 63 Hz; or 19V to 30V DC power supplied
-5.5	-5.5-volt power supply functioning
+7	+7-volt power supply functioning
+5.5	+5.5-volt power supply functioning
+10.5	+10.5-volt power supply functioning
+5	+5-volt power supply functioning

Connecting to Antenna

Connect the Encompass Reader to an AA3152 Universal Toll Antenna (UTA) using the single low-loss coaxial cable. Figure 3-5 shows the antenna connectors on the Encompass Reader enclosure. For a single-antenna installation, where the transmit and receive data is communicated over a single cable, use the connector labeled RF MONO.

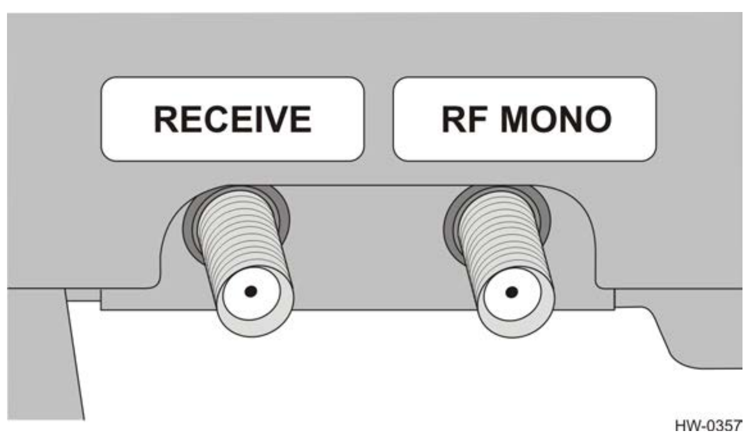

Figure 3-5 Antenna Connector Locations

Note: *The RECEIVE connector is used for bistatic configuration (separate transmit and receive antennas) only.*

Table 3-4 lists the RF antenna connector parameters.

Table 3-4 RF Antenna Connector Specifications

Connector Type	SMA receptacle

Table 3-4 RF Antenna Connector Specifications

Output Power	Up to 2 watts

Connecting to Host Computer

Depending on whether you choose UDP or AI1200-emulation commands to operate the Encompass Reader, you can communicate with the host computer via the Ethernet or COM1 (RS–232) port.

For UDP operation, the Encompass Reader communicates with the host computer via the Ethernet port. A single Encompass Reader can be connected directly to a single host, which is known as point-to-point connection. Multiple Encompass Readers also can be connected to a single host on a private local area network, or LAN.

In a multiple reader-to-host configuration, TransCore recommends that the setup has a dedicated network interface card (NIC) on the host that is then connected to an Ethernet switch into which **only** the Encompass Readers are connected.

Note: *Do not connect any other device to that switch.*

In this configuration the host would have another NIC that is connected to the main network infrastructure to interact with the remainder of the toll system components.

The Ethernet switch should support 100 Mb/s full duplex operation to be fully compatible with the Encompass Reader.

Ethernet Connector for UDP Communication

The Encompass Reader communicates with a host via an Ethernet communications protocol. This connection requires an RJ–45 connector. If you connect the Encompass Reader directly to a host personal computer (PC) then you need a crossover cable. TransCore recommends that you use Belden 7929A Category 5e twisted-pair cable for Ethernet connections. Table 3-5 lists the Ethernet connector pin assignments.

Table 3-5 Ethernet Connector

Pin	Signal	Description	568A[a]	568B[a]
1	TX+	Output Differential Transmit Data (+)	White w/ green stripe	White w/ orange stripe
2	TX-	Output Differential Transmit Data (-)	Green w/ white stripe or solid green	Orange w/ white stripe or solid orange
3	RX+	Input Differential Receive Data (+)	White w/ orange stripe	White w/ green stripe
4	Not connected	N/A	Blue w/ white stripe or solid blue	Blue w/ white stripe or solid blue
5	Not connected	N/A	White w/ blue stripe	White w/ blue stripe

Table 3-5 Ethernet Connector (continued)

6	RX-	Input Differential Receive Data (-)	Orange w/ white stripe or solid orange	Green w/ white stripe or solid green
7	Not connected	N/A	White w/ brown stripe or solid brown	White w/ brown stripe
8	Not connected	N/A	Brown w/ white stripe or solid brown	Brown w/ white stripe or solid brown

a. 568A and 568B are Ethernet cable designations.

RS–232 Connector for AI1200-Emulation Communication

Wire the host computer to the Encompass Reader using the COM1 (RS–232B)/time-division multiplexing (TDM) connector (Figure 3-6). This connector is an 8-pin terminal block header (TransCore P/N 33357-01).

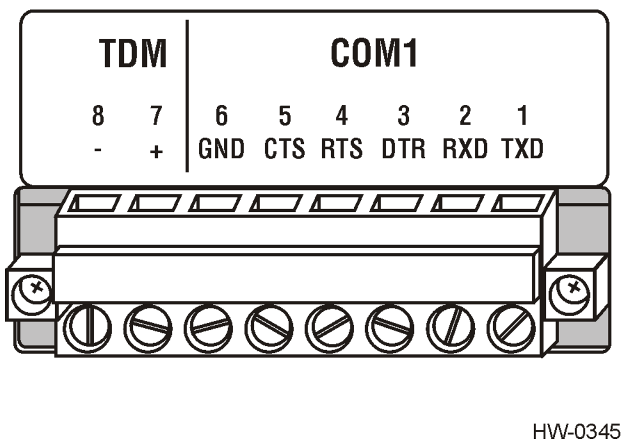

Figure 3-6 COM1 (RS–232B)/TDM Connector

Table 3-6 lists the RS–232B portion connector specifications.

Table 3-6 COM1 (RS–232) Connector Specifications

Connector Type	9-pin D-subminiature, right angle plug
Protocol	RS–232
Baud	Default is 9600 bps. (Baud rate is selectable, see command #100N in Chapter 7.)
Bits	8
Parity	None
Stop Bits	1

Table 3-6 COM1 (RS–232) Connector Specifications (continued)

Flow Control	Default is no flow control. (Flow control is selectable, see command #614N in Chapter 7.)
End of Line Delay	0 milliseconds

Table 3-7 lists the signal descriptions for the RS–232B/TDM connector.

Table 3-7 TDM/COM1 Connector Parameters

Pin	Signal	Description	DB-9 Socket Connector
1	TXD	Transmit Data	2
2	RXD	Receive Data	3
3	DTR	Data Terminal Ready (not connected)	4
4	RTS	Request to Send	7
5	CTS	Clear to Send	8
6	GND	Ground	5
7	TDM+	TDM positive signal	-
8	TDM-	TDM negative signal	-

Time-Division Multiplexing

At installations where cross-lane interference can occur and frequency management is not sufficient to solve the problem, you may need to use TDM. By using the TDM function in the Encompass readers, the readers operate only during interleaved time periods.

Note: *In sites where installing TDM cabling is not an option, you can use the global positioning system (GPS) timing alternative. See Appendix D, "Encompass Reader Options," for more information.*

The Encompass Reader can support multiple lanes using TDM cabling. This connection provides a synchronization interface between readers where RF interference between readers is reduced by multiplexing the RF reader transmission to independent time slots. Allowing each reader or group of readers to operate at an allotted time eliminates interference from readers in adjacent lanes.

Although you need to configure the readers to operate using TDM, the interface connection for TDM can be provided to all the readers in a plaza before or during installation by connecting a pair of wires to the TDM connector of each reader as shown in Figure 3-7. An RS-485 terminator board (TransCore P/N 06636-01) should be used on each end of the TDM chain. The termination resistor used depends on the characteristic impedance of the cable being used. You need to follow the polarity conventions as shown because this interface is polarity dependent.

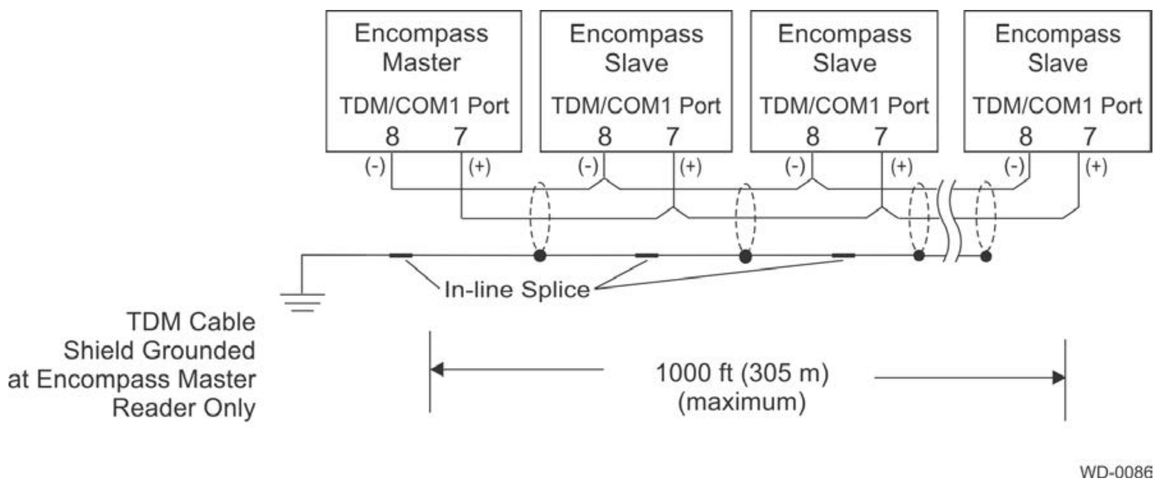

Figure 3-7 TDM Configuration Example

TransCore recommends Belden 89182 (150 Ω impedance), which is a single twisted-pair shielded cable rated for outdoor use, or 8132 (120 Ω impedance), which is a double twisted-pair shielded cable that must be installed in conduit. The Belden 8132 cable has an extra pair that is not used. Using these low-loss, low-capacitance twisted-pair cable, a distance of 1000 feet (305 m) has been obtained. Cables with lower capacitance can be used to run the TDM cables for longer distances while maintaining signal integrity. This maximum distance may be slightly longer or shorter depending on the cable used.

Because the TDM signals are based on RS–485 signals, you can extend the length of the TDM bus by using RS–485 repeaters or by using fiber with converters. The standard TDM interconnect is provided via an 8-pin terminal block header RS–232 connector (Figure 3-8).

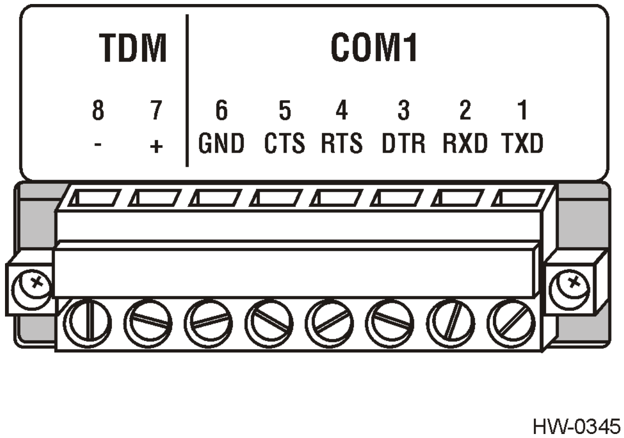

Figure 3-8 TDM/COM1 Connector on Encompass Reader

Refer to Table 3-7 for signal descriptions.

Connecting to Additional System Components

RF Antenna Multiplexer/Check Tag Connector

The Encompass Reader digital board controls the optional antenna multiplexer, which can support up to four separate read zones by switching between antennas. This connector also drives the optional check tag. The digital board connector is a D-subminiature, 9-socket receptacle. These options are described in detail in Appendix D, “Encompass Reader Options.”

Diagnostic Communications Connector (COM2)

The Encompass Reader communicates diagnostic data via a serial communications protocol (Table 3-8). The diagnostic port can be used to display the operating system boot sequence, diagnostic, and error messages. By using the version command (“Diagnostic Commands” on page 10-8), you can display data about the configuration of the Encompass Reader including its Internet Protocol (IP) address. Refer to “Communicating Via Diagnostic Port (COM2)” on page 10-4 for complete diagnostic information

Table 3-8 RS–232 Connector Specifications

Connector Type	9-pin D-subminiature plug
Protocol	RS–232
Baud	9600
Bits	8
Parity	None

Table 3-8 RS–232 Connector Specifications (continued)

Stop Bits	1
Flow Control	None

Note: *If you connect the Encompass Reader COM2 port directly to a PC's serial port, you must use a null-modem serial cable or adapter.*

Diagnostic Test Port Connector

The Diagnostic Test Port Connector is a 40-pin card-edge connector that should be accessed by TransCore factory-trained personnel only.

External Digital Input/Output Connector

The External Digital Input/Output Assembly is used to interface the Encompass Reader with external inputs and outputs. Inputs can be devices such as light curtains or loops, and outputs can be devices such as gates or lights. (Connector is TransCore P/N 33357-01). This option is described in detail in Appendix D, "Encompass Reader Options."

Global Positioning System Connector

The Global Positioning System (GPS) timing option is used when traditional TDM cabling linking readers is not feasible. This option is described in detail in Appendix D, "Encompass Reader Options."

Installing the Reader System Components

This section contains instructions for installing each component of the reader system. You will need the following tools to install the system.

- Standard tools, such as Phillips and slotted screwdrivers, and wrenches
- Hydraulic lift or ladder for installing antennas
- Torque wrench for securing antenna connections
- Inclinometer or angle finder for measuring antenna angles
- Multimeter, Fluke 87 or equivalent for measuring electrical signals

Note: *Chapter 9, "Configuring the Lane," lists additional equipment required for configuring lanes to optimize system performance.*

Mounting the Encompass Reader

The Encompass Reader can be mounted in a cabinet or rack, or in an optional NEMA enclosure. This option is described in detail in Appendix D, “Encompass Reader Options.”

TransCore recommends that when you mount the Encompass Reader in a cabinet, rack, or NEMA enclosure, you ensure the fan is at the bottom (Figure 3-9). Mounting the Encompass Reader this way permits the fan to pull cooler air up through the Encompass Reader enclosure. Figure 3-9 shows an Encompass Reader mounted in a NEMA enclosure that has a cable gland, or pass-through, already installed. TransCore offers a NEMA enclosure without the cable gland for custom installations.

Figure 3-9 Encompass Reader Mounted in a NEMA Enclosure

Mounting the AA3152 UTA in an Overhead Location

For most overhead installations, the UTA is mounted on a 2- to 3-inch (5.0- to 7.6-cm) diameter pipe to accommodate various angles for lane configuring. TransCore provides a mounting kit that includes the following hardware:

- Antenna
- Two U-bolts with hex nuts
- Two brackets
- Spacers
- Lock washers
- Fender washers (may not be included in your accessory kit)
- One 1.0-inch (2.5 cm) length of 1.1-inch (2.8-cm) diameter heat-shrink tubing

Figure 3-10 shows the standard way to mount and connect a UTA.

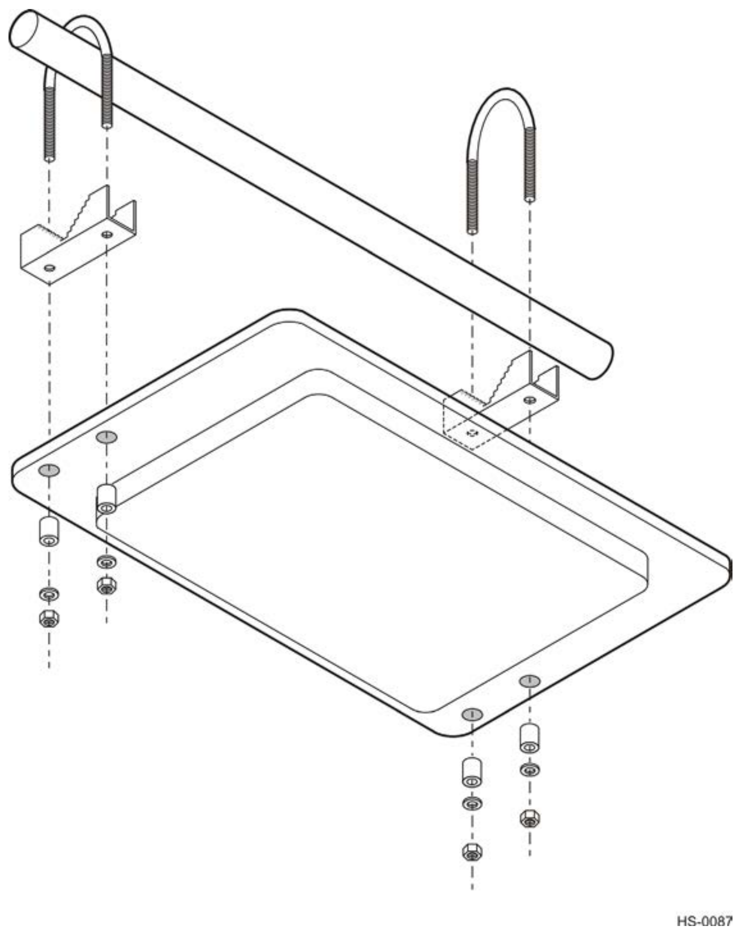

Figure 3-10 AA3152 UTA Mounting and Connections

Caution

When installing the UTA use only the mounting hardware provided. Do not use oversized washers to secure the plastic radome to the bracket. This practice can weaken the radome material.

To install the UTA

1. Place the UTA below the mounting pipe and insert a U-bolt around the pole and down through the bracket on the side of the antenna closest to the center of the lane. This antenna should be mounted toward the driver side of the traffic lane. Place a spacer, lock washer, and nut over each end of the U-bolt, but do not tighten the nuts. Repeat for the other U-bolt.
2. Rotate the antenna up and toward oncoming traffic. Rotate up 15° from horizontal for a lane. Use an inclinometer or angle finder to check the angle.
3. Tighten nuts with a torque wrench to 50 ft-lb (68 N-m).

4. Slide the shrink tubing over the coaxial cable, but do not heat it.
5. Connect the coaxial cable to the antenna and to the appropriate connector on the Encompass Reader. Leave the shrink tubing loose until you have finished configuring the lane.

Starting the Encompass Reader

Once the system components are in place, you need to connect them to the Encompass Reader, and power up and start the Encompass Reader.

To start the Encompass Reader

1. Connect coaxial cable from UTA to RF MONO port on Encompass Reader.
2. Connect host PC or lane controller to Encompass Reader using either the Ethernet UDP communications port (see Table 3-5) or COM1 serial communications port (pins 1 through 6) (see Table 3-7)
3. If using TDM to operate multiple lanes with Encompass Reader, connect TDM cable to pins 7 and 8 of the COM1 port on Encompass Reader.
4. Connect other options as required. See Appendix D, “Encompass Reader Options” for detailed installation and operation information.
5. Connect the Encompass Reader to 19V to 30V DC or 19V to 27V AC RMS @47-63 Hz power supply. See Figure 3-2 and Figure 3-3 for recommended wiring directions.

   The Power Supply LEDs light and remain lit when the Encompass Reader is powered up. Eight other indicator LEDs light to show processes (Table 3-9).

Table 3-9 Operational LED Indicator Descriptions #$#

Operational LED			Description
Three fault indication LEDs			
ERR3	**ERR2**	**ERR1**	**Failure Mode**
Off	Off	Off	No failure
Off	Off	On	Data in buffer
Off	On	Off	Other failures
Off	On	On	No communication with lane controller/host system
On	Off	Off	TDM/GPS failure
On	Off	On	Transceiver failure

Table 3-9 Operational LED Indicator Descriptions (continued)#$#

Operational LED			Description
On	On	Off	Power supply failure
On	On	On	Microprocessor resetting
RDR			Encompass Reader communicating with host
LC			Host communicating with Encompass Reader
TIF			Encompass Reader is transacting with tag. LED lit when Encompass Reader receives correctly decoded tag message including correct CRC for message. The LED is lit for 250 ms following a tag transaction.
UL			RF uplink signal on
DL			RF downlink signal on

Resetting the Encompass Reader

If you need to restart the Encompass Reader, the only information that is maintained by the reader is the reader IP address, buffered tag data, and error logs. All other information must be resent or reconfigured before the Encompass Reader can be operated again. See Chapter 10 for more information on reconfiguring and restarting the reader.

4

General Software Information

Chapter 4

General Software Information

This chapter provides user datagram protocol (UDP) and AI1200-emulation software-related information for the Encompass® Reader.

Software Information

This chapter presents various software-related topics arranged in alphabetical order by subject. In addition to this chapter, see Chapter 5, “Communications Protocols,” Chapter 6, “Configuring and Operating the Encompass Reader Using UDP Commands,” and Chapter 7, “Configuring and Operating the Encompass Reader Using AI1200-Emulation Commands,” for more information.

The Encompass Reader can operate using UDP commands or TransCore AI1200-emulation commands. This chapter presents UDP command information first followed by AI1200-emulation command information.

UDP Command Entry and Response Conventions

The Encompass Reader implements UDP command requests, data acknowledgements, command responses, asynchronous responses, and unsolicited status messages as required for configuration and operation. The messages are listed in Table 4-1.

Table 4-1 UDP Command Messages

Message	Description
Command request	The host initiates and uses these messages to request the Encompass Reader to perform specific actions.
Data acknowledge	The Encompass Reader initiates and uses these messages to signal the reception of command request messages received from the host. Additionally, the host initiates and uses data acknowledge messages to signal the receipt of command response, asynchronous response, and unsolicited status messages from the Encompass Reader.
Command response	The Encompass Reader initiates these messages in response to specific command request messages received from the host.
Asynchronous response	The Encompass Reader optionally initiates these messages in response to specific command request messages received from the host.
Unsolicited status	The Encompass Reader initiates and uses these messages to inform the host about specific error conditions in the Encompass Reader.

Note: Throughout this chapter, host or host system refers to a host personal computer (PC) or lane controller.

System Startup Controls

On system startup or reset following a 20-second boot time, the Encompass Reader sends the Diagnostic Status Change Error Report (unsolicited status message format) to inform the host of the Encompass Reader startup status. The host and the Encompass Reader use the software communication system startup controls defined in this section:

On receiving the Diagnostic Status Change Error Report from the Encompass Reader, the host sends the appropriate data acknowledge message to the Encompass Reader.

From this time forward, the host optionally can send the Get Diagnostic Status command request message to get the current diagnostic status information from the Encompass Reader.

The Encompass Reader sends, according to the data acknowledge time-out period, the Diagnostic Status Change Error Report until the data acknowledge message is received, or the retransmit count is exhausted. Figure 4-1 shows the Encompass Reader startup control details.

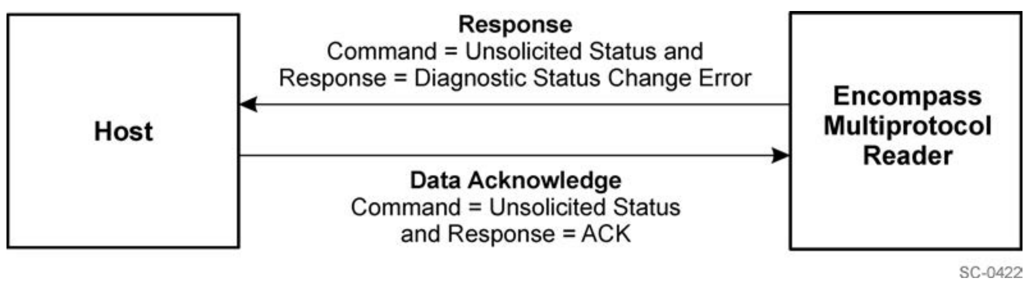

Figure 4-1 Encompass Reader Startup Controls

Sequence Number Controls

The Encompass Reader implements message sequence numbers (MSN) and command sequence numbers (CSN) in all of the message types (e.g., command request, data acknowledge, command response, asynchronous response, and unsolicited status). All transmitted messages, except for the data acknowledge message, increment the MSN and CSN. The host and the Encompass Reader must implement independent transmit and receive counters for both the MSNs and the CSNs. The transmit counters are used in generating the transmitted messages, and the receive counters are used in the received message out-of-sequence error checking. An out-of-sequence error indicates that a message was missed.

Note: CSNs are checked and generated by the reader for the System Interface Command Group only. For all other command groups the reader ignores host-generated CSNs, and the reader does not implement CSNs on any reader-generated *message. The host should ignore CSNs on all messages from the reader for all command groups except for the System Interface Command Group.*

With the exception of received data acknowledge messages, the Encompass Reader performs automatic MSN and CSN resynchronizations on all received messages that are out-of-sequence. Upon receiving an out-of-sequence MSN, the Encompass Reader sets the receive MSN counter to the out-of-sequence MSN plus one. Similarly, upon receiving an out-of-sequence CSN, the Encompass Reader sets the receive CSN counter to the out-of-sequence CSN plus one.

The host MSNs independently track the number of messages sent to the Encompass Reader and the Encompass Reader MSNs independently track the number of messages sent to the host. These MSNs are used on the receiving end to determine if a message has been missed.

The host CSNs for each command group independently track the number of command request messages sent to the Encompass Reader. The Encompass Reader CSNs for each command group independently track the number of command response, asynchronous response, and unsolicited status messages sent to the host. These CSNs are used on the receiving end to determine if the appropriate message as specified above has been missed.

The host and the Encompass Reader use software communication sequence number controls as defined in the following paragraphs.

The Encompass Reader sends data acknowledge, command response, asynchronous response, and unsolicited status messages to the host with MSNs starting at zero and incremented by one for each message sent, except for the data acknowledge message. Additionally, the CSNs for each command group start at zero and are incremented by one for each command response, asynchronous response, and unsolicited status message sent. Figure 4-2 and Figure 4-3 provide details on the sequence number controls.

The host receives data acknowledge, command response, asynchronous response, and unsolicited status messages from the Encompass Reader and checks that the MSNs and CSNs are correct for all received message types except for the data acknowledge message.

The Encompass Reader receives command request messages and data acknowledge messages from the host and checks that the MSNs and CSNs are correct for all command request messages received. The Encompass Reader performs automatic MSN and CSN resynchronizations on all received command request messages that are out-of-sequence. Currently, the CSN resynchronizations are not fully supported.

If the Encompass Reader detects either a message sequence error or command sequence error, the Encompass Reader sends the appropriate error message to the host. The error message contains the expected (EXP) and received (RX) sequence numbers and then continues processing the received message. Currently the message sequence error and command sequence error messages are not fully supported.

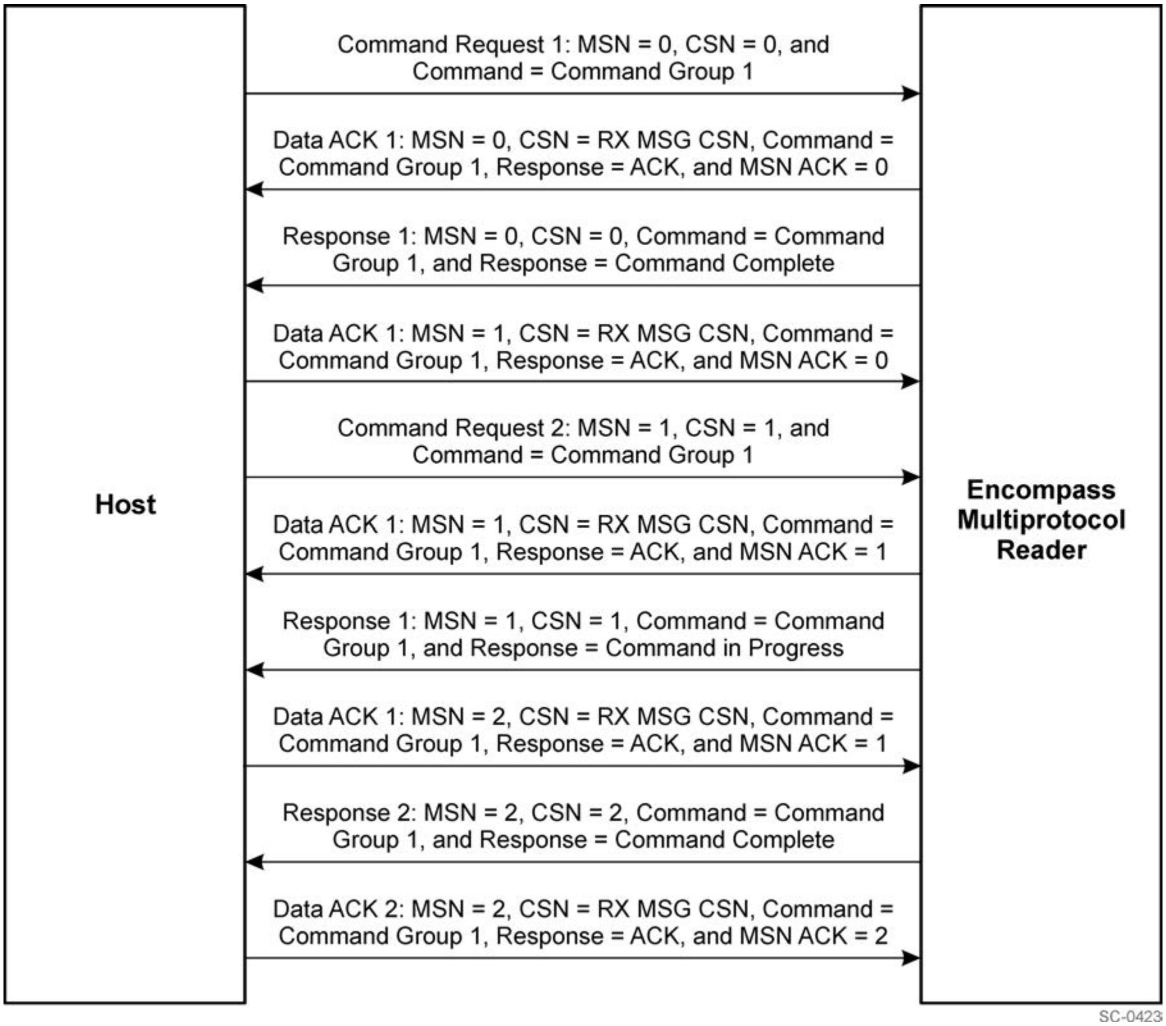

Figure 4-2 Encompass Reader Sequence Number Controls

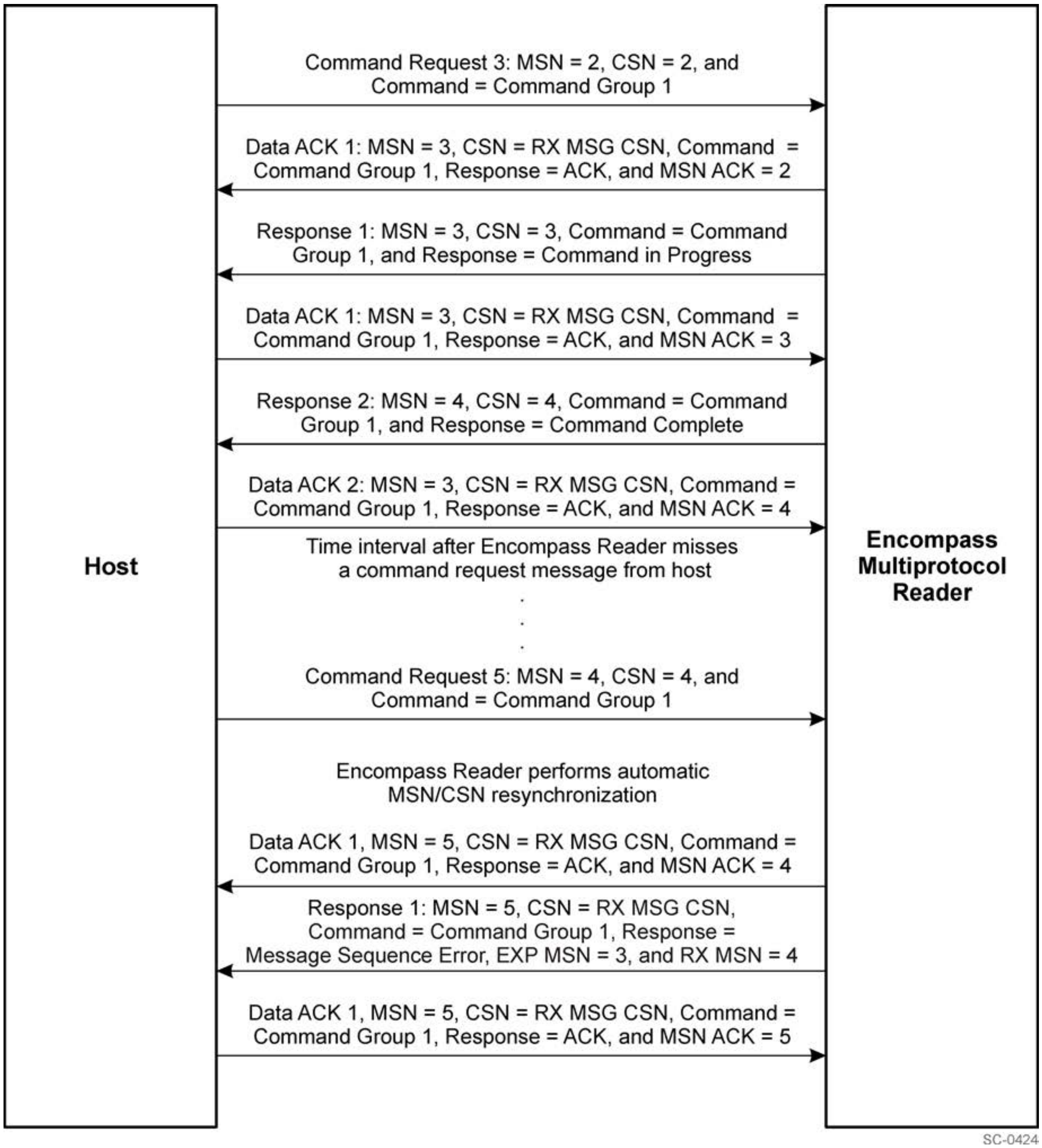

Figure 4-3 Encompass Reader Sequence Number Controls (cont'd.)

Data Acknowledge Controls

The Encompass Reader initiates and uses data acknowledge messages to signal the reception of command request messages received from the host. Additionally, the host initiates and uses data acknowledge messages to signal the receipt of command response, asynchronous response, and unsolicited status messages from the Encompass Reader.

After receiving command request messages from the host, the Encompass Reader sends data acknowledge, command response, asynchronous response, and unsolicited status messages to the host.

After receiving command response, asynchronous response, and unsolicited status messages from the Encompass Reader, the host sends data acknowledge messages to the Encompass Reader.

Use of Data Acknowledge Controls by Host and Encompass Reader

The host and the Encompass Reader use software communication data acknowledge controls as defined here.

- The host sends command request messages to the Encompass Reader.
- The host receives data acknowledge messages, or a data acknowledge time-out occurs for each command request message sent to the Encompass Reader.
- The host receives command response, asynchronous response, and unsolicited status messages from the Encompass Reader, and sends data acknowledge messages for these message types.
- The Encompass Reader receives command request messages from the host and sends data acknowledge, command response, asynchronous response, and unsolicited status messages to the host.
- The Encompass Reader receives data acknowledge messages, or a data acknowledge time-out occurs for each command response, asynchronous response, and unsolicited status messages sent to the host.

For more details on the Encompass Reader Data Acknowledge Controls, see Figure 4-4.

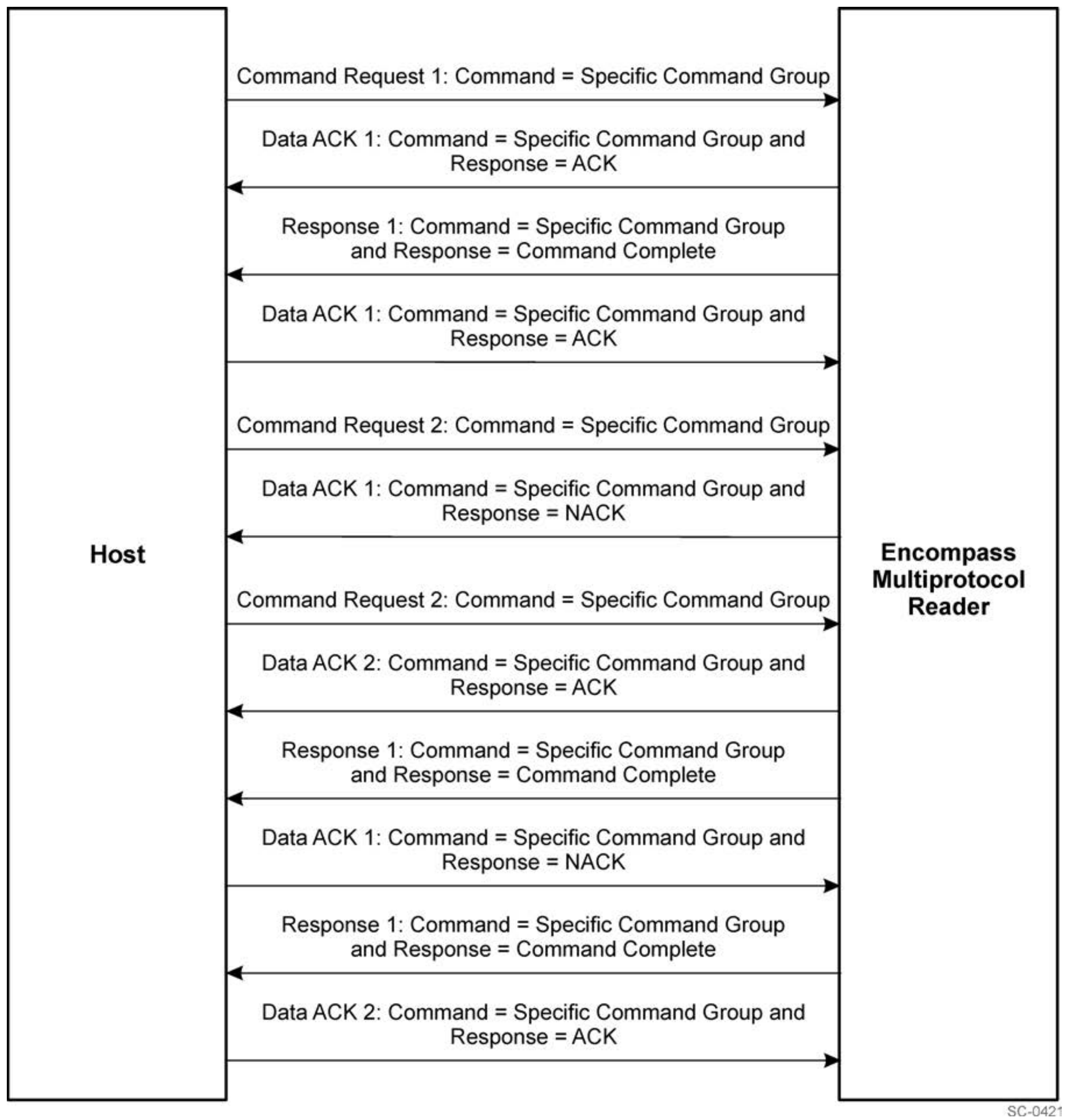

Figure 4-4 Encompass Reader Data Acknowledge Controls

AI1200-Emulation Command Entry Conventions

All AI1200-emulation commands are preceded by the start-of-message character (#). The end-of-message sequence expected from the host is a carriage return (CR). The Encompass Reader terminates messages with a return and a line-feed (CR/LF). For example, the command #01 SWITCH TO COMMAND MODE is typed as follows:

```
#01<ENTER>
```

where <ENTER> is the Enter or Return key.

Some command characters may be represented by the letter N. This letter indicates you are to supply a value. Maximum valid entries are the numbers 0 through 9 and the uppercase letters A through F. These letters allow for as many as 16 available user responses and are based on the hexadecimal numbering system.

Commands have at least two characters following the # character. Table 4-2 lists the basic structure of a command.

Table 4-2 Basic Command Structure Example

#1000 **Set Baud Rate To 9600 Baud**	
#	All commands are preceded by the # character.
1	Indicates the command group. This command is in Group 1-Communications Port Control.
0	Indicates the command subgroup. In this example, all commands with a second digit of 0 apply to the main port.
0	The command digit. In this example, the 0 indicates that this command affects the baud rate.
0	Indicates the setting. Normally this is a variable and is usually a hexadecimal value from 0 through F. In this example, 5 sets the baud rate to 9600, the factory setting. In some commands, this digit may be a four-place hexadecimal string or a character string.

AI1200-Emulation Response Structure

Like the AI1200-emulation commands, responses are preceded by the # character. Many AI1200-emulation commands respond with `#Done` or `#Error` indicating the command was or was not recognized and completed. Other commands respond with a four-character identifier followed by one or more values.

Table 4-3 shows an example of a command/reply sequence.

Table 4-3 Sample Command Sequence

Entry	Encompass Reader Response	Notes
`#01 <CR>`	`#Done <CR/LF>`	Switches Encompass Reader to command mode.
`#00 <CR>`	`#Done <CR/LF>`	Returns Encompass Reader to data mode.

In command discussions, Encompass response characters may be shown in brackets < >. The use of brackets indicates that the response is a value in the range of characters. The brackets are not part of the response. An example is Command `#522 DISPLAY COM1 PORT COMMUNICATION PARAMETERS`. Values correspond to those used to set the communications parameters through the various `#10NN`-series commands. The reader responds as follows:

```
#COM1 B<0-9> S<0-1> P<0-2> D<0-3>
```

where `B` is the baud rate, `S` is the stop bits, `P` is the parity, and `D` is the end-of-line delay. There is one space between each value. For example, if the reader has the factory settings, the display reads:

```
#COM1 B5 S0 P0 D1
```

This corresponds to a baud rate of 9600, one stop bit, parity disabled, and 100-millisecond end-of-line delay.

5

Communication Protocols

Chapter 5
Communication Protocols

This chapter describes the user datagram protocol (UDP) communications via Ethernet and AI1200-emulation protocol communications via RS-232 for the Encompass® Reader.

Communication Between Encompass Reader and Host

The Encompass Reader can communicate with a host using UDP/IP Ethernet communication protocol or RS–232 serial communication protocol.

UDP/IP Fast Ethernet Connection

The Ethernet connector is an RJ-45 jack and uses a 100-base T interface. If the Encompass Reader is connected directly to the host system then a crossover cable is required. Table 5-1 lists the Ethernet connector pin assignments.

Table 5-1 Ethernet Connector

Pin	Signal	Description	568A[a]	568B[a]
1	TX+	Output Differential Transmit Data (+)	White w/ green stripe	White w/ orange stripe
2	TX-	Output Differential Transmit Data (-)	Green w/ white stripe or solid green	Orange w/ white stripe or solid orange
3	RX+	Input Differential Receive Data (+)	White w/ orange stripe	White w/ green stripe
4	Not connected	N/A	Blue w/ white stripe or solid blue	Blue w/ white stripe or solid blue
5	Not connected	N/A	White w/ blue stripe	White w/ blue stripe
6	RX-	Input Differential Receive Data (-)	Orange w/ white stripe or solid orange	Green w/ white stripe or solid green
7	Not connected	N/A	White w/ brown stripe or solid brown	White w/ brown stripe
8	Not connected	N/A	Brown w/ white stripe or solid brown	Brown w/ white stripe or solid brown

a. 568A and 568B are Ethernet cable designations.

UDP/IP Fast Ethernet Communications Protocol

The UDP/IP fast Ethernet communications protocol implements the UDP/IP fast Ethernet protocol. Table 5-2 lists the message parts.

Table 5-2 UDP/IP Communications Message Field Descriptions

Field	Length (bytes)	Description
LENGTH	2	Two-byte field specifying the number of bytes in the message.
MSN	1	One-byte field specifying the message sequence number of the message. See the “Sequence Number Controls” section in Chapter 4 for details.
CMD	2	Two-byte field specifying the system command. See the “Command Request Message” for details.
CSN	1	One-byte field specifying the command sequence number of the message. See the “Sequence Number Controls” section in Chapter 4 for details.
OPTIONAL DATA PAYLOAD	Varies	Optional data payload field varying in length from 0 to 65 bytes or 0 to 63 bytes and specifies the data transmitted in message.
CHKSUM	1	One-byte field specifying the checksum of the message. Checksum is the sum from the length bytes through the data bytes. Sum rolls over if value is greater than 256.
RESP	2	Field specifying the system response and is typically two bytes. See the response sections for details.
MSN ACK	1	One-byte field specifying the MSN of message being acknowledged.
STATUS	2	Field specifying the system status and is typically two bytes.

Not all fields are used in each command message. The following sections provide specific message descriptions.

Command Request Message

The host sends command request messages to the Encompass Reader as required for system operation. The host and Encompass Reader use the UDP/IP fast Ethernet communications command request message shown in Figure 5-1. Refer to Table 5-2 for message field descriptions.

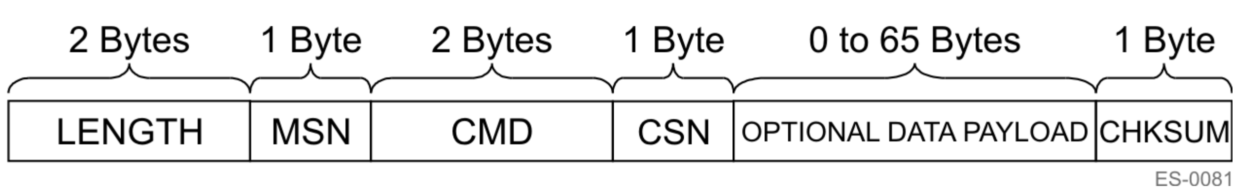

Figure 5-1 Command Request Message Fields

Data Acknowledge Message

The host returns data acknowledge messages after receiving command response messages, asynchronous response messages, and unsolicited status messages. The host and Encompass Reader use the UDP/IP fast Ethernet communications data acknowledge message shown in Figure 5-2. Refer to Table 5-2 for message field descriptions.

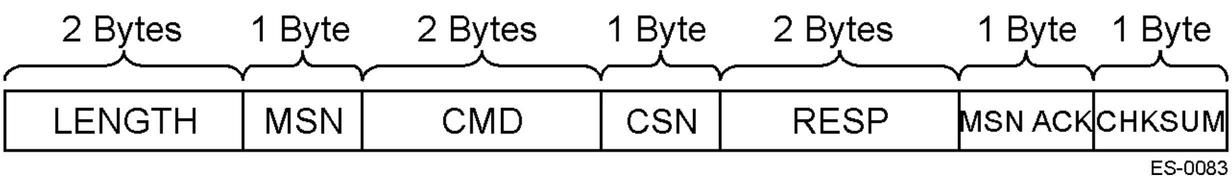

Figure 5-2 Data Acknowledge Message Fields

Command Response Message

After receiving command request messages from the host, the Encompass Reader returns command response messages. The host and Encompass Reader use the UDP/IP fast Ethernet communications command response message shown in Figure 5-3. Refer to Table 5-2 for message field descriptions.

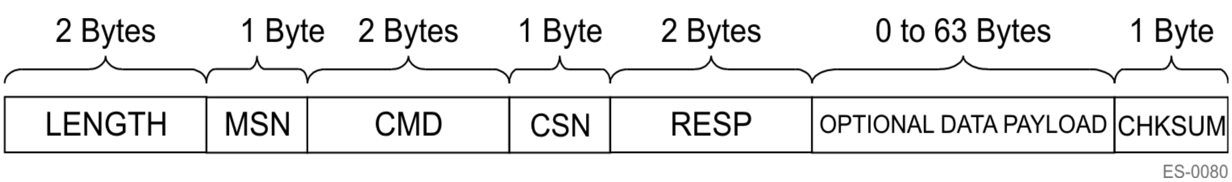

Figure 5-3 Command Response Message Fields

Asynchronous Response Message

After receiving command request messages from the host, the Encompass Reader optionally returns asynchronous response messages. The host and Encompass Reader use the UDP/IP fast Ethernet communications asynchronous response message shown in Figure 5-4. Refer to Table 5-2 for message field descriptions.

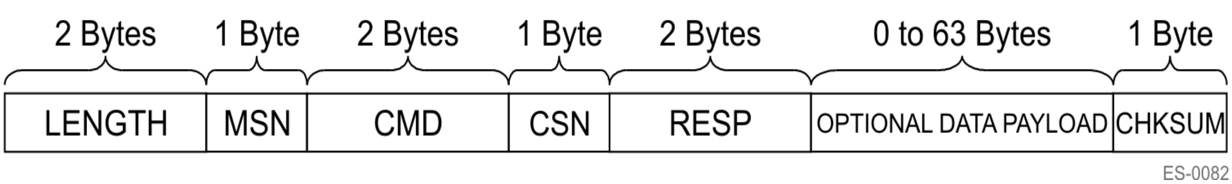

Figure 5-4 Asynchronous Response Message Fields

Unsolicited Status Message

The Encompass Reader sends unsolicited status messages as required for system operation. The host and Encompass Reader use the UDP/IP fast Ethernet communications unsolicited status message shown in Figure 5-5. Refer to Table 5-2 for message field descriptions.

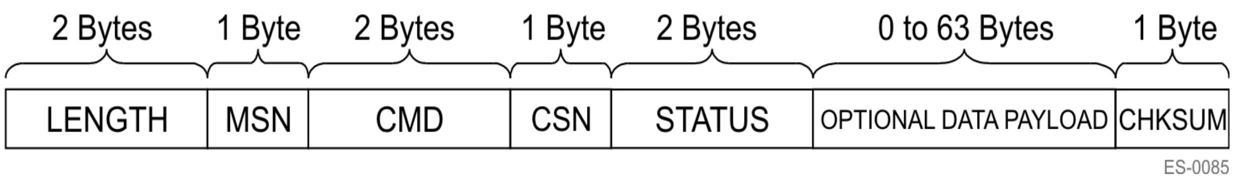

Figure 5-5 Unsolicited Status Message Fields

RS–232 Serial Communication Connection for AI1200-Emulation Application

Wire the host computer to the Encompass Reader using the COM1 (RS–232B)/time-division multiplexing (TDM) connector (Figure 5-6). This connector is an 8-pin terminal block header (TransCore P/N 33357-01).

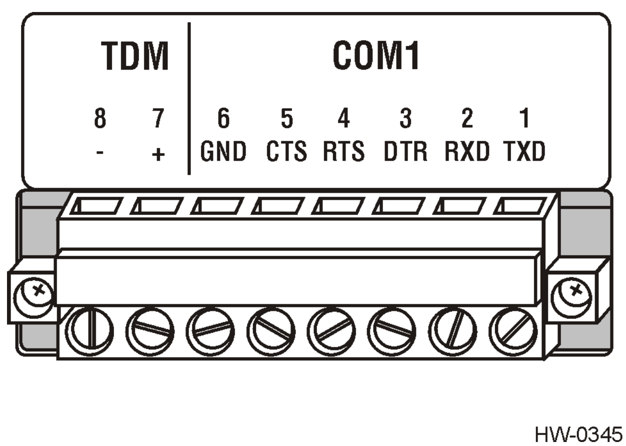

Figure 5-6 COM1 (RS–232B)/TDM Connector

Table 5-3 lists the RS–232B portion connector specifications.

Table 5-3 COM1 (RS–232) Connector Specifications

Connector Type	9-pin D-subminiature, right angle plug
Protocol	RS–232
Baud	Default is 9600 bps. (Baud rate is selectable, see command #100N in Chapter 7.)
Bits	8
Parity	None

Table 5-3 COM1 (RS–232) Connector Specifications (continued)

Stop Bits	1
Flow Control	Default is no flow control. (Flow control is selectable, see command #614N in Chapter 7.)
End of Line Delay	0 milliseconds

Table 5-4 lists the signal descriptions for the RS-232B/TDM connector.

Table 5-4 TDM/COM1 Connector Parameters

Pin	Signal	Description	DB-9 Socket Connector
1	TXD	Transmit Data	2
2	RXD	Receive Data	3
3	DTR	Data Terminal Ready (not connected)	4
4	RTS	Request to Send	7
5	CTS	Clear to Send	8
6	GND	Ground	5
7	TDM+	TDM positive signal	-
8	TDM-	TDM negative signal	-

AI1200-Emulation Communications Protocols

Basic and error correcting protocol (ECP) are the two methods used to communicate with the Encompass Reader. The basic protocol is used by technicians to enter commands on a terminal emulation device. ECP differs from basic protocol in that the reader requires an acknowledge response with a sequence number (0 to F hexadecimal, or hex) that each message is received. The following sections describe each protocol and provide examples of each.

Command Entry Conventions — Basic Protocol

In basic protocol, a command sent to the Encompass Reader is formatted as follows:

`#100N<Enter>`

where

`#` = start of message (SOM) character
`100` = the numeric identifier of the command. The body of the command can

be 2, 3, or 4 numeric characters. In this example the command 100 sets the baud rate.

`N` = a range of single hexadecimal characters to enumerate the possible options available

`<Enter>` = the **Enter** or **Return** key

Command Response Conventions — Basic Protocol

In basic protocol, you will receive either `#DONE` or `#ERROR` response to your basic protocol command.

A response in basic protocol is formatted as follows:

<som><data>

where

`<som>` = SOM character (ASCII # character)

`<data>` = message text (DONE or ERROR)

Command Response Conventions — ECP Protocol

In ECP protocol, you will receive a response of either `#yDONE1ED8` or `#yERROR8528` to your ECP protocol command. Also, the `<seq>` value matches the `<seq>` value in the message sent.

A response in ECP protocol is formatted as follows:

<som><seq><data><crc>

where

`<som>` = SOM character (ASCII # character)

`<seq>` = a message sequence number that iterates for each message from 0 to F (hex)

`<data>` = message text (DONE or ERROR)

`<crc>` = four-digit CRC hexadecimal number (or `''''` to bypass CRC)

Reader Transmissions

The basic protocol format and the data inquiry protocol format are as follows:

`<som><data><eom>`

The ECP format is as follows:

`<som><seq><data><crc><eom>`

where

`<som>` Start of message (ASCII # character)

`<seq>` Sequence number (ASCII hex digit) that represents an even number in the range 0–9, A–F (0, 2, 4, 6, 8, A, C, E). The reader maintains the number. The host must acknowledge reader transmissions by sending an ACK message with the same sequence number received from the reader. The reader updates its sequence number upon receipt of a valid host ACK. If an ACK is not received, the reader retransmits the message. A reader transmission sequence is not considered complete until the reader receives an ACK and updates its sequence number.

<data> An ASCII string up to 72 characters long. This string may contain a tag response; a sensor input report; a sensor status change report; or a sign-on message. Auxiliary data may also be included.

<crc> Field containing four ASCII digits that represent the 16-bit CRC value calculated on the message. The CRC value is calculated on bytes between the som character and the first <crc> byte. When the host receives a properly framed message, it can calculate a 16-bit CRC value. The calculation is applied to the character string that immediately follows the <som> and that ends with the character immediately preceding the first <crc> character. The transmitted CRC value can then be compared with the binary equivalent of the received <crc> characters. If the transmitted and received CRC values do not match, the recipient assumes the message was received in error, and transmits a NAK message response <eom> end-of-message characters (ASCII CR and LF). The system includes both a carriage return <CR> and line feed <LF> to facilitate the use of terminals and printers. If the host receives a <som> character in the middle of a data message, the message in progress is aborted. The assumption is that an <eom> was lost and the reader is in the process of retransmitting the previous message.

Host Transmission

The host computer initiates synchronous communications between the reader and the host. The host begins a sequence by issuing a command; the reader responds accordingly.

The basic protocol format is as follows:

```
<som><cmd>[<data>]<eom>
```

The ECP format is as follows:

```
<som><seq><cmd>[<data>]<crc><eom>
```

where

<som> Start-of-message (ASCII # character)

<seq> Sequence number (ASCII hex digit) that represents an odd number in the range 0–9, A–F (1, 3, 5, 7, 9, B, D, F). The host should use odd sequence numbers in its command since the reader uses even sequence numbers in its transmissions. This method eliminates the possibility of a synchronous host command and an asynchronous reader transmission having the same sequence number. Upon receiving a host command, the reader echoes the command’s sequence number in its response. Therefore, the host computer updates its sequence number upon receipt of a valid reader message. If the sequence number is not updated before transmission of the next command, the reader will not service the new command; it will retransmit its previous message. A command/message sequence is not complete until the host updates its sequence number.

<cmd> Command code, a string that contains ASCII hex characters

[<data>] Optional data field, an ASCII string of as many as 20 characters in length. For example, the store hardware configuration string command is #696S...S or command #696 Store Hardware Configuration String followed by the data string S...S.

<crc> CRC value for the message

<eom> End-of-message character (ASCII CR)

Reader Transmission Formats

The reader transmits the following messages to the host computer:

- Sensor Input Report
- Sensor Status Change
- Sign-on
- Error/Done
- Time and Date Stamps
- Auxiliary Information
- Command Responses
- Tag Responses

Sensor Input Report

This report is issued when sensor input presence true conditions are satisfied, but tag acquisition does not occur; presence detectors indicate a vehicle passed, but no tag ID was received. The report is useful for reporting the passage of untagged vehicles.

Sending command #6901 will enable this report. The report format is SENSOR INPUT REPORT.

The report length is 20 ASCII characters including the spaces between SENSOR and INPUT and INPUT and REPORT. There is one space at the message end.

Sensor Status Change

The enabled sense input lines are monitored for any changes in logic states. If a change is detected, the system generates a SENSOR STATUS CHANGE message if the appropriate #82X command is enabled. If the auxiliary information option is enabled, the sensor input status field displays the current de-bounced input values.

The status change format is
SENSOR STATUS CHANGE.

The message length is 20 ASCII characters including the spaces between SENSOR and STATUS and STATUS and CHANGE. There is no space at the message end.

Sign-on

After the reader has finished booting, the following two-line sign-on message displays.

```
#Model E5 AI1200 Ver X.XX SNXXXXXXX

#Copyright 200X, TransCore, Inc.
```

Error/Done

When a valid command is successfully received, the system responds with a `#Done` message. When an a invalid command is received the system responds with a `#Error` message.

Time and Date Stamps

AI1200-emulation commands (#30N) select the options of appending time and date to transmitted IDs, error messages, and sensor input reports. The factory setting is time and date appended.

Time only: `#<string>&HH:MM:SS.hh<%aux>`

Time and date: `#<string>&HH:MM:SS.hh MM/DD/YY<%aux>`

string is the tag response, sensor status change, or sensor input report.

& separates the string from the time and provides a means for the host computer to determine if time or time and date are appended.

% separates any auxiliary information aux defined by the #31N commands and provides a means for the host computer to determine if auxiliary information is appended.
`:` are time delimiters

/ are date delimiters

Two spaces separate the time from the date. HH, MM, SS, and hh represent time as hours, minutes, seconds, and hundredths of seconds, respectively.

MM, DD, and YY represent the month, day, and the last two digits of the year, respectively.

Auxiliary Information

AI1200-emulation commands (#31N) select the options of appending auxiliary information to the tag response, sensor status change, and sensor input report outputs.

Enabling Aux Info Append has the following effect on tag responses, sensor status change, and sensor input report messages:

`#<string><&time date>%xx-y-zz-q`

`<string>` is the tag ID code, error message, or sensor input report. Brackets are not included.

& separates the string from any optional time and date information time date appended by the #30N commands and provides a means for the host computer to determine if time or time and date are appended.

% separates the auxiliary information and provides a means for the host computer to determine if auxiliary information is appended.

Tag ID Report

<xx-y-zz-q>

xx: Reader ID value from 00 to FF hex

y: Antenna number from 0–3

zz: The number of reads of the previous tag per antenna from 00 to FF hex

q: The logical value of the sensor input status when the tag read occurred from 0 to F hex.

Sensor Input Report

<xx-y-zz-q>

xx: Reader ID value from 00 to FF hex

y: The I/O channel where an input was detected, debounced, and met the minimum true period from 0–3.

Presence True Criteria: An input completed a de-bounced false-to-true transition, minimum true period, followed by a de-bounced true-to-false transition.

zz: The number of reads of the previous tag per antenna from 00 to FF hex.

q: The logical value of the input event, true =1, false = 0, from 0 to F hex.

Sensor Status Change Report

<xx-y-zz-q>

xx: Reader ID value from 00 to FF hex

y: The I/O channel that detected a change in input status from 0–3.

zz: The number of reads of the previous tag per antenna from 00 to FF hex.

q: The value of the sensor input status when the input event occurred from 0 to F hex.

Command Responses

In basic protocol, you will receive either `#DONE` or `#ERROR` response to your basic protocol command. See “Command Response Conventions — Basic Protocol” on page 5-8 for more information.

In ECP protocol, you will receive a response of either `#yDONE1ED8` or `#yERROR8528` to your ECP protocol command. Also, the `<seq>` value matches the `<seq>` value in the message sent. “Command Response Conventions — ECP Protocol” on page 5-8 for more information.

Tag Responses

In general, the tag response is transmitted as a # sign followed by the tag response record type code and the tag response data. Response lengths vary depending on the tag response record type. The tag response record type communicates to the host the tag response type that the reader processed.

For example, *`No Append Information: (#300, #310)`*

ECP protocol: `<som><seq><rrrr><data><crc><eom>`

Basic protocol: `<som><rrrr><data> <eom>`

Append Information: (#302, #311)

ECP protocol: `<som><`*`seq`*`><rrrr><data>&<time><date>%<aux info><`*`crc`*`><eom>`

Basic protocol: `<som><data>&<time><date>%<aux info><eom>`

where

the tag response contains the following:

<som>	#
<*seq*>	hexadecimal character 0-F, *ECP protocol only*
<rrrr>	Transaction record type (hex)
<data>	Tag response data (hex/AMTECH 6-bit, length and format depend on tag type)

For complete tag responses, see “AI1200-Emulation Tag Responses” on page 8-26.”

6

Configuring and Operating the Encompass Reader Using UDP Commands

Chapter 6

Configuring and Operating the Encompass Reader Using UDP Commands

This chapter describes the Encompass® reader mode and commands that are used to configure and operate the reader. This chapter also contains system commands and responses that are needed to develop host software for the UDP command set.

Chapter Organization

The Encompass reader is controlled through mode settings, which configure the reader for specific applications. The Encompass reader starts in Mode 0, Stop Mode, and must be changed to another mode as needed for a specific application.

This chapter first lists the operating mode to show what UDP-based command operations are available with this Encompass reader application.

The remainder of the chapter provides a complete listing of system commands and responses that are required to develop host interface software for configuring the Encompass reader. The system commands are divided into system command groups:

"System Interface Command Group Commands (8000H)" on page 6-13

"Digital I/O Command Group Commands (4000H)" on page 6-39

"RF Transceiver Command Group Commands (2000H)" on page 6-79

"Tag Transaction Configuration Command Group Commands (1000H)" on page 6-98

"Mode Command Group Commands (0400H)" on page 6-119

"Diagnostic Command Group Commands (0200H)" on page 6-155

Information for each of these command groups is grouped in the following manner:

- One table that lists the system command group commands
- One table that lists the system command group responses
- A series of tables that present system command group response data
- A full set of commands that are used to set an Encompass reader function and obtain data resulting from that function within the specific system command group

Operating the Encompass Reader in Mode 88

An Encompass reader operating in Mode 88 can read any combination of tag protocols (SeGo, eGo, IT2200, Title 21, ATA full-frame and half-frame, IAG or CVISN (ASTM Standard 6 application) by using either the Ethernet port for user datagram protocol communications or the serial port for AI1200-emulation communications.

Caution

Where multiple tag protocols are used in the same installation, an Encompass reader operating in Mode 88 is capable of reading any combination of the protocols; however, to read more than two protocols ensure that you are using an Encompass 6 reader platform.

Working with Mode 88

The Encompass reader powers up in Mode 0, Stop Mode. You must issue the commands (Table 6-1), via the host computer, to configure the reader.

Table 6-1 Commands Used to Configure Encompass Reader in Mode 88

Sequence #	Command	Definition
1	Set Protocol(s)[a]	This command sets the protocols needed for a specific application. The user can choose to set any number of protocols in any combination.[b]
2	Set Secondary Tag Sequence[a]	This command specifies which state machine to run by selecting from Title 21, ATA, and eGo® tag protocols. The user must also set the acknowledge (Ack) for Title 21, as well as the antenna number.
3	Reset[a]	This command resets the Encompass reader so that the previously entered command(s) can take effect.
	The following commands are required to configure Mode 88	
4	If running a configuration script, re-execute script at this time.	Ensure that any changes made to protocols and secondary tag sequences are reflected in the script file. Set the reader to Stop Mode before executing the script file.
5	Set Frequency in MHz	Sets the Encompass reader uplink and downlink frequencies. Reader must be in Stop Mode.
6	Set Master/Slave	This command specifies which Encompass reader is to be designated as master, setting all other readers as slaves.
7	Set Uplink Source Control	This command is used if the SeGo RF uplink needs to use the RF downlink frequency. This command must be set before setting RF attenuation.
8	Set RF Attenuation	This command retrieves the associated attenuation and range adjust settings for a specified tag protocol.

Table 6-1 Commands Used to Configure Encompass Reader in Mode 88

Sequence #	Command	Definition
9	Set Retry Count	This command sets the number of times the Encompass reader attempts to retry tag read. Some modes require that this command is set more than once because of multiple tag protocols. The retry count for IT2200 is set using Set SeGo/eGo Configuration Data (0043H); the retry count for Title 21 is fixed.
10	Set Data Detect	This command sets the data detect value for a specific protocol: SeGo, eGo, IT2200, ATA, Title 21, IAG, or CVISN. This value is an independent detection threshold level for backscatter protocols of up to 20dB. Data Detect can be incremented or decremented in 1dB steps through the command interface port. The threshold level for CVISN is 15 dB.
11	Set Seen Count and Uniqueness Count	This command sets a counter that records the number of times a tag is read after the system had finished a complete transaction.
12	Group Select Equals Configuration	This command is derived from Set SeGo/eGo Configuration Data (0043H). The address, mask, command depth, and antenna all should be set for either SeGo or eGo protocols.
13	Set Time and Date	This command sets the Encompass reader real-time clock to the time and date specified in the request data.
14	Set Line Loss	This command sets the Encompass reader system line loss value from 0 to 3 decibels (dB) in 1-dB increments via the command interface port. This command must be set only after RF attenuation is set.
15	Set Manual Antenna Channel	This command sets the antenna channel.
16	Set Antenna Multiplexer Configuration Data	This command selects the antenna multiplexer mode.
17	Set IT2200 Configuration w/Gen Ack or Set IT2200 Read Request Configuration	The first command sets the audio/visual options, conditions, and so on for IT2200-series tags. The second command requires the reader to read data from the specified memory area of the speicified tag.
18	Set IAG Slot	This command sets the IAG trigger pulse slot, which allows multiple readers to have non-overlapping IAG time slots.
19	Append Time-stamp	This command is optional.
20	Run Check Tag	This command is an optional setting and is used if user needs to “fire” the check tag and check the Encompass reader system operation. Use this command to select protocol and operate the check tag.
21	Set Mode	This command sets the Encompass reader to Mode 88.

a. Set Protocol(s), Reset, Set Secondary Tag Sequence, and Reset Command must be transmitted in the order shown in table.

b. To select more than two protocols, ensure that you are using the Encompass 6 reader platform.

System Commands

This section lists the Encompass reader system commands. Table 6-2 lists the system commands, command groups, and command codes that are used with the Encompass reader.

Table 6-2 System Commands Used in Encompass Reader

System Command	Command Code
System Interface (SI) Command Group	8000H
SI Command Group Data Acknowledge	8001H
Reserved	8002H
Reserved	8003H
Reserved	8004H
Reserved	8005H
Reserved	8008H
Reserved	8009H
SI Command Group Unsolicited Status	8010H
SI Command Group Unsolicited Status Data Acknowledge	8011H
Digital I/O Command Group	4000H
Digital I/O Command Group Data Acknowledge	4001H
Reserved	4002H
Reserved	4003H
Reserved	4004H
Reserved	4005H
Reserved	4008H
Reserved	4009H
Digital I/O Command Group Unsolicited Status	4010H
Digital I/O Command Group Unsolicited Status Data Acknowledge	4011H
RF Transceiver (RFT) Command Group	2000H

Table 6-2 System Commands Used in Encompass Reader

System Command	Command Code
RFT Command Group Data Acknowledge	2001H
Reserved	2002H
Reserved	2003H
Reserved	2004H
Reserved	2005H
Reserved	2008H
Reserved	2009H
RFT Command Group Unsolicited Status	2010H
RFT Command Group Unsolicited Status Data Acknowledge	2011H
Tag Transaction Configuration (TTC) Command Group	1000H
TTC Command Group Data Acknowledge	1001H
Reserved	1002H
Reserved	1003H
Reserved	1004H
Reserved	1005H
Reserved	1008H
Reserved	1009H
TTC Command Group Unsolicited Status	1010H
TTC Command Group Unsolicited Status Data Acknowledge	1011H
Tag Transaction (TT) Command Group[a]	0800H
TT Command Group Data Acknowledge	0801H
Reserved	0802H
Reserved	0803H
Reserved	0804H
Reserved	0805H

Table 6-2 System Commands Used in Encompass Reader

System Command	Command Code
Reserved	0808H
Reserved	0809H
TT Command Group Unsolicited Status	0810H
TT Command Group Unsolicited Status Data Acknowledge	0811H
Mode (M) Command Group	0400H
Mode Command Group Data Acknowledge	0401H
Reserved	0402H
Reserved	0403H
Reserved	0404H
Reserved	0405H
Reserved	0408H
Reserved	0409H
Mode Command Group Unsolicited Status	0410H
Mode Command Group Unsolicited Status Data Acknowledge	0411H
Diagnostic (Diag) Command Group	0200H
Diag Command Group Data Acknowledge	0201H
Reserved	0202H
Reserved	0203H
Reserved	0204H
Reserved	0205H
Reserved	0208H
Reserved	0209H
Diag Command Group Unsolicited Status	0210H
Diag Command Group Unsolicited Status Data Acknowledge	0211H

a. Tag Transaction Command Group commands and responses are discussed in detail in Chapter 8, “Tag Responses.”

Table 6-3 lists the bit definitions for the system commands.

Table 6-3 System Command Bit Definitions

Bit Definition	Description	System Command Bit Code
Bit 15	System Interface Command Group Bit Field	8000H
Bit 14	Digital Input/Output (I/O) Command Group Bit Field	4000H
Bit 13	RF Transceiver Command Group Bit Field	2000H
Bit 12	Tag Transaction Configuration Command Group Bit Field	1000H
Bit 11	Reserved	0800H
Bit 10	Mode Command Group Bit Field	0400H
Bit 9	Diagnostic Command Group Bit Field	0200H
Bit 8	Reserved	0100H
Bit 7	Reserved	0080H
Bit 6	Reserved	0040H
Bit 5	Reserved	0020H
Bit 4	Unsolicited Status Bit Field	0010H
Bit 3	Reserved	0008H
Bit 2	Reserved	0004H
Bit 1	Reserved	0002H
Bit 0	Data Acknowledge Bit Field	0001H

Command Group Bit Fields

The host sets the appropriate command group bit fields in the system command when sending command request and data acknowledge messages to the Encompass reader.

The Encompass reader sets the appropriate command group bit fields in the system command when sending data acknowledge, command response, asynchronous response, and unsolicited status messages to the host.

Unsolicited Status Bit Field

The Encompass reader sets this bit field in the system command when sending unsolicited status messages to the host.

Data Acknowledge Bit Field

The host sets this bit field in the system command when sending data acknowledge messages to the Encompass reader. The Encompass reader sets this bit field in the system command when sending data acknowledge messages to the host.

Responses to System Commands

This section lists the responses to the Encompass reader system commands.

Responses and Codes for System Commands

Table 6-4 lists the response definitions and codes that are applicable to all system commands.

Table 6-4 System Responses

System Response	System Response Code
Synchronous OK Status	88XXH
Asynchronous OK Status	48XXH
Unsolicited OK Status	28XXH
Reserved	84XXH
Reserved	44XXH
Reserved	24XXH
Synchronous Error Status	82XXH
Asynchronous Error Status	42XXH
Unsolicited Error Status	22XXH
Synchronous Control Status	81XXH
Asynchronous Control Status	41XXH
Unsolicited Control Status	21XXH

Table 6-5 lists the bit definitions for the responses.

Table 6-5 System Command Response Bit Definitions

Bit Definition	Description	System Response Bit Code
Bit 15	Synchronous Response Bit Field	8000H
Bit 14	Asynchronous Response Bit Field	4000H
Bit 13	Unsolicited Response Bit Field	2000H
Bit 12	Reserved	1000H
Bit 11	OK Status Bit Field	0800H
Bit 10	Reserved	0400H
Bit 9	Error Status Bit Field	0200H
Bit 8	Control Status Bit Field	0100H
Bit 7	Command Group Command Response Bit 7	0080H
Bit 6	Command Group Command Response Bit 6	0040H
Bit 5	Command Group Command Response Bit 5	0020H
Bit 4	Command Group Command Response Bit 4	0010H
Bit 3	Command Group Command Response Bit 3	0008H
Bit 2	Command Group Command Response Bit 2	0004H
Bit 1	Command Group Command Response Bit 1	0002H
Bit 0	Command Group Command Response Bit 0	0001H

Synchronous Response Bit Field

The host sets this bit field in the system response when sending data acknowledge messages to the Encompass reader. The Encompass reader sets this bit in the system response when sending data acknowledge and command response messages to the host.

Asynchronous Response Bit Field

The Encompass reader sets this bit in the system response when sending asynchronous response messages to the host.

Unsolicited Response Bit Field

The Encompass reader sets this bit in the system response when sending unsolicited status messages to the host.

OK Status Bit Field

The Encompass reader sets this bit field in the system response when the response is an OK status.

Error Status Bit Field

The Encompass reader sets this bit field in the system response when the response is an error status.

Control Status Bit Field

The host sets this bit field in the system response when sending data acknowledge messages to the Encompass reader. The Encompass reader sets this bit field in the system response when sending data acknowledge messages to the host.

Command Group Command Response Bit Fields

The host and the Encompass reader sets these bit fields in the system response to indicate the command group command response. See the individual command group command response sections for details.

The remaining sections discuss the system command groups.

System Interface Command Group Commands (8000H)

The following sections detail the individual system command group commands and responses. Refer to page 6-3 for an ordered list of the command groups.

Table 6-6 lists the System Interface Command Group commands that are used in the Encompass reader.

Table 6-6 System Interface Command Group (8000H)

System Interface Commands	Command Code
System Identify	0000H
Set Time and Date	0003H
Get Time and Date	0004H
CPU Firmware Download	0005H
Reset Reader	0006H
Get Buffered Tag Transaction	0007H
Get Number of Buffered Tag Transactions	0008H
Delete All Buffered Tag Transactions	0009H
Get System Startup Status	000AH
Get Lane Controller Interface Status	000BH
Get System Interface Status	000CH
Set UDP/IP Core Lane Controller Parameters	0011H
Get UDP/IP Core Lane Controller Parameters	0012H
Set UDP/IP Core IP Address	0013H
Get UDP/IP Core IP Address	0014H
Get UDP/IP Core UDP Port Number	0015H
Set Buffered Tag Transaction Mode	0016H
Get Buffered Tag Transaction Mode	0017H
Set Data Acknowledge Time-out Period	0018H
Get Data Acknowledge Time-out Period	0019H
Set Switch Buffered Tag Transaction Mode Enable	001AH
Get Switch Buffered Tag Transaction Mode Enable	001BH

Table 6-6 System Interface Command Group (8000H)

System Interface Commands	Command Code
FPGA Firmware Download	001CH
Boot Firmware Download	001DH
Reserved	001EH
Get System Serial Number	001FH
Get Firmware Version Numbers	0021H
Reserved	0022H to 0029H
Load Default Operating Parameters	002BH

System Interface Command Group Responses

Table 6-7 lists the responses and codes for the system interface command group.

Table 6-7 System Interface Command Group Responses

System Interface Response	Response Code
Synchronous OK Status Responses	88XXH
Reserved	8800H
Reserved	8801H
Asynchronous OK Status Responses	48XXH
Command Complete	4800H
Command In Progress	4801H
Firmware Download Active	4802H
Firmware Download Complete	4803H
S-Record Processed	4804H
Unsolicited OK Status Responses	28XXH
Reserved	84XXH

Table 6-7 System Interface Command Group Responses

System Interface Response	Response Code
Reserved	44XXH
Reserved	24XXH
Synchronous Error Status Responses	82XXH
Message Length Error	8200H
Message Sequence Error	8201H
Reserved	8202H
Command Group Error	8203H
Reserved	8204H
Reserved	8205H
Reserved	8206H
Reserved	8207H
Reserved	8208H
Data Acknowledge Response Error	8209H
Reserved	820AH
Asynchronous Error Status Responses	42XXH
Message Length Error	4200H
Command Sequence Error	4201H
Reserved	4202H
Command Group Error	4203H
Command Time-out Error	4204H
Reserved	4205H
Command Failed Error	4206H
System Command Error	4207H

Table 6-7 System Interface Command Group Responses

System Interface Response	Response Code
Sub-command Error	4208H
Reserved	4209H
Invalid Control Word Error	420AH
Invalid Command Data Error	420BH
Application Code Checksum Error	420CH
S-Record Checksum Error	420DH
Erase Flash Error	420EH
Write Flash Error	420FH
Unsolicited Error Status Responses	22XXH
Synchronous Control Status Responses	81XXH
Data Acknowledge (Ack), data valid	8100H
Data Negative Acknowledge (Nack), data invalid	8101H
Reserved	8102H
Reserved	8104H
Asynchronous Control Status Responses	41XXH
Unsolicited Control Status Responses	21XXH

System Interface Command Group Response Data

Asynchronous OK Status Responses

The following system interface command group asynchronous OK status responses use the specified data payload.

Command Complete (4800H)

Command Complete Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

Firmware Download Active System (4802H)

Firmware Download Active Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

Firmware Download Complete System (4803H)

Firmware Download Complete Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

S-Record Processed System (4804H)

S-Record Processed Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

Synchronous Error Status Responses

The following system interface command group synchronous error status responses use the specified data payload.

Message Length Error Response Data (8200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Message Sequence Error Response Data (8201H)

Message Sequence Error Response Data	Data Payload
Expected Message Sequence Number	XXH
Received Message Sequence Number	XXH

Command Group Error Response Data (8203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Data Acknowledge Response Error Response Data (8209H)

Data Acknowledge Response Error Response Data	Data Payload
Invalid Data Acknowledge Response	XXXXH

Asynchronous Error Status Responses

The following system interface command group asynchronous error status responses use the specified data payload.

Message Length Error Response Data (4200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Command Sequence Error Response Data (4201H)

Command Sequence Error Response Data	Data Payload
Expected Command Sequence Number	XXH
Received Command Sequence Number	XXH

Command Group Error (4203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Command Time-out Error (4204H)

Command Time-out Error Response Data	Data Payload
N/A	

Command Failed Error (4206H)

Command Failed Error Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

System Command Error (4207H)

System Command Error Response Data	Data Payload
N/A	

Sub-Command Error (4208H)

Sub-Command Error Response Data	Data Payload
Sub-command	XXXXH

Invalid Control Word Error (420AH)

Invalid Control Word Error Response Data	Data Payload
N/A	

Invalid Command Data Error (420BH)

Invalid Command Data Error Response Data	Data Payload
N/A	

Application Code Checksum Error System (420CH)

Application Code Checksum Error Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH
S-Record Address (MSB)	XXXXH
S-Record Address (LSB)	XXXXH

S-Record Checksum Error System (420DH)

S-Record Checksum Error Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH
S-Record Address (MSB)	XXXXH
S-Record Address (LSB)	XXXXH

Erase Flash Error System (420EH)

Erase Flash Error Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

Write Flash Error System (420FH)

Write Flash Error Response Data	Data Payload
System Interface Command Group Command (sub-command)	XXXXH

System Identify

This command gets the reader's system identify remote inventory. Table 6-8 and Table 6-9 list the command and response data.

Table 6-8 System Identify Command (0000H)

System Identify Command Data	Data Payload
System Identify Command	0000H

Table 6-9 System Identify Response

System Identify Response Data	Data Payload
System Identify Command	0000H
Vendor Name	*
Version ID	*
Part Number	*
Serial Number	*

*The information in this field is specific to each reader.

Each field's data size is listed in Table 6-10.

Table 6-10 System Identify Data

System Identify Data	Data Size
Vendor Name	15 bytes
Version ID	15 bytes
Part Number	15 bytes
Serial Number	15 bytes

Set Time and Date

The Set Time and Date command sets the Encompass reader real-time clock to the time and date specified in the request data.

The data associated with the Set Time and Date defines the format of the time and date (Table 6-11). You can modify and read this data at any time. This field is used with the tag read parameters to append time and date to any response to the host system. The Encompass reader has a battery-backed clock. Table 6-12 lists the response data.

Table 6-11 Set Time and Date Command (0003H)

Set Time and Data Command Data	Data Payload
Set Time and Date Command	0003H
Hours	XXH
Minutes	XXH
Seconds	XXH
Hundredths of Seconds	XXH
Month	XXH
Day	XXH
Year	XXH

Data	Data Range
Hours	0 to 23 (00H to 17H)
Minutes	0 to 59 (00H to 3BH)
Seconds	0 to 59 (00H to 3BH)
Hundredths of seconds	0 to 99 (00H to 63H)
Month	1 to 12 (01H to 0CH)
Day	1 to 31 (01H to 1FH)
Year	0 to 99 (00H to 63H)

Table 6-12 Set Time and Date Response

Set Time and Date Response Data	Data Payload
Set Time and Date Response	0003H

Get Time and Date

The Get Time and Date command requests the current time and date that is set on the Encompass reader real-time clock. The data associated with the Get Time and Date defines the format of the time and date (Table 6-13). You can modify and read this data at any time. This field is used with the tag read parameters to append time and date to any response to the host system. Table 6-14 lists the response data.

Table 6-13 Get Time and Date Command (0004H)

Get Time and Date Command Data	Data Payload
Get Time and Date Command	0004H

Table 6-14 Get Time and Date Response

Get Time and Date Response Data	Data Payload
Get Time and Date Command	0004H
Hours	XXH
Minutes	XXH
Seconds	XXH
Hundredths of Seconds	XXH
Month	XXH
Day	XXH
Year	XXH

CPU Firmware Download

This command downloads the reader's CPU application firmware. Table 6-15 and Table 6-16 list the command data and response.

Table 6-15 CPU Firmware Download Command (0005H)

CPU Firmware Download Command Data	Data Payload
CPU Firmware Download Command	0005H

Table 6-16 CPU Firmware Download Response

CPU Firmware Download Response Data	Data Payload
CPU Firmware Download Command	0005H

Reset Reader

The Reset Reader command initializes a power-up state (based on the nonvolatile settings) of all of the Encompass reader parameters and starts the Encompass reader power-on diagnostics. Table 6-17 and Table 6-18 list the command and response data.

Table 6-17 Reset Reader Command (0006H)

Reset Reader Command Data	Data Payload
Reset Reader Command	0006H
Reset Reader Control Word	A5A5H

Table 6-18 Reset Reader Response

Reset Reader Response Data	Data Payload
Reset Reader Command	0006H

When the Encompass reader is reset, the reader IP address, buffered tags, and error log are maintained, all other information must be resent or reconfigured before the Encompass reader can be operated again.

Get Buffered Tag Transaction

This command gets a specific buffered tag transaction from the reader. Table 6-19 and Table 6-20 list the command and response data.

Table 6-19 Get Buffered Tag Transaction Command (0007H)

Get Buffered Tag Transaction Command Data	Data Payload
Get Buffered Tag Transaction Command	0007H
Buffered Tag Transaction Number (MSW)	XXXXH
Buffered Tag Transaction Number (LSW)	XXXXH

Table 6-20 Get Buffered Tag Transaction Response

Get Buffered Tag Transaction Response Data	Data Payload
Get Buffered Tag Transaction Command	0007H
Buffered Tag Transaction Number (MSW)	XXXXH
Buffered Tag Transaction Number (LSW)	XXXXH
Buffered Tag Transaction Data	

The Buffered Tag Transaction Number field specifies the number of the buffered tag transactions to be retrieved. The data values for this field range from `01H` to `0FFFFFFFFH`.

The Buffered Tag Transaction Data field contains the buffered tag transaction response data that has a maximum byte length of 57.

Get Number of Buffered Tag Transactions

This command gets the number of buffered tag transactions that are stored in the reader. Table 6-21 and Table 6-22 list the command and response data.

Table 6-21 Get Number of Buffered Tag Transactions Command (0008H)

Get Number of Buffered Tag Transactions Command Data	Data Payload
Get Number of Buffered Tag Transactions Command	0008H

Table 6-22 Get Number of Buffered Tag Transactions Response Data

Get Number of Buffered Tag Transactions Response Data	Data Payload
Get Number of Buffered Tag Transactions Command	0008H
Number of Buffered Tag Transactions (MSW)	XXXXH
Number of Buffered Tag Transactions (LSW)	XXXXH
Buffered Tag Transaction Overflow Status: 0 = no overflow, 1 = overflow	XXH

The buffered tag transaction overflow status is returned as 0 for no overflow or 1 for overflow. The Number of Buffered Tag Transactions field specifies the current number of buffered tag transactions. The data values for this field range from `0H` to `0FFFFFFFFH`. Using the UDP command set, the Encompass reader can store up to 500,000 tag IDs in the buffer and the buffered tag information is saved upon reader reset. The data values for this field range from 0H to 0FFFFFFFFH.

Delete All Buffered Tag Transactions

This command deletes all buffered tag transactions stored in the reader. Table 6-23 and Table 6-24 list the command and response data.

Table 6-23 Delete All Buffered Tag Transactions Command (0009H)

Delete All Buffered Tag Transactions Command Data	Data Payload
Delete All Buffered Tag Transactions Command	0009H
Delete All Buffered Tag Transactions Control Word	A5A5H

Table 6-24 Delete All Buffered Tag Transactions Response

Delete All Buffered Tag Transactions Response Data	Data Payload
Delete All Buffered Tag Transactions Command	0009H

Get System Startup Status

This command gets the Encompass reader system startup status. Table 6-25 and Table 6-26 list the command and response data.

Table 6-25 Get System Startup Status Command (000AH)

Get System Startup Status Command Data	Data Payload
Get System Startup Status Command	000AH

Table 6-26 Get System Startup Status Response

Get System Startup Status Response Data	Data Payload
Get System Startup Status Command	000AH
System Startup Module Number (System Initialization)	XXXXH
System Timer Initialization Status Error Number	XXXXH
System BMU Initialization Status Error Number	XXXXH
System Queue Create Status Error Number	XXXXH
System Task Create Status Error Number	XXXXH

Get Lane Controller Interface Status

This command gets the status of the reader's lane controller interface software. Table 6-27 and Table 6-28 list the command and response data.

Table 6-27 Get Lane Controller Interface Status Command (000BH)

Get Lane Controller Interface Status Command Data	Data Payload
Get Lane Controller Interface Status Command	000BH

Table 6-28 Get Lane Controller Interface Status Response

Get Lane Controller Interface Status Response Data	Data Payload
Get Lane Controller Interface Status Command	000BH
Module Number	XXXXH
Error Number	XXXXH

Get System Interface Status

This command gets the status of the reader's system interface software. Table 6-29 and Table 6-30 list the command and response data.

Table 6-29 Get System Interface Status Command (000CH)

Get System Interface Status Command Data	Data Payload
Get System Interface Status Command	000CH

Table 6-30 Get System Interface Status Response

Get System Interface Status Response Data	Data Payload
Get System Interface Status Command	000CH
Module Number	XXXXH
Error Number	XXXXH

Set UDP/IP Core Lane Controller Parameters

This command sets the UDP/IP core lane controller parameters stored in the reader. Table 6-31 and Table 6-32 list the command and response data.

Table 6-31 Set UDP/IP Core Lane Controller Parameters Command (0011H)

Set UDP/IP Core Lane Controller Parameters Command Data	Data Payload
Set UDP/IP Core Lane Controller IP Address and Port Number Parameters Command	0011H
IP Address (MSW)	XXXXH
IP Address (LSW)	XXXXH
Port Number	XXXXH

Note: *MSW refers to the most significant word and LSW refers to the least significant word.*

Caution

This command creates a dynamic IP address that is not saved upon a power cycle. The IP address reverts back to the address set with the bootChange command. Using the Set UDP/IP Core IP Address command does not permit use of a hardware reset command, therefore, TransCore recommends strongly against using this Set UDP/IP Core IP Address command.

Table 6-32 Set UDP/IP Core Lane Controller Parameters Response

Set UDP/IP Core Lane Controller Parameters Response Data	Data Payload
Set UDP/IP Core Lane Controller Parameters Command	0011H

Get UDP/IP Core Lane Controller Parameters

This command gets the UDP/IP core lane controller parameters from the reader. Table 6-33 and Table 6-34 list the command and response data.

Table 6-33 Get UDP/IP Core Lane Controller Parameters Command (0012H)

Get UDP/IP Core Lane Controller Parameters Command Data	Data Payload
Get UDP/IP Core Lane Controller Parameters Command	0012H

Table 6-34 Get UDP/IP Core Lane Controller Parameters Response

Get UDP/IP Core Lane Controller Parameters Response Data	Data Payload
Get UDP/IP Core Lane Controller Parameters Command	0012H
IP Address (MSW)	XXXXH
IP Address (LSW)	XXXXH
Port Number	XXXXH

Set UDP/IP Core IP Address

This command sets the Encompass reader UDP/IP core IP address in the reader. Table 6-35 and Table 6-36 list the command and response data.

Table 6-35 Set UDP/IP Core IP Address Command (0013H)

Set UDP/IP Core IP Address Command Data	Data Payload
Set UDP/IP Core IP Address Command	0013H
IP Address (MSW)	XXXXH
IP Address (LSW)	XXXXH

Caution

This command creates a dynamic IP address that is not saved upon a power cycle. The IP address reverts back to the address set with the bootChange command. Using the Set UDP/IP Core IP Address command does not permit use of a hardware reset command, therefore, TransCore recommends strongly against using this Set UDP/IP Core IP Address command.

Table 6-36 Set UDP/IP Core IP Address Response

Set UDP/IP Core IP Address Response Data	Data Payload
Set UDP/IP Core IP Address Command	0013H

Get UDP/IP Core IP Address

This command gets the Encompass reader UDP/IP core IP address from the reader. Table 6-37 and Table 6-38 list the command and response data.

Table 6-37 Get UDP/IP Core IP Address Command (0014H)

Get UDP/IP Core IP Address Command Data	Data Payload
Get UDP/IP Core IP Address Command	0014H

Table 6-38 Get UDP/IP Core IP Address Response

Get UDP/IP Core IP Address Response Data	Data Payload
Get UDP/IP Core IP Address Command	0014H
IP Address (MSW)	XXXXH
IP Address (LSW)	XXXXH

Get UDP/IP Core Port Number

This command sets the UDP/IP core port number from the reader. Table 6-39 and Table 6-40 list the command and response data.

Table 6-39 Get UDP/IP Core Port Number Command (0015H)

Get UDP/IP Core Port Number Command Data	Data Payload
Get UDP/IP Core Port Number Command	0015H

Table 6-40 Get UDP/IP Core Port Number Response Data

Get UDP/IP Core Port Number Response Data	Data Payload
Get UDP/IP Core Port Number Command	0015H
Port Number	XXXXH

Set Buffered Tag Transaction Mode

This command sets the buffered tag transaction mode in the reader. The mode control byte can be set to 0 for real-time mode or 1 for buffered mode. Table 6-41 and Table 6-42 list the command and response data.

Table 6-41 Set Buffered Tag Transaction Mode Command (0016H)

Set Buffered Tag Transaction Mode Command Data	Data Payload
Set Buffered Tag Transaction Command	0016H

Table 6-41 Set Buffered Tag Transaction Mode Command (0016H)

Mode Control Byte: 0 = Real-Time Mode, 1 = Buffered Mode	XXH

Table 6-42 Set Buffered Tag Transaction Mode Response

Set Buffered Tag Transaction Mode Response Data	Data Payload
Set Buffered Tag Transaction Command	0016H

Get Buffered Tag Transaction Mode

This command gets the buffered tag transaction mode from the reader. The mode control byte is returned as 0 for real-time mode or 1 for buffered mode. Table 6-43 and Table 6-44 list the command and response data.

Table 6-43 Get Buffered Tag Transaction Mode Command (0017H)

Get Buffered Tag Transaction Mode Command Data	Data Payload
Get Buffered Tag Transaction Command	0017H

Table 6-44 Get Buffered Tag Transaction Mode Response Data

Get Buffered Tag Transaction Mode Response Data	Data Payload
Get Buffered Tag Transaction Command	0017H
Mode Control Byte: 0 = Real-Time Mode, 1 = Buffered Mode	XXH

Set Data Acknowledge Time-out Period

This command sets the reader's data acknowledge time-out period in milliseconds. Table 6-45 and Table 6-46 list the command and response data.

Table 6-45 Set Acknowledge Time-out Period Command (0018H)

Set Data Acknowledge Time-out Period Command Data	Data Payload
Set Data Acknowledge Time-out Period Command	0018H
Communication Protocol	XXH
Time-out Period in ms (MSB)	XXH
Time-out Period in ms (LSB)	XXH

Table 6-46 Set Acknowledge Time-out Period Response

Set Data Acknowledge Time-out Period Response Data	Data Payload
Set Data Acknowledge Time-out Period Command	0018H
Communication Protocol	XXH

Communication Protocols

Table 6-47 lists the communication protocols that can be returned by the response.

Table 6-47 Set Acknowledge Time-Out Period Communication Protocols

Communication Protocol	Data Code
UDP/IP Communication	00H
Serial Communication	01H
Serial Debug Communication	02H

Get Data Acknowledge Time-out Period

This command gets the data acknowledge time-out period from the reader. Table 6-48 and Table 6-49 list the command and response data.

Table 6-48 Get Acknowledge Time-Out Period Command (0019H)

Get Data Acknowledge Time-out Period Command Data	Data Payload
Get Data Acknowledge Time-out Period Command	0019H
Communication Protocol	XXH

Table 6-49 Get Acknowledge Time-out Period Response Data

Get Data Acknowledge Time-out Period Response Data	Data Payload
Get Data Acknowledge Time-out Period Command	0019H
Communication Protocol	XXH
Time-out Period in ms (MSB)	XXH
Time-out Period in ms (LSB)	XXH

Table 6-50 lists the response protocols.

Table 6-50 Get Acknowledge Time-out Period Communication Protocols

Communication Protocol	Data Code
UDP/IP Communication	00H
Serial Communication	01H
Serial Debug Communication	02H

Set Switch Buffered Tag Transaction Mode Enable

This command sets the switch buffered tag transaction mode enable in the reader. The enable control byte is returned as 0 for disabled or 1 for enabled. Table 6-51 and Table 6-52 list the command and response data.

Table 6-51 Set Switch Buffered Tag Transaction Mode Enable Command (001AH)

Set Switch Buffered Tag Transaction Mode Enable Command Data	Data Payload
Set Switch Buffered Tag Transaction Mode Enable Command	001AH
Enable Control Byte: 0 = Disabled, 1 = Enabled	XXH

Table 6-52 Set Switch Buffered Tag Transaction Mode Enable Response

Set Switch Buffered Tag Transaction Mode Enable Response Data	Data Payload
Set Switch Buffered Tag Transaction Mode Enable Command	001AH

Get Switch Buffered Tag Transaction Mode Enable

This command gets the switch buffered tag transaction mode enable from the reader. The enable control byte is returned as 0 for disabled or 1 for enabled. Table 6-53 and Table 6-54 list the command and response data.

Table 6-53 Get Switch Buffered Tag Transaction Mode Enable Command (001BH)

Get Switch Buffered Tag Transaction Mode Enable Command Data	Data Payload
Get Switch Buffered Tag Transaction Mode Enable Command	001BH

Table 6-54 Get Switch Buffered Tag Transaction Mode Enable Response

Get Switch Buffered Tag Transaction Mode Enable Response Data	Data Payload

Table 6-54 Get Switch Buffered Tag Transaction Mode Enable Response

Get Switch Buffered Tag Transaction Mode Enable Command	001BH
Enable Control Byte: 0 = Disabled, 1 = Enabled	XXH

FPGA Firmware Download

This command downloads the reader's FPGA firmware. Table 6-55 and Table 6-56 list the command and response data.

Table 6-55 FPGA Firmware Download Command (001CH)

FPGA Firmware Download Command Data	Data Payload
FPGA Firmware Download Command	001CH

Table 6-56 FPGA Firmware Download Response

FPGA Firmware Download Response Data	Data Payload
FPGA Firmware Download Command	001CH

Boot Firmware Download

This command downloads the reader's CPU boot firmware. Table 6-57 and Table 6-58 list the command and response data.

Table 6-57 Boot Firmware Download Command (001DH)

Boot Firmware Download Command Data	Data Payload
Boot Firmware Download Command	001DH

Table 6-58 Boot Firmware Download Response

Boot Firmware Download Response Data	Data Payload
Boot Firmware Download Command	001DH

Get System Serial Number

This command gets the reader's serial number. Table 6-59 and Table 6-60 list the command and response data.

Table 6-59 Get System Serial Number Command (001FH)

Get System Serial Number Command Data	Data Payload
Get System Serial Number Command	001FH

Table 6-60 Get System Serial Number Response

Get System Serial Number Response Data	Data Payload
Get System Serial Number Command	001FH
Serial Number Data: 15 bytes	

Get Firmware Version Numbers

This command gets the reader's firmware version numbers. Table 6-61 and Table 6-62 list the command and response data.

Table 6-61 Get Firmware Version Numbers Command (0021H)

Get Firmware Version Numbers Command Data	Data Payload
Get Firmware Version Numbers Command	0021H

Table 6-62 Get Firmware Version Numbers Response

Get Firmware Version Numbers Response Data	Data Payload
Get Firmware Version Numbers Command	0021H
Digital Board Central Processing Unit (CPU) Boot Firmware Version Number (MSW)	XXXXH
Digital Board CPU Boot Firmware Version Number (LSW)	XXXXH
Digital Board CPU Application Firmware Version Number (MSW)	XXXXH
Digital Board CPU Application Firmware Version Number (LSW)	XXXXH
Digital Board FPGA1 Firmware Version Number (MSW)	XXXXH
Digital Board FPGA1 Firmware Version Number (LSW)	XXXXH
Daughter Board FPGA2 Firmware Version Number (MSW)	XXXXH
Daughter Board FPGA2 Firmware Version Number (LSW)	XXXXH
RF Transceiver FPGA Firmware Version Number (MSW)	XXXXH
RF Transceiver FPGA Firmware Version Number (LSW)	XXXXH

Load Default Operating Parameters

This command loads the reader's default operating parameters. Table 6-63 and Table 6-64 list the command and response data.

Table 6-63 Load Default Operating Parameters Command (002BH)

Load Default Operating Parameters Command Data	Data Payload
Load Default Operating Parameters Command	002BH
Load Default Operating Parameters Control Word (MSB)	A5H
Load Default Operating Parameters Control Word (LSB)	A5H

Table 6-64 Load Default Operating Parameters Response

Load Default Operating Parameters Response Data	Data Payload
Load Default Operating Parameters Command	002BH

Note: *This command resets the AI1200 tag buffer.*

Digital I/O Command Group Commands (4000H)

The digital input/output (I/O) assembly is used to interface the Encompass reader with external inputs and outputs. Inputs can be devices such as light curtains or loops, and outputs can be devices such as gates or lights. Table 6-65 lists the Digital I/O Command Group commands that are used in the Encompass multiprotocol reader.

Table 6-65 Digital I/O Command Group Commands

Digital I/O Configuration Command	Command Code
Set Digital I/O Sensor Status Change Report	0000H
Get Digital I/O Sensor Status Change Report	0001H
Set Digital I/O Output Host Control	0002H
Get Digital I/O Output Host Control	0003H
Set Digital I/O Output Tag Read Control	0004H
Get Digital I/O Output Tag Read Control	0005H
Set Digital I/O RF Control	0006H
Get Digital I/O RF Control	0007H
Set Digital I/O RF Multiplexing Mode	0008H
Get Digital I/O RF Multiplexing Mode	0009H
Set Digital I/O Output Pulse Duration	000AH
Get Digital I/O Output Pulse Duration	000BH
Set Digital I/O Minimum Presence True Period	000CH
Get Digital I/O Minimum Presence True Period	000DH
Set Digital I/O Sensor Input Inversion	000EH
Get Digital I/O Sensor Input Inversion	000FH
Set Digital I/O Port Configuration	0010H
Get Digital I/O Port Configuration	0011H
Set Digital I/O Sensor Input Report	0012H
Get Digital I/O Sensor Input Report	0013H
Set Digital I/O Presence RF Control Algorithm	0014H
Get Digital I/O Presence RF Control Algorithm	0015H

Table 6-65 Digital I/O Command Group Commands

Digital I/O Configuration Command	Command Code
Set Digital I/O Presence RF Control Time-Out Period	0016H
Get Digital I/O Presence RF Control Time-Out Period	0017H
Get Digital I/O Port Status	0018H
Set Digital I/O Mode	0019H
Get Digital I/O Mode	001AH
Set External Interrupt Control	056DH
Get External Interrupt Control	06ADH

Digital I/O Command Group Responses

Table 6-66 lists the responses and codes for the Digital I/O command group.

Table 6-66 Digital I/O Command Group Responses

Digital I/O Responses	Response Code
Synchronous OK Status Responses	88XXH
Reserved	8800H
Reserved	8801H
Asynchronous OK Status Responses	48XXH
Command Complete	4800H
Command In Progress	4801H
Unsolicited OK Status Responses	28XXH
Reserved	84XXH
Reserved	44XXH

Table 6-66 Digital I/O Command Group Responses

Digital I/O Responses	Response Code
Reserved	24XXH
Synchronous Error Status Responses	82XXH
Message Length Error	8200H
Message Sequence Error	8201H
Reserved	8202H
Command Group Error	8203H
Reserved	8204H
Reserved	8205H
Reserved	8206H
Reserved	8207H
Reserved	8208H
Data Acknowledge Response Error	8209H
Reserved	820AH
Asynchronous Error Status Responses	42XXH
Message Length Error	4200H
Command Sequence Error	4201H
Reserved	4202H
Command Group Error	4203H
Command Time-out Error	4204H
Reserved	4205H
Command Failed Error	4206H
System Command Error	4207H
Sub-command Error	4208H
Reserved	4209H
Invalid Control Word Error	420AH

Table 6-66 Digital I/O Command Group Responses

Digital I/O Responses	Response Code
Invalid Command Data Error System	420BH
Unsolicited Error Status Responses	22XXH
Synchronous Control Status Responses	81XXH
Data Acknowledge (Ack), data valid	8100H
Data Negative Acknowledge (Nack), data invalid	8101H
Reserved	8102H
Reserved	8104H
Asynchronous Control Status Responses	41XXH
Unsolicited Control Status Responses	21XXH

Digital I/O Command Group Response Data

Asynchronous OK Status Responses

The following Digital I/O command group asynchronous OK status responses use the specified data payload.

Command Complete (4800H)

Command In Progress Response Data	Data Payload
Digital I/O Command Group Command (sub-command)	XXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
Digital I/O Command Group Command (sub-command)	XXXXH

Synchronous Error Status Responses

The following Digital I/O command group synchronous error status responses use the specified data payload.

Message Length Error Response Data (8200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Message Sequence Error Response Data (8201H)

Message Sequence Error Response Data	Data Payload
Expected Message Sequence Number	XXH
Received Message Sequence Number	XXH

Command Group Error Response Data (8203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Data Acknowledge Response Error Response Data (8209H)

Data Acknowledge Response Error Response Data	Data Payload
Invalid Data Acknowledge Response	XXXXH

Asynchronous Error Status Responses

The following Digital I/O command group asynchronous error status responses use the specified data payload.

Message Length Error Response Data (4200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Command Sequence Error Response Data (4201H)

Command Sequence Error Response Data	Data Payload
Expected Command Sequence Number	XXH
Received Command Sequence Number	XXH

Command Group Error (4203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Command Time-out Error (4204H)

Command Time-out Error Response Data	Data Payload
N/A	

Command Failed Error (4206H)

Command Failed Error Response Data	Data Payload
Digital I/O Command Group Command (sub-command)	XXXXH

System Command Error (4207H)

System Command Error Response Data	Data Payload
N/A	

Sub-Command Error (4208H)

Sub-Command Error Response Data	Data Payload
Sub-command	XXXXH

Invalid Control Word Error (420AH)

Invalid Control Word Error Response Data	Data Payload
N/A	

Invalid Command Data Error (420BH)

Invalid Command Data Error Response Data	Data Payload
N/A	

Digital I/O Asynchronous Reports

The Digital I/O supports the generation of the following asynchronous response message reports as defined by the transaction record type code (Table 6-67).

Table 6-67 Digital I/O Asynchronous Reports

Digital I/O Asynchronous Report Type	Code
Sensor Status Change Report	3050H
Sensor Input Report	3051H

Sensor Status Change Report

This Digital I/O report is generated when a sensor detects a presence change and that sensor is configured to generate a report (Table 6-68).

Table 6-68 Sensor Status Change Report

Sensor Status Change Report	Data Payload
Sensor Status Change Report Transaction Record Type	3050H
Port Configuration	0XH
Port number Reporting Status Change: 0–3 for Port0–Port 3	0XH
Port Status	0XH

Port Configuration — This field specifies the digital port input/output configuration. In Table 6-69, INPUT = 0 and OUTPUT = 1.

Table 6-69 Port Configuration

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	INPUT	INPUT	INPUT	INPUT
01H	INPUT	INPUT	INPUT	OUTPUT
02H	INPUT	INPUT	OUTPUT	INPUT
03H	INPUT	INPUT	OUTPUT	OUTPUT
04H	INPUT	OUTPUT	INPUT	INPUT
05H	INPUT	OUTPUT	INPUT	OUTPUT
06H	INPUT	OUTPUT	OUTPUT	INPUT
07H	INPUT	OUTPUT	OUTPUT	OUTPUT
08H	OUTPUT	INPUT	INPUT	INPUT
09H	OUTPUT	INPUT	INPUT	OUTPUT
0AH	OUTPUT	INPUT	OUTPUT	INPUT
0BH	OUTPUT	INPUT	OUTPUT	OUTPUT
0CH	OUTPUT	OUTPUT	INPUT	INPUT
0DH	OUTPUT	OUTPUT	INPUT	OUTPUT
0EH	OUTPUT	OUTPUT	OUTPUT	INPUT
0FH	OUTPUT	OUTPUT	OUTPUT	OUTPUT

Port Status — This field specifies the digital port status. In Table 6-70, LOW = 0 and HIGH = 1.

Table 6-70 Port Status

Status Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	LOW	LOW	LOW	LOW
01H	LOW	LOW	LOW	HIGH
02H	LOW	LOW	HIGH	LOW
03H	LOW	LOW	HIGH	HIGH

Table 6-70 Port Status

Status Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
04H	LOW	HIGH	LOW	LOW
05H	LOW	HIGH	LOW	HIGH
06H	LOW	HIGH	HIGH	LOW
07H	LOW	HIGH	HIGH	HIGH
08H	HIGH	LOW	LOW	LOW
09H	HIGH	LOW	LOW	HIGH
0AH	HIGH	LOW	HIGH	LOW
0BH	HIGH	LOW	HIGH	HIGH
0CH	HIGH	HIGH	LOW	LOW
0DH	HIGH	HIGH	LOW	HIGH
0EH	HIGH	HIGH	HIGH	LOW
0FH	HIGH	HIGH	HIGH	HIGH

Sensor Input Report

This digital I/O report generates when a sensor detects a vehicle presence but no valid tag read occurs (Table 6-71).Se

Table 6-71 Sensor Input Report

Sensor Input Report	Data Payload
Sensor Input Report Transaction Record Type	3051H
Port Configuration	0XH
Port Number Reporting Missed Tag Read: 0–3 for Port0–Port3	0XH

Port Configuration — This field specifies the digital port input/output configuration. In Table 6-72, INPUT = 0 and OUTPUT = 1.

Table 6-72 Port Configuration

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	INPUT	INPUT	INPUT	INPUT
01H	INPUT	INPUT	INPUT	OUTPUT

Table 6-72 Port Configuration

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
02H	INPUT	INPUT	OUTPUT	INPUT
03H	INPUT	INPUT	OUTPUT	OUTPUT
04H	INPUT	OUTPUT	INPUT	INPUT
05H	INPUT	OUTPUT	INPUT	OUTPUT
06H	INPUT	OUTPUT	OUTPUT	INPUT
07H	INPUT	OUTPUT	OUTPUT	OUTPUT
08H	OUTPUT	INPUT	INPUT	INPUT
09H	OUTPUT	INPUT	INPUT	OUTPUT
0AH	OUTPUT	INPUT	OUTPUT	INPUT
0BH	OUTPUT	INPUT	OUTPUT	OUTPUT
0CH	OUTPUT	OUTPUT	INPUT	INPUT
0DH	OUTPUT	OUTPUT	INPUT	OUTPUT
0EH	OUTPUT	OUTPUT	OUTPUT	INPUT
0FH	OUTPUT	OUTPUT	OUTPUT	OUTPUT

Set Digital I/O Sensor Status Change Report

This command sets the digital I/O sensor status change report mask. Table 6-73 and Table 6-74 list the command and response data.

Table 6-73 Set Digital I/O Sensor Status Change Report Command (0000H)

Set Digital I/O Sensor Status Change Report Data	Data Payload
Set Digital I/O Sensor Status Change Report	0000H
Sensor Status Change Report Mask	0XH

Table 6-74 Set Digital I/O Sensor Status Change Report Response

Set Digital I/O Sensor Status Change Report Response Data	Data Payload
Set Digital I/O Sensor Status Change Report Command	0000H

Sensor Status Change Report Mask — This field specifies the sensor inputs that are monitored for status change and associated sensor status change report generation. In Table 6-75, OFF = 0 and ON = 1.

Table 6-75 Sensor Status Change Report Mask Values

Mask Value	Sensor Input 3	Sensor Input 2	Sensor Input 1	Sensor Input 0
00H	OFF	OFF	OFF	OFF
01H	OFF	OFF	OFF	ON
02H	OFF	OFF	ON	OFF
03H	OFF	OFF	ON	ON
04H	OFF	ON	OFF	OFF
05H	OFF	ON	OFF	ON
06H	OFF	ON	ON	OFF
07H	OFF	ON	ON	ON
08H	ON	OFF	OFF	OFF
09H	ON	OFF	OFF	ON
0AH	ON	OFF	ON	OFF
0BH	ON	OFF	ON	ON
0CH	ON	ON	OFF	OFF
0DH	ON	ON	OFF	ON
0EH	ON	ON	ON	OFF
0FH	ON	ON	ON	ON

Get Digital I/O Sensor Status Change Report

This command gets the digital I/O sensor status change report mask. Table 6-76 and Table 6-77 list the command and response data.

Table 6-76 Get Digital I/O Sensor Status Change Report Command (0001H)

Get Digital I/O Sensor Status Change Report Data	Data Payload
Get Digital I/O Sensor Status Change Report	0001H

Table 6-77 Get Digital I/O Sensor Status Change Report Response

Get Digital I/O Sensor Status Change Report Response Data	Data Payload
Get Digital I/O Sensor Status Change Report Command	0001H
Sensor Status Change Report Mask	0XH

Sensor Status Change Report Mask — This field specifies the sensor inputs that are monitored for status change and associated sensor status change report generation. In Table 6-78, OFF = 0 and ON = 1.

Table 6-78 Sensor Status Change Report Mask Values

Mask Value	Sensor Input 3	Sensor Input 2	Sensor Input 1	Sensor Input 0
00H	OFF	OFF	OFF	OFF
01H	OFF	OFF	OFF	ON
02H	OFF	OFF	ON	OFF
03H	OFF	OFF	ON	ON
04H	OFF	ON	OFF	OFF
05H	OFF	ON	OFF	ON
06H	OFF	ON	ON	OFF
07H	OFF	ON	ON	ON
08H	ON	OFF	OFF	OFF
09H	ON	OFF	OFF	ON
0AH	ON	OFF	ON	OFF
0BH	ON	OFF	ON	ON
0CH	ON	ON	OFF	OFF
0DH	ON	ON	OFF	ON
0EH	ON	ON	ON	OFF
0FH	ON	ON	ON	ON

Set Digital I/O Output Host Control

This command sets the digital I/O outputs that the host controls. Table 6-79 and Table 6-80 list the command and response data.

Table 6-79 Set Digital I/O Output Host Control Command (0002H)

Set Digital I/O Output Host Control Data	Data Payload
Set Digital I/O Output Host Control Command	0002H
Output Control	0XH

Table 6-80 Set Digital I/O Output Host Control Response

Set Digital I/O Output Host Control Response Data	Data Payload
Set Digital I/O Output Host Control Command	0002H

Output Control — This field specifies the digital outputs that the host controls. In Table 6-81, OFF = 0 and ON = 1.

Table 6-81 Output Control Values

Control Value	Output Control 3	Output Control 2	Output Control 1	Output Control 0
00H	OFF	OFF	OFF	OFF
01H	OFF	OFF	OFF	ON
02H	OFF	OFF	ON	OFF
03H	OFF	OFF	ON	ON
04H	OFF	ON	OFF	OFF
05H	OFF	ON	OFF	ON
06H	OFF	ON	ON	OFF
07H	OFF	ON	ON	ON
08H	ON	OFF	OFF	OFF
09H	ON	OFF	OFF	ON
0AH	ON	OFF	ON	OFF
0BH	ON	OFF	ON	ON
0CH	ON	ON	OFF	OFF
0DH	ON	ON	OFF	ON
0EH	ON	ON	ON	OFF
0FH	ON	ON	ON	ON

Note: *RESET READER command required to set output host control, but not required if only asserting outputs.*

Get Digital I/O Output Host Control

This command gets the digital I/O outputs that the host controls. Table 6-82 and Table 6-83 list the command and response data.

Table 6-82 Get Digital I/O Output Host Control Command (0003H)

Get Digital I/O Output Host Control Data	Data Payload
Get Digital I/O Output Host Control Command	0003H

Table 6-83 Get Digital I/O Output Host Control Response

Get Digital I/O Output Host Control Response Data	Data Payload
Get Digital I/O Output Host Control Command	0003H
Output Control	0XH

Output Control — This field specifies the digital outputs that the host controls. In Table 6-84, OFF = 0 and ON = 1.

Table 6-84 Output Control Values

Control Value	Output Control 3	Output Control 2	Output Control 1	Output Control 0
00H	OFF	OFF	OFF	OFF
01H	OFF	OFF	OFF	ON
02H	OFF	OFF	ON	OFF
03H	OFF	OFF	ON	ON
04H	OFF	ON	OFF	OFF
05H	OFF	ON	OFF	ON
06H	OFF	ON	ON	OFF
07H	OFF	ON	ON	ON
08H	ON	OFF	OFF	OFF
09H	ON	OFF	OFF	ON
0AH	ON	OFF	ON	OFF
0BH	ON	OFF	ON	ON
0CH	ON	ON	OFF	OFF

Table 6-84 Output Control Values

Control Value	Output Control 3	Output Control 2	Output Control 1	Output Control 0
0DH	ON	ON	OFF	ON
0EH	ON	ON	ON	OFF
0FH	ON	ON	ON	ON

Set Digital I/O Output Tag Read Control

This command sets the digital I/O outputs that are controlled by a good tag read. Table 6-85 and Table 6-86 list the command and response data.

Table 6-85 Set Digital I/O Output Tag Read Control Command (0004H)

Set Digital I/O Output Tag Read Control Command Data	Data Payload
Set Digital I/O Output Tag Read Control Command	0004H

Table 6-86 Set Digital I/O Output Tag Read Control Response

Set Digital I/O Output Tag Read Control Response Data	Data Payload
Set Digital I/O Output Tag Read Control Command	0004H

Note: *RESET READER command required for changes to take effect.*

Get Digital I/O Output Tag Read Control

This command gets the digital I/O outputs that are controlled by a good tag read. Table 6-87 and Table 6-88 list the command and response data.

Table 6-87 Get Digital I/O Output Tag Read Control Command (0005H)

Get Digital I/O Output Tag Read Control Command Data	Data Payload
Get Digital I/O Output Tag Read Control Command	0005H

Table 6-88 Get Digital I/O Output Tag Read Control Response

Get Digital I/O Output Tag Read Control Response Data	Data Payload
Get Digital I/O Output Tag Read Control Command	0005H

Table 6-88 Get Digital I/O Output Tag Read Control Response

Get Digital I/O Output Tag Read Control Response Data	Data Payload
Output Control	0XH

Output Control — This field specifies the digital outputs that are controlled by a good tag read. In Table 6-89, OFF = 0 and ON = 1.

Table 6-89 Output Control Values

Control Value	Output Control 3	Output Control 2	Output Control 1	Output Control 0
00H	OFF	OFF	OFF	OFF
01H	OFF	OFF	OFF	ON
02H	OFF	OFF	ON	OFF
03H	OFF	OFF	ON	ON
04H	OFF	ON	OFF	OFF
05H	OFF	ON	OFF	ON
06H	OFF	ON	ON	OFF
07H	OFF	ON	ON	ON
08H	ON	OFF	OFF	OFF
09H	ON	OFF	OFF	ON
0AH	ON	OFF	ON	OFF
0BH	ON	OFF	ON	ON
0CH	ON	ON	OFF	OFF
0DH	ON	ON	OFF	ON
0EH	ON	ON	ON	OFF
0FH	ON	ON	ON	ON

Set Digital I/O RF Control

This command sets the digital I/O RF control mode. Table 6-90 and Table 6-91 list the command and response data.

Table 6-90 Set Digital I/O RF Control Command (0006H)

Set Digital I/O RF Control Command Data	Data Payload
Set Digital I/O RF Control Command	0006H
RF Control Mode	0XH

Table 6-91 Set Digital I/O RF Control Response

Set Digital I/O RF Control Response Data	Data Payload
Set Digital I/O RF Control Command	0006H

RF Control Mode — This field specifies the RF control mode.

Mode Value	RF Control Mode
00H	RF controlled by sensor
01H	RF on continuously

Note: *RESET READER command required for changes to take effect.*

Get Digital I/O RF Control

This command gets the digital I/O RF control mode. Table 6-92 and Table 6-93 list the command and response data.

Table 6-92 Get Digital I/O RF Control Command (0007H)

Get Digital I/O RF Control Command Data	Data Payload
Get Digital I/O RF Control Command	0007H

Table 6-93 Get Digital I/O RF Control Response

Get Digital I/O RF Control Response Data	Data Payload
Get Digital I/O RF Control Command	0007H
RF Control Mode	0XH

RF Control Mode — This field specifies the RF control mode.

Mode Value	RF Control Mode
00H	RF controlled by sensor
01H	RF on continuously

Set Digital I/O RF Multiplexing Mode

This command sets the digital I/O RF multiplexing mode. Table 6-94 and Table 6-95 list the command and response data.

Table 6-94 Set Digital I/O RF Multiplexing Mode Command (0008H)

Set Digital I/O RF Multiplexing Mode Command Data	Data Payload
Set Digital I/O RF Multiplexing Mode Command	0008H
RF Multiplexing Mode	0XH

Table 6-95 Set Digital I/O RF Multiplexing Mode Response

Set Digital I/O RF Multiplexing Mode Response Data	Data Payload
Set Digital I/O RF Multiplexing Mode Command	0008H

RF Multiplexing Mode — This field specifies the RF multiplexing mode (Table 6-96).

Table 6-96 RF Multiplexing Mode Values

Mode Value	RF Multiplexing Mode
00H	No RF multiplexing
01H	One-channel multiplexing (channel 0)
03H	Two-channel multiplexing (channels 0 and 1)
0CH	Two-channel multiplexing (channels 2 and 3)
07H	Three-channel multiplexing (channels 0, 1, and 2)
0FH	Four-channel multiplexing (channels 0, 1, 2, and 3)

Note: *RESET READER command required for changes to take effect.*

Get Digital I/O RF Multiplexing Mode

This command gets the digital I/O RF multiplexing mode. Table 6-97 and Table 6-98 list the command and response data.

Table 6-97 Get Digital I/O RF Multiplexing Mode Command (0009H)

Get Digital I/O RF Multiplexing Mode Command Data	Data Payload
Get Digital I/O RF Multiplexing Mode Command	0009H

Table 6-98 Get Digital I/O RF Multiplexing Mode Response

Set Digital I/O RF Multiplexing Mode Response Data	Data Payload
Set Digital I/O RF Multiplexing Mode Command	0009H
RF Multiplexing Mode	0XH

RF Multiplexing Mode — This field specifies the RF multiplexing mode (Table 6-99).

Table 6-99 RF Multiplexing Mode Values

Mode Value	RF Multiplexing Mode
00H	No RF multiplexing
01H	One-channel multiplexing (channel 0)
03H	Two-channel multiplexing (channels 0 and 1)

Table 6-99 RF Multiplexing Mode Values

Mode Value	RF Multiplexing Mode
0CH	Two-channel multiplexing (channels 2 and 3)
07H	Three-channel multiplexing (channels 0, 1, and 2)
0FH	Four-channel multiplexing (channels 0, 1, 2, and 3)

Set Digital I/O Output Pulse Duration

This command sets the Digital I/O output pulse duration. Table 6-100 and Table 6-101 list the command and response data.

Table 6-100 Set Digital I/O Output Pulse Duration Command (000AH)

Set Digital I/O Output Pulse Duration Command Data	Data Payload
Set Digital I/O Output Pulse Duration Command	000AH
Output Port Number: 0–3 for Port0–Port3	0XH
Output Pulse Duration	0XH

Table 6-101 Set Digital I/O Output Pulse Duration Response

Set Digital I/O Output Pulse Duration Response Data	Data Payload
Set Digital I/O Output Pulse Duration Command	000AH

Output Pulse Duration — This field specifies the output pulse duration (digital outputs ON and OFF times). The digital outputs have a 50% duty cycle (Table 6-102).

Table 6-102 Output Pulse Duration Values

Duration Value	Pulse Duration (ms)
00H	4
01H	8
02H	12
03H	16
04H	20
05H	24

Table 6-102 Output Pulse Duration Values

Duration Value	Pulse Duration (ms)
06H	32
07H	40
08H	48
09H	60
0AH	76
0BH	152
0CH	228
0DH	300
0EH	376
0FH	752

Get Digital I/O Output Pulse Duration

This command gets the Digital I/O output pulse duration. Table 6-103 and Table 6-104 list the command and response data.

Table 6-103 Get Digital I/O Output Pulse Duration Command (000BH)

Get Digital I/O Output Pulse Duration Command Data	Data Payload
Get Digital I/O Output Pulse Duration Command	000BH
Output Port Number: 0–3 for Port0–Port3	0XH

Table 6-104 Get Digital I/O Output Pulse Duration Response

Get Digital I/O Output Pulse Duration Response Data	Data Payload
Get Digital I/O Output Pulse Duration Command	000BH
Output Port Number: 0–3 for Port0–Port3	0XH
Output Pulse Duration	0XH

Output Pulse Duration — This field specifies the output pulse duration (digital outputs ON and OFF times). The digital outputs have a 50% duty cycle (Table 6-105).

Table 6-105 Output Pulse Duration Values

Duration Value	Pulse Duration (ms)
00H	4
01H	8
02H	12
03H	16
04H	20
05H	24
06H	32
07H	40
08H	48
09H	60
0AH	76
0BH	152
0CH	228
0DH	300
0EH	376
0FH	752

Set Digital I/O Minimum Presence True Period

This command sets the digital I/O minimum presence true period, which is the minimum amount of time that the input must be valid. Table 6-106 and Table 6-107 list the command and response data.

Table 6-106 Set Digital I/O Minimum Presence True Period Command (000CH)

Set Digital I/O Minimum Presence True Period Command Data	Data Payload
Set Digital I/O Minimum Presence True Period Command	000CH
Minimum Presence True Period	0XH

Table 6-107 Set Digital I/O Minimum Presence True Period Response

Set Digital I/O Minimum Presence True Period Response Data	Data Payload
Set Digital I/O Minimum Presence True Period Command	000CH

Minimum Presence True Period — This field specifies the minimum presence true period (Table 6-108).

Table 6-108 Minimum Presence True Period Values

True Period Value	True Period (ms)
00H	0 (always true)
01H	4
02H	8
03H	12
04H	20
05H	24
06H	**32 (default)**
07H	48
08H	60
09H	92
0AH	152
0BH	300

Table 6-108 Minimum Presence True Period Values

True Period Value	True Period (ms)
0CH	452
0DH	600
0EH	752
0FH	Infinite (never true)

Get Digital I/O Minimum Presence True Period

This command gets the digital I/O minimum presence true period, which is the minimum amount of time that the input must be valid. Table 6-109 and Table 6-110 list the command and response data.

Table 6-109 Get Digital I/O Minimum Presence True Period Command (000DH)

Get Digital I/O Minimum Presence True Period Command Data	Data Payload
Get Digital I/O Minimum Presence True Period Command	000DH

Table 6-110 Get Digital I/O Minimum Presence True Period Response

Set Digital I/O Minimum Presence True Period Response Data	Data Payload
Set Digital I/O Minimum Presence True Period Command	000DH
Minimum Presence True Period	0XH

Minimum Presence True Period — This field specifies the minimum presence true period (Table 6-111).

Table 6-111 Minimum Presence True Period Values

True Period Value	True Period (ms)
00H	0 (always true)
01H	4
02H	8

Table 6-111 Minimum Presence True Period Values

True Period Value	True Period (ms)
03H	12
04H	20
05H	24
06H	**32 (default)**
07H	48
08H	60
09H	92
0AH	152
0BH	300
0CH	452
0DH	600
0EH	752
0FH	Infinite (never true)

Set Digital I/O Sensor Input Inversion

This command sets the digital I/O sensor input inversion. Table 6-112 and Table 6-113 list the command and response data.

Table 6-112 Set Digital I/O Sensor Input Inversion Command (000EH)

Set Digital I/O Sensor Input Inversion Command Data	Data Payload
Set Digital I/O Sensor Input Inversion Command	000EH
Logic True Inversion: 0 = normal logic true, 1 = inverted logic true	0XH

Table 6-113 Set Digital I/O Sensor Input Inversion Command Response

Set Digital I/O Sensor Input Inversion Response Data	Data Payload
Set Digital I/O Sensor Input Inversion Command	000EH

The logic true inversion is in relationship with the OPTO22 digital input.

Get Digital I/O Sensor Input Inversion

This command gets the digital I/O sensor input inversion. Table 6-114 and Table 6-115 list the command and response data.

Table 6-114 Get Digital I/O Sensor Input Inversion Command (000FH)

Get Digital I/O Sensor Input Inversion Command Data	Data Payload
Get Digital I/O Sensor Input Inversion Command	000FH

Table 6-115 Get Digital I/O Sensor Input Inversion Response

Get Digital I/O Sensor Input Inversion Response Data	Data Payload
Get Digital I/O Sensor Input Inversion Command	000FH
Logic True Inversion: 0 = normal logic true, 1 = inverted logic true	0XH

The logic true inversion is in relationship with the OPTO22 digital input.

Set Digital I/O Port Configuration

This command configures the digital I/O ports. Table 6-116 and Table 6-117 list the command and response data.

Table 6-116 Set Digital I/O Port Configuration Command (0010H)

Set Digital I/O Port Configuration Command Data	Data Payload
Set Digital I/O Port Configuration Command	0010H
Port Configuration	0XH

Table 6-117 Set Digital I/O Port Configuration Response

Set Digital I/O Port Configuration Response Data	Data Payload
Set Digital I/O Port Configuration Command	0010H

Port Configuration — This field specifies the digital port input/output configuration. In Table 6-118, INPUT = 0 and OUTPUT = 1.

Table 6-118 Digital I/O Port Configuration Values

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	INPUT	INPUT	INPUT	INPUT
01H	INPUT	INPUT	INPUT	OUTPUT
02H	INPUT	INPUT	OUTPUT	INPUT
03H	INPUT	INPUT	OUTPUT	OUTPUT
04H	INPUT	OUTPUT	INPUT	INPUT
05H	INPUT	OUTPUT	INPUT	OUTPUT
06H	INPUT	OUTPUT	OUTPUT	INPUT
07H	INPUT	OUTPUT	OUTPUT	OUTPUT
08H	OUTPUT	INPUT	INPUT	INPUT
09H	OUTPUT	INPUT	INPUT	OUTPUT
0AH	OUTPUT	INPUT	OUTPUT	INPUT
0BH	OUTPUT	INPUT	OUTPUT	OUTPUT
0CH	OUTPUT	OUTPUT	INPUT	INPUT
0DH	OUTPUT	OUTPUT	INPUT	OUTPUT
0EH	OUTPUT	OUTPUT	OUTPUT	INPUT
0FH	OUTPUT	OUTPUT	OUTPUT	OUTPUT

Note: *RESET READER command required for changes to take effect.*

Get Digital I/O Port Configuration

This command gets the digital I/O port configuration settings. Table 6-119 and Table 6-120 list the command and response data.

Table 6-119 Get Digital I/O Port Configuration Command (0011H)

Get Digital I/O Port Configuration Command Data	Data Payload
Get Digital I/O Port Configuration Command	0011H

Table 6-120 Set Digital I/O Port Configuration Response

Get Digital I/O Port Configuration Response Data	Data Payload
Get Digital I/O Port Configuration Command	0011H
Port Configuration	0XH

Port Configuration — This field specifies the digital port input/output configuration. In Table 6-121, INPUT = 0 and OUTPUT = 1.

Table 6-121 Digital I/O Port Configuration Values

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	INPUT	INPUT	INPUT	INPUT
01H	INPUT	INPUT	INPUT	OUTPUT
02H	INPUT	INPUT	OUTPUT	INPUT
03H	INPUT	INPUT	OUTPUT	OUTPUT
04H	INPUT	OUTPUT	INPUT	INPUT
05H	INPUT	OUTPUT	INPUT	OUTPUT
06H	INPUT	OUTPUT	OUTPUT	INPUT
07H	INPUT	OUTPUT	OUTPUT	OUTPUT
08H	OUTPUT	INPUT	INPUT	INPUT
09H	OUTPUT	INPUT	INPUT	OUTPUT
0AH	OUTPUT	INPUT	OUTPUT	INPUT
0BH	OUTPUT	INPUT	OUTPUT	OUTPUT
0CH	OUTPUT	OUTPUT	INPUT	INPUT
0DH	OUTPUT	OUTPUT	INPUT	OUTPUT
0EH	OUTPUT	OUTPUT	OUTPUT	INPUT
0FH	OUTPUT	OUTPUT	OUTPUT	OUTPUT

Set Digital I/O Sensor Input Report

This command sets the digital I/O sensor input report mask. Table 6-122 and Table 6-123 list the command and response data.

Table 6-122 Set Digital I/O Sensor Input Report Command (0012H)

Set Digital I/O Sensor Input Report Command Data	Data Payload
Set Digital I/O Sensor Input Report Command	0012H
Sensor Input Report Mask: 0 = reports disabled, 1 = reports enabled	0XH

Table 6-123 Set Digital I/O Sensor Input Report Response

Set Digital I/O Sensor Input Report Response Data	Data Payload
Set Digital I/O Sensor Input Report Command	0012H

Get Digital I/O Sensor Input Report

This command gets the digital I/O sensor input report mask. Table 6-124 and Table 6-125 list the command and response data.

Table 6-124 Get Digital I/O Sensor Input Report Command (0013H)

Get Digital I/O Sensor Input Report Command Data	Data Payload
Get Digital I/O Sensor Input Report Command	0013H

Table 6-125 Set Digital I/O Sensor Input Report Response

Get Digital I/O Sensor Input Report Response Data	Data Payload
Get Digital I/O Sensor Input Report Command	0013H
Sensor Input Report Mask: 0 = reports disabled, 1 = reports enabled	0XH

Set Digital I/O Presence RF Control Algorithm

This command sets the digital I/O presence RF control algorithm. Table 6-126 and

Table 6-127 list the command and response data.

Table 6-126 Set Digital I/O Presence RF Control Algorithm Command (0014H)

Set Digital I/O Presence RF Control Algorithm Command Data	Data Payload
Set Digital I/O Presence RF Control Algorithm Command	0014H
RF Control Algorithm	0XH

Table 6-127 Set Digital I/O Presence RF Control Algorithm Response

Set Digital I/O RF Control Response Data	Data Payload
Set Digital I/O Presence RF Control Algorithm Command	0014H

RF Control Algorithm — This field specifies the trigger for RF de-assertion.

Control Value	RF Power Off
00H	On time-out only
01H	Time-out or good tag read
02H	Time-out or presence false

Get Digital I/O Presence RF Control Algorithm

This command gets the digital I/O presence RF control algorithm. Table 6-128 and Table 6-129 list the command and response data.

Table 6-128 Get Digital I/O Presence RF Control Algorithm Command (0015H)

Get Digital I/O Presence RF Control Algorithm Command Data	Data Payload
Get Digital I/O Presence RF Control Algorithm Command	0015H

Table 6-129 Get Digital I/O Presence RF Control Algorithm Response

Get Digital I/O RF Control Response Data	Data Payload
Get Digital I/O Presence RF Control Algorithm Command	0015H
RF Control Algorithm	0XH

RF Control Algorithm — This field specifies the trigger for RF de-assertion.

Control Value	RF Power Off
00H	On time-out only
01H	Time-out or good tag read
02H	Time-out or presence false

Set Digital I/O Presence RF Control Time-out Period

This command sets the digital I/O presence RF control time-out period. Table 6-130 and Table 6-131 list the command and response data.

Table 6-130 Set Digital I/O Presence RF Control Time-out Period Command (0016H)

Set Digital I/O Presence RF Control Time-out Period Command Data	Data Payload
Set Digital I/O Presence RF Control Time-out Period Command	0016H
RF Assertion Duration	0XH

Table 6-131 Set Digital I/O Presence RF Control Time-out Period Response

Set Digital I/O Presence RF Control Time-out Period Response Data	Data Payload
Set Digital I/O Presence RF Control Time-out Period Command	0016H

RF Assertion Duration — This field specifies the RF assertion duration (time-out period) (Table 6-132).

Table 6-132 RF Assertion Duration Values

Duration Value	Assertion Duration (ms)
00H	0 (always true)
01H	20
02H	32
03H	60
04H	92
05H	152
06H	**300 (factory setting)**
07H	452
08H	600
09H	752
0AH	1500

Table 6-132 RF Assertion Duration Values

Duration Value	Assertion Duration (ms)
0BH	3000
0CH	6000
0DH	12000
0EH	24000
0FH	Infinite (never true)

Get Digital I/O Presence RF Control Time-out Period

This command gets the digital I/O presence RF control time-out period. Table 6-133 and Table 6-134 list the command and response data.

Table 6-133 Get Digital I/O Presence RF Control Time-out Period Command (0017H)

Get Digital I/O Presence RF Control Time-out Period Command Data	Data Payload
Get Digital I/O Presence RF Control Time-out Period Command	0017H

Table 6-134 Get Digital I/O Presence RF Control Time-out Period Response)

Get Digital I/O Presence RF Control Time-out Period Response Data	Data Payload
Get Digital I/O Presence RF Control Time-out Period Command	0017H
RF Assertion Duration	0XH

RF Assertion Duration — This field specifies the RF assertion duration (time-out period) (Table 6-135).

Table 6-135 RF Assertion Duration Values

Duration Value	Assertion Duration (ms)
00H	0 (always true)
01H	20
02H	32

Table 6-135 RF Assertion Duration Values

Duration Value	Assertion Duration (ms)
03H	60
04H	92
05H	152
06H	**300 (factory setting)**
07H	452
08H	600
09H	752
0AH	1500
0BH	3000
0CH	6000
0DH	12000
0EH	24000
0FH	Infinite (never true)

Get Digital I/O Port Status

This command gets the digital I/O port configuration and status. Table 6-136 and Table 6-137 list the command and response data.

Table 6-136 Get Digital I/O Port Status Command (0018H)

Get Digital I/O Port Status Command Data	Data Payload
Get Digital I/O Port Status Command	0018H

Table 6-137 Get Digital I/O Port Status Response

Get Digital I/O Port Status Response Data	Data Payload
Get Digital I/O Port Status Command	0018H
Port Configuration	0XH
Port Status	0XH

Port Configuration — This field specifies the digital port input/output configuration.

In Table 6-138, INPUT = 0 and OUTPUT = 1.

Table 6-138 Port Configuration Values

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	INPUT	INPUT	INPUT	INPUT
01H	INPUT	INPUT	INPUT	OUTPUT
02H	INPUT	INPUT	OUTPUT	INPUT
03H	INPUT	INPUT	OUTPUT	OUTPUT
04H	INPUT	OUTPUT	INPUT	INPUT
05H	INPUT	OUTPUT	INPUT	OUTPUT
06H	INPUT	OUTPUT	OUTPUT	INPUT
07H	INPUT	OUTPUT	OUTPUT	OUTPUT
08H	OUTPUT	INPUT	INPUT	INPUT
09H	OUTPUT	INPUT	INPUT	OUTPUT
0AH	OUTPUT	INPUT	OUTPUT	INPUT
0BH	OUTPUT	INPUT	OUTPUT	OUTPUT
0CH	OUTPUT	OUTPUT	INPUT	INPUT
0DH	OUTPUT	OUTPUT	INPUT	OUTPUT
0EH	OUTPUT	OUTPUT	OUTPUT	INPUT
0FH	OUTPUT	OUTPUT	OUTPUT	OUTPUT

Port Status — This field specifies the digital port status. In Table 6-139, LOW = 0 and HIGH = 1.

Table 6-139 Port Status Values

Status Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
00H	LOW	LOW	LOW	LOW
01H	LOW	LOW	LOW	HIGH
02H	LOW	LOW	HIGH	LOW
03H	LOW	LOW	HIGH	HIGH
04H	LOW	HIGH	LOW	LOW

Table 6-139 Port Status Values

Status Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
05H	LOW	HIGH	LOW	HIGH
06H	LOW	HIGH	HIGH	LOW
07H	LOW	HIGH	HIGH	HIGH
08H	HIGH	LOW	LOW	LOW
09H	HIGH	LOW	LOW	HIGH
0AH	HIGH	LOW	HIGH	LOW
0BH	HIGH	LOW	HIGH	HIGH
0CH	HIGH	HIGH	LOW	LOW
0DH	HIGH	HIGH	LOW	HIGH
0EH	HIGH	HIGH	HIGH	LOW
0FH	HIGH	HIGH	HIGH	HIGH

Set Digital I/O Mode

This command sets the digital I/O start and stop modes. Table 6-140 and Table 6-141 list the command and response data.

Table 6-140 Set Digital I/O Mode Command (0019H)

Set Digital I/O Mode Command Data	Data Payload
Set Digital I/O Mode Command	0019H
Digital I/O Mode: 0 = stop, 1 = start	0XH

Table 6-141 Set Digital I/O Mode Response

Set Digital I/O Mode Response Data	Data Payload
Set Digital I/O Mode Command	0019H

Get Digital I/O Mode

This command gets the digital I/O mode. Table 6-142 and Table 6-143 list the command and response data.

Table 6-142 Get Digital I/O Mode Command (001AH)

Get Digital I/O Mode Command Data	Data Payload
Get Digital I/O Mode Command	001AH

Table 6-143 Get Digital I/O Mode Response

Get Digital I/O Mode Response Data	Data Payload
Get Digital I/O Mode Command	001AH
Digital I/O Mode: 0 = stop, 1 = start	0XH

Set External Interrupt Control

This command sets the external interrupt control for the digital I/O devices. Table 6-144 and Table 6-145 list the command and response data.

Table 6-144 Set External Interrupt Control Command (056DH)

Set External Interrupt Control Command Data	Data Payload
Bits 7–0	
Set External Interrupt Control Command	05H
Command (continued)	6DH
Lead time	XXH
Lead time (continued)	XXH
Lag time	XXH
Lag time (continued)	XXH
Polarity	XXH
Event Mode	XXH

Polarity — used to establish the polarity of the external interrupt

Bit Value	Event Type
0	Positive polarity (default)

Bit Value	Event Type
1	Negative polarity

Event Mode — specifies type of event

Lead and Lag Times — equal to 10 milliseconds multiplied by the decimal equivalent of the data payload

Event Mode Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Reserved			Second car entry enable	No tag read enable	Light curtain entry enable	Light curtain exit enable	Lag timer time-out enable	XXH

Table 6-145 Set External Interrupt Control Response

Set External Interrupt Control Response Data	Data Payload
Bits 7–0	
Set External Interrupt Control Command	05H
Command (continued)	6DH

Changing the polarity for a light curtain using the Set External Interrupt Control command after the polarity has been initially established requires that two digital I/O command group commands be sent prior to using the Set External Interrupt Control command. Issue the commands in the order shown in Table 6-146.

Table 6-146 Digital I/O Commands

Digital I/O Commands	Command Code
Set Digital I/O Mode	0019H
Set Digital I/O Sensor Input Inversion	000EH

When issuing these commands, ensure that the Digital I/O mode is stopped and the sensor input inversion command is set to inverted.

Note: *RESET READER command required for changes to take effect.*

Get External Interrupt Control

This command gets the external interrupt control for the digital I/O devices. Table 6-147 and Table 6-148 list the command and response data.

Table 6-147 Get External Interrupt Control Command (06ADH)

Get External Interrupt Control Command Data	Data Payload
Bits 7–0	
Get External Interrupt Control Command	06H
Command (continued)	ADH

Table 6-148 Get External Interrupt Control Response

Get External Interrupt Control Response Data	Data Payload
Bits 7–0	
Get External Interrupt Control Command	06H
Command (continued)	ADH
Lead time	XXH
Lead time (continued)	XXH
Lag time	XXH
Lag time (continued)	XXH
Polarity	XXH
Event Mode	XXH

Table 6-149 lists the light curtain asynchronous responses.

Table 6-149 Light Curtain Asynchronous Response (8003H)

Light Curtain Asynchronous Response Data	Data Payload
Bits 7–0	
Record Type (MSB)	80H
Record Type (LSB)	03H
Event	XXH

Table 6-149 Light Curtain Asynchronous Response (8003H)

Hour	XXH
Minute	XXH
Second	XXH
Hundredths of Seconds	XXH
Month	XXH
Day	XXH
Year	XXH

Event — This field specifies the event type.

Field Value	Event Type
01H	Lag timer time-out
02H	Light curtain exit
04H	Light curtain entry
08H	No tag read
10H	Second car entry

RF Transceiver Command Group Commands (2000H)

Table 6-150 lists the RF Transceiver Command Group commands that are used in the Encompass multiprotocol reader.

Table 6-150 RF Transceiver Command Group Command

RF Transceiver Configuration Command	Command Code
Set Attenuation	51H
Get Attenuation	52H
Set Data Detect	53H
Get Data Detect	54H
Set Line Loss	55H

Table 6-150 RF Transceiver Command Group Command

RF Transceiver Configuration Command	Command Code
Get Line Loss	56H
Set Uplink Source Control	57H
Get Uplink Source Control	58H
Reserved	59H
Set Frequency in MHz	60H
Get Frequency in MHz	61H

RF Transceiver Command Group Responses

Table 6-151 lists the responses and codes for the RF transceiver command group.

Table 6-151 RF Tranceiver Command Group Responses

RF Transceiver Response	Response Code
Synchronous OK Status Responses	88XXH
Reserved	8800H
Reserved	8801H
Asynchronous OK Status Responses	48XXH
Command Complete	4800H
Command In Progress	4801H
Unsolicited OK Status Responses	28XXH
Reserved	84XXH
Reserved	44XXH
Reserved	24XXH

Table 6-151 RF Tranceiver Command Group Responses

RF Transceiver Response	Response Code
Synchronous Error Status Responses	82XXH
Message Length Error	8200H
Message Sequence Error	8201H
Reserved	8202H
Command Group Error	8203H
Reserved	8204H
Reserved	8205H
Reserved	8206H
Reserved	8207H
Reserved	8208H
Data Acknowledge Response Error	8209H
Reserved	820AH
Asynchronous Error Status Responses	42XXH
Message Length Error	4200H
Command Sequence Error	4201H
Reserved	4202H
Command Group Error	4203H
Command Time-out Error	4204H
Reserved	4205H
Command Failed Error	4206H
System Command Error	4207H
Sub-command Error	4208H
Reserved	4209H
Invalid Control Word Error	420AH

Table 6-151 RF Tranceiver Command Group Responses

RF Transceiver Response	Response Code
Unsolicited Error Status Responses	22XXH
Synchronous Control Status Responses	81XXH
Data Acknowledge (Ack), data valid	8100H
Data Negative Acknowledge (Nack), data invalid	8101H
Reserved	8102H
Reserved	8104H
Asynchronous Control Status Responses	41XXH
Unsolicited Control Status Responses	21XXH

RF Transceiver Command Group Response Data

synchronous OK Status Responses

The following Digital I/O command group asynchronous OK status responses use the specified data payload.

Command Complete (4800H)

Command In Progress Response Data	Data Payload
Digital I/O Command Group Command (sub-command)	XXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
Digital I/O Command Group Command (sub-command)	XXXXH

Synchronous Error Status Responses

The following RF Transceiver command group synchronous error status responses use the specified data payload.

Message Length Error Response Data (8200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Message Sequence Error Response Data (8201H)

Message Sequence Error Response Data	Data Payload
Expected Message Sequence Number	XXH
Received Message Sequence Number	XXH

Command Group Error Response Data (8203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Data Acknowledge Response Error Response Data (8209H)

Data Acknowledge Response Error Response Data	Data Payload
Invalid Data Acknowledge Response	XXXXH

Asynchronous Error Status Responses

The following RF Transceiver command group asynchronous error status responses use the specified data payload.

Message Length Error Response Data (4200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Command Sequence Error Response Data (4201H)

Command Sequence Error Response Data	Data Payload
Expected Command Sequence Number	XXH
Received Command Sequence Number	XXH

Command Group Error (4203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Command Time-out Error (4204H)

Command Time-out Error Response Data	Data Payload
N/A	

Command Failed Error (4206H)

Command Failed Error Response Data	Data Payload
RF Transceiver Command Group Command (sub-command)	XXXXH

System Command Error (4207H)

System Command Error Response Data	Data Payload
N/A	

Sub-Command Error (4208H))

Sub-Command Error Response Data	Data Payload
Sub-Command	XXH

Invalid Control Word Error (420AH)

Invalid Control Word Error Response Data	Data Payload
N/A	

Set RF Attenuation

This command sets the RF attenuation for the specific protocol from 0 to 15 decibels (dB) in 1-dB increments. Table 6-152 and Table 6-153 list the command and response data.

Table 6-152 Set RF Attenuation Command (51H)

Set RF Attenuation Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set RF Attenuation Command								51H
Protocol				Reserved				X0H
Downlink Attenuation				Uplink Attenuation				XXH
Carriage Return								0DH

Table 6-153 Set RF Attenuation Response

Set RF Attenuation Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set RF Attenuation Command								51H
Protocol				Reserved				X0H
ACK or NACK, where ACK = 0 and NACK = 1								0XH
Carriage Return								0DH

Protocol — This field sets the protocol for the RF Attenuation command

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

Get RF Attenuation

This command gets the RF attenuation as set using the Set RF Attenuation command. Table 6-154 and Table 6-155 list the command and response data.

Table 6-154 Get RF Attenuation Command (52H)

Get RF Attenuation Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get RF Attenuation Command								52H
Protocol				Reserved				X0H
Carriage Return								0DH

Table 6-155 Get RF Attenuation Response

Get RF Attenuation Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get RF Attenuation Command								52H
Protocol				Reserved				X0H
Downlink Attenuation				Uplink Attenuation				XXH
ACK or NACK, where ACK = 0 and NACK = 1								0XH

Table 6-155 Get RF Attenuation Response

Carriage Return	0DH

Protocol — This field specifies the protocol for the Get RF Attenuation command.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

Set Data Detect

This command sets the independent detection threshold levels for backscatter protocols of up to 20 dB in 1-dB increments via the command interface port. The respective protocol response is not passed until the data detect threshold has been exceeded. Table 6-156 and Table 6-157 list the command and response data.

Table 6-156 Set Data Detect Command (53H)

Set Data Detect Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Data Detect Command								53H
Protocol				Reserved				X0H
Data Detect Value (0–20)								XXH
Carriage Return								0DH

Table 6-157 Set Data Detect Response

Set Data Detect Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Data Detect Command								53H
Protocol				Reserved				X0H
ACK or NACK, where ACK = 0 and NACK = 1								0XH
Carriage Return								0DH

Protocol — This field sets the protocol for the Data Detect command.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

Get Data Detect

This command gets the data detect value. Table 6-158 and Table 6-159 list the command and response data.

Table 6-158 Get Data Detect Command

Get Data Detect Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Data Detect Command								54H
Protocol				Reserved				X0H
Carriage Return								0DH

Table 6-159 Get Data Detect Response

Get Data Detect Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Data Detect Command								54H
Protocol				Reserved				X0H
Data Detect Value								XXH
ACK or NACK, where ACK = 0 and NACK = 1								0XH
Carriage Return								0DH

Protocol — This field specifies the protocol for the Data Detect command.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

Set Line Loss

This command sets the Encompass reader system line loss value from 0 to 3 dB. Table 6-160 and Table 6-161 list the command and response data.

Note: *This command should be set only after you set the RF attenuation(s).*

Table 6-160 Set Line Loss Command (55H)

Set Line Loss Command Data	Data Payload
Bits 7–0	

Table 6-160 Set Line Loss Command (55H)

Set Line Loss Command	55H
Line Loss Value (0, 1, 2, or 3)	0XH
Carriage Return	0DH

Table 6-161 Set Line Loss Response

Set Line Loss Response Data	Data Payload
Bits 7–0	
Set Line Loss Command	55H
Line Loss Value (0, 1, 2, or 3)	0XH
ACK or NACK, where ACK = 0 and NACK = 1	0XH
Carriage Return	0DH

Get Line Loss

This command gets the Encompass reader system line loss value. Table 6-162 and Table 6-163 list the command and response data.

Table 6-162 Get Line Loss Command (56H)

Get Line Loss Command Data	Data Payload
Bits 7–0	
Get Line Loss Command	56H
Carriage Return	0DH

Table 6-163 Get Line Loss Response

Get Line Loss Response Data	Data Payload
Bits 7–0	
Get Line Loss Command	56H
Line Loss Value (0, 1, 2, or 3)	0XH
ACK or NACK, where ACK = 0 and NACK = 1	0XH
Carriage Return	0DH

Set Uplink Source Control

The protocol-dependent Set Uplink Source Control command is used if the RF uplink needs to use the RF downlink frequency, that is, eGo and ATA used with IT2200 and Title 21 while running step-lock. There are four uplink frequencies available. If more than four frequencies are needed, then the Uplink Source Control command must be used to provide the remaining needed frequencies with downlink frequency capability. Table 6-164 and Table 6-165 list the command and response data.

Table 6-164 Set Uplink Source Control Command (57H)

Set Uplink Source Control Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Uplink Source Control Command								57H
Protocol				Control				XXH

Table 6-164 Set Uplink Source Control Command (57H)

Set Uplink Source Control Command Data	Data Payload
Carriage Return	0DH

Table 6-165 Set Uplink Source Control Response

Set Uplink Source Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Uplink Source Control Command								57H
Protocol				Control				XXH
Acknowledge								00H
Carriage Return								0DH

Protocol — This field specifies the protocol for the Uplink Source Control command.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

Control — This field specifies the protocol for the Uplink Source Control command.

Control	Definition
0	Use Uplink Source (source 2)
1	Use Uplink Source (source 1)

Get Uplink Source Control

The Get Uplink Source Control command retrieves the source control information. Table 6-166 and Table 6-167 list the command and response data.

Table 6-166 Get Uplink Source Control Command (58H)

Get Uplink Source Control Command Data								**Data Payload**
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Uplink Source Control Command								58H
Protocol				Control				XXH
Carriage Return								0DH

Table 6-167 Get Uplink Source Control Response

Get Uplink Source Control Response Data								**Data Payload**
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Uplink Source Control Command								58H
Protocol				Control				XXH
Acknowledge								00H
Carriage Return								0DH

Protocol — This field specifies the protocol for the Source Control command

Protocol	**Definition**
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA
6	eGo
7	ATA Half-Frame
8	Reserved

Control — This field specifies the Uplink Source.

Control	Definition
0	Uplink Source (source 2)
1	Uplink Source (source 1)

Set Frequency in MHz

Note: *Set the reader to Stop Mode 0 before issuing the Set Frequency in MHz command.*

This command is used to set the RF frequency of source 1 (downlink) and source2 (uplink). Table 6-168 and Table 6-169 list the command and response data.

Table 6-168 Set Frequency in MHz Command (60H)

Set Frequency in MHz Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Frequency in MHz Command								60H
Reserved							Source	0XH
Frequency Control MSB								XXH
Frequency Control LSB								XXH
Carriage Return								0DH

Table 6-169 Set Frequency in MHz Rresponse

Set Frequency in MHz Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Frequency in MHz Command								60H
Reserved							Source	0XH
Acknowledge								00H
Carriage Return								0DH

Source — This field sets the source for the RF Frequency Control.

Protocol	Definition
0	Source 1
1	Source 2

Frequency Control — Two-byte word to set frequency in 250-kHz steps starting at 800MHz. Examples of frequency settings are listed here.

Setting	Frequency
0118H	870.00 MHz
0198H	902.00 MHz
0199H	902.25 MHz
01E8H	922.00 MHz

Get Frequency in MHz

This command is used to get the RF frequency of source 1 (downlink) and source2 (uplink). Table 6-170 and Table 6-171 list the command and response data.

Table 6-170 Get Frequency in MHz Command (61H)

Get Frequency in MHz Command Data								Data Payload
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Get Frequency in MHz Command								61H
Reserved							Source	0XH
Carriage Return								0DH

Table 6-171 Get Frequency in MHz Response

Get Frequency in MHz Response Data								Data Payload
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Get Frequency in MHz Command								61H
Reserved							Source	0XH
Frequency Control MSB								XXH
Frequency Control LSB								XXH
Acknowledge								00H
Carriage Return								0DH

Source — This field sets the source for the RF Frequency Control

Protocol	Definition
0	Source 1
1	Source 2

Frequency Control — Two-byte word to set frequency in 250-kHz steps starting with 0000H at 800MHz. Examples of frequency settings are listed here.

Setting	Frequency
0118H	870.00 MHz
0198H	902.00 MHz

0199H	902.25 MHz
01E8H	922.00 MHz

Allowable Frequency Ranges by Protocol — There are permitted frequency ranges that are protocol-dependent. When operating within North America, the following are the *approved* defaulted uplink frequencies:

MIN_UL_FREQ1 902.25 MHz

MAX_UL_FREQ1 903.75 MHz

MIN_UL_FREQ2 910.00 MHz

MAX_UL_FREQ2 921.50 MHz

The downlink frequencies are protocol-dependent and are set to an allowable minimum and maximum range. The frequency range combinations of protocols must be set within these allowable frequency ranges.

IAG/CVSN MIN_FREQ 914.75 MHz

IAG/CVSN MAX_FREQ 916.75 MHz

ALLEGRO/T21 MIN_FREQ 912.75 MHz

ALLEGRO/T21 MAX_FREQ 918.75 MHz

EGO/SEGO MIN_FREQ 911.75 MHz

EGO/SEGO MAX_FREQ 919.75 MHz

Tag Transaction Configuration Command Group Commands (1000H)

Table 6-172 lists the Tag Transaction Configuration Command Group commands that are used in the Encompass multiprotocol reader.

Table 6-172 Tag Transaction Configuration Command Group Commands

Tag Transaction Configuration Command	Command Code
Reserved	0000H to 0001H
Set Asynchronous Response Append Data	0002H
Get Asynchronous Response Append Data	0003H
Reserved	004H to 0024H
Run Check Tag	0025H
Set Manual Antenna Channel Control	002AH
Get Manual Antenna Channel Control	002BH
Get SeGo Table Version Number	002EH
Get Configuration Table Version Number Command	002FH
Set IAG Slot	0030H
Get IAG Slot	0031H
Set Secondary Tag Sequence	0040H
Get Secondary Tag Sequence	0041H
Set Master/Slave Mode	0045H
Get Master/Slave Mode	0046H
Reserved	0047H to 0049H

Tag Transaction Configuration Command Group Responses

Table 6-173 lists the responses and codes for the Tag Transaction Configuration command group.

Table 6-173 Tag Transaction Configuration Command Group Responses

Tag Transaction Configuration Response	Response Code
Synchronous OK Status Responses	88XXH
Reserved	8800H
Reserved	8801H
Asynchronous OK Status Responses	48XXH
Command Complete	4800H
Command In Progress	4801H
Unsolicited OK Status Responses	28XXH
Reserved	84XXH
Reserved	44XXH
Reserved	24XXH
Synchronous Error Status Responses	82XXH
Message Length Error	8200H
Message Sequence Error	8201H
Reserved	8202H
Command Group Error	8203H
Reserved	8204H
Reserved	8205H

Table 6-173 Tag Transaction Configuration Command Group Responses

Tag Transaction Configuration Response	Response Code
Reserved	8206H
Reserved	8207H
Reserved	8208H
Data Acknowledge Response Error	8209H
Reserved	820AH
Asynchronous Error Status Responses	42XXH
Message Length Error	4200H
Command Sequence Error	4201H
Message Queue Full Error	4202H
Command Group Error	4203H
Command Time-out Error	4204H
Command Nack Error	4205H
Command Failed Error	4206H
System Command Error	4207H
Sub-Command Error	4208H
Data Acknowledge Time-out Error	4209H
Invalid Control Word Error	420AH
Invalid Command Data Error System	420BH
Unsolicited Error Status Responses	22XXH
Synchronous Control Status Responses	81XXH
Data Acknowledge (Ack), data valid	8100H
Data Negative Acknowledge (Nack), data invalid	8101H
Reserved	8102H
Reserved	8104H

Table 6-173 Tag Transaction Configuration Command Group Responses

Tag Transaction Configuration Response	Response Code
Asynchronous Control Status Responses	41XXH
Unsolicited Control Status Responses	21XXH

Tag Transaction Configuration Command Group Response Data

Asynchronous OK Status Responses

The following tag transaction configuration command group asynchronous OK status responses use the specified data payload.

Command Complete (4800H)

Command In Progress Response Data	Data Payload
TTC Command Group Command (sub-command)	XXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
TTC Command Group Command (sub-command)	XXXXH

Synchronous Error Status Responses

The following tag transaction configuration command group synchronous error status responses use the specified data payload.

Message Length Error Response Data (8200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Message Sequence Error Response Data (8201H)

Message Sequence Error Response Data	Data Payload
Expected Message Sequence Number	XXH
Received Message Sequence Number	XXH

Command Group Error Response Data (8203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Data Acknowledge Response Error Response Data (8209H)

Data Acknowledge Response Error Response Data	Data Payload
Invalid Data Acknowledge Response	XXXXH

Asynchronous Error Status Responses

The following tag transaction configuration command group asynchronous error status responses use the specified data payload.

Message Length Error Response Data (4200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Command Sequence Error Response Data (4201H)

Command Sequence Error Response Data	Data Payload
Expected Command Sequence Number	XXH
Received Command Sequence Number	XXH

Command Group Error (4203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Command Time-out Error (4204H)

Command Time-out Error Response Data	Data Payload
N/A	

Command Failed Error (4206H)

Command Failed Error Response Data	Data Payload
TTC Command Group Command (sub-command)	XXXXH

System Command Error (4207H)

System Command Error Response Data	Data Payload
N/A	

Sub-Command Error (4208H)

Sub-Command Error Response Data	Data Payload
Sub-command	XXXXH

Invalid Control Word Error (420AH)

Invalid Control Word Error Response Data	Data Payload
N/A	

Invalid Command Data Error System (420BH)

Invalid Command Data Error System Response Data	Data Payload
N/A	

Set Asynchronous Response Append Data

This command sets the append time-stamp data control parameter for all asynchronous tag responses. Table 6-174 and Table 6-175 list the command and response data.

Table 6-174 Set Asynchronous Response Append Data Command (0002H)

Set Asynchronous Response Append Command		Data Payload
Bits 7–0		
Set Asynchronous Response Append Data Command (MSB)		00H
Set Asynchronous Response Append Data Command (LSB)		02H
Reserved	Append Data Control	0XH

Table 6-175 Set Asynchronous Response Append Data Response

Set Asynchronous Response Append Data Response	Data Payload
Bits 7–0	
Set Asynchronous Response Append Data Command (MSB)	00H
Set Asynchronous Response Append Data Command (LSB)	02H

Append data control — This field controls whether the date and time-stamp is appended to all tag asynchronous responses.

Append Data Control	Definition
0	Disable
1	Append time and date time-stamp

Formats for Time and Date Time-stamp

Table 6-176 lists the time and date time-stamp formats.

Table 6-176 Time and Date Time-Stamp Formats

Time and Date Time-stamp Format	Data Payload
Hours	XXH
Minutes	XXH
Seconds	XXH
Hundredths of Seconds	XXH
Month	XXH
Day	XXH
Year	XXH

Data	**Data Range**
Hours	0 to 23 (00H to 17H)
Minutes	0 to 59 (00H to 3BH)
Seconds	0 to 59 (00H to 3BH)
Hundredths of seconds	0 to 99 (00H to 63H)
Month	1 to 12 (01H to 0CH)
Day	1 to 31 (01H to 1FH)
Year	0 to 99 (00H to 63H)

Get Asynchronous Response Append Data

This command gets the append time-stamp data control parameter for all asynchronous tag responses. Table 6-177 and Table 6-178 list the command and response data.

Table 6-177 Get Asynchronous Response Append Data Command (0003H

Get Asynchronous Response Append Data Response	Data Payload
Bits 7–0	
Get Asynchronous Response Append Data Command (MSB)	00H
Get Asynchronous Response Append Data Command (LSB)	03H

Table 6-178 Get Asynchronous Response Append Data Response

Get Asynchronous Response Append Command								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Asynchronous Response Append Data Command (MSB)								00H
Get Asynchronous Response Append Data Command (LSB)								03H
Reserved							Append Data Control	0XH

Append Data Control — This field controls whether the time and date time-stamp is appended to all tag asynchronous responses.

Append Data Control	Definition
0	Disable
1	Append time and date time-stamp

Run Check Tag

The check tag is designed to test the Encompass reader system. The Run Check Tag command activates the check tag for a system test. The check tag is designed to operate without interfering with vehicle tag reads. The check tag function switches on for one synchronous pulse frame.

For optimum results, TransCore recommends that you operate the check tag when no vehicles are in the Encompass reader system read zone. Table 6-179 lists the command data.

Table 6-179 Run Check Tag Command (0025H)

Run Check Tag Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Run Check Tag Command (MSB)								00H
Run Check Tag Command (LSB)								25H
Protocol				Interval				XXH

Protocol — This field sets the check tag protocol.

Protocol	Definition
0	IT2200, Title 21 – manual
1	SeGo, eGo, ATA – manual
2	IT2200, Title 21 – periodic
3	SeGo – periodic
E	Enable all protocols – periodic
F	Enable all protocols – manual

Interval — This field sets the time interval for the Periodic Check Tag test..

Interval	Definition
0	30 seconds
1	2 minutes
2	4 minutes
3	8 minutes
4	15 minutes
5	30 minutes
6	1 hour
7	2 hours
8	4 hours

Note: *There is no specific response to the Run Check Tag command. Any response is reported as a tag read through the Mode Command Group responses. The reader responds with a command complete.*

Set Manual Antenna Channel Control

This command sets the reader's manual antenna channel control. Table 6-180 and Table 6-181 list the command and response data.

Table 6-180 Set Manual Antenna Channel Control Command (002AH)

Set Manual Antenna Channel Control Command	Data Payload
Bits 7–0	
Set Manual Antenna Channel Control Command	002AH
Channel Control	0XH

The channel control definitions are as follows:

Channel Control	Definition
01H	Channel 0 on
02H	Channel 1 on
03H	Channel 2 on
04H	Channel 3 on
05H	Disable manual channel control

Table 6-181 Set Manual Antenna Channel Control Response

Set Manual Antenna Channel Control Response Data	Data Payload
Bits 7–0	
Set Manual Antenna Channel Control Command	002AH

Get Manual Antenna Channel Control

This command gets the reader's manual antenna channel control. Table 6-182 and Table 6-183 list the command and response data.Get SeGo Table Version Number

Table 6-182 Get Manual Antenna Channel Control Command (002BH)

Get Manual Antenna Channel Control Command	Data Payload
Bits 7–0	
Get Manual Antenna Channel Control Command	002BH

Table 6-183 Get Manual Antenna Channel Control Response

Get Manual Antenna Channel Control Response Data	Data Payload
Bits 7–0	
Get Manual Antenna Channel Control Command	002BH
Channel Control	0XH

This command gets the reader's SeGo table version numbers. Table 6-184 and Table 6-185 list the command and response data.

Table 6-184 Get SeGo Table Version Number Command (002EH)

Get SeGo Table Version Command Data	Data Payload
Bits 7–0	
Get SeGo Table Version Command	002EH

Table 6-185 Get SeGo Table Version Number Response

Get SeGo Table Version Response Data	Data Payload
Bits 7–0	
Get SeGo Table Version Command	002EH
SeGo ASIC Command Table Version	13 bytes
SeGo Sequence Table Version	13 bytes

The version number for each table is 13 ASCII characters, which provide the version number in the following format: `V00.00.00.01`. The 13th character is a NULL (0x00) termination character.

Get Configuration Table Version Number Command (002 FH)

This command returns the version number of the Universal Configuration Table. It is one of two commands that are used in the Universal Reader mode to help support a single configuration file. Table 6-186 and Table 6-187 list the command and response data.

Precondition: None

Post Condition: Command takes effect immediately.

Table 6-186 Get UR Configuration Table Version Number Command Data Command

Get UR Configuration Table Version Number Command Data								Data Payload
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Get UR Configuration Table Version Number Command (MSB)								00H
Get UR Configuration Table Version Number Command (LSB)								2FH

Table 6-187 Get UR Configuration Tabler Version Number Command Data Response

Get UR Configuration Table Version Number Command Data								Data Payload
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Get UR Configuration Table Version Number Command (MSB)								00H
Get UR Configuration Table Version Number Command (LSB)								2FH
Universal Configuration Version								XXH x 13

Set IAG Slot

The Set IAG Slot Command configures the downlink values used with IAG modes. Table 6-188 and Table 6-189 list the command and response data.

Table 6-188 Set IAG Slot Command (0030H)

Set IAG Slot Command Data	Data Payload
Bits 7–0	
Set IAG Slot Command (MSB)	00H
Set IAG Slot Command (LSB)	30H
Slot	0XH

Table 6-189 Set IAG Slot Response

Set IAG Slot Response Data	Data Payload
Bits 7–0	
Set IAG Slot Command (MSB)	00H
Set IAG Slot Command (LSB)	30H

Slot — The value of the downlink slot for setting up the IAG sequence, the value can be 1, 2, or 3.

1 = Downlink on slots 1 and 4

2 = Downlink on slots 2 and 5

3 = Downlink on slots 3 and 6

Get IAG Slot

The Get IAG Slot command returns the downlink values used with IAG modes. Table 6-190 and Table 6-191 list the command and response data.

Table 6-190 Get IAG Slot Command (0031H)

Get IAG Slot Command Data	Data Payload
Bits 7–0	
Get IAG Slot Command (MSB)	00H
Get IAG Slot Command (LSB)	31H

Table 6-191 Get IAG Slot Command Data Response

Get IAG Slot Response Data	Data Payload
Bits 7–0	
Get IAG Slot Command (MSB)	00H
Get IAG Slot Command (LSB)	31H
Slot	0XH

Slot — The value of the downlink slot for setting up the IAG sequence, the value can be 1, 2, or 3.

1 = Slots 1 and 4

2 = Slots 2 and 5

3 = Slots 3 and 6

Set Secondary Tag Sequence

The Set Secondary Tag Sequence Command specifies which tag sequence to run, which allows the user to select from a set of protocols and the respective Ack/No Ack.

Table 6-192 and Table 6-193 list the command and response data.

Table 6-192 Set Secondary Tag Sequence Command (0040H)

Set Secondary Tag Sequence Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Secondary Tag Sequence Command (MSB)								00H
Set Secondary Tag Sequence Command (LSB)								40H
Reserved								00H
Protocol ID				Configuration ID				XXH
Antenna Number								0XH

Table 6-193 Set Secondary Tag Sequence Response

Set Secondary Tag Sequence Response Data	Data Payload
Bits 7–0	
Set Secondary Tag Sequence Command (MSB)	00H
Set Secondary Tag Sequence Command (LSB)	40H

Protocol — This field sets the protocol for the secondary tag sequence.

Protocol	Definition
0	IT2200
4	Title 21

Configuration ID — This field sets the configuration ID for IT2200 and Title 21 protocols.

Configuration ID	Definition
0	No Ack
1	Ack

Antenna Number — This field specifies the antenna number, which ranges from 0 to 03H.

Note: *Reset the Encompass reader after setting the secondary tag sequence. See “Reset Reader” on page 6-25 for command information.*

Get Secondary Tag Sequence

The Get Secondary Tag Sequence Command retrieves the tag sequence. Table 6-194 and Table 6-195 list the command and response data.

Table 6-194 Get Secondary Tag Sequence Command (0041H)

Get Secondary Tag Sequence Command Data	Data Payload
Bits 7–0	
Get Secondary Tag Sequence Command (MSB)	00H
Get Secondary Tag Sequence Command (LSB)	41H
Protocol ID	0XH
Antenna Number	0XH

Table 6-195 Get Secondary Tag Sequence Response

Get Secondary Tag Sequence Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Secondary Tag Sequence Command (MSB)								00H
Get Secondary Tag Sequence Command (LSB)								41H
Reserved								00H
Protocol ID				Configuration ID				XXH
Antenna Number								0XH

Protocol — This field gets the protocol for the secondary tag sequence.

Protocol	Definition
0	IT2200
4	Title 21

Configuration ID — This field gets the configuration ID for IT2200 and Title 21 protocols.

Configuration ID	Definition
0	No Ack
1	Ack

Antenna Number — This field gets the antenna number, which ranges from 0 to 03H.

Set Master/Slave Mode

The Set Master/Slave Mode Command specifies which reader to set as master, which then enables all other readers as slaves. Table 6-196 and Table 6-197 list the command and response data.

Table 6-196 Set Master/Slave Mode Command (0045H)

Set Master/Slave Mode Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Master/Slave Mode Command (MSB)								00H
Set Master/Slave Mode Command (LSB)								45H
Reserved				GPS Primary	GPS Secondary	Master	Slave	0XH
Slave Select Count								XXH

Table 6-197 Set Master/Slave Mode Response

Set Master/Slave Mode Response Data	Data Payload
Bits 7–0	
Set Master/Slave Mode Command (MSB)	00H
Set Master/Slave Mode Command (LSB)	45H

Mode — This field sets the protocol for the secondary tag sequence.

Mode*	Data Payload
Slave	01
Master	02
GPS Secondary	04
GPS Primary	08

Note: **Select only one mode from this list.*

Choose one field only, for example, GPS primary, GPS secondary, master, or slave.

GPS Primary — This field specifies whether the reader is to be configured as the

GPS primary.

GPS Primary	Definition
0	Not GPS Primary
1	GPS Primary

GPS Secondary — This field specifies whether the reader is to be configured as the GPS secondary.

GPS Secondary	Definition
0	Not GPS Secondary
1	GPS Secondary

Master — This field specifies whether the reader is to be configured as the master.

Master	Definition
0	Not Master
1	Master

Slave — This field specifies whether the reader is to be configured as the slave.

Slave	Definition
0	Not Slave
1	Slave

For this example, the sum of the delay and duration period is 19.9 milliseconds, which is less than the synchronization rate of 20 milliseconds. If the sum of the delay and duration periods equals the synchronization rate, unexpected results can occur.

Slave Select Count — This field specifies the order that a slave or GPS primary or secondary reader issues a synchronization pulse whenever a given reader within a synchronization group fails to recognize the signal from the preassigned master or whenever a GPS receiver fails to issue a 1-pps signal, respectively. The maximum slave count = 26.

Scenario 1 — One master, n slaves. The master has no slave behavior, therefore it is assigned a slave select count of 0. Each slave is assigned an increasingly greater number from 1 to n. When the master fails, slave 1 becomes the master, and so on.

Scenario 2 — GPS primary, GPS secondary, N slave readers. When in fault mode (1-pps signal missing), a GPS primary is slave to a GPS secondary and all other slaves and is assigned the last slave select count, n. A GPS secondary takes over when a GPS primary is in fault mode, therefore it is assigned a slave select count of 1. All slaves are assigned increasingly greater numbers from 2 to n+1.

Scenario 3 — One GPS primary and n slaves. This scenario forces the GPS primary to have no slave behavior by specifying a slave select count of 0. Each slave is an increasingly higher number from 1 to n. When the master fails, slave 1 becomes the master. If slave 1 should fail, slave 2 takes over, and so on (Table 6-198).

Table 6-198 Reader Slave Configuration Table

Scenario 1 — One Master, n Slaves						
Reader Mode	Master	Slave	Slave	Slave	Slave	Slave
Slave Select Count	0	1	2	…	n-1	n
Scenario 2 — GPS Primary, GPS Secondary, n Slaves						
Reader Mode	GPS Secondary	Slave	Slave	Slave	Slave	GPS Primary
Slave Select Count	1	2	3	…	n+1	n+2
Scenario 3 — One GPS Primary, n Slaves						
Reader Mode	GPS Primary	Slave	Slave	Slave	Slave	Slave

Table 6-198 Reader Slave Configuration Table

Slave Select Count	0	1	2	…	n-1	n
n = Total number of slave readers						

Get Master/Slave Mode

The Get Master/Slave Mode Command retrieves the reader that is set as master. Table 6-199 and Table 6-200 list the command and response data.

Table 6-199 Get Master/Slave Mode Command (0046H)

Get Master/Slave Mode Command Data	Data Payload
Bits 7–0	
Get Master/Slave Mode Command (MSB)	00H
Get Master/Slave Mode Command (LSB)	46H

Table 6-200 Get Master/Slave Mode Response Data

Get Master/Slave Mode Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Master/Slave Mode Command (MSB)								00H
Get Master/Slave Mode Command (LSB)								46H
Reserved				GPS Primary	GPS Secondary	Master	Slave	0XH
Slave Select Count								XXH

Mode — This field sets the protocol for the secondary tag sequence.

Mode*	Data Payload
Slave	01
Master	02
GPS Secondary	04
GPS Primary	08

Note: **Select only one mode from this list.*

Mode Command Group Commands (0400H)

Table 6-201 lists the Mode Command Group commands that are used to configure and operate the Encompass multiprotocol reader in any of the modes.

Table 6-201 Mode Command Group Commands

Mode Command Group Command	Command Code
Set Mode	0001H
Get Mode	0002H
Set Protocol	0003H
Get Protocol	0004H
Set IT2200 Read Request Configuration	0043H
CVISN Enforcement Last Tag Status Reset	0043H
Set SeGo/eGo Configuration Data	0043H
Get IT2200 Read Request Configuration	0044H
Get IT2200 Configuration with Gen Ack	0044H
Get SeGo/eGo Configuration Data	0044H
Reserved	0052H
Reserved	0053H
Set Seen Count	0066H
Get Seen Count	0067H

Mode Command Group Responses

Table 6-202 lists the responses and codes for the Mode command group.

Table 6-202 Mode Command Group Responses

Mode Command Group Responses	Response Code
Synchronous OK Status Responses	88XXH
Reserved	8800H
Reserved	8801H
Asynchronous OK Status Responses	48XXH
Command Complete	4800H
Command In Progress	4801H
Unsolicited OK Status Responses	28XXH
Reserved	84XXH
Reserved	44XXH
Reserved	24XXH
Synchronous Error Status Responses	82XXH
Message Length Error	8200H
Message Sequence Error	8201H
Reserved	8202H
Command Group Error	8203H
Reserved	8204H
Reserved	8205H
Reserved	8206H
Reserved	8207H

Table 6-202 Mode Command Group Responses

Mode Command Group Responses	Response Code
Reserved	8208H
Data Acknowledge Response Error	8209H
Reserved	820AH
Asynchronous Error Status Responses	42XXH
Message Length Error	4200H
Command Sequence Error	4201H
Reserved	4202H
Command Group Error	4203H
Command Time-out Error	4204H
Reserved	4205H
Command Failed Error	4206H
System Command Error	4207H
Sub-Command Error	4208H
Reserved	4209H
Invalid Control Word Error	420AH
Invalid Command Data Error System	420BH
Unsolicited Error Status Responses	22XXH
Synchronous Control Status Responses	81XXH
Data Acknowledge (Ack), data valid	8100H
Data Negative Acknowledge (Nack), data invalid	8101H
Reserved	8102H
Reserved	8104H
Asynchronous Control Status Responses	41XXH

Table 6-202 Mode Command Group Responses

Mode Command Group Responses	Response Code
Unsolicited Control Status Responses	21XXH

Table 6-203 lists the mode command group asynchronous response codes and record types.

Table 6-203 Mode Command Group Asynchronous Responses

Mode Command Group Asynchronous Response	Response Code	Record Type
IT2200 Read Response (e.g., Page 3 Read)	4800H	4303H
Reserved	4800H	3020H
SeGo Streamlined Read	4800H	3021H
Read Verify Page	4800H	3022H
Group Select Equals SeGo	4800H	3023H
Title 21 Read Response	4800H	3024H
Seen Frame Counter Error Report	4204H	3042H
Seen Frame Counter Report	4800H	3043H
Reserved	4204H	3044H
Reserved	4800H	2303H
Reserved	4204H	3040H
Reserved	4204H	3041H
CVISN Read Response	4800H	5014H
Reserved	4800H	5013H
eGo Streamlined Read		4021H
eGo Group Select		4023H
ATA Full-Frame Read		4001H
ATA Half-Frame Read		4000H
IAG Read		5026H
IAG Cross-Lane Read		5027H

Mode Command Group Response Data

Asynchronous OK Status Responses

The following mode command group asynchronous OK status responses use the specified data payload.

Command Complete (4800H)

Command In Progress Response Data	Data Payload
Mode Command Group Command (sub-command)	XXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
Mode Command Group Command (sub-command)	XXXXH

Synchronous Error Status Responses

The following mode command group synchronous error status responses use the specified data payload.

Message Length Error Response Data (8200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Message Sequence Error Response Data (8201H)

Message Sequence Error Response Data	Data Payload
Expected Message Sequence Number	XXH
Received Message Sequence Number	XXH

Command Group Error Response Data (8203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Data Acknowledge Response Error Response Data (8209H)

Data Acknowledge Response Error Response Data	Data Payload
Invalid Data Acknowledge Response	XXXXH

Asynchronous Error Status Responses

The following mode command group asynchronous error status responses use the specified data payload.

Message Length Error Response Data (4200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Command Sequence Error Response Data (4201H)

Command Sequence Error Response Data	Data Payload
Expected Command Sequence Number	XXH
Received Command Sequence Number	XXH

Command Group Error (4203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Command Time-out Error (4204H)

Command Time-out Error Response Data	Data Payload
N/A	

Command Failed Error (4206H)

Command Failed Error Response Data	Data Payload
Mode Command Group Command (sub-command)	XXXXH

System Command Error (4207H)

System Command Error Response Data	Data Payload
N/A	

Sub-Command Error (4208H)

Sub-Command Error Response Data	Data Payload
Sub-command	XXXXH

Invalid Control Word Error (420AH)

Invalid Control Word Error Response Data	Data Payload
N/A	

Invalid Command Data Error (420BH)

Invalid Command Data Error Response Data	Data Payload
N/A	

Set Mode

This command sets the Encompass reader to mode 88. Table 6-204 and Table 6-205 list the command and response data.

Table 6-204 Set Mode Command (0001H)

Set Mode Command Data	Data Payload
Bits 7–0	
Set Mode Command (MSB)	00H
Set Mode Command (LSB)	01H
Mode Number	58H

Table 6-205 Set Mode Response

Set Mode Command Response Data	Data Payload
Bits 7–0	
Set Mode Command (MSB)	00H
Set Mode Command (LSB)	02H
Mode Number	58H

Mode Number — This field identifies mode as 88.

Note: *RESET READER command required for changes to take effect.*

Get Mode

This command gets the Encompass reader mode. Table 6-206 and Table 6-207 list the command and response data.

Table 6-206 Get Mode Command (0002H)

Get Mode Command Data	Data Payload
Bits 7–0	
Get Mode Command (MSB)	00H
Get Mode Command (LSB)	02H

Table 6-207 Get Mode Command Response

Get Mode Command Response Data	Data Payload
Bits 7–0	
Get Mode Command (MSB)	00H
Get Mode Command (LSB)	02H
Mode Number	58H

Mode Number — This field identifies mode as 88.

Set Protocol

This command configures the Encompass reader to enable specified protocols. Table 6-208 and Table 6-209 list the command and response data.

Note: Reset the Encompass reader after setting the protocol. See *"Reset Reader" on page 6-25* *for command information.*

Table 6-208 Set Protocol Command (0003H)(

Set Protocol Command Data								Data Payload
Bits 7–0								
Set Protocol Command (MSB)								00H
Set Protocol Command (LSB)								03H
Reserved						CVISN	IAG Rsvd	0XH
IAG Read	SeGo	eGo	IT2200	Title 21	ATA 1/2-Frame	ATA Full-Frame	Reserved	XXH

Table 6-209 Set Protocol Response

Set Protocol Response Data	Data Payload
Bits 7–0	
Set Protocol Command (MSB)	00H
Set Protocol Command (LSB)	03H

Protocols — These fields specify the protocol to enable. The example shows three enabled protocols.

All protocols off	00H
Enabling three protocols:	
eGo	20H
ATA	02H
Title 21	08H
	2AH

Note: RESET READER command required for changes to take effect.

Get Protocol

This command retrieves the Encompass reader specified protocols. Table 6-210 and Table 6-211 list the command and response data.

Table 6-210 Get Protocol Command (0004H)

Set Protocol Command Data	Data Payload
Bits 7–0	
Get Protocol Command (MSB)	00H
Get Protocol Command (LSB)	04H

Table 6-211 Get Protocol Response

Set Protocol Response Data								Data Payload
Bits 7–0								
Get Protocol Command (MSB)								00H
Get Protocol Command (LSB)								04H
Reserved						CVISN	IAG Rsvd	0XH
IAG Read	SeGo	eGO	IT2200	Title 21	ATA 1/2-Frame	ATA Full-Frame	Reserved	XXH

Protocols — These fields specify the protocol to enable. The example shows three enabled protocols.

All protocols off	00H
Enabling three protocols:	
eGo	20H
ATA	02H
Title 21	08H
	2AH

Set IT2200 Read Request Configuration

This command sets the reader to read data from the specified memory area of the chosen tag. Table 6-212 and Table 6-213 list the command and response data.

Note: *READER must be in STOP Mode for changes to take effect.*

Table 6-212 Set IT2200 Read Request Configuration Command (0043H)

Set IT2200 Read Request Configuration Command Data	Data Payload
Bits 7–0	
Set IT2200 Read Request Configuration Command (MSB)	00H
Set IT2200 Read Request Configuration Command (LSB)	43H
Protocol	00H
Command Action	00H
Command Action	00H
Tag Request Code	C0H
Tag Request Code	03H
Bit Count (MSB)	00H
Bit Count (LSB)	50H
Options	XXH
Starting Page Number	XXH
Starting Page Number	XXH
Page Count	01H
Reserved	00H
Reserved	00H
Op-type	0XH
Retry (MSB)	XXH
Retry (LSB)	XXH
Antenna Number	XXH

Table 6-213 Set IT2200 Read Request Configuration Response

Set IT2200 Read Request Configuration Response Data	Data Payload

Table 6-213 Set IT2200 Read Request Configuration Response

Bits 7–0	
Set IT2200 Read Request Configuration Command (MSB)	00H
Set IT2200 Read Request Configuration Command (LSB)	43H

Protocol — A one-byte value that is used to set the intended tag type data for the IT2200 protocol – 00H.

Command Action — This configuration parameter is sent into the flash memory. The command action for Mode 88 is set to 0.

Tag Request Code — This field identifies the message as a read request. The field is set to C003.

Value	Definition
C003	Read Request

Bit Count — This field indicates the number of bits in a message. The bit count includes the number of bits in all fields after the bit count including the CRC.

Options — This field contains subfields that identify options for the message. Subfields and definitions are specified in Table 6-214.

Table 6-214 Options

Bit 7	Bit 6	Bit 5–4	Bit 3	Bit 2	Bit 1–0
Unused	Tag type	Page/password select	BIST request	Anti-playback request	Tag addressing

Tag Type — This subfield indicates the tag type that should respond. The tag type includes toll tags and check tags.

Value	Description
0	Toll tags
1	Check tags

Page/Password Select — This subfield indicates the tag data area selected and the specific data contained in the command for that tag data area. Valid values and corresponding definitions are specified in Table 6-215.

Table 6-215 Definition of Page/Password Select Values

Value	Definition
00	General data page area selected, no password specified
01*	General data page area selected, user password specified
11*	Owner area selected with a global password specified

*For future use, not currently supported.

BIST Request — This subfield indicates whether the tag should return a built-in self test (BIST) code in the read response. The BIST code is returned by the tag and displays the results of the BIST test that was run the last time the tag entered idle mode. The definitions for this subfield are listed in Table 6-216.

Table 6-216 Definition of BIST Request Values

Value	Definition
0	BIST code not returned
1	BIST code returned

Anti-Playback Request — This subfield indicates whether the tag should return an anti-playback code in the read response. The anti-playback code indicates whether a tag has been tampered with. The anti-playback code is returned by the tag and is incremented each time the tag is read. This function may be used for post-validation of tags at the system level by monitoring the sequencing of this field for a given tag. The definitions for this field are listed in Table 6-217.

Table 6-217 Definition of Anti-Playback Request Values

Value	Definition
0	Anti-playback code not returned
1	Anti-playback code returned

Tag Addressing — This subfield specifies which tags should respond to the read request. The valid values and corresponding definitions for this subfield are listed in Table 6-218.

Table 6-218 Definitions of Tag Addressing Value

Value	Definition
00	All tags respond to this request. The response contains the Title 21 ID.
01	All tags respond to this request. The response contains the tag serial number.
10	Only tags with the specified Title 21 ID respond. The response contains the specified Title 21 ID in the tag ID field.
11	Only tags with the specified tag serial number will respond. The responses contain the specified tag serial number in the tag ID field.

Starting Page Number — This field is a binary integer corresponding to the tag page number to be read.

Page Count — This functionality is for multipage reads only and is not implemented in the IT2221 and IT2235 tags, and should be set to 01H.

Reserved — This field is saved for future use.

Op-Type — This is a one-byte field that is used to indicate whether the associated command should be considered for auto send (mode-based). The values and definitions are listed in Table 6-219**.**

Table 6-219 Definition of Op-Type Values

Value	Definition
0	Normal operation
1	Auto send

Retry — This two-byte field specifies the number of transmission attempts to be made for the given transaction.

Antenna Number — This two-byte field represents the antenna channel field and indicates which channel-associated command to configure.

Get IT2200 Read Request Configuration

This command sets the reader to read data from the specified memory area of the chosen tag. Table 6-220 and Table 6-221 list the command and response data.

Table 6-220 Get IT2200 Read Request Configuration (0044H)

Get IT2200 Read Request Configuration Command Data	Data Payload
Bits 7–0	
Get IT2200 Read Request Configuration Command (MSB)	00H
Get IT2200 Read Request Configuration Command (LSB)	44H

Table 6-221 Get IT2200 Read Request Configuration Response Data

Get IT2200 Read Request Configuration Response Data	Data Payload
Bits 7–0	
Get IT2200 Read Request Configuration Command (MSB)	00H

Table 6-221 Get IT2200 Read Request Configuration Response Data

Get IT2200 Read Request Configuration Command (LSB)	44H
Protocol	00H
Command Action	00H
Command Action	00H
Tag Request Code	C0H
Tag Request Code	03H
Bit Count (MSB)	00H
Bit Count (LSB)	50H
Options	XXH
Starting Page Number	XXH
Starting Page Number	XXH
Page Count	01H
Reserved	00H
Reserved	00H
Op-Type	0XH
Retry (MSB)	XXH
Retry (LSB)	XXH
CRC	XXH
CRC	XXH
Antenna Number	XXH

See “Set IT2200 Read Request Configuration” on page 6-131 for field definitions.

Set IT2200 Configuration With Gen Ack

This command sets the reader to inform a tag not to respond to any commands from the reader for a specified time. This command also provides the capability to control the audio/visual (A/V) and liquid-crystal display (LCD) functions of IT2200-series tags. Table 6-222 and Table 6-223 list the command and response data.

Note: *Command number (0043H) has the capability and is used to configure all tag* *protocols.*

Table 6-222 Set IT2200 Configuration with Gen Ack Command (0043H)

Set IT2200 Configuration with Gen Ack Command Data	Data Payload
Bits 7–0	
Set IT2200 Configuration with Gen Ack Command (MSB)	00H
Set IT2200 Configuration with Gen Ack Command (LSB)	43H
Protocol	00H
Command Action	00H
Command Action	00H
Command Code	F0H
Command Code	0FH
Bit Count (MSB)	00H
Bit Count (LSB)	50H
Options	XXH
Tag ID (MSB)	XXH
Tag ID	XXH
Tag ID	XXH
Tag ID (LSB)	XXH
Time-out	XXH
Condition Code	XXH
LCD Message Page Pointer	XXH
Reserved	00H
Reserved	00H
Send Option	0XH
Retry (MSB)	XXH
Retry (LSB)	XXH
Antenna Number	XXH

Table 6-223 Set IT2200 Configuration with Gen Ack Response

Set IT2200 Configuration with Gen Ack Response Data	Data Payload
Bits 7–0	
Set IT2200 Configuration with Gen Ack Command (MSB)	00H
Set IT2200 Configuration with Gen Ack Command (LSB)	43H

Protocol — This one-byte value that is used to set the intended tag type data for the IT2200 configuration command to the IT2200 protocol.

Command Action — This configuration parameter is sent into the flash memory. The command action for Mode 88 is set to 0.

Command Code — This field identifies the message as a general acknowledge (Gen Ack) request message. The field contains the value: F00FH = Gen Ack Req.

Bit Count — This field indicates the number of bits in a message. The bit count includes the number of bits in all fields after the bit count. This field is a binary-coded integer.

Send option — This one-byte field indicates whether the associated command should be configured for normal operation or *auto send*.

Send Option	Definition
0	Normal operation
1	Auto send

Antenna Number — This two-byte field ranges from 0 to 0FH.

General Acknowledge Options

This field contains subfields that identify options for the message. Subfields and definitions are specified in Table 6-224.

Table 6-224 Gen Ack Options

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved	Reserved for ACK type	A/V bit 4	A/V bit 3	A/V bit 2	A/V bit 1	A/V bit 0	All tags respond

Reserved — This bit is set to 1.

Reserved for ACK type — This subfield is reserved for ACK type decoding and is not interpreted by the tag. This subfield should be set to 0 when using this command.

A/V bits 0-4 — These subfields decode which A/V combinations will execute (Table

6-225).

Table 6-225 A/V Options Bit Decoding

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	LED Sequence	Audio Sequence
0	0	0	0	0	None	None
0	0	0	0	1	*Long GREEN	HI-HI-HI-HI
0	0	0	1	0	*Long RED	LO-LO-LO-LO
0	0	0	1	1	*Flash GREEN	LO-HI
0	0	1	1	1	*Long RED	Long LO
0	1	0	1	1	*Long Yellow	HI-LO-HI-LO
0	1	1	1	1	*Flash RED	LO-LO-LO
1	0	0	1	1	*Long GREEN	HI-HI-HI
1	0	1	1	1	*Flash GREEN	HI-HI
1	1	0	1	1	*Long Green	Long HI
1	1	1	0	1	Short RED	LO
1	1	1	1	0	Short GREEN	HI
1	1	1	1	1	**GREEN-YEL-RED	HI
*Denotes that the LED stays on for 1 second longer than the audio **Denotes that this sequence is used for testing.						

All Tags Respond — When set, this subfield allows all tags in the Encompass reader view to accept this command.

LCD Message Page Pointer — This one-byte field points to the page where the LCD message to display is stored in ASCII. If this field is a value other than zero, the tag, upon receipt of a general ACK command, displays this ASCII data to the LCD display from the page specified in this field. The A/V sequence specified in the A/V options bits is associated with this action. Valid range for this LCD message page pointer is 02H to 0FH. This pointer is retained over a power loss in the tag.

Tag ID — This field is a four-byte tag request ID.

Time-out — This field contains a binary-coded integer with a range of 0 to 127 representing the amount of time in seconds that the tag ignores commands from the Encompass reader. The time-out value is set to the integer value in seconds as specified by the 7 bits (6-0) of the time-out field.

Condition Code — Each condition code bit represents a condition applicable to a tolling environment. There are eight different conditions that can occur and multiple conditions can occur concurrently. The condition with the highest priority is the sequence that is displayed upon receipt of a General ACK Request. The other set conditions can be accessed by cycling to them using the push button switch on the tag. Conditions are shown in Table 6-226 and Table 6-227. These codes are retained over a power loss in the tag.

Table 6-226 Condition Code

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Neg list	Insuff funds	Low Batt	Conv to cash/ticket	Acct replen	Low Bal	Good read	Pass used

Table 6-227 Condition Code Descriptions

Bit	Condition	LCD	Priority
7	Negative list	Invalid	1
6	Insufficient funds	Insuff Bal	2
**5	Low battery	Low Battery	3
*4	Conversion to cash/ticket	Cur Bal=±XXX.XX	4
*3	Account replenishment	New Bal=±XXX.XX	5
2	Good read-low balance	Low Balance	6
*1	Good read	Toll=±XXX.XX	7
0	Pass used	Pass used	8
*Denotes that the data to be inserted in ±XXX.XX is pulled from the balance/tolling page specified in page 0000H configuration. ** Denotes that this bit is set or reset from the internal tag BIST. This bit may change independently from a General ACK command.			

Get IT2200 Configuration With Gen Ack

This command gets the reader to inform a tag that the tag should not respond to any commands from the reader for a specified time. Table 6-228 and Table 6-229 list the command and response data.

Table 6-228 Get IT2200 Configuration with Gen Ack Command (0044H)

Get IT2200 Configuration with Gen Ack Command Data	Data Payload
Bits 7–0	
Get IT2200 Configuration with Gen Ack Command (MSB)	00H
Get IT2200 Configuration with Gen Ack Command (LSB)	44H

Table 6-229 Get IT2200 Configuration with Gen Ack Response

Get IT2200 Configuration with Gen Ack Response Data	Data Payload
Bits 7–0	
Get IT2200 Configuration with Gen Ack Command (MSB)	00H
Get IT2200 Configuration with Gen Ack Command (LSB)	44H
Protocol	00H
Command Action	00H
Command Action	00H
Command Code	F0H
Command Code	0FH
Bit Count (MSB)	00H
Bit Count (LSB)	50H
Options	XXH
Tag ID (MSB)	XXH
Tag ID	XXH
Tag ID	XXH
Tag ID (LSB)	XXH
Time-out	XXH
Condition Code	XXH
LCD Message Page Pointer	XXH

Table 6-229 Get IT2200 Configuration with Gen Ack Response

Reserved	00H
Reserved	00H
Send Option	0XH
Retry	XXH
Retry	XXH
Antenna Number	XXH

See “Set IT2200 Configuration With Gen Ack” on page 6-136 for field definitions.

Set SeGo/eGo Configuration Data

Pre-firmware version 16: For SeGo/eGo configuration, the command action is 0000H. The tag responds to the Group Select Equals command if the tag’s data stored in the location designated by the address field matches the byte data. The starting address field specifies the starting address of the data to be read for a streamlined read command. Because Mode 88 does not use streamlined reads, the starting address always is 00H.

Post-firmware version 16: This command is a Group Select Equals and does not support a streamlined read and therefore is not configurable. This command automatically sends all zeros--Group Select All. Any setting changes applied to eGo/eGo Plus in Mode 88 will not take effect. If configuration of the parameters is required, contact TransCore Technical Support for additional instructions.

The Read Verify Page starting address also must match the starting address (50H) used in the Streamlined Write command. Table 6-230 and Table 6-231 list the command and response data.

Table 6-230 Set SeGo/eGo Configuration Data Command (0043H)

Set SeGo/eGo Configuration Data Command Data	Data Payload	Byte Number
Bits 7–0		
Set SeGo/eGo Configuration Data Command (MSB)	00H	0
Set SeGo/eGo Configuration Data Command (LSB)	43H	1
Protocol	0XH	2
Command Action	XXXXH	3-4
Command Code	XXH	5
Tag ID	0000000000000000H	6-13

Table 6-230 Set SeGo/eGo Configuration Data Command (0043H)

Address	XXH	14
Byte Mask	XXH	15
Starting Address	XXH	16
Page Data	XXXXXXXXXXXXXXXXH	17-24
Command Depth	XXH	25
Antenna Number	0XH	26

Table 6-231 Set SeGo/eGo Configuration Data Response

Set SeGo/eGo Configuration Data Command Response Data	Data Payload	Byte Number
Bits 7–0		
Set SeGo/eGo Configuration Data Command (MSB)	00H	0
Set SeGo/eGo Configuration Data Command (LSB)	43H	1

Protocol — This field is a one-byte value that indicates the intended tag type data for the SeGo/eGo Configuration Command.

Protocol	Definition
1	SeGo
6	eGo

Command Action — This field is a configuration parameter that is sent to the flash memory. The Command Action for Mode 88 is set to 0.

Command Code — This field sets the Group Select or Group Unselect for Equals, Not Equals, Greater Than, and Less Than relationships.

Note: Mode 88 only uses GSE*, therefore the Command Code is set to 00H.*

Tag ID — This field is an eight-byte tag request ID.

Note: Tag ID is not used in Mode 88, *therefore the Data Payload is set to 0.*

Address — This field is the tag memory address for the byte mask.

Byte Mask — This field is used to extract and/or compare information stored in the Page Data/Byte Data. When set to 1, the specific bit is switched on and the information is extracted and/or compared. When set to 0, the information is masked and/or left alone.

Starting Address — This field is the starting address of the comparison data.

Note: *This field is not used in Mode 88, therefore the Data Payload is set to 0.*

Page Data (Byte Data) — This field is eight bytes of comparison data.

Note: *This field is not used in Mode 88, therefore the Data Payload is set to 0.*

Command Depth — This field allows the access of specific information within a sequence. That is, (1) to read byte 8, set the command depth to 9; (2) to access/read the third sequence of a specific read/write sequence, set the command depth to 3.

Note: *The command depth for Mode 88 is 0 because the only command being performed are direct reads.*

Antenna Number — This two-byte field ranges from 0 to 0FH. For Mode 88, the Antenna Number is 0.

Note: *RESET READER command required for changes to take effect.*

Get SeGo/eGo Configuration Data

This command gets the SeGo/eGo configuration data settings only. Applicable SeGo/eGo ASIC commands are Streamlined Read (80H) and Read Verify Page (92H). Table 6-232 and Table 6-233 list the command and response data.

Table 6-232 Get SeGo/eGo Configuration Data Command (0044H)

Get SeGo/eGo Configuration Data Command Data	Data Payload	Byte Number
Bits 7–0		
Get SeGo/eGo Configuration Data Command (MSB)	00H	0
Get SeGo/eGo Configuration Data Command (LSB)	44H	1
Protocol	0XH	2
Command Action	XXXXH	3-4
Command Code	XXH	5
Command Depth	XXH	6
Antenna Number	0XH	7

Table 6-233 Set SeGo/eGo Configuration Response

Get SeGo/eGo Configuration Data Response Data	Data Payload	Byte Number
Bits 7–0		
Get SeGo/eGo Configuration Data Command (MSB)	00H	0
Get SeGo/eGo Configuration Data Command (LSB)	44H	1
Protocol	0XH	2
Command Action	XXXXH	3-4
Command Code	XXH	5
ID	0000000000000000H	6-13
Address	XXH	14

Table 6-233 Set SeGo/eGo Configuration Response

Byte Mask	XXH	15
Starting Address	XXH	16
Page Data	XXXXXXXXXXXXXXXXH	17-24
Command Depth	XXH	25
Antenna Number	0XH	26

CVISN Seen Frame Counter Report

This message reports the seen count value when the seen frame counter times out if the seen count is greater than zero for a tag listed in the table. The seen frame counter report is populated with a minimum of one tag and a maximum of eight tags. The report is always the same size. Active tags are packed in ascending order; the first active tag and associated seen count read from the FPGA firmware seen count table is placed in the report at tag ID 0. The first seen count field in the report (MSB and LSB) that is set to zero indicates the end of the active tag list in the report (Table 6-234).

Table 6-234 CVISN Seen Frame Counter Report (5012H)

CVISN Seen Frame Counter Report Data	Data Payload
Bits 7–0	
Record Type (MSB)	50H
Record Type (LSB)	12H
Protocol	0XH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 0 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 1 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 2 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 2 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 3 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH

Table 6-234 CVISN Seen Frame Counter Report (5012H)

Tag ID 4 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 5 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 6 (32 bits)	XXXXXXXXH
Seen Count (MSB)	XXH
Seen Count (LSB)	XXH
Tag ID 7 (32 bits)	XXXXXXXXH

CVISN Read Response

This message is the CVISN tag response (Table 6-235).

Table 6-235 CVISN Read Response (5014H)

CVISN Read Response Data	Data Payload
Bits 7–0	
Record Type (MSB)	50H
Record Type (LSB)	14H
Valid Tag 1	0000H/0001H
Valid Tag 2	0000H/0001H
Valid Tag 3	0000H/0001H
Valid Tag 4	0000H/0001H
Transponder Message and Message Type Tag 1 (not used)	XXH
Transponder ID Tag 1	XXXX.XXXXH
CRC Tag 1	XXXXH
Tag Type Indicator (Enforcement Tag = 00H, Toll Tag = 01H)	XXH
Transponder Message and Message Type Tag 2 (not used)	XXH
Transponder ID Tag 2	XXXX.XXXXH

Table 6-235 CVISN Read Response (5014H)

CRC Tag 2	XXXXH
Tag Type Indicator (Enforcement Tag = 00H, Toll Tag = 01H)	XXH
Transponder Message and Message Type Tag 3 (not used)	XXH
Transponder ID Tag 3	XXXX.XXXXH
CRC Tag 3	XXXXH
Tag Type Indicator (Enforcement Tag = 00H, Toll Tag = 01H)	XXH
Transponder Message and Message Type Tag 4 (not used)	XXH
Transponder ID Tag 4	XXXX.XXXXH
CRC Tag 4	XXXXH
Tag Type Indicator (Enforcement Tag = 00H, Toll Tag = 01H)	XXH
Antenna Number	XXH

The valid tags are set to 0 for tag not in frame slot and 1 for tag in frame slot. The transponder message is the high-order nibble and the message type tag is the low-order nibble. This byte is passed with each tag but currently is not used. The transponder ID tag is the identifier read from the tag. There may be one to four tags read for a given response. A read with no transponder ID tags is not forwarded to the host. The reader also presents a tag's CRC to the host as part of the response in the CRC field.

Set SeGo SGSPR Data

This command specifies the read data used for the SeGo read transaction. Table 6-236 and Table 6-237 list the command and response data.

Table 6-236 Set SeGo SGSPR Data Command (0054H)

Set SeGo SGSPR Data Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set SeGo SGSPR Data Command (MSB)								00H
Set SeGo SGSPR Data Command (LSB)								54H
Reserved							SeGo Enable	0XH
Reserved							SGSPR Enable	
Command Code								80H

Table 6-236 Set SeGo SGSPR Data Command (0054H)

Address	XXH
Byte Data	XXH
Starting Address	XXH

Table 6-237 Set SeGo SGSPR Data Response

Set SeGo SGSPR Data Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set SeGo SGSPR Data Command (MSB)								00H
Set SeGo SGSPR Data Command (LSB)								54H
Reserved							SeGo Enable	0XH

Get SeGo SGSPR Data

This command gets the read data used for the SeGo read transaction. Table 6-238 and Table 6-239 list the command and response data.

Table 6-238 Get SeGo SGSPR Data Command (0055H)

Get SeGo SGSPR Data Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get SeGo SGSPR Data Command (MSB)								00H
Get SeGo SGSPR Data Command (LSB)								55H
Reserved							SeGo Enable	0XH

Table 6-239 Get SeGo SGSPR Data Response

Get SeGo SGSPR Data Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get SeGo SGSPR Data Command (MSB)								00H
Get SeGo SGSPR Data Command (LSB)								55H

Table 6-239 Get SeGo SGSPR Data Response

Reserved	SeGo Enable	0XH
Reserved	SGSPR Enable	0XH
Command Code		80H
Address		XXH
Byte Data		XXH
Starting Address		XXH

Set Title 21 Read Data

This command specifies the parameters for the Title 21 read transaction. Table 6-240 and Table 6-241 list the command and response data.

Table 6-240 Set TitTable 6-240le 21 Read Data Command (005AH)

Set Title 21 Read Data Command Data								**Data Payload**
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Title 21 Read Data Command (MSB)								00H
Set Title 21 Read Data Command (LSB)								5AH
Reserved							Read Enable	0XH
Transaction Record Type (MSB)								80H
Transaction Record Type (LSB)								00H
Agency Code (MSB)								XXH
Agency Code (LSB)								XXH

Table 6-241 Set Title 21 Read Data Response

Set Title 21 Read Data Response Data								**Data Payload**
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Title 21 Read Data Command (MSB)								00H
Set Title 21 Read Data Command (MSB)								5AH

Set Seen Count

This command records the number of times the Encompass reader reads a tag after the system has finished the complete transaction. Table 6-242 and Table 6-243 list the command and response data.

Table 6-242 Set Seen Count Command (0066H)

Set Seen Count Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Seen Count Command (MSB)								00H
Set Seen Count Command (LSB)								66H
Protocol								0XH
Seen Frame Counter in TDM Frames (MSB)								XXH
Seen Frame Counter in TDM Frames (LSB)								XXH
Uniqueness Counter in TDM Frames (MSB)								XXH
Uniqueness Counter in TDM Frames (LSB)								XXH

Table 6-243 Set Seen Count Response

Set Seen Count Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Set Seen Count Command (MSB)								00H
Set Seen Count Command (LSB)								66H
Protocol								0XH

Protocol — This field specifies the protocol for the counters.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame

6	eGo
7	ATA Half-Frame
8	Reserved

Seen Frame Counter — Length of Seen Frame Counter in number of frames. Counts the specified number of TDM frames, then reports the Seen Count to the host. This field is used to vary the time interval between seen count messages.

Uniqueness Counter — Length of Uniqueness Counter in number of frames. This field removes a tag from the seen table when that tag has not been read for the specified number of TDM frames.

Get Seen Count

This command gets the seen count. Table 6-244 and Table 6-245 list the command and response data.

Table 6-244 Get Seen Count Command (0067H)

Get Seen Count Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Seen Count Command (MSB)								00H
Get Seen Count Command (LSB)								67H
Protocol								0XH

Table 6-245 Get Seen Count Response

Get Seen Count Response Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Get Seen Count Command (MSB)								00H
Get Seen Count Command (LSB)								67H
Protocol								0XH
Seen Frame Counter in TDM Frames (MSB)								XXH
Seen Frame Counter in TDM Frames (LSB)								XXH
Uniqueness Counter in TDM Frames (MSB)								XXH
Uniqueness Counter in TDM Frames (LSB)								XXH

Protocol — This field specifies the protocol for the counters.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

Seen Frame Counter — Length of Seen Frame Counter in number of frames. Counts the specified number of TDM frames, then reports the Seen Count to the host. This field is used to vary the time interval between seen count messages.

Uniqueness Counter — Length of Uniqueness Counter in number of frames. This field removes a tag from the seen table when that tag has not been read for the specified number of TDM frames.

Diagnostic Command Group Commands (0200H)

Table 6-246 lists the Diagnostic Command Group commands that are used in the Encompass multiprotocol reader.

Table 6-246 Diagnostic Command Group Commands

Diagnostic Command	Command Code
Get Diagnostic Status	0001H
Get Diagnostic Interface Status	0002H
Get Error Log	0003H
Get Number of Error Logs	0004H
Clear Error Logs	0005H
Reserved	0006H
Reserved	0007H

Diagnostic Command Group Responses

Table 6-247 lists the responses and codes for the Diagnostic Command Group.

Table 6-247 Diagnostic Command Group Responses

Diagnostic Response	Response Code
Synchronous OK Status Responses	88XXH
Reserved	8800H
Reserved	8801H
Asynchronous OK Status Responses	48XXH
Command Complete	4800H
Command In Progress	4801H
Unsolicited OK Status Responses	28XXH
Diagnostic Status Change OK Report	2810H

Table 6-247 Diagnostic Command Group Responses

Diagnostic Response	Response Code
Reserved	84XXH
Reserved	44XXH
Reserved	24XXH
Reserved	2410H
Synchronous Error Status Responses	82XXH
Message Length Error	8200H
Message Sequence Error	8201H
Reserved	8202H
Command Group Error	8203H
Reserved	8204H
Reserved	8205H
Reserved	8206H
Reserved	8207H
Reserved	8208H
Data Acknowledge Response Error	8209H
Reserved	820AH
Asynchronous Error Status Responses	42XXH
Message Length Error	4200H
Command Sequence Error	4201H
Reserved	4202H
Command Group Error	4203H
Command Time-out Error	4204H

Table 6-247 Diagnostic Command Group Responses

Diagnostic Response	Response Code
Reserved	4205H
Command Failed Error	4206H
System Command Error	4207H
Sub-Command Error	4208H
Reserved	4209H
Invalid Control Word Error	420AH
Unsolicited Error Status Responses	22XXH
Diagnostic Status Change Error Report	2210H
Synchronous Control Status Responses	81XXH
Data Acknowledge (Ack), data valid	8100H
Data Negative Acknowledge (Nack), data invalid	8101H
Reserved	8102H
Reserved	8104H
Asynchronous Control Status Responses	41XXH
Unsolicited Control Status Responses	21XXH

Diagnostic Command Group Response Data

Asynchronous OK Status Responses

The following diagnostic command group asynchronous OK status responses use the specified data payload.

Command Complete (4800H)

Command In Progress Response Data	Data Payload
Diagnostic Command Group Command (sub-command)	XXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
Diagnostic Command Group Command (sub-command)	XXXXH

Synchronous Error Status Responses

The following diagnostic command group synchronous error status responses use the specified data payload.

Message Length Error Response Data (8200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Message Sequence Error Response Data (8201H)

Message Sequence Error Response Data	Data Payload
Expected Message Sequence Number	XXH
Received Message Sequence Number	XXH

Command Group Error Response Data (8203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Data Acknowledge Response Error Response Data (8209H)

Data Acknowledge Response Error Response Data	Data Payload
Invalid Data Acknowledge Response	XXXXH

Asynchronous Error Status Responses

The following diagnostic command group asynchronous error status responses use the specified data payload.

Message Length Error Response Data (4200H)

Message Length Error Response Data	Data Payload
Expected Message Length	XXXXH
Received Message Length	XXXXH

Command Sequence Error Response Data (4201H)

Command Sequence Error Response Data	Data Payload
Expected Command Sequence Number	XXH
Received Command Sequence Number	XXH

Command Group Error (4203H)

Command Group Error Response Data	Data Payload
Invalid Command Group	XXXXH

Command Time-out Error (4204H)

Command Time-out Error Response Data	Data Payload
N/A	

Command Failed Error (4206H)

Command Failed Error Response Data	Data Payload
Diagnostic Command Group Command (sub-command)	XXXXH

System Command Error (4207H)

System Command Error Response Data	Data Payload
N/A	

Sub-Command Error (4208H)

Sub-Command Error Response Data	Data Payload
Sub-command	XXXXH

Invalid Control Word Error (420AH)

Invalid Control Word Error Response Data	Data Payload
N/A	

Unsolicited Diagnostic Status Reports

Diagnostics supports the generation of the following unsolicited status message reports as defined by the response code (Table 6-248).

Table 6-248 Diagnostic Unsolicited Status Reports

Diagnostic Unsolicited Status Reports	Response Code
Diagnostic Status Change OK Report	2810H
Reserved	2410H
Diagnostic Status Change Error Report	2210H

Get Diagnostic Status

This command gets the current diagnostic status of the Encompass reader as defined by the Diagnostic Status Bit definitions that include FRAM test status, FPGA1/FPGA2 test status, digital board power supply status, RF transceiver status, GPS status, TDM status, communication link status, reset count, CPU firmware fault status, buffered tag transaction entries status, and error log entries status. Table 6-249 and Table 6-250 list the command and response data.

Table 6-249 Get Diagnostic Status Command (0001H)

Get Diagnostic Status Command Data	Data Payload
Get Diagnostic Status Command	0001H

Table 6-250 Get Diagnostic Status Response

Get Diagnostic Status Response Data	Data Payload
Get Diagnostic Status Command	0001H
Diagnostic Status (MSB)	XXH
Diagnostic Status	XXH
Diagnostic Status	XXH
Diagnostic Status	XXH
Diagnostic Status	XXH
Diagnostic Status	XXH
Diagnostic Status	XXH
Diagnostic Status (LSB)	XXH

Diagnostic Status Bit Definitions

Table 6-251 lists the bit definitions for the diagnostic status response.

Table 6-251 Diagnostic Status Bit Definitions

Bit	Diagnostic Status Bit Definition
63	Reserved
62	Reserved
61	Reserved
60	Reserved
59	Reserved
58	FRAM test status, where 0 = OK, 1 = error
57	FRAM data storage test status, where 0 = OK, 1 = error
56	Reserved
55	Reserved
54	Reserved
53	Reserved
52	Reserved
51	Reserved
50	FPGA1 test status, where 0 = OK, 1 = error
49	FPGA2 test status, where 0 = OK, 1 = error
48	Power supply status, where 0 = OK, 1 = error
47	Digital board overvoltage error, where 0 = no error, 1 = error
46	Digital board undervoltage error, where 0 = no error, 1 = error
45	Reserved
44	Reserved
43	RF transceiver ADC above maximum error, where 0 = no error, 1 = error
42	RF transceiver ADC below minimum error, where 0 = no error, 1 = error
41	RF transceiver ATTN DAC1 above maximum error, where 0 = no error, 1 = error
40	RF transceiver ATTN DAC1 below minimum error, where 0 = no error, 1 = error
39	RF transceiver ATTN DAC2 above maximum error, where 0 = no error, 1 = error
38	RF transceiver ATTN DAC2 below minimum error, where 0 = no error, 1 = error

Table 6-251 Diagnostic Status Bit Definitions

Bit	Diagnostic Status Bit Definition
37	RF transceiver DOM DAC above maximum error, where 0 = no error, 1 = error
36	RF transceiver DOM DAC below minimum error, where 0 = no error, 1 = error
35	RF transceiver source1 PLL unlocked error, where 0 = no error, 1 = error
34	RF transceiver source2 PLL unlocked error, where 0 = no error, 1 = error
33	RF transceiver uncalibrated error, where 0 = no error, 1 = error
32	RF transceiver 5VDC overvoltage error, where 0 = no error, 1 = error
31	RF transceiver 5VDC undervoltage error, where 0 = no error, 1 = error
30-23	Reserved
22	GPS T-RAIM alarm set, where 0 = alarm not set, 1 = alarm set
21	GPS self-test fault, where 0 = no fault, 1 = fault
20	GPS power-on fault, where 0 = no fault, 1 = fault
19	TDM two masters error, where 0 = no error, 1 = error
18	TDM master-slave error, where 0 = no error, 1 = error
17	TDM clock error, where 0 = no error, 1 = error
16	GPS window error, where 0 = no error, 1 = error
15	GPS one-PPS error, where 0 = no error, 1 = error
14	GPS communication link status, where 0 = link up, 1 = link down
13	Serial communication link status, where 0 = link up, 1 = link down
12	UDP/IP communication link status, where 0 = link up, 1 = link down
11	Serial debug communication link status, where 0 = link up, 1 = link down
10	RF transceiver communication link status, where 0 = link up, 1 = link down
9	Reserved
8	Reserved
7	Reset count (MSB)
6	Reset count
5	Reset count
4	Reset count (LSB)
3	CPU firmware fault, where 0 = no fault, 1 = fault

Table 6-251 Diagnostic Status Bit Definitions

Bit	Diagnostic Status Bit Definition
2	Reserved
1	Buffered tag transaction entries, where 0 = no entries, 1 = entries
0	Error log entries, where 0 = no entries, 1 = entries

Get Diagnostic Interface Status

This command gets the reader's current diagnostic interface software status. Table 6-252 and Table 6-253 list the command and response data.

Table 6-252 Get Diagnostic Interface Status Command (0002H)

Get Diagnostic Interface Status Command Data	Data Payload
Get Diagnostic Interface Status Command	0002H

Table 6-253 Get Diagnostic Interface Status Response

Get Diagnostic Interface Status Response Data	Data Payload
Get Diagnostic Interface Status Command	0002H
Module Number	XXXXH
Error Number	XXXXH

Get Error Log

This command gets the error log. The error log lists the errors in chronological order. Table 6-254 and Table 6-255 list the command and response data.

Table 6-254 Get Error Log Command (0003H)

Get Error Log Command Data	Data Payload
Get Error Log Command	0003H
Error Log Number	XXXXH

Table 6-255 Get Error Log Response

Get Error Log Response Data	Data Payload
Get Error Log Command	0003H
Error log number	XXXXH
Module number	XXXXH
Error number	XXXXH
Time stamp: hours	XXH
Time stamp: minutes	XXH

Table 6-255 Get Error Log Response

Get Error Log Response Data	Data Payload
Time stamp: seconds	XXH
Time stamp: hundredths of seconds	XXH
Time stamp: month	XXH
Time stamp: day	XXH
Time stamp: year	XXH

Get Number of Error Logs

This command gets the number of error logs. The error log overflow status is returned as 0 for no overflow or 1 for overflow. Table 6-256 and Table 6-257 list the command and response data..

Table 6-256 Get Number Error Logs Command (0004H)

Get Number of Error Logs Command Data	Data Payload
Get Number of Error Logs Command	0004H

Table 6-257 Get Number Error Logs Response

Get Number of Error Logs Response Data	Data Payload
Get Number of Error Logs Command	0004H
Number of error logs	XXXXH
Error log overflow status, where 0 = no overflow, 1 = overflow	XXH

Clear Error Logs

This command clears entries from the error log. Table 6-258 and Table 6-259 list the command and response data

Table 6-258 Clear Error Logs Command (0005H)

Clear Error Logs Command Data	Data Payload
Clear Error Logs Command	0005H
Clear Error Logs Control Word	A5A5H

Table 6-259 Clear Error Logs Response

Clear Error Logs Response Data	Data Payload
Clear Error Logs Command	0005H

7

Configuring and Operating the Encompass Reader Using AI1200-Emulation Commands

Chapter 7

Configuring and Operating the Encompass Reader Using AI1200-Emulation Commands

This chapter describes the Encompass® Reader AI1200-emulation commands that are used to configure and operate the reader. This chapter also contains commands and responses that are useful in developing host software for the AI1200 command set.

Chapter Organization

The Encompass Reader is controlled through mode settings, which configure the reader for specific applications. The Encompass Reader starts in Mode 0, Stop Mode, and must be changed to another mode as needed for a specific application.

This chapter first lists the operating modes to show what operations are available with this Encompass Reader application.

The remainder of the chapter provides a complete listing of system commands and responses that are required to develop host interface software for the Encompass Reader.

Encompass Reader Operational Mode 88

The Encompass Reader uses operational mode 88 to perform its processes. This mode contains specific parameters that are needed to do the required processes.

Working with Mode 88

The Encompass Reader powers up in Mode 0, Stop Mode. You must issue the commands (Table 7-1), via the host computer, to configure the reader.

Table 7-1 Commands Used to Configure the Encompass Reader

Sequence #	Command	Definition
1[a]	#01	Set the reader to command mode
2[a]	#4700	Set the reader to stop mode, RF off
	The following commands are required to configure Mode 88	

Table 7-1 Commands Used to Configure the Encompass Reader (continued)

Sequence #	Command	Definition
3[a]	#4ANNNN, where NNNN = protocol enable bits	Sets the protocols and sets the reader to *universal tag* mode
4[a]	#4B[AP]	Sets the secondary tag sequences
5[a]	#641N	Sets the RF to on continuously.
6[a]	#493PPAAAACCTTTTTTTTTT TTTTTTAAMMSSDDDDDDDD DDDDDDDDTTAA	If using the SeGo or eGo protocol, this command is needed to configure the group select equals parameters per channel.
7	#487N	Sets the IAG slot number if applicable
8	#63	Resets the reader
9	#9FNNNNN	Sets the reader downlink frequency in MHz. The reader must be in Stop Mode (0).
10	#9CNNNNN	Sets the reader uplink frequency in MHz. The reader must be in Stop Mode (0).
11	#984NYY	Sets the TDM as master or slave and switches TDM on.
12	#94PS	Sets the uplink source control when the SeGo RF uplink needs to use the RF downlink
13	#920N	Sets the downlink and uplink attenuations. Repeat this sequence step for all enabled protocols.
14	#921NRR	Sets the range adjust. Repeat this sequence step for all enabled protocols.
15	#493PPAAAAQQQQBBBBOO PPPPNNCCCCSSRRRRAA	If using the IT2200 protocol, this command is needed to configure IT2200 read request per antenna channel. The reader must be in Stop Mode (0).
16	#960N	Sets the line loss value of up to 3 decibels (dB) in 1-dB increments via the command interface port. The line loss command must be set after the RF Attenuation command has been set.
17	#642N	Sets the antenna multiplexer mode (if needed)
18	#410N	Sets the ID separation
19	#311	Sets the auxiliary information, that is, reader ID, antenna number, number of previous tag reads, status of digital input/output input bits, and so on.
20	#30	Append time and date, optional
21	#813YX	Sets the time interval for the periodic system check tag test and activates the check tag
22	#4788	Sets the reader to Mode 88

Table 7-1 Commands Used to Configure the Encompass Reader (continued)

Sequence #	Command	Definition

Note [a]Set these commands in the order shown.

Note TransCore recommends that you set Command Group 5 commands after entering #63 RESET READER to verify all configuration settings.

Operating Modes

The Encompass Reader has two modes of operation: data mode and command mode.

Data Mode

The Encompass Reader powers up in data mode. When in the data mode, the Encompass Reader sends all communications as data messages, such as tag IDs and reports, to the host computer. Reports provide information on input status changes and presence without tag report. The host computer can send only one command to the Encompass Reader while in data mode:

Command #`01` SWITCH TO COMMAND MODE changes the Encompass Reader from the data mode to the command mode.

Note: *The Encompass Reader transmits ID codes to the host computer when the Encompass Reader is in data mode. If the Encompass Reader remains in the command mode with tags passing through the read zone, the reader will buffer up to 10,000 tags.*

Command Mode

When the Encompass Reader is in the command mode, the host computer sends commands to the Encompass Reader that can be used to control the operation and configuration of the reader. After the Encompass Reader receives a command, it transmits a command response message. Typically, the command message contains `Done`, `Error`, or data relating specifically to the command request. These messages may be of variable length because some commands require information as part of the message, for example, DISPLAY READER ID NUMBER.

Communications can be lost if the host computer attempts to send certain commands under marginal communications conditions. For example, if the host computer transmits the command request to change the baud rate and the Encompass Reader properly receives the request and transmits the `Done` message, one of the two following conditions may occur:

- If the host computer receives the `Done` message, then both the host and the Encompass Reader switch to the new baud rate, and communications are maintained.
- If the host computer does not receive the `Done` message transmitted by the Encompass Reader, the host assumes that the command was not properly sent and does not switch to the new baud rate, causing a loss of communications.

Note: *In many applications, the host must be set to the new baud rate as it will not change automatically.*

Note: *You must reset the Encompass Reader before the baud rate change takes effect.*

Encompass Reader Operational Mode 88

The Encompass Reader operates in Mode 88 to perform specific tag processes. The Encompass Reader has been configured at the factory for most needed operations. Some parameters require commands for application-specific settings. These commands are listed in this chapter.

Note: *Throughout this chapter, host or host system refers to a host personal computer (PC) or lane controller.*

Reader Command Groups

Reader commands are divided by primary function into 10 groups. An additional ASCII command group follows the 10 primary command groups.

"Command Group 0 – Reader Mode Control"

Command group 0 controls reader mode.

Data mode is the Encompass Reader startup mode and the factory setting. When the reader is in data mode, you can enter #01 SWITCH TO COMMAND MODE only.

Command mode is the mode in which the reader can accept commands from a host computer. Tag ID data transmission from the reader is suspended while the reader is in command mode. You must enter #00 SWITCH TO DATA MODE to resume transmissions of IDs to the host computer.

"Command Group 1 – Communications Port Control"

Group 1 commands configure the communications parameters.

"Command Group 2 – Real-Time Clock Control"

Group 2 commands control the real-time clock. The real-time clock is supported by an capacitor so that the time and date are preserved in case of power outage. The real-time clock maintains the time and date for approximately seven days after power-off.

"Command Group 3 – Transmission Formats"

Group 3 commands control appended information to reader transmissions, such as IDs, authority information, error messages, and sensor input reports.

"Command Group 4 – ID Filter Parameters"

Group 4 commands control tag uniqueness, tag time-out, consecutive valid tag ID, and tag types.

"Command Group 5 – Reader Status"

Group 5 commands provide reader status and configuration.

"Command Group 6 – Reader Control Functions"

Group 6 commands configure the reader operating parameters, including control of the multiple antennas used with this reader.

"Command Group 7 – Search Control Functions"

Not used at this time.

"Command Group 8 – Auxiliary Reader Control"

Group 8 commands control reader functions, such as the system check tag.

"Command Group 9 – Reader System Configuration"

Group 9 commands control the reader system configuration, such as RF attenuation, frequency setting, and time-division multiplexing (TDM) control.

"ASCII Extended Command Set"

An additional ASCII extended command supplements the standard AI1200 Reader protocol used by the Encompass Reader.

Reader Command List

In this chapter, reader commands are described with the following identifiers:

- `#<COMMAND GROUP>` NAME
- Full description of command
- ***Format*** of the command string with parameters
- ***Pre-condition*** describes the system before command was executed
- ***Post-condition*** describes the system after command was executed
- ***Default*** parameter values
- #<`Response`> to the command
- ***See Also*** lists commands or system behavior that are impacted as a result of executing this command.
- ***Notes*** provide information that further clarifies the current discussion.

In the case when a command identifier does not contain information, a sentence stating this fact occurs in the text.

Factory-default reader settings are shown in **bolded command numbers**.

Command Group 0 – Reader Mode Control

Group 0 commands determine whether the reader is operating in data or command mode. These commands also lock and unlock the **COM1** port on the reader.

#00 SWITCH TO DATA MODE

This command switches the reader to data mode, which allows transmission of ID codes to the host computer. Data mode is the mode in which the reader powers up; it is the factory setting. When in this mode, you can enter the following command only: #01 SWITCH TO COMMAND MODE. The reader supports XON/XOFF protocol while in data mode. However, transmission of reader output, for example, IDs, is not suspended until the current ID has been completely transmitted. The reader also supports hardware flow control via RTS and CTS lines.

Format

#00

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in COMMAND MODE to switch to DATA MODE. The reader cannot be in #6161 BUFFER CONTROL MODE and be switched to DATA MODE.

Post-condition

This command takes effect immediately.

Default

#00 DATA MODE is the default mode following the sign-on message after boot up.

Response

#DONE, when switching from Command Mode to Data Mode. When the reader is in #6161 BUFFER CONTROL MODE, and if the reader receives a #00 SWITCH TO DATA MODE request, then the reader responds with `#ERROR`. When the reader is already in Data Mode, and if the reader receives a #00 SWITCH TO DATA MODE request, then the reader responds with #ERROR.

See Also

#01 SWITCH TO COMMAND MODE
#616N BUFFER CONTROL MODE SETTINGS

#01 SWITCH TO COMMAND MODE

This command switches the reader to command mode, which allows the reader to receive commands from a host computer or terminal. While in this mode, the reader does not transmit IDs to the host computer but instead stores up to 10,000 tags in its output buffer for later transmission. If the buffer becomes full, new IDs are lost. The SWITCH TO DATA MODE (`#00`) command must be issued to resume transmissions of IDs to the host computer.

Format

#01

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

The Encompass Reader is ready to receive commands after #01 is entered.

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#DONE`

See Also

#00 SWITCH TO DATA MODE

#06 TRANSMIT BUFFER ENTRY

This command allows the host to request data (tag IDs and reports) from the reader one at a time, first-in-first-out (FIFO) when all IDs and reports are transferred, responds with #DONE.

Format

`#06`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode. This command is supported if ECP is selected (`#611`) and buffer control has been enabled (`#6161`)

Post-condition

A response is sent, see “Response.”

This command takes effect immediately.

Default

This command does not have a default condition.

Response

If the reader receives command #06 and it has data in its message buffer, then it transmits the buffered messages in FIFO order. If the reader's message buffer is empty, then it transmits the #DONE message. If the reader receives command #06 when ECP and/or the buffer control have not been enabled, it transmits the #ERROR message.

Response	Meaning
`#DONE`	Buffer empty
`#ERROR`	Buffer control mode not enabled
`#<Tag Response>`	Messages in buffer
`#<Sensor Input Reports>`	Messages in buffer
`#<Sensor Status Change>`	Messages in buffer

See Also

#61N SELECT COMMUNICATION PROTOCOL
#616N BUFFER CONTROL MODE SETTINGS

Command Group 1 – Communications Port Control

Group 1 commands configure the communication links between the reader and the host computer or local terminal.

Reader response to Group 1 commands is at the pre-command setting. For example, when changing the baud rate in bits per second (bps) from 9600 baud to 19200 baud, the reader responds with `#DONE.` The reader must be reset by sending a `#63` for the settings to take effect. After the reader has been reset, the host computer or terminal must be changed to the new baud rate, in this case, 19200 baud, to communicate with the reader.

#100N SET BAUD RATE

Sets the baud rate of the COM1 RS–232 serial link.

Format

#100N

Parameters

B can be a value from 0 to 9

B	Baud Rate (bps)
0	300
1	600
2	1200
3	2400
4	4800
5	**9600**
6	19200
7	38400
8	57600
9	115200*
*Requires the use of a high-quality RS–232 cable	

Pre-condition

The reader must be in command mode with the previously set baud rate or the factory default.

Post-condition

System ready to change baud rate to new setting

Note: *#63 RESET READER command required for changes to take effect.*

Default

#1005	9600 baud

Response

#DONE	Valid baud rate
#ERROR	Invalid baud rate

See Also

#522 DISPLAY COM1 PORT COMMUNICATION PARAMETERS

#101N SET COM1 PORT STOP BITS

This command specifies the number of stop bits for COM1 port character transmission.

Format

#101N

Parameters

N can be either 0 or 1

N	Stop Bits
0	1 stop bit
1	2 stop bits

Pre-condition

The reader must be in command mode.

Post-condition

System must be ready to change stop bit setting.

Note: *#63 RESET READER command required for changes to take effect.*

Default

#1010 1 stop bit

Response

#DONE Valid entry
#ERROR Invalid entry

See Also

#522 DISPLAY COM1 PORT COMMUNICATION PARAMETERS

#102N SET COM1 PORT PARITY

This command selects the COM1 port parity setting. The factory setting is parity disabled.

Format

#1020 provides eight data bits and parity disabled.

#1021 provides seven data bits and even parity.

#1022 provides seven data bits and odd parity.

Parameters

N can be a value from 0 to 2

N	Parity
0	Disable parity
1	Enable even parity
2	Enable odd parity

Pre-condition

The reader must be in command mode.

Post-condition

System ready to change parity setting

Note: *#63 RESET READER command required for changes to take effect.*

Default

#1020 Disable parity

Response

#DONE Valid entry
#ERROR Invalid entry

See Also

#522 DISPLAY COM1 PORT COMMUNICATION PARAMETERS

#103N SET END OF LINE DELAY

This command adds a delay to the COM port prior to a handshake response. The factory setting is end of line delay of 0 ms.

Format

#1030 provides a 0 ms delay (factory default)

#1031 provides a 100 ms delay

#1032 provides a 200 ms delay

#1033 provides a 300 ms delay

Parameters

N can be a value from 0 to 3

N	Delay
0	0 ms delay
1	100 ms delay
2	200 ms delay
3	300 ms delay

Pre-condition

The reader must be in command mode.

Post-condition

System ready to change delay setting

Note: *#63 RESET READER command required for changes to take effect.*

Default

#1030	0 ms delay

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#522 DISPLAY COM1 PORT COMMUNICATION PARAMETERS

Command Group 2 – Real-Time Clock Control

Group 2 commands control the real-time clock, which maintains the time and date. This time and date can be appended to IDs, error messages, and sensor input reports.

The real-time clock is supported by a capacitor so that the time and date are preserved in case of power outage. The real-time clock maintains the time and date for approximately seven days after power-off.

#20 SET TIME

This command sets the time.

Format

The entry format is: #20HH:MM:SS

The time must be entered exactly as shown, as two-digit decimal entries with no spaces between characters and using colons (:) as delimiters.

Parameters

HH, MM, and SS represent hours, minutes, and seconds, respectively.

Values for HH (hours) range from 00 to 23. Values for MM (minutes) and SS (seconds) range from 00 to 59.

Pre-condition

The reader must be in command mode. Real-time clock holds the previously set time.

Post-condition

Time entered sets the time on the real-time clock.

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#22 DISPLAY TIME AND DATE
#30N APPEND TIME AND DATE SELECTION

#21 SET DATE

This command sets the date on the real-time clock.

Format

#21MM/DD/YY

The date must be entered exactly as shown, as two-digit entries with no spaces between characters and with forward slashes (/) as delimiters.

Parameters

MM, DD, and YY represent the month, day, and year, respectively. Values for MM (month) range from 01 to 12. Values for DD (day) range from 01 to 31. Values for YY range from 00 to 99.

Pre-condition

The reader must be in command mode. The real-time clock holds the previously set date.

Post-condition

Time entered sets the date on the real-time clock.

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#22 DISPLAY TIME AND DATE
#30N APPEND TIME AND DATE SELECTION

#22 DISPLAY TIME AND DATE

This command displays the reader's current time and date.

Format

#22

Parameters

There are no parameters associated with this command.

Response

#HH:MM:SS.hh MM/DD/YY. There are two spaces between the time and the date output.

HH, MM, SS, and hh represent time as hours, minutes, seconds, and hundredths of seconds, respectively. MM, DD, and YY represent the month, day, and last two digits of the year, respectively.

Pre-condition

The reader must be in command mode.

Post-condition

Time and date are displayed.

This command takes effect immediately.

Default

This command does not have a default condition.

See Also

#20 SET TIME
#21 SET DATE
#30N APPEND TIME AND DATE SELECTION

Command Group 3 – Transmission Formats

Command Group 3 commands determine what, if any, information is appended to IDs, error messages, sensor input reports, and modem connect and disconnect messages. This information includes time, date, and auxiliary information. Auxiliary information consists of reader number, antenna number, number of reads of the previous tag, and sensor input status.

#30N APPEND TIME AND DATE SELECTION

This command selects the options of appending time and date to transmitted IDs, error messages, and sensor input reports. The factory setting is time and date appended.

Format

`#30N`

Parameters

N can be a value from 0 to 2

N	Time/Date
0	No time and date appended
1	Time only appended
2	Time and date appended

Pre-condition

The reader must be in command mode. The previously selected option is in effect.

Post-condition

Enabling Time or Time and Date Stamp has the following effect on Tag Response, Sensor Status Change, and Sensor Input Report Messages:

Time only: `#<string>&HH:MM:SS.hh<%aux>`

Time and date: `#<string>&HH:MM:SS.hh MM/DD/YY<%aux>`

String is the tag response, sensor status change, or sensor input report.

& separates the string from the time and provides a means for the host computer to determine if time or time and date are appended.

% separates any auxiliary information aux defined by the #31N commands and provides a means for the host computer to determine if auxiliary information is appended.

: are time delimiters

/ are date delimiters

Two spaces separate the time from the date. HH, MM, SS, and hh represent time as hours, minutes, seconds, and hundredths of seconds, respectively.

MM, DD, and YY represent the month, day, and the last two digits of the year, respectively.

This command takes effect immediately.

Default

#302	time and date appended

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#20 SET TIME
#21 SET DATE
#22 DISPLAY TIME AND DATE

#31N APPEND AUXILIARY INFORMATION SELECTION

This command selects the options of appending auxiliary information to the tag response, sensor status change, and sensor input report outputs.

Parameters

N can be either 0 or 1

N	Meaning
0	No auxiliary information appended
1	Auxiliary information appended

Pre-condition

The reader must be in command mode. The previously selected option is in effect.

Post-condition

This command takes effect immediately.

Enabling Aux Info Append has the following effect on tag responses, sensor status change, and sensor input report messages:

```
#<string><&time date>%xx-y-zz-q
```

`<string>` is the tag ID code, error message, or sensor input report. Brackets are not included.

& separates the string from any optional time and date information time date appended by the #30N commands and provides a means for the host computer to determine if time or time and date are appended.

% separates the auxiliary information and provides a means for the host computer to determine if auxiliary information is appended.

Tag ID Report

<xx-y-zz-q>

xx: Reader ID value from 00 to FF hex

y: Antenna number from 0–3

zz: The number of reads of the previous tag per antenna from 00 to FF hex

q: The logical value of the sensor input status when the tag read occurred from 0 to F hex.

Sensor Input Report

<xx-y-zz-q>

xx: Reader ID value from 00 to FF hex

y: The I/O channel where an input was detected, debounced, and met the minimum true period from 0–3.

Presence True Criteria: An input completed a de-bounced false-to-true transition, minimum true period, followed by a de-bounced true-to-false transition.

zz: The number of reads of the previous tag per antenna from 00 to FF hex.

q: The logical value of the input event, true =1, false = 0, from 0 to F hex.

Sensor Status Change Report

<xx-y-zz-q>

xx: Reader ID value from 00 to FF hex

y: The I/O channel that detected a change in input status from 0–3.

zz: The number of reads of the previous tag per antenna from 00 to FF hex.

q: The value of the sensor input status when the input event occurred from 0 to F hex.

Default

#300	No auxiliary information appended

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#524 DISPLAY APPENDED INFORMATION STATUS
#690N SENSOR INPUT REPORTS
#82X SET SENSOR STATUS CHANGE MODE

Command Group 4 – ID Filter Parameters

Group 4 commands set criteria for buffering or discarding ID codes, such as filtering. These commands are useful for eliminating duplicate ID codes and filtering unwanted IDs obtained from fringe areas of the antenna reading range.

Please note that these commands use a *comparison register.* The comparison register manages IDs for filtering purposes. When an ID passes all of the filtering tests, it is stored in the reader's main buffer prior to transmission to the host computer.

#40 TRANSMIT ALL ID CODES

This command transmits to the host computer all IDs received by the antenna. This command bypasses some tag data processing that is normally performed when a tag is read. The bypassed processing includes the following:

- Uniqueness testing
- Tag buffering
- Removing old tag IDs from buffer
- Pulsing of Outputs 2 and 3 upon tag read, if #621 SET PREDEFINED OUTPUT CONTROL command is used
- RF and time-out are disabled when #641 SET RF BY SENSOR command is combined with #6921 SELECT PRESENCE RF CONTROL ALGORITHM command.
- Handshake counts for #590 and #311 are set to 0.

Format

#40

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode. Previously Selected #410N or #40 Uniqueness Option is in effect.

Post-condition

This command bypasses some tag data processing that is normally performed when a tag is read. The bypassed processing includes the following:

- Uniqueness testing
- Tag buffering
- Removing old tag IDs from buffer
- Pulsing of Outputs 2 and 3 upon tag read (if #621 SET PREDEFINED OUTPUT

CONTROL command is used)

- RF and time-out are disabled when #641 SET RF BY SENSOR command is combined with #6921 SELECT PRESENCE RF CONTROL ALGORITHM command.
- Handshake counts for #590 and #311 are set to 0.

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#410N SELECT UNIQUE ID CODE CRITERIA

Note: *There is no #6XX display command that indicates that #40 is in effect. The command #410N must be sent to restore a verifiable uniqueness state (i.e., display command reflects the state).*

#410N SELECT UNIQUE ID CODE CRITERIA

This command directs the reader to select, buffer, and transmit ID codes according to the following test:

- A tag response is buffered, if in the time interval since the new ID was last received, the previously decoded IDs have changed values at least N+1 times or the uniqueness time-out has been achieved or reset.
- Tag responses that do not pass the test are lost.

Each time the reader receives an ID, the uniqueness filter compares it with the contents of a comparison register(s).

This register contains two items. The first item is the most recently acquired ID, but only if it differs from the second item. The second item is the second most recent ID.

Comparison Register

Item 1	Most recently acquired ID (different from Item 2)
Item 2	Second most recent ID (different from Item 1)

When the uniqueness filter is set to separation of one ID, the newly acquired ID is transmitted only if it differs from the first item. Separation of two IDs allows transmission if the new ID is different from Items 1 and 2 in the comparison register.

A new ID can fail the filter test and not be transmitted; however, it is stored in the comparison register for comparison if it differs from Item 1.

Format

```
#410N
```

Parameters

N can be either 0 or 1

N	Meaning
0	Separation of 1 ID
1	Separation of 2 IDs

Pre-condition

The reader must be in command mode.

Previously selected #410N or #40 uniqueness option in effect.

The previously set #410N or #40 was in effect.

The uniqueness test has a time limit imposed by the #44N SET VARIABLE TIME-OUT commands. Expiration of the time-out clock effectively erases the comparison register. In effect, the first ID that the reader acquires after the clock expires always appears to be new and is buffered and transmitted. Newly acquired IDs are only tested against IDs that are registered after the clock expires. This time-out clock can be reset with the #440 RESET UNIQUENESS ON ALL CHANNELS command.

The validation procedure is executed before the unique ID test (#420N SELECT VALID ID CODE CRITERIA commands). IDs that do not pass the validation test are lost.

Post-condition

This command takes effect immediately.

Command #40 will be disabled, if it was in effect, upon executing #410N. The command affects all four RF antenna channels' uniqueness settings.

Default

#4100	Separation of 1 ID

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#530 DISPLAY FILTER PARAMETER STATUS

#420N SELECT VALID ID CODE CRITERIA

This command directs the reader to validate an ID received only after it has been obtained a specified number of times in sequence. The validation procedure is executed before the unique ID test (#410N SELECT UNIQUE ID CODE CRITERIA commands). IDs that do not pass the validation test are lost. For example, command #4204 specifies that the same ID must be obtained from the antenna/RF module five times in succession before it is considered for the uniqueness test. This feature is useful in installations where RF reflections may cause a single tag to be read multiple times or where an occasional ID might be read from fringe areas.

Format

#420N

Parameters

N can be a value from 0 to 4

N	Meaning
0	1 response acquisition before valid
1	2 response acquisitions before valid
2	3 response acquisitions before valid
3	4 response acquisitions before valid
4	5 response acquisitions before valid

Pre-condition

The reader must be in command mode. The previous #420N command executed is in effect.

Post-condition

This command takes effect immediately.

The command affects all four RF antenna channel's validation settings.

Default

#4200	1 response acquisition before valid

Response

`#DONE`	Valid entry
`#ERROR`	Invalid entry

See Also

#530 DISPLAY FILTER PARAMETER STATUS

#440 RESET UNIQUENESS ON ALL CHANNELS

This command causes the ID filtering process set by #410N SELECT UNIQUE ID CODE CRITERIA to restart. It is used in conjunction with the #44N SET VARIABLE TIME-OUT commands.

Format

#440

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Unique tags that are in the compare register(s) are cleared on all four RF antenna multiplexer channel uniqueness tests.

This command provides a one-time reset of the uniqueness time-out at which point the previously set time-out interval resumes on all four RF antenna multiplexer channels.

The value of the last handshake count is cleared by this command on all four RF antenna multiplexer channels.

Default

This command does not have a default condition.

Response

`#DONE`	Valid entry
`#ERROR`	Invalid entry

See Also

#44N	SET VARIABLE TIME-OUT
#410N	SELECT UNIQUE ID CODE CRITERIA
#590	DISPLAY HANDSHAKE COUNT ON ALL CHANNELS
#31N	APPEND AUXILIARY INFORMATION SELECTION

Note: *See #590 DISPLAY HANDSHAKE COUNT ON ALL CHANNELS.*

#440N RESET UNIQUENESS PER CHANNEL

This command causes the ID filtering process set by #410N SELECT UNIQUE ID CODE CRITERIA to restart on a per RF antenna multiplexer channel basis. Each RF antenna multiplexer channel has a separate tag uniqueness test.

Format

#440N

Parameters

N can be a value from 0 to 4

N	Meaning
0	Antenna multiplexer channel 0 (used for single-channel modes)
1	Antenna multiplexer channel 1
2	Antenna multiplexer channel 2
3	Antenna multiplexer channel 3

Pre-condition

The reader must be in command mode.

Post-condition

The uniqueness compare registers are cleared on the selected RF multiplexer channel. The value of the last tag's handshake count is cleared by this command on the selected RF antenna multiplexer channel basis. (Each multiplexed channel has a last tag handshake count.)

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#31N APPEND AUXILIARY INFORMATION SELECTION
#410N SELECT UNIQUE ID CODE CRITERIA
#44N SET VARIABLE TIME-OUT
#590 DISPLAY HANDSHAKE COUNT ON ALL CHANNELS
#590N DISPLAY HANDSHAKE COUNT PER CHANNEL
#642N RF ANTENNA MULTIPLEXER MODE

#44N SET VARIABLE TIME-OUT

This command sets a time limit on the uniqueness criteria set by #410N SELECT UNIQUE ID CODE CRITERIA.

Format

#44N

Parameters

The parameter N sets the number of minutes on the time-out clock. Each RF channel has an independent timer. These commands set the time-out period for all channels, that is, all channels are set to 2 or 20 minutes.

N	Time-out Clock
1	2 minutes (factory setting)
2	20 minutes

Pre-condition

The reader must be in command mode. The previous #44N setting is in effect.

Post-condition

Entering these commands effectively expires the time-out clock, which erases all current IDs in the comparison register. In effect, the first ID that is acquired after the clock expires always appears to be new and is stored. Newly acquired IDs are only tested against IDs that are registered after the clock resets. The reader restarts the time-out clock for an RF channel when a new ID is buffered from that RF channel. The time-out clock is continually reset (does not expire) as long as the reader receives the same tag ID.

This command takes effect immediately.

Default

#441 2 minutes

Response

#DONE Valid entry
#ERROR Invalid entry

See Also

#410N SELECT UNIQUE ID CODE CRITERIA
#440 RESET UNIQUENESS ON ALL CHANNELS
#440N RESET UNIQUENESS PER CHANNEL
#527 DISPLAY RF STATUS

#47NN SELECT TAG TYPE MODE

This command selects the tag processing mode for the Encompass Reader.

Format

#47NN

Parameters

The NN parameter specifies tag read mode.

NN	Tag Mode
00	Stop Mode (RF off)
88	Set Mode 88

Pre-condition

The reader must be in command mode.

Post-condition

The reader must be in command mode.

Note: *#63 RESET READER command required for changes to take effect.#$#*

Default

Factory Default Scenario: First time to configure tag mode
(Powers up in mode 00)
#01 (command mode)
#DONE
#4788 (Set desired tag mode)
#DONE
(Perform setup configuration)
#63 (Restart — to get mode 4788 to take effect)

Scenario 1: Toggle between Stop Mode and Mode 88
(#4788 pre-existing tag mode)
#01 (command mode)
#DONE
#4700 (Stop tag mode processing, RF off)
#DONE
#4788 (Restart tag mode processing, RF on, no reset required)
#DONE
#00
#DONE (system running in mode 4788)

Default

#4700 STOP TAG MODE (RF OFF)

Response

#DONE	Valid entry
#ERROR	Invalid entry

See Also

#565 DISPLAY TAG MODE SETTING

#487N SET IAG SLOT NUMBER

Sets the IAG trigger pulse slot, which allows multiple readers to have non-overlapping timeslots.

Format

#487N

Parameters

N = IAG Trigger Slot Number with a range from 1 to 3

Pre-condition

Adjacent readers using this configuration require synchronization using the TDM cable and synchronization pulse.

Post-condition

This command takes effect immediately.

Default

N = 1

Response

`#DONE`

See Also

#587 DISPLAY IAG SLOT NUMBER

Note: *Lane Setup: Adjacent readers are configured with different slots in order, that is, Reader 1 (N = 1), Reader 2 (N =2), Reader 3 (N = 3), Reader 4 (N = 1), and so on.*

#493 IT2200 GENERAL COMMAND REQUEST CONFIGURATION

This command sets a specified IT2200 command configuration per antenna channel. The configuration is saved to nonvolatile memory upon completion.

Format

```
#493<Protocol><Command Action>[<Tag Request Data>]<Optype><Antenna>
#493PPAAAAQQQQBBBBOOPPPPNNCCCCSSRRRRAA
#493000000C003003001000701000000000000
```

Parameters

PP **Protocol**
Set to 00 for IT2200. This determines the request structure.

AAAA **Command Action**
Set to 0000.

QQQQ **Request Code**
C003 Read Request

BBBB **Bit Count**
This field indicates the number of bits in the message. The bit count includes the number of bits in all fields after the bit count, including the CRC.

OO **Options**

Read Request Options

Option Bits

Bit 7	Bit 6	Bit 5–4	Bit 3	Bit 2	Bit 1–0
Unused	Tag type	Page/ password select	BIST request	Anti-playback request	Tag addressing

Tag Type — This field indicates the type of tag that has responded. The types include standard toll tags and check tags.

Value	Description
0	Toll tags
1	Check tags

Page/Password Select — This field indicates the tag data area selected and the specific data contained in the command for that tag data area. Valid values and corresponding definitions are specified in Table 7-2.

Table 7-2 Definition of Page/Password Select Values

Value	Definition
00	General data page area selected, no password specified
01*	General data page area selected, user password specified
11*	Owner area selected with a global password specified
*For future use, not currently supported.	

The owner and user areas contain user and global passwords that cannot be read.

BIST Request — This field indicates whether the tag should return a built-in self test (BIST) code in the read response. The BIST code is returned by the tag and displays the results of the BIST test that was run the last time the tag entered idle mode.

Value	Definition
0	BIST code not returned
1	BIST code returned

Anti-playback Request — This field indicates whether the tag should return an anti-playback code in the read response. The anti-playback code indicates whether a tag has been tampered with. The anti-playback code is returned by the tag and is incremented each time the tag is read. This function may be used for post-validation of tags at the system level by monitoring the sequencing of this field for a given tag.

Value	Definition
0	Anti-playback code not returned
1	Anti-playback code returned

Tag Addressing — This field specifies which tags should respond to the read request. Table 7-3 lists the valid values and corresponding definitions.

Table 7-3 Definitions of Tag Addressing Value

Value	Definition
00	All tags respond to this request. The response contains the Title 21 ID.
01	All tags respond to this request. The response contains the tag serial number.

Table 7-3 Definitions of Tag Addressing Value (continued)

10	Only tags with the specified Title 21 ID respond. The response contains the specified Title 21 ID in the tag ID field (serial number field).
11	Only tags with the specified tag serial number will respond. The responses contain the specified tag serial number in the tag ID field.

PPPP ***Starting Page Number***

This field is a binary integer corresponding to the tag page number to be read.

NN ***Count***

This field is for multipage reads only and is not implemented in the IT2200-series tags. It should be set to a 01H.

(SSSSSSSS) ***Tag ID (serial number or Title 21 ID)***

This field is optional for read requests without passwords, and contains a Title 21 tag serial number. It is required for requests with passwords. The contents of this data field are indicated by the tag addressing field in the option bits.

(PPPPPPPP) ***User Password***

This field is optional and contains a user password. The contents of this data field are indicated by the page/password select subfield. A user password consists of four bytes of data.

(PPPPPPPP)
(PPPPPPPP) ***Global Password***

This field is optional and contains a global password. The contents of this data field are indicated by the page/password select subfield. A global password consists of eight bytes of data.

CCCC ***Reserved***

CRC placeholder

SS ***OpType***

This one-byte field indicates whether the associated command should be configured for auto send (mode-based).

Setting	Description
00	Normal operation
01	Auto send

TTTT ***Tries***

This two-byte data field specifies the number of transmission attempts to be made for the given transaction.

AA ***Ant***

This antenna channel field indicates the channel-associated command to configure.

Example

```
#493<Protocol><Command Action>[<Tag Request Data>]<Optype><Antenna>
#493PPAAAAQQQQBBBBOOPPPPNNCCCCSSRRRRAA
#493000000C00300300100070100000000000
```

where

PP	(protocol)	=	00	=	IT2200
AAAA	(cmd action)	=	0000	=	Command action
QQQQ	(request code)	=	C003	=	IT2200 read request
		=	8000	=	Title 21 read request
BBBB	(bit count)	=	0030	=	Bit count
OO	(options)	=	01	=	Option
PPPP	(starting page #)	=	000x, where x corresponds to tag type	=	Starting page number
NN	(page count)	=	01	=	Page count
CCCC	(reserved - CRC)	=	0000	=	Reserved (CRC placeholder)
SS	(op type)	=	00	=	OpType (normal operation)
RRRR	(retry)	=	0000	=	Retry
AA	(antenna)	=	00	=	Antenna number

Pre-condition

The reader must be in stop mode (#4700).

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#DONE — Valid Parameters
#ERROR — Invalid Parameters

See Also

#5493 DISPLAY IT2200 CONFIGURATION

#493 SET EGO/SEGO GROUP SELECT EQUALS CONFIGURATION

This command sets the eGo/SeGo Group Select Equals configuration per antenna channel. Using the group select equals operation the reader can select tags that match the mask and data in the command. Using this command, the reader transmits the group select equals command code <CMDCDE>, byte mask <MASK>, byte address <ADDR>, and eight data bytes <DATA> to the tag. The tag applies the mask to the data. Each bit set to a 1 in the mask enables the associated data byte to be compared with eight data bytes in the tag memory offset by the address. If any enabled bytes do not match the memory, the tag does not respond.

Format

```
#493<PROT><CMDACT><CMDCDE><TAGID><ADDR><MASK><STRADR><DATA><DEPTH><ANT>
#493PPAAAACCTTTTTTTTTTTTTTTTAAMMSSDDDDDDDDDDDDDDDDTTAA
```

Parameters

PP	<PROT>:	Protocol	Range:	03 - eGo 05 - SeGo
AAAA	<CMDACT>:	Command Action	Range:	0000 - FFFF hex
CC	<CMDCDE>:	Command Code	Range:	00 - FF hex
T...T	<TAGID>:*	8_Bytes_Tag ID	Range:	0000000000000000 - FFFFFFFFFFFFFFFF hex
AA	<ADDR>:	Byte_Address	Range:	00 - FF hex
MM	<MASK>	Byte_Mask	Range:	00 - FF hex
SS	<STRADR>:*	Start_Address	Range:	00 - FF hex
D...D	<DATA>:	8_Bytes_Data	Range:	0000000000000000 - FFFFFFFFFFFFFFFF hex
TT	<DEPTH>:	Command Depth	Range:	00 - FF hex
AA	<ANT>:	Nibble_Antenna	Range:	0 - 3
PP	Protocol			
03	eGo			
05	SeGo			

Note: **These protocols are not used in Mode 88, therefore those "unused" bits are filled with 0's,*
(i.e., #493PPAAAACC0000000000000000AAMM00DDDDDDDDDDDDDDDDTTAA
#493PPAAAACC*0000000000000000*AAMM*00*DDDDDDDDDDDDDDDDTTAA
#49305000000*0000000000000000*000000*00*0000000000000000000

Pre-condition

The reader must be in command mode.

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Defaults

The defaults equal a Group Select All (all tags respond)

<PROT>:	Default:	03 and 05 both protocols
<CMDACT>:	Default:	0000
<CMDCDE>:	Default:	00
<MASK>:	Default:	00
<ADDR>:	Default:	00
<DATA>:	Default:	0000000000000000 hex
<ANT>:	Default:	Defaults applied to all antenna channels

Response

#DONE — Valid Parameters
#ERROR — Invalid Parameters

See Also

#5493 DISPLAY eGo/SeGo CONFIGURATION

Note: *Group select settings are based on the tags deployed in specific markets and locations. MASK, DATA, and ADDR settings should be chosen to work with the market and site-specific requirements. Group Select parameters should be kept in a script file due to the large number of parameters.*

#4ANNNN SET PROTOCOLS — UNIVERSAL TAG MODE

This command sets the Encompass Reader protocols.

Format

#4ANNNN

Where NNNN specifies the tag read mode

Range NNNN Hex: 0000–03FF Hex
(0000 0000 0000 0000–0000 0011 1111 1111 binary)

Binary	MSB											LSB
	Rsvd	Rsvd	CVISN	Rsvd	IAG	SeGo	eGo	IT2200	Title 21	ATA 1/2	ATA Full	Rsvd
0NNN	X	X	X	X	X	X	X	X	X	X	X	X

10 bits used, 16 allocated

The first 4 bits are reserved (Rsvd) as indicated by 0. Where X is a bit.

Example

0000HEX	-->	0000	0000	0000	0000	binary = No protocols enabled
003FHEX	-->	0000	0000	0011	1111	binary = eGo, IT2200, Title 21, ATA 1/2, ATA full
003EHEX	-->	0000	0000	0011	1110	binary = eGo, IT2200, Title 21, ATA 1/2, ATA full ***
03FFHEX	-->	0000	0011	1111	1111	binary = All protocols enabled

Pre-condition

Note: *The Encompass Reader must be in COMMAND MODE (#01)*

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

#4700 STOP TAG MODE (RF OFF)

Response

#DONE — Valid entry
#ERROR — Invalid entry

See Also

#566 DISPLAY PROTOCOLS

Note: *The Encompass Reader skips the reserved fields, which are indicated by ***. If the reserved bit is enabled, then the bit field does not change the transaction state machine.*

#4B [APN] SECONDARY TAG SEQUENCES

This command supplies the options to set the Encompass Reader to Mode 88 operation by allowing the user to select from a set of predefined tag operations per protocol.

Format

#4B [APN]
where

A = Antenna Number
Range: 0-3

P = Tag Protocol
0 IT2200
1 Title 21
2 ATA full-frame
3 eGo
4 IAG
5 SeGo
6 CVISN
7 ATA half-frame

N = Sequence per Protocol
Range: 0-F

Parameters

Sequence Matrix

P/N	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
1	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
2	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
3	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
4	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
5	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
6	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
7	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F

PN	Sequence	Description
00	IT2200 read-only	Restores normal operation
01	IT2200 read w/Gen Ack	Read followed by a Gen Ack configured with #493
10	Title 21 read-only	Restores normal operation
11	Title 21 read w/Title 21 Ack	Read followed by a Title 21 Ack

Note: *Order changed for symmetry with the Display Tag Sequence command*

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

See Also

#54B[AP] DISPLAY SECONDARY TAG SEQUENCE

Command Group 5 – Reader Status

Group 5 commands provide status reports on the parameters and operation of the reader. Thus, each command has a different response. Reader response characters may be shown in brackets <>. The brackets indicate that the response is a value in the range of numbers in the brackets; the brackets are not part of the response. For example, the #521 DISPLAY READER ID NUMBER command responds with a hex value ranging between 00 and FF. In the command discussion, the response is

```
#RDID <00–FF>
```

If the reader ID number is 7, for example, the actual response is

```
#RDID 07
```

All spaces shown in the response are actual spaces sent from the reader. In the previous example, there is one space between #RDID and 07.

#505 DISPLAY FIRMWARE VERSION AND SERIAL NUMBER

This command displays the primary microcontroller firmware version number and serial number.

Format

#505

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

The firmware version displays.

Default

This command does not have a default condition.

Response

#Model E5 AI1200 Ver X.XX SNXXXXXXX

The displayed line contains the current version of the microcontroller firmware and reader-assigned serial number (SN). The SN is a seven-digit decimal value (0 through 9), with the first 2 digits representing the year. Refer to the firmware version number when contacting TransCore about the firmware.

#506 DISPLAY HARDWARE CONFIGURATION INFORMATION

This command displays hardware configuration information stored in the reader memory by the user. Hardware configuration information is empty by default until you set the information to any 20-character ASCII string desired using command #696S...S STORE HARDWARE CONFIGURATION. The reader responds with an ASCII string from 1 to 20 characters long.

Format

`#506`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command displays hardware configuration information.

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#<1 to 20 Character ASCII string>`

See Also

#696S...S STORE HARDWARE CONFIGURATION

#520 DISPLAY POWER OUTAGE AND RESTORE BITS

This command displays the value of the reader's power outage and restore bits. The power outage bit value changes from 0 to 1 when power to the reader is interrupted. To reset the bit, use the #63 RESET READER command or the #65 RESET POWER OUTAGE BIT. On initial power-up, one of these two commands must be used to properly initialize this bit.

Format

```
#520
```

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

```
#PWRB P<0–1>
```

where

P0	indicates power to reader has been maintained since last zeroing of this bit.
P1	indicates power to reader has been lost since last zeroing of this bit.

See Also

#63 RESET READER
#65 RESET POWER OUTAGE BIT

#521 DISPLAY READER ID NUMBER

This command displays the reader identification (ID) number.

Format

`#521`

Parameters

There are no parameters for this command.

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#RDID <00–FF>`

This value is hex from 00 to FF and is set by the #60NN SET READER ID NUMBER command. This number is stored in non-volatile EEPROM and is preserved across a power interruption.

See Also

#31N APPEND AUXILIARY INFORMATION SELECTION
#60NN SET READER ID NUMBER

#522 DISPLAY COM1 PORT COMMUNICATION PARAMETERS

This command displays the parameters set for the COM1 port communications. Values correspond to those used to set the communications parameters through the various #100N-series commands.

Format

`#522`

Parameters

There are no parameters for this command.

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#COM1 B<0–9> S<0–1> P<0–2> D<0–3>`

where

B is the baud rate and can be a value from 0 to 9

B	Baud Rate (bps)
0	300
1	600
2	1200
3	2400
4	4800
5	**9600**
6	19200
7	38400
8	57600
9	115200*
*Requires the use of a high-quality RS–232 cable	

S is the stop bits. Stop bits (S) can be either 0 or 1

S	Stop Bits
0	1 stop bit
1	2 stop bits

P is the parity and can be a value from 0 to 2

P	Parity
0	Disable parity
1	Enable even parity
2	Enable odd parity

D is the end-of-line delay and can be a value from 0 to 3

D	End-Of-Line Delay
0	0 ms
1	100 ms
2	200 ms
3	300 ms

There is one space between each value.

For example, if the reader has the factory settings, the display reads:
`#COM1 B5 S0 P0 D1`

B5 baud rate of 9600
S0 one stop bit
P0 parity disabled
D1 100-ms end-of-line delay

See Also

#100N SET BAUD RATE
#101N SET COM1 PORT STOP BITS
#102N SET COM1 PORT PARITY

#524 DISPLAY APPENDED INFORMATION STATUS

This command displays the information being appended to reader transmissions. The information can be a combination of time, date, auxiliary, and authority information, such as reader ID number, antenna number, number of times the previous tag was read, sensor input status, and whether authority information is numeric or ASCII.

Format

`#524`

Parameters

There are no parameters for this command.

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#IDAP T<0–1> D<0–1> X<0–1>`

where

T0	indicates time is not appended
T1	indicates time is appended
D0	indicates date is not appended
D1	indicates date is appended
X0	indicates auxiliary information is not appended
X1	indicates auxiliary information appended

There is one space between each of the values.

For example, if the reader has the factory settings, the display reads
`#IDAP T1 D1 X1`.

This corresponds to time, date, auxiliary, and four-byte numeric authority information appended. When time and date are appended, they are appended to ID codes, sensor status change and sensor input report messages.

See Also

#30N APPEND TIME AND DATE SELECTION
#31N APPEND AUXILIARY INFORMATION SELECTION

#525 ENQUIRE COMMUNICATION PROTOCOL STATUS

This command displays the communication protocol status set by the #61N command.

Format

#525

Parameters

There are no parameters for this command.

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

See Response section.

Response

#ECPS P<0–1> T<00–FF> X<0–2> S<0>

where

P0	basic protocol enabled	factory setting
P1	error correcting protocol (ECP) enabled	
T	ECP acknowledgment time-out	
X0	disable flow control	factory setting
X1	enable XON/XOFF flow control	
X2	enable hardware flow control	
S0	<som> = # (23 hex)	factory setting

If the reader has factory settings, the response is

`#ECPS P0 TFE X0 S0`

basic protocol enabled
time-out set to 3 (@150 ms)
ON/XOFF flow control enabled
as <som> character

See Also

#61N SELECT COMMUNICATION PROTOCOL
#612NN SET ERROR CORRECTING PROTOCOL TIME-OUT
#614N FLOW CONTROL SETTINGS

#526 DISPLAY I/O STATUS

This command displays the I/O status indicating whether the output status modules are controlled externally through the #620N SET OUTPUT CONTROL commands or internally through the #62N SET PREDEFINED OUTPUT CONTROL command. If the output modules are controlled externally, this command displays the current energized or de-energized states. This command also displays the condition of the four sensor input circuits. The final value displayed is the output pulse duration set by the #67NP SET OUTPUT PULSE DURATION command.

Format

```
#526
```

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

```
#IOST C<0–2> O<0–F> I<0–F> D0<0–F> D1<0–F> D2<0–F> D3<0–F>
```

where

C0	control is external (See #620N commands)
C1	control is internal (See #621 command)
C2	control is internal (See #622 command)
ON	output status N<0–F> (see table below)
IN	input status N<0–F> (see table below)
D0	output pulse duration DIGITAL I/O port D0
D1	output pulse duration DIGITAL I/O port D1
D2	output pulse duration DIGITAL I/O port D2
D3	output pulse duration DIGITAL I/O port D3

	Output Port #			
	0	**1**	**2**	**3**
O0	–	–	–	–
O1	X	–	–	–
O2	–	X	–	–

	Output Port #			
	0	**1**	**2**	**3**
O3	X	X	–	–
O4	–	–	X	–
O5	X	–	X	–
O6	–	X	X	–
O7	X	X	X	–
O8	–	–	–	X
O9	X	–	–	X
OA	–	X	–	X
OB	X	X	–	X
OC	–	–	X	X
OD	X	–	X	X
OE	–	X	X	X
OF	X	X	X	X

	Input Port #			
	0	**1**	**2**	**3**
I0	–	–	–	–
I1	X	–	–	–
I2	–	X	–	–
I3	X	X	–	–
I4	–	–	X	–
I5	X	–	X	–
I6	–	X	X	–

	Input Port # 0	1	2	3
I7	X	X	X	–
I8	–	–	–	X
I9	X	–	–	X
IA	–	X	–	X
IB	X	X	–	X
IC	–	–	X	X
ID	X	–	X	X
IE	–	X	X	X
IF	X	X	X	X
X = configured as output or input				

See Also

#620N SET OUTPUT CONTROL
#62N SET PREDEFINED OUTPUT CONTROL
#67NP SET OUTPUT PULSE DURATION

Note: *The values for D0 through D3 correspond to the values entered through the #67NP SET OUTPUT PULSE DURATION commands and range from 0 (4 ms) to F (752 ms).*

#527 DISPLAY RF STATUS

This command displays the current RF status. The command also shows if the RF is controlled through external host commands, sense input, or is in dual-channel multiplex mode; whether the RF is off or on; and the uniqueness time-out setting determined by the #44N SET VARIABLE TIME-OUT commands.

Format

`#527`

Parameters

There are no parameters associated with this command.

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#RFST C<0–1> M<0–F> O<0–5> T<1–2>`

where

C0	RF on continuously enabled	(see command #6411 for detailed description)
C1	RF on by presence enabled	(see command #6410 for detailed description)
M0	Single channel	(see command #6420 for detailed description)
M1	Single-channel antenna synchronization compatible	(see command #6421 for detailed description)
M3	Two-channel multiplexing (0, 1)	(see command #6423 for detailed description)
MC	Two-channel multiplexing (2, 3)	(see command #642C for detailed description)
M7	Three-channel multiplexing (0, 1, 2)	(see command #6427 for detailed description)
MF	Four-channel multiplexing (0, 1, 2, 3)	(see command #642F for detailed description)
O0	RF off (real-time status)	
O1	Manual antenna channel 0 on (1, 2, 3 off)	
O2	Manual antenna channel 1 on (0, 2, 3 off)	
O3	Manual antenna channel 2 on (0, 1, 3 off)	
O4	Manual antenna channel 3 on (0, 1, 2 off)	
O5	RF on (real-time status)	
T1	Variable time-out clock set to 2 minutes	

T2	Variable time-out clock set to 20 minutes	

See Also

#44N SET VARIABLE TIME-OUT
#620N SET OUTPUT CONTROL
#640N RF CONTROL
#641N RF MODE CONTROL
#642N RF ANTENNA MULTIPLEXER MODE

Note: *#6410 RF BY PRESENCE ENABLED*
O0 displayed when presence is deasserted for any RF channel
O5 displayed when presence is asserted for any RF channel

Note: *#6411 RF ON CONTINUOUSLY ENABLED*
O0 displayed if #6400 TURN RF OFF is in effect
O5 displayed is #6405 TURN RF ON is in effect

#529 DISPLAY PRESENCE DETECTOR STATUS

This command displays the parameters set for presence detector status as defined by the #69N-series of commands.

Format

`#529`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#PRST P<0–1> D<0–F> A<0–2> T<0–F> I<0–1>

where

P0	Sensor input reports disabled	(see command #6900)
P1	Sensor input reports enabled	(see command #6901)
DN	Presence minimum true period	(see command #691N)
A0	RF off on time-out only	(see command #6920)
A1	RF off on time-out or tag	(see command #6921)
A2	RF off on time-out or presence conditions false	(see command #6922)
TN	Presence control time-out	(see command #693N)
I0	Sense input energized for true	(see command #6940)
I1	Sense input de-energized for true	(see command #6941)

For example, if the reader has the factory settings, it responds with:

`#PRST P0 D6 A2 TF I0`

which corresponds to

Sensor input reports disabled
Presence true period of 32 ms
RF control off on time-out only
Presence RF control time-out of 32 ms
Digital sense input module energized for positive logic

See Also

#690N SENSOR INPUT REPORTS
#691N SET MINIMUM PRESENCE TRUE PERIOD
#692N SELECT PRESENCE RF CONTROL ALGORITHM
#693N SELECT PRESENCE RF CONTROL TIME-OUT PERIOD
#694N SELECT SENSE INPUT INVERSION

#530 DISPLAY FILTER PARAMETER STATUS

This command displays the parameters set for the identification separation and validation parameters.

Format

```
#530
```

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

```
#RF0S U<0–1> V<0–4>
```

U: Uniqueness filter criteria
V: Valid ID code criteria.

Values correspond to those used to set the uniqueness and valid ID code parameters through the #410N SELECT UNIQUE ID CODE CRITERIA and #420N SELECT VALID ID CODE CRITERIA commands.

For example, if the reader is set to the factory values, the display would read as follows:

```
#RF0S U0 V0
```

U0: separation of one ID for uniqueness filtering
V0: obtaining an ID one time to consider it valid.

See Also

#410N SELECT UNIQUE ID CODE CRITERIA
#420N SELECT VALID ID CODE CRITERIA.

#535 DISPLAY BUFFER CONTROL STATUS

This command displays buffer control mode status as enabled or disabled.

Format

`#535`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#BCM <0–1>`

where
0 buffer control mode disabled
1 buffer control mode enabled

See Also

#616N BUFFER CONTROL MODE SETTINGS

#5493 DISPLAY IT2200 CONFIGURATION

This command displays the IT2200 configuration.

Field Format

```
#5493<Protocol><Command Action><Command Code><Reserved><Antenna>
```

Text Format

#5493PPAAAACCCCVVVVAA

Parameters

where

Protocol (PP) — 1-byte value indicating IT2200 as the tag type data

0x00 = IT2200

Command Action (AAAA) — 2-byte value

0x0000

Command Code (CCCC) — 2-byte value indicating a Gen Ack or Page Read

0xC003 = Page Read
0xF00F = Gen Ack

Reserved (VVVV) — 2-byte field for future use

0x0000

Antenna (AA) — 1-byte value indicating the antenna channel

0x00 = Antenna 0
0x01 = Antenna 1
0x02 = Antenna 2
0x03 = Antenna 3

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Example

```
//Get Antenna 0 Parameters
#5493000000C003000000
#5493000000C00300300100070100000000000000
```

where

PP = 00 = IT2200

AAAA = 0000 = Command Action

QQQQ = C003 = IT2200 Read Request

BBBB = 0030 = Bit Count

OO = 01 = Option

PPPP = 0007 = Starting Page Number

NN = 01 = Page Count

CCCC = 0000 = Reserved (CRC placeholder)

SS = 00 = OpType (normal operation)

TTTT = 0000 = Tries

AA = 00 = Antenna Number

See Also

#493 IT2200 GENERAL COMMAND REQUEST CONFIGURATION

#5493 DISPLAY eGo/SeGo CONFIGURATION

This command displays the Group Select Equal settings for eGo or SeGo.

Field Format

```
#5493<Protocol><Command Action><Command Code><Command Depth><Antenna>
```

Text Format

```
#5493PPAAAACCDDAA
```

where

Protocol (PP) — 1-byte value indicating tag type data

0x03 = eGo

0x05 = SeGo

Command Action (AAAA) — 2-byte value

0x0000

Command Code (CC) — 1-byte value indicating a Group Select Equals

0x00 = Group Select Equals

Command Depth (DD) — 1-byte value

0x00 = 1st layer

Antenna (AA) — 1-byte indicating the antenna channel

0x00 = Antenna 0

0x01 = Antenna 1

0x02 = Antenna 2

0x03 = Antenna 3

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

Valid Entry:

```
#5493PPAAAACCTTTTTTTTTTTTTTTTMMAADDDDDDDDDDDDDDDDSSTTTTAA
```

Invalid Entry

```
#Error
```

Example

```
//Get Antenna 0 Parameters
#5493050000000000
#549305000000000000000000001C0A0123456701234567000000000
```

See Also

#493 SET eGo/SeGo GROUP SELECT EQUALS CONFIGURATION

#54B [AP] DISPLAY SECONDARY TAG SEQUENCE

This command displays the options to the Mode 88 operation by allowing the user to select from a set of predefined tag operations per protocol.

Format

```
#54B [AP]
```

Parameters

A = Antenna Number and has a range from 0 to 3

P = Tag Protocol and has a range from 0 to 7 where

0	IT2200
1	Title 21
2	ATA full-frame
3	eGo
4	IAG
5	SeGo
6	CVISN
7	ATA half-frame

Pre-condition

The reader must be in command mode

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

For IT2200, no acknowledge (Ack)

Response

The possible responses are shown here.

P		
0	#IT2200	A[A] N[N]
1	#T21	A[A] N[N]
2	#ATA	A[A] N[N]
3	#EGO	A[A] N[N]
4	#IAG	A[A] N[N]
5	#SEGO	A[A] N[N]
6	#CVISN	A[A] N[N]
7	#ATA1/2	A[A] N[N]

where

A = Antenna Number and has a range from 0 to 3

N = Sequence per Protocol and has a range from 0 to F

Parameters

Sequence Matrix

P/N	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
1	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
2	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
3	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
4	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
5	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
6	60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
7	70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F

PNA	Sequence	Description
00	IT2200 read-only	Restores normal operation
01	IT2200 read w/Gen Ack	Read followed by a Gen Ack configured with #493
10	Title 21 read-only	Restores normal operation
11	Title 21 read w/Title 21 Ack	Read followed by a Title 21 Ack

Examples:

#4B010	Set Title 21 read-only on Antenna 0 #4BN
#DONE	
#54B01	Get Title 21 N on Antenna 0
#T21	A0 N0 T21 read-only on Antenna 0
#4B101	Set IT2200 read w/Gen Ack on Antenna 1
#DONE	
#54B01	Get IT2200 N on Antenna 1
#IT2200 A1 N1	IT2200 read w/Gen Ack

See Also

#4B[AP] SECONDARY TAG SEQUENCES

#550 DISPLAY SYSTEM CHECK TAG CONTROL PARAMETERS

This command displays the control parameters for the system check tag.

Format

`#550`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#SCTS M<0–1> T<0–F> X<0–1>

where
M0 indicates periodic test mode disabled
M1 indicates periodic test mode enabled
T0 is a repetitive time interval of 30 seconds
T1 is a repetitive time interval of 2 minutes
T2 is a repetitive time interval of 4 minutes
T3 is a repetitive time interval of 8 minutes
T4 is a repetitive time interval of 15 minutes
T5 is a repetitive time interval of 30 minutes
T6 is a repetitive time interval of 1 hour
T7 is a repetitive time interval of 2 hours
T8 is a repetitive time interval of 4 hours
T9 is a repetitive time interval of 8 hours
X0 indicates eGo, SeGo, or ATA check tag modes
X1 indicates Title 21 or IT2200 check tag modes

See Also

#810 DISABLE SYSTEM CHECK TAG PERIODIC MODE
#813YX SET SYSTEM CHECK TAG PERIODIC TIME INTERVAL

#560 DISPLAY SENSOR STATUS CHANGE MODE

This command displays the sensor status change feature status.

Format

#560

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

```
#SSTC E<0–1> M<0–F>
```

where

E0	indicates sensor status change status disabled
E1	indicates sensor status change status enabled
MN	indicates value of mask for inputs enabled (see table)

	Input Port			
	0	**1**	**2**	**3**
M0	–	–	–	–
M1	X	–	–	–
M2	–	X	–	–
M3	X	X	–	–
M4	–	–	X	–
M5	X	–	X	–
M6	–	X	X	–
M7	X	X	X	–
M8	–	–	–	X
M9	X	–	–	X

	Input Port			
	0	**1**	**2**	**3**
MA	–	X	–	X
MB	X	X	–	X
MC	–	–	X	X
MD	X	–	X	X
ME	–	X	X	X
MF	X	X	X	X
where X = on, – = off				

See Also

#82X SET SENSOR STATUS CHANGE MODE

#561 DISPLAY LINE LOSS

This command displays the coaxial cable line loss between the Encompass Reader and the antenna.

Format

`#561`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#LINE LOSS N`

where
N
0 dB
1 dB
2 dB
3 dB

See Also

#960N SET LINE LOSS

#565 DISPLAY TAG MODE SETTING

This command displays the Encompass Reader tag mode.

Format

`#565`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#56500	Stop Mode (RF off)
#56588	Mode 88

See Also

#47NN SELECT TAG TYPE MODE

#566 DISPLAY PROTOCOLS

This command displays the current tag mode.

Format

`#566`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#566NNNN
where

NNNN parameter specifies the tag read mode. This parameter must be converted to binary to yield the protocol enable bits.

Range NNNN Hex: 0000–03FF Hex
(0000 0000 0000 0000–0000 0011 1111 1111 binary)

Binary	MSB											LSB
	Rsvd	Rsvd	CVISN	Rsvd	IAG	SeGo	eGo	IT2200	Title 21	ATA 1/2	ATA Full	Rsvd
0NNN	X	X	X	X	X	X	X	X	X	X	X	X

10 bits are used, 16 are allocated

The first 4 bits are reserved (Rsvd) as indicated by 0, where X specifies an enabled bit.

Example

0000HEX	-->	0000	0000	0000	0000	binary = No protocols enabled
0037HEX	-->	0000	0000	0011	1111	binary = eGo, IT2200, Title 21, ATA 1/2, ATA full
0036HEX	-->	0000	0000	0011	1110	binary = eGo, IT2200, Title 21, ATA 1/2, ATA full
****						
0FFFHEX	-->	0000	0011	1111	1111	binary = All protocols enabled

See Also

#4ANNNN SET PROTOCOLS — UNIVERSAL TAG MODE

Note: *The Encompass Reader skips the reserved fields (indicated by ***). If the reserved bit is enabled, then the bit field does not change the transaction state machine.*

#57N DISPLAY ATTENUATION AND RANGE SETTINGS

This command displays the attenuation and range settings for a given tag type N.

Format

`#57N`

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

N	Response
0	`#ITGS D<0–F> U<0–F> R<00–14>`
1	`#T21S D<0–F> U<0–F> R<00–14>`
2	`#ATAS U<0–F> R<00–14>`
3	`#EGOS D<0–F> U<0–F> R<00–14>`
4	`#IAGS D<0–F>`
5	`#SEGO D<0–F> U<0–F> R<00–14>`
6	`#CVISN D<0-F> U<0-F> R<00-F>`
7	`#ATA1/2       U<0-F> R<00-14>`

where

DN	downlink attenuation
UN	uplink attenuation
RNN	range adjust

See Also

#920NDU SET RF ATTENUATION
#921NRR SET RANGE ADJUST

#581 DISPLAY FREQUENCY IN MHZ

This command displays the frequency parameters in MHz.

Format

`#581`

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#F UNNN.NN DNNN.NN

where

UNNN.NN Uplink frequency setting (see UNNN.NN table for settings)
DNNN.NN Downlink frequency setting (see DNNN.NN table for settings)

UNNN.NN Frequency (MHz)	UNNN.NN Frequency (MHz)
U800.00*	
U902.25	U915.00
U902.50	U915.25
U902.75	U915.50
U903.00	U915.75
U903.25	U916.00
U903.50	U916.25
U903.75	U916.50
U910.00	U916.75
U910.25	U917.00
U910.50	U917.25
U910.75	U917.50
U911.00	U917.75
U911.25	U918.00

UNNN.NN Frequency (MHz)	UNNN.NN Frequency (MHz)
U911.50	U918.25
U911.75	U918.00
U912.00	U918.50
U912.25	U918.75
U912.50	U919.00
U912.75	U919.25
U913.00	U919.50
U913.25	U919.75
U913.50	U920.25
U913.75	U920.50
U914.00	U920.75
U914.25	U921.00
U914.50	U921.25
U914.75	U921.50
Note * These frequencies are not in the location and monitoring service band and are not available for use in the United States; these include all 800.00 MHz frequencies.	

DNNN.NN Frequency (MHz)	DNNN.NN Frequency (MHz)
D870.00*	
D902.25*	D915.00
D902.50*	D915.25
D902.75*	D915.50
D903.00*	D915.75
D903.25*	D916.00
D903.50*	D916.25
D903.75*	D916.50
D910.00*	D916.75

DNNN.NN Frequency (MHz)	DNNN.NN Frequency (MHz)
D910.25*	D917.00
D910.50*	D917.25
D910.75*	D917.50
D911.00*	D917.75
D911.25*	D918.00
D911.50*	D918.25
D911.75*	D918.50
D912.00*	D918.75
D912.25*	D919.00*
D912.50*	D919.25*
D912.75	D919.50*
D913.00	D919.75*
D913.25	D920.00*
D913.50	D920.25*
D913.75	D920.50*
D914.00	D920.75*
D914.25	D921.00*
D914.50	D921.25*
D914.75	D921.50*
Note *These frequencies are not in the location and monitoring service band and are not available for use in the United States; these include all 800.00 MHz frequencies.	

Exceptions

Note: *When using eGo/SeGo protocol tags, use downlink frequencies from 911.75 MHz to 919.75 MHz.*

Note: *When using IT2200 and Title 21 protocol tags, use downlink frequencies from 912.75 MHz to 918.75 MHz.*

Note: *When using active tags, such as IAG protocol tags, use downlink frequencies from 914.75 MHz to 916.75 MHz.*

See Also

#9CNNNN SET UPLINK RF IN MHZ
#9FNNNN SET DOWNLINK RF IN MHZ

#582 DISPLAY TDM TIME VALUES

This command displays the TDM time values currently active in the Encompass Reader.

Format

`#582`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#TDMT D<NNN> U<NNN> S<NN>

where

D<NNN>	transaction delay, transaction delay time = NNN*50 μs.
U<NNN>	transaction duration, transaction duration time = NNN*50 μs.
S<NN>	synchronization rate, where NN = synchronization rate in periods per second. The value range for S is 02 to FF hex. The synchronization rate = 1/synchronization period.

#585 DISPLAY TDM SETTINGS

This command displays the active TDM settings in the Encompass Reader.

Format

`#585`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#TDMS T<0–1> M<0–3> S<0–26>

where
T = TDM is off (0) or TDM is on (1)
M = reader is GPS slave (0), master (1), secondary (2), or GPS primary (3)
S = slave number from 0 to 26

See Also

#984NYY SET TDM AS MASTER OR SLAVE

#587 DISPLAY IAG SLOT NUMBER

This command displays the IAG slot number.

Format

`#587`

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#Slot S<1–3>

where
S = 1 to 3

See Also

#487N SET IAG SLOT NUMBER

#590 DISPLAY HANDSHAKE COUNT ON ALL CHANNELS

This command displays the tag read handshake count for all active RF antenna multiplexer channels.

Format

#590

Parameters

There are no parameters associated with this command.

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#TRHS <00–FF>

See Also

#440 RESET UNIQUENESS ON ALL CHANNELS

#590N DISPLAY HANDSHAKE COUNT PER CHANNEL

This command displays the tag read handshake count on a per channel basis. Each RF antenna multiplexer channel has a last tag handshake count value.

Format

`#590N`

Parameter

N<0-3>

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

N	Response
0	#TRHS <00–FF>
1	#TRHS <00–FF>
2	#TRHS <00–FF>
3	#TRHS <00–FF>

See Also

#440N RESET UNIQUENESS PER CHANNEL
#642N RF ANTENNA MULTIPLEXER MODE

#594P DISPLAY UPLINK SOURCE CONTROL PER PROTOCOL

This command displays the uplink source on the transceiver board per protocol.

Format

`#594P`

Parameters

P	Tag Protocol
0	IT2200
1	Title 21
2	ATA full-frame
3	eGo
4	IAG
5	SeGo
6	CVISN
7	ATA half-frame

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately

Default

There is no default setting.

Response

P	Tag Protocol
0	#ITG S<0-1>
1	#T21 S<0-1>
2	#ATA S<0-1>
3	#EGO S<0-1>
4	#IAG S<0-1>
5	#SEGO S<0-1>
6	#CVISN S<0-1>
7	#ATA 1/2 S<0-1>

where

S	Uplink Source
0	Use Uplink Source (Source 2)
1	Use Downlink Source (Source 1)

See Also

#94PS SET UPLINK SOURCE CONTROL

#597 DISPLAY OPTO PORT(S) DIRECTION

This command displays the OPTO port(s) direction as either input or output.

Format

`#597`

Parameter

N<0-F>

Pre-condition

There is no pre-condition for this command.

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

#OPTO DN

where N = range from 0–F

	Port			
N	**0**	**1**	**2**	**3**
0	I	I	I	I
1	O	I	I	I
2	I	O	I	I
3	O	O	I	I
4	I	I	O	I
5	O	I	O	I
6	I	O	O	I
7	O	O	O	I
8	I	I	I	O
9	O	I	I	O
A	I	O	I	O

N	Port 0	1	2	3
B	O	O	I	O
C	I	I	O	O
D	O	I	O	O
E	I	O	O	O
F	O	O	O	O
where I = input, O = output				

See Also

#697N SET OPTO PORT(S) DIRECTION

Command Group 6 – Reader Control Functions

Command Group 6 commands set such reader control functions as output control, RF control, and ECP.

Note: *Unless otherwise indicated, Group 6 commands return `#DONE` or `#ERROR`.*

#60NN SET READER ID NUMBER

This command assigns an ID number (NN) to the reader. This number can be displayed by using the #521 DISPLAY READER ID NUMBER command. See #31N APPEND AUXILIARY INFORMATION SELECTION commands.

Format

`#60NN`

Parameters

Values for NN are hexadecimal entries of 00 through FF.

Pre-condition

The reader must be in command mode. The previously set or default reader number must be in effect.

Post-condition

The reader number is stored and is preserved in case of power outages.

This command takes effect immediately.

Default

The factory value is N = 00.

Response

`#DONE`	Valid setting
`#ERROR`	Invalid setting

See Also

#521 DISPLAY READER ID NUMBER
#31N APPEND AUXILIARY INFORMATION SELECTION

#61N SELECT COMMUNICATION PROTOCOL

This command selects between the two communication protocol options: basic or ECP.

Format

#61N

Parameters

Command	**Function**
#610	Enables basic protocol
#611	Selects AI1200-emulation ECP

Pre-condition

The reader must be in command mode. The message buffer must be empty prior to changing communications protocol. Allow the buffer to empty or issue #63 RESET READER command to empty the buffer.

Post-condition

This command takes effect immediately.

Default

#610 Enables basic protocol

Response

`#DONE`	Valid Setting
`#ERROR`	Invalid Setting

See Also

#525 ENQUIRE COMMUNICATION PROTOCOL STATUS

#612NN SET ERROR CORRECTING PROTOCOL TIME-OUT

This command sets time-out interval for ECP. The time-out value applies to both transmission and receipt of serial data over the COM1 communications port. The time-out on transmission is initiated immediately following the transmission of the last character of a message (<eom>). The time-out on receipt is initiated immediately after the <som> character is received.

Format

`#612NN`

Parameters

Values for ECP are NN with a range of 03 to FE.

If NN = FF, then the time-out is disabled. The time-out value in ms is approximated by the following formula:
Time-out (ms) = 50 * nn

Pre-condition

The reader must be in command mode. Unless the timer is already operating, this command will take effect after the next timer reset.

Post-condition

This command takes effect immediately.

Default

`#612FE,` the default interval is 12.7 seconds, NN = FE hex

Response

`#DONE`	Valid setting
`#ERROR`	Invalid setting

See Also

#525 ENQUIRE COMMUNICATION PROTOCOL STATUS

#614N FLOW CONTROL SETTINGS

This command controls the flow control settings for reader-to-host communications.

Software Flow Control: XON/XOFF, where

XOFF
CTRL-S: host character used to stop reader transmission
ASCII symbol DC3
Hex 13, Decimal 19

XON
CTRL-Q: host character used to resume reader transmission
ASCII symbol DC1
Hex 11, Decimal 17

Hardware Flow Control: The reader controls the ready to send (RTS) line and monitors the readiness of the host device via the clear to send (CTS) line. When the CTS line switches to false, the reader will halt transmission within one character.

Format

`#614N`

Parameters

Command	Function
#6140	Disables the flow control
#6141	Enables software flow control (XON/XOFF)
#6142	Enables hardware flow control (CTS/RTS)

Pre-condition

The reader must be in command mode.

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

#6140 Flow control disabled

Response

`#DONE` Valid setting
`#ERROR` Invalid setting

See Also

#525 ENQUIRE COMMUNICATION PROTOCOL STATUS

#616N BUFFER CONTROL MODE SETTINGS

Buffer control mode (BCM) is an ECP option that prevents unsolicited (asynchronous) reader transmissions.

If the **buffer control is disabled**, then the reader transmits data to the host as soon as the data is acquired. The host must acknowledge the data according to the ECP acknowledgment/negative acknowledgment (Ack/Nak) protocol. If the **buffer control is enabled**, then the host must request messages from the reader using the #06 TRANSMIT BUFFER ENTRY command. The **exception** to this rule occurs on startup when the reader transmits its two-line sign-on message asynchronously. When in BCM, the reader remains in command mode. If the reader receives a #00 SWITCH TO DATA MODE request, then the reader responds with #ERROR. To exit BCM, send #6160 DISABLE BUFFER CONTROL MODE.

The reader returns an error message if it receives #06 when BCM is not enabled. If buffer control is enabled, the reader does not support ECP Ack or Nak messages from the host. Since all messages are transmitted in response to a host command, acknowledgment from the host is not required. Instead, the ECP sequence numbers are used to ensure data integrity. If the host receives an erroneous reader message, it should retransmit #06, TRANSMIT BUFFER ENTRY, with the same sequence number. This causes the reader to search and replace its previous message. If buffer control is enabled, the reader will not use the time-out to trigger re- transmission of data because in BCM, reader data is transmitted only when requested by the host.

Number	Command Description	Message
06	Transmit buffer entry	Done, error, or <message>
535	Display buffer control status where x = 0 for disabled, 1 for enabled	BCM x
6160	Disable BCM (default)	Done
6161	Enable BCM	Done

Format

`#616N`

Parameters

#6160 Disable Buffer Control Mode
#6161 Enable Buffer Control Mode

Pre-condition

The reader must be in ECP mode. The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

#6160 Disable Buffer Control Mode

Response

#DONE	Valid setting
#ERROR	Invalid setting

See Also

#06 TRANSMIT BUFFER ENTRY
#525 ENQUIRE COMMUNICATION PROTOCOL STATUS
#535 DISPLAY BUFFER CONTROL STATUS

#617N ECHO SETTINGS

This command controls whether or not the reader echoes received host commands. If echo is enabled, then as the reader receives a host command, it echoes each character of the command. Once the entire command has been received and processed, the reader transmits its response. If echoing is disabled, the reader will not echo the command but only transmits its response. The reader never echoes while in ECP operation.

Format

#617N

Parameters

Command	Function
#6170	Disable Echo
#6171	Enable Echo

Pre-condition

The reader must be in command mode.

Post-condition

This command takes effect immediately.

Default

#6171 Enable echo

Response

#DONE

See Also

Note: *There is no associated Get command.*

#620N SET OUTPUT CONTROL

This command sets any of the reader's four output OPTO 22 circuits either on or off. These commands are for the host computer to control external hardware, such as gates or traffic lights.

Format

`#620N`

Parameters

Command	Outputs			
#620N	**0**	**1**	**2**	**3**
#6200	–	–	–	–
#6201	X	–	–	–
#6202	–	X	–	–
#6203	X	X	–	–
#6204	–	–	X	–
#6205	X	–	X	–
#6206	–	X	X	–
#6207	X	X	X	–
#6208	–	–	–	X
#6209	X	–	–	X
#620A	–	X	–	X
#620B	X	X	–	X
#620C	–	–	X	X
#620D	X	–	X	X
#620E	–	X	X	X
#620F	X	X	X	X
where X = on, – = off				

Pre-condition

The reader must be in command mode. Ports must be configured as outputs and have the supporting OPTO 22 output hardware.

Post-condition

This command takes effect immediately. Command execution disables #621 SET PREDEFINED OUTPUT CONTROL. These commands are stored only in volatile memory. After a power outage or reader reset, all output status modules return to an off position.

Note: *#63 RESET READER command required for changes to take effect.*

Default

#6200 is the default condition.

Response

#DONE	Valid setting
#ERROR	Invalid setting

See Also

#526 DISPLAY I/O STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#62N SET PREDEFINED OUTPUT CONTROL

#62N SET PREDEFINED OUTPUT CONTROL

This command configures the reader to activate outputs when tag reads occur under a variety of input/output (I/O) configurations and antenna multiplexing options.

Format

`#62N`

Parameters

N	Function
1	Activate all available outputs
2	Activate outputs per antenna channel

Pre-condition

Outputs are activated for the allotted time defined by the #67NP SET OUTPUT PULSE DURATION commands.

#621 Configure I/Os according to the system requirements
All outputs fire upon a tag read.

#622 Activate outputs per antenna channel

#6411 RF on is in effect (configure outputs with #697N command)
Single-channel read occurs ⇒ Output 0 activated
All #642N Antenna Multiplex Modes
Read occurs on Antenna 0 ⇒ Output 0 activated
Read occurs on Antenna 1 ⇒ Output 1 activated
Read occurs on Antenna 2 ⇒ Output 2 activated
Read occurs on Antenna 3 ⇒ Output 3 activated

#6410 RF by Sensor is in effect
#6420/#6421 Single-channel Mode
#6974, #6976, #697C, #697E SET OPTO PORT(S) DIRECTION allowed (Ports 0 1 2 3: I X 0 X)
Input 0 controls RF
Read Occurs ⇒ Output 2 activated

#6423 Two-Channel Mode (antenna channels 0 and 1)
#697C SET OPTO PORT(S) DIRECTION (Ports 0 1 2 3 = I I O O)
Input 0 controls RF for Antenna 0
Input 1 controls RF for Antenna 1
Read Occurs on Antenna 0 ⇒ Output 2 activated
Read Occurs on Antenna 1 ⇒ Output 3 activated

#642C Two Channel Mode (antenna channels 2 and 3)
#6973 SET OPTO PORT(S) DIRECTION (Ports 0 1 2 3 = O O I I)
Input 2 controls RF for Antenna 2
Input 3 controls RF for Antenna 3
Read Occurs on Antenna 2 ⇒ Output 0 activated

Read Occurs on Antenna 3 ⇒ Output 1 activated

#6427 Three-Channel Mode (antenna channels 0, 1, and 2)
#6978 SET OPTO PORT(S) DIRECTION (ports 0 1 2 3 = I I I O)
Input 0 controls RF for Antenna 0
Input 1 controls RF for Antenna 1
Input 2 controls RF for Antenna 2
Read Occurs on any antenna ⇒ output 3 activated

#642F Four-Channel Mode (Antenna Channels 0, 1, 2, and 3)
(Ports 0 1 2 3 = I I I I)
#6970 No outputs available

Post-condition

This command takes effect immediately.

Outputs are ready to be activated on a valid tag read.

Default

There is no default setting for this command.

Response

#DONE	Valid setting
#ERROR	Invalid setting

See Also

#526 DISPLAY I/O STATUS
#620N SET OUTPUT CONTROL
#642N RF ANTENNA MULTIPLEXER MODE
#67NP SET OUTPUT PULSE DURATION
#697N SET OPTO PORT(S) DIRECTION

#63 RESET READER

This command performs a software reset of the reader.

Format

`#63`

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

All volatile settings return to the last programmed state prior to reset, except for the power outage bit that is reset to 0.

Caution
All buffered data are lost when this command is executed.

- Retains nonvolatile settings
- Clears unacknowledged tag and report data
- Sets output status modules to off
- Reader responds with sign-on message:

```
#Model E5 AI1200 Ver X.XX SNXXXXXXX
```

```
#Copyright 200X, TransCore, Inc.
```

where

Line 1 lists the current version of the microcontroller firmware and reader-assigned serial number (SN). The SN is a 1 to 7 digit decimal value (0 through 9 for each digit) with the first 2 digits representing the year.

Line 2 lists the firmware copyright year and the TransCore name.

Default

`#00` DATA MODE is the default mode coming out of reset following the sign on message.

Response

```
#Model E5 AI1200 Ver X.XX SNXXXXXXX
```

```
#Copyright 200X, TransCore, Inc.
```

See Also

#505 DISPLAY FIRMWARE VERSION AND SERIAL NUMBER

Note: *Refer to the firmware version number when contacting TransCore about the firmware.*

#640N RF CONTROL

This command selects the RF channel.

Format

`#640N`

Parameters

The N variable controls the RF channel selection as follows:

Command	RF Control
#6400	RF off for all channels
#6401	RF channel 0 on (automatic antenna multiplexing override)
#6402	RF channel 1 on (automatic antenna multiplexing override)
#6403	RF channel 2 on (automatic antenna multiplexing override)
#6404	RF channel 3 on (automatic antenna multiplexing override)
#6405	RF on for all channels (restore antenna multiplexing operation)

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Sending command #6401, #6402, #6403, or #6404 immediately overrides the current antenna multiplexing commands #6420 through #6423. Sending #6405 disables the manual antenna channel control and enables the previously set #642x command. When set in #6410, #6405 restores the previously set #642X command. When #6411 is invoked, #6405 RF on is invoked.

Default

#6400 RF off for all channels

Response

#DONE Valid setting
#ERROR Invalid setting

See Also

#31N APPEND AUXILIARY INFORMATION SELECTION
#527 DISPLAY RF STATUS
#641N RF MODE CONTROL

Note: *RF channels are never on simultaneously.*

#641N RF MODE CONTROL

This command sets the RF mode control type to 0 for RF by sensor or 1 for RF on continuously.

Set RF by Sensor

A sensor is a device installed in the lane that detects whether or not a vehicle is present in the lane; vehicle present equals presence detected. Any given sensor must be capable of asserting a voltage or current signal that can be interfaced to an OPTO 22 input module. Some sensor examples are

- Detection loops
- Light curtains
- Treadles
- Laser scanners

Format

`#641N`

Parameters

N, with a range of 0-1

`#6410`	Set RF by sensor
`#6411`	Set RF on continuously

Pre-condition

A #47XX tag mode also must be enabled.

For #6410:
RF is controlled according to the algorithm set under the Presence RF control selection, which is determined by the #692N SELECT PRESENCE RF CONTROL ALGORITHM commands.

Post-condition

#4700 STOP MODE switches RF off.

Sending #47NN SELECT TAG TYPE MODE switches RF on if #6411 has already been sent.

Note: *#63 RESET READER command required for changes to take effect.*

Default

#6410

Response

`#DONE`	Valid setting
`#ERROR`	Invalid setting

See Also

#527 DISPLAY RF STATUS
#529 DISPLAY PRESENCE DETECTOR STATUS
#642N RF ANTENNA MULTIPLEXER MODE
#690N SENSOR INPUT REPORTS
#691N SET MINIMUM PRESENCE TRUE PERIOD
#692N SELECT PRESENCE RF CONTROL ALGORITHM
#693N SELECT PRESENCE RF CONTROL TIME-OUT PERIOD
#694N SELECT SENSE INPUT INVERSION
#697N SET OPTO PORT(S) DIRECTION

#642N RF ANTENNA MULTIPLEXER MODE

This command selects the RF antenna multiplexer modes.

Single Channel: No antenna multiplexer required

Single Channel: Antenna synchronization compatible.

Two Channel: The antenna multiplexer cycles between two antennas continuously at a 50% duty cycle for each antenna port.

Three Channel: The antenna multiplexer cycles between three antennas continuously at a 33% duty cycle for each antenna port.

Four Channel: The antenna multiplexer cycles between four antennas continuously at a 25% duty cycle for each antenna port.

Format

`#642N`

Parameters

N ranges from 0 to F and is restricted to {0, 1, 3, 7, C, F}

Command #642N	Antenna 3	2	1	0	Multiplexing Mode
#6420	–	–	–	–	Single-Channel Mode (no multiplexing, switch on TDM synchronization)
#6421	–	–	–	X	Single-Channel Mode (antenna synchronization compatible, slot-based)
#6423	–	–	X	X	Two-Channel Mode (antenna channels 0 and 1)
#642C	X	X	–	–	Two-Channel Mode (antenna channels 2 and 3)
#6427	–	X	X	X	Three-Channel Mode (antenna channels 0, 1, and 2)
#642F	X	X	X	X	Four-Channel Mode (antenna channels 0, 1, 2, and 3)

Pre-condition

#6410 SET RF BY SENSOR
If the reader is configured to #6410 SET RF BY SENSOR, then the number of input ports must match the number of antenna channels being used.

Input Port Setup
<u>Single Channel</u>
#6420: Configure OPTO 22 port 0 to input by sending #697E SET OPTO PORT(S) DIRECTION.

<u>Single Channel</u>
#6421: Configure OPTO 22 port 0 to input by sending #697E SET OPTO PORT(S) DIRECTION.

Two Channel
#6423: Configure OPTO 22 ports 0 and 1 to inputs by sending #697C SET OPTO PORT(S) DIRECTION.
#642C: Configure OPTO 22 ports 2 and 3 to inputs by sending #6973 SET OPTO PORT(S) DIRECTION.

Three Channel
#6427: Configure OPTO 22 ports 0, 1, and 2 to inputs by sending #6978 SET OPTO PORT(S) DIRECTION.

Four Channel
#642F: Configure OPTO 22 ports 0, 1, 2, and 3 to inputs by sending #6970 SET OPTO PORT(S) DIRECTION.

After OPTO 22s are configured:
RF switches on for Antenna Port 0 if Input 0 is true (single-, two-, three-, and four-channel modes)
RF switches on for Antenna Port 1 if Input 1 is true (two-, three-, and four-channel modes)
RF switches on for Antenna Port 2 if Input 2 is true (three- and four-channel modes)
RF switches on for Antenna Port 3 if Input 3 is true (four-channel mode)

If reader is configured to #6411 SET RF ON, then RF remains on as antennas are cycled for all modes.

Post-condition

Single channel mode to multiplexing mode.

Note: *This command takes effect immediately.*

Default

#6420 Single-Channel Mode

Response

`#DONE`	Valid setting
`#ERROR`	Invalid setting

See Also

#31N APPEND AUXILIARY INFORMATION SELECTION
#527 DISPLAY RF STATUS
#641N RF MODE CONTROL
#691N SET MINIMUM PRESENCE TRUE PERIOD
#692N SELECT PRESENCE RF CONTROL ALGORITHM
#693N SELECT PRESENCE RF CONTROL TIME-OUT PERIOD
#694N SELECT SENSE INPUT INVERSION
#697N SET OPTO PORT(S) DIRECTION

#65 RESET POWER OUTAGE BIT

This command resets the power outage counter bit to zero. The bit changes from 0 to 1 when reader power is restored. On reader power-up, either #65 RESET POWER OUTAGE BIT or #63 RESET READER must be executed to properly initialize this bit. To display the status of the power outage bit, use the #520 DISPLAY POWER OUTAGE AND RESTORE BITS command.

Format

`#65`

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

`#DONE`

See Also

#520 DISPLAY POWER OUTAGE AND RESTORE BITS
#63 RESET READER

#66F LOAD DEFAULT OPERATING PARAMETERS

This command restores the reader to factory defaults.

Format

`#66F`

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

Factory defaults are restored following a reset.

Note: *This command resets the AI1200 tag buffer.*

Basic mode:
#63 RESET READER command required for changes to take effect.

ECP mode:
The system switches to basic mode immediately following a
`#<odd seq num>66F<CRC>` command.

Therefore, a #63 RESET READER command without the `<seq nums>` and `<CRC>` is required.

Default

This command does not have a default condition.

Response

`#DONE`

See Also

#63 RESET READER

#67NP SET OUTPUT PULSE DURATION

This command sets the output pulse duration for the #62N SET PREDEFINED OUTPUT CONTROL command. The variable N has a value from 0 to F and ranges from 4 to 752 ms, and P is the port to activate (0 through 3):

Format

#67NP

Parameters

N: pulse duration, range of 0–F (4 to 752 ms)
P: output port, range of 0–3

Command	Time (ms)
#670P	4
#671P	8
#672P	12
#673P	16
#674P	20
#675P	24
#676P	32
#677P	40
#678P	48
#679P	60
#67AP	76
#67BP	152
#67CP	228
#67DP	**300**
#67EP	376
#67FP	752

Pre-condition

Command #62N is in effect. Output modules installed on the OPTO 22 board are matched to the #697N SET OPTO PORT(S) DIRECTION command.

Note: *This command should be used with discretion. When the tag acquisition interval is short compared to the programmed pulse period, distinct pulses cannot be generated. The durations indicated apply to minimum energized and de-energized* *periods. For example, the command #67FP (752 ms) provides a 752-ms energized period and a 752-ms de-energized period.*

Post-condition

Additional IDs can be acquired either during the energized period or de-energized period; however, the timing is restarted upon each successive ID acquisition.

This command takes effect immediately.

Default

#67DP	300

Response

#DONE	Valid setting
#ERROR	Invalid setting

See Also

#526 DISPLAY I/O STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#62N SET PREDEFINED OUTPUT CONTROL
#697N SET OPTO PORT(S) DIRECTION

#690N SENSOR INPUT REPORTS

Enabling #690N SENSOR INPUT REPORTS causes the reader to send a report when sensor input presence true conditions are satisfied, but tag ID acquisition does not occur. This command is useful for reporting the passage of untagged vehicles.

The format of the report is as follows:
#SENSOR INPUT REPORT <&time date><%aux>

where <&time date> is optionally appended time or time and date
<%aux> is optionally appended auxiliary information.

There is one space between SENSOR INPUT REPORT and any optionally appended information.

Format

`#690N`

Parameters

Command	**Function**
`#6900`	Disable Sensor Input Reports
`#6901`	Enable Sensor Input Reports

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

`#6900` DISABLE SENSOR INPUT REPORTS

Response

#DONE Valid setting
#ERROR Invalid setting

See Also

#30N APPEND TIME AND DATE SELECTION
#31N APPEND AUXILIARY INFORMATION SELECTION
#526 DISPLAY I/O STATUS
#529 DISPLAY PRESENCE DETECTOR STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#641N RF MODE CONTROL
#691N SET MINIMUM PRESENCE TRUE PERIOD
#697N SET OPTO PORT(S) DIRECTION

#691N SET MINIMUM PRESENCE TRUE PERIOD

This command sets the presence sensor minimum true time. The hardware debounces the presence signal for the time period (ms), which corresponds to the command setting. For example, #6916 = 32 ms, prior to applying the true criteria. An additional debounce period, determined by the command setting, is applied to the presence signal transition to no presence.

Format

`#691N`

Parameters

N = range 0 to F [0 ms (always true) to infinite (never true)]

N determines the minimum time (presence true period) that an input must be asserted to be a valid presence true.

Command	True Period (ms)
`#6910`	0 (always true)
`#6911`	4
`#6912`	8
`#6913`	12
`#6914`	20
`#6915`	24
`#6916`	32
`#6917`	48
`#6918`	60
`#6919`	92
`#691A`	152
`#691B`	300
`#691C`	452
`#691D`	600
`#691E`	752
`#691F`	infinite (never true)

Pre-condition

Inputs require debouncing. TransCore recommends using the default (**#6916**).

Post-condition

This command takes effect immediately.

Default

#6916 32 ms

Response

Not applicable

See Also

#527 DISPLAY RF STATUS
#529 DISPLAY PRESENCE DETECTOR STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#641N RF MODE CONTROL
#692N SELECT PRESENCE RF CONTROL ALGORITHM
#693N SELECT PRESENCE RF CONTROL TIME-OUT PERIOD
#697N SET OPTO PORT(S) DIRECTION

#692N SELECT PRESENCE RF CONTROL ALGORITHM

This command selects the algorithm for turning RF power off, when the RF power is controlled by sense input modules.

#6920 command: Reader switches off RF power based on the time-out established by the #693N commands.

#6921 command: Reader allows turning off RF power either after the time-out period or the acquisition of a tag ID, whichever occurs first.

#6922 command: Reader switches off RF power either after the time-out period, or when the sense input modules indicate the vehicle has passed, whichever occurs first.

Format

`#692N`

Parameters

N = range from 0 to 2

Command	RF Power Off
`#6920`	On time-out only
`#6921`	Time-out or tag ID acquired
`#6922`	Time-out or presence false

Pre-condition

#6410 SET RF BY SENSOR is in effect.

Post-condition

This command takes effect immediately.

Default

`#6922` Time-out or presence false

Response

Not applicable

See Also

#527 DISPLAY RF STATUS
#529 DISPLAY PRESENCE DETECTOR STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#641N RF MODE CONTROL
#67NP SET OUTPUT PULSE DURATION
#691N SET MINIMUM PRESENCE TRUE PERIOD
#693N SELECT PRESENCE RF CONTROL TIME-OUT PERIOD
#697N SET OPTO PORT(S) DIRECTION

#693N SELECT PRESENCE RF CONTROL TIME-OUT PERIOD

This command sets the RF Off time-out period used for the #692N SELECT PRESENCE RF CONTROL ALGORITHM.

Format

`#693N`

Parameters

N = range from 0 to F [0 ms (always expired) to infinite (never expires)]

Command	Time-out (ms)
#6930	0 (always expired)
#6931	20
#6932	32
#6933	60
#6934	92
#6935	152
#6936	300
#6937	452
#6938	600
#6939	752
#693A	1500
#693B	3000
#693C	6000
#693D	12000
#693E	24000
#693F	infinite (never expires)

Pre-condition

There is no pre-condition for this command.

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

#693F infinite (never expires)

Response

Not applicable

See Also

#527 DISPLAY RF STATUS
#529 DISPLAY PRESENCE DETECTOR STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#641N RF MODE CONTROL
#691N SET MINIMUM PRESENCE TRUE PERIOD
#692N SELECT PRESENCE RF CONTROL ALGORITHM
#697N SET OPTO PORT(S) DIRECTION

#694N SELECT SENSE INPUT INVERSION

This command selects either energized or de-energized digital I/O modules for the logic true algorithm. This command applies to the inputs as they are directed to the OPTO 22 input modules. All four inputs are configured by this command.

Format

`#694N`

Parameters

N = 0 or 1

Command	Option
#6940	Energized digital I/O modules for logic true (positive logic)
#6941	De-energized digital I/O modules for logic true (negative logic)

Pre-condition

There is no pre-condition for this command.

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

#6940 Energized digital I/O modules for logic true (positive logic)

Response

Not applicable

See Also

#31N APPEND AUXILIARY INFORMATION SELECTION
#526 DISPLAY I/O STATUS
#527 DISPLAY RF STATUS
#529 DISPLAY PRESENCE DETECTOR STATUS
#597 DISPLAY OPTO PORT(S) DIRECTION
#641N RF MODE CONTROL
#691N SET MINIMUM PRESENCE TRUE PERIOD
#692N SELECT PRESENCE RF CONTROL ALGORITHM
#697N SET OPTO PORT(S) DIRECTION

#696S...S STORE HARDWARE CONFIGURATION

This command stores hardware configuration information into reader memory.

Format

The hardware configuration string is assigned according to the following format:
696S...S

Parameters

S...S is the hardware configuration string that may contain as many as 20 uppercase or lowercase ASCII alphanumeric characters.

Pre-condition

There is no pre-condition for this command.

Post-condition

Once assigned, configuration information is preserved during power-down and loading of default parameters.

This command takes effect immediately.

Default

SSSSSSSSSSSSSSSSSSSS = 00000000000000000000

Response

`#DONE`

See Also

#506 DISPLAY HARDWARE CONFIGURATION INFORMATION

#697N SET OPTO PORT(S) DIRECTION

This command sets OPTO port(s) to output(s) or input(s).

Format

#697N

Parameters

N = range from 0 to F

Command #697N	Port 0	1	2	3
#6970	I	I	I	I
#6971	O	I	I	I
#6972	I	O	I	I
#6973	O	O	I	I
#6974	I	I	O	I
#6975	O	I	O	I
#6976	I	O	O	I
#6977	O	O	O	I
#6978	I	I	I	O
#6979	O	I	I	O
#697A	I	O	I	O
#697B	O	O	I	O
#697C	I	I	O	O
#697D	O	I	O	O
#697E	I	O	O	O
#697F	O	O	O	O
where I = input, O = output				

Pre-condition

The appropriate hardware has been installed and matches the selected #697N setting.

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

#697C (I I O O)

Response

Not applicable

See Also

#597 DISPLAY OPTO PORT(S) DIRECTION

Command Group 7 – Search Control Functions

Group 7 commands are not used at this time.

Command Group 8 – Auxiliary Reader Control

Group 8 commands provide control over the reader functions, such as the system check tag. These commands control writing parameters to and restoring parameters from the EEPROM.

Note: *Unless otherwise indicated, Group 8 commands return* `#DONE` *or* `#ERROR`.

#810 DISABLE SYSTEM CHECK TAG PERIODIC MODE

This command disables the period operation of the system check tag.

Format

`#810`

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

#810 DISABLE SYSTEM CHECK TAG PERIODIC MODE is the default setting for command #813YX SET SYSTEM CHECK TAG PERIODIC TIME INTERVAL

Response

#DONE	Valid setting
#ERROR	Invalid setting

See Also

#550 DISPLAY SYSTEM CHECK TAG CONTROL PARAMETERS

#813YX SET SYSTEM CHECK TAG PERIODIC TIME INTERVAL

This command sets the time interval for the periodic system check tag test and activates the check tag.

Format

`#813YX`

Parameters

Time interval Y = range 0–9 [30 seconds to 8 hours].

#813YX	Periodic Time Value
#8130X	30 seconds
#8131X	2 minutes
#8132X	4 minutes
#8133X	8 minutes
#8134X	15 minutes
#8135X	30 minutes
#8136X	1 hour
#8137X	2 hours
#8138X	4 hours
#8139X	8 hours

Tag Type X = range 0–3

where

0 = eGo, SeGo, or ATA – periodic

1 = Title 21 or IT2200 – periodic

2 = eGo, SeGo, or ATA – manual

3 = Title 21 or IT2200 – manual

E = enable all protocols – periodic

F = enable all protocols – manual

Note: *Enable all runs the check tag on all of the protocols that have been enabled by the Set Protocols command (#4ANNNN)*

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Response

#DONE	Valid setting
#ERROR	Invalid setting

Note: *You can choose only one value for X at a time.*

#82X SET SENSOR STATUS CHANGE MODE

#82X commands are used to enable selected sense input lines. The enabled sense input lines are monitored for any changes in logic states. If a change is detected, the system generates a SENSOR STATUS CHANGE report and treats it as a tag ID. If the auxiliary information option is enabled, the sensor input status field displays the current debounced input values.

Format

#82X

Parameters

X = range 0–F

Command	Inputs				
#82X	**3**	**2**	**1**	**0**	
#820	–	–	–	–	(feature disabled)
#821	–	–	–	X	
#822	–	–	X	–	
#823	–	–	X	X	
#824	–	X	–	–	
#825	–	X	–	X	
#826	–	X	X	–	
#827	–	X	X	X	
#828	X	–	–	–	
#829	X	–	–	X	
#82A	X	–	X	–	
#82B	X	–	X	X	
#82C	X	X	–	–	
#82D	X	X	–	X	
#82E	X	X	X	–	
#82F	X	X	X	X	

Command	Inputs
	where X = on, – = off

Pre-condition

The selected input lines are configured as inputs using the #697N command.

Post-condition

When the selected sense input lines change, a SENSOR STATUS CHANGE report is issued.

This command takes effect immediately.

Default

#82X (3 2 1 0)
#820 (– – – –) (feature disabled)

Response

#DONE	Valid setting
#ERROR	Invalid setting

See Also

#560 DISPLAY SENSOR STATUS CHANGE MODE

Command Group 9 – Reader System Configuration

Group 9 commands provide control of reader system configuration, such as RF attenuation and TDM control.

#920NDU SET RF ATTENUATION

This command sets the uplink and downlink attenuations. Downlink attenuation represents the downlink continuous wave (CW) RF attenuation in 1-dB increments. Uplink attenuation represents the uplink CW RF attenuation in 1-dB increments.

Format

`#920NDU`

Parameters

N indicates tag mode
D indicates downlink attenuation
U indicates uplink attenuation

where

D = range 0–F [0 dB to 15 dB]
U = range 0–F [0 dB to 15 dB]

#920NDU	Tag Type
#9200DU	IT2200
#9201DU	Title 21
#9202DU	ATA Full-Frame
#9203DU	eGo
#9204DU	IAG
#9205DU	eGo Plus
#9206DU	CVISN
#9207DU	ATA Half-Frame

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

D = 6 dB (06H)
U = 6 dB (06H)

Response

Not applicable

See Also

#57N DISPLAY ATTENUATION AND RANGE SETTINGS

Note: *IAG uplink attenuation is a non-critical variable. However, TransCore recommends that the IAG uplink attenuation be set to the same value as the downlink attenuation. For the IAG protocol, the receive attenuation is set to the same value as the downlink attenuation. The display command returns the value of the IAG receive setting.*

#921NRR SET RANGE ADJUST

This command provides a means to restrict the receiver sensitivity, which helps to control the read zone. Higher values correspond to a smaller read zone.

Format

#921NRR

Parameters

N indicates tag mode

RR indicates range

where

N = range of 0–7
RR = range of 00–14 hex (0 dB to 20 dB decimal), except for CVISN, which has a range of 00–F hex (0 dB to 15 dB decimal)

#921NRR	Tag Type
#9210RR	IT2200
#9211RR	Title 21
#9212RR	ATA Full-Frame
#9213RR	eGo
#9214RR	IAG
#9215RR	eGo Plus
#9216RR	CVISN
#9217RR	ATA Half-Frame

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

RR = 00 (00dB for all tag types)

Response

Not applicable

See Also

#57N DISPLAY ATTENUATION AND RANGE SETTINGS

Note: *There is no range adjust control for IAG or CVISN tags.*

#9CNNNNN SET UPLINK RF IN MHZ

This command sets the uplink RF in MHz.

Format

#9CNNNNN

Parameters

Frequency settings change in 250-kHz increments. The user can enter any frequency, in 250-kHz increments, preceded by #9C.

NNNNN Range: 800.00 to 999.75 MHz

Example

Command	Uplink Frequency
#9C80000	800.00 MHz
#9C80025	800.25 MHz
#9C80050	800.50 MHz
#9C80075	800.75 MHz
#9C82100	821.00 MHz
#9C82125	821.25 MHz
#9C82150	821.50 MHz
#9C82175	821.75 MHz
#9C90200	902.00 MHz
#9C90225	902.25 MHz
#9C90250	902.50 MHz
#9C90275	902.75 MHz
#9C91700	917.00 MHz
#9C91725	917.25 MHz
#9C91750	917.50 MHz
#9C91775	917.75 MHz
#9C99900	999.00 MHz
#9C99925	999.25 MHz
#9C99950	999.50 MHz
#9C99975	999.75 MHz

Pre-condition

Note: *Set the reader to STOP MODE (#4700) before sending this command*

Note: *The reader must be in command mode*

Post-condition

This command takes effect immediately.

Default

#9C30300 903.00 MHz

Response

#DONE

Examples

#9C80000 = 800.00 MHz frequency

#9C90225 = 902.25 MHz frequency

#ERROR

Note: *#Error occurs when setting a frequency that is not in the frequency range permitted for the region. For example, setting #9C87000 (870.00 MHz) in North America results in #Error.*

See Also

#581 DISPLAY FREQUENCY IN MHZ

#94PS SET UPLINK SOURCE CONTROL

This command sets the uplink source on the transceiver board.

Format

`#94PS`

Parameters

P	**Tag Protocol**
0	IT2200
1	Title 21
2	ATA full-frame
3	eGo
4	IAG
5	SeGo
6	CVISN
7	ATA half-frame

S	**Uplink Source**
0	Use Uplink Source (Source 2)
1	Use Downlink Source (Source 1)

Pre-condition

The reader must be in command mode.

Post-condition

Note: *#63 RESET READER command required for changes to take effect.*

Default

There is no default setting.

Response

```
#DONE = Success
#ERROR = Invalid Parameters
```

See Also

#594P DISPLAY UPLINK SOURCE CONTROL PER PROTOCOL

#9FNNNNN SET DOWNLINK RF IN MHZ

This command sets the downlink RF in MHz.

Format

`#9FNNNNN`

Parameters

Frequency settings change in 250-kHz increments. The user can enter any frequency, in 250-kHz increments, preceded by #9F.

NNNNN Range: 800.00 to 999.75 MHz

Example:

Command	Downlink Frequency
#9F80000	800.00 MHz
#9F80025	800.25 MHz
#9F80050	800.50 MHz
#9F80075	800.75 MHz
#9F80100	801.00 MHz
#9F80125	801.25 MHz
#9F80150	801.50 MHz
#9F80175	901.75 MHz
#9F90200	902.00 MHz
#9F90225	902.25 MHz
#9F90250	902.50 MHz
#9F90275	902.75 MHz
#9F91700	917.00 MHz
#9F91725	917.25 MHz
#9F91750	917.50 MHz
#9F91775	917.75 MHz
#9F99900	999.00 MHz
#9F99925	999.25 MHz
#9F999.50	999.50 MHz
#9F999.75	999.75 MHz

Pre-condition

Note: *Set the reader to STOP MODE (#4700) before sending this command*

Post-condition

This command takes effect immediately.

Default

#9F91775 917.75 MHz

Response

#Done

Examples

#9F80000 = 800.00 MHz frequency

#9F90225 = 902.25 MHz frequency

`#Error`

Note: *#Error occurs when setting a frequency that is not in the frequency range permitted for the region. For example, setting #9F87000 (870.00 MHz) in North America results in #Error.*

Note: *When using eGo/SeGo protocol tags, use downlink frequencies from 911.75 MHz to 919.75 MHz.*

Note: *When using IT2200 and Title 21 protocol tags, use downlink frequencies from 912.75 MHz to 918.75 MHz.*

Note: *When using active tags, such as IAG protocol tags, use downlink frequencies from 914.75 MHz to 916.75 MHz.*

See Also

#581 DISPLAY FREQUENCY IN MHZ

#960N SET LINE LOSS

This command sets the line loss value to the loss of the coaxial cable between the Encompass Reader and the antenna.

Format

#960N

Parameters

N is the line loss in dB.

The range for N is 0 to 3.

Pre-condition

The line loss has been measured.

Post-condition

This command takes effect immediately.

Default

N = 0 dB

Response

`#DONE`

See Also

#561 DISPLAY LINE LOSS

#980 TURN TDM OFF

This command disables the reader TDM function. The TDM function requires that the TDM synchronization interconnect be attached between readers for the readers to operate together.

Format

#980

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

TDM off is the default #98N setting.

Response

`#DONE`

See Also

#585 DISPLAY TDM SETTINGS

#984NYY SET TDM AS MASTER OR SLAVE

This command sets the TDM as master or slave and switches TDM on. The reader can operate as slave or master, or GPS secondary or GPS primary based strictly on the values programmed into each of the readers for the TDM synchronization parameters. If you configure a reader as the master and it receives an external synchronization pulse, the reader generates an error message and the ERR3 LED on the Encompass Reader lights. Similarly, If you configure a reader as a slave and it does not receive an external synchronization pulse prior to the end of its own internal synchronization pulse, the reader generates an error message and the ERR3 LED lights on the Encompass Reader.

Format

#984NYY

Parameters

N is the master/slave designation as follows:

YY is the slave select count and can have a range of values from 0 to 26

#984NYY	TDM Control
#9840YY	Slave
#9841YY	Master
#9842YY	GPS secondary
#9843YY	GPS primary

Pre-condition

Only one reader can be set as the master reader on a given TDM group at any given time.

Post-condition

This command takes effect immediately.

Default

#984100 Master

Response

#DONE

See Also

#585 DISPLAY TDM SETTINGS

Choose one field only, for example, GPS primary, GPS secondary, master, or slave.

GPS Primary — This field specifies whether the reader is to be configured as the GPS primary.

GPS Primary	Definition
0	Not GPS Primary
1	GPS Primary

Note: *For AI1200-emulation command set use #9843YY.*

GPS Secondary — This field specifies whether the reader is to be configured as the GPS secondary.

GPS Secondary	Definition
0	Not GPS Secondary
1	GPS Secondary

Note: *For AI1200-emulation command set use #9842YY.*

Master — This field specifies whether the reader is to be configured as the master.

Master	Definition
0	Not Master
1	Master

Note: *For AI1200-emulation command set use #9841YY.*

Slave — This field specifies whether the reader is to be configured as the slave.

Slave	Definition
0	Not Slave
1	Slave

Note: *For AI1200-emulation command set use #9840YY.*

For this example, the sum of the delay and duration period is 19.9 milliseconds, which is less than the synchronization rate of 20 milliseconds. If the sum of the delay and duration periods equals the synchronization rate, unexpected results can occur.

Slave Select Count — This field specifies the order that a slave or GPS primary or secondary reader issues a synchronization pulse whenever a given reader within a synchronization group fails to recognize the signal from the preassigned master or whenever a GPS receiver fails to issue a 1-pps signal, respectively. The maximum slave count = 26.

Scenario 1 — One master, n slaves. The master has no slave behavior, therefore it is assigned a slave select count of 0. Each slave is assigned an increasingly greater number from 1 to n. When the master fails, slave 1 becomes the master, and so on.

Scenario 2 — GPS primary, GPS secondary, N slave readers. When in fault mode (1-pps signal missing), a GPS primary is slave to a GPS secondary and all other slaves and is assigned the last slave select count, n. A GPS secondary takes over when a GPS primary is in fault mode, therefore it is assigned a slave select count of 1. All slaves are assigned increasingly greater numbers from 2 to n+1.

Scenario 3 — One GPS primary and n slaves. This scenario forces the GPS primary to have no slave behavior by specifying a slave select count of 0. Each slave is an increasingly higher number from 1 to n. When the master fails, slave 1 becomes the master. If slave 1 should fail, slave 2 takes over, and so on (Table 7-4).

Table 7-4 Reader Slave Count Configuration Table

Scenario 1 — One Master, n Slaves						
Reader Mode	Master	Slave	Slave	Slave	Slave	Slave
Slave Select Count	0	1	2	…	n-1	n
Scenario 2 — GPS Primary, GPS Secondary, n Slaves						
Reader Mode	GPS Secondary	Slave	Slave	Slave	Slave	GPS Primary
Slave Select Count	1	2	3	…	n+1	n+2
Scenario 3 — One GPS Primary, n Slaves						
Reader Mode	GPS Primary	Slave	Slave	Slave	Slave	Slave
Slave Select Count	0	1	2	…	n-1	n
n = Total number of slave readers						

ASCII Extended Command Set

The operation and configuration commands supplement the standard AI1200 Reader protocol used by the Encompass Reader.

#STATUS REPORT E5 STATUS

Description

This command reports the details of the Encompass Reader.

Format

#STATUS

Parameters

There are no parameters associated with this command.

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

This command does not have a default condition.

Response

The reader responds as follows:

```
#STATUS T<0–3> P<0–1> R<0–1> C<0–1> O<0–1> B<0–1> E<0–1>
```

where

T = TDM status
- T0 = no fault
- T1 = GPS fault
- T2 = master-slave fault
- T3 = two-master fault

P = power supply status
- P0 = no fault
- P1 = power supply fault

R = transceiver status
- R0 = no fault
- R1 = transceiver fault

C = com links
- C0 = no fault
- C1 = communication fault

O = other error
- O0 = no fault
- O1 = other fault

B = buffer tags
- B0 = no tags in buffer
- B1 = tags in buffer

E = error log
- E0 = no data in log
- E1 = data in log

8

Tag Responses

Chapter 8

Tag Responses

This chapter provides tag responses for both User Datagram Protocol (UDP) and AI1200-emulation tag requests.

UDP Tag Responses

In general, the tag response is transmitted as the record type code and the tag response data. Response lengths vary depending on the tag response record type. The tag response record type communicates to the host the tag response type that the reader processed.

UDP Tag Response Field Definitions

Tag command processing allows the host-Encompass® Reader interface to be more understandable and maintainable. All of the interfaces closely parallel the Encompass Reader-to-tag interface. Tag processing responses are listed in Table 8-1.

Table 8-1 Tag Transaction Record Types

Record Type Code	Corresponding Tag Response
3003H	SeGo Non-Group Select Response
3021H	SeGo Streamlined Read Response
3022H	SeGo Read Verify Page Response
3023H	SeGo ID Word Response (SeGo Group Select Equals)
3024H	Title 21 Read Response
3042H	Seen Frame Counter Error Report
3043H	Seen Frame Counter Report
4000H	ATA Half-Frame Read Response
4001H	ATA Full-Frame Read Response
4021H	eGo Streamlined Read Response
4022H	eGo Read Verify Page Response
4023H	eGo ID Word Response (eGo Group Select Equals)

Table 8-1 Tag Transaction Record Types (continued)

Record Type Code	Corresponding Tag Response
4303H	IT2000 Read Response
5014H	CVISN Read Response
5026H	IAG Read Response
5027H	IAG Cross-Lane Read Response
7000H	Reserved

Specific UDP Tag Responses

This section describes the various tag responses to requests.

SeGo Streamlined Read Response

The SeGo streamlined read response is as follows: `3021<Data><CRC>`. Table 8-2 lists the streamlined read response.

Table 8-2 SeGo Streamlined Read Response (3021H)

Streamlined Read Response Data									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								30H
Record	Record Type (LSB)								21H
Data	ID Byte 0								XXH
Data	ID Byte 1								XXH
Data	ID Byte 2								XXH
Data	ID Byte 3								XXH
Data	ID Byte 4								XXH
Data	ID Byte 5								XXH
Data	ID Byte 6								XXH
Data	ID Byte 7								XXH
Data	Page Data Byte 0								XXH
Data	Page Data Byte 1								XXH

Table 8-2 SeGo Streamlined Read Response (3021H) (continued)

Data	Page Data Byte 2		XXH
Data	Page Data Byte 3		XXH
Data	Page Data Byte 4		XXH
Data	Page Data Byte 5		XXH
Data	Page Data Byte 6		XXH
Data	Page Data Byte 7		XXH
CRC	CRC (MSB)		XXH
CRC	CRC (MSB)		XXH
Antenna		Antenna Number	XXH

SeGo Streamlined Read Response Example

SeGo Streamlined Read Response `3021AABBCCDDEEFF0011ABCDEF0123456789A1B5`

where

`3021`	SeGo Page Data Record Type, 2 bytes in hex
`AABBCCDDEEFF0011`	ID Word Data, 8 bytes in hex
`ABCDEF0123456789`	Page Data, 8 bytes in hex
`A1B5`	CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

SeGo ID Word Data Response

The SeGo ID Word (SeGo Group Select Equals) response is as follows: `3023<Data><CRC>`. Table 8-3 lists the response data.

Table 8-3 SeGo ID Word Data Response (3023H)

SeGo ID Word Data Response									**Data Payload**
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								30H
Record	Record Type (LSB)								23H
Data	ID Byte 0								XXH

Table 8-3 SeGo ID Word Data Response (3023H)

Data	ID Byte 1		XXH
Data	ID Byte 2		XXH
Data	ID Byte 3		XXH
Data	ID Byte 4		XXH
Data	ID Byte 5		XXH
Data	ID Byte 6		XXH
Data	ID Byte 7		XXH
CRC	CRC (MSB)		XXH
CRC	CRC (LSB)		XXH
Antenna		Antenna Number	0XH

SeGo ID Word Data – Group Select Example

SeGo ID Word Data Response `3023ABCDEF0123456789A1B5`

where

`3023` SeGo ID Word Data Record Type, 2 bytes in hex

`ABCDEF0123456789` Tag ID, 8 bytes in hex

`A1B5` CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

Title 21 Read Response

The Title 21 Read Response is as follows: `3024<Data><CRC>`. Table 8-4 lists the response data.

Table 8-4 Title 21 Read Response (3024H)

Title 21 Read Response Data									**Data Payload**
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								30H
Record	Record Type (LSB)								24H
Data (MSB)	Tag Type (4 bits)				Facility Code (18 bits)				XXH

Table 8-4 Title 21 Read Response (3024H)

Data	Facility Code		
Data	Facility Code	Internal Tag ID	XXH
Data (LSB)	Internal Tag ID (10 bits)		XXH
CRC	CRC		XXH
CRC	CRC		XXH
Antenna		Antenna Number	0XH

Note: *A Title 21 response consists of a 0001 record type; however, there is a response code conflict with the Set Mode Command response (0001) in UDP. The Encompass Reader addresses this conflict by replacing the 0001 Title 21 response code with a 3024 response code.*

Record Type

This field identifies the message as a Title 21 Read Response message. This field contains the following value: 3024H - Title 21 Read_Response.

Tag Type

This four-bit field is used to uniquely differentiate the State of California tags/transponders from those originating in other state agencies. Currently, the tag type value defaults to 0 (California). Values of 1 to 15 are unassigned at this time.

Internal Tag ID

This field contains the Title 21 ID for the responding tag.

CRC

This field contains the standard message CRC. The CRC is calculated for all data beginning with the transaction record type code and includes everything occurring previous to the error detection code field.

Facility Code

This field identifies the agency issuing the tags.

Title 21 Read Response Example:

Title 21 Tag Read Response `30240FCE8E7DD4E400 0 258979 637`

where

`3024`	Title 21 tag response code
`0FCE8E7D`	32-bit tag ID

`D4E4`	CRC
`00`	Antenna number (single channel)
`0  258979  637`	Parsed Title 21 32-bit tag ID (decimal)

where

`0`	Tag type
`258979`	Facility code
`637`	Internal tag ID

Seen Frame Counter Report

This message is use to report the value of the Seen Count when the Seen Frame Counter times out and if the Seen Count is greater than zero. The Seen Frame Counter Response is as follows: `3043<Data><CRC>` Table 8-5 lists the response data.

Table 8-5 Seen Frame Counter Report (3043H)

Seen Frame Counter Report		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	30H
Record	Record Type (LSB)	43H
Data	Protocol	0XH
Data	Seen Count (MSB)	XXH
Data	Seen Count (LSB)	XXH
Antenna	Antenna	0XH

Protocol — This field specifies the protocol for the counters.

Protocol	Definition
0	IT2200
1	SeGo
2	IAG
3	CVISN
4	Title 21
5	ATA Full-Frame
6	eGo
7	ATA Half-Frame
8	Reserved

ATA Half-Frame Tag Response

ATA Half-Frame Read Response Data is as follows: `4000<Data><CRC>` Table 8-6 lists the response data.

Table 8-6 ATA Half-Frame Tag Response (4000H)

ATA Half-Frame Tag Response Data									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								40H
Record	Record Type (LSB)								00H
Data	Response Data Byte 0								XXH
Data	Response Data Byte 1								XXH
Data	Response Data Byte 2								XXH
Data	Response Data Byte 3								XXH
Data	Response Data Byte 4								XXH
Data	Response Data Byte 5								XXH
Data	Response Data Byte 6								XXH
Data	Response Data Byte 7								XXH
Antenna							Antenna Number		0XH

ATA Half-Frame Read Response Examples

ATA Half-Frame Read Response 1 `4000ABCDEFGH`

where

`4000` ATA half-frame record type

`ABCDEFGH` 8 characters of raw hex data

ATA Half-Frame Read Response 2 `400001234567`

where

`4000` ATA half-frame record type

`XYZ.123456789` 8 characters of raw hex data

ATA Half-Frame Read Response 3	400001234567

where

4000	ATA half-frame record type
XYZTAGSR	8 characters of raw hex data

ATA Full-Frame Tag Response

ATA Full Frame Read Response Data is as follows: 4001<Data><CRC> Table 8-7 lists the response data.

Table 8-7 ATA Full-Frame Tag Response (4001H)

ATA Full Frame Tag Response Data									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								40H
Record	Record Type (LSB)								01H
Data	Response Data Byte 0								XXH
Data	Response Data Byte 1								XXH
Data	Response Data Byte 2								XXH
Data	Response Data Byte 3								XXH
Data	Response Data Byte 4								XXH
Data	Response Data Byte 5								XXH
Data	Response Data Byte 6								XXH
Data	Response Data Byte 7								XXH
Data	Response Data Byte 8								XXH
Data	Response Data Byte 9								XXH
Data	Response Data Byte 10								XXH
Data	Response Data Byte 11								XXH
Data	Response Data Byte 12								XXH
Data	Response Data Byte 13								XXH
Data	Response Data Byte 14								XXH

Table 8-7 ATA Full-Frame Tag Response (4001H) (continued)

Data	Response Data Byte 15		XXH
Antenna		Antenna Number	0XH

ATA Full-Frame Read Response Examples

ATA Full-Frame Read Response 1   `4001ABCDEFGHIJKLMNOP`

where

`4001`   ATA full-frame record type in ASCII

`ABCDEFGHIJKLMNOP`   16 characters of raw hex data

ATA Full-Frame Read Response 2   `4001XYZ.123456789TAG`

where

`4001`   ATA full-frame record type in ASCII

`XYZ.123456789TAG`   16 characters of raw hex data

eGo Streamlined Read Response

The eGo Streamlined Read Response is as follows: 4021<Data><CRC>. Table 8-8 lists the response data.

Table 8-8 eGo Streamlined Read Response (4021H)

eGo Streamlined Read Response									**Data Payload**
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								40H
Record	Record Type (LSB)								21H
Data	ID Byte 0								XXH
Data	ID Byte 1								XXH
Data	ID Byte 2								XXH
Data	ID Byte 3								XXH
Data	ID Byte 4								XXH
Data	ID Byte 5								XXH
Data	ID Byte 6								XXH

Table 8-8 eGo Streamlined Read Response (4021H) (continued)

Data	ID Byte 7		XXH
Data	Page Data Byte 0		XXH
Data	Page Data Byte 1		XXH
Data	Page Data Byte 2		XXH
Data	Page Data Byte 3		XXH
Data	Page Data Byte 4		XXH
Data	Page Data Byte 5		XXH
Data	Page Data Byte 6		XXH
Data	Page Data Byte 7		XXH
CRC	CRC (MSB)		XXH
CRC	CRC (LSB)		XXH
Antenna		Antenna Number	0XH

eGo Streamlined Read Example

eGo Streamlined Read Response `4021AABBCCDDEEFF0011ABCDEF0123456789A1B5`

where

`4021`	eGo Page Data Record Type, 2 bytes in hex
`AABBCCDDEEFF0011`	ID Word Data, 8 bytes in hex
`ABCDEF0123456789`	Page Data, 8 bytes in hex
`A1B5`	CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

eGo Word ID Data Response

The eGo Word ID Data Response (Group Select Equals) is as follows: `4023<Data><CRC>`. Table 8-9 lists the response data.

Table 8-9 eGo Word ID Data Response (4023H)

eGo ID Word Data Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	

Table 8-9 eGo Word ID Data Response (4023H) (continued)

Record	Record Type (MSB)		40H
Record	Record Type (LSB)		23H
Data	ID Byte 0		XXH
Data	ID Byte 1		XXH
Data	ID Byte 2		XXH
Data	ID Byte 3		XXH
Data	ID Byte 4		XXH
Data	ID Byte 5		XXH
Data	ID Byte 6		XXH
Data	ID Byte 7		XXH
CRC	CRC (MSB)		XXH
CRC	CRC (LSB)		XXH
Antenna		Antenna Number	0XH

eGo ID Word Data – Group Select Example

eGo ID Word Response `4023ABCDEF0123456789A1B5`

where

`4023` eGo ID Word Data record type, 2 bytes in hex

`ABCDEF0123456789` Tag ID, 8 bytes in hex

`A1B5` CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

IT2200 Read Response

The IT2200 Read Response is as follows 4303<Data><CRC>. Table 8-10 lists the response data.

Table 8-10 IT2200 Read Response (4303H)

IT2200 Read Response Data		Data Payload
Field	**Bits 7–0**	

Table 8-10 IT2200 Read Response (4303H) (continued)

Record	Record Type (MSB)	43H
Record	Record Type (LSB)	03H
Data	Bit Count (MSB)	00H
Data	Bit Count (LSB)	00H
Data	Options	00H
Data	Tag ID (MSB)	F0H
Data	Tag ID	0FH
Data	Tag ID	00H
Data	Tag ID (LSB)	50H
Data	Page Number (MSB)	XXH
Data	Page Number (LSB)	XXH
Data	Page Data Byte 15 (MSB)	XXH
Data	Page Data Byte 14	XXH
Data	Page Data Byte 13	XXH
Data	Page Data Byte 12	XXH
Data	Page Data Byte 11	XXH
Data	Page Data Byte 10	XXH
Data	Page Data Byte 9	00H
Data	Page Data Byte 8	00H
Data	Page Data Byte 7	0XH
Data	Page Data Byte 6	XXH
Data	Page Data Byte 5	XXH
Data	Page Data Byte 4	
Data	Page Data Byte 3	
Data	Page Data Byte 2	
Data	Page Data Byte 1	
Data	Page Data Byte 0 (LSB)	
CRC	CRC	
CRC	CRC	

Table 8-10 IT2200 Read Response (4303H) (continued)

Antenna		Antenna Number	

IT2200 Read Response Example:

IT2200 Read Response `430300CD0E0123456720AABBCCDDEEFF11223344556677889900A1B5`

where

`4303`	IT2200 Record Type, 2 bytes in hex
`00CD`	Bit count, 2 bytes in hex
`0E`	Options, 1 byte in hex
`01234567`	Tag ID, 4 bytes in hex
`20`	Page number, 1 byte in hex
`AABBCCDDEEEFF1122334 4556677889900`	Page data, 16 bytes in hex
`A1B5`	CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

CVISN Read Response

The CVISN Read Response format is as follows: 5014<Data><CRC>. Table 8-11 lists the response data.

Table 8-11 CVISN Read Response (5014H)

CVISN Read Response Data		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	50H
Record	Record Type (LSB)	14H
Data	Valid Tag 1	0000H/0001H
Data	Valid Tag 2	0000H/0001H
Data	Valid Tag 3	0000H/0001H
Data	Valid Tag 4	0000H/0001H
Data	Transponder Message and Message Type Tag 1 (not used)	XXH
Data	Transponder ID Tag 1	XXXX.XXXXH
CRC	CRC Tag 1	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH

Table 8-11 CVISN Read Response (5014H) (continued)

Data	Transponder Message and Message Type Tag 2 (not used)	XXH
Data	Transponder ID Tag 2	XXXX.XXXXH
CRC	CRC Tag 2	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Data	Transponder Message and Message Type Tag 3 (not used)	XXH
Data	Transponder ID Tag 3	XXXX.XXXXH
CRC	CRC Tag 3	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Data	Transponder Message and Message Type Tag 4 (not used)	XXH
Data	Transponder ID Tag 4	XXXX.XXXXH
CRC	CRC Tag 4	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Antenna	Antenna Number	XXH

The valid tags are set to 0 for tag not in frame slot and 1 for tag in frame slot. The transponder message is the high-order nibble and the message type tag is the low-order nibble. This byte is passed with each tag but currently is not used. The transponder ID tag is the identifier read from the tag. There may be one to four tags read for a given response. A read with no transponder ID tags is not forwarded to the host. The reader also presents a tag's CRC to the host as part of the response in the CRC field.

IAG Read Response

The IAG Read Response format is as follows: 5026<Data><CRC>. Table 8-12 lists the response data.

Table 8-12 IAG Read Response Data Parameters (5026H)

IAG Read Response									**Data Payload**
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								50H
Record	Record Type (LSB)								26H
	Read Only Partition								
Data	Header (3 bits)			Tag Type (3 bits)			App ID (3 bits)		XXH

Table 8-12 IAG Read Response Data Parameters (5026H) (continued)

IAG Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Data	App ID	Group ID (7 bits)							XXH
Data	Agency ID (7 bits)							Ser Num	XXH
Data	Serial Number (24 bits)								XXH
Data	Serial Number								XXH
Data	Serial Number							V. Class	XXH
Data	Vehicle Class (11 bits)								XXH
Data	Vehicle Class		Revenue Type (4 bits)				C. S.	M. L.	XXH
Data	M. L.		Agency Data 1 (3 bits)			ISTHA Class (4 bits)			XXH
Data	Agency Data 2 (24 bits)								XXH
Data	Agency Data 2								XXH
Data	Agency Data 2								XXH
	Read/Write Partition								
Data	Reader ID (12 bits)								XXH
Data	Reader ID				TM Date (9 bits)				XXH
Data	TM Date					TM Time (17 bits)			XXH
Data	TM Time								XXH
Data	TM Time						Agency ID (7 bits)		XXH
Data	Agency ID					Plaza ID (7)			XXH
Data	Plaza ID				Lane ID (5 bits)				XXH
Data	Lane ID	Data (9 bits)							XXH
Data	Date			Time (17 bits)					XXH
Data	Time								XXH
Data	Time				Vehicle Class (11 bits)				XXH
Data	Vehicle Class						Future (4 bits)		XXH
Data	Future		Agency Data (30 bits)						XXH
Data	Agency Data								XXH

Table 8-12 IAG Read Response Data Parameters (5026H) (continued)

IAG Read Response									**Data Payload**
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Data	Agency Data								XXH
Data	Agency Data								XXH
Data	Transaction Number (16 bits)								XXH
Data	Transaction Number								XXH
CRC	CRC								XXH
CRC	CRC								XXH
Antenna							Antenna		

IAG Read Response Example

`#5026ECC11E01FCB21200010587052DBAAAD1607852D89687D54E03060001AAFB5983`

where

`5026`   IAG Read Record Type, 2 bytes in hex

Note: *Due to overlap of byte boundaries by tag data fields, all further data breakdown will be in binary.*

Hex tag data:

`MSB ECC11E01FCB21200 010587052DBAAAD1 607852D89687D54E 03060001AAFB5983 LSB`

32 bytes tag data*8 bits/byte = 256 bits

32 bytes/8 bytes per line = 4 lines

256 bits/4 lines = 64 bits/line from MSB to LSB

```
MSB 1110110011000001000111100000000111111100101100100001001000000000
    0000000100000101100001110000010100101101101110101010101011010001
    0110000001111000010100101101100010010110100001111101010101001110
    0000001100000110000000000000000110101010111110110101100110000011 LSB
```

Response breakdown is from MSB to LSB, starting with the header field and ending with the CRC.

Read-Only Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Header (3 bits)	:	111	:	7
Tag Type (3 bits)	:	011	:	3
Application ID (3 bits)	:	001	:	1
Group ID (7 bits)	:	1000001	:	65
Agency ID (7 bits)	:	0001111	:	15
Serial Number (24 bits)	:	000000001111111001011001	:	65113
Vehicle Class (11 bits)	:	00001001000	:	72
Revenue Type (4 bits)	:	0000	:	0
Commission Status (1 bit)	:	0	:	0
Mounting Location (2 bits)	:	00	:	00
Agency Data 1 (3 bits)	:	000	:	000
ISTHA Class (4 bits)	:	0001	:	1
Agency Data 2 (24 bits)	:	000001011000011100000101	:	362245

Read/Write Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Reader ID (12 bits)	:	001011011011	:	731
TM Date (9 bits)	:	101010101	:	341
TM Time (17 bits)	:	01011010001011000	:	46168
Agency ID (7 bits)	:	0001111	:	15
Plaza ID (7 bits)	:	0000101	:	5
Lane ID (5 bits)	:	00101	:	5
Date (9 bits)	:	101100010	:	354
Time (17 bits)	:	01011010000111110	:	46142
Vehicle Class (11 bits)	:	10101010011	:	1363
Future (4 bits)	:	1000	:	8
Agency Data (30 bits)	:	000011000001100000000000000001	:	50724865
Transaction Number (16 bits)	:	1010101011111011	:	43771

CRC (16 bits) : `0101100110000011` : 22915

IAG Cross-Lane Read Response

The IAG Cross-Lane Read Response format is as follows: 5027<Data><CRC>. Table 8-13 lists the response data.

Table 8-13 IAG Cross-Lane Read Response (5027H)

IAG Cross-Lane Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								50H
Record	Record Type (LSB)								27H
	Read-Only Partition								
Data	Header (3 bits)			Tag Type (3 bits)			App. ID (3 bits)		XXH
Data	App ID	Group ID (7 bits)							XXH
Data	Agency ID (7 bits)							Ser Num	XXH
Data	Serial Number (24 bits)								XXH
Data	Serial Number								XXH
Data	Serial Number							V. Class	XXH
Data	Vehicle Class (11 bits)								XXH
Data	Vehicle Class		Revenue Type (4 bits)				C. S.	M. L	XXH
Data	M. L.	Agency Data 1 (3 bits)			ISTHA Class (4 bits)				XXH
Data	Agency Data 2 (24 bits)								XXH
Data	Agency Data 2								XXH
Data	Agency Data 2								XXH
	Read/Write Partition								
Data	Reader ID (12 bits)								XXH
Data	Reader ID				TM Date (9 bits)				XXH
Data	TM Date					TM Time (17 bits)			XXH
Data	TM Time								XXH
Data	TM Time						Agency ID (7 bits)		XXH

Table 8-13 IAG Cross-Lane Read Response (5027H) (continued)

IAG Cross-Lane Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Data	Agency ID					Plaza ID (7)			XXH
Data	Plaza ID				Lane ID (5 bits)				XXH
Data	Lane ID	Date (9 bits)							XXH
Data	Date		Time (17 bits)						XXH
Data	Time								XXH
Data	Time				Vehicle Class (11 bits)				XXH
Data	Vehicle Class						Future (4 bits)		XXH
Data	Future		Agency Data (30 bits)						XXH
Data	Agency Data								XXH
Data	Agency Data								XXH
Data	Agency Data								XXH
Data	Transaction Number (16 bits)								XXH
Data	Transaction Number								XXH
CRC	CRC								XXH
CRC	CRC								XXH
Antenna							Antenna Number		

IAG Cross-Lane Read Response Example

The IAG Cross-Lane Read Response example is

`#5027ECC11E01FCB21200010587052DBAAAD1607852D89687D54E03060001AAFB5983`

where

`5027` IAG Cross-Lane Read Record Type, 2 bytes in hex

Note: *Due to overlap of byte boundaries by tag data fields, all field breakdowns are in binary.*

Hex tag data:

`MSB ECC11E01FCB21200 010587052DBAAAD1 607852D89687D54E 03060001AAFB5983 LSB`

32 bytes tag data*8 bits/byte = 256 bits

32 bytes/8 bytes per line = 4 lines

256 bits/4 lines = 64 bits/line from MSB to LSB

```
MSB 1110110011000001000111100000000111111100101100100001001000000000
    0000000100000101100001110000010100101101101110101010101011010001
    0110000001111000010100101101100010010110100001111101010101001110
    0000000110000001100000000000000001101010101111101101011001100000011   LSB
```

Response breakdown is from MSB to LSB, starting with the header field and ending with the CRC.

Read-Only Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Header (3 bits)	:	111	:	7
Tag Type (3 bits)	:	011	:	3
Application ID (17 bits)	:	001	:	1
Group ID (7 bits)	:	1000001	:	65
Agency ID (7 bits)	:	0001111	:	15
Serial Number (24 bits)	:	000000001111111001011001	:	65113
Vehicle Class (11 bits)	:	00001001000	:	72
Revenue Type (4 bits)	:	0000	:	0
Commission Status (11 bits)	:	0	:	0
Mounting Location (2 bits)	:	00	:	00
Agency Data 1 (3 bits)	:	000	:	000
ISTHA Class (4 bits)	:	0001	:	1
Agency Data 2 (24 bits)	:	000001011000011100000101	:	362245

Read/Write Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Reader ID (12 bits)	:	001011011011	:	731
TM Date (9 bits)	:	101010101	:	341

TM Time (17 bits)	:	01011010001011000	:	46168
Agency ID (7 bits)	:	0001111	:	15
Plaza ID (7 bits)	:	0000101	:	5
Lane ID (5 bits)	:	00101	:	5
Date (9 bits)	:	101100010	:	354
Time (17 bits)	:	01011010000111110	:	46142
Vehicle Class (11 bits)	:	10101010011	:	1363
Future (4 bits)	:	1000	:	8
Agency Data (30 bits)	:	000011000000110000000000000000001	:	50724865
Transaction Number (16 bits)	:	1010101011111011	:	43771
CRC (16 bits)	:	0101100110000011	:	22915

AI1200-Emulation Tag Responses

In general, the tag response is transmitted as a # sign followed by the tag response record type code and the tag response data. Response lengths vary depending on the tag response record type. The tag response record type communicates to the host the tag response type that the reader processed.

Tag Response Format

No Append Information: (#300, #310)

ECP protocol: `<som><seq><rrrr><data><crc><eom>`

Basic protocol: `<som><rrrr><data> <eom>`

Append Information: (#302, #311)

ECP protocol: `<som><seq><rrrr><data>&<time><date>%<aux info><crc><eom>`

Basic protocol: `<som><data>&<time><date>%<aux info><eom>`

where

the tag response contains the following:

`<som>`	#
`<seq>`	hexadecimal character 0-F, *ECP mode only*
`<rrrr>`	Transaction record type (hex)
`<data>`	Tag response data (hex/AMTECH 6-bit, length and format depend on tag type)

Append options: (see Commands #300, #301, #302, #310, #311)

Time and Time/Date Stamps

& = Time stamp delimiter and time/date stamp delimiter

Time only appended: (#301 Time Only Appended)

<time>: &HH:MM:SS.hh

HH = Hours (00-23 decimal)

MM = Minutes (00-59 decimal)

SS = Seconds (00-59 decimal)

hh = Hundredths of seconds (00-99 decimal)

```
Time and date stamp:  (#302 Time and Date Appended)
      <time><date>:  &HH:MM:SS.hh MM/DD/YY
                  MM = Month (01-12 decimal)
                  DD = Day (01–31 decimal)
                  YY = Year (00–99 decimal)

Auxiliary Information: (#311 Auxiliary Information Appended)
      % = Auxiliary information delimiter
      <aux info> = xx-y-zz-q
               xx = reader ID (00–FF hex)
               y = antenna number (0–3)
               zz = number of reads of the previous tag
               (00–FF hexadecimal)
               q = state of Digital I/O input bits (0-F
               hexadecimal)
      <crc> = CRC (2-byte CRC) ECP mode only
      <eom> = CR+LF
```

Basic Protocol Example

Title 21 Tag Report with Time and Date Stamp and Auxiliary Information:

`#0001D52F80044FFC&12:45:23.99 03/15/07%00-1-20-b`

Note: *<eom> omitted from basic mode example*

ECP Protocol Example

Title 21 Tag Report with Sequence Number, Time and Date Stamp, Auxiliary Information and CRC:

`#020001D52F80044FFC&12:45:23.99 03/15/07%00-1-20-b45F3`

Note: *<eom> omitted from ECP mode example*

Note: *The data presented in the examples are invalid and are used for illustration purposes only.*

AI1200-Emulation Tag Response Field Definitions

Tag response record type codes are entered before each tag data response to indicate the type of transaction processed by the reader. All transaction response codes are hexadecimal (Table 8-14).

Table 8-14 Tag Response Record Types and Associated Codes

Record Type Code	Corresponding Tag Responses
0001H	Title 21 Read Response
3002H	ATA Full-Frame Read Response
3012H	ATA Half-Frame Read Response
4303H	IT2200 Read Response
5014H	CVISN Read Response
5026H	IAG Read Response
5027H	IAG Cross Lane Response
E000H	eGo ID Word Data Response
E2XXH, where XX = page address byte	eGo Streamlined Read Response
E800H	SeGo ID Word Data Response
EAXXH, where XX = page address byte	SeGo Streamlined Read Response

Title 21 Read Response

The format for the general tag response is as follows: `#0001<data><CRC>.` Table 8-15 lists the Title 21 Read Response format fields.

Table 8-15 Title 21 Read Response Format

Field	Size (bytes)	Field Source	Description
Record Type	2	Tag	Title 21 response code/ record type
Data	4	Tag	Title 21 tag ID
CRC	2	Tag	Calculated on record type and data
Total Response	8	—	—

where

RS-232 transmission format is hexadecimal to ASCII

ASCII Characters: 16

Table 8-16 lists the Title 21 Read Response Data parameters:

Table 8-16 Title 21 Read Response Data Parameters (0001H)

Title 21 Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	**Byte**
Record	Record Type (MSB)								00H
Record	Record Type (LSB)								01H
Data (MSB)	Tag Type (4 bits)				Facility Code (18 bits)				XXH
Data	Facility Code								XXH
Data	Facility Code						Internal Tag ID		XXH
Data (LSB)	Internal Tag ID (10 bits)								XXH
CRC	CRC								XXH
CRC	CRC								XXH

Title 21 Tag Response Example

The SIRIT/TransCore tag response example is #`0001D52F80044FFC`

where

#	SOM
`0001`	Title 21 record type, two bytes hex
`D52F8004`	32-bit Title 21 ID, four bytes hex
`4FFC`	CRC, two bytes hex

32-bit Title 21 Tag ID Composition (Table 8-16).

32 bit Title 21 ID hex

MSB `D52F8004` LSB hex

MSB `11010101001011111000000000000100`LSB binary

MSB Tag Type 4 bits

Facility Code 18 bits

Internal Tag ID 10 bits LSB

	Binary	Decimal
Tag Type	1101	13
Facility Code	010100101111100000	84960
Tag ID	0000000100	4

ATA Full-Frame Response

The ATA full-frame response is as follows: `#3002<Data>.` Table 8-17 lists the ATA Full-Frame Response format fields.

Table 8-17 ATA Full-Frame Response Format

Field	Size (bytes)	Field Source	Description
Record Type	2	Reader	3002H: ATA Full-Frame Response
Data	20	Tag	AMTECH Six Bit Alphanumeric
Total Response	22	—	—

RS-232 Transmission Format: Record Type (hex to ASCII), data (AMTECH 6-bit ASCII)

ASCII Characters: 24

Table 8-18 lists the ATA Full-Frame Data Response parameters.

Table 8-18 ATA Full-Frame Data Response Parameters

ATA Full-Frame Data Response		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	30H
Record	Record Type (LSB)	02H
Data	AMTECH SIX BIT ASCII Byte 0	XXH
Data	AMTECH SIX BIT ASCII Byte 1	XXH
Data	AMTECH SIX BIT ASCII Byte 2	XXH
Data	AMTECH SIX BIT ASCII Byte 3	XXH
Data	AMTECH SIX BIT ASCII Byte 4	XXH
Data	AMTECH SIX BIT ASCII Byte 5	XXH
Data	AMTECH SIX BIT ASCII Byte 6	XXH

Table 8-18 ATA Full-Frame Data Response Parameters (continued)

ATA Full-Frame Data Response		Data Payload
Field	**Bits 7–0**	
Data	AMTECH SIX BIT ASCII Byte 7	XXH
Data	AMTECH SIX BIT ASCII Byte 8	XXH
Data	AMTECH SIX BIT ASCII Byte 9	XXH
Data	AMTECH SIX BIT ASCII Byte 10	XXH
Data	AMTECH SIX BIT ASCII Byte 11	XXH
Data	AMTECH SIX BIT ASCII Byte 12	XXH
Data	AMTECH SIX BIT ASCII Byte 13	XXH
Data	AMTECH SIX BIT ASCII Byte 14	XXH
Data	AMTECH SIX BIT ASCII Byte 15	XXH
Data	AMTECH SIX BIT ASCII Byte 16	XXH
Data	AMTECH SIX BIT ASCII Byte 17	XXH
Data	AMTECH SIX BIT ASCII Byte 18	XXH
Data	AMTECH SIX BIT ASCII Byte 19	XXH
Data	AMTECH SIX BIT ASCII Byte 20	XXH

ATA Full-Frame Response Examples

The ATA full-frame response example is `#3002ABCDEFGHIJKLMNOPQRST`

where

`#`	SOM
`3002`	ATA full-frame record type
`ABCDEFGHIJKLMNOPQRST`	20 characters of AMTECH 6-bit alphanumeric in ASCII

One response is `#3002ZYXWVUTSRQPONMLKJIHG`

where

`#`	SOM
`3002`	ATA full-frame record type

ZYXWVUTSRQPONMLKJIHG	20 characters of AMTECH 6-bit alphanumeric in ASCII

Another response is #3002XYZ.123456789TAGSRUS

where

#	SOM
3002	ATA full-frame record type
XYZ.123456789TAGSRUS	20 characters of AMTECH 6-bit alphanumeric in ASCII

ATA Half-Frame Response

The ATA half-frame response is as follows: #3012<Data>. Table 8-19 lists the ATA Half-Frame Response format fields.

Table 8-19 ATA Half-Frame Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	2	Reader	3012H: ATA half-frame response
Data	10	Tag	AMTECH six-bit alphanumeric
Total Response	12	—	—

RS-232 Transmission Format: Record type (hex to ASCII), data (AMTECH 6-bit ASCII)

ASCII Characters: 14

Table 8-20 lists the ATA Half-Frame Data Response parameters.

Table 8-20 ATA Half-Frame Data Response Parameters

ATA Half-Frame Data Response		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	30H
Record	Record Type (LSB)	12H
Data	AMTECH SIX BIT ASCII Byte 0	XXH
Data	AMTECH SIX BIT ASCII Byte 1	XXH
Data	AMTECH SIX BIT ASCII Byte 2	XXH
Data	AMTECH SIX BIT ASCII Byte 3	XXH
Data	AMTECH SIX BIT ASCII Byte 4	XXH

Table 8-20 ATA Half-Frame Data Response Parameters (continued)

ATA Half-Frame Data Response		Data Payload
Field	**Bits 7–0**	
Data	AMTECH SIX BIT ASCII Byte 5	XXH
Data	AMTECH SIX BIT ASCII Byte 6	XXH
Data	AMTECH SIX BIT ASCII Byte 7	XXH
Data	AMTECH SIX BIT ASCII Byte 8	XXH
Data	AMTECH SIX BIT ASCII Byte 9	XXH
Data	AMTECH SIX BIT ASCII Byte 10	XXH

ATA Half-Frame Response Examples

One ATA half-frame response is `#3012ABCDEFGHIJ`

where

`#`	SOM
`3012`	ATA half-frame record type
`ABCDEFGHIJ`	10 characters of AMTECH 6-bit alphanumeric in ASCII

Another ATA half-frame response is `#30120123456789`

where

`#`	SOM
`3012`	ATA half-frame record type
`0123456789`	10 characters of AMTECH 6-bit alphanumeric in ASCII

The ATA half-frame response is `#3012XYZTAGSRUS`

where

`#`	SOM
`3012`	ATA half-frame record type
`XYZTAGSRUS`	10 characters of AMTECH 6-bit alphanumeric in ASCII

IT2200 Read Response

The IT2200 Read Response is as follows: `#4303<Data><CRC>`. Table 8-21 lists the IT2200 Read Response format fields.

Table 8-21 IT2200 Read Response Format

Field	Size (bytes)	Field Source	Description
Record Type	2	Tag	4303H: IT2200 read response
Data	25	Tag	—
CRC	2	Tag	CRC uses record type and data
Total Response	29	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 58

Table 8-22 lists the IT2200 Read Response Data parameters.

Table 8-22 IT2200 Read Response Data Parameters (4303H)

IT2200 Read Response		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	43H
Record	Record Type (LSB)	03H
Data	Bit Count (MSB)	XXH
Data	Bit Count (LSB)	XXH
Data	Options	XXH
Data	Tag ID (MSB)	XXH
Data	Tag ID	XXH
Data	Tag ID	XXH
Data	Tag ID (LSB)	XXH
Data	Page number (MSB)	XXH
Data	Page number (LSB)	XXH
Data	Page Data byte 15 (MSB)	XXH

Table 8-22 IT2200 Read Response Data Parameters (4303H) (continued)

IT2200 Read Response		Data Payload
Field	**Bits 7–0**	
Data	Page Data byte 14	XXH
Data	Page Data byte 13	XXH
Data	Page Data byte 12	XXH
Data	Page Data byte 11	XXH
Data	Page Data byte 10	XXH
Data	Page Data byte 9	XXH
Data	Page Data byte 8	XXH
Data	Page Data byte 7	XXH
Data	Page Data byte 6	XXH
Data	Page Data byte 5	XXH
Data	Page Data byte 4	XXH
Data	Page Data byte 3	XXH
Data	Page Data byte 2	XXH
Data	Page Data byte 1	XXH
Data	Page Data byte 0 (LSB)	XXH
CRC	CRC	XXH
CRC	CRC	XXH

IT2200-Series Read Page Response Example

The IT2200-series response example is

`#430300CD0E0123456720AABBCCDDEEFF11223344556677889900A1B5`

where

`#`	SOM
`4303`	IT2200 Record Type, 2 bytes in hex
`00CD`	Bit count, 2 bytes in hex
`0E`	Options, 1 byte in hex
`01234567`	Tag ID, 4 bytes in hex

`20`	Page number, 2 bytes in hex
`AABBCCDDEEFF11222334455667788990 0`	Page data, 16 bytes in hex
`A1B5`	CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

CVISN Read Response

The CVISN response is as follows: #5014<Data><CRC>. Table 8-23 lists the CVISN Read Response format fields.

Table 8-23 CVISN Read Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	2	Reader	5014H: CVISN Read Response
Data	39	Tag	—
Total Response	41	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 82

Table 8-24 lists the IAG Read Response Data parameters.

Table 8-24 CVISN Read Response (5014H)

CVISN Read Response Data		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	50H
Record	Record Type (LSB)	14H
Data	Valid Tag 1	0000H/0001H
Data	Valid Tag 2	0000H/0001H
Data	Valid Tag 3	0000H/0001H
Data	Valid Tag 4	0000H/0001H
Data	Transponder Message and Message Type Tag 1 (not used)	XXH
Data	Transponder ID Tag 1	XXXX.XXXXH

Table 8-24 CVISN Read Response (5014H) (continued)

CRC	CRC Tag 1	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Data	Transponder Message and Message Type Tag 2 (not used)	XXH
Data	Transponder ID Tag 2	XXXX.XXXXH
CRC	CRC Tag 2	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Data	Transponder Message and Message Type Tag 3 (not used)	XXH
Data	Transponder ID Tag 3	XXXX.XXXXH
CRC	CRC Tag 3	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Data	Transponder Message and Message Type Tag 4 (not used)	XXH
Data	Transponder ID Tag 4	XXXX.XXXXH
CRC	CRC Tag 4	XXXXH
Data	Tag Type Indicator (Toll Tag = 01H)	XXH
Antenna	Antenna Number	XXH

The valid tags are set to 0 for tag not in frame slot and 1 for tag in frame slot. The transponder message is the high-order nibble and the message type tag is the low-order nibble. This byte is passed with each tag but currently is not used. The transponder ID tag is the identifier read from the tag. There may be one to four tags read for a given response. A read with no transponder ID tags is not forwarded to the host. The reader also presents a tag's CRC to the host as part of the response in the CRC field.

IAG Read Response

The IAG Read Response is as follows: `#5026<Data><CRC>`. Table 8-25 lists the IAG Read Response format fields.

Table 8-25 IAG Read Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	2	Reader	5026H: IAG Read Response
Data	30	Tag	—
CRC	2	Tag	CRC of data only

Table 8-25 IAG Read Response Format (continued)

Field	Size (Bytes)	Field Source	Description
Total Response	34	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 68

Table 8-26 lists the IAG Read Response Data parameters.

Table 8-26 IAG Read Response Data Parameters (5026H)

<table>
<tr><th colspan="9">IAG Read Response</th><th>Data Payload</th></tr>
<tr><th>Field</th><th>Bit 7</th><th>Bit 6</th><th>Bit 5</th><th>Bit 4</th><th>Bit 3</th><th>Bit 2</th><th>Bit 1</th><th>Bit 0</th><th></th></tr>
<tr><td>Record</td><td colspan="8">Record Type (MSB)</td><td>50H</td></tr>
<tr><td>Record</td><td colspan="8">Record Type (LSB)</td><td>26H</td></tr>
<tr><td></td><td colspan="8">Read Only Partition</td><td></td></tr>
<tr><td>Data</td><td colspan="3">Header (3 bits)</td><td colspan="3">Tag Type (3 bits)</td><td colspan="2">App ID (3 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td>App ID</td><td colspan="7">Group ID (7 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="7">Agency ID (7 bits)</td><td>Ser Num</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="8">Serial Number (24 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="8">Serial Number</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="7">Serial Number</td><td>V. Class</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="8">Vehicle Class (11 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="2">Vehicle Class</td><td colspan="4">Revenue Type (4 bits)</td><td>C. S.</td><td>M. L.</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="2">M. L.</td><td colspan="3">Agency Data 1 (3 bits)</td><td colspan="3">ISTHA Class (4 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="8">Agency Data 2 (24 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="8">Agency Data 2</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="8">Agency Data 2</td><td>XXH</td></tr>
<tr><td></td><td colspan="8">Read/Write Partition</td><td></td></tr>
<tr><td>Data</td><td colspan="8">Reader ID (12 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="4">Reader ID</td><td colspan="4">TM Date (9 bits)</td><td>XXH</td></tr>
<tr><td>Data</td><td colspan="5">TM Date</td><td colspan="3">TM Time (17 bits)</td><td>XXH</td></tr>
</table>

Table 8-26 IAG Read Response Data Parameters (5026H) (continued)

IAG Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Data	TM Time								XXH
Data	TM Time						Agency ID (7 bits)		XXH
Data	Agency ID					Plaza ID (7)			XXH
Data	Plaza ID				Lane ID (5 bits)				XXH
Date	Lane ID	Date (9 bits)							XXH
Date	Date			Time (17 bits)					XXH
Date	Time								XXH
Date	Time				Vehicle Class (11 bits)				XXH
Date	Vehicle Class						Future (4 bits)		XXH
Date	Future		Agency Data (30 bits)						XXH
Date	Agency Data								XXH
Date	Agency Data								XXH
Date	Agency Data								XXH
Date	Transaction Number (16 bits)								XXH
Date	Transaction Number								XXH
CRC	CRC								XXH
CRC	CRC								XXH

IAG Read Response Example

The IAG Read Response example is

`#5026ECC11E01FCB21200010587052DBAAAD1607852D89687D54E03060001AAFB5983`

where

#	SOM
`5026`	IAG Read Record Type, 2 bytes in hex

Note: *Due to overlap of byte boundaries by tag data fields, all further data breakdown will be in binary.*

Hex tag data:

```
MSB ECC11E01FCB21200 010587052DBAAAD1 607852D89687D54E 03060001AAFB5983 LSB
```

32 bytes tag data*8 bits/byte = 256 bits

32 bytes/8 bytes per line = 4 lines

256 bits/4 lines = 64 bits/line from MSB to LSB

```
MSB 111011001100000100011110000000001111111001011001000010010000000000
    0000000100000010110000111000001010010110110111010101010101101000l
    0110000001111000010100101101100010010110100001111101010101001110
    00000001100000110000000000000000110101010111110110101100110000011  LSB
```

Response breakdown is from MSB to LSB, starting with the header field and ending with the CRC.

Read-Only Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Header (3 bits)	:	111	:	7
Tag Type (3 bits)	:	011	:	3
Application ID (3 bits)	:	001	:	1
Group ID (7 bits)	:	1000001	:	65
Agency ID (7 bits)	:	0001111	:	15
Serial Number (24 bits)	:	000000001111111001011001	:	65113
Vehicle Class (11 bits)	:	00001001000	:	72
Revenue Type (4 bits)	:	0000	:	0
Commission Status (1 bit)	:	0	:	0
Mounting Location (2 bits)	:	00	:	00
Agency Data 1 (3 bits)	:	000	:	000
ISTHA Class (4 bits)	:	0001	:	1
Agency Data 2 (24 bits)	:	000001011000011100000101	:	362245

Read/Write Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Reader ID (12 bits)	:	001011011011	:	731
TM Date (9 bits)	:	101010101	:	341
TM Time (17 bits)	:	01011010001011000	:	46168
Agency ID (7 bits)	:	0001111	:	15
Plaza ID (7 bits)	:	0000101	:	5
Lane ID (5 bits)	:	00101	:	5

Date (9 bits)	:	`101100010`	:	354
Time (17 bits)	:	`01011010000111110`	:	46142
Vehicle Class (11 bits)	:	`10101010011`	:	1363
Future (4 bits)	:	`1000`	:	8
Agency Data (30 bits)	:	`000011000001100000000000000001`	:	50724865
Transaction Number (16 bits)	:	`1010101011111011`	:	43771
CRC (16 bits)	:	`0101100110000011`	:	22915

IAG Cross-Lane Read Response

The IAG Cross-Lane Read Response is as follows: `#5027<Data><CRC>.` Table 8-27 lists the IAG Cross-Lane Read Response format fields.

Table 8-27 IAG Cross-Lane Read Response Format

Field	Size (bytes)	Field Source	Description
Record Type	2	Reader	5027H: IAG Cross-Lane Read
Data	30	Tag	—
CRC	2	Tag	CRC of data only
Total Response	34	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 68

Table 8-28 lists the IAG Cross-Lane Read Response data parameters.

Table 8-28 IAG Cross-Lane Read Response Data Parameters (5027H)

IAG Cross-Lane Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Record	Record Type (MSB)								50H
Record	Record Type (LSB)								27H
Data	Header (3 bits)			Tag Type (3 bits)			App. ID (3 bits)		XXH
Data	App ID	Group ID (7 bits)							XXH
Data	Agency ID (7 bits)							Ser Num	XXH

Table 8-28 IAG Cross-Lane Read Response Data Parameters (5027H) (continued)

IAG Cross-Lane Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Data	Serial Number (24 bits)								XXH
Data	Serial Number								XXH
Data	Serial Number							V. Class	XXH
Data	Vehicle Class (11 bits)								XXH
Data	Vehicle Class		Revenue Type (4 bits)				C. S.	M. L	XXH
Data	M. L.	Agency Data 1 (3 bits)			ISTHA Class (4 bits)				XXH
Data	Agency Data 2 (24 bits)								XXH
Data	Agency Data 2								XXH
Data	Agency Data 2								XXH
Data	Reader ID (12 bits)								XXH
Data	Reader ID				TM Date (9 bits)				XXH
Data	TM Date					TM Time (17 bits)			XXH
Data	TM Time								XXH
Data	TM Time						Agency ID (7 bits)		XXH
Data	Agency ID					Plaza ID (7)			XXH
Data	Plaza ID				Lane ID (5 bits)				XXH
Data	Lane ID	Date (9 bits)							XXH
Data	Date		Time (17 bits)						XXH
Data	Time								XXH
Data	Time				Vehicle Class (11 bits)				XXH
Data	Vehicle Class						Future (4 bits)		XXH
Data	Future		Agency Data (30 bits)						XXH
Data	Agency Data								XXH
Data	Agency Data								XXH
Data	Agency Data								XXH
Data	Transaction Number (16 bits)								XXH

Table 8-28 IAG Cross-Lane Read Response Data Parameters (5027H) (continued)

IAG Cross-Lane Read Response									Data Payload
Field	**Bit 7**	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Data	Transaction Number								XXH
CRC	CRC								XXH
CRC	CRC								XXH

IAG Cross-Lane Read Response Example

The IAG Cross-Lane Read Response example is

`#5027ECC11E01FCB21200010587052DBAAAD1607852D89687D54E03060001AAFB5983`

where

#	SOM
`5027`	IAG Cross-Lane Read Record Type, 2 bytes in hex

Note: *Due to overlap of byte boundaries by tag data fields, all field breakdowns are in binary.*

Hex tag data:

```
MSB ECC11E01FCB21200 010587052DBAAAD1 607852D89687D54E 03060001AAFB5983 LSB
```

32 bytes tag data*8 bits/byte = 256 bits

32 bytes/8 bytes per line = 4 lines

256 bits/4 lines = 64 bits/line from MSB to LSB

```
MSB 1110110011000001000111100000000111111100101100100001001000000000
    0000000100000101100001110000010100101101101110101010101011010001
    0110000001111000010100101101100010010110100001111101010101001110
    0000001100000110000000000000000110101010111110110101100110000011 LSB
```

Response breakdown is from MSB to LSB, starting with the header field and ending with the CRC.

`Read-Only Partition`

Field (# of bits)	:	Bit Pattern	:	Decimal
Header (3 bits)	:	111	:	7

Tag Type (3 bits)	:	011	:	3
Application ID (17 bits)	:	001	:	1
Group ID (7 bits)	:	1000001	:	65
Agency ID (7 bits)	:	0001111	:	15
Serial Number (24 bits)	:	000000001111111001011001	:	65113
Vehicle Class (11 bits)	:	00001001000	:	72
Revenue Type (4 bits)	:	0000	:	0
Commission Status (11 bits)	:	0	:	0
Mounting Location (2 bits)	:	00	:	00
Agency Data 1 (3 bits)	:	000	:	000
ISTHA Class (4 bits)	:	0001	:	1
Agency Data 2 (24 bits)	:	000001011000011100000101	:	362245

Read/Write Partition

Field (# of bits)	:	Bit Pattern	:	Decimal
Reader ID (12 bits)	:	001011011011	:	731
TM Date (9 bits)	:	101010101	:	341
TM Time (17 bits)	:	01011010001011000	:	46168
Agency ID (7 bits)	:	0001111	:	15
Plaza ID (7 bits)	:	0000101	:	5
Lane ID (5 bits)	:	00101	:	5
Date (9 bits)	:	101100010	:	354
Time (17 bits)	:	01011010000111110	:	46142
Vehicle Class (11 bits)	:	10101010011	:	1363
Future (4 bits)	:	1000	:	8
Agency Data (30 bits)	:	000011000001100000000000000001	:	50724865
Transaction Number (16 bits)	:	1010101011111011	:	43771
CRC (16 bits)	:	0101100110000011	:	22915

eGo ID Word Data Response

The eGo ID Word Data Response is as follows: `#E000<Data><CRC>`. Table 8-29 lists the eGo ID Word Data Response format fields.

Table 8-29 eGo ID Word Data Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	2	Reader	eGo ID word data record type
Data	8	Tag	ID word data
CRC	2	Tag	CRC of data only
Total Response	12	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 24

Table 8-30 lists the eGo ID Word Data Response parameters.

Table 8-30 eGo ID Word Data Response Parameters (E000H)

eGo ID Word Data Response		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	E0H
Record	Record Type (LSB)	00H
Data	ID Byte 0	XXH
Data	ID Byte 1	XXH
Data	ID Byte 2	XXH
Data	ID Byte 3	XXH
Data	ID Byte 4	XXH
Data	ID Byte 5	XXH
Data	ID Byte 6	XXH
Data	ID Byte 7	XXH
CRC	CRC (MSB)	XXH
CRC	CRC (LSB)	XXH

eGo ID Word Data Response Example

The eGo ID Word Data Response example is `#E000ABCDEF0123456789A1B5`

where

`#`	SOM
`E000`	eGo ID Word Data Record Type, 2 bytes in hex
`ABCDEF0123456789`	Tag ID, 8 bytes in hex
`A1B5`	CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

eGo Streamlined Read Response

The eGo Streamlined Read response is `#E2h<Data><CRC>.` Table 8-31 lists the eGo Streamlined Read Response format fields.

Table 8-31 eGo Streamlined Read Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	1	Reader	eGo streamlined read record type
XX Page Address	1	Reader	Page address
Data	16	Tag	Page data
CRC	2	Tag	CRC of data only
Total Response	20	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 40

Table 8-32 lists the eGo Streamlined Read response parameters.

Table 8-32 eGo Streamlined Read Response Parameters (E2HXXH)

eGo Streamlined Read Response Data		Data Payload
Field	**Bits 7–0**	
Record	Record Type	E2H
Record	Page Address	XXH
Data	ID Byte 0	XXH
Data	ID Byte 1	XXH
Data	ID Byte 2	XXH
Data	ID Byte 3	XXH
Data	ID Byte 4	XXH
Data	ID Byte 5	XXH
Data	ID Byte 6	XXH
Data	ID Byte 7	XXH
Data	Page Data Byte 0	XXH

Table 8-32 eGo Streamlined Read Response Parameters (E2HXXH) (continued)

eGo Streamlined Read Response Data		Data Payload
Field	**Bits 7–0**	
Data	Page Data Byte 1	XXH
Data	Page Data Byte 2	XXH
Data	Page Data Byte 3	XXH
Data	Page Data Byte 4	XXH
Data	Page Data Byte 5	XXH
Data	Page Data Byte 6	XXH
Data	Page Data Byte 7	XXH
CRC	CRC	XXH
CRC	CRC	XXH

eGo Streamlined Read Response Example

The eGo Streamlined Read response is `#E250AABBCCDDEEFF0011ABCDEF0123456789A1B5`

where

`#`	SOM
`E2`	eGo Page Data Record Type, 1 byte in hex
`50`	XX Page Address, 1 byte in hex
`AABBCCDDEEFF0011`	ID Word Data, 8 bytes in hex
`ABCDEF0123456789`	Page Data, 8 bytes in hex
`A1B5`	CRC, 2 bytes in hex

XX Page Address: 50 hex → 80 decimal/8 bytes/page = Page 10

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

SeGo ID Word Data Response

The SeGo ID Word Data response is `#E800<Data><CRC>`. Table 8-33 lists the SeGo ID Word Data Response format fields.

Table 8-33 SeGo ID Word Data Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	2	Reader	SeGo ID word data record type
Data	8	Tag	ID word data
CRC	2	Tag	CRC of data only
Total Response	12	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 24

Table 8-34 lists the SeGo ID Word Data Response parameters.

Table 8-34 SeGo ID Word Data Response Parameters (E800H)

SeGo ID Word Data Response		Data Payload
Field	**Bits 7–0**	
Record	Record Type (MSB)	E8H
Record	Record Type (LSB)	00H
Data	ID Byte 0	XXH
Data	ID Byte 1	XXH
Data	ID Byte 2	XXH
Data	ID Byte 3	XXH
Data	ID Byte 4	XXH
Data	ID Byte 5	XXH
Data	ID Byte 6	XXH
Data	ID Byte 7	XXH
CRC	CRC	XXH
CRC	CRC	XXH

SeGo ID Word Data Response Example

The SeGo ID Word Data Response example is #E800ABCDEF0123456789A1B5

where

#	SOM
`E800`	SeGo ID Word Data Record Type, 2 bytes in hex
`ABCDEF0123456789`	Tag ID, 8 bytes in hex
`A1B5`	CRC, 2 bytes in hex

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

SeGo Streamlined Read Response

The SeGo Streamlined Read response is `#EAXX<Data><CRC>`. Table 8-35 lists the SeGo Streamlined Read Response format fields.

Table 8-35 SeGo Streamlined Read Response Format

Field	Size (Bytes)	Field Source	Description
Record Type	1	Reader	SeGo streamlined read record type
XX Page Address	1	Reader	Page address
Data	16	Tag	Page data
CRC	2	Tag	CRC of data only
Total Response	20	—	—

RS-232 Transmission Format: hex to ASCII

ASCII Characters: 40

Table 8-36 lists the SeGo Streamlined Read Response data parameters.

Table 8-36 SeGo Streamlined Read Response Parameters (EAXXH)

SeGo Streamlined Read Response Data		Data Payload
Field	Bits 7–0	
Record	Record Type	EAH
Record	Page Address	XXH

Table 8-36 SeGo Streamlined Read Response Parameters (EAXXH) (continued)

SeGo Streamlined Read Response Data		Data Payload
Field	**Bits 7–0**	
Data	ID Byte 0	XXH
Data	ID Byte 1	XXH
Data	ID Byte 2	XXH
Data	ID Byte 3	XXH
Data	ID Byte 4	XXH
Data	ID Byte 5	XXH
Data	ID Byte 6	XXH
Data	ID Byte 7	XXH
Data	Page Data Byte 0	XXH
Data	Page Data Byte 1	XXH
Data	Page Data Byte 2	XXH
Data	Page Data Byte 3	XXH
Data	Page Data Byte 4	XXH
Data	Page Data Byte 5	XXH
Data	Page Data Byte 6	XXH
Data	Page Data Byte 7	XXH
CRC	CRC	XXH
CRC	CRC	XXH

SeGo Streamlined Read Response Example

The SeGo Streamlined Read Response example is `#EA50AABBCCDDEEFF0011ABC-DEF0123456789A1B5`

where

`#`	SOM
`EA`	SeGo Page Data Record Type, 1 byte in hex
`50`	XX Page Address, 1 byte in hex
`AABBCCDDEEFF0011`	ID Word Data, 8 bytes in hex

`ABCDEF0123456789`	Page Data, 8 bytes in hex
`A1B5`	CRC, 2 bytes in hex

XX Page Address: 50 hex → 80 decimal/8 bytes/page = Page 10

Note: *Tag Data and CRC are used for parsing and format purposes only. The record types shown contain valid data.*

Cyclic Redundancy Check

All <som> and <eom> character conversions are performed after the CRC of the transmit data and before the CRC of the receive data. The CRC is calculated as follows:

```
typedef unsigned short          UWORD;
typedef unsigned char           UCHAR;

UWORD
uwAI1200eCalculateCrc(
    UCHAR *pucStr
){
    UWORD uwCrc;
    /*
     * this array taken from AMTECH code to speed up calculation
     */
    UWORD puwCrcTab[256] = {
      0x0000,  0x1021,  0x2042,  0x3063,  0x4084,  0x50a5,  0x60c6,  0x70e7,
      0x8108,  0x9129,  0xa14a,  0xb16b,  0xc18c,  0xd1ad,  0xe1ce,  0xf1ef,
      0x1231,  0x0210,  0x3273,  0x2252,  0x52b5,  0x4294,  0x72f7,  0x62d6,
      0x9339,  0x8318,  0xb37b,  0xa35a,  0xd3bd,  0xc39c,  0xf3ff,  0xe3de,
      0x2462,  0x3443,  0x0420,  0x1401,  0x64e6,  0x74c7,  0x44a4,  0x5485,
      0xa56a,  0xb54b,  0x8528,  0x9509,  0xe5ee,  0xf5cf,  0xc5ac,  0xd58d,
      0x3653,  0x2672,  0x1611,  0x0630,  0x76d7,  0x66f6,  0x5695,  0x46b4,
      0xb75b,  0xa77a,  0x9719,  0x8738,  0xf7df,  0xe7fe,  0xd79d,  0xc7bc,
      0x48c4,  0x58e5,  0x6886,  0x78a7,  0x0840,  0x1861,  0x2802,  0x3823,
      0xc9cc,  0xd9ed,  0xe98e,  0xf9af,  0x8948,  0x9969,  0xa90a,  0xb92b,
      0x5af5,  0x4ad4,  0x7ab7,  0x6a96,  0x1a71,  0x0a50,  0x3a33,  0x2a12,
      0xdbfd,  0xcbdc,  0xfbbf,  0xeb9e,  0x9b79,  0x8b58,  0xbb3b,  0xab1a,
      0x6ca6,  0x7c87,  0x4ce4,  0x5cc5,  0x2c22,  0x3c03,  0x0c60,  0x1c41,
      0xedae,  0xfd8f,  0xcdec,  0xddcd,  0xad2a,  0xbd0b,  0x8d68,  0x9d49,
      0x7e97,  0x6eb6,  0x5ed5,  0x4ef4,  0x3e13,  0x2e32,  0x1e51,  0x0e70,
      0xff9f,  0xefbe,  0xdfdd,  0xcffc,  0xbf1b,  0xaf3a,  0x9f59,  0x8f78,
      0x9188,  0x81a9,  0xb1ca,  0xa1eb,  0xd10c,  0xc12d,  0xf14e,  0xe16f,
      0x1080,  0x00a1,  0x30c2,  0x20e3,  0x5004,  0x4025,  0x7046,  0x6067,
      0x83b9,  0x9398,  0xa3fb,  0xb3da,  0xc33d,  0xd31c,  0xe37f,  0xf35e,
      0x02b1,  0x1290,  0x22f3,  0x32d2,  0x4235,  0x5214,  0x6277,  0x7256,
```

```
        0xb5ea,  0xa5cb,  0x95a8,  0x8589,  0xf56e,  0xe54f,  0xd52c,  0xc50d,
        0x34e2,  0x24c3,  0x14a0,  0x0481,  0x7466,  0x6447,  0x5424,  0x4405,
        0xa7db,  0xb7fa,  0x8799,  0x97b8,  0xe75f,  0xf77e,  0xc71d,  0xd73c,
        0x26d3,  0x36f2,  0x0691,  0x16b0,  0x6657,  0x7676,  0x4615,  0x5634,
        0xd94c,  0xc96d,  0xf90e,  0xe92f,  0x99c8,  0x89e9,  0xb98a,  0xa9ab,
        0x5844,  0x4865,  0x7806,  0x6827,  0x18c0,  0x08e1,  0x3882,  0x28a3,
        0xcb7d,  0xdb5c,  0xeb3f,  0xfb1e,  0x8bf9,  0x9bd8,  0xabbb,  0xbb9a,
        0x4a75,  0x5a54,  0x6a37,  0x7a16,  0x0af1,  0x1ad0,  0x2ab3,  0x3a92,
        0xfd2e,  0xed0f,  0xdd6c,  0xcd4d,  0xbdaa,  0xad8b,  0x9de8,  0x8dc9,
        0x7c26,  0x6c07,  0x5c64,  0x4c45,  0x3ca2,  0x2c83,  0x1ce0,  0x0cc1,
        0xef1f,  0xff3e,  0xcf5d,  0xdf7c,  0xaf9b,  0xbfba,  0x8fd9,  0x9ff8,
        0x6e17,  0x7e36,  0x4e55,  0x5e74,  0x2e93,  0x3eb2,  0x0ed1,  0x1ef0 };

    /*
     * Traverse thru the string calculating the CRC as we go
     */
    for( uwCrc = 0; *pucStr != '\0'; ++pucStr ){

        uwCrc = puwCrcTab[ ((uwCrc >> 8) & 0xff) ] ^
            (uwCrc << 8) ^ ( *pucStr & 0xff );
    }
    return( uwCrc );
}

strcpy(sOutBuf, "#620");
sprintf(sTmp, "%04X", uwAI1200eCalculateCrc(&sOutBuf[1]) );
strcat(sOutBuf, sTmp);
```

9

Configuring the Lane

Chapter 9

Configuring the Lane

This chapter provides information on the importance of lane tuning for optimum automatic vehicle identification (AVI) system performance. This chapter also describes the Encompass® Reader functions and features that can assist you in tuning an AVI lane.

Why You Need to Configure a Lane

Lane configuration optimizes the radio frequency (RF) characteristics and signal timing of an AVI-equipped toll lane to maximize the performance prescribed by the lane's traffic requirements. Typically, consideration of these factors is necessary for each individual lane, although in some installations it may be possible to identify broader solutions, then apply these solutions to certain classes of lanes having similar characteristics, followed by additional fine adjustment on an individual lane-by-lane basis. This process is necessitated by the radio link, which is subject to varying factors such as:

- Lane type
- Geometry of fixed objects near the capture zone
- Interference from external sources
- Adjacent lane interference
- Natural non-homogeneity of RF field strength within the ideal capture zone
- Varying tag environments

These factors may vary within an installation and from lane to lane within the same plaza.The tag protocol types used at an installation play a significant role in configuring the lanes for operation. Knowing the appropriate factors and available tools is necessary for the set-up and troubleshooting of AVI lanes.

Marking the Read Zone

The area where the Encompass Reader reads tags at the current RF range is called the read zone. The antenna pattern, or read zone, of the Encompass Reader would look roughly like a pear-shaped balloon if you were able to see it. When installing the AA3152 Universal Toll Antenna (UTA), you should first mark the unit's read zone using the RF range set at the factory-default maximum.

If two UTAs are installed near each other, TransCore recommends that you fine-tune each reader for the ideal read zone before connecting it permanently to sense input/ sense output and communications cables.

Required Supplies

You need the following supplies to mark the read zone:

- Test tags, supplied by the TransCore dealer or distributor
- Piece of windshield-type glass 0.19 to 0.23 inches (4.82 to 5.84 mm) in thickness and approximately 12 inches (30.48 cm) square on which to attach the eGo Plus Sticker Tag

Caution
The eGo Plus Sticker Tag and eGo Windshield Sticker Tag have a reduced read range if not mounted on glass.

- Audible circuit tester and 9V DC battery for circuit tester power as described in the section
- Piece of chalk or roll of tape
- Plastic or wooden yardstick for tags
- Vinyl electrical tape or hook-and-loop material

Guidelines

Note: *Using test tags that are not mounted to vehicles give a general idea of the read pattern, but the pattern will vary somewhat when actual vehicles with tags are tested. Final adjustments must be made with tags properly mounted on a variety of vehicles.*

To mark the read zone

1. Turn on continuous RF power using the #6411 command.
2. Secure the test tag to the end of the yardstick using electrical tape or hook-and-loop material or affix the test eGo Plus Sticker Tag or eGo Windshield Sticker Tag to the glass piece. Be sure the tag polarization (horizontal or vertical alignment) matches that of the UTA. If using an eGo Plus Sticker Tag or eGo Windshield Sticker Tag as the test tag, the glass should be in front of the tag (between the tag and the reader).
3. Stand directly in front of and about 5 feet (1.5 m) away from the overhead UTA. Hold the stick or the piece of glass so that the tag is positioned at a height and angle consistent with a tag installed on a vehicle. The audible tester sounds upon tag read. If the tester does not sound, try a different tag. If the tester still does not sound, verify that the tester is working correctly and retest the tag.

   Note: *If you hold the test tag in your hand, your hand absorbs the RF signal and* *the test results are not accurate.*

4. Mark the spot with chalk or tape.
5. Move to the left until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
6. Return to the center and then move to the right until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
7. Return to the center and step backward 2 feet (0.6 m) and repeat steps 5 through 7.
8. Continue moving the tag in this manner, placing marks on the ground to identify the boundary of the read zone each time the sound stops. Continue moving the tag to various locations until the read zone is fully marked.
9. You can now connect the outer marks to draw the outer boundary of the read zone.

   Figure 9-1 is a view of a sample read zone within a controlled lane. The outer *X* marks show the outside edges of the read zone.

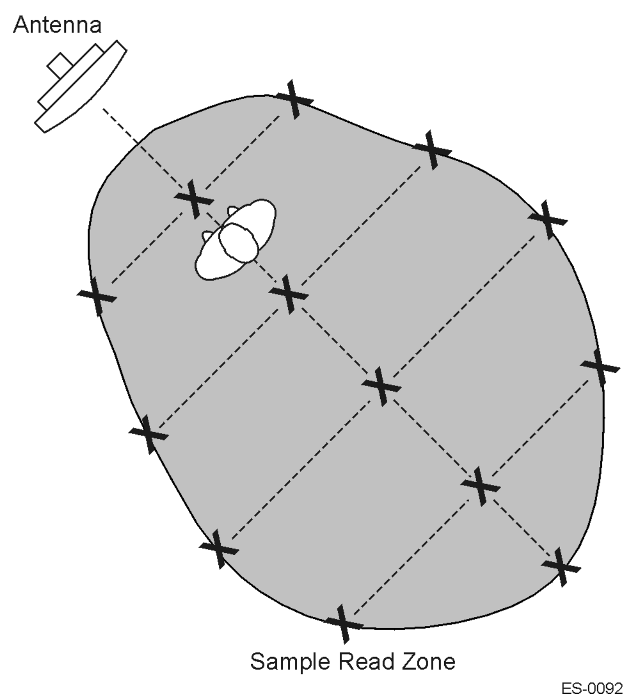

Figure 9-1 Sample Read Zone Marking Pattern

10. Standing at the farthest point of the pattern, walk toward the UTA and listen for a continuous sound from the audible tester. If the sound is not continuous, it could indicate a weak or *patchy* RF pattern.

    Use the appropriate UDP command (Set RF Attenuation (0051H) or Set Data Detect (0053H) or both) or AI1200-emulation command (#920NDU) to adjust the footprint for the installation’s tag protocols. To decrease the size of the footprint, increase the attenuation, which lowers the transmit RF power.

Lane Configuration Examples

This section presents starting values for lane configuration parameters that can be used for various protocol combinations. The tables do not represent all of the possible protocol combinations available with the Encompass Reader, but they provide a framework for developing installation-specific configuration parameters.

Lane Configuration Parameters for SeGo/IT2200 Protocols

To configure the reader for initial use reading SeGo and IT2200 protocols, set the recommended starting values for the parameters listed in Table 9-1.

Table 9-1 Initial Configuration Parameters for IT2200 and SeGo Protocols

Parameter	Recommended Starting Value
Protocol Selection	IT2200 and SeGo
Enable Sequence	IT2200 → Ack or Nack → Antenna → Set
SeGo Group Select Equals (GSE)	If using GSE, use the recommended settings shown in *italics*.and marked with [a]
[a]*Tag ID*	*8-byte tag request ID; however, it is not used in Mode 88 so value should be set to 0000000000000000H.*
[a]*Command Control*	*Always set to 00H for GSE*
[a]*Page Data*	*Contains 8 bytes of configurable comparison data. Set to 0 by default*
[a]*Antenna*	*Set antenna with values between 0 to 0FH. Set to 0 by default*
[a]*Address*	*Tag memory address for byte mask. Tag memory address varies, so values for this field may vary*
[a]*Mask*	*Set mask to desired bit, range = 0–FF*
[a]*Start Address*	*Set to 00H*
[a]*Command Depth*	*Set to 00H*
Reset	Reset reader for changes to take effect
Downlink Frequency	Set downlink frequency to 916.00 dB
Uplink Frequency	Set uplink frequency to 903.00 dB
IT2200 Downlink Attenuation	Set attenuation so that the line loss and attenuation value = 8 dB

Table 9-1 Initial Configuration Parameters for IT2200 and SeGo Protocols (continued)

IT2200 Uplink Attenuation	Set attenuation so that the line loss and attenuation value = 8 dB
SeGo Downlink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
SeGo Uplink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
Retry Count	Recommend setting of 5 for all required retry counts
IT2200 Data Detect	Set to 2 dB
SeGo Data Detect	Set to 4 dB
IT2200 Seen Count	Set to 10 (every 140 ms) for both tag types
IT2200 Uniqueness Count	Set to 1000 every 140 seconds for both tag types
SeGo Seen Count	Set to 10 (every 140 ms) for both tag types
SeGo Uniqueness Count	Set to 1000 every 140 seconds for both tag types
Line Loss	Set the RF cable loss (line loss from reader to antenna) to the nearest dB value or 0, 1, 2, or 3
IT2200 Configuration Parameters	Set recommended IT2200 configuration parameters as shown in *italics* and marked with [b]
[b]*Retry Count*	*Recommend setting of 5 for all required retry counts*
[b]*Time-out*	*If using IT2200 Gen Ack, set desired tag “sleep time” ranging between 0 and 127 seconds (s).*
[b]*Tag ID*	*Set 4-bit tag request ID*
[b]*LCD*	*Set desired value between 02H–0FH*
[b]*Antenna*	*Set antenna with values between 0 to 0FH. Set to 0 by default*
[b]*Audio/Visual Options*	*Set desired options*
[b]*Check Tag (optional)*	*Select IT2200, SeGo, or All, and “fire” check tag*

Lane Configuration Parameters for Title 21/SeGo Protocols

To configure the reader for initial use reading Title 21 and SeGo protocols, set the recommended starting values for the parameters listed in Table 9-2.

Table 9-2 Initial Configuration Parameters for Title 21 and SeGo Protocols

Parameter	Recommended Starting Value
Protocol Selection	Title 21 and SeGo
Enable Sequence	Title 21 → Ack or Nack → Antenna → Set
SeGo GSE	If using GSE, use the recommended settings shown in *italics*.and marked with [c]
[c]*Tag ID*	*8-byte tag request ID; however, it is not used in Mode 88 so value should be set to 0000000000000000H*
[c]*Command Control*	*Always set to 00H for GSE*
[c]*Page Data*	*Contains 8 bytes of configurable comparison data. Set to 0 by default*
[c]*Antenna*	*Set antenna with values between 0 to 0FH. Set to 0 by default*
[c]*Address*	*Tag memory address for byte mask. Tag memory address varies, so values for this field may vary*
[c]*Mask*	*Set mask to desired bit, range = 0–FF*
[c]*Start Address*	*Set to 00H*
[c]*Command Depth*	*Set to 00H*
Reset	Reset reader for changes to take effect
Downlink Frequency	Set downlink frequency to 916.00 dB
Uplink Frequency	Set uplink frequency to 903.00 dB
Title 21 Downlink Attenuation	Set Attenuation so that the line loss and attenuation value = 10 dB
Title 21 Uplink Attenuation	Set Attenuation so that the line loss and attenuation value = 0 dB
SeGo Downlink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
SeGo Uplink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
Retry Count	Recommend setting of 5 for all required retry counts
Title 21 Data Detect	Set to 0 dB
SeGo Data Detect	Set to 0 dB
Title 21 Seen Count	Set to 10 (every 140 ms) for both tag types
Title 21 Uniqueness Count	Set to 1000 every 140 seconds for both tag types

Table 9-2 Initial Configuration Parameters for Title 21 and SeGo Protocols (continued)

SeGo Seen Count	Set to 10 (every 140 ms) for both tag types
SeGo Uniqueness Count	Set to 1000 every 140 seconds for both tag types
Line Loss	Set the RF cable loss (line loss from reader to antenna) to the nearest dB value or 0, 1, 2, or 3

Lane Configuration Parameters for Title 21/eGo/ ATA Protocols

To configure the reader for initial use reading Title 21, eGo, and ATA protocols, set the recommended starting values for the parameters listed in Table 9-3.

Table 9-3 Initial Configuration Parameters for Title 21, eGo, and ATA Protocols

Parameter	Recommended Starting Value
Protocol Selection	Title 21, ATA, and eGo
Enable Sequence	Title 21 → Ack or Nack → Antenna → Set
eGo GSE	If using GSE, use the recommended settings shown in *italics*.and marked with [d]
[d]*Tag ID*	*8-byte tag request ID; however, it is not used in Mode 88 so value should be set to 0000000000000000H*
[d]*Command Control*	*Always set to 00H for GSE*
[d]*Page Data*	*Contains 8 bytes of configurable comparison data. Set to 0 by default*
[d]*Antenna*	*Set antenna with values between 0 to 0FH. Set to 0 by default*
[d]*Address*	*Tag memory address for byte mask. Tag memory address varies, so values for this field may vary*
[d]*Mask*	*Set mask to desired bit, range = 0–FF*
[d]*Start Address*	*Set to 00H*
[d]*Command Depth*	*Set to 00H*
Reset	Reset reader for changes to take effect
Downlink Frequency	Set downlink frequency to 916.00 dB
Uplink Frequency	Set uplink frequency to 903.00 dB
Title 21 Downlink Attenuation	Set attenuation so that the line loss and attenuation value = 10 dB
Title 21 Uplink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
ATA Downlink Attenuation	Set attenuation so that the line loss and attenuation value = 6 dB
ATA Uplink Attenuation	Set attenuation so that the line loss and attenuation value = 6 dB
eGo Downlink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
eGo Uplink Attenuation	Set attenuation so that the line loss and attenuation value = 0 dB
Retry Counts	Recommend setting of 5 for all required retry counts

Table 9-3 Initial Configuration Parameters for Title 21, eGo, and ATA Protocols (continued)

Title 21 Data Detect	Set to 0 dB
ATA Data Detect	Set to 2 dB
eGo Data Detect	Set to 4 dB
Title 21 Seen Count	Set to 10 (every 140 ms) for both tag types
Title 21 Uniqueness Count	Set to 1000 every 140 seconds for both tag types
ATA Seen Count	Set to 10 (every 140 ms) for both tag types
ATA Uniqueness Count	Set to 1000 every 140 seconds for both tag types
eGo Seen Count	Set to 10 (every 140 ms) for both tag types
eGo Uniqueness Count	Set to 1000 every 140 seconds for both tag types
Line Loss	Set the RF cable loss (line loss from reader to antenna) to the nearest dB value or 0, 1, 2, or 3.

10

System Diagnostics and Preventive Maintenance

Chapter 10

System Diagnostics and Preventive Maintenance

This chapter provides information on diagnosing problems with the Encompass® Reader components and schedule and instructions for preventive maintenance.

Error Indicators

The Encompass reader has light-emitting diodes (LED) that display operational functions and error conditions. Figure 10-1 shows the LED locations.

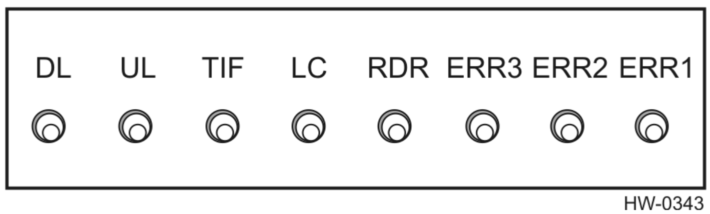

Figure 10-1 Operational LEDs

Table 10-1 describes the LED indications.

Table 10-1 Operational LED Indicator Descriptions

Operational LED			**Description**
Three fault indication LEDs			
ERR3	**ERR2**	**ERR1**	**Failure Mode**
●	●	●	Microprocessor resetting
●	●	○	Power supply failure
●	○	●	Transceiver failure
●	○	○	TDM/GPS failure
○	●	●	No communication with lane controller/host system
○	●	○	Other failure
○	○	●	Data in buffer

Table 10-1 Operational LED Indicator Descriptions (continued)

Operational LED			Description
❍	❍	❍	No failure
RDR			Encompass reader communicating with host
LC			Host communicating with Encompass reader
TIF			Encompass reader is transacting with tag. LED lit when Encompass reader receives correctly decoded tag message including correct cyclic redundancy check for message. The LED is lit for 250 ms following a tag transaction.
UL			RF uplink signal on
DL			RF downlink signal on
Note All ERR LEDs light red.			

Troubleshooting Guidelines

The Encompass reader is very reliable, so any service-related problems will most likely be due to external causes, such as damage to components. Visually inspect each system component and replace or repair components as needed.

To perform a visual inspection

1. Make sure all component connectors are secure.
2. Make sure that the antenna is connected to the Encompass reader.
3. Make sure the Encompass reader is powered up by checking the Encompass reader Power LEDs.
4. Make sure the Encompass reader is communicating with the lane controller/host system by checking operational/error LEDs.
5. Review diagnostic commands and responses by accessing diagnostic port (COM2).

Communicating Via Diagnostic Port (COM2)

You can check the Encompass reader diagnostics by connecting a personal computer (PC) to the Encompass reader COM2 port using a serial null-modem cable. This cable crosses over the transmit and receive pins, which allows you to communicate with the Encompass reader.

Once you have connected the PC to the Encompass reader, you need to configure the terminal emulation software.

Starting the Terminal Emulation Software

You can use a PC and any terminal emulation software to enter the host commands to retrieve diagnostic information. The following procedures show examples using Hyper Terminal™, an application included with Microsoft Windows. Most terminal emulation applications have a similar sequence for launching.

Note: *In this hyperterminal selection, COM1 refers to the PC communications port.*

To start the terminal emulation software

1. At the command prompt, type your terminal emulation start command, or if using Windows Hyper Terminal, select: `Programs>Accessories>Hyperterm` and press `ENTER`.

   The application displays the **Connection Description** dialog box as shown in Figure 10-2.

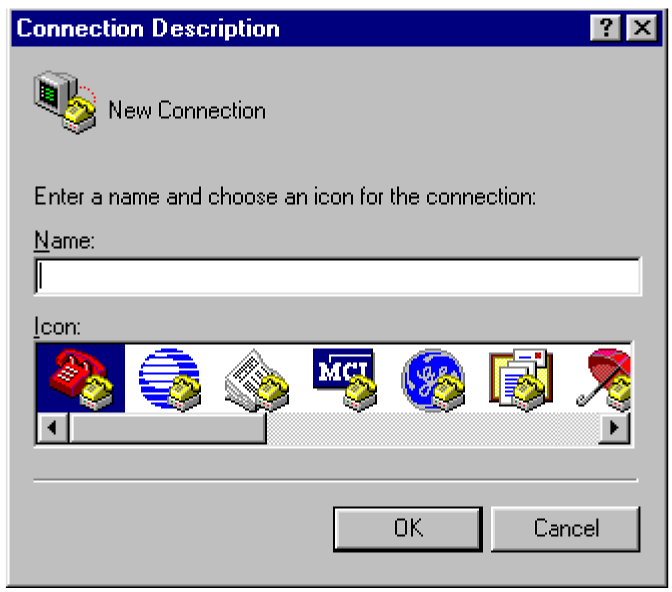

Figure 10-2 Connection Description Dialog Box

2. Enter a name for the session and click **OK**.

   The application displays the **Phone Number** dialog box as shown in Figure 10-3.

Figure 10-3 Phone Number Dialog Box

3. From the **Connect using** pull-down list, choose the **Com1** option (or whichever com port on the PC to which the RS–232 cable is attached) and click **OK**.

   The application displays the **COM1 Properties** dialog box as shown in Figure 10-4.

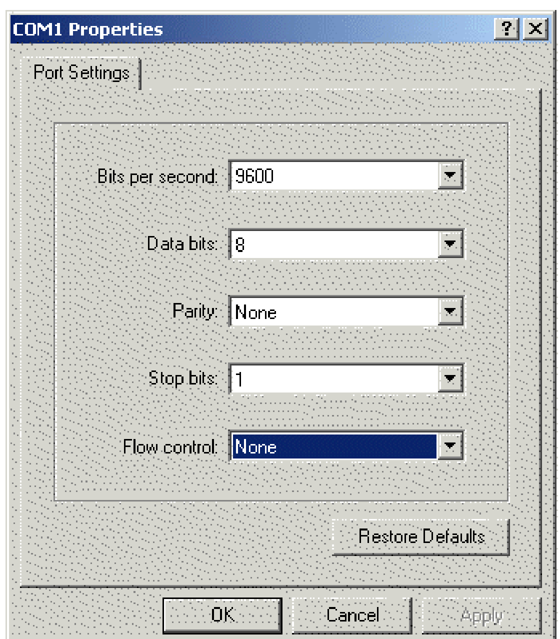

Figure 10-4 COM1 Properties Dialog Box

4. In the pull-down lists on the **COM1 Properties** dialog box, choose the following values:

   - Bits per second: 9600 baud
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

5. Click **OK**.

   The application displays the **configparms - Hyper Terminal** main screen as shown in Figure 10-5.

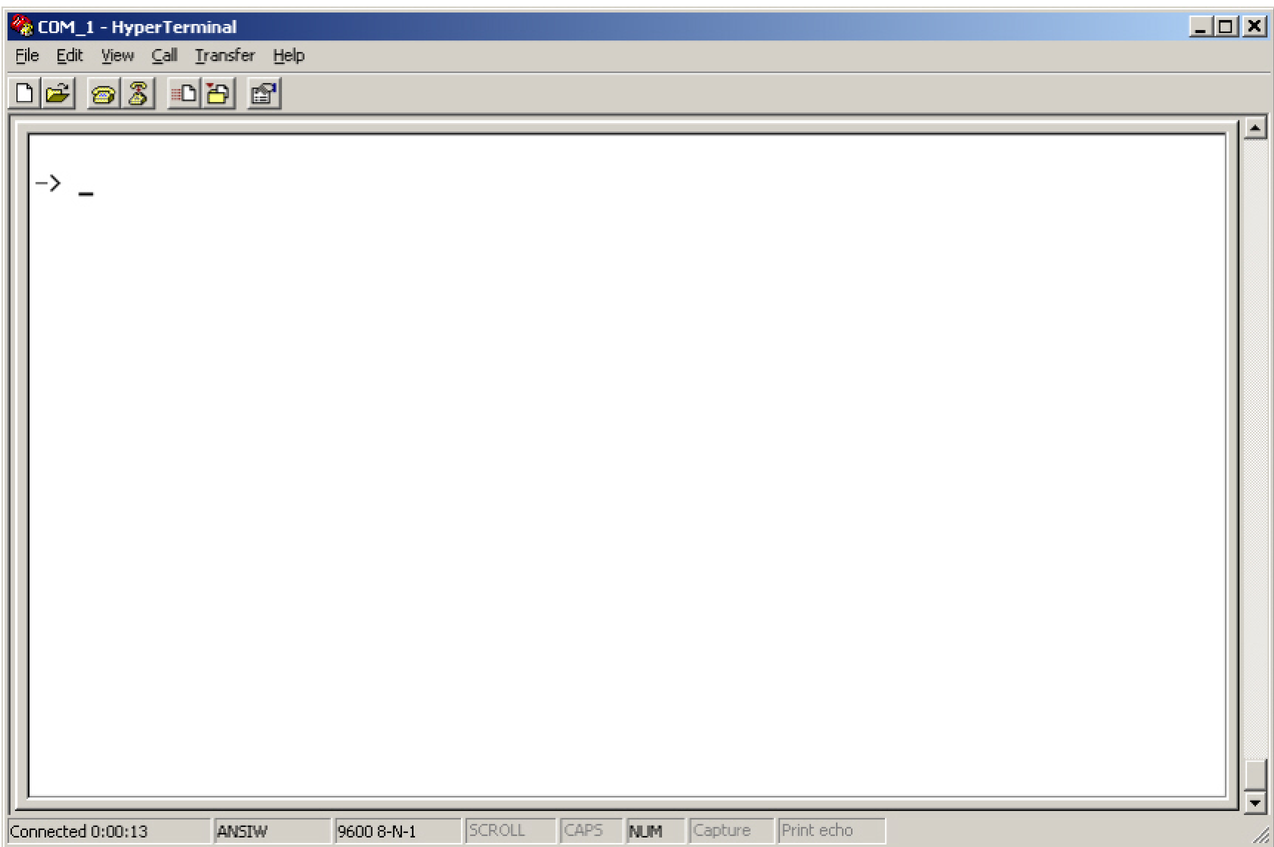

Figure 10-5 Hyper Terminal Main Screen

6. Press ENTER several times to get a flashing cursor prompt (–>_).

   You can enter any of the diagnostic commands (see Diagnostic Command Group).

Diagnostic COM2 Port Pin Assignments

This connector is a DB9 subminiature plug. The diagnostic signal descriptions are listed in Table 10-2.

Table 10-2 Diagnostic Communications Connector Parameters

Pin	Signal	Description
1	RSD	Received line signal detect (not connected)
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready (not connected)
5	GND	Ground
6	DSR	Data Set Ready (not connected)
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring indicator (not connected)

Diagnostic Commands

The Encompass reader uses the commands outlined in this section to help you diagnose problems between the host and Encompass reader (Table 10-3).

Table 10-3 Diagnostic Commands

Diagnostic Command	Command Description
version	Responds with the Encompass reader's IP addresses. The last IP address is the Encompass reader's address (udpinet = XXX.XXX.XXX.XXX)
`bootChange`	Used to change the Encompass reader's IP address. Press **Enter** until the cursor is at the other line, then type: udpinet=XXX.XXX.XXX.XXX where the X's are the new IP address. You must begin the line with "udpinet=" See "bootChange" section below for detailed description of this command.
`ShowErrorLog`	Scrolls the error log in chronological order.
`ClearErrorLog`	Clears entries from the error log.

Table 10-3 Diagnostic Commands

`ShowSysStatusBits`	Shows the status bits for error conditions in the Encompass reader.

Note: *All diagnostic host commands are case sensitive.*

bootChange

This section describes each line of the bootChange command and provides instructions for sending this command.

boot device		Required, must be motfec0
processor number		Required, must be 0
host name		Required, must be lcHost
file name		Not required, should be left as is or blank
inet on Ethernet (e)		Should be left as 10.3.11.96:ffff0000. Changing this value will cause errors on startup.
inet on backplane (b)		Not required, should be left as is or blank
host inet (h)		Required, should be set to IP address of host computer
gateway inet (g)		Not required, should be left as is or blank
user (u)		Not required, should be left as is or blank
ftp password (pw) (blank = use rsh)		Not required, should be left as is or blank
flags (f)		Required, should be 0x0
target name (tn)		Not required, should be left as is or blank
startup script (s)		Not required, should be left blank
other (o)	!	**Mandatory:** Encompass reader IP address must be udpinet=xxx.xxx.xxx.xxx

Press Enter if you do not want to change an entry. To clear an entry on a line, type a "." (period). To change a line, type what is needed, then press Enter. On the other (o) line you must enter the Encompass reader IP address with "udpinet=xxx.xxx.xxx.xxx" where the xxx.xxx.xxx.xxx is the Encompass reader IP address.

Note: *If you do not enter the Encompass reader IP address exactly as shown, the Encompass reader's Ethernet communications will not work.*

Upon boot-up, the Encompass reader uses the host inet (h) IP address as the IP address where it sends UDP data.

When you have finished entering the bootChange, the screen displays the following information:

boot device	`motfec0`
processor number	`0`
host name	`lcHost`

boot device	`motfec0`
file name	
inet on Ethernet (e)	`10.3.11.96:ffff0000`
inet on backplane (b)	
host inet (h)	`192.168.10.1`
gateway inet (g)	
user (u)	
ftp password (pw) (blank = use rsh)	
flags (f)	`0x0`
target name (tn)	
startup script (s)	
Other (o)	udpinet=192.168.10.3

Power Cycling the Encompass Reader

If the Encompass reader stops communicating with the host system and does not respond to RESET READER (0006H) for UDP command set or #63 RESET READER command if using AI1200-emulation command set, try power cycling the reader.

To power cycle the reader

1. Note the reader's operational LEDs statuses.
2. Display the version by typing **version**. This provides the IP addresses for the Encompass reader.
3. Display the error log by typing **ShowErrorLog**. Using the Hyper Terminal, save the error log to a file by selecting **Capture Text...** from the **Transfer** drop-down menu (Figure 10-6). The **Capture** feature in the menu bar at the bottom of the screen darkens to show text is captured.

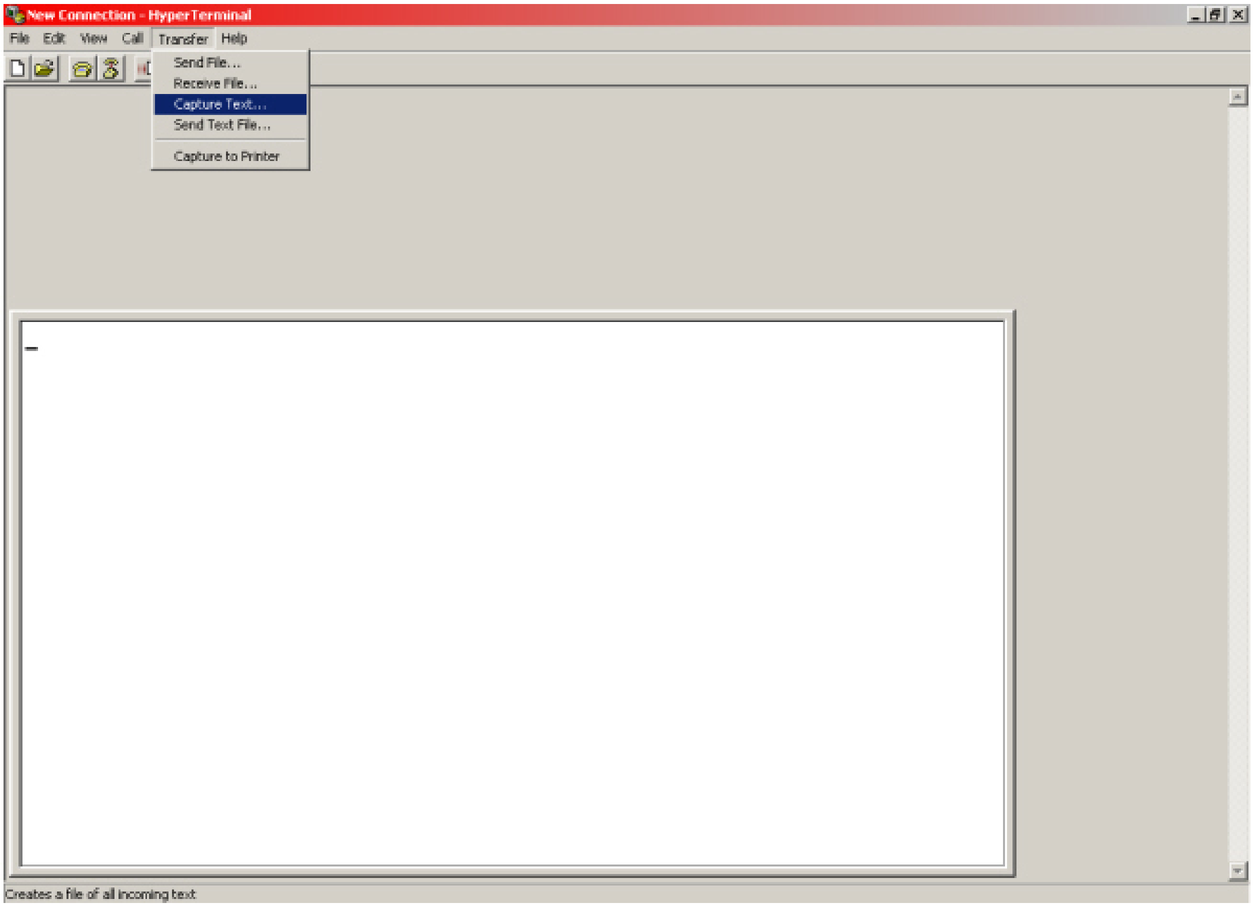

Figure 10-6 Capture Text Feature

Stop or pause the error log capture by selecting **Capture Text...** from the **Transfer** drop-down menu by selecting **Stop** or **Pause** from the **Capture Text...** feature (Figure 10-7).

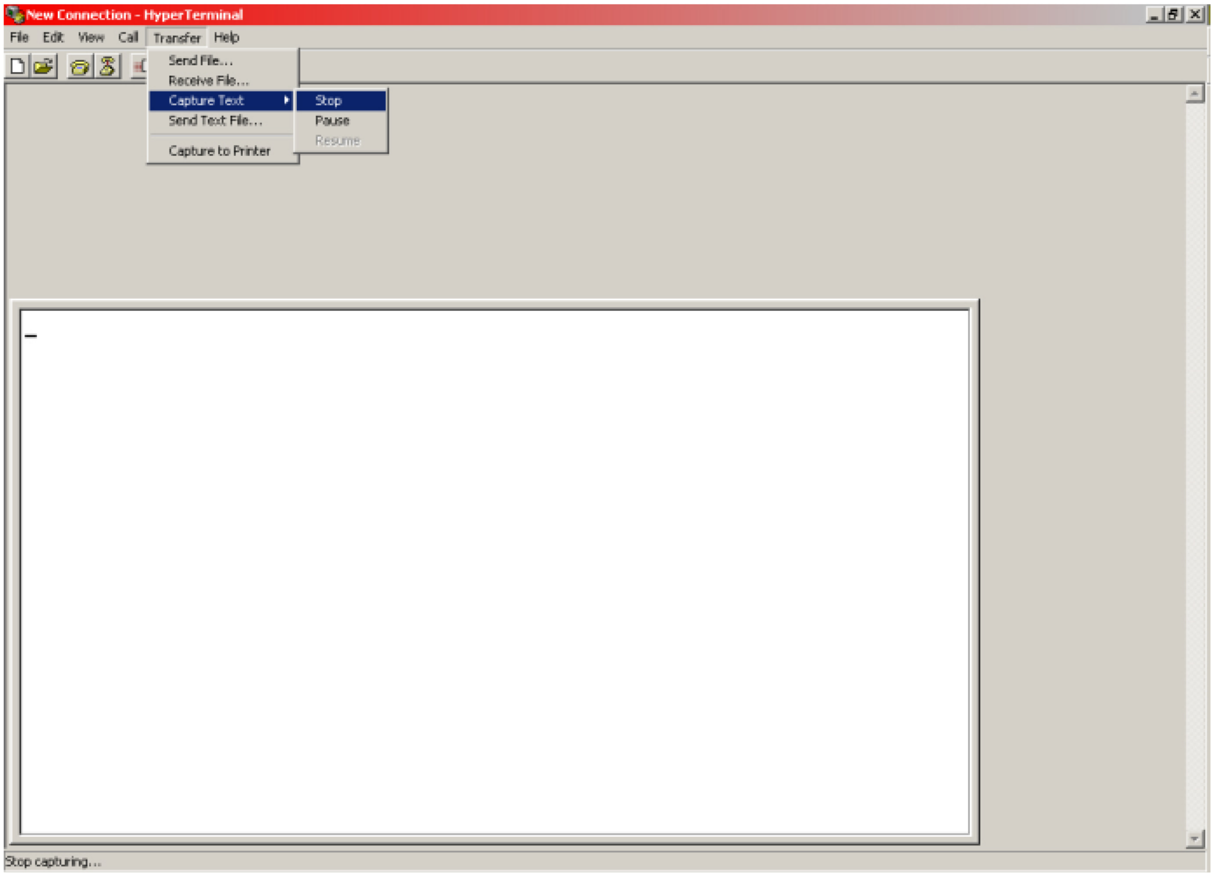

Figure 10-7 Stop or Pause Text Capture

4. Display the error condition status bits by typing **ShowSysStatusBits**.
5. Cycle power to the Encompass reader by unplugging the AC/DC transformer/ power supply cord or by loosening the two mounting screws securing the power connector to the reader and unplugging the power for at least 10 seconds.
6. Plug the power supply cord to the transformer and/or plug connector back into the reader and tighten the two mounting screws.

Error Log Reference

This section lists all the error log messages that can occur in the Encompass reader system. Table 10-4 lists the Encompass reader software module numbers for reference.

Table 10-4 Software Module Numbers

Software Module	Module Number
System Initialization Module	0000H
Lane Controller Interface Module	0001H
System Interface Module	0002H
Mode Interface Module	0003H
Tag Interface Module	0004H
Time-Division Multiplexing (TDM) Module	0005H
Global Positioning System (GPS) Module	0006H
Radio Frequency (RF) Transceiver Interface Module	0007H
Diagnostic Module	0008H
Not used	0009H
Tag Buffer Module	000AH
Not used	000BH
Not used	000CH
Digital I/O (DIO) Module	000DH

Note: *Only those software module error logs that are currently being used in the Encompass reader are listed here.*

System Initialization Module Errors

Table 10-5 contains the system initialization module (MSIM) error numbers and log entry descriptions.

Table 10-5 System Initialization Module Errors (0000H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Timer Initialization Error	This error indicates that the system timer initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0001H
Buffer Management (BM) Initialization Error	This error indicates that the BM system initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0002H
Tag Buffer Initialization Error	This error indicates that the tag buffer module initialization failed.	0003H
System Queue Create Error	This error indicates that the creation of one or more system message queues failed. This error could prevent the Encompass reader's ability to transact with tags.	0004H
System Task Create Error	This error indicates that the creation of one or more system tasks failed. This error could prevent the Encompass reader's ability to transact with tags.	0005H
System Security Error	This error indicates that the system security was violated. This error could prevent the Encompass reader's ability to transact with tags.	0006H
Error Recovery Event	One or more of the errors recovered.	0007H

Lane Controller Interface Module Errors

Table 10-6 contains the lane controller interface module (LCIM) error numbers and log entry descriptions.

Table 10-6 Lane Controller Interface Module Errors (0001H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Saved SysComMsgs Initialization Error	This error indicates that the system communication message buffer initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0001H

Table 10-6 Lane Controller Interface Module Errors (0001H) (continued)

Buffer Management Create Queue Error	This error indicates that the creation of the LCI BM queue failed. This error could prevent the Encompass reader's ability to transact with tags.	0002H
Buffer Management Not Initialized Error	This error indicates that BM is not initialized. This error could prevent the Encompass reader's ability to transact with tags.	0003H
UDP/IP Core Initialization Error	This error indicates that the initialization of the UDP/IP Core failed. This error could prevent the Encompass reader's ability to transact with tags.	0004H
System Serial Device Error	This error indicates that the initialization of the system serial port failed.	0005H
System Message Queue Full Error	This error indicates that the LC Message Queue is full. This error could prevent the Encompass reader's ability to transact with tags.	0006H
Get Buffer Management Buffer Error	This error indicates that the get BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	0007H
Message Queue Send Error	This error indicates that the message queue send failed. This error could prevent the Encompass reader's ability to transact with tags.	0008H
Reserved	N/A	0009H
Message Queue Receive Error	This error indicates that the message queue receive failed. This error could prevent the Encompass reader's ability to transact with tags.	000AH
Return Buffer Management Buffer Error	This error indicates that the return BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	000BH
Reserved	N/A	000CH
Reserved	N/A	000DH
Reserved	N/A	000EH
Wait For UDP/IP Core Transmit (Tx) Buffer Time-out Error	This error indicates that there are no Tx buffers available and the time-out period for waiting has expired. This error could prevent the Encompass reader's ability to transact with tags.	000FH
Tag Buffer Write Error	This error indicates that tag data failed to be written into the tag buffering location in flash memory.	0010H
Tag Buffer Overflow Error	This error indicates that there is a tag buffer overflow.	0011H
Tag Buffer State Not Idle Error	This error indicates that the tag buffering runtime state is not idle.	0012H
Serial Communication Link Error	This error indicates that the serial communication link is down.	0013H

Table 10-6 Lane Controller Interface Module Errors (0001H) (continued)

UDP/IP Communication Link Error	This error indicates that the UDP/IP communication link is down. This error could prevent the Encompass reader's ability to transact with tags.	0014H
Reserved	N/A	0015H
Error Recovery Event	One or more of the errors recovered.	0016H

System Interface Module Errors

Table 10-7 contains the system interface module (SIM) error numbers and log entry descriptions.

Table 10-7 System Interface Module Errors (0002H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Buffer Management Create Queue Error	This error indicates that the creation of the SI BM queue failed. This error could prevent the Encompass reader's ability to transact with tags.	0001H
Buffer Management Not Initialized Error	This error indicates that BM is not initialized. This error could prevent the Encompass reader's ability to transact with tags.	0002H
Message Queue Receive Error	This error indicates that the message queue receive failed. This error could prevent the Encompass reader's ability to transact with tags.	0003H
Return Buffer Management Buffer Error	This error indicates that the return BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	0004H
Get Buffer Management Buffer Error	This error indicates that the get BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	0005H
Message Queue Send Error	This error indicates that the message queue send failed. This error could prevent the Encompass reader's ability to transact with tags.	0006H
Tag Buffer Read Error	This error indicates that tag data failed to be read from the tag buffering location in flash memory.	0007H
Tag Buffer Overflow Error	This error indicates that there is a tag buffer overflow.	0008H
Erase Tag Buffers Error	Tags in the Tag Buffer location in Flash failed to erased.	0009H
Erase Entire Tag Buffer Space Error	This error indicates that erase entire tag buffers flash space failed.	000AH
Wait For Tag Buffer Idle State Time-out Error	This error indicates that the wait for tag buffering runtime idle state, timed out.	000BH
Reserved	N/A	000CH
Error Recovery Event	One or more of the errors recovered.	000DH

Mode Interface Module Error Numbers

Table 10-8 contains the mode interface module (MIM) error numbers and log entry descriptions.

Table 10-8 Mode Interface Module Errors (0003H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Prior Required Configuration Not Set Error	This error indicates that not all required configuration parameters are set for the system to be able to start running in the requested mode. This error could prevent the Encompass reader's ability to transact with tags.	0001H
Reserved	N/A	0002H
Error Recovery Event	One or more of the errors recovered.	0003H

Tag Interface Module Error Numbers

Table 10-9 contains the tag interface module (TIM) error numbers and log entry descriptions.

Table 10-9 Tag Interface Module Errors (0004H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
TIM System Error	This error indicates that a system call failed. This error could prevent the Encompass reader's ability to transact with tags.	0001H
FPGA1 Not Ready Error	This error indicates that the FPGA1 is not ready. This error could prevent the Encompass reader's ability to transact with tags.	0002H
RF Transceiver Not Ready Error	This error indicates that the RF Transceiver is not ready. This error could prevent the Encompass reader's ability to transact with tags.	0003H
FPGA1 Memory Test Error	This error indicates that the FPGA1 memory test failed. This error could prevent the Encompass reader's ability to transact with tags.	0004H
FPGA2 Memory Test Error	This error indicates that the FPGA2 memory test failed. This error could prevent the Encompass reader's ability to transact with tags.	0005H

Table 10-9 Tag Interface Module Errors (0004H) (continued)

Queue Message Error	This error indicates that the source of the message is invalid. This error could prevent the Encompass reader's ability to transact with tags.	0006H
Reserved	N/A	0007H
Tag Transaction Configuration Command Error	This error indicates that an invalid tag transaction configuration command was sent to the reader. This error could prevent the Encompass reader's ability to transact with tags.	0008H
Tag Transaction Sequence Command Error	This error indicates that an invalid tag transaction sequence command was sent to the reader. This error could prevent the Encompass reader's ability to transact with tags.	0009H
Reserved	N/A	000AH
Reserved	N/A	000BH
Reserved	N/A	000CH
Reserved	N/A	000DH
Reserved	N/A	000EH
Reserved	N/A	000FH
Buffer Management Create Queue Error	This error indicates that the creation of a BM queue failed. This error could prevent the Encompass reader's ability to transact with tags.	0010H
Get Buffer Management Buffer Error	This error indicates that the get BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	0011H
Return Buffer Management Buffer Error	This error indicates that the return BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	0012H
Get System Queue Identification (ID) Error	This error indicates that getting the system queue identification failed. This error could prevent the Encompass reader's ability to transact with tags.	0013H
Error Recovery Event	One or more of the errors recovered.	0014H
Product ID Error	This error indicates that the Encompass reader is being set to communicate with three or more protocols but the reader platform is an Encompass 5. Setting three or more protocols requires an Encompass 6 reader platform.	0015H
Queue Create Error	This error indicates that the message queues create failed. This error could prevent the Encompass reader's ability to transact with tags.	0016H
Task Create Error	This error indicates that the creation of a tag interface task failed. This error could prevent the Encompass reader's ability to transact with tags.	0017H

Table 10-9 Tag Interface Module Errors (0004H) (continued)

M5e Antenna Configuration Error	This error indicates that the antenna configuration on the M5e module is in error. This error could prevent the Encompass reader's ability to transact with tags.	0018H
M5e Antenna Configuration Recovery	The antenna configuration error has recovered.	0019H
Tag Interface Module Configuration Initialization Error	This error indicates that the tag interface configuration initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	001AH

TDM Module Error Numbers

Table 10-10 contains the TDM module (TDMM) error numbers and log entry descriptions.

Table 10-10 TDM Module Errors (0005H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
TDM Two Masters Error	This error indicates that two readers are configured as masters.	0001H
TDM Master Slave Error	This error indicates that a reader, configured as a slave, does not detect the master.	0002H
TDM Clock Error	This error indicates that a TDM clock error occurred.	0003H
GPS Window Error	This error indicates that a GPS window error occurred.	0004H
GPS One-PPS Error	This error indicates that the one-pulse per second failed.	0005H
TDM Two Masters Error Recovery Event	This event indicates that the two masters error, recovered.	0006H
TDM Master Slave Error Recovery Event	This event indicates that the master slave error, recovered.	0007H
TDM Clock Error Recovery Event	This event indicates that the TDM clock error, recovered.	0008H
GPS Window Error Recovery Event	This event indicates that the GPS Window error, recovered	0009H
GPS One PPS Error Recovery Event	This event indicates that the one-pulse per second, recovered.	000AH

GPS Module Error Numbers

Table 10-11 contains the GPS module (GPSM) module error numbers and log entry descriptions.

Table 10-11 GPS Module Errors (0006H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
GPS Communication Link Error	This error indicates that the communication with the GPS module is down.	0001H

Table 10-11 GPS Module Errors (0006H) (continued)

GPS T-RAIM Alarm Set Event	This error indicates that the T-RAIM algorithm of the GPS module failed.	0002H
GPS Self-Test Failed Event	This error indicates that the self-test of the GPS module failed.	0003H
GPS Power On Failure Event	This error indicates that the GPS module failed the power on test.	0004H
GPS Auto Survey Failure Event	This error indicates that the auto survey failed.	0005H
GPS Communication Link Error Recovery Event	This event indicates that GPS Communication link, recovered.	0006H
GPS T-RAIM Alarm Set Error Recovery Event	This event indicates that T-RAIM alarm cleared.	0007H
GPS Self-Test Failed Recovery Event	This event indicates that self-test error cleared.	0008H
GPS Power-On Failure Recovery Event	This event indicates that self-test error cleared.	0009H
GPS Auto Survey Failure Recovery Event	This event indicates that the auto survey failure cleared.	000AH

RF Transceiver Interface Module Error Numbers

Table 10-12 contains the RF transceiver interface module (RFTIM) error numbers and log entry descriptions.

Table 10-12 RF Transceiver Interface Module Errors (0007H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Buffer Management Create Queue Error	This error indicates that the creation of a BM queue failed. This error could prevent the Encompass reader's ability to transact with tags.	0001H
Memory Allocate Error	This error indicates that the Memory allocation failed. This error could prevent the Encompass reader's ability to transact with tags.	0002H
System Queue ID Retrieve Error	This error indicates that getting the system queue identification failed. This error could prevent the Encompass reader's ability to transact with tags.	0003H
Serial SMC Open Error	This error indicates that opening the serial SMC failed. This error could prevent the Encompass reader's ability to transact with tags.	0004H

Table 10-12 RF Transceiver Interface Module Errors (0007H) (continued)

Connect Interrupt Handler Error	This error indicates that connecting the interrupt handler failed. This error could prevent the Encompass reader's ability to transact with tags.	0005H
Enable Interrupt Error	This error indicates that enabling the interrupt failed. This error could prevent the Encompass reader's ability to transact with tags.	0006H
I/O Semaphore Create Error	This error indicates that creating the I/O semaphore failed. This error could prevent the Encompass reader's ability to transact with tags.	0007H
Non-volatile Random Access Memory (NVRAM) Configuration Data Retrieve Error	This error indicates that retrieving configuration data from NVRAM failed. This error could prevent the Encompass reader's ability to transact with tags.	0008H
NVRAM Configuration Data Corrupt Error	This error indicates that the configuration data in NVRAM is corrupt. This error could prevent the Encompass reader's ability to transact with tags.	0009H
NVRAM Configuration Data Write Error	This error indicates that writing configuration data to NVRAM failed. This error could prevent the Encompass reader's ability to transact with tags.	000AH
RF Transceiver Reset Error	This error indicates that the transceiver reset failed. This error could prevent the Encompass reader's ability to transact with tags.	000BH
RF Heartbeat Task Create Error	This error indicates that the creation of the heartbeat task failed. This error could prevent the Encompass reader's ability to transact with tags.	000CH
Get Buffer Management Buffer Error	This error indicates that the get BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	000DH
Return Buffer Management Buffer Error	This error indicates that the return BM buffer failed. This error could prevent the Encompass reader's ability to transact with tags.	000EH
Serial Command Code Error	This error indicates that an invalid command was received. This error could prevent the Encompass reader's ability to transact with tags.	000FH
Message Queue Send Error	This error indicates that the message queue send failed. This error could prevent the Encompass reader's ability to transact with tags.	0010H
Set Tx Attenuation (Attn) Invalid Input Error	This error indicates that invalid input was sent to the reader for setting the Tx Attn. This error could prevent the Encompass reader's ability to transact with tags.	0011H
Set Rx Attn Invalid Input Error	This error indicates that invalid input was sent to the reader for setting the Rx Attn. This error could prevent the Encompass reader's ability to transact with tags.	0012H

Table 10-12 RF Transceiver Interface Module Errors (0007H) (continued)

Set Range Adjust Invalid Input Error	This error indicates that invalid input was sent to the reader for setting the Range Adjust. This error could prevent the Encompass reader's ability to transact with tags.	0013H
Set Protocol Parameters Invalid Input Error	This error indicates that invalid input was sent to the reader for setting the protocol parameters. This error could prevent the Encompass reader's ability to transact with tags.	0014H
Set Frequency Invalid Input Error	This error indicates that invalid input was sent to the reader for setting the frequency. This error could prevent the Encompass reader's ability to transact with tags.	0015H
Reserved	N/A	0016H
Reserved	N/A	0017H
Reserved	N/A	0018H
Reserved	N/A	0019H
Reserved	N/A	001AH
Reserved	N/A	001BH
Message Queue Receive Error	This error indicates that the message queue receive failed. This error could prevent the Encompass reader's ability to transact with tags.	001CH
Error Recovery Event	One or more of the errors recovered.	001DH
Task Create Error	This error indicates that the creation of an RF transceiver task failed. This error could prevent the Encompass reader's ability to transact with tags.	001EH
Queue Create Error	This error indicates that the message queues create failed. This error could prevent the Encompass reader's ability to transact with tags.	001FH
Invalid Operation Mode Initialization	This error indicates that the RF transceiver interface module was given an invalid mode number. This error could prevent the Encompass reader's ability to transact with tags.	0040H
Transceiver Serial Communication Error	This error indicates that a serial communication link is down.	0041H
Transceiver Reset Error	This error indicates that the transceiver reset failed upon initialization. This error could prevent the Encompass reader's ability to transact with tags.	0042H
Frequency Initialization Error	This error indicates that the frequency initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0043H
Tx Attenuation Initialization Error	This error indicates that the transmit attenuation initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0044H

Table 10-12 RF Transceiver Interface Module Errors (0007H) (continued)

Rx Attenuation Initialization Error	This error indicates that the receive attenuation initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0045H
Data Detect Initialization Error	This error indicates that the data detect initialization failed. This error could prevent the Encompass reader's ability to transact with tags.	0046H
13-MHz Disable Initialization Error	This error indicates that there is a 13-MHz disable error. This error could prevent the Encompass reader's ability to transact with tags.	0047H
RF Transceiver ADC Above Maximum Error	This error indicates that the analog-to-digital converter (ADC) in the control feedback loop has exceeded a maximum set value. This error could prevent the Encompass reader's ability to transact with tags.	0201H
RF Transceiver ADC Below Minimum Error	This error indicates that the ADC in the control feedback loop has fallen below a minimum set value. This error could prevent the Encompass reader's ability to transact with tags.	0202H
RF Transceiver Attn DAC1 Above Maximum Error	This error indicates that the attenuation DAC for source 1 has exceeded a maximum set value. This error could prevent the Encompass reader's ability to transact with tags.	0203H
RF Transceiver Attn DAC1 Below Minimum Error	This error indicates that the attenuation DAC for source 1 has fallen below a minimum set value. This error could prevent the Encompass reader's ability to transact with tags.	0204H
RF Transceiver Attn DAC2 Above Maximum Error	This error indicates that the attenuation DAC for source 2 has exceeded a maximum set value. This error could prevent the Encompass reader's ability to transact with tags.	0205H
RF Transceiver Attn DAC2 Below Minimum Error	This error indicates that the attenuation DAC for source 2 has fallen below a minimum set value. This error could prevent the Encompass reader's ability to transact with tags.	0206H
RF Transceiver Depth-of-Modulation (DOM) DAC Above Maximum Error	This error indicates that the depth of modulation DAC has exceeded a maximum set value. This error could prevent the Encompass reader's ability to transact with tags.	0207H
RF Transceiver DOM DAC Below Minimum Error	This error indicates that the depth of modulation DAC has fallen below a minimum set value. This error could prevent the Encompass reader's ability to transact with tags.	0208H
RF Transceiver Source1 PLL Unlocked Error	This error indicates that the source 1 phase lock loop is unlocked. This error could prevent the Encompass reader's ability to transact with tags.	0209H
RF Transceiver Source2 PLL Unlocked Error	This error indicates that the source 2, phase lock loop is unlocked. This error could prevent the Encompass reader's ability to transact with tags.	020AH
RF Transceiver 13-MHz Control Error	This error indicates that there is a 13-MHz Control error. This error could prevent the Encompass reader's ability to transact with tags.	020BH

Table 10-12 RF Transceiver Interface Module Errors (0007H) (continued)

RF Transceiver 5V DC Fault Error	This error indicates that the 5VDC digital supply is above or below the threshold. This error could prevent the Encompass reader's ability to transact with tags.	020CH
RF Transceiver Uncalibrated Error	This error indicates that the Transceiver is uncalibrated. This error could prevent the Encompass reader's ability to transact with tags.	020DH
Reserved	N/A	020EH
RF Transceiver 5V DC Undervoltage Error	This error indicates that the 5VDC digital supply is below the threshold. This error could prevent the Encompass reader's ability to transact with tags.	020FH
Nack From RF Error	This error indicates that the digital board received a Nack from the Transceiver board. This error could prevent the Encompass reader's ability to transact with tags.	0401H
Serial Command Time-out Error	This error indicates that the digital board failed to send data to the Transceiver board. This error could prevent the Encompass reader's ability to transact with tags.	0402H
Reserved	N/A	0403H
Set Tx Attn Command Failure Error	This error indicates that the "Set Tx Attn Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0404H
Get Tx Attn Command Failure Error	This error indicates that the "Get Tx Attn Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0405H
Set Rx Attn Command Failure Error	This error indicates that the "Set Rx Attn Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0406H
Get Rx Attn Command Failure Error	This error indicates that the "Get Rx Attn Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0407H
Set Range Adjust Command Failure Error	This error indicates that the "Set Range Adjust Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0408H
Get Range Adjust Command Failure Error	This error indicates that the "Get Range Adjust Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0409H
Set Protocol Parameters Command Failure Error	This error indicates that the "Set Protocol Parameters Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	040AH
Get Protocol Parameters Command Failure Error	This error indicates that the "Get Protocol Parameters Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	040BH

Table 10-12 RF Transceiver Interface Module Errors (0007H) (continued)

Set Frequency Command Failure Error	This error indicates that the "Set Frequency Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	040CH
Get Frequency Command Failure Error	This error indicates that the "Get Frequency Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	040DH
Get Firmware ID Command Failure Error	This error indicates that the "Get Firmware ID Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	040EH
Get Status Command Failure Error	This error indicates that the "Get Status Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	040FH
13-MHz Control Command Failure Error	This error indicates that the "13-MHz Control Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0410H
RF Transceiver Reset Command Failure Error	This error indicates that the "RF Transceiver Reset Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0411H
Reference Synchronization Command Failure Error	This error indicates that the "Reference Synchronization Command" failed. This error could prevent the Encompass reader's ability to transact with tags.	0412H

Diagnostic Module Error Numbers

Table 10-13 contains the diagnostic module (DM) error numbers and log entry descriptions.

Table 10-13 Diagnostic Module Error Numbers (0008H)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Buffer Management Create Queue Error	This error indicates that the creation of a BM queue failed.	0001H
Memory Allocate Error	This error indicates that allocation of memory failed.	0002H
System Queue ID Retrieve Error	This error indicates that getting the system queue identification failed.	0003H
Connect Interrupt Handler Error	This error indicates that connecting the interrupt handler failed.	0004H
Enable Interrupt Error	This error indicates that enabling the interrupt failed.	0005H

Table 10-13 Diagnostic Module Error Numbers (0008H) (continued)

Get Buffer Management Buffer Error	This error indicates that the get BM buffer failed.	0006H
Return Buffer Management Buffer Error	This error indicates that the return BM buffer failed.	0007H
Illegal Command Code Error	This error indicates that illegal command was sent to the reader for setting the frequency.	0008H
Message Queue Send Error	This error indicates that the message queue send failed.	0009H
Message Queue Receive Error	This error indicates that the message queue receive failed.	000AH
WatchDog Create Error	This error indicates that creation of a watchdog timer failed.	000BH
WatchDog Start Error	This error indicates that starting a watchdog timer failed.	000CH
Power On or Reset Event	This error indicates that a power on or reset event occurred. This error could prevent the Encompass reader’s ability to transact with tags.	000DH
Power Supply Fault Error	This error indicates that a power supply fault occurred. This error could prevent the Encompass reader’s ability to transact with tags.	000EH
Digital Board OverVoltage Error	This error indicates that an overvoltage fault occurred on the digital board power supply. This error could prevent the Encompass reader’s ability to transact with tags.	000FH
Digital Board UnderVoltage Error	This error indicates that an undervoltage fault occurred on the digital board power supply. This error could prevent the Encompass reader’s ability to transact with tags.	0010H
Reserved	N/A	0011H
Power Supply Fault Status Error	This error indicates that an invalid power supply fault occurred. This error could prevent the Encompass reader’s ability to transact with tags.	0012H
Power Supply Fault Source Error	This error indicates that an erroneous power supply fault occurred. This error could prevent the Encompass reader’s ability to transact with tags.	0013H
Error Recovery Event	One or more of the errors recovered.	0014H

Tag Buffer Module Error Numbers

Table 10-14 contains the tag buffer module (TBM) error numbers and log entry descriptions.

Table 10-14 Tag Buffer Module Errors (000AH)

Log Entry	Description	Error Number
Reserved	N/A	0000H
Tag Buffer Threshold Error	This error indicates that there is a tag buffer threshold error.	0001H
Error Recovery Event	One or more of the errors recovered.	0002H

Digital Input/Output Module Error Numbers

Table 10-15 contains the digital input/output module (DIO) error numbers and log entry descriptions.

Table 10-15 Digital I/O Module Errors (000DH)

Log Entry	Description	Error Number
Reserved	N/A	0000H
DIOM Task Create Error	This error indicates that the creation of the digital I/O task failed. This error could prevent the Encompass reader’s ability to transact with tags.	0001H
Buffer Management Create Queue Error	This error indicates that the creation of a BM queue failed. This error could prevent the Encompass reader’s ability to transact with tags.	0002H
Get Buffer Management Buffer Error	This error indicates that the get BM buffer failed. This error could prevent the Encompass reader’s ability to transact with tags.	0003H
Return Buffer Management Buffer Error	This error indicates that the return BM buffer failed. This error could prevent the Encompass reader’s ability to transact with tags.	0004H
DIOM Synchronization Error	This error indicates that there is a synchronization error. This error could prevent the Encompass reader’s ability to transact with tags.	0005H
Message Queue Create Error	This error indicates that the message queues create failed. This error could prevent the Encompass reader’s ability to transact with tags.	0006H
Message Queue Send Error	This error indicates that the message queue send failed. This error could prevent the Encompass reader’s ability to transact with tags.	0007H
Message Queue Receive Error	This error indicates that the message queue receive failed. This error could prevent the Encompass reader’s ability to transact with tags.	0008H
DIOM Invalid Configuration Error	This error indicates that there is an invalid configuration command error. This error could prevent the Encompass reader’s ability to transact with tags.	0009H
DIOM Event Error	This error indicates that there is an invalid event error.	000AH
DIOM Synchronization Error Recovery Event	One or more of the synchronization errors recovered.	000BH
Error Recovery Event	One or more of the errors recovered.	000CH

Check Tag Operation

The check tag is designed to test the Encompass reader system.

Set Check Tag Using UDP Command Set

If using UDP command set, you must issue the Run Check Tag command.

Run Check Tag

The check tag is designed to test the Encompass reader system. The Run Check Tag command activates the check tag for a system test. The check tag is designed to operate without interfering with vehicle tag reads. The check tag function switches on for one synchronous pulse frame.

For optimum results, TransCore recommends that you operate the check tag when no vehicles are in the Encompass reader system read zone. Table 10-16 lists the command data.

Table 10-16 Run Check Tag Command (0025H)

Run Check Tag Command Data								Data Payload
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**	
Run Check Tag Command (MSB)								00H
Run Check Tag Command (LSB)								25H
Protocol				Interval				XXH

Protocol — This field sets the check tag protocol.

Protocol	Definition
0	IT2200, Title 21 – manual
1	SeGo, eGo, ATA – manual
2	IT2200, Title 21 – periodic
3	SeGo – periodic
E	Enable all protocols – periodic
F	Enable all protocols – manual

Interval — This field sets the time interval for the Periodic Check Tag test..

Interval	Definition
0	30 seconds
1	2 minutes
2	4 minutes
3	8 minutes
4	15 minutes
5	30 minutes
6	1 hour
7	2 hours
8	4 hours

Note: *There is no specific response to the Run Check Tag command. Any response is reported as a tag read through the Mode Command Group responses. The reader responds with a command complete.*

Set Check Tag Using the AI1200-Emulation Command Set

If you are using AI1200-emulation commands, then you must run command #813YX. This command activates the check tag for a system test. The check tag function switches on for one synchronous pulse frame. For optimum results, TransCore recommends that you operate the check tag when no vehicles are in the Encompass reader system read zone.

#813YX SET SYSTEM CHECK TAG PERIODIC TIME INTERVAL

This command sets the time interval for the periodic system check tag test and activates the check tag.

Format

`#813YX`

Parameters

Time interval Y = range 0–9 [30 seconds to 8 hours]

#813YX	Periodic Time Value
`#8130X`	30 seconds
`#8131X`	2 minutes
`#8132X`	4 minutes
`#8133X`	8 minutes
`#8134X`	15 minutes
`#8135X`	30 minutes
`#8136X`	1 hour
`#8137X`	2 hours
`#8138X`	4 hours
`#8139X`	8 hours

Tag Type X = range 0–3

where

0 = eGo, SeGo, or ATA – periodic

1 = Title 21 or IT2200 – periodic

2 = eGo, SeGo, or ATA – manual

3 = Title 21 or IT2200 – manual

E = enable all protocols – periodic

F = enable all protocols – manual

Note: *Enable all runs the check tag on all of the protocols that have been enabled by the Set Protocol command (#4ANNNN).*

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

F = enable all protocols

Response

#DONE	Valid setting
#ERROR	Invalid setting

Note: *You can choose only one value for X at a time.*

Hardware Preventive Maintenance and Troubleshooting Procedures

The Encompass reader system has limited serviceable parts, however, there are preventive maintenance steps that can help to keep the equipment operating to specification. This section describes the preventive maintenance steps and troubleshooting techniques that can help determine if a component is failing.

Hardware Preventive Maintenance Schedule

Table 10-17 lists the schedule of preventive maintenance activities for the Encompass reader system components.

Table 10-17 Preventive Maintenance Task Schedule

Period	Task Description
Weekly	Visually inspect the antennas for physical damage, such as cracks or stressed cables.
Quarterly	Visually inspect all transmit/receive and check tag antenna cables for signs of damage or water invasion.
Semiannually	Check the lane configuration. See Chapter 9 for detailed lane configuration settings. The AA3152 UTAs have two weep holes located at the lower left and right corners of the radome. Check that these holes are open to allow any trapped water to drain from the antenna. **Note** If the antennas are installed upside down (TransCore logo is upside down) drill two new weep holes in the lower left and right corners of the radome.
Annually	Check NEMA enclosure seal for signs of damage or water invasion.

Visual Inspection

The Encompass reader system is very reliable, so any service-related problems most likely will be due to external causes, such as damage to components. Visually inspect each system component and replace or repair components, if serviceable, as needed.

To perform a visual inspection

1. Inspect the transmit/receive antenna and check tag antenna for signs of damage or corrosion.
2. Check cables between the transmit/receive antenna, check tag antenna, and Encompass reader. Look for damage or loose connections.

Figure 10-8 shows the visual inspection process.

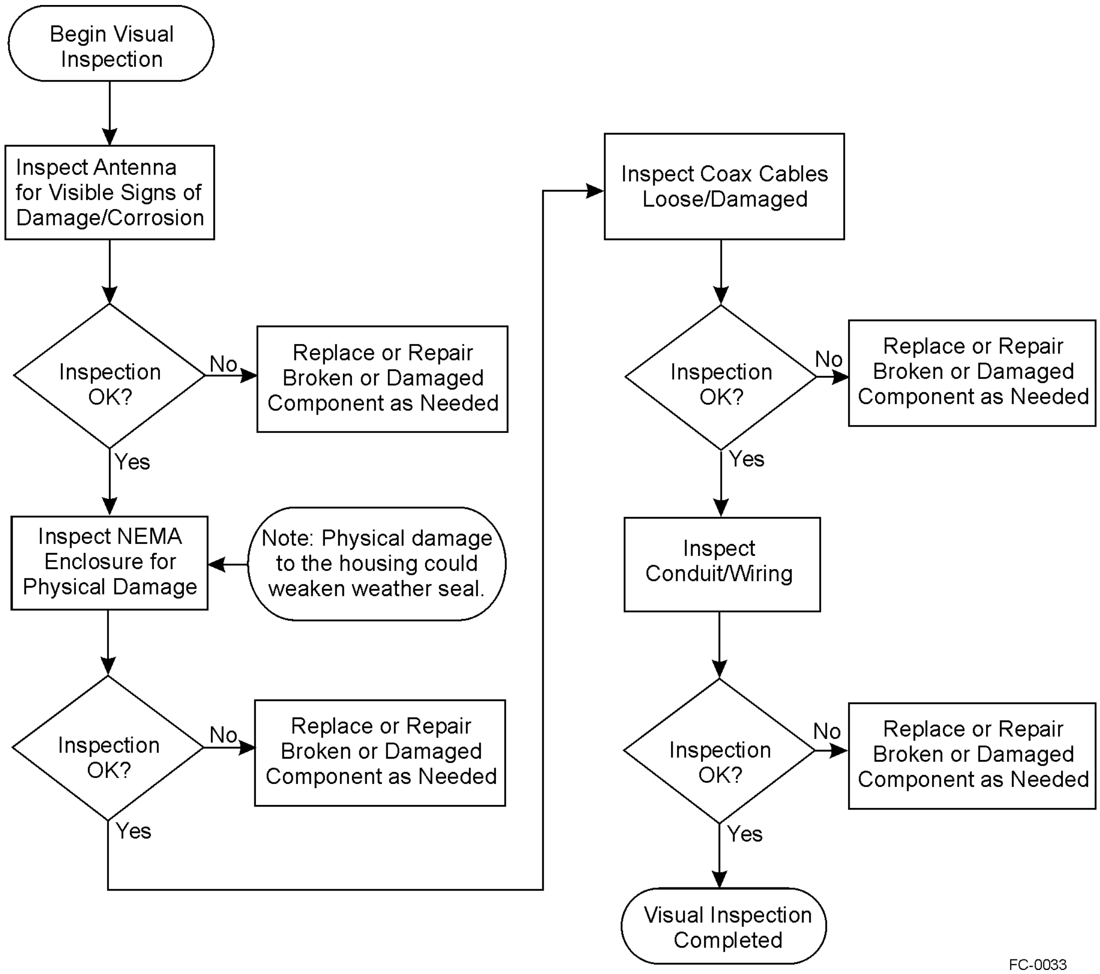

Figure 10-8 Visual Inspection Process

Replacement Instructions for Encompass Reader and AVI Equipment

This section explains how to replace an Encompass reader and other AVI equipment. This section shows Encompass readers that are installed in NEMA enclosures at the factory.

These instructions provide the following:

- Replacement instructions for an Encompass in a NEMA enclosure
- Replacement instructions for a transmit/receive antenna

Check tag assembly and antenna replacement instructions can be found in Appendix D, “Assembling the Check Tag Antenna” on page D-11.

Figure 10-9 shows the basic Encompass reader and its connection ports and LEDs.

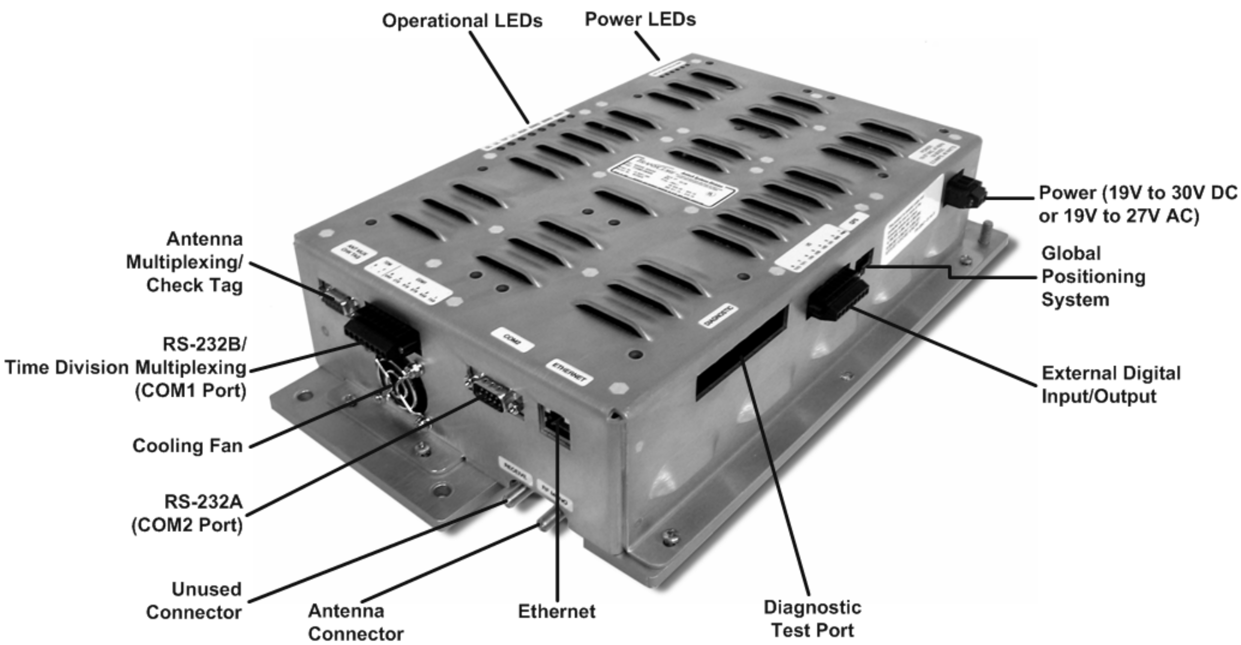

Figure 10-9 Connector and Indicator Locations on the Encompass Reader

Replacing an Encompass Reader in a NEMA Enclosure

Refer to Figure 10-9 for port and connector locations.

Note: *There are no serviceable parts on the Encompass reader. These instructions explain how to replace a failed Encompass reader only.*

To remove an Encompass reader in a NEMA enclosure

1. Open the NEMA enclosure.
2. Disconnect the power supply at the Encompass connector. Be sure to unscrew the two mounting screws on the connector before pulling connector away from the Encompass (Figure 10-10).

Figure 10-10 Encompass Power Plug

3. Using a 5/16-inch torque wrench, loosen and then disconnect the SMA connector on the RF antenna cable.

Note: *Be sure to move the cable and connector aside from the RF MONO connection before removing the Encompass reader from the NEMA enclosure.*

4. Disconnect Ethernet cable from Encompass reader.

   If the check tag assembly is not being returned, remove it from the Encompass reader.

5. Loosen the mounting screws and disconnect the check tag assembly data cable from the Encompass reader.
6. Using a 5/16-inch torque wrench, loosen and then disconnect the check tag antenna SMA connector from the check tag assembly.

Note: *Be sure to move this cable and connector aside before removing Encompass reader from NEMA enclosure.*

7. Loosen and remove the four locking nuts and washers securing the Encompass reader from the mounting posts. Carefully lift the Encompass reader out of the NEMA enclosure. Be sure to keep all hardware available for replacing the reader.
8. Return Encompass reader to TransCore.

To install an Encompass reader in a NEMA enclosure

1. Open NEMA enclosure.
2. Place Encompass reader onto the four mounting posts. Screw the washers and locking nuts over posts and tighten the locking nuts until snug-tight.

3. Place the check tag assembly atop Encompass reader (follow procedure outlined in “Installing the Check Tag Assembly” on page D-9).
4. Connect Ethernet cable to the Encompass reader.
5. Using a 5/16-inch torque wrench, tighten the SMA connector on the RF antenna cable to 10 in-lb.
6. Connect the power supply plug at the Encompass connector. Be sure to tighten the two mounting screws on the connector after plugging in connector at the Encompass reader.

Replacing a Transmit/Receive Antenna on a Gantry

To remove an antenna

1. Close traffic lane below where the antenna is being replaced.
2. Shut off RF power to the antenna.
3. Use an inclinometer to record the antenna angle from horizontal before moving it.
4. Cut off the shrink tubing from around the RF coaxial cable connector.
5. Disconnect the RF connector from the rear of the antenna.
6. Remove nuts and washers from U-bolts.
7. Remove antenna from mounting pipe.
8. Return antenna to TransCore.

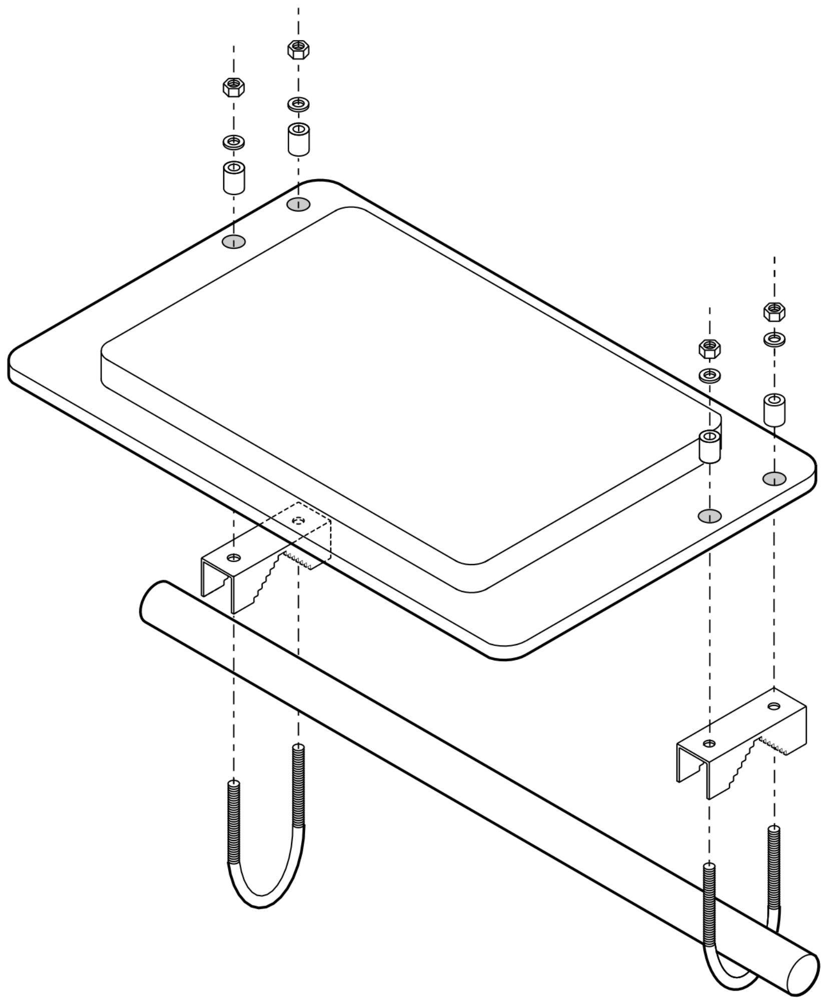

Figure 10-11 Transmit/Receive Antenna Mounting and Connections

To install a Transmit/Receive Antenna

1. Place the antenna below the mounting pipe and insert a U-bolt around the pole and down through the bracket on the side of the antenna closest to the center of the lane. This antenna should be mounted toward the driver side of the traffic lane. Place a spacer, lock washer, and nut over each end of the U-bolt, but do not tighten the nuts. Repeat for the other U-bolt (Figure 10-11).

CAUTION

Caution

When installing the antenna use only the mounting hardware provided. Do not use oversized washers to secure the plastic radome to the bracket. This practice can weaken the radome material.

2. Rotate the antenna up and toward oncoming traffic. Rotate up 15° from horizontal for a dedicated lane or 10° up for a mixed-use lane. Use an inclinometer or angle finder to check the angle.
3. Tighten nuts with a torque wrench to 50 ft-lb (68 N-m).
4. Slide the shrink tubing over the coaxial cable, but do not heat it.
5. Connect the coaxial cable to the antenna. Heat the shrink tubing at the back of the antenna after configuring the lane.

Preventive Maintenance Schedule

Table 10-18 lists the schedule of preventive maintenance activities for the Encompass reader components.

Table 10-18 Preventive Maintenance Schedule

Period	Task Description
Weekly	Visually inspect the antennas and NEMA enclosure for physical damage such as cracks or stressed cables.
Quarterly	Visually inspect all antenna and cables entering NEMA enclosure for signs of damage or water invasion.
Semiannually	Check the lane configuration. See Chapter 9, “Configuring the Lane.”

Removal and Replacement Procedures

This section outlines the procedures to remove or replace the Encompass reader components.

Transmit/Receive Antenna

Removal

To remove a transmit/receive antenna

1. Switch off power to the Encompass reader and disconnect the antenna from the port.
2. Remove shrink tubing covering connector.
3. Disconnect the antenna cable from the antenna.
4. Check the antenna mounting angle using an inclinometer and record the angle. Also, note the position of any spacers on the mounting bracket.
5. Remove the nuts holding the mounting bracket U-bolts, then remove the antenna.

6. When lane tuning is complete, use a heat gun to shrink the tubing covering the antenna cable connections.

Replacement

To install a replacement antenna

1. Position the new antenna along the mounting pipe.
2. Insert the U-bolts through the mounting brackets and secure with lock washers and nuts. Replace any spacers in the same position as before.
3. Set the antenna mounting angle to match the original antenna.
4. Tighten the mounting nuts to 50 ft-lb (68 N-m).
5. Put a length of heat shrink tubing over the antenna cable and connect the cable to the antenna.
6. Check the lane tuning.
7. When lane tuning is complete, use a heat gun to shrink the tubing covering the antenna cable connection.

Antenna Cable

Removal

To remove an antenna cable

1. Switch off power to the Encompass reader.
2. Disconnect the antenna cable from the Encompass reader antenna port.
3. Remove antenna cable from installation site. Because each installation may differ (e.g., cabling may be located inside or alongside mounting pipes), detailed removal instructions are not provided here.

Replacement

To install a replacement antenna cable

1. Route the new antenna cable between the antenna and Encompass reader as needed.
2. Connect the new cable to the Encompass reader at the antenna port.
3. Place a piece of heat shrink tubing over the antenna cable.
4. Connect the cable to the antenna.
5. Switch on power to the Encompass reader.
6. Check the lane tuning.
7. When lane tuning is complete, heat the shrink tubing covering the antenna cable connector.

Technical Support

Contact TransCore at 505-856-8007.

11

Remote Hardware Reset

Chapter 11

Remote Hardware Reset

This chapter provides information on resetting the Encompass® Reader remotely.

Performing a Remote Hardware Reset

You can perform a full hardware reset through the Ethernet interface on the Encompass Reader. To reset the Encompass Reader, the host sends three special packets in sequence. The Encompass Reader is reset when it receives these three packets correctly and in the correct order (Figure 11-1).

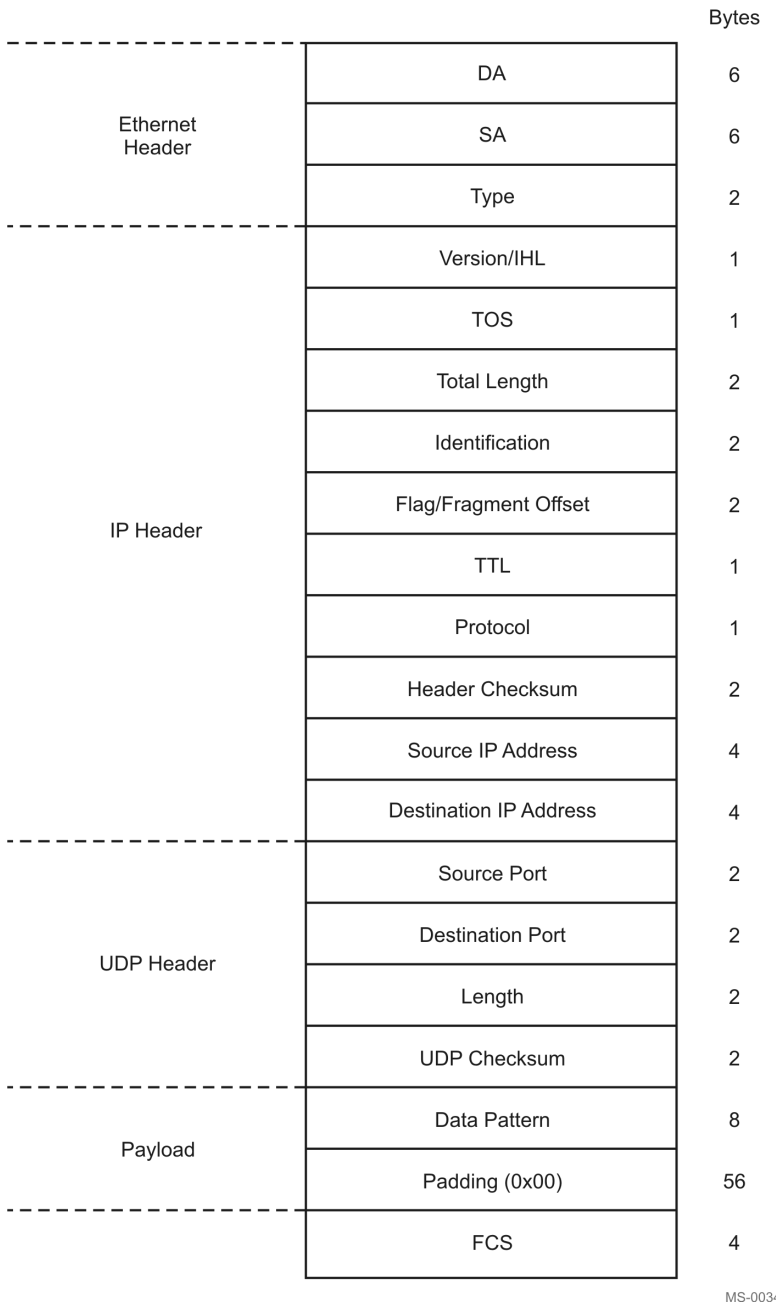

Figure 11-1 Packet Format for Remote Hardware Reset

As shown in Figure 11-1 in the packet payload, an 8-byte data pattern is used for remote reset. The three data patterns are defined as follows:

Data Pattern 1: `0xFFFFFFFFFFFFFFFF`

Data Pattern 2: `0x0000000000000000`

Data Pattern 3: `0xB0B5DEADBEEFCAFE`

The following fields in the packet are processed for remote reset:

- Destination Ethernet address
- Destination IP address
- Source IP address (the host must send packets for remote reset)
- Layer 4 protocol (must be UDP)
- Destination UDP port number
- Data pattern
- FCS (32-bit cyclic redundancy check (CRC))

Figure 11-2 shows the process for remote hardware reset control operation.

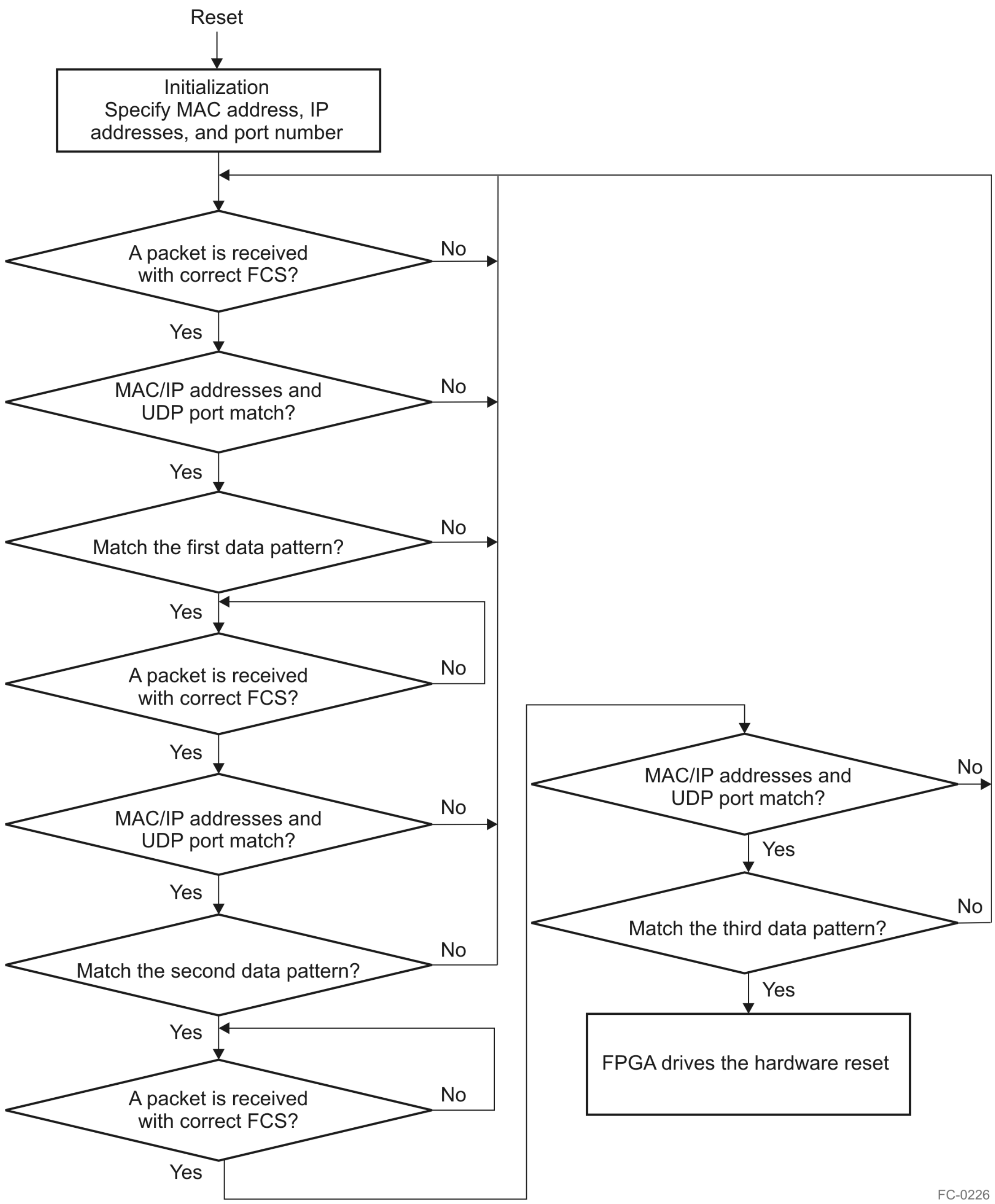

Figure 11-2 Remote Reset Control Operation Flow Chart

The definitions for acronyms used in Figure 11-1 and Figure 11-2 are listed here.

DA	Destination address
FCS	Frame check sequence
FPGA	Field programmable gate-array
IHL	Internet protocol header length
IP	Internet protocol
MAC	Media access control
SA	Source address
TOS	Type of service
TTL	Transistor-transistor logic
UDP	User datagram protocol

A

Acronyms and Glossary

Appendix A

Acronyms and Glossary

Acronyms and Glossary

A

A	amp(s)
A/V	audio/visual
AC	alternating current
ACK	acknowledge (data valid)
ADC	analog-to-digital converter
antenna	passive device that converts RF energy into magnetic energy (RF signal)
APP	application
ASCII	American Standard Code for Information Interchange
ATA	American Trucking Associations, which refers to a standard RF communications protocol and data storage method. ATA-type tags are read only.
AVI	automatic vehicle identification
AWG	American Wire Gauge

B

backscatter	portion of an RF signal that is modulated by a tag and radiated back to the reader
baud	measure of number of bits per second of a digital signal; for example, 9600 baud = 9600 bits per second
BCM	buffer control mode
bit	The smallest unit of information, consisting of a 0 or 1, that is formed from a binary digit
byte	binary character; for example, one 8-bit ASCII character

C

C	Centigrade
CHKSUM	checksum
cm	centimeter(s)
CMD	command
command	data set that is recognized by the receiving device as intending to elicit a specific response
CPU	central processing unit
CR	carriage return
CRC	cyclic redundancy check
crossover cable	Ethernet cable equivalent of a null modem for serial cables. The crossover cable is used so that two systems that use the same transmit and receive pins on the RJ-45 connector can communicate.
CS	commission status
CSN	command sequence number
CTRL	control
CTS	clear to send
CVISN	Commercial Vehicle Information Systems and Networks application, an ASTM Draft 6 Specification
CW	continuous wave

D

DAC	digital-to-analog converter
data	information that is processed by a computing device
DC	direct current
dB	decibel(s)
dB_i	decibel(s), referencing isotropic radiator
DIAG	diagnostic (command)
DL	downlink
DLL	dynamic link library

DM	diagnostic module
DOM	depth of modulation
DSR	data set ready
DTR	data terminal ready

E

ECP	error correcting protocol
EEPROM	electrically erasable programmable read-only memory
eGo®	Proprietary name for ANS INCITS 256-2001 and ISO 18000-6 compliant TransCore products. A registered trademark of TC IP, Ltd.
eGo PST	eGo Plus Sticker Tag
Encompass®	proprietary name for ANS INCITS 256-2001 compliant TransCore tag products. TransCore brand of readers that are capable of reading single to multiple tag protocols. The Encompass Multiprotocol Reader can read from all tag protocols within North America. A trademark of TC IP, Ltd.
eom	end of message
ERR	error
ESD	electrostatic discharge
ETC	electronic toll collection

F

f	frequency
F	Farenheit
FCC	Federal Communications Commission
field	physical area/space in which a tag can be read by the reader; also, an element of a data record/frame, for example, division within a tag's data frame
FIFO	first-in, first-out
FPGA	field programmable gate-array
frame	consecutive bits of data in memory that are read and written as a group
frequency bands	range of RF frequencies assigned for transmission by an RF device
ft	foot or feet
ftp	file transfer protocol

G

G	antenna gain referenced to an isotropic radiator
G	giga (10^9)

Gen Ack	general acknowledgment
GHz	gigahertz
GND	ground
GPS	global positioning system
GPSM	GPS module
GSE	group select equals

H

hex	hexadecimal
hexadecimal	base 16 numbering system that uses the characters 0 through 9 and A through F to represent the digits 0 through 15
HH	hours
hh	hundredths of seconds
host	device, generally a computer, that is connected to reader system components through the communications port
Hz	hertz

I

IC	Industry Canada
I/O	Input/output
IAG	Interagency Group
ID	identification; for example, encoded information unique to a particular tag, or an FCC identifier number
IEC/EN	International Electrotechnical Commission/*Comite, Europe, en de Normalisation*
IHL	Internet protocol header length
in	inch(es)
interface	connection point for communications with another device
IP	Internet protocol
ISTHA	Illinois State Toll Highway Authority

K

k	kilo (10^3)
kg	kilogram(s)
kHz	kilohertz

L

L	uniqueness counter timing feature
lane controller	device that is used to integrate all activity that occurs in a toll lane
lb	pound(s)
LC	lane controller
LCD	liquid crystal display
LCIM	lane controller interface module
LED	light-emitting diode
LF	line feed
LSB	least significant byte
LSW	least significant word

M

μs	microsecond(s)
m	meter(s)
M	million (10^6)
mA	milliamp(s)
MB	megabyte(s)
message	combination of fields, frames, and pages as required by the system to transmit or receive associated command and response data to and from the reader and host computer
MHz	megahertz
milli	one-thousandth (10^{-3})
MIM	mode interface module
ML	mounting location

mode	method of operation
MPI	multiprotocol interrogator
MPR	multiprotocol reader
ms	milliseconds
MSB	most significant byte
MSIM	system interface module
MSW	most significant word
mW	milliwatt(s)

N

N-m	Newton-meter(s)
NACK	nonacknowledge
NEMA	National Electrical Manufacturers Association
NIC	network interface card
null modem	a communications cable that allows you to connect to another PC or serial device using modem protocol.
NVRAM	non-volatile random access memory

O

ORT	open road tolling
OSHA	Occupational Safety and Health Administration

P

P	antenna input power
P/N	part number
PC	personal computer
PLL	phase-lock loop
PPS	pulse-per-second
protocol	specified convention for the format of data messages communicated between devices
PST	(eGo) Plus Sticker Tag

pw	password
PWA	printed wiring assembly

R

read	process of acquiring data from a device, for example, from a tag or from computer memory
reader	controlled interrogating device capable of acquiring data from a device, for example, acquiring and interrupting data from a tag
read zone	physical area in which a tag can be read by the reader system
RESP	response
RF	radio frequency
RFID	radio frequency identification
RFTIM	RF transceiver interface module
RI	ring indicator
RMS	root-mean-square
RSD	received line signal detect
RTS	request to send
RX	receive data
RXD	receive data

S

s	second(s)
S/N	serial number
SA	source address
S-record	an S-record file consists of a sequence of specially formatted ASCII character strings. An S-record is less than or equal to 78 bytes.
SeGo	SeGo is a superset of the TransCore eGo protocol.
seq	sequence
Ser Num	serial number
SGSPR	SeGo Streamlined Group Select Page Read
SI	system interface (command)

SIM	system interface module
SL	step-lock
SMA	sub-miniature A connector
SMC	serial management controller
SN	serial number
som	start of message
step-lock	a specific method of synchronizing RFID signals to eliminate or reduce the effect of interference among colocated RFID readers
system	a reader, RF module, antenna, and tag, which are described by the general application and interfaces with each other and any connected devices that are defined as being outside the system

T

tag	small, self-contained device acting as an identifying transponder
TBM	tag buffer module
TDM	time-division multiplexing, used in this document to refer to the use of time-division multiplexing of multiple readers in proximity of each other.
TDMM	TDM module
TIM	tag interface module
Title 21	state of California code of regulations, Chapter 16, Title 21, which is the standard used for AVI/DSRC (digital short-range communications) protocol
TM	traffic management, also timer module
toll	any application of the system equipment wherein the equipment is used to assist in the orderly collection of money in exchange for the passage of a vehicle through a particular installation point
T-RAIM	Timing-Receiver Autonomous Integrity Monitoring
transponder	a tag
TX	transmit data
TXD	transmit data

U

UDP/IP	User datagram protocol/Internet protocol
UL	uplink
UTA	universal toll antenna

V

V	volt(s)
V. Class	vehicle class
VCC	voltage controlled current
Ver	version (software)

W

W	watt(s)

B

Hardware Interfaces

Appendix B

Hardware Interfaces

This appendix describes the physical interconnections within the Encompass® Reader.

Hardware Interfaces

This appendix describes the hardware interfaces in the Encompass Reader and to external components, such as antennas. Figure B-1 shows the basic hardware interconnections for the Encompass Reader.

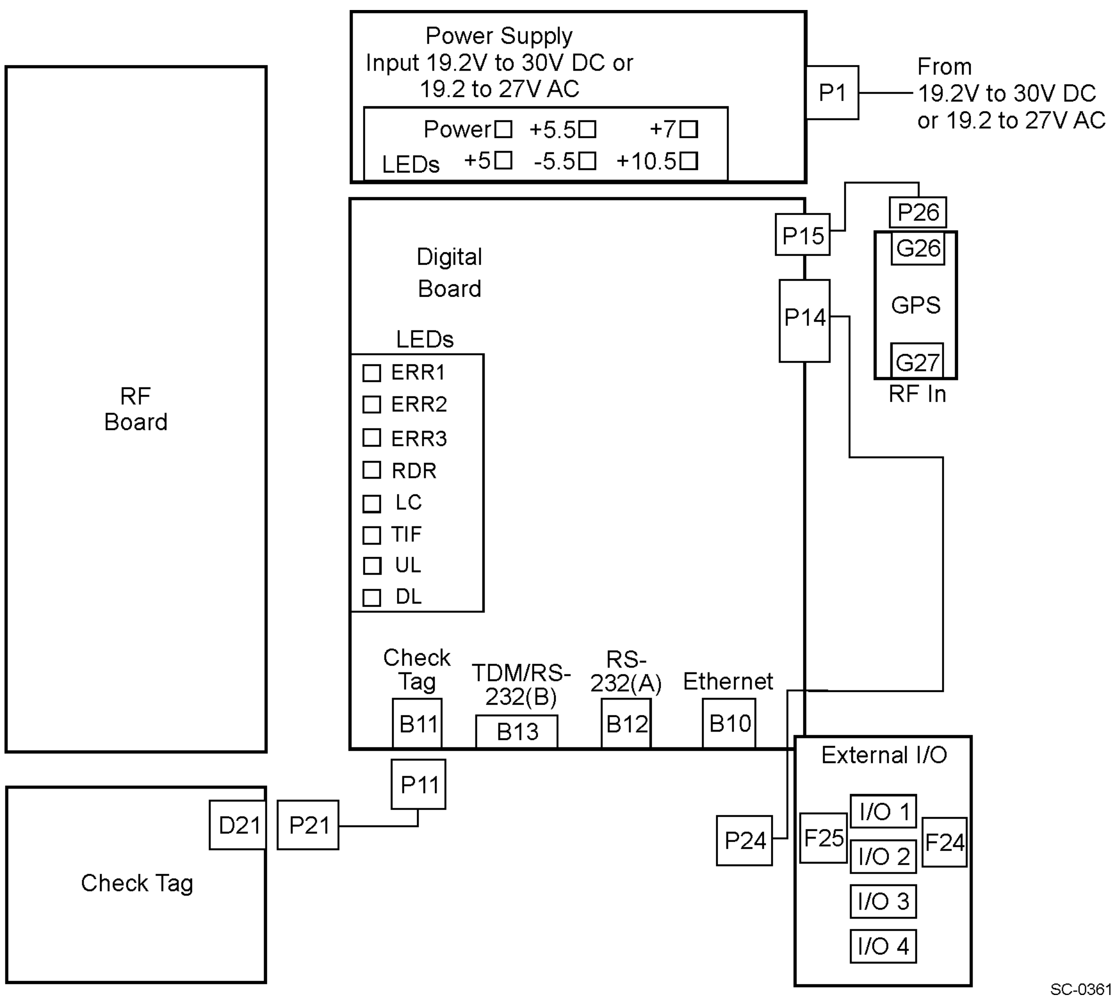

Figure B-1 Encompass Reader Hardware Interconnection Block Diagram

Communications

The Encompass Reader communicates with a host via an Ethernet or serial communication protocol.

UDP/IP Fast Ethernet Connection

The Encompass Reader communicates with a host via an Ethernet communications protocol. This connection requires an RJ–45 connector. If you connect the Encompass Reader directly to a host personal computer (PC) then you need a crossover cable. TransCore recommends that you use Belden 7929A Category 5e twisted-pair cable for Ethernet connections.

The Ethernet connector is an RJ-45 jack and uses a 100-base T interface. If the Encompass Reader is connected directly to the host system then a crossover cable is required. Table B-1 lists the Ethernet connector pin assignments.

Table B-1 Ethernet Connector

Pin	Signal	Description	568A[a]	568B[a]
1	TX+	Output Differential Transmit Data (+)	White w/ green stripe	White w/ orange stripe
2	TX-	Output Differential Transmit Data (-)	Green w/ white stripe or solid green	Orange w/ white stripe or solid orange
3	RX+	Input Differential Receive Data (+)	White w/ orange stripe	White w/ green stripe
4	Not connected	N/A	Blue w/ white stripe or solid blue	Blue w/ white stripe or solid blue
5	Not connected	N/A	White w/ blue stripe	White w/ blue stripe
6	RX-	Input Differential Receive Data (-)	Orange w/ white stripe or solid orange	Green w/ white stripe or solid green
7	Not connected	N/A	White w/ brown stripe or solid brown	White w/ brown stripe
8	Not connected	N/A	Brown w/ white stripe or solid brown	Brown w/ white stripe or solid brown

a. 568A and 568B are Ethernet cable designations.

TDM/COM1 Port

This connector is an 8-pin block header receptacle (TransCore P/N 33357-01). The signal descriptions are listed in Table B-2.

Table B-2 RS-232B/TDM Connector Parameters

Pin	Signal	Description	DB-9 Socket Connector
1	TXD	Transmit Data	2
2	RXD	Receive Data	3
3	DTR	Data Terminal Ready (not connected)	4
4	RTS	Request to Send	7
5	CTS	Clear to Send	8
6	GND	Ground	5
7	TDM+	TDM positive signal	-
8	TDM-	TDM negative signal	-

Diagnostic COM2 Port

This connector is a DB-9 subminiature plug. The diagnostic signal descriptions are listed in Table B-3.

Table B-3 Diagnostic Communications Connector Parameters

Pin	Signal	Description
1	RSD	Received line signal detect (not connected)
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready (not connected)
5	GND	Ground
6	DSR	Data Set Ready (not connected)
7	RTS	Request to Send
8	CTS	Clear to Send
9	RI	Ring indicator (not connected)

Hardware Diagnostic Port

This 40-pin connector is used for factory diagnostics checks. The signal parameters are listed in Table B-4.

Table B-4 Encompass Reader Hardware Diagnostic Port Parameters

Pin	Signal	Source	Description
1	I	RF	I channel from RF receiver
2	Q	RF	Q channel from RF receiver
3	IQ Switch	RF	Active channel: high for I, low for Q
4	RANGE_ADJ_CNTL	RF	Range adjust control signal
5	+3.3V	Digital	+3.3V
6	Spare	RF	N/A
7	GND	-	Ground
8	Spare	RF	N/A
9	Spare	RF	N/A
10	IAG_New_Sig_Det	RF	IAG new signal detection line
11	IAG	RF	IAG channel from RF receiver
12	GND	-	Ground
13	Config Type 0	Digital	Configuration selection bit 1
14	Config Type 1	Digital	Configuration selection bit 2
15	Config Type 2	Digital	Configuration selection bit 3
16	Config Type 3	Digital	Configuration selection bit 4
17	Tag Type Ack	RF	Acknowledges the tag type inputs and indicates that the DL and DOM DACS are settled.
18	Ready to Tx	RF	Ready to transmit
19	Config Load	Digital	Signal to RF to load new configuration
20	MOD	Digital	RF modulation signal
21	RF ON/OFF	Digital	RF on-off control
22	UL/DL Cntrl	Digital	Controls whether active source is uplink or downlink
23	TDM	Digital	TDM synchronization pulse
24	GPS 1pps	Digital	1 pulse-per-second signal for frequency stabilization

Table B-4 Encompass Reader Hardware Diagnostic Port Parameters (continued)

25	Error (txcvr fault)	RF	RF error indicator active low
26	Power Supply Fault	Digital	Fault signal from the power supply board
27	GND	-	Ground
28	Tx Serial Comm	Digital	Transmit serial signal
29	Rx Serial Comm	RF	Receive serial signal
30	GoodTagRead	Digital	Active high pulse from FPGA1
31	CRC Failed	Digital	Active high pulse from FPGA1
32	ActivatePort	Digital	Enable the test port buffer when the connector plugged in
33	GND	-	Ground
34	SW1	Digital	GPIO from MPC852
35	SW2	Digital	GPIO from MPC852
36	SW3	Digital	GPIO from MPC852
37	SW4	Digital	GPIO from MPC852
38	DecoderOutput	Digital	Decoder bit stream from FPGA1
39	PLL Clock (decoder)	Digital	PLL clock from FPGA1
40	GND	Digital	Ground

Antenna Multiplexer/Check Tag Connector

The antenna multiplexer is used to power multiple antennas in multiple AVI lanes. This connector is a DB9 subminiature connector. The signal descriptions are listed in Table B-5.

Table B-5 Antenna Multiplexer Connector Pin-outs

Pin	Signal	Description
1	Trinity_Control	Check tag control signal
2	Antenna Mux Control A	Control signal A for antenna multiplexer
3	CTMEM_WR_EN	Check tag control signal
4	IT2200 Control	Check tag control signal
5	GND	Ground
6	+5V PWR	+5V power
7	Antenna Mux Control B	Control signal B for antenna multiplexer

Table B-5 Antenna Multiplexer Connector Pin-outs

8	No signal	Not connected
9	RESET	Check tag reset

External Digital Input/Output Connector

This connector is used for the digital input/output assembly, which is used to interface the Encompass Reader with external inputs and outputs. Inputs can be devices such as light curtains or loops, and outputs can be devices such as gates or lights (connector is TransCore P/N 33357-01). The signal descriptions are listed in Table B-6.

Table B-6 Digital I/O Connector Pin-outs

Pin	Signal	Description	I/O	Type	Level
1	5V PWR	5V power supply for I/O board	O	Supply	+5V DC ±2%
2	GND	GND	I/O	Return	Ground
3	I/O Signal 1		I/O	CMOS	+5.0V
4	I/O Signal 2		I/O	CMOS	+5.0V
5	I/O Signal 3		I/O	CMOS	+5.0V
6	I/O Signal 4		I/O	CMOS	+5.0V
7	Tag in Field 1[a]	Contact Closure 1 for Tag in Field Signal	I/O	Switch	+5.5V
8	Tag in Field 2[a]	Contact Closure 2 for Tag in Field Signal	I/O	Switch	+5.5V

a. 125 mA maximum switch rating

C

System Technical Specifications

C

System Technical Specifications

This appendix provides reference specifications for the Encompass® Reader components.

Component Specifications

This appendix describes the engineering specifications for the reader components. This appendix does not include specifications for reader options, those are described in Appendix D, “Options.”

Encompass Reader

The reader environmental specifications are listed in Table C-1.

Table C-1 Encompass Reader Environmental Specifications

Environment	Specification
Shock	10 G, sawtooth pulse @11ms duration
Vibration	5-20 Hz: 0.1 inch; peak to peak 20-200 Hz: 2 G peak **Note** No more than 2-dB tag-in-box sensitivity degradation under the vibration conditions on all 3 axis
Temperature range	Operational without a NEMA enclosure: -40C to +70C Operational mounted inside a NEMA 4X enclosure: -40C to +55C Storage temperature range: –40C to +85C
Humidity	0% to 95% noncondensing over all temperatures.

AA3152 Universal Toll Antenna

The AA3152 Universal Toll Antenna (UTA) specifications are as follows:

- Operates in the location and monitoring service band (902 to 928 MHz).
- Optimum radiation pattern — Virtually no side or back lobes help to confine

antenna coverage to a single lane.

- Weatherproof — Each antenna is housed in a radome made of materials with favorable electrical characteristics and resistance to ultraviolet radiation.
- Bandpass filtering helps to attenuate interference from other RF sources.

Environmental Specifications

The AA3152 UTA can withstand the environmental tolerances shown in Table C-2.

Table C-2 Antenna Environmental Tolerances

Environment	Specification
Dust	NEMA pub 250-1991, Sec. 6.5, page 18
Rain	NEMA pub 250-1991, Sec. 6.4, page 17 and Sec. 6.7, page 19
Corrosion resistance	NEMA pub 250-1991, Sec. 6.9, page 20
Shock	5 G ½-sine pulse, 10 ms duration, 3 axes
Vibration	0.5 G_{rms} 10-500 Hz
Temperature range	-40°F to +167°F (-40°C to +75°C)
Humidity	100% condensing

D

Encompass Reader Options

Appendix D
Encompass Reader Options

This appendix will describe each of the options available with the Encompass® Reader.

Encompass Reader Options

This appendix describes the installation, operation, technical specifications, and preventive maintenance for the options available with the Encompass Reader. Not all of the options can be used on the same Encompass Reader due to conflicts between the connectors.

- “NEMA 4X Enclosure”
- “Check Tag Assembly and Antenna”
- “Antenna Multiplexer”
- “Digital Input/Output Assembly”
- “Global Positioning System Timing Option”

Figure D-1 shows the optional assemblies.

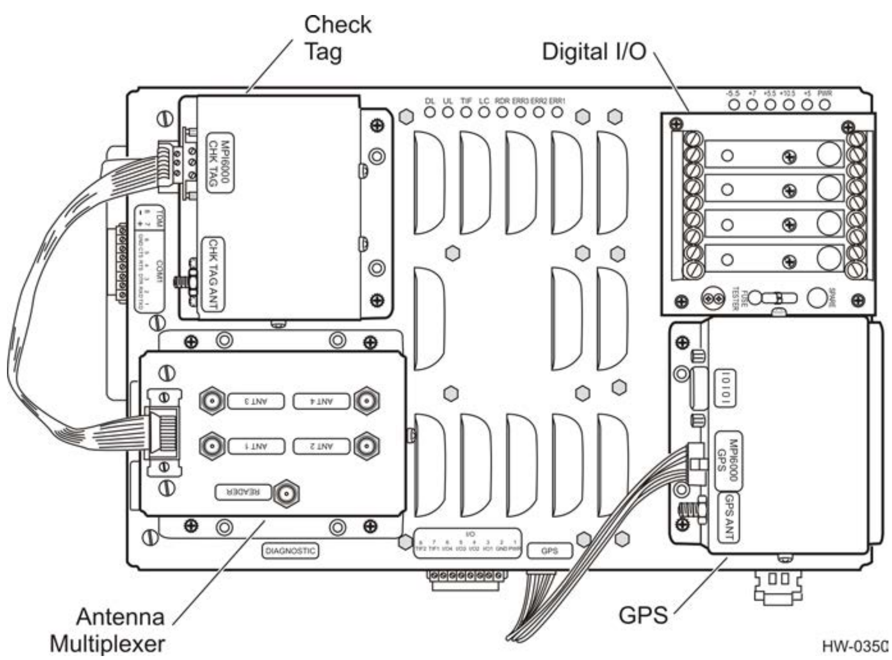

Figure D-1 Connector Locations for External Options

NEMA 4X Enclosure

The NEMA enclosure is a weatherproof fiberglass enclosure with easy, flip-open latches. For the Encompass Reader application, the NEMA enclosure comes mounted to a stainless steel backing plate. The entire assembly is then mounted to a pole or other structure using the mounting hardware provided with the NEMA kit.

Caution
TransCore recommends that you install the NEMA enclosure with the cable connectors at the bottom.

Required Equipment/Tools

Before proceeding, make sure you have the following TransCore-supplied items:

- Cable entry system (TransCore P/N 71023-01)
- Tube of Dow Corning® 111 Valve Lubricant and Sealant

You need the following additional equipment and tools to install the NEMA enclosure:

- 5/16-inch torque wrench for SMA connector on RF antenna cable. The maximum torque specification for the SMA connector is 10 inch-pounds (in-lb). Do not exceed this specification.
- Two adjustable wrenches with 3-inch (7.6-cm) jaw capacity and/or two wrenches available from Roxtec (www.roxtec.com) to tighten gland assembly
- Standard set of tools (wrenches, screwdrivers, and pliers)

Figure D-2 shows the NEMA enclosure and backplate.

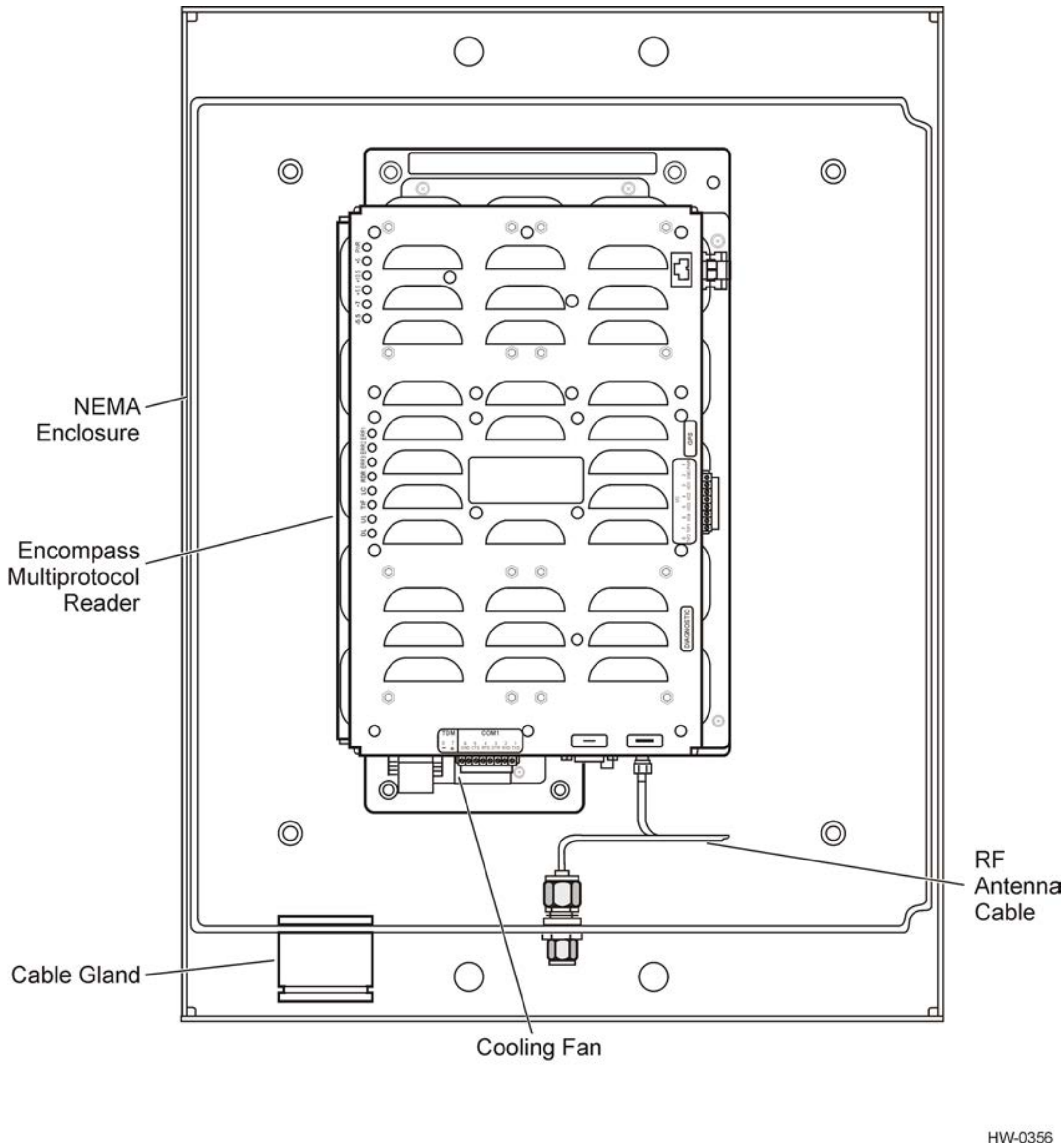

Figure D-2 Encompass Reader Mounted in NEMA Enclosure

NEMA Enclosure Connections

TransCore offers three NEMA enclosure options:

- NEMA enclosure that has a cable gland and one RF cable connector
- NEMA enclosure without the cable gland and one RF cable connector
- NEMA enclosure with the cable gland and two RF cable connectors

If your NEMA enclosure has the cable gland (TransCore P/N 71023-01), you need to install it. This connector routes the wires and cables from the Encompass Reader through the NEMA enclosure wall. You need to follow the installation instructions packed with the Roxtec cable gland kit.

Caution
TransCore recommends that you use the Dow Corning lubricant instead of the lubricant supplied with the Roxtec gland housing.

1. Pull all cables and wires through the gland and secure the gland in accordance with the packed instructions.
2. Check all wiring and cable connections before installing the NEMA enclosure.

If you chose the NEMA enclosure without the cable gland, you will need to install a different cable pass-through fitting into the NEMA enclosure.

Installation/Mounting

Connect the stainless steel backplate used to mount the NEMA enclosure to earth ground using a ground cable and stake. TransCore recommends that you follow the National Electric Code for lightning protection for the locale where you are installing the Encompass Reader. Figure D-3 shows an example of a site installation using a

NEMA enclosure.

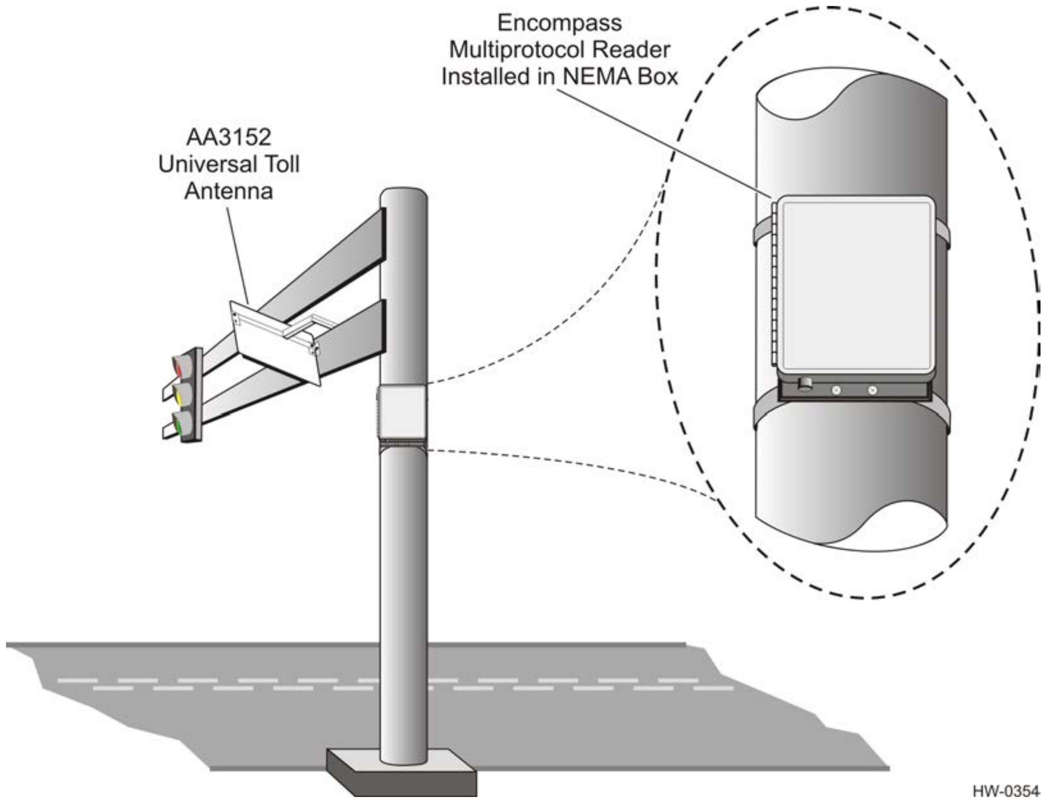

Figure D-3 Sample NEMA Enclosure Installation

Caution

To protect the Encompass Reader, TransCore also recommends that you attach the mounting plate to the ground cable. To ensure that the mounting structure and NEMA enclosure housing the Encompass Reader are sufficiently grounded, have a licensed electrician certify the grounding system.

If you install the backplate on a mounting pole or other assembly that is sufficiently grounded to earth, and all of the surfaces are good conductors, you may not need to use a grounding cable.

Tighten the mounting hardware to 50 ft/lb (68 N/m) to ensure that the box will sustain vibration requirements.

Troubleshooting the NEMA Enclosure Installation

These troubleshooting procedures need to be completed.

- Check power supply

- Check ground cable continuity

Testing

Once you have installed the Encompass Reader/NEMA enclosure, connect the Encompass Reader to the other system components and then configure and test the entire system. Follow the operating procedures listed in Chapter 3.

Preventive Maintenance

Perform visual inspection of NEMA enclosure. Open NEMA enclosure and check for moisture. Check bulkhead connections for leakage.

Technical Specifications

The backing plate dimensions are22.20 x 16.75 x 1.50 in (56.4 x 42.5 x 3.81 cm). The NEMA enclosure dimensions are 18.6 x 18.0 x 10.6 in (47.2 x 45.7 x 26.9 cm).

Check Tag Assembly and Antenna

This section explains how to install and connect the check tag assembly and check tag antenna.

Installing the Check Tag Assembly

Before proceeding, make sure you have the following TransCore-supplied items:

- Check tag accessory kit (TransCore P/N 13-6000-001), which consists of the items listed in Table D-1:

Table D-1 Check Tag Accessory Kit Contents

Quantity	Description
1	Check tag assembly
1	Check tag antenna assembly (see “Required Supplies for Assembling and Installing Check Tag Antenna” on page D-11)
1	DB9 ribbon cable assembly
4	#6-32 x 3/8 inch stand-off
4	#6-32 x 1/4 inch Phillips screw
2	3/4-inch round spacer
1	Coaxial in-line attenuator, 8-dB, 1 watt, SMA
1	RF cable assembly

Note: *The 8-decibel inline attenuator supplied with the check tag assembly kit should be adequate for most applications; however, the attenuator value may need to be adjusted depending on a customer’s reader and system configuration.*

Note: *If you plan to use a check tag and antenna multiplexer on the same Encompass Reader, you must use a different data cable (TransCore P/N 08315-01) to connect the two optional assemblies to the Encompass Reader’s DB-9 port.*

You need the following additional equipment and tools to install the check tag assembly.

- 50-ohm coaxial cable from check tag to check tag antenna (no more than 3 decibel (dB) loss in cable). Use same type of coaxial cable as used to connect RF antenna to Encompass Multiprotocol Reader.)
- N-type coaxial cable connectors
- Cable terminating/crimping tools

- Torque-limiting wrench (in-lb range)
- Standard set of tools (wrenches, screwdrivers, and pliers)

Mounting and Connecting the Check Tag Assembly

To mount and connect the check tag assembly

1. Check that you have all parts as listed on the check tag assembly accessory kit.
2. Insert and tighten the four mounting stand-offs.
3. Place the check tag assembly on top of the stand-offs and secure with Phillips screws.
4. Connect 8-dB inline attenuator to check tag assembly antenna port (Figure D-4) and tighten to 10 in-lb.
5. Connect check tag antenna cable fitting to other end of inline attenuator and tighten to 10 in-lb.
6. Connect the serial cable to the serial ports on the check tag assembly and Encompass Reader. Secure connections by tightening screws.

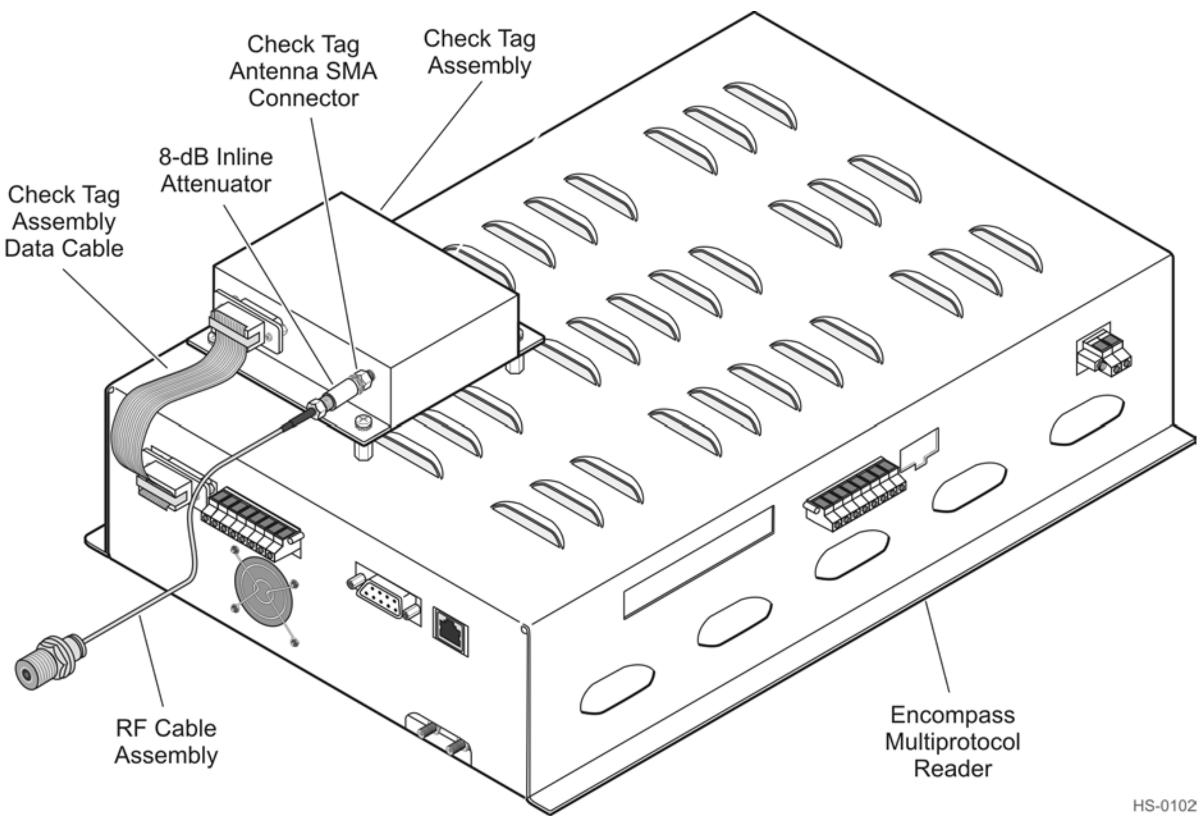

Figure D-4 Check Tag Assembly Mounted on Encompass Housing

Do not connect the check tag antenna cable to the check tag assembly until you have completed the antenna installation.

The check tag is mounted next to or directly on a Universal Toll Antenna (UTA).

CAUTION

Caution

When using a non-TransCore supplied enclosure, to prevent damage to the SMA connectors, TransCore strongly recommends that you provide a strain-relief bracket or other means of securing the antenna coaxial cable that terminates at the check tag assembly.

Assembling the Check Tag Antenna

Follow the instructions in this section to assemble and install the check tag antenna.

Required Supplies for Assembling and Installing Check Tag Antenna

- Check tag antenna kit (TransCore P/N 05429-01), which consists of the items listed in Table D-2:

Table D-2 Check Tag Antenna Accessory Kit Contents

Quantity	Description
1	Check tag antenna mounting bracket
1	N-connector antenna mount
1	Antenna connector spacer
1	3/32” hex wrench
2	O-ring, .614”, .754” OD
1	Antenna

- Standard set of tools
- Torque wrench with 0 to 100 ft-lb (0 to 136 N-m) range

Note: *Check tag antenna has been factory-tuned to 912 MHz. This setting permits operation in the 902.25 to 921.5 MHz frequency range.*

To assemble the check tag antenna and base

1. Insert whip antenna into collar (Figure D-5).

CAUTION

Caution

Ensure the whip antenna is fully seated in the collar.

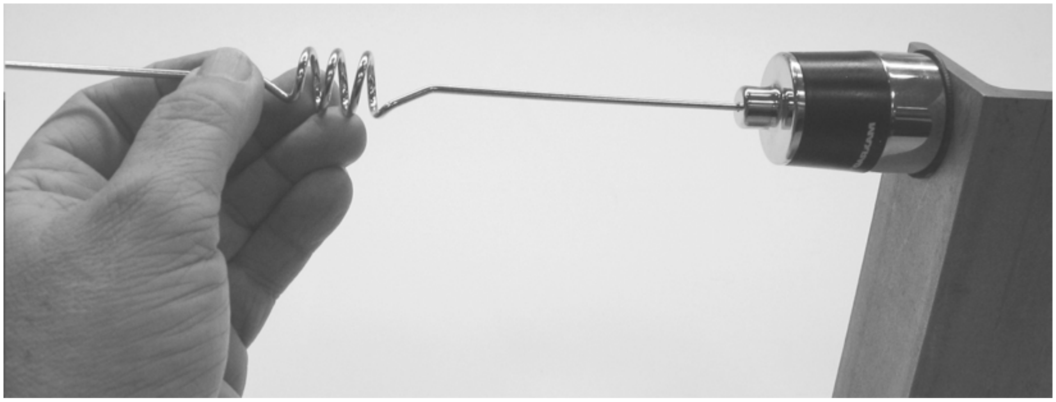

Figure D-5 Whip Antenna Inserted into Collar

2. Tighten the lower and upper hex screws (Figure D-6).

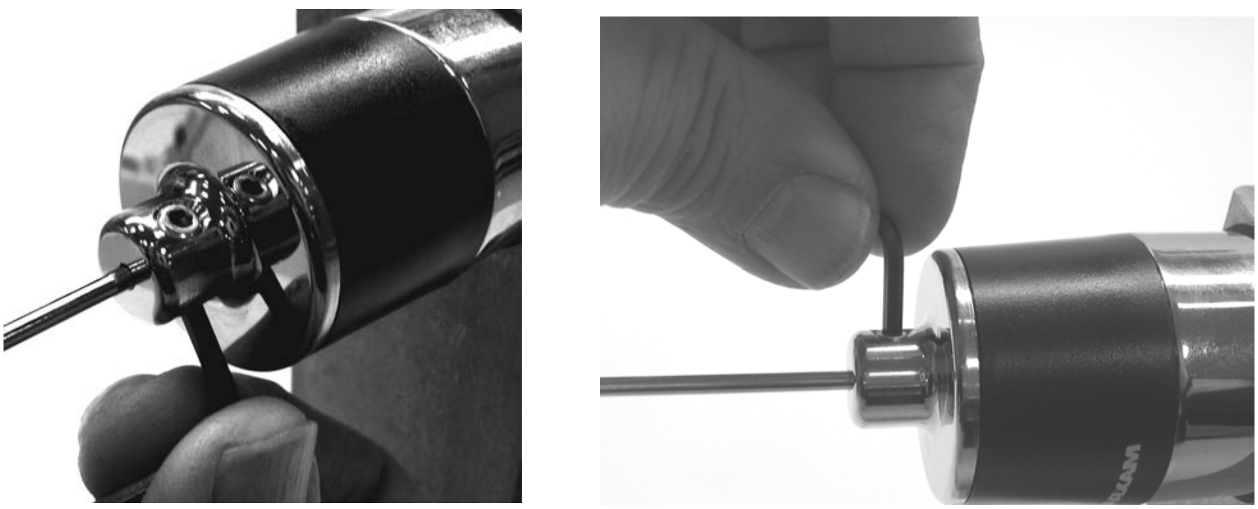

Figure D-6 Lower and Upper Hex Screws

The check tag antenna is now ready for installation with the UTA.

Installing the Check Tag Antenna with UTA

Figure D-7 shows where the check tag antenna is located in the reader system. The check tag antenna is installed on a mounting pipe next to the UTA and the check tag antenna extends in front of the UTA radome. For UTA installations that do not use a mounting pipe, the check tag antenna can be installed on the antenna radome.

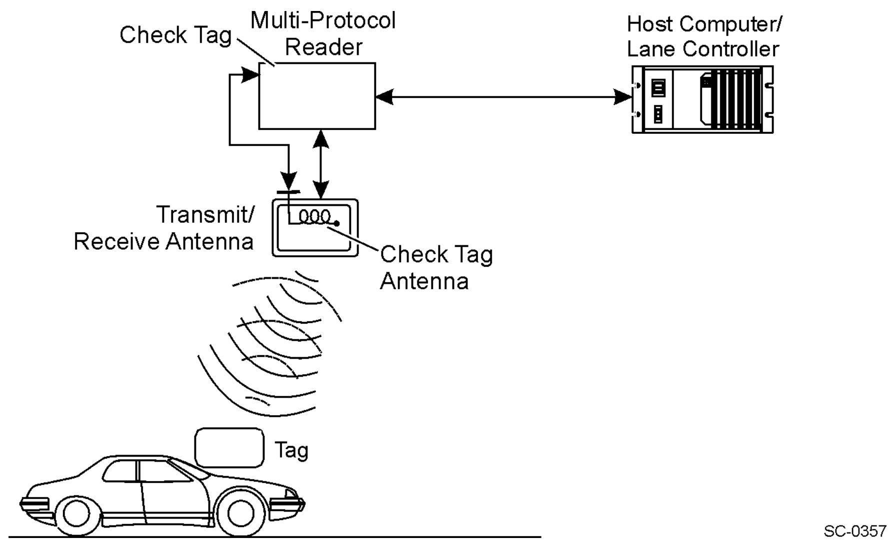

Figure D-7 Installation Location for Check Tag Antenna

To install the check tag antenna on the mounting pipe next to the UTA

1. Place the check tag antenna along the mounting pipe and insert a U-bolt around the pole and through the mounting bracket. Place a washer, spacer, lock washer and nut in that order over each side of the U-bolt. For a typical configuration, adjust the check tag antenna so that it is about 1 inch (2.5 cm) from and centered on the transmit antenna. It should extend across about 1/3 of the transmit antenna's width. The check tag antenna should be visible to the receive antenna.
2. Tighten the nuts with a torque wrench to 50 ft-lb (68 N-m).
3. Slide the shrink tubing over the check tag antenna cable, but do not heat it.
4. Leave the shrink tubing loose until you have finished tuning the lane.

Figure D-8 illustrates the correct way to mount a check tag antenna on the mounting pipe next to the UTA.

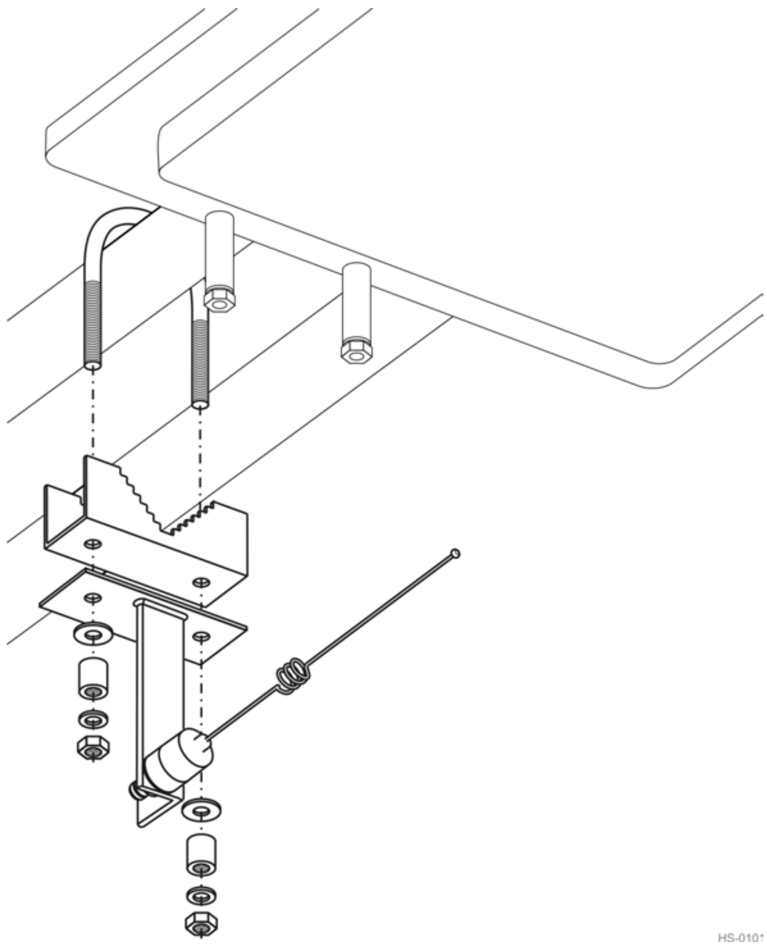

Figure D-8 Check Tag Antenna Installed on Mounting Pipe

To install the check tag antenna on the UTA radome

1. Place the check tag antenna on the UTA radome. On the end opposite the check tag antenna, place a 1-inch spacer, lock washer, and locking nut over each end of the U-bolt. At the end where you are mounting the check tag antenna, place a short spacer (9/16 inch) between the check tag antenna bracket and UTA radome. Place a lock washer and nut over each of the bolts.
2. Tighten the nuts with a torque wrench to 50 ft-lb (68 N-m).
3. Slide the shrink tubing over the check tag antenna cable and heat shrink it.

Figure D-9 shows the correct way to mount the check tag antenna on the UTA.

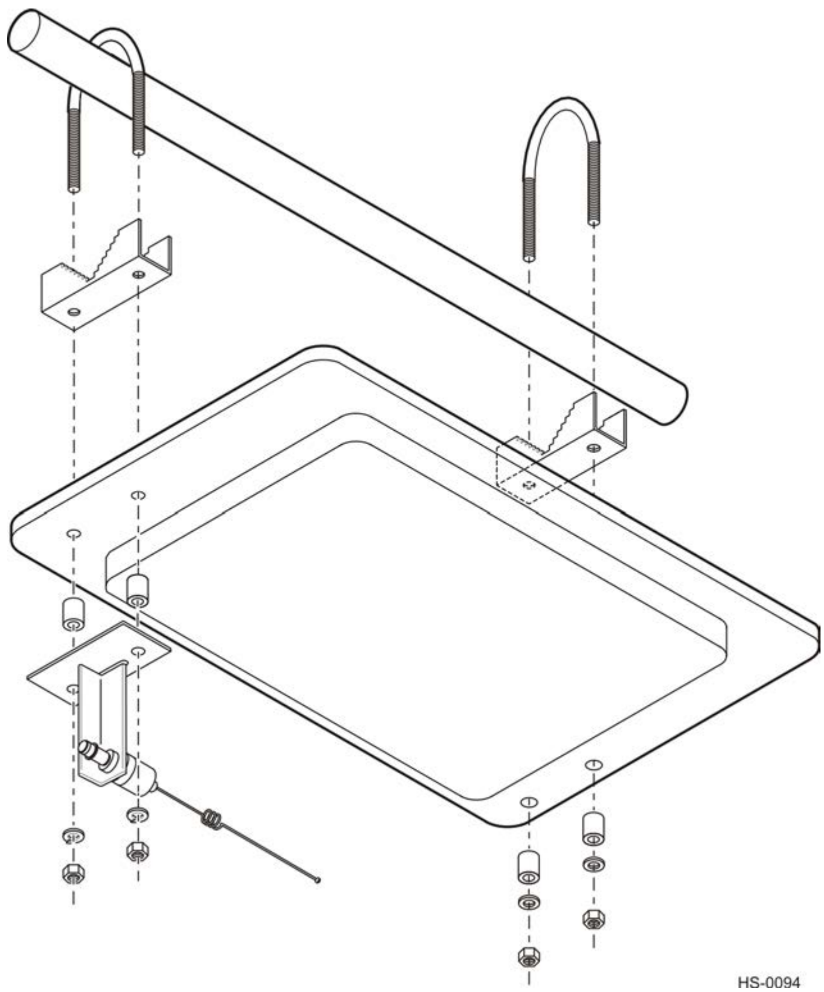

Figure D-9 Check Tag Antenna Installed on UTA Radome

Testing the Check Tag Using UDP Commands

Once you have installed the check tag assembly and antenna, test the check tag to see if it is working properly.

Before testing the check tag, remove all other tags in the field or run the test with no vehicles present.

To test the check tag using UDP commands

Set the check tag using the Run Check Tag command.

Run Check Tag

The check tag is designed to test the Encompass Reader system. The Run Check Tag command activates the check tag for a system test. The check tag is designed to operate without interfering with vehicle tag reads. The check tag function switches on for one synchronous pulse frame.

For optimum results, TransCore recommends that you operate the check tag when no vehicles are in the Encompass Reader system read zone. Table D-3 lists the command data.

Table D-3 Run Check Tag Command (0025H)

Run Check Tag Command Data								Data Payload
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
Run Check Tag Command (MSB)								00H
Run Check Tag Command (LSB)								25H
Protocol				Unused				X0H

Protocol — This field sets the check tag protocol.

Protocol	Definition
0	IT2200, Title 21 – manual
1	SeGo, eGo, ATA – manual
2	IT2200, Title 21 – periodic
3	SeGo – periodic
E	Enable all protocols – periodic
F	Enable all protocols – manual

Note: *There is no specific response to the Run Check Tag command. Any response is reported as a tag read through the Mode Command Group responses. The reader responds with a command complete.*

Testing the Check Tag Using AI1200-Emulation Commands

To test the check tag using AI1200-emulation commands

1. Enter the appropriate #813YX SET SYSTEM CHECK TAG PERIODIC TIME INTERVAL command for the tag mode using a host terminal.
2. Enter command #00 to place the reader in data mode. The reader sends a check tag response to the host terminal.

#813YX SET SYSTEM CHECK TAG PERIODIC TIME INTERVAL

This command sets the time interval for the periodic system check tag test and activates the check tag.

Format

`#813YX`

Parameters

Time interval Y = range 0–9 [30 seconds to 8 hours]

#813YX	Periodic Time Value
#8130X	30 seconds
#8131X	2 minutes
#8132X	4 minutes
#8133X	8 minutes
#8134X	15 minutes
#8135X	30 minutes
#8136X	1 hour
#8137X	2 hours
#8138X	4 hours
#8139X	8 hours

Tag Type X = range 0–3

where

0 = eGo, SeGo, or ATA – periodic

1 = Title 21 or IT2200 – periodic

2 = eGo, SeGo, or ATA – manual

3 = Title 21 or IT2200 – manual

E = enable all protocols – periodic

F = enable all protocols – manual

Note: *Enable all runs the check tag on all of the protocols that have been enabled by the Set Protocols command (#4ANNNN).*

Pre-condition

Not applicable

Post-condition

This command takes effect immediately.

Default

F = enable all protocols

Response

#DONE	Valid setting
#ERROR	Invalid setting

Note: *You can choose only one value for X at a time.*

Troubleshooting

If the testing shows the check tag is not working, follow the steps in Table D-4 and Table D-5 to troubleshoot the check tag.

Table D-4 Failure During Check Tag Test

Indication	Action
No response to check tag read request	Repeat the check tag test described in the Testing section, being careful to verify that all test parameters are correctly set.
Slow or intermittent read count or incorrect check tag response	The check tag antenna may have failed. Verify that the check tag antenna is correctly positioned in relation to the UTA. See Figure D-8 or Figure D-9 for correct location of check tag antenna depending on the installation. Be sure that the check tag antenna coaxial cable is securely fastened to the check tag antenna port on the check tag assembly and that the data cable is securely fastened between the check tag assembly and the Encompass Reader. Repeat the check tag test described in the Testing section. If the problem persists, replace the check tag antenna.

Table D-5 Unacceptable RF Attenuation Statistics Using Check Tag

Indication	Action
Unacceptable RF attenuation statistics using check tag	Verify that the check tag antenna is correctly positioned in relation to the UTA. See Figure D-8 or Figure D-9 for correct location of check tag antenna depending on the installation. Be sure that the check tag antenna cable is securely fastened to the check tag antenna port on the check tag assembly and that the data cable is securely fastened between the check tag assembly and the Encompass 6. Repeat the Run Check Tag command described on page D-14. If the problem persists, replace the check tag antenna.

Preventive Maintenance

Visually inspect the check tag antenna and coaxial cable and replace or repair components as needed.

To perform a visual inspection

1. Inspect the check tag antenna for signs of damage or corrosion.
2. Check cables between the check tag assembly and Encompass Reader. Look for damaged or loose connections.

Check Tag Antenna Removal and Replacement Procedures

To remove the check tag antenna

1. Disconnect the check tag antenna cable.
2. Note the position of the check tag antenna with relation to the UTA. See Figure D-8 or Figure D-9 for correct check tag antenna mounting location.
3. Remove the nuts securing the antenna to the mounting bracket U-bolts or the UTA radome, then remove the check tag antenna. If you do not have a replacement check tag antenna available, be sure to fasten the UTA by replacing the mounting hardware.

To install the replacement check tag antenna

1. Follow the steps outlined previously for installing the check tag antenna.
2. Perform a check tag test.
3. When lane tuning is complete, use a heat gun to shrink the tubing covering the check tag antenna cable connection.

Technical Specifications

The specifications apply to the check tag assembly and check tag antenna.

Check Tag Assembly

Table D-6 lists the check tag assembly specifications.

Table D-6 Check Tag Assembly Specifications

Parameter	Specification
Operating temperature Installed in NEMA enclosure Not installed in NEMA enclosure	-40°F to +131°F (-40°C to +55°C) -40°F to +158°F (-40°C to +70°C)
Storage temperature	-40°F to +185°F (-40°C to +85°C)
Humidity	0% to 95% noncondensing
Power supply	+5V DC ±0.1V
Current	<20 mA
Vibration 5 to 20 Hz 20 to 200 Hz	0.1 inch, peak-to-peak displacement 2.0 G, peak acceleration
Vibration, random limits 10 to 500 Hz	2 g_{rms}
Shock	10 G, sawtooth, 11-ms duration

Table D-7 lists the frequency range for each tag protocol.

Table D-7 Check Tag Frequency Range

Protocol	FCC Frequency Range (MHz)	
	Downlink (modulated)	**Uplink (continuous wave)**
eGo	911.75 - 919.75	902.25 - 903.75 910.00 - 921.50
SeGo	911.75 - 919.75	
IT2200	912.75 - 918.75	
Title 21	912.75 - 918.75	

Check Tag Antenna

Table D-8 lists the check tag antenna specifications.

Table D-8 Check Tag Antenna Specifications

Parameter	Specification
Polarization	Linear with Universal Toll Antenna
Output VSWR	<1.5:1
Gain	3 dB

Antenna Multiplexer

The antenna multiplexer option provides a means for multiplying the coverage of a single Encompass Reader to four antennas covering four traffic lanes.

Required Components/Tools

Before installing the antenna multiplexer assembly, make sure you have the necessary components.

Antenna Multiplexer Accessory Kit (TransCore P/N 14-6000-001), which consists of the items listed in Table D-9.

Table D-9 Antenna Multiplexer Accessory Kit Contents

Quantity	Description
1	Antenna multiplexer assembly
4	#6-32 x 3/8 inch stand-off
4	#6-32 x 1/4 inch Phillips screw
1	Reader-to-antenna multiplexer RF cable
1	DB9 ribbon cable assembly

Note: *If you are installing an antenna multiplexer assembly and check tag assembly on the same Encompass Reader, you need to use a different DB9 data cable (TransCore P/N 08315-01) to connect the two assemblies.*

You need the following additional equipment and tools to complete the installation, testing, and troubleshooting.

- 50-ohm coaxial cable from antenna multiplexer assembly cable port(s) to RF antenna(s) (no more than 2 decibel (dB) loss in cable). Use same type of coaxial cable as used to connect RF antenna to Encompass Multiprotocol Reader.)
- N-type plug connectors and SMA plug connectors
- 50-ohm, 2-watt receptacle SMA termination for unused antenna multiplexer output ports
- RF power meter and RF source capable of operating in the 915-MHz frequency range
- Cable terminating/crimping tools
- Torque-limiting wrench (in-lb range)

- Standard set of tools (wrenches, screwdrivers, and pliers)

Installation/Mounting

Refer to Figure D-10 for all procedure steps listed here.

To mount the antenna multiplexer assembly on the Encompass Reader

1. Screw the four standoffs into the mounting holes as shown in Figure D-10.
2. Place the antenna multiplexer assembly on the standoffs and secure with the Phillips screws provided in the kit.
3. Connect and secure the DB9 data cable.
4. Connect the antenna multiplexer assembly (READER port) to the Encompass reader (RF MONO port) with the RF cable and tighten both SMA connectors to 10 in-lb.
5. Connect all antenna coaxial cables to multiplexer ports ANT0, ANT1, ANT2, ANT3, if used, and tighten all SMA connectors to 10 in-lb.

Note: *You must terminate all unused antenna multiplexer output ports using a 50-ohm, two-watt SMA termination.*

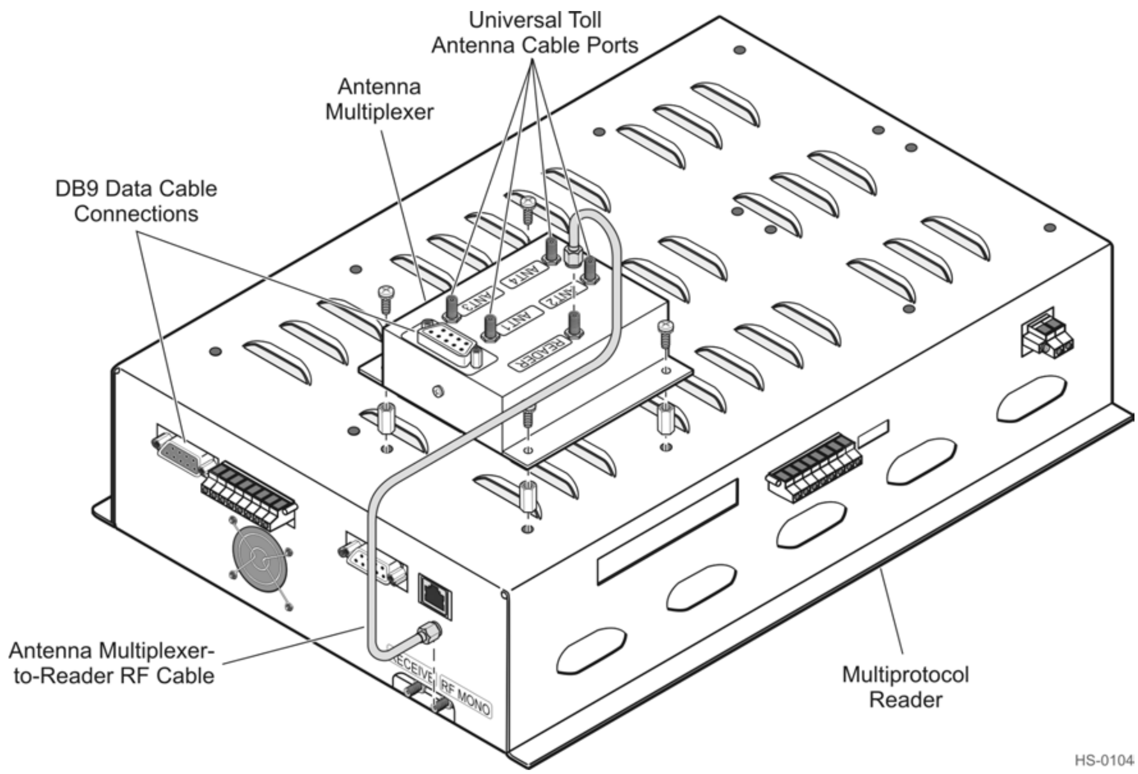

Figure D-10 Antenna Multiplexer Assembly Location

Caution

When using a non-TransCore supplied enclosure, to prevent damage to the SMA connectors, TransCore strongly recommends that you provide a strain-relief bracket

or other means of securing the antenna coaxial cables that terminate at the antenna multiplexer assembly.

Figure D-11 shows the locations of the reader and the four antenna connections.

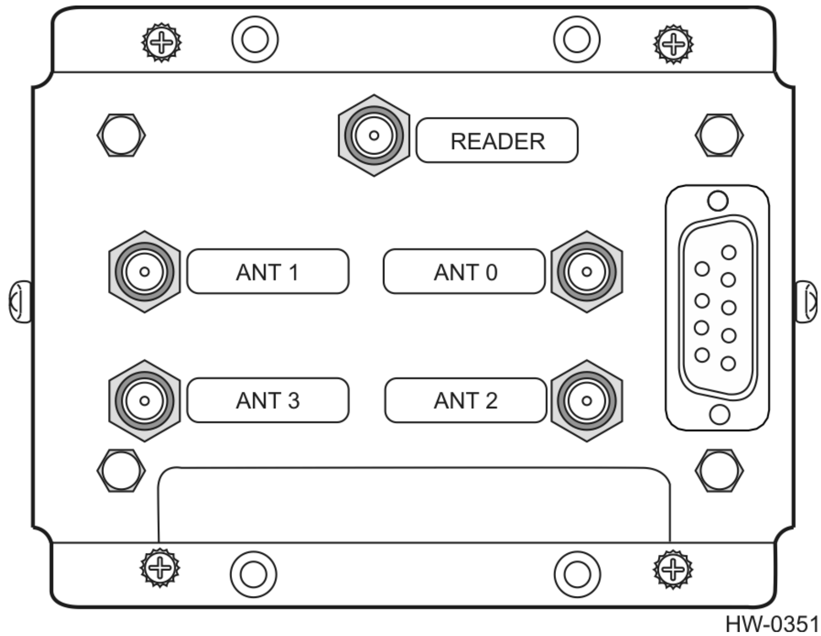

Figure D-11 Antenna Multiplexer Connector Locations

With the Encompass Reader RF output connected to the antenna multiplexer input (READER), the multiplexer output can be directed via a host computer by sending the appropriate UDP or AI1200-emulation commands.

Testing the Antenna Multiplexer Components Using UDP Commands

To test the antenna multiplexer using UDP commands, place a tag under antenna 0 and send the following commands:

- Set/Get Digital I/O RF Multiplexing Mode (0008H/0009H)
- Set/Get Manual Antenna Channel Control

Testing the Antenna Multiplexer Components Using AI1200-Emulation Commands

To test the antenna multiplexer using AI1200-emulation commands, place a tag under antenna 0 and send a #6401 command. You should receive a tag read response. Continue the test for the other three antennas 1, 2, and 3 by sending commands #6402, #6403, and #6404. For each succeeding test, place the test tag under the corresponding antenna. You should get the results listed in Table D-10.

Table D-10 Antenna Multiplexer Results Using AI1200-emulation Commands

Test	Tag Read			
	Antenna 0	Antenna 1	Antenna 2	Antenna 3
#6401	Y	N	N	N
#6402	N	Y	N	N
#6403	N	N	Y	N
#6404	N	N	N	Y

Refer to #642N commands when using the automatic multiplexing operation. Be sure to send a #6405 command to restore automatic multiplexing operation after sending #640N manual multiplexing commands. Command #311 Append Auxiliary Information appends the antenna number to the tag response.

Troubleshooting the Installation

If the testing shows the antenna multiplexer is not working, perform these troubleshooting steps.

1. Ensure that the cables are not crossed and are routed to the correct antennas.
2. Verify that the connectors at the antenna multiplexer, Encompass Reader, and at the UTAs are connected.
3. Verify that the data cable between the Encompass Reader and the antenna multiplexer is connected.
4. Test the line loss for each RF cable between the antenna multiplexer and the UTAs.
5. Connect the RF power meter to the RF source without the cable in-line and measure the power.
6. Connect the RF power meter to the RF source with the cable in-line and measure the power.

   Line loss is the difference between the two measurements. Line losses greater than 2 dB indicate potential problems for SeGo and eGo protocol installations. Large line losses indicate potential cable problems. Inspect the suspect cable for faulty terminations or connectors. Replace and/or repair as needed.

   If Steps 1 to 6 do not remedy the problem, contact TransCore Systems Engineering for further assistance.

Preventive Maintenance

Visually inspect the antenna multiplexer assembly and coaxial cables and replace or repair components as needed.

To perform a visual inspection

1. Inspect the UTAs for signs of damage or corrosion.
2. Check RF and data cables between the antenna multiplexer, Encompass Reader, and UTAs. Look for damaged or loose connections. Repair and/or replace cables as needed.

Technical Specifications

Table D-11 lists the antenna multiplexer specifications.

Table D-11 Antenna Multiplexer Specifications

Parameter	Specification
Operating temperature	-40°F to 158°F (-40°C to +70°C), when Encompass Reader is not installed in NEMA enclosure. -40°F to 131°F (-40°C to +55°C), when Encompass Reader is installed in NEMA enclosure.
Storage temperature	-40°F to 185°F (-40°C to +85°C)
Vibration 5-20 Hz (sinusoidal) 20-200 Hz (sinusoidal) 10-500 Hz (random)	 0.1 inch, peak-to-peak displacement 2.0 G, peak acceleration 2 gRMS
Shock	10 G sawtooth pulse at 11-ms duration
Humidity	0% to 95%, non-condensing

Table D-12 lists the RF control port cable pin-outs.

Table D-12 Antenna Multiplexer RF Control Port Pin-outs

Pin	Description	Function	Limits
1	Not connected	N/A	N/A
2	MUX_SEL_A	Switch logic input	0-5V, 2 mA maximum
3	Not connected	N/A	N/A
4	Not connected	N/A	N/A
5	GND	Ground	N/A

Table D-12 Antenna Multiplexer RF Control Port Pin-outs (continued)

Pin	Description	Function	Limits
6	+5V input	DC bias	5V ±5%, 5 mA maximum
7	MUX_SEL_B	Switch logic input	0-5V, 2 mA maximum
8	Not connected	N/A	N/A
9	Not connected	N/A	N/A

Digital Input/Output Assembly

The digital input/output (I/O) assembly is used to interface the Encompass Reader with external inputs and outputs. Inputs can be devices such as light curtains or loops, and outputs can be devices such as gates or lights.

The digital I/O circuit board can accommodate up to four OPTO 22 G4-model input or output modules and screw terminal connectors for connecting the Encompass reader to external interfaces.

Presence detectors (loop detectors, wheel detectors, infrared/laser lights) can be installed through the input sense circuits to turn on the Encompass reader when an object is detected approaching the reading range.

Output functions such as traffic lights, cameras, signs and gates may be controlled through the reader's status output circuits.

The output modules are controlled by 5V signals from the Encompass reader. The output modules support voltages up to 100V DC or 130V AC on their output pins. The input module outputs a 5V signal to the Encompass reader. The input modules recommended by TransCore use from 2.5V to 28V DC.

The OPTO 22 input/output modules are not supplied with the digital I/O assembly. Go to www.opto22.com for a listing of input and output modules.

Caution

The Encompass Reader digital I/O port is not surge protected, therefore TransCore strongly recommends that only OPTO 22 modules be used to configure any external I/O device that will be controlled through the digital I/O port. DO NOT connect any external device directly to the digital I/O port.

Damage to the Encompass Reader caused by power surges or spikes linked to incorrect use of the digital I/O port will void the reader warranty.

Required Components/Tools

Before installing the digital I/O assembly and modules, make sure you have the necessary components.

- Digital I/O Kit (TransCore P/N 77-6000-001). Here is a parts list for the kit:

Quantity	Description
1	Mounting rack for OPTO modules
4	#6-32 x 1/4 inch Phillips screw

- Phillips head screwdriver for installing the I/O assembly and modules to the Encompass reader.

- Assortment of 14-22 AWG wires to connect modules to mounting rack.

Installation/Mounting

To mount the digital I/O assembly on the Encompass reader

1. Place the assembly on the housing as shown in Figure D-12.

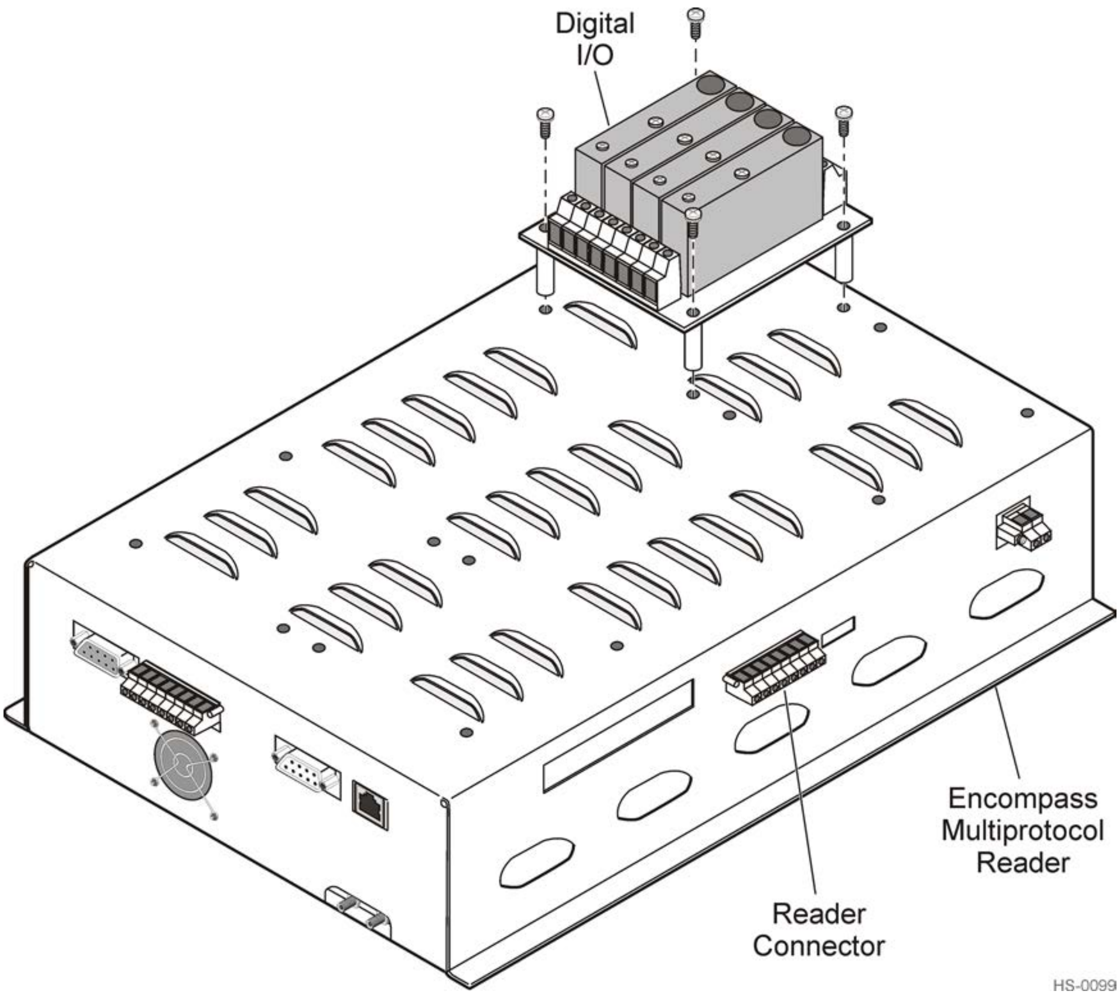

Figure D-12 Location of Digital I/O Assembly on Encompass Reader

2. Insert and tighten the four Phillips head mounting screws.
3. Insert I/O module(s) into assembly and tighten mounting screw at top of module.
4. Connect wires to plug (TransCore P/N 33357-01). TransCore recommends you use 14-22 AWG wire to connect modules to the mounting rack.
5. Connect mounting rack wires to Encompass reader plug as shown in Figure D-13.

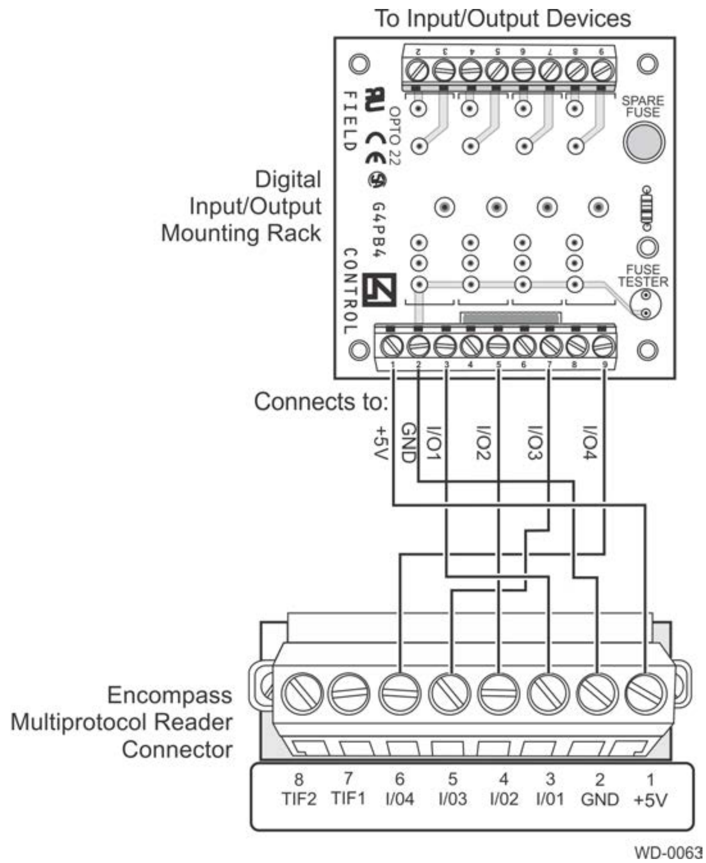

Figure D-13 Digital I/O Mounting Rack-to-Encompass Reader Connector Wiring Diagram

Figure D-14 shows sample wiring schematic for digital I/O Input 1.

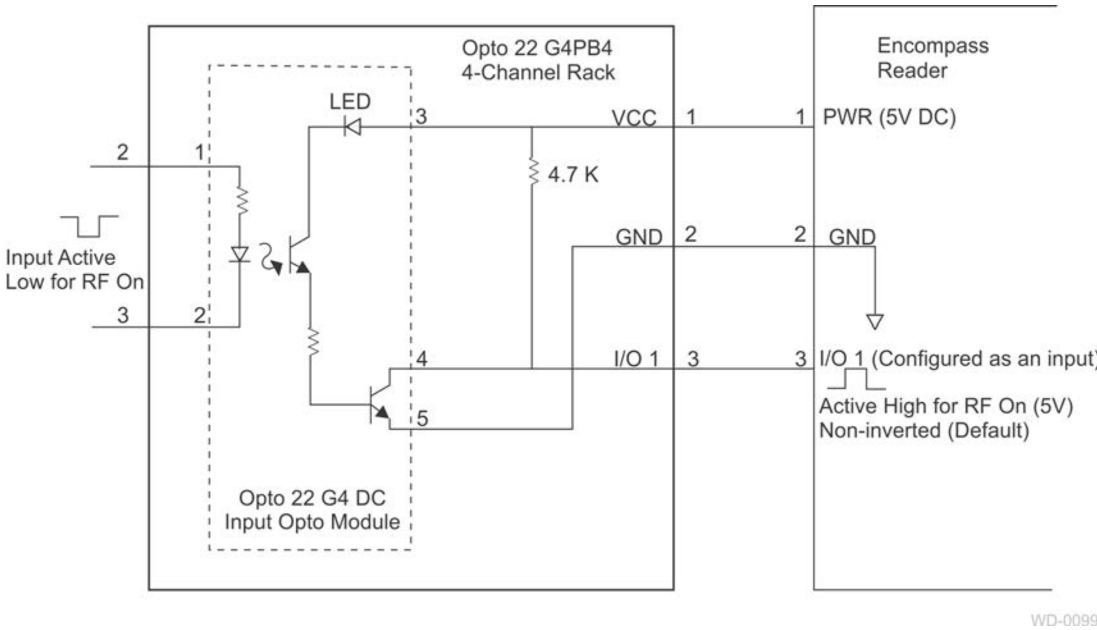

Figure D-14 Example of Digital I/O Input 1 Wiring

Testing the Digital I/O Components Using UDP Commands

To test the digital I/O components using UDP commands, send the applicable UDP commands listed in Table D-13.

Table D-13 Digital I/O Command Group Commands

Digital I/O Configuration Command	Command Code
Set Digital I/O Sensor Status Change Report	0000H
Get Digital I/O Sensor Status Change Report	0001H
Set Digital I/O Output Host Control	0002H
Get Digital I/O Output Host Control	0003H
Set Digital I/O Output Tag Read Control	0004H
Get Digital I/O Output Tag Read Control	0005H
Set Digital I/O RF Control	0006H
Get Digital I/O RF Control	0007H

Table D-13 Digital I/O Command Group Commands (continued)

Digital I/O Configuration Command	Command Code
Set Digital I/O RF Multiplexing Mode	0008H
Get Digital I/O RF Multiplexing Mode	0009H
Set Digital I/O Output Pulse Duration	000AH
Get Digital I/O Output Pulse Duration	000BH
Set Digital I/O Minimum Presence True Period	000CH
Get Digital I/O Minimum Presence True Period	000DH
Set Digital I/O Sensor Input Inversion	000EH
Get Digital I/O Sensor Input Inversion	000FH
Set Digital I/O Port Configuration	0010H
Get Digital I/O Port Configuration	0011H
Set Digital I/O Sensor Input Report	0012H
Get Digital I/O Sensor Input Report	0013H
Set Digital I/O Presence RF Control Algorithm	0014H
Get Digital I/O Presence RF Control Algorithm	0015H
Set Digital I/O Presence RF Control Time-Out Period	0016H
Get Digital I/O Presence RF Control Time-Out Period	0017H
Get Digital I/O Port Status	0018H
Set Digital I/O Mode	0019H
Get Digital I/O Mode	001AH
Set External Interrupt Control	056DH
Get External Interrupt Control	06ADH

Testing the Digital I/O Components Using AI1200-Emulation Commands

To test the digital I/O components using AI1200-emulation commands, send the appropriate I/O commands (e.g., #620N and #62N) to the external devices and verify the device response.

Troubleshooting

To troubleshoot the digital I/O assembly

1. Plug the spare fuse into the fuse tester. If the LED lights, the assembly has power. If the LED fails to light, replace the fuse and/or assembly.
2. Configure reader port direction (Set Digital I/O Port Configuration (0010H) for UDP and SET OPTO PORT(S) DIRECTION (#697N) for AI1200-emulation to required site application (i.e., number of inputs, number of outputs).
3. Toggle input lines by activating devices and ensure the devices assert correct signal and that the corresponding I/O module LED lights.
4. If performing steps 1 to 3 does not remedy the problem, contact TransCore Systems Engineering for further assistance.

Preventive Maintenance

Ensure that the I/O modules and wire connections are tight, and that the connection to the Encompass reader is secure.

Technical Specifications

Table D-14 lists the digital I/O assembly specifications.

Table D-14 Technical Specifications

Parameter	Specification
Nominal Input Voltage	5V DC ±0.1V DC
Dimensions	3.25 x 3.25 x 1.5 in. (8.26 x 8.26 x 3.8 cm) assembly only 3.25 x 3.25 x 2.25 in. (8.26 x 8.26 x 5.7 cm) assembly and modules
Weight	2.7 oz (76.5 g) assembly only 6.4 oz (181.4 g) assembly and modules
Operating temperature Installed in NEMA enclosure Not installed in NEMA enclosure	 -40°F to +131°F (-40°C to +55°C) -40°F to +158°F (-40°C to +70°C)
Storage temperature range	-40°F to +185°F (-40°C to +85°C)

Table D-14 Technical Specifications (continued)

Relative humidity	5% to 95% non-condensing

Guidelines for Ordering the I/O Modules

The digital I/O assembly can accommodate up to four OPTO 22 G4-model input or output modules for connecting the Encompass reader to external interfaces. TransCore recommends that the I/O modules have the following specifications:

Input Module — input voltage from Encompass reader: 2.5V to 28V DC; output voltage to Encompass reader: 5V DC logic

Output Module — input voltage from Encompass reader: 5V DC logic; output voltages of up to 100V DC or 130V AC on their output pins.

Table D-15 lists the acceptable OPTO 22 input modules and Table D-16 lists the acceptable OPTO 22 output modules to be used with the Encompass reader.

Table D-15 Acceptable Input Modules

OPTO 22 MODULE P/N	INPUT VOLTAGE	OUTPUT VOLTAGE
G4IAC5	90V-140V AC or DC	4.5V-6V DC
G4IAC5L	90V-140V AC or DC	4.5V-6V DC
G4IAC5MA	90V-140V AC or DC	4.5V-6V DC
G4IDC5	10V-32V DC or 12V-32V AC	4.5V-6V DC
G4IDC5B	4V-16V DC or AC	4.5V-6V DC
G4IDC5D	2.5V-28V DC	4.5V- 6V DC
G4IDC5K	2.5V-16V DC	4.5V-6V DC
G4IDC5MA	10V-32V DC or 12V-32V AC	4.5V-6V DC
G4IDC5-SW	Dry contact	4.5V-6V DC
G4IDC5-SWNC	Dry contact	4.5V-6V DC

Table D-16 Acceptable Output Modules

OPTO 22 MODULE P/N	INPUT VOLTAGE	OUTPUT VOLTAGE
G4OAC5	4V-8V DC	12-140V AC
G4OAC5FM	4V-8V DC	12-140V AC
G4OAC5MA	4V-8V DC	12-140V AC

Table D-16 Acceptable Output Modules (continued)

G4ODC5	4V-8V DC	5V-60V DC
G4ODC5FM	4V-8V DC	5V-60V DC
G4ODC5MA	4V-8V DC	5V-60V DC
G4ODC5R	4.8V-6V DC	100V DC or 130V AC
G4ODC5RFM	4.8V-6V DC	100V DC or 130V AC
G4ODC5R5	4.8V-6V DC	100V DC or 130V AC
G4ODC5R5FM	4.8V-6V DC	100V DC or 130V AC

You can configure the I/O assembly with any combination of the four modules; for instance, four inputs, four outputs, three inputs and one output, three outputs and one input, and so on.

Global Positioning System Timing Option

The Global Positioning System (GPS) timing option available on Encompass 6 and Encompass 5 Multiprotocol Readers permits a GPS-equipped multiprotocol reader in one plaza to be synchronized with another GPS-equipped multiprotocol reader in another location without being physically connected by a time-division multiplexing (TDM) data cable. This configuration is highly useful when physical barriers or boundaries prevent a TDM data cable between plazas to be used. The GPS option also can be used to synchronize any number of GPS-equipped multiprotocol readers when no physical barrier is present.

The GPS timing assembly, which uses the globally available NAVSTAR GPS satellite navigation and timing service, can provide a precise 1 pulse per second (PPS) timing signal to the Encompass Reader. The GPS timing assembly mounts to the top of the Encompass Reader (Figure D-15).

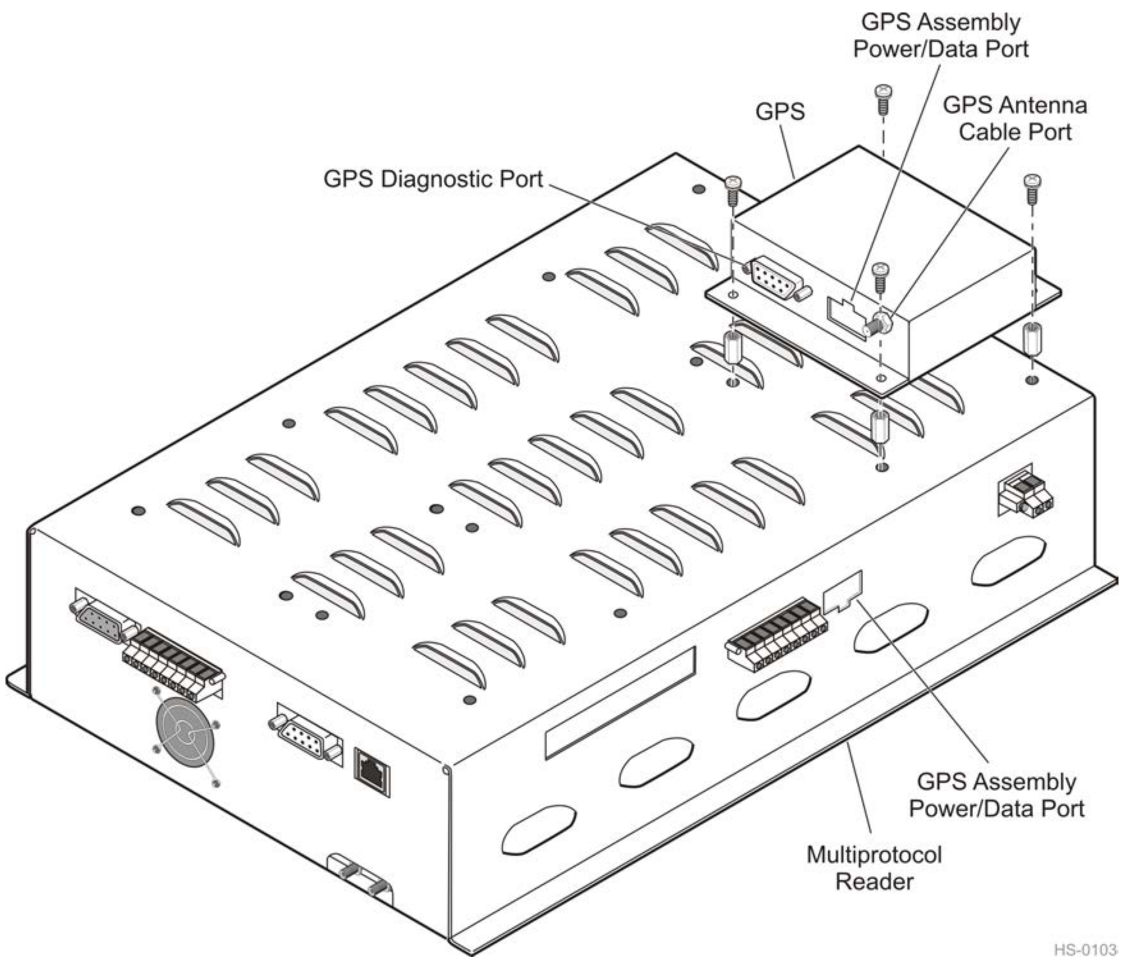

Figure D-15 GPS Assembly Mounted to Encompass Reader

This GPS timing option permits a GPS-equipped Encompass Reader in one plaza to be synchronized with another GPS-equipped Encompass Reader in another plaza without being physically connected by a TDM data cable (Figure D-16). This configuration is useful when physical barriers or long distances prevent a TDM data cable between plazas to be used.

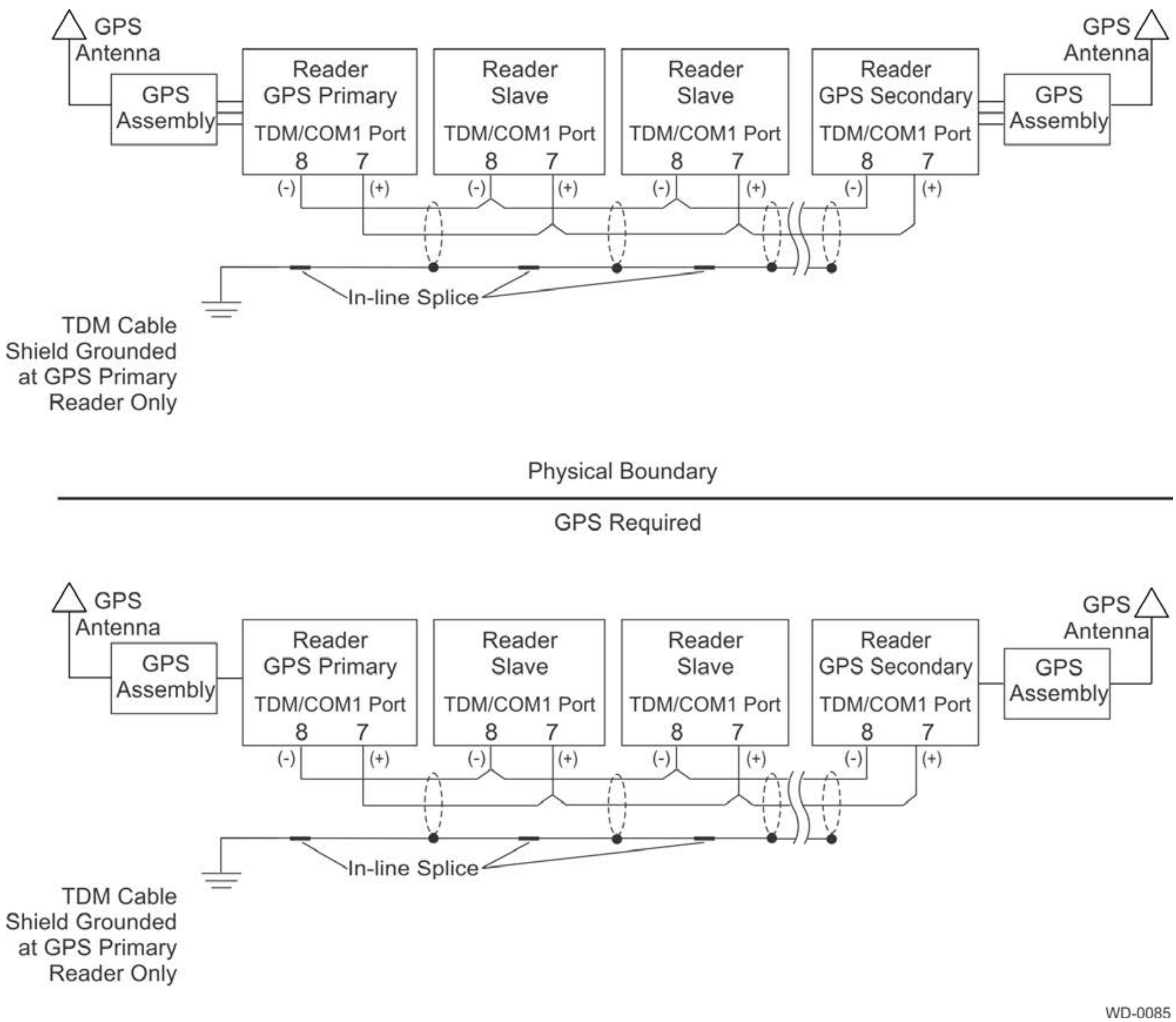

Figure D-16 TDM Configuration Using GPS Timing Option

TransCore recommends Belden 89182 (150 Ω impedance), which is a single twisted-pair shielded cable rated for outdoor use, or 8132 (120 Ω impedance), which is a double twisted-pair shielded cable that must be installed in conduit. The Belden 8132 cable has an extra pair that is not used. Using these low-loss, low-capacitance twisted-pair cable, a distance of 1000 feet (305 m) has been obtained. This maximum distance may be slightly longer or shorter depending on the cable type used.

TransCore recommends using the cable shielding and grounding scheme shown in Figure D-16 to reduce the risk of electromagnetic interference disrupting or damaging the TDM circuitry in the Encompass reader.

Additional slave Encompass Readers are connected to the primary Encompass Reader through pins 7 and 8 of the TDM/COM1 port (Figure D-17), which is located just above the fan. Refer to Figure D-15 for the connector location.

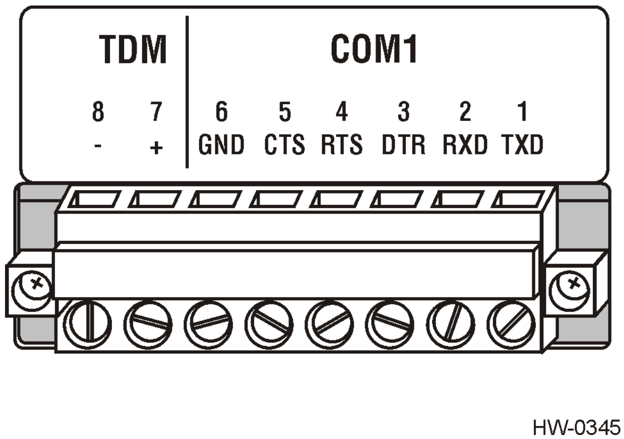

Figure D-17 GPS Timing Module Port

GPS Power and Data Connector

Figure D-18 shows the power and data connector and Table D-17 lists the connector pin assignments and descriptions.

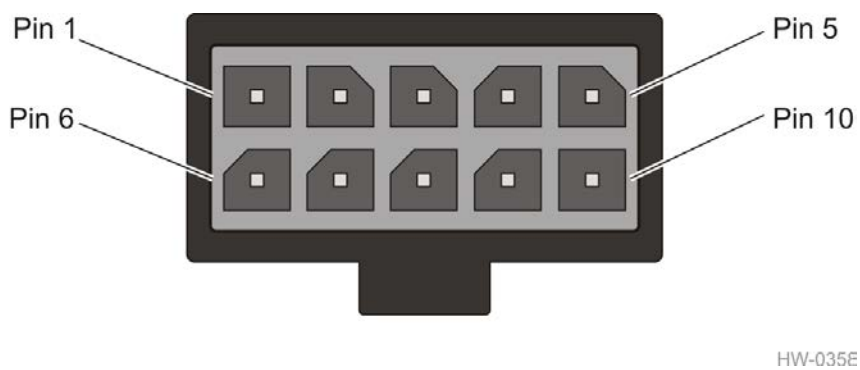

Figure D-18 GPS Assembly Power/Data Connector

Table D-17 GPS Assembly Connector Pin Assignments and Signal Descriptions

Pin	Signal	Description
1	TXD1	Transmit data (3V logic)
2	RXD1	Receive commands (3V logic)

Table D-17 GPS Assembly Connector Pin Assignments and Signal Descriptions

3	Not connected	N/A
4	1 PPS	1 pulse-per-second output
5	Ground	Signal and power common
6	Not connected	N/A
7	Not connected	N/A
8	Not connected	N/A
9	GPS receiver and antenna power	+5V
10	Not connected	N/A

The GPS antenna mounts outside the plaza structure (Figure D-19). The antenna connects to the GPS assembly with a coaxial cable.

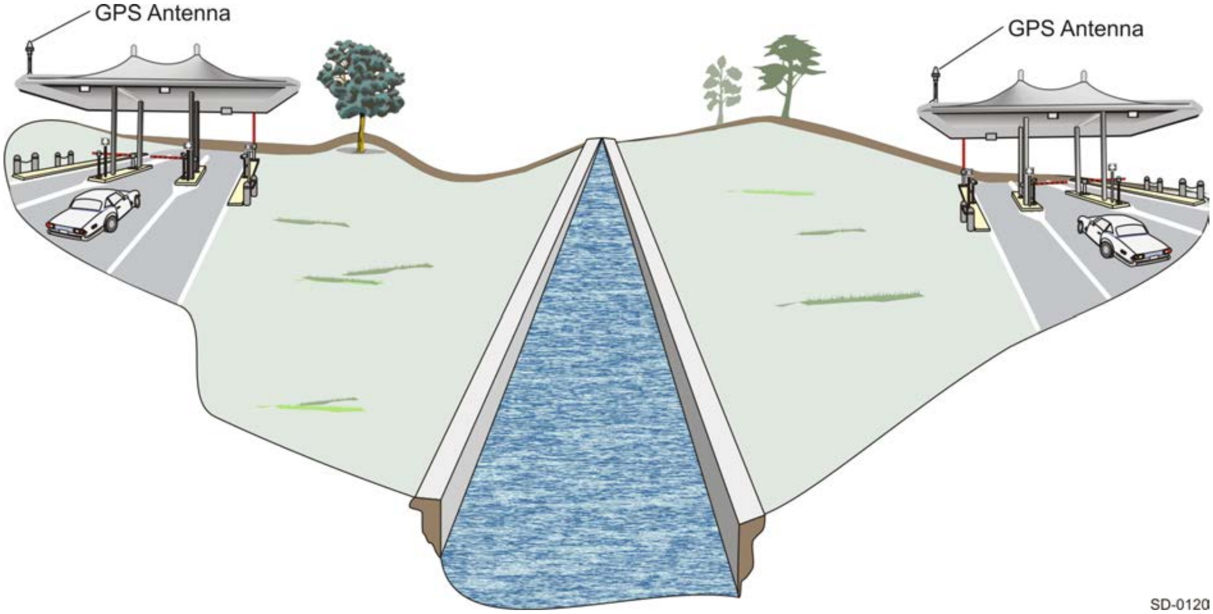

Figure D-19 Example of GPS Used to Connect Separate Parking Sites

Before Installing the GPS Antenna

Before installing the GPS for the toll plaza, you need to ensure that the antenna will be visible to GPS satellites. You should choose an antenna location that has clear, 360-degree visibility to the sky.

Once you are sure that the antenna reception will be unobstructed, you can begin installing the antenna. Make sure you have the following TransCore-supplied items:

GPS kit (TransCore P/N 23-5000-001 or 23-6000-001) consists of the items listed in Table D-18:

Table D-18 Global Positioning System Accessory Kit Contents

Quantity	Description
1	Global positioning system assembly
1	Active GPS antenna
1	GPS power/data cable
4	#6-32 x 3/8 inch stand-off
4	#6-32 x 1/4 inch Phillips screw

Required Components/Tools

Once you are sure that the antenna reception will be unobstructed, you can begin installing the antenna. Make sure you have the following TransCore-supplied items:

- GPS timing accessory kit (GPS assembly, power/data cable, antenna, and mounting hardware, TransCore P/N 19100-00)

You need the following additional equipment and tools to complete the installation:

- Coaxial cable connectors (Type-N plug connector for GPS antenna and 50-ohm SMA plug connector for GPS assembly)
- Fifty-ohm antenna coaxial cable with attenuation loss of less than 12 dB @1.575 GHz.

Note: *Maximum cable length is determined by cable attenuation loss. Installer should calculate the cable loss for the specific cable being used.*

- Pole/pipe mounting hardware (e.g., anchor bolts)
- Length of 1 1/4-inch (3.175 cm) Schedule 40 pipe (stainless steel, aluminum, or galvanized steel) to be used for antenna pole
- Cable terminating/crimping tools
- Torque-limiting wrench (in-lb range)
- Standard set of tools (screwdrivers, pliers, wrenches) for fastening the GPS assembly to the multiprotocol reader.
- Special tools for installing the GPS antenna at site, for example, impact hammer for drilling into concrete, if needed.

You can order additional GPS antennas (P/N 20015-01) from TransCore.

GPS Timing Assembly Mounting

1. Screw the four standoffs into the mounting holes of the multiprotocol reader as shown in Figure D-15.
2. Place the GPS assembly on the standoffs and secure with the Phillips screws provided in the kit.

Caution
Tighten the standoffs and mounting screws until snug. Do not overtighten.

3. Connect the GPS assembly to the reader with the power/data cable provided in the GPS assembly kit.

GPS Antenna Mounting

Note: *The GPS antenna installation must comply with applicable structural and building codes for the locale where it is being installed.*

1. Select a location for the GPS antenna that provides maximum visibility to the sky.
2. Secure the antenna pole mounting hardware to the site structure.
3. Connect the antenna pole to the mounting hardware.
4. Insert the RF coaxial cable up through the inside of the mounting pipe and connect the cable to the antenna using a Type-N plug connector.

   Refer to Figure D-20 when assembling the antenna components.

   You also can cut a 1-inch (2.54-cm) wide by 2-inch (5.1-cm) long slot in the side of the mounting pipe (Figure D-20). TransCore recommends this procedure for installing the RF coaxial cable when it cannot be pulled through the bottom of the pipe.
5. Pull the cable up through the pipe bottom or slot and terminate it at the antenna port.

Note: *If you choose to use a different mounting pole material than the 1-¼ inch (3.175 cm) Schedule 40 pipe, the pole material should have a nominal outside diameter of 1.66 inches (4.2 cm). Proper material selection for the field installation is left to the system installers.*

6. Slip the antenna mount over the coaxial cable.
7. Screw the Type-N plug connector onto the type-N antenna receptacle connector and tighten until snug.
8. Connect the mount to the antenna by tightening the four captive screws until snug.
9. Push the antenna-mount assembly onto the antenna pipe or pole and tighten the hex-head set screws on the antenna mount.

10. Connect the antenna to the multiprotocol reader at the GPS antenna cable port (Figure D-15). Tighten this SMA connector to 10 in-lb.

.

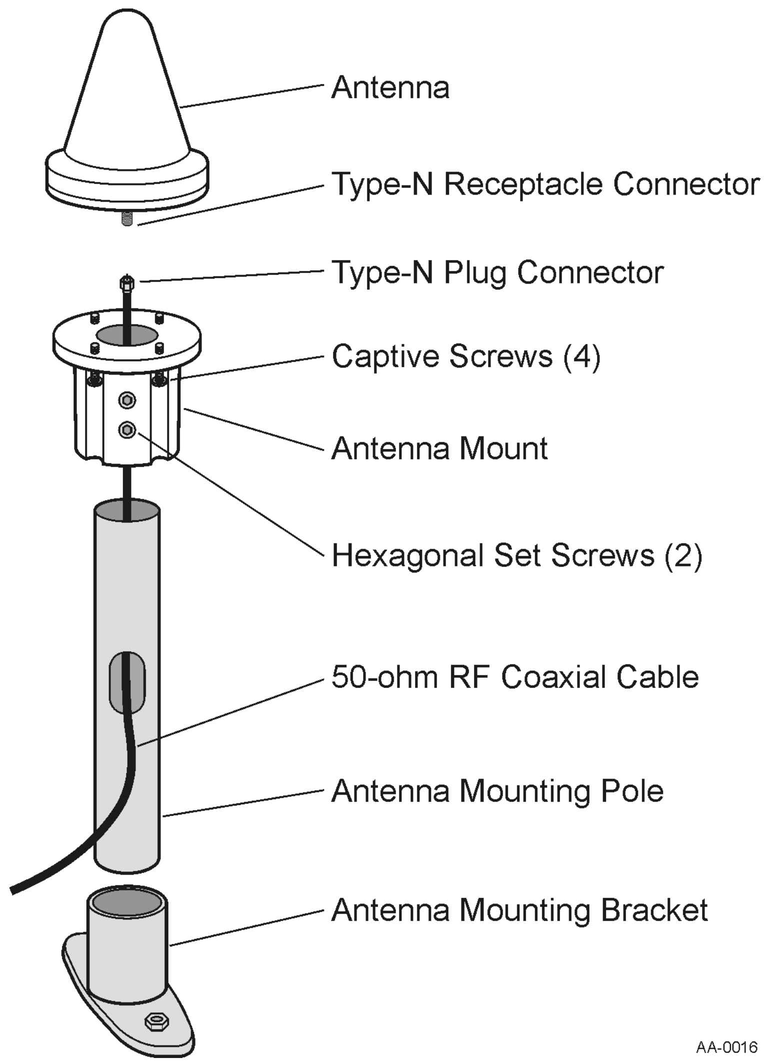

Figure D-20 GPS Antenna Assembly

Caution

CAUTION ***To prevent damage to the SMA connector, TransCore strongly recommends that you provide a strain-relief bracket or other means of securing the GPS antenna coaxial cable that terminates at the GPS timing assembly.***

Note: *The antenna mount must be grounded in accordance with National Electrical Code regulations for the locale where the Encompass reader/GPS antenna system is being installed.*

Testing the GPS Timing System

The following sections list basic command information for testing using a UDP or AI1200-emulation command.

Note: *As the GPS system activates, the TDM error LED lights on the Encompass reader. This error indication usually clears in about 1 minute, but it can take as long as 15 minutes.*

Using the UDP Command Set

Configure and test the GPS timing option using the UDP command set by sending the appropriate UDP command ("Set Master/Slave Mode" on page 6-115).

Using the AI1200-Emulation Command Set

Configure the GPS timing option using the AI1200-emulation command set by sending the "#984NYY SET TDM AS MASTER OR SLAVE" on page 7-138 to enable the GPS primary function.

Configuring the Reader/Slave Count

This section explains how to configure the reader/slave hierarchy (GPS primary/GPS secondary or master/slave) using the GPS UDP or AI1200-emulation command.

Choose one field only, for example, GPS primary, GPS secondary, master, or slave.

GPS Primary — This field specifies whether the reader is to be configured as the GPS primary.

GPS Primary	Definition
0	Not GPS Primary
1	GPS Primary

Note: *For AI1200-emulation command set use #9843YY.*

GPS Secondary — This field specifies whether the reader is to be configured as the GPS secondary.

GPS Secondary	Definition
0	Not GPS Secondary
1	GPS Secondary

Note: *For AI1200-emulation command set use #9842YY.*

Master — This field specifies whether the reader is to be configured as the master.

Master	Definition
0	Not Master
1	Master

Note: *For AI1200-emulation command set use #9841YY.*

Slave — This field specifies whether the reader is to be configured as the slave.

Slave	Definition
0	Not Slave
1	Slave

Note: *For AI1200-emulation command set use #9840YY.*

For this example, the sum of the delay and duration period is 19.9 milliseconds, which is less than the synchronization rate of 20 milliseconds. If the sum of the delay and duration periods equals the synchronization rate, unexpected results can occur.

Slave Select Count — This field specifies the order that a slave or GPS primary or secondary reader issues a synchronization pulse whenever a given reader within a synchronization group fails to recognize the signal from the preassigned master or whenever a GPS receiver fails to issue a 1-pps signal, respectively. The maximum slave count = 26.

Scenario 1 — One master, n slaves. The master has no slave behavior, therefore it is assigned a slave select count of 0. Each slave is assigned an increasingly greater number from 1 to n. When the master fails, slave 1 becomes the master, and so on.

Scenario 2 — GPS primary, GPS secondary, N slave readers. When in fault mode (1-pps signal missing), a GPS primary is slave to a GPS secondary and all other slaves and is assigned the last slave select count, n. A GPS secondary takes over when a GPS primary is in fault mode, therefore it is assigned a slave select count of 1. All slaves are assigned increasingly greater numbers from 2 to n+1.

Scenario 3 — One GPS primary and n slaves. This scenario forces the GPS primary to have no slave behavior by specifying a slave select count of 0. Each slave is an increasingly higher number from 1 to n. When the master fails, slave 1 becomes the master. If slave 1 should fail, slave 2 takes over, and so on (Table D-19).

Table D-19 Reader Slave Count Configuration Table

Scenario 1 — One Master, n Slaves						
Reader Mode	Master	Slave	Slave	Slave	Slave	Slave
Slave Select Count	0	1	2	…	n-1	n
Scenario 2 — GPS Primary, GPS Secondary, n Slaves						
Reader Mode	GPS Secondary	Slave	Slave	Slave	Slave	GPS Primary
Slave Select Count	1	2	3	…	n+1	n+2
Scenario 3 — One GPS Primary, n Slaves						
Reader Mode	GPS Primary	Slave	Slave	Slave	Slave	Slave
Slave Select Count	0	1	2	…	n-1	n
n = Total number of slave readers						

Environmental

Temperature Range for GPS Assembly

The GPS assembly can operate within the following operating and storage temperature conditions (Table D-20).

Table D-20 Operating/Storage Temperature Limits and Conditions

Specification	Limits/Conditions
Operating temperature Installed in NEMA enclosure Not installed in NEMA enclosure	 -40°F to +131°F (-40°C to +55°C) -40°F to +158°F (-40°C to +70°C)
Storage temperature range	-40°F to +185°F (-40°C to +85°C)

Humidity

The Encompass Reader GPS assembly is rated to operate within humidity levels of 0% to 95%, non-condensing.

GPS Antenna

Table D-21 lists the GPS antenna specifications.

Table D-21 GPS Antenna Specifications

Parameter	Specification
Operating temperature	-40°F to +185°F (-40°C to +85°C)
Operating frequency	1527.42 ±1.023 MHz, typical
Power supply	5V DC
Current	27 mA maximum
Polarization	RT hand circular
Output VSWR	2.5 maximum
Gain	30 dB minimum

GPS Assembly Connector

GPS Diagnostic Port

The GPS diagnostic port is used for factory diagnostics only.

GPS Antenna Cable

The antenna connects to the GPS assembly via an RF coaxial cable that is supplied by the Encompass Reader user. The GPS antenna cable connects the receiver to the assembly's end panel and is externally available.

For applications requiring lightning protection on the GPS assembly/antenna system, the lightning arrestor must be able to pass DC voltage or current on the center conductor of the coaxial cable. The GPS assembly transmits a DC bias voltage and current through the center conductor from to the antenna to power the low-noise amplifier, which is integrated into the active GPS antenna. Using a DC-block lightning protection system will not work. TransCore recommends you use a gas-discharge-type system designed for an active GPS antenna.

Regulatory Requirements

Emissions

The GPS assembly complies with the requirements of FCC Part 90, FCC Part 15, and industry Canada RSS-137 (where applicable).

Safety

The GPS assembly is UL60950 approved.

Electrical Protection

ESD

With the GPS assembly installed and operated as part of a complete Encompass chassis assembly, the assembly complies with the requirements of the International Electrotechnical Commission/Comite, Europe, en de Normalisation (IEC/EN) 61000-4-2, Class 4 standard (Table D-22).

Table D-22 ESD Limits and Conditions

Discharge Voltage	16.0 kV
Polarity	Positive
Number of Repetitions	2 pulses
ESD System	NSG438 system, which complies with a 150-picofarad/330-ohm discharge network of the IEC/EN 61000-4-2 standard
Test conditions	All ESD tests are performed at +77°F (+25°C)

Antenna Drive and Protection Circuitry

The receiver uses an antenna sense circuit that detects under-current (open), over-current (shorted or exceeding maximum), or valid antenna connection. The receiver supplies up to 80 milliamps (mA) of current via the antenna power supply circuit.

If the antenna draws 15 mA or more, a status bit in the antenna status information is set, giving a good indication that an antenna is attached.

If the antenna draws less than 15 mA, an alarm bit is set indicating an under-current condition in the antenna status information.

If more then 80 mA is drawn through the antenna port, then the over-current detection circuitry will reduce the antenna feed current to approximately 45 mA until the fault is cleared.

Detection of an under-current situation will not prevent the receiver from operating. The receiver will continue to operate normally, but will issue an error flag indicating a possible antenna problem.

Antenna Drive Current Limits

Undercurrent detect @+77^{o}F (25^{o}C)

Good Indication: greater than 15 mA

Undercurrent Indication: less than 15 mA

Over-current Detect @+77^{o}F (25^{o}C): 80 mA maximum for normal operation

Troubleshooting the GPS System

Note: *See "Communicating Via Diagnostic Port (COM2)" on page 10-4 to learn how to access system diagnostics fault messages.*

When the GPS receiver initializes, it performs a self-test, which includes a check of the GPS antenna status. If a fault condition exists, the message displays GPS Self Test Fault = 1, which means that an error condition exists with either the GPS receiver or coaxial antenna cable. You can display the fault status by entering a ShowSysStatus-Bits command from a PC.

If a fault condition exists, first check the GPS coaxial cable and connections. After checking the cable, if the fault condition remains, switch the cable with another, good, cable. If the fault condition continues, return the GPS assembly to TransCore.

If the GPS self-test reveals no faults, the status bit displays GPS Self Test Fault = 0. No further action is required.

E

Command-Based Pre- and Post-Conditions

Appendix E

Command-Based Pre- and Post-Conditions

This appendix lists pre- and post-conditions for both user datagram protocol (UDP) and AI1200-emulation configuration commands. In these tables, Stop Mode Required indicates that the reader first must be set to Stop Mode (Mode 0) as a pre-condition to entering the specified command. The post-conditions, Immediate or Reset Required, indicate that the command either takes effect immediately or that the reader must be reset after the command has been entered. This is a subset of the complete list of commands and lists only those commands that are needed to configure an Encompass multiprotocol reader.

UDP Command Pre- and Post-Conditions

Table E-1 lists the UDP command pre- and post-conditions.

Table E-1 Pre- and Post-Conditions for UDP Commands

UDP Command Group	Command #	Command	Stop Mode Required/ Immediate/Reset Required
0x0200 - Diagnostics	0x0005	Clear Error Logs	Immediate
0x0400 - Mode	0x0001	Set Mode	Immediate if 1) UDP host startup selected and mode and has not been set previously; 2) Stop Mode is requested; or 3) Mode has been set previously, Stop Mode is current mode, and requested mode is same as previous operational mode. Reset Required if 1) UDP non-volatile memory startup selected and requested mode is not Stop Mode; or 2) requested mode is different from previous operational mode.

Table E-1 Pre- and Post-Conditions for UDP Commands (continued)

UDP Command Group	Command #	Command	Stop Mode Required/ Immediate/Reset Required
0x0400 - Mode	0x0003	Set Protocol	Reset Required
0x0400 - Mode	0x0043	Set Tag Command Data	Immediate if 1) Protocol is ATA or ATA 1/2-frame 2) Protocol is IT2200 and request is host driven; or 3) Protocol is CVISN. Stop Mode Required if 1) Protocol is IT2200 and request is not host driven. Reset Required if 1) Protocol is SeGo or eGo and Command Action is 0.
0x0400 - Mode	0x0066	Set Seen Count	Immediate
0x1000 - Tag	0x0002	Set Append Data	Immediate
0x1000 - Tag	0x0025	Run Check Tag	Immediate
0x1000 - Tag	0x002A	Set Manual Antenna Channel Control	Immediate
0x1000 - Tag	0x0030	Set IAG Slot	Reset Required
0x1000 - Tag	0x0040	Set Secondary Tag Sequence	Reset Required
0x1000 - Tag	0x0045	Set Master/Slave Mode	Immediate
0x2000 - RF	0x51	Set Attenuation	Immediate
0x2000 - RF	0x53	Set Data Detect	Immediate
0x2000 - RF	0x55	Set Line Loss	Immediate
0x2000 - RF	0x57	Set Uplink Source Control	Immediate
0x2000 - RF	0x60	Set Frequency in MHz	Stop Mode Required
0x4000 - Digital I/O	0x0000	Set Sensor Status Change Report	Immediate

Table E-1 Pre- and Post-Conditions for UDP Commands (continued)

UDP Command Group	Command #	Command	Stop Mode Required/ Immediate/Reset Required
0x4000 - Digital I/O	0x0002	Set Output Host Control	Immediate if output host control is enabled (i.e., both predefined output control and output by channel are disabled) Reset Required if output host control is disabled (i.e., either predefined output control or output by channel is disabled)
0x4000 - Digital I/O	0x0004	Set Output Tag Read Control	Reset Required
0x4000 - Digital I/O	0x0006	Set RF Control	Reset Required
0x4000 - Digital I/O	0x0008	Set RF Multiplexing Mode	Reset Required
0x4000 - Digital I/O	0x000A	Set Output Pulse Duration	Stop Mode Required
0x4000 - Digital I/O	0x000C	Set Minimum Presence True Period	Stop Mode Required
0x4000 - Digital I/O	0x000E	Set Sensor Input Inversion	Stop Mode Required
0x4000 - Digital I/O	0x0010	Set Port Configuration	Reset Required
0x4000 - Digital I/O	0x0012	Set Sensor Input Report	Immediate
0x4000 - Digital I/O	0x0014	Set Presence RF Control Algorithm	Stop Mode Required
0x4000 - Digital I/O	0x0016	Set Presence RF Control Time-out Period	Stop Mode Required
0x4000 - Digital I/O	0x056D	Set External Interrupt Control	Reset Required (may only be set if UDP Host Startup is configured, and must be set prior to setting mode. Reset is required to change parameters.)
0x8000 - System	0x0003	Set Time and Date	Immediate
0x8000 - System	0x0009	Delete All Buffered Tag Transactions	Immediate
0x8000 - System	0x0011	Set UDP/IP Core Lane Controller Parameters	Reset Required
0x8000 - System	0x0013	Set UDP/IP Core IP Address	Immediate

Table E-1 Pre- and Post-Conditions for UDP Commands (continued)

UDP Command Group	Command #	Command	Stop Mode Required/ Immediate/Reset Required
0x8000 - System	0x0016	Set Buffered Tag Transaction Mode	Immediate
0x8000 - System	0x0018	Set Data Acknowledge Time-out Period	Immediate
0x8000 - System	0x001A	Set Switch Buffered Tag Transaction Mode Enable	Immediate
0x8000 - System	0x001F	Get System Serial Number	Immediate

AI1200-Emulation Command Pre- and Post-Conditions

Table E-2 lists the AI1200-emulation command pre- and post-conditions.

Table E-2 Pre- and Post-Conditions for AI1200-emulation Commands

AI1200-emulation Command #	Command	Stop Mode Required/ Immediate/Reset Required
#00	Switch to Data Mode	Immediate
#01	Switch to Command Mode	Immediate
#100N	Set Baud Rate	Reset Required
#101N	Set COM1 Port Stop Bits	Reset Required
#102N	Set COM1 Port Parity	Reset Required
#103N	Set End of Line Delay	Reset Required
#20	Set Time	Immediate
#21	Set Date	Immediate
#30N	Append Time and Date Selection	Immediate
#31N	Append Auxiliary Information Selection	Immediate
#40	Transmit All ID Codes	Immediate

Table E-2 Pre- and Post-Conditions for AI1200-emulation Commands (continued)

AI1200-emulation Command #	Command	Stop Mode Required/ Immediate/Reset Required
#410N	Select Unique ID Code Criteria	Immediate
#420N	Select Valid ID Code Criteria	Immediate
#440	Reset Uniqueness on All Channels	Immediate
#440N	Reset Uniqueness Per Channel	Immediate
#44N	Set Variable Time-out	Immediate
#47NN	Select Tag Type Mode	Immediate if 1) Stop Mode is requested; or 2) Mode has been set previously, Stop Mode is current mode, and requested mode is same as previous operational mode. Reset Required if 1) Mode has not been set previously; or 2) Requested mode is different from previous operational mode, and is not Stop Mode.
#487N	Set IAG Slot Number	Immediate
#493	Set Tag Command Parameters	Immediate if protocol is IT2200. Reset Required if protocol is SeGo or eGo.
#4ANNNN	Set Protocols — Universal Tag Mode	Reset Required
#4B[APN]	Set Secondary Tag Sequences	Reset Required
#60NN	Set Reader ID Number	Immediate
#61N	Select Communication Protocol	Immediate
#612NN	Set Error Correcting Protocol Time-out	Immediate
#614N	Flow Control Settings	Reset Required
#616N	Buffer Control Mode Settings	Immediate
#617N	Echo Settings	Immediate

Table E-2 Pre- and Post-Conditions for AI1200-emulation Commands (continued)

AI1200-emulation Command #	Command	Stop Mode Required/ Immediate/Reset Required
#620N	Set Output Control	Immediate
#62N	Set Predefined Output Control	Reset Required
#640N	RF Control	Immediate
#641N	RF Mode Control	Reset Required
#642N	RF Antenna Multiplexer Mode	Immediate
#65	Reset Power Outage Bit	Immediate
#66F	Load Default Operating Parameters	Reset Required
#67NP	Set Output Pulse Duration	Immediate
#690N	Sensor Input Reports	Immediate
#691N	Set Minimum Presence True Period	Immediate
#692N	Select Presence RF Control Algorithm	Immediate
#693N	Select Presence RF Control Time-out Period	Immediate
#694N	Select Sense Input Inversion	Immediate
#696S...S	Store Hardware Configuration	Immediate
#697N	Set Opto Port(s) Direction	Reset Required
#810	Disable System Check Tag Periodic Mode	Immediate
#813YX	Set System Check Tag Periodic Time Interval	Immediate
#82N	Set Sensor Status Change Mode	Immediate
#920NDU	Set RF Attenuation	Immediate
#921NRR	Set Range Adjust	Immediate
#9CNNNNN	Set Uplink Frequency in MHz	Stop Mode Required
#94PS	Set Uplink Source Control	Immediate
#9FNNNNN	Set Downlink Frequency in MHz	Stop Mode Required
#960N	Set Line Loss	Immediate
#980	Turn TDM Off	Immediate

Table E-2 Pre- and Post-Conditions for AI1200-emulation Commands (continued)

AI1200-emulation Command #	Command	Stop Mode Required/ Immediate/Reset Required
#984NNYY	Set TDM As Master or Slave	Immediate

Index

Index