

Encompass® Multiprotocol Reader System Guide

PMN: E5/E6

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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 FIHE6PT90V3. The IC ID number is 11584A-E6RSS137V3. 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.

**LABELING REQUIREMENTS
47 CFR §15.19(a)(3)**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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 could void the user's authority to operate the equipment 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

**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 FIHE6PT90V3. Le numéro d'identification pour IC est 1584A-E6RSS137V3. 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.

**EXIGENCES D'ÉTIQUETAGE
47 CFR §15.19(a)(3)**

Cet appareil est conforme à la partie 15 de la réglementation FCC. Son utilisation est soumise aux deux conditions suivantes: (1) Cet appareil ne doit pas provoquer d'interférences nuisibles; (2) Il doit accepter toute interférence reçue, y compris celles susceptibles de provoquer un fonctionnement indésirable.

AUCUNE MODIFICATION SANS AUTORISATION
47 CFR §15.21



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 annuler l'autorisation de l'utilisateur à utiliser l'équipement 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/cm²) 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/cm² 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/cm². The average time is thirty minutes.

The maximum permissible exposure for occupational/controlled exposures is 3.0 mW/cm². 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



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/cm². 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.

Warning



For Canada Users:

This equipment complies with ISED RSS-102 radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 123 cm between the radiator and any part of your body.

(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/cm²) 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/cm²:

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

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/cm² 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/cm² 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



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/cm². 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.

Mise en garde



Pour les utilisateurs Canadiens

Cet équipement est conforme aux limites d'exposition aux rayonnements ISED CNR-102 établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec une distance minimale de 123 cm entre le radiateur et toute partie de votre corps.

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.
-012	8/25	Updated the FCC ID number, and the IC ID number.
-013	9/15	Added the Product number on the front page and removed the confidentiality statement. Added a warning for the Canadian users' exposure. Added the FCC labeling requirement. Updated the 47 CFR 15.21 section to reflect the wording required by FCC.

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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
	This procedure might cause harm to the equipment and/or the user.
	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.
<i>Note</i>	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.
<i>before</i>	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.

Developing the Installation Site Plan

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.

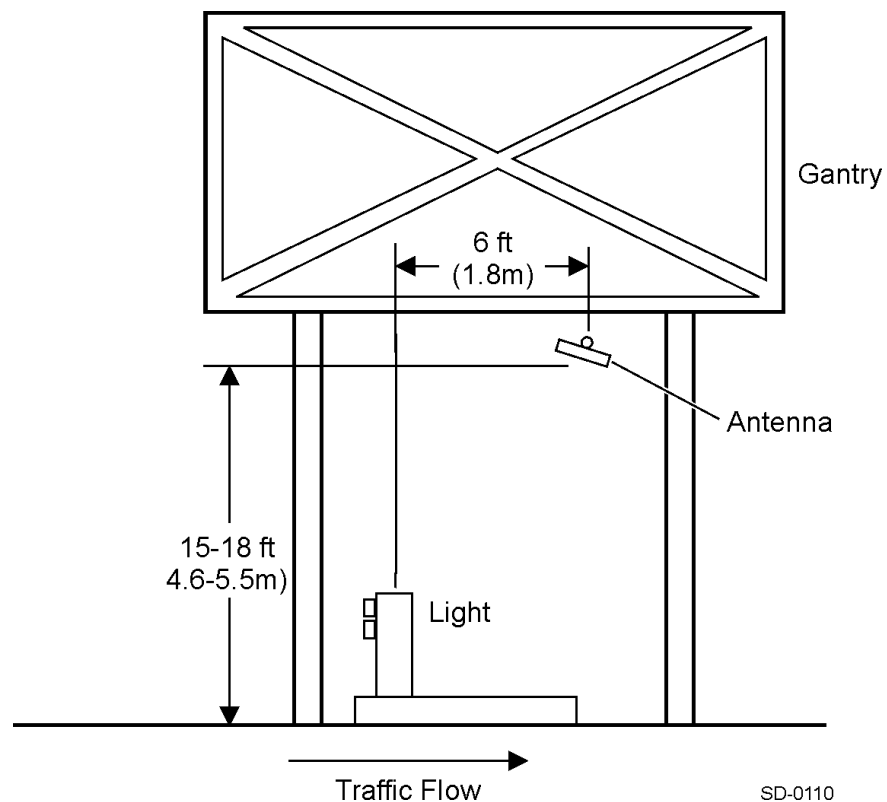
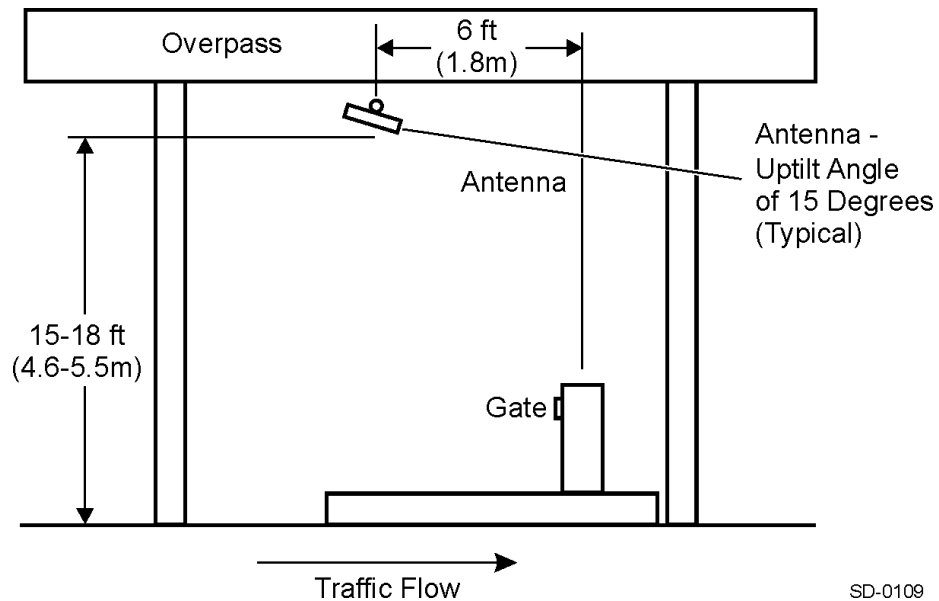


Figure 2-1 Overhead Gantry Mount

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.



SD-0109

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.

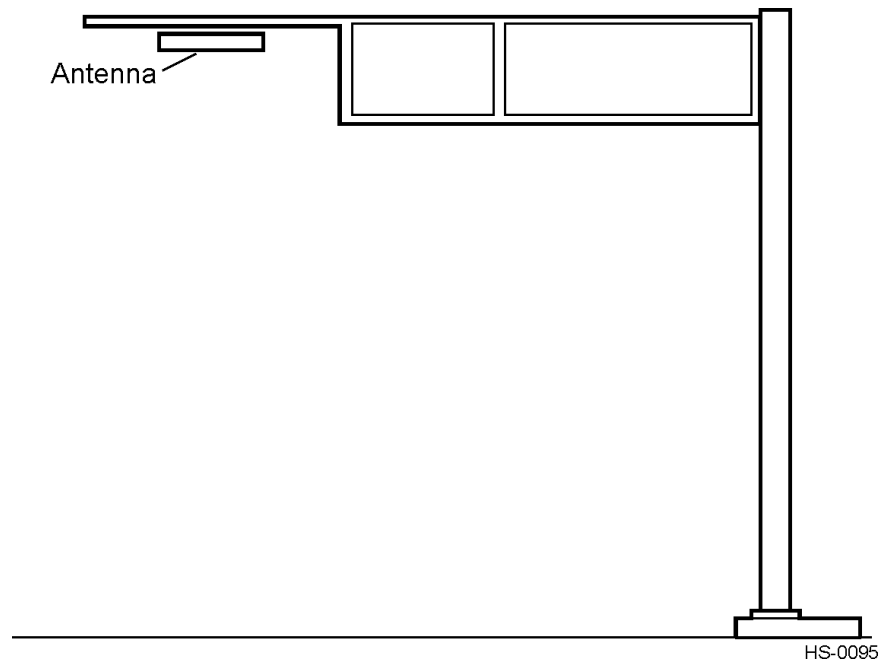


Figure 2-3 Cantilever Arm Mount

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.

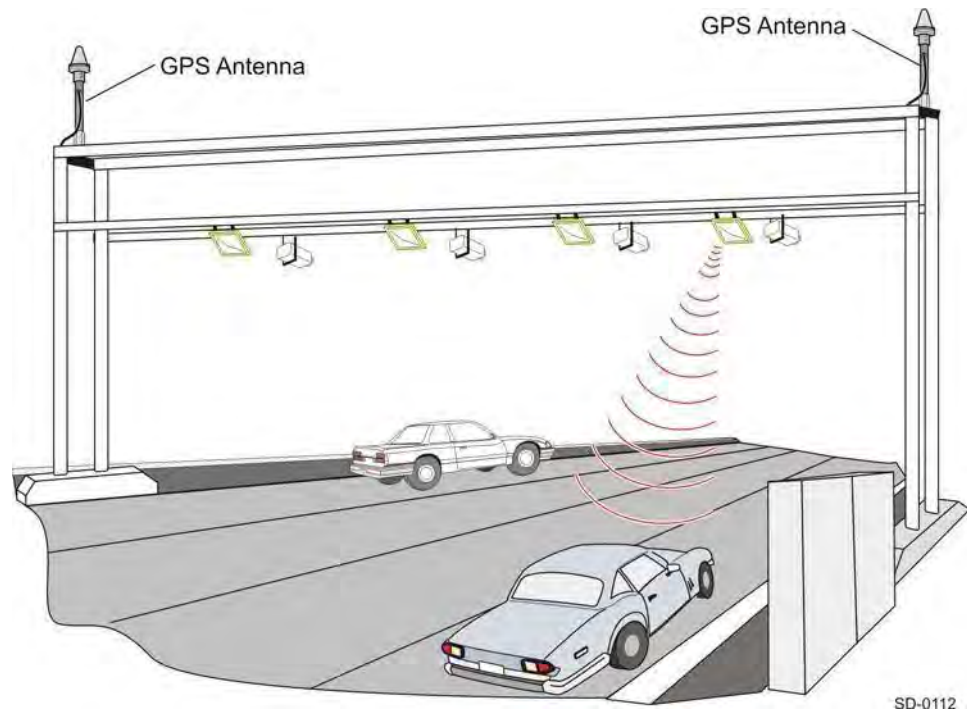


Figure 2-4 ORT Gantry Mount

Installing the Encompass Reader

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.

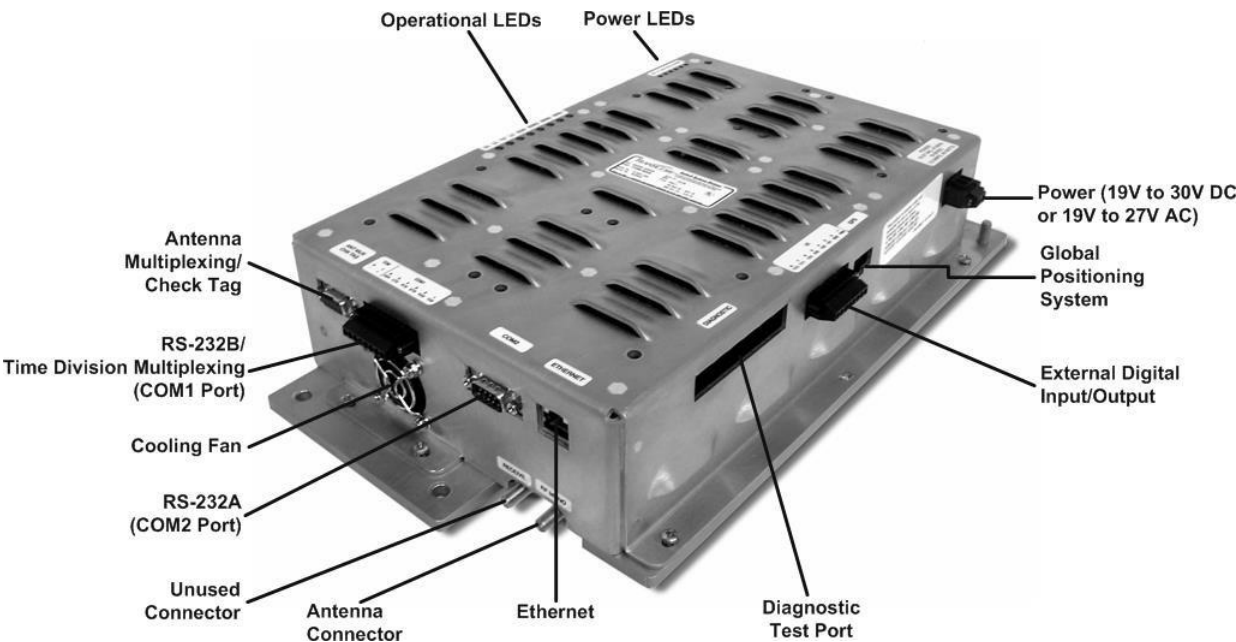


Figure 3-1 Connector and LED Locations on the Encompass Reader

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

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

Loosen mounting screws on power supply connector before removing plug.

Recommended 3AG In-line Fuses:

BEL FUSE, Inc.

P/N: 3SB 5

Rating: 5A, Slo-Blo, 250V

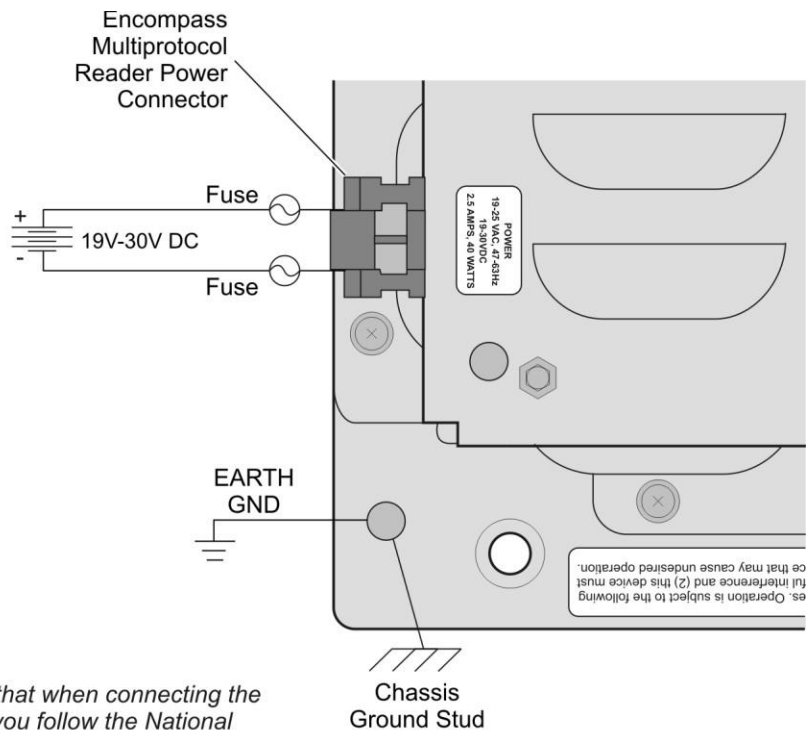
or

LITTELFUSE, Inc.

P/N: 313 005P

Rating: 5A, Slo-Blo, 250V

CAUTION: TransCore recommends that when connecting the Encompass reader to earth ground, you follow the National Electric Code for lightning protection for the locale where you are installing the reader.

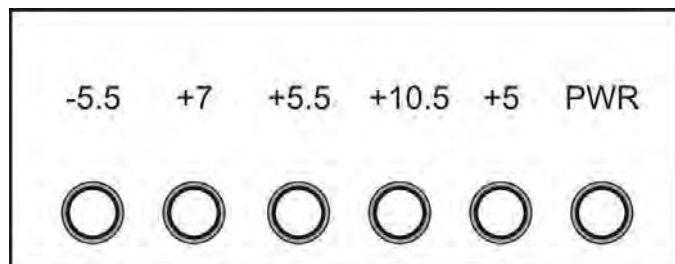


WD-0068

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.



HW-0344

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.

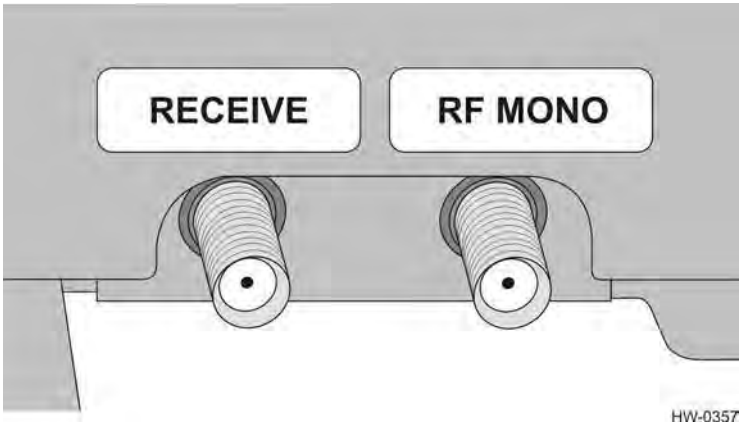


Figure 3-5 Antenna Connector Locations

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

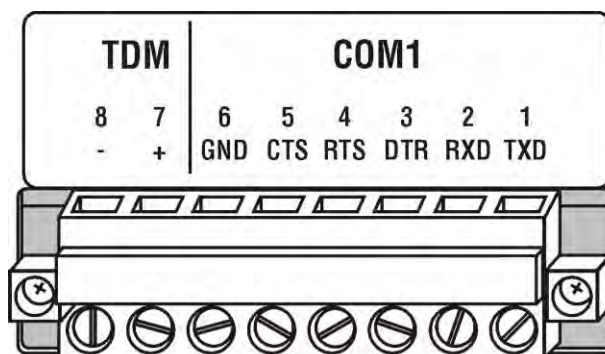
Table 3-5 Ethernet Connector (continued)

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).



HW-0345

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

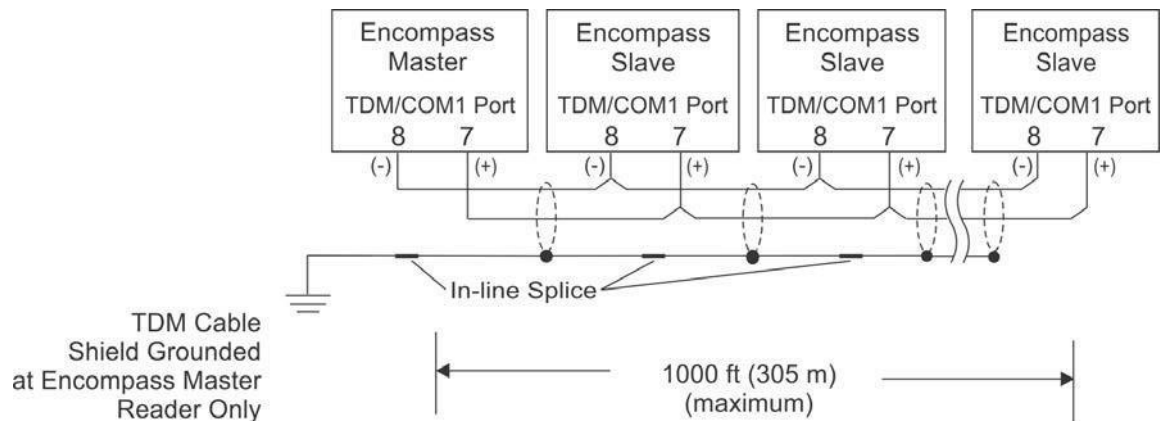
At installations where cross-lane interference can occur and frequency management is not sufficient to solve the problem, you may need to use TDM. By using the TDM function in the Encompass readers, the readers operate only during interleaved time periods.

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 characteris-

tic impedance of the cable being used. You need to follow the polarity conventions as shown because this interface is polarity dependent.



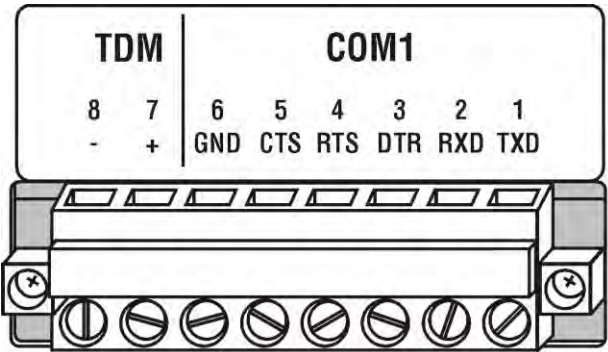
WD-0086

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 con-

nector (Figure 3-8).



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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
- Inclinator 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.

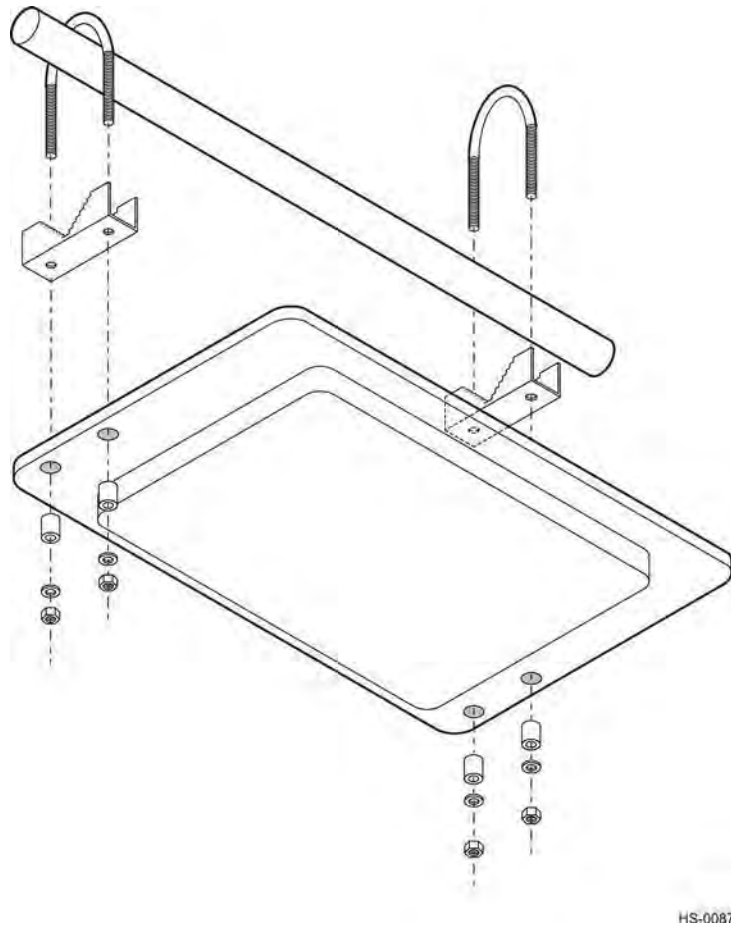


Figure 3-10 AA3152 UTA Mounting and Connections



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.

General Software Information

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 acknowledgments, 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.

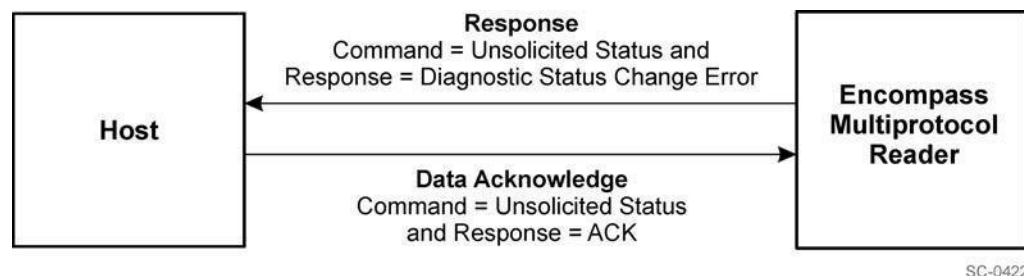


Figure 4-1 Encompass Reader Startup Controls

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.

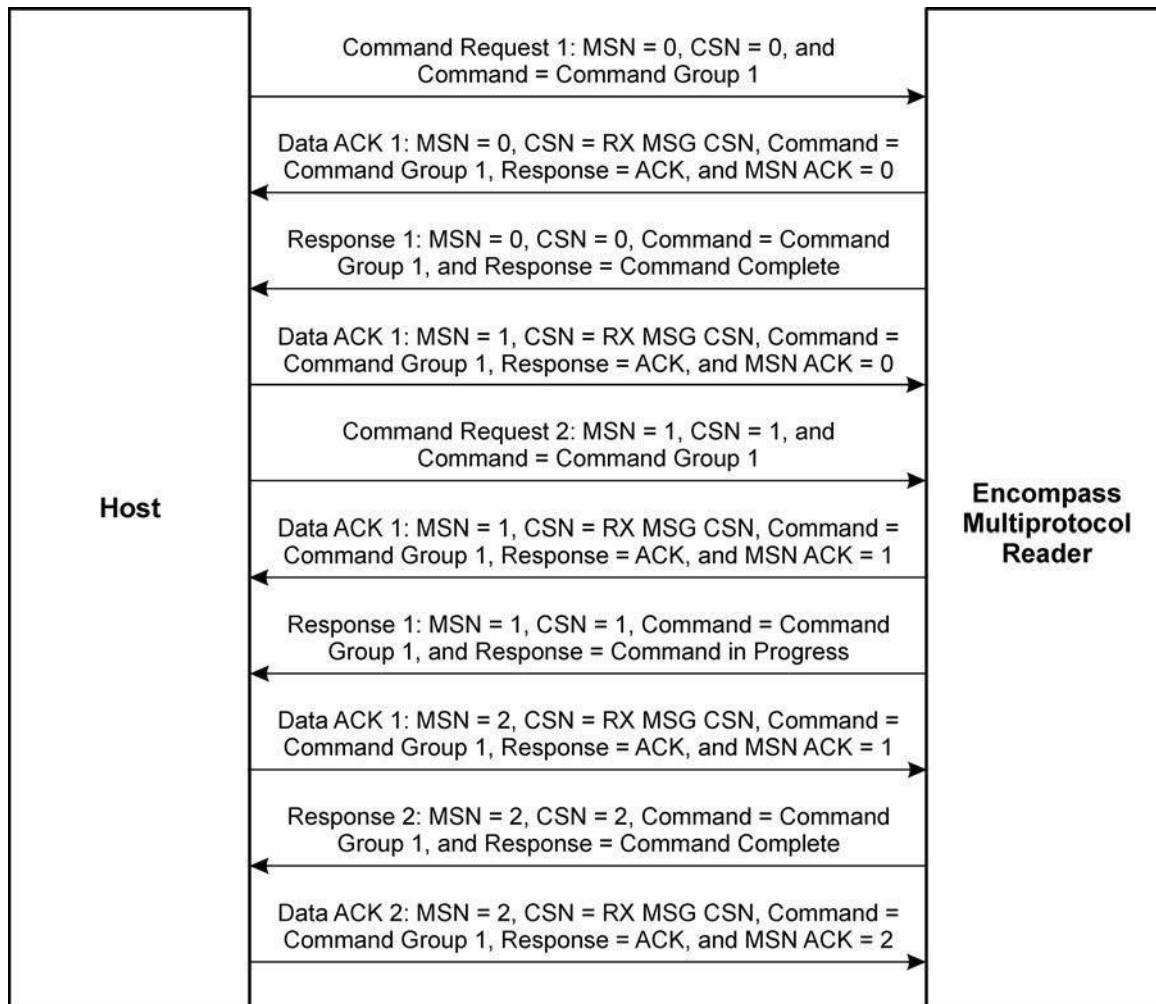
The host and the Encompass Reader use software communication sequence number controls as defined in the following paragraphs.

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.

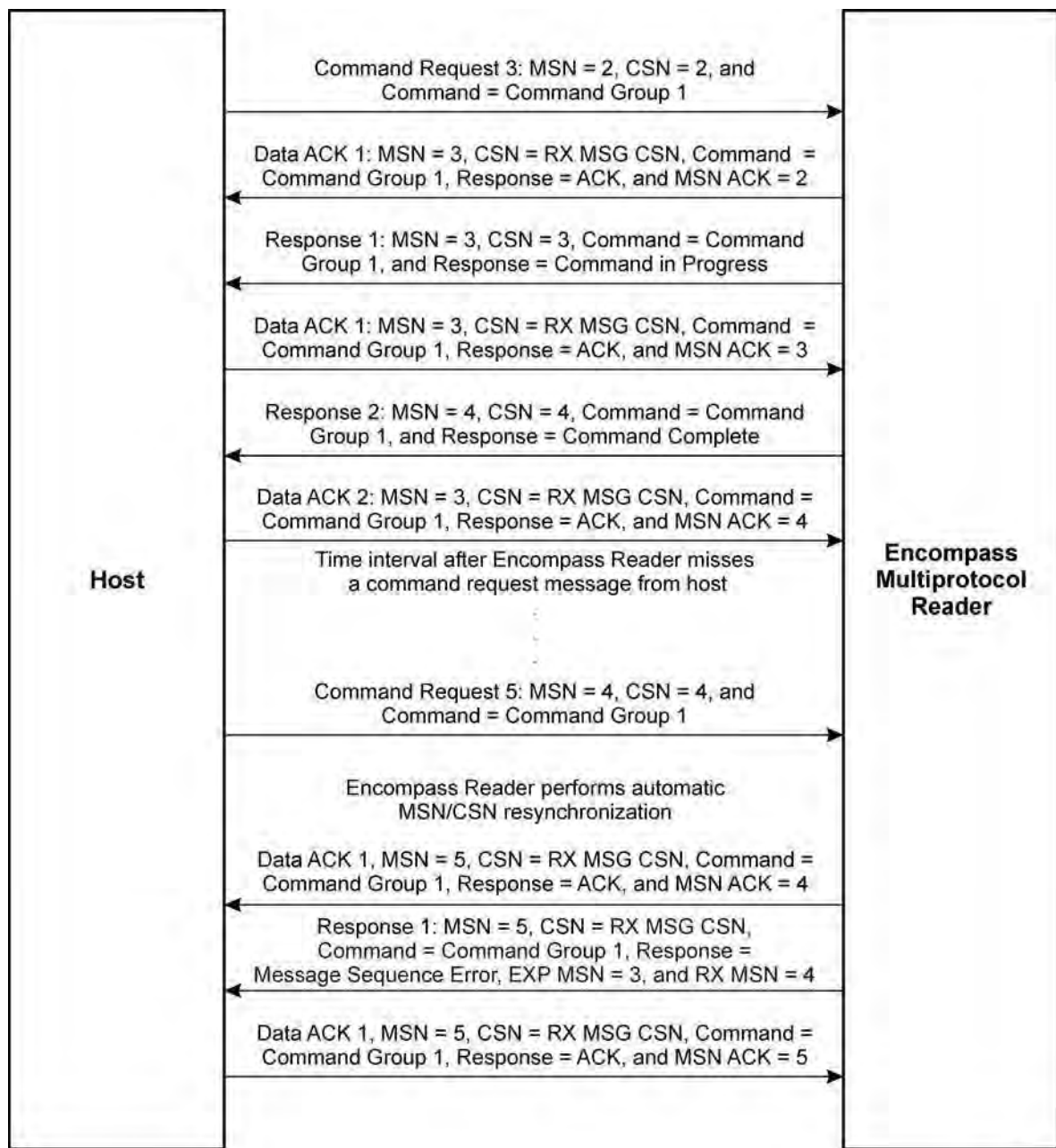
The Encompass Reader receives command request messages and data acknowledge messages from the host and checks that the MSNs and CSNs are correct for all command request messages received. The Encompass Reader performs automatic MSN and CSN resynchronizations on all received command request messages that 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.



SC-0423

Figure 4-2 Encompass Reader Sequence Number Controls



SG-0424

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 Encom-

pass 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.

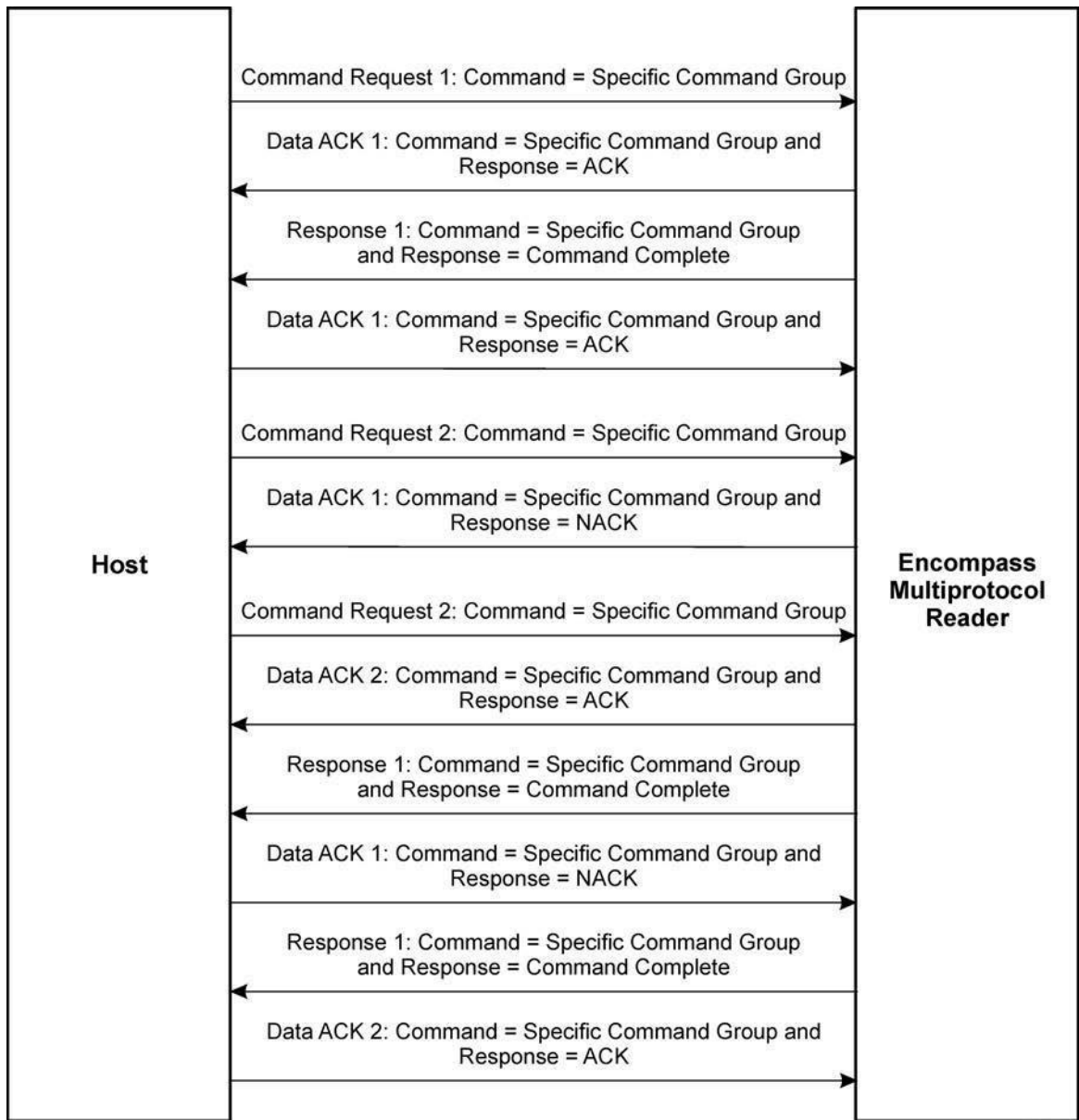
After receiving command response, asynchronous response, and unsolicited status messages from the Encompass Reader, the host sends data acknowledge messages to the Encompass Reader.

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](#).



SC-0421

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-milli-second end-of-line delay.

Communication Protocols

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.

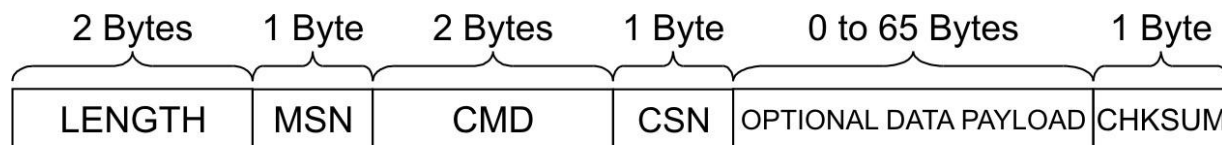
Table 5-2 UDP/IP Communications Message Field Descriptions

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.



ES-0081

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.

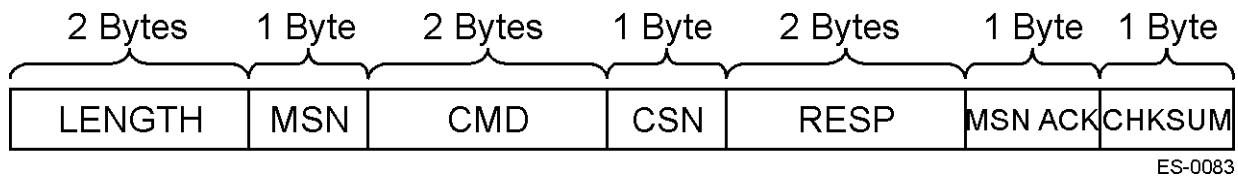


Figure 5-2 Data Acknowledge Message Fields

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.

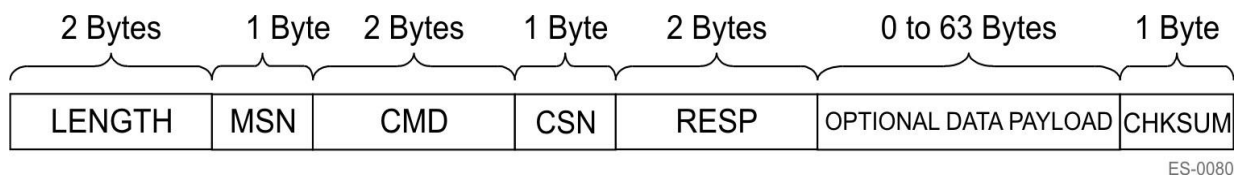


Figure 5-3 Command Response Message Fields

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.

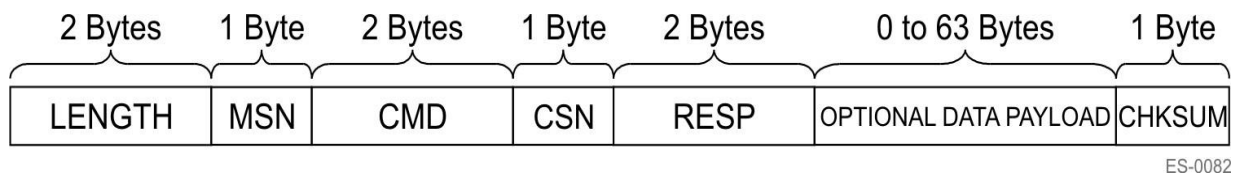


Figure 5-4 Asynchronous Response Message Fields

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.

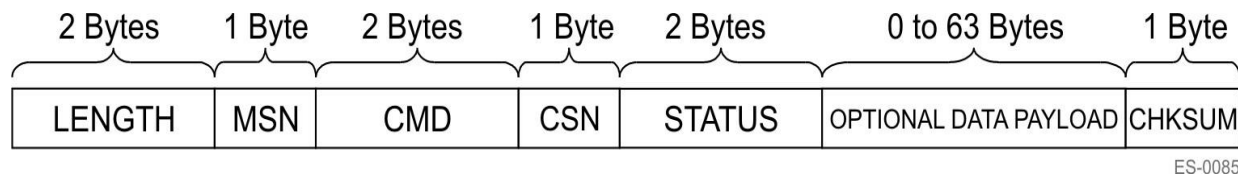
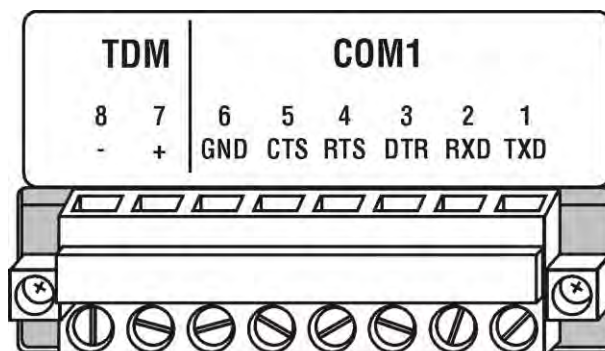


Figure 5-5 Unsolicited Status Message Fields

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).



HW-0345

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

<com> 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 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.”

Configuring and Operating the Encompass Reader Using UDP Commands

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 specified 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 Date 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

<u>Data</u>	<u>Data Range</u>
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 0FFFFFFFH.

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 0FFFFFFFH. 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 0FFFFFFFH.

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 A11200 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 out-

puts 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 com-

mand 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 carentry 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 Transceiver 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 Transceiver 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 Transceiver 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

Carriage Return	0DH
-----------------	-----

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

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 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	0004H 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 asynchro-

nous 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.

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)	XXXXXH

Command In Progress (4801H)

Command In Progress Response Data	Data Payload
Mode Command Group Command (sub-command)	XXXXXH

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.