Encompass® 4H

Reader System Guide

16-0038-001 Rev D X3

TransCore's Encompass 4H Reader System is a dual-protocol reader that reads TransCore Super eGo® (SeGo), American Trucking Associations (ATA)/International Organization for Standardization (ISO), and Inter-Agency Group (IAG) tag protocols.

This guide provides site planning and testing, installing, and operating instructions.

This information is intended for use by authorized TransCore dealers, installers, and service personnel.

Because the Encompass 4H Reader System has no operator- or end-user serviceable components or features, no end-user manual or operator guide exists. Once the system is set up and tested by the authorized installer, Encompass 4H Reader System operation requires no end-user intervention.

TRANSCORE
Trusted Transportation Solutions

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WARNING TO USERS IN THE UNITED STATES

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 laws in effect, the user may be required to correct the interference at their own expense.

NO UNAUTHORIZED MODIFICATIONS
47 CFR §15.21

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

AVERTISSEMENT À L'ATTENTION DES UTILISATEURS AUX ÉTATS-UNIS

DÉCLARATION 47 CFR §15.105(A) DE LA FCC SUR LES INTERFÉRENCES DES FRÉQUENCES RADIO

REMARQUE : Cet appareil a été testé et déclaré conforme à la catégorie d'un appareil numérique de classe A en accord avec la partie 15 des directives de la FCC. Ces normes visent à assurer une protection raisonnable contre les interférences nuisibles lorsque l'appareil est utilisé dans un environnement commercial. Cet appareil génère, utilise et peut émettre de l'énergie RF et peut être à l'origine d'interférences nuisibles aux communications radio s'il n'est pas installé et utilisé en suivant les directives du manuel d'instructions. Si cet appareil est utilisé dans une zone résidentielle, il est probable qu'il cause des interférences nuisibles. Dans ce cas, l'utilisateur pourrait être amené à remédier aux interférences à ses propres frais, selon les lois du pays en vigueur.

AUCUNE MODIFICATION NON AUTORISÉE 47 CFR §15.21

MISE EN GARDE : ***Il est interdit de modifier, d'altérer ou d'apporter des changements à cet appareil de quelque manière que ce soit sans autorisation. Toute modification non autorisée peut annuler l'autorisation d'utilisation accordée par la FCC et annulera la garantie.***

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

REMARQUE : Il est recommandé d'utiliser des câbles blindés et une mise à la terre avec cet appareil afin de répondre aux réglementations de la FCC

TRANSCORE, LP
ÉTATS-UNIS

WARNING TO USERS IN CANADA

INDUSTRY CANADA (IC) COMPLIANCE STATEMENT
RSS 247

This device complies with Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions:

1) This device may not cause interference; and

2) This device must accept any interference, including interference that may cause undesired operation of the device.

INDUSTRIE CANADA DÉCLARATION DE CONFORMITÉ
RSS 247

AVERTISSEMENT AUX UTILISATEURS AU CANADA

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

1) l'appareil ne doit pas produire de brouillage, et

2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTICES FOR ETSI (EUROPEAN TELECOMMUNICATIONS STANDARDS INSTITUTE)

IEC60950 NOTICE

For IEC60950 compliance, this unit must be used in conjunction with a certified limited power source (LPS). The LPS should be rated for 16-20VAC output voltage, 3Amps maximum output current or 16-28VDC 3Amps maximum output current, and limited to less than 100VA apparent power.

RADIO FREQUENCY HEALTH LIMITS FOR ENCOMPASS 4H READER IN FREQUENCY BAND OF 902 – 928 MHZ

Several agencies (OSHA, FCC, IC) have environmental guidelines regulating maximum permissible exposure (MPE) or "safe" exposure levels that this product falls under. To ensure that proper safety guideline for the end users of this product, i.e. Occupational (Controlled) and General Population/Public (Uncontrolled), the recommended levels for each of the agencies are presented in the next sections with TransCore's recommendations for safety in the last section.

OSHA (Occupational Safety and Health Administration)

OSHA (an agency of The United States of America) legislates in the Code of Federal Regulations (CFR) Title 29 Part 1910 Subpart G 1910.97 titled "Nonionizing radiation", a maximum safe exposure limit of 10 milliwatts per square centimeter (mW/cm^2) during any 0.1-hour period (i.e. 6 minutes). Using the frequency (in the middle of the band of operation of this equipment) of 915 MHz and the highest antenna gain that this equipment is certified for use in a final installation, the minimum safe distance was calculated to be 2.4in (6cm).

FCC (Federal Communication Commission)

FCC (an agency of The United States of America) legislates in the Code of Federal Regulations (CFR) Title 47 Chapter I Subchapter A Part 1 Subpart I Section 1.1310 titled "Radiofrequency radiation exposure limits" that the maximum permissible exposure (MPE) is the following:

Occupational/Controlled Exposure

Power density = frequency (in MHz)/300 mW/cm^2 with an Averaging time of 6 Min

General Population/Uncontrolled Exposure

Power density = frequency (in MHz)/1500 mW/cm^2 with an Averaging time of 30 Min

Using the frequency (in the middle of the band of operation of this equipment) of 915MHz and the highest antenna gain that this equipment is certified for use in a final installation, the minimum safe distance was calculated. The MPE minimum distances are 4.3in (11cm) for the Occupational/Controlled environment, and 9.1in (23cm) for the General Population/Uncontrolled environment.

Industry Canada (Innovation, Science and Economic Development Canada)

Industry Canada (a Department of the Government of Canada) sets out the requirements in Radio Standards Specification RSS-102, Issue 5 guidelines, recommending a maximum safe power density in W/m^2. Thus, the maximum permissible exposure for general population/uncontrolled exposure at 915MHz is 2.77 W/m^2. The average time is 6 minutes. The maximum permissible exposure (MPE) is the following:

Controlled Environment

*Power density = 0.6455*frequency (in MHz)$^{0.5}$ W/m^2 with a Reference Period time of 6 Min*

General Public/Uncontrolled Environment

*Power density = 0.02619*frequency (in MHz)$^{0.6834}$ W/m^2 with a Reference Period time of 6 Min*

Using the frequency (in the middle of the band of operation of this equipment) of 915MHz and the highest antenna gain that this equipment is certified for use in a final installation, the minimum safe distance was calculated. The MPE minimum distances are 5.1in (13cm) for the Controlled environment and 13.4in (34cm) for the General Public/Uncontrolled environment.

TransCore Recommendation on MPE (Maximum Permissible Exposure)

The calculated power densities and MPE distance for each of the agencies respective to the environment is shown below.

Occupational/Controlled Environment				
Agency	Power Density (mW/cm^2)	MPE minimum distance		Time (min)
		in	cm	
OSHA	10	2.4	6	6
FCC	3.05	4.3	11	6
IC	1.95	5.12	13	6

General Population/Public/Uncontrolled Environment				
Agency	Power Density (mW/cm^2)	MPE minimum distance		Time (min)
		In	cm	
OSHA	10	2.4	6	6
FCC	0.61	9.1	23	30
IC	0.28	13.4	34	6

With the equipment installed and running at the maximum transmit power of 36 dBm EIRP, 0dB transmit attenuation, the recommendation for each of the operation environments is as follows:

1) The antenna should be installed at least 14in (34cm) from the General Population/ Public i.e. Uncontrolled Environment.

2) Maintenance personnel (i.e. Occupational/Controlled Environment) must remain at least 6in (13cm) from the antenna and limit their time in the environment to 6 minutes when the system is operating.

LIMITES D'EXPOSITION AUX RADIOFRÉQUENCES POUR LE LECTEUR ENCOMPASS 4H SUR LA BANDE DE FRÉQUENCES DE 902 À 928 MHZ

Plusieurs organismes (OSHA, FCC, IC) publient des directives environnementales qui recommandent des limites d'exposition maximale autorisée (normes MPE) ou des niveaux d'exposition « sûrs » auxquels cet appareil se conforme. Pour faire en sorte que chaque utilisateur final ait connaissance des directives de sécurité qui le concerne, que ce soit dans son travail (accès contrôlé) ou pour la population générale/le grand public (accès non contrôlé), TransCore présente les niveaux recommandés par chaque organisme dans ses recommandations sécuritaires détaillées dans la dernière section.

OSHA (Occupational Safety and Health Administration)

Dans le Code des réglementations fédérales (CFR), Titre 29, Partie 1910, Sous-partie G 1910.97, intitulée « Nonionizing radiation » (Rayonnements non ionisants), l'OSHA (organisme américain) recommande un plafond d'exposition maximale de 10 milliwatts par centimètre carré (mW/cm^2) pendant une période de 0,1 heure (soit 6 minutes). En utilisant la fréquence de 915 MHz (milieu de la bande de fréquences de cet appareil) et le gain d'antenne maximal pour lequel cet appareil a reçu une certification d'utilisation dans une installation finale, la distance minimale sécuritaire est de 6 cm (2,4 po).

FCC (Federal Communication Commission)

Dans le Code des réglementations fédérales (CFR), Titre 47, Chapitre I, Sous-chapitre A, Partie 1, Sous-partie I, Section 1.1310 intitulée « Radiofrequency radiation exposure limits » (Limites d'exposition aux rayonnements de radiofréquence), la FCC (organisme américain) établit les limites d'exposition maximale autorisée (normes MPE) comme suit :

Exposition professionnelle/contrôlée

Densité de puissance = fréquence (en MHz)/300 mW/cm^2 avec une durée moyenne de 6 min.

Exposition de la population générale/non contrôlée

Densité de puissance = fréquence (en MHz)/1500 mW/cm^2 avec une durée moyenne de 30 min.

En utilisant la fréquence de 915 MHz (milieu de la bande de fréquences de cet appareil) et le gain d'antenne maximal pour lequel cet appareil a reçu une certification d'utilisation dans une installation finale, la distance minimale sécuritaire est la suivante : les distances MPE minimales sont de 11 cm (4.3 po) pour l'environnement professionnel/contrôlé et de 23 cm (9,1 po) pour la population générale/environnement non contrôlé.

Industrie Canada (Innovation, Sciences et Développement économique Canada)

Le Cahier des charges sur les normes radioélectriques 102, 5e édition, d'Industrie Canada (un ministère du Gouvernement du Canada) établit des recommandations pour une densité de puissance maximale sécuritaire en W/m². Ainsi, l'exposition maximale admissible pour la population générale/non contrôlée à 915 MHz est calculée à 2,77 W/m². La durée moyenne est de 6 minutes. Les limites d'exposition maximale autorisée (normes MPE) sont les suivantes :

Environnement contrôlé

*Densité de puissance = 0,6455*fréquence (en MHz)^{0,5} W/m² avec une durée de référence de 6 min.*

Grand public/environnement non contrôlé

*Densité de puissance = 0,02619*fréquence (en MHz)^{0,6834} W/m² avec une durée de référence de 6 min.*

En utilisant la fréquence de 915 MHz (milieu de la bande de fréquences de cet appareil) et le gain d'antenne maximal pour lequel cet appareil a reçu une certification d'utilisation dans une installation finale, la distance minimale sécuritaire est la suivante : les distances MPE minimales sont de 45 cm (5,1 po) pour l'environnement professionnel/contrôlé et de 34 cm (13,4 po) pour le grand public/environnement non contrôlé.

Recommandations de TransCore sur les limites d'exposition maximale autorisée (normes MPE)

Les densités de puissance et la distance MPE calculées par chaque organisme pour un environnement donné sont présentées ci dessous.

Exposition professionnelle/environnement contrôlé				
Organisme	**Densité de puissance (mW/cm2)**	**Distance MPE minimale**		**Durée (en min.)**
		po	**cm**	
OSHA	10	2,4	6	6
FCC	3,05	4.3	11	6
IC	1,95	5,12	13	6

Population générale/environnement non contrôlé				
Organisme	**Densité de puissance (mW/cm2)**	**Distance MPE minimale**		**Durée (en min.)**
		po	**cm**	
OSHA	10	2,4	6	6
FCC	0,61	9,1	23	30
IC	0,28	13,4	34	6

Avec l'appareil installé et fonctionnant à la puissance de transmission maximale de 36 dBm EIRP), 0dB d'atténuation de transmission, et en utilisant le gain d'antenne maximal pour lequel l'appareil a reçu une certification, les recommandations pour chaque environnement d'exploitation sont les suivantes :

1) L'antenne devrait être installée à au moins 34 cm (14 po) de la population générale/du grand public, c'est-à-dire d'un environnement non contrôlé.

2) Le personnel d'entretien (c'est-à-dire dans un environnement professionnel/contrôlé) doit rester à au moins 13 cm (6 po) de l'antenne et limiter son temps d'exposition à 6 minutes lorsque l'appareil est en fonctionnement.

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Chapter 1 Introduction

System Guide Organization

This guide provides site planning and testing, installing, and operating instructions for TransCore's Encompass 4H Reader System. Please read this entire manual before installing the Encompass 4H Reader System.

System Description

The Encompass 4H Reader System is a dual-protocol reader supporting the low-cost, high-performance SeGo radio frequency identification (RFID) technology. SeGo technology provides the capability to read miniature RFID tags in a myriad of options including rugged, durable, or thin flexible forms such as the eGo Plus Micro Mini Sticker Tag. The Encompass 4H Reader System also supports legacy transportation applications such as gated toll, parking, or security gate access and is designed to be compatible with existing TransCore SmartPass® parking access control applications certified for licensed use. The Encompass 4H Reader System also supports TransCore ATA/ISO tag types, as well as the IAG tag protocol.

The Encompass 4H Reader System can also read both half-frame and full-frame tags.

Reader

The Encompass 4H Reader System consists of an input/output (I/O) module, a power supply, a reader logic board (also called a tag decoder), a radio frequency (RF) transmitter/receiver (called the RF module), and a patch antenna.

The Encompass 4H Reader System components are contained in a highly reliable, compact, and easy-to-install environmentally-sealed package. Figure 1 shows the front and side views of an Encompass 4H Reader System.

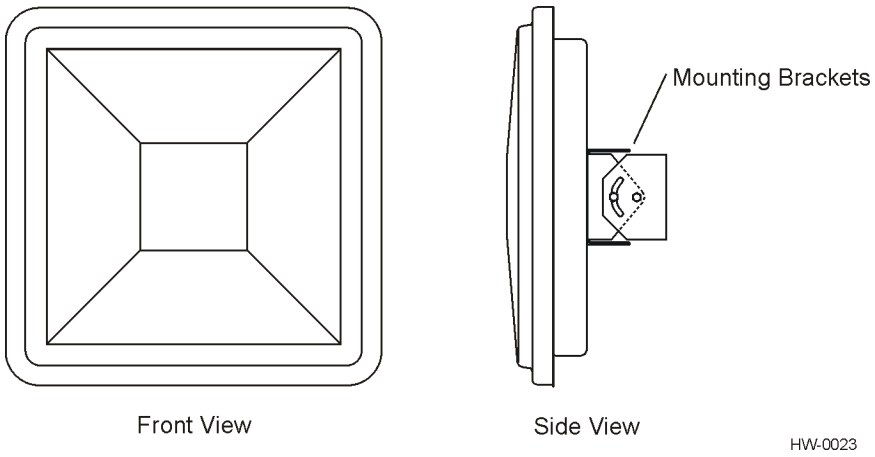

Figure 1 Encompass 4H Reader System Front and Side Views

Tags

The Encompass 4H Reader System has the capability to read TransCore SeGo, ATA and IAG protocol tags, and ISO-compliant read-only full- and half-frame tags.

How It Works

The Encompass 4H Reader System directs the RF module to generate an RF signal, which is broadcast through the integrated antenna. Entering the Encompass 4H Reader System's reading range, a TransCore RFID tag installed on a vehicle or other object to be tracked adds its programmed identification information to the signal and reflects the signal back to the Encompass 4H Reader System. The Encompass 4H Reader System receives this modified, or modulated signal, and decodes the tag data carried by the reflected signal and transmits this data to a local host computer for processing.

Chapter 2 Developing the Site Plan

This chapter discusses site plan development for installing the Encompass® 4H Reader System.

Overview

Developing a site plan provides the foundation for the site's system design and establishes the number and general location of primary components.

Also, consider the following factors when developing a site plan:

- Reading of mixed population tags
- Reader and tag alignment
- Site layout , mounting requirements, and traffic flow
- Electrical and communications

These factors provide relevant information regarding each site's physical and electromagnetic environment and the conditions under which the system must perform.

Reading of Mixed Population Tags

The Encompass 4H Reader reads TransCore's Super eGo® (SeGo) protocol tags, the American Trucking Association (ATA) and International Organization for Standardization (ISO) read-only tags, whether powered by battery or beam, and Inter-Agency Group (IAG) tags.

Note: *The Encompass 4H Reader can read ATA or ISO read-only tags in the presence of IT-Series tags, however, it is not recommended to read an IT-Series tag in the presence of an ATA or ISO read-only tag. Doing so may provide unreliable results.*

The factors that influence the readability include, but are not limited to physical orientation and configuration, type of read-only tag, ratio of backscatter cross-section of the tags, and whether the tag is battery or beam-powered.

Reader and Tag Alignment

The position of the Encompass 4H Reader and placement of the tag on the vehicle must be compatible. Also, consider any existing tagged vehicles now using the facility to determine the optimal Encompass 4H Reader and tag location and orientation at the site.

Note: *If any of the vehicles using your facility already have tags, such as those used in toll applications, contact TransCore for information about mixed-tag installations before you plan tag type, location, and programming.*

Three primary criteria must be satisfied to achieve the highest read reliability:

- Polarization of the tag and the Encompass 4H Reader must be aligned in the same direction — both horizontal.

- The installed tag must be in a direct, unobstructed line of sight to the Encompass 4H Reader.
- Tags designed to be mounted in a vehicle windshield must be mounted in the vehicle's windshield, and tags designed to be mounted on the exterior surface of the vehicle must be mounted on the exterior surface of the vehicle.

Caution

A tag may not be reliably read unless the preceding criteria are met.

Polarization

The polarization of the tag must be aligned in the same direction as the Encompass 4H Reader, as shown in Figure 2.

Note: *Matching the tag and antenna polarization is critical to obtain optimal system performance.*

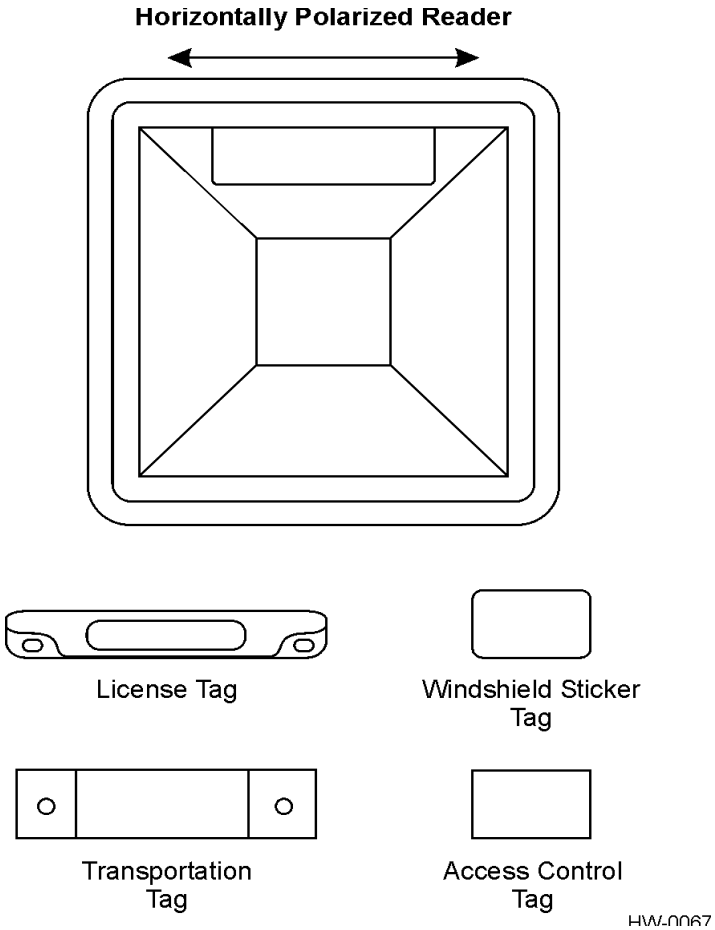

Figure 2 Tag and Reader Orientation

Unobstructed Line of Sight

For optimum readability, install the Encompass 4H Reader and the vehicle's tag so that when the vehicle approaches the Encompass 4H Reader, the tag is directly facing the reader and the line of sight is clear between the Encompass 4H Reader and the tag. If a fence or barrier is between the tag and the reader,

the Encompass 4H Reader cannot reliably read the tags. Figure 3 illustrates possible installation locations of an Encompass 4H Reader in relation to a tag's mounting location on a vehicle. If the tags are not in the recommended location, reliable optimum operation requires lower vehicle speeds.

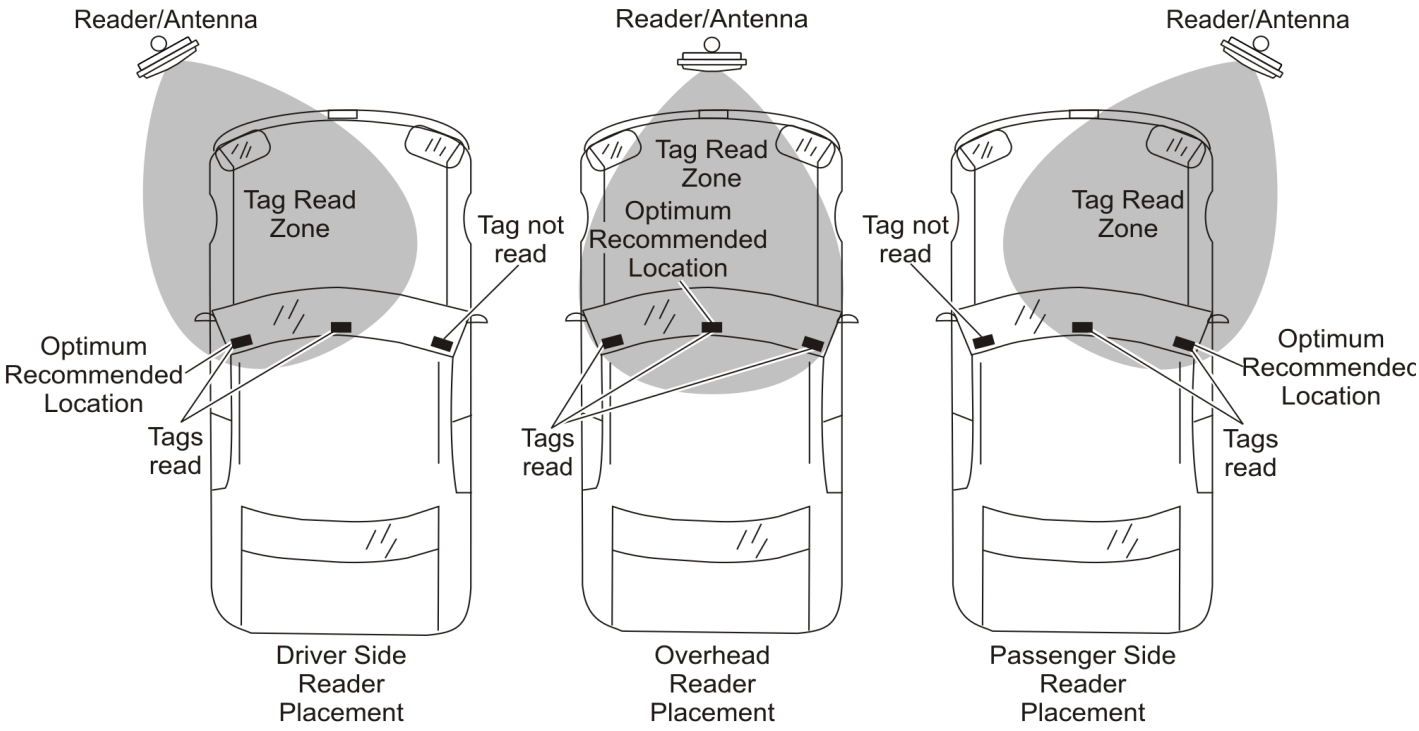

Figure 3 Encompass 4H Reader Location Relative to Tag Position

If the Encompass 4H Reader is installed on a pole or wall to the left of the vehicle, optimal tag position is on the left side of the vehicle as illustrated in Figure 4.

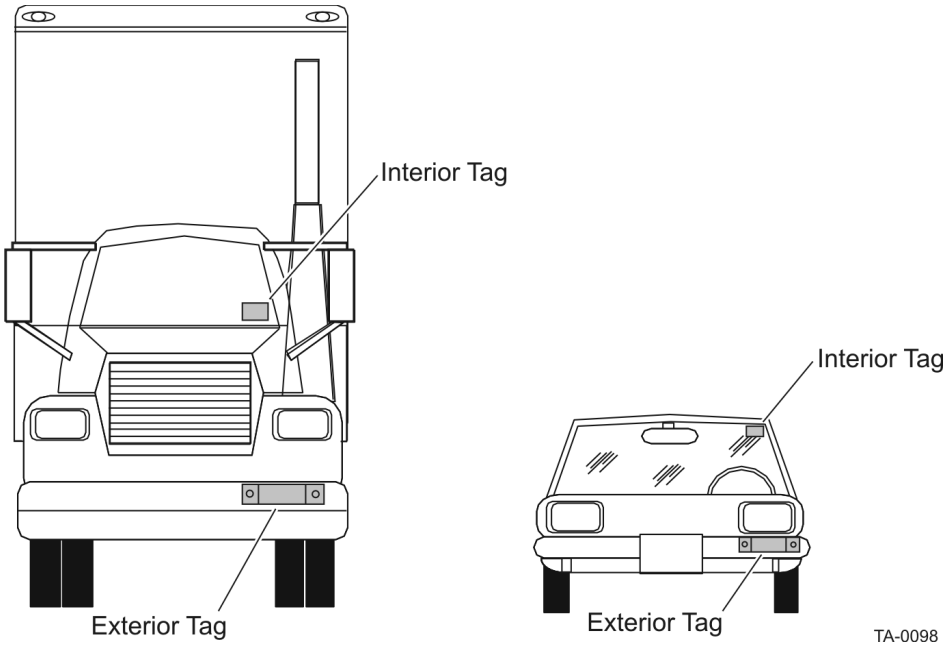

Figure 4 Typical Tag Positions for U.S. Driver's Side Reader

If an Encompass 4H Reader is installed on a pole or wall to the right of the vehicle, optimal tag position is on the right side of the vehicle as illustrated in Figure 5.

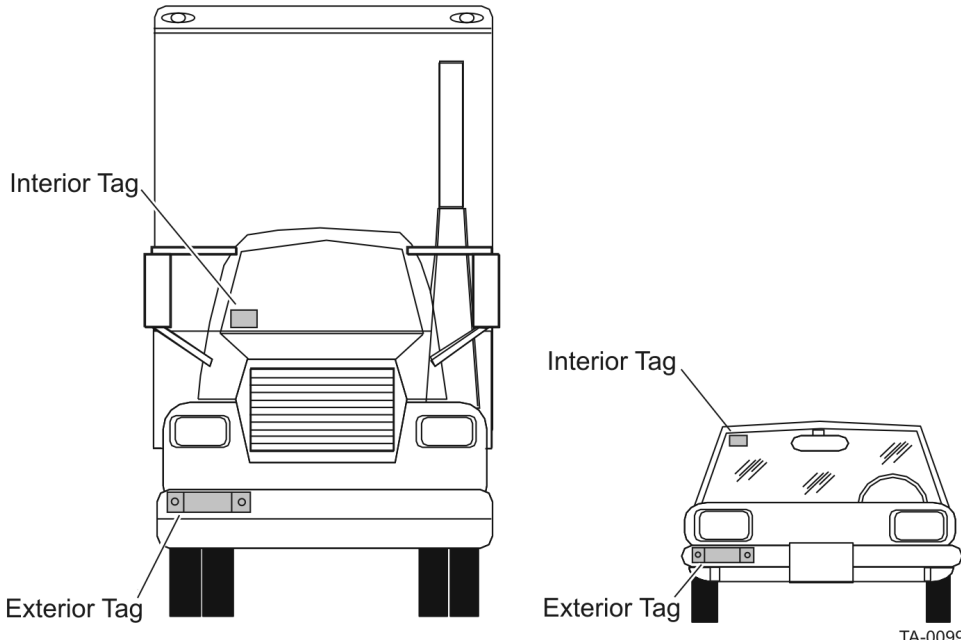

Figure 5 Typical Tag Positions for U.S. Passenger's Side Reader

If the Encompass 4H Reader is installed in an overhead location, optimal tag position is in the top center of the windshield in the area behind the rear view mirror or on the vehicle's front license plate or center bumper as illustrated in Figure 6.

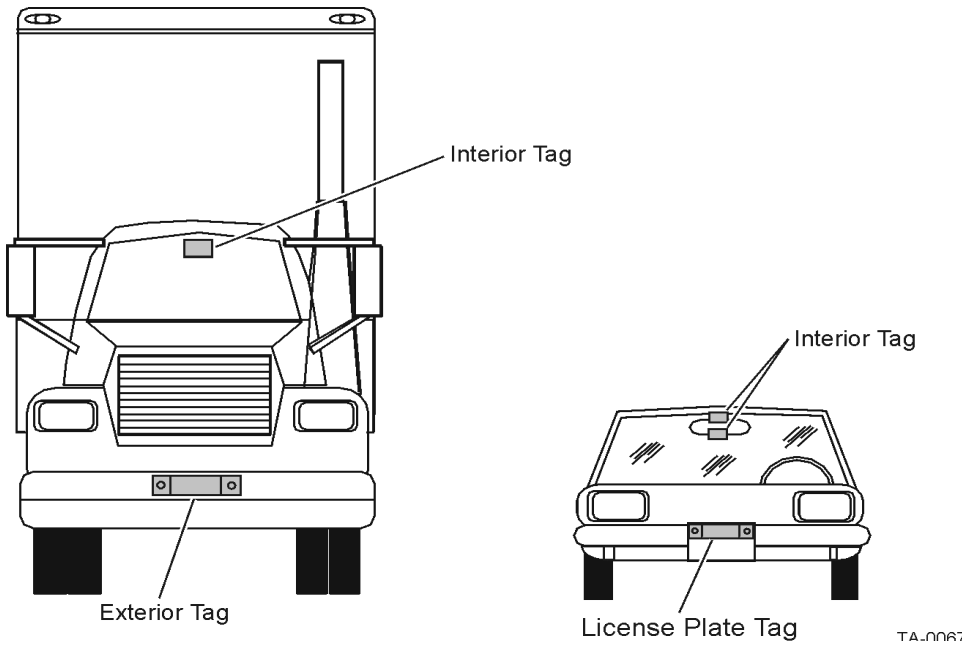

Figure 6 Typical Tag Positions Used with Overhead Reader

Note: *Metallized coatings on some vehicle windshields and windows shield the RF energy emitted by the Encompass 4H Reader and may cause tags to be misread. Many metallized windshields have areas that are not metallized in which the tag can be placed and reasonable results achieved. If there are no openings in the metallized coating in which to install an interior tag, install exterior-type tags on the exterior of the vehicle.*

Refer to "Chapter 3 Choosing, Installing, Removing Tags" on page 3–16 for more detailed information on tag positioning.

Site Layout, Mounting Requirements, and Traffic Flow

The following site layout and traffic flow considerations are critical when determining Encompass 4H Reader installation locations:

- The Encompass 4H Reader read zone
- Other Encompass 4H Reader units in the area
- Lane configurations
- Reflection, refraction, and diffraction of RF signals
- Existing signal interference

The Encompass 4H Reader Read Zone

The Encompass 4H Reader must be able to read the tag data properly within a specified area, called the read zone, without reading other nearby tags or interfering with other Encompass 4H Readers at the site. The following are some of the factors that affect the size and shape of the read zone:

- Mounting method used (pole or wall mount)
- Mounting location (overhead or side mount)
- Height from the ground and mounting angle
- Indoor or outdoor location
- RF output attenuation
- Range discrimination setting
- Other sources of interference and reflection

The Encompass 4H Reader must be positioned to allow the RF signal to travel to and return from the tags within the designated range and be placed in an area where it is not likely to be bumped out of alignment. If a nearby structure is added or removed, system operation can be seriously affected.

For instructions on setting the read zone, refer to "Fine-Tuning and Verifying the Read Zone" on page 8–127.

Other Encompass 4H Readers in the Area

Encompass 4H Readers may not operate accurately if they directly face each other or are positioned back-to-back.

Lane Configurations

TransCore recommends that traffic be guided through a controlled lane to consistently obtain accurate tag readings and to prevent physical damage to the Encompass 4H Reader. The following subsections describe some common lane configurations and offer suggestions for positioning the Encompass 4H Reader within the controlled traffic flow.

Note: *Regulatory requirements restrict the amount of RF power to 4 Watts EIRP that can be transmitted from the Encompass 4H reader. In a side fire mounted application, this reduction in RF power has been shown to impact the available read zone size and speed at which the tagged vehicles can pass by the reader and be reliably read for all tags except ATA battery tags. If any other tag type is being used, the end user needs to be aware of the reduction in performance and should perform testing in their anticipated application to confirm it will meet their system requirements.*

Gate with Center Island Configuration

Figure 7 illustrates a typical gate application with the Encompass 4H Reader units positioned on a center island to read tags mounted on the inside windshield on the driver's side (United States). The readers are placed to allow time for the gate to open so the vehicle can roll through without stopping while not allowing room for an untagged vehicle to be between the vehicle being read and the gate.

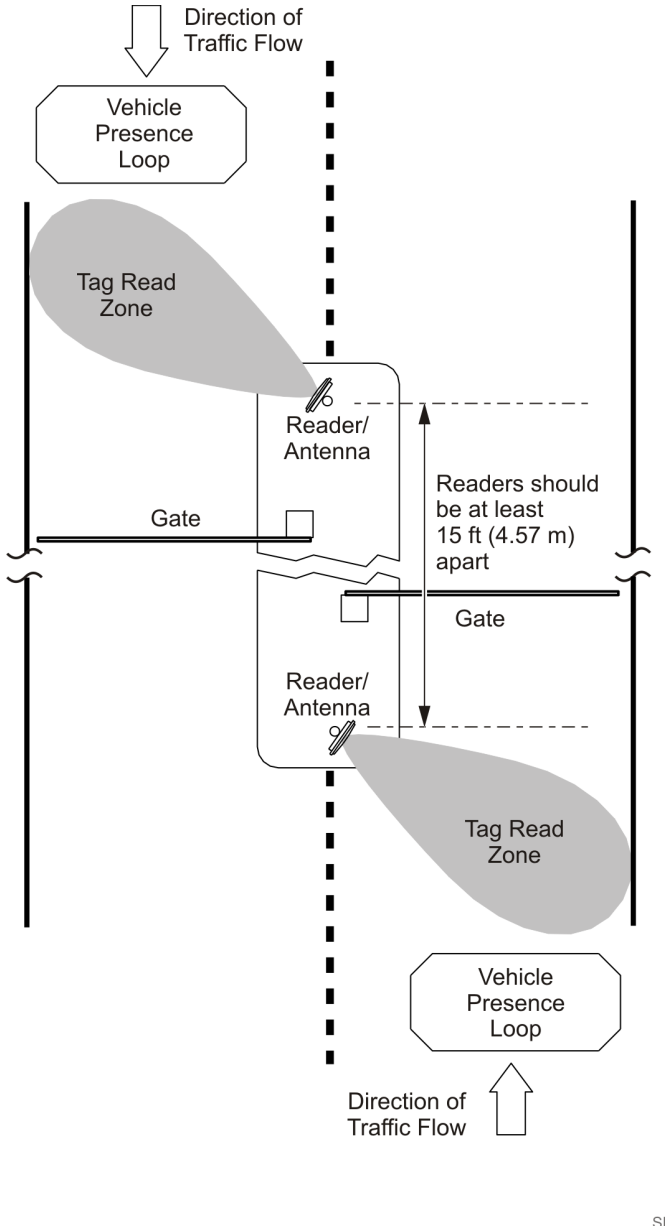

Figure 7 Gate Application with Center Island

Parking Garage with Ticket Island Configuration

Figure 8 illustrates a parking garage application with each Encompass 4H Reader mounted on the ticket island to read tags mounted on the inside center windshield or on the center front vehicle bumper. The Encompass 4H Reader placement may require the vehicle to stop before the gate opens.

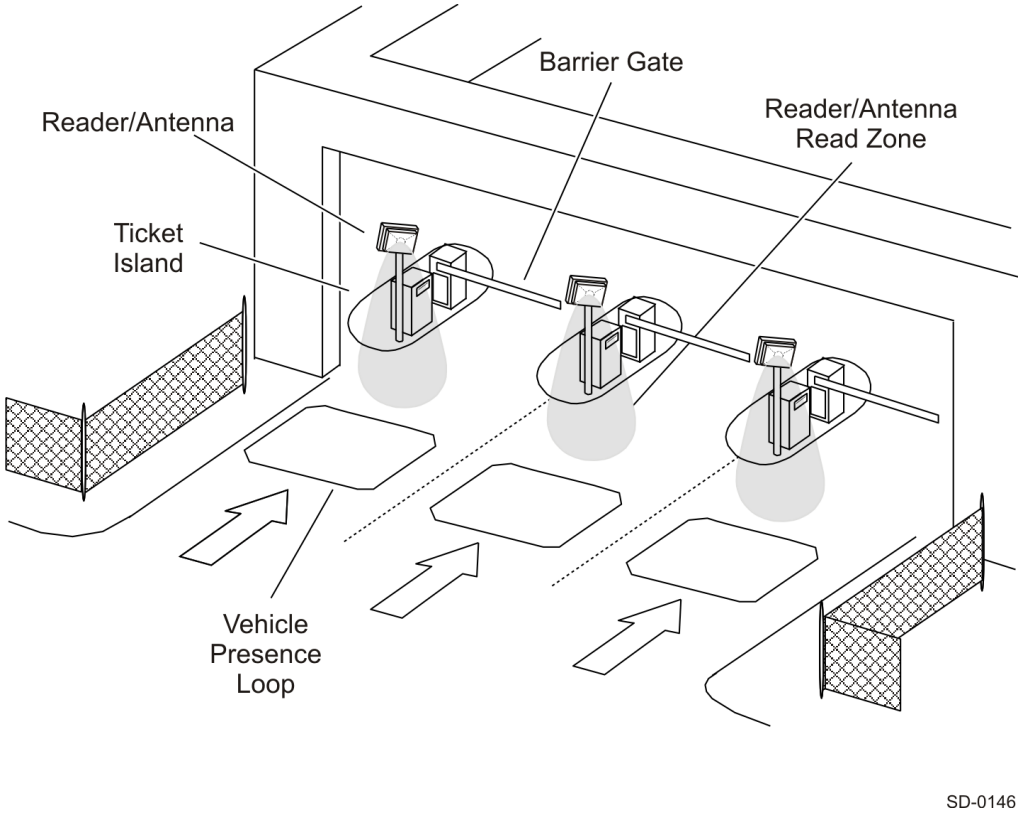

Figure 8 Parking Garage Application

Overhead Reader Installation Configuration

Another option for Encompass 4H Reader placement is to mount it overhead in each lane as illustrated in Figure 9. This illustration assumes that tags are mounted on the inside center windshield or center bumper of the vehicle.

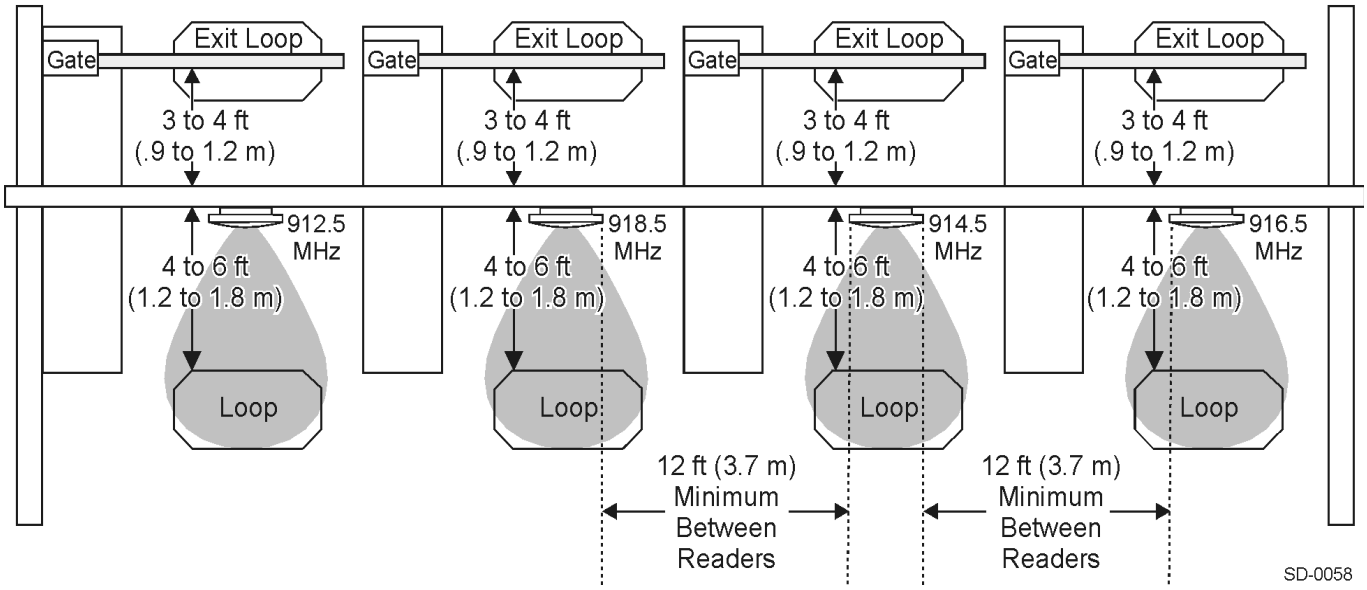

Figure 9 Overhead Installation

Lane Configurations

TransCore recommends that traffic be guided through a controlled lane to consistently obtain accurate tag readings and to prevent physical damage to the Encompass 4H Reader.

Reflection, Refraction, and Diffraction of RF Signals

RF signals can be reflected, refracted, or diffracted by metal objects, walls, and even wet pavement or ice. Any of these factors can alter or degrade system performance. When designing your site plan, you must consider permanent structures and transient factors in the vicinity that may affect RF signals being generated by the Encompass 4H Reader. Permanent structures include buildings, chain link fences, guard shacks, and gates. Transient factors include passing traffic and local weather conditions, such as rain or snow. Symptoms of reflection, refraction, and diffraction include reading tags that are out of the desired read zone or tags being read from another lane.

The most common RF reflectors are metallic surfaces. RF signals may also be partially reflected by nonconducting materials such as dirt, wood, ice, asphalt, and concrete. When nonconducting materials in the system environment become wet, they increase reflection of RF signals.

The Encompass 4H Reader and/or antenna mounting location, aiming, and range control adjustment, and use of presence detectors can reduce interference from RF reflections. When these actions cannot adequately control reflections, other techniques such as shielding, absorbing, range sensitivity adjustment, or barriers can also be used. Refer to “Chapter 9 Troubleshooting and Maintenance” on page 9–130 for more information.

Existing Signal Interference

Interference from RF and electrical sources can degrade system performance and must also be considered in the site design. Fluorescent lights, neon signs, nearby radio stations, or power lines can interfere with the optimal operation of the system. The magnetic impulse noise from relays that control gate opening and closing can also disrupt the RF signal.

Interference may degrade both reader and tag performance. Existing interference at the site may be shielded, removed, or positioned further from the Encompass 4H Reader. Strong RF sources of any frequency, in proximity to the tag, can preclude the tag receiving the reader interrogation. Refer to "Chapter 9 Troubleshooting and Maintenance" on page 9–130 for more information.

Electrical and Communications Requirements

All construction work at the site must be completed before installing the Encompass 4H Reader. Electrical and communications cables should be installed according to all applicable local and federal building code requirements. Specific instructions for positioning and installing the Encompass 4H Reader are discussed in "Chapter 4 Installing the Encompass 4H Reader" on page 4-28.

Junction Box

Use a watertight junction box that meets applicable local and national building codes for connecting power and communications wiring. The junction box houses the terminal strip for power and communications connections. TransCore recommends a NEMA Type-4 junction box with a back-mounting panel.

Power and Communications Cables

Cable length for power and communications depends on the physical characteristics of the Encompass 4H Reader installation site. Table 1 lists accessory kits available for cabling options based on your site's requirements.

Table 1 Connector Cabling Accessory Kits

Part Number	Description
58-1620-001	5-ft connector cable harness
58-1620-002	20-ft connector cable harness
58-1620-006	35-ft connector cable harness
58-1620-007	45-ft connector cable harness
20-1620-003	Connector kit only
56-1620-004	13-pair cable (sold by the foot)
76-1620-005	110V AC to 18V AC Class C transformer
76-1620-006	12V AC to 18V AC step-up transformer
76-1620-008	220V AC to 18V AC Class C transformer

Electrical Power

A dedicated electrical power supply must be present at the site and available to the Encompass 4H Reader at all times. The power must be 16-20V AC or 16-28V DC. A step-down transformer is available (North America only) to convert a 120V AC duplex wall outlet with ground to 18V AC, as is a step-up transformer to convert a low-voltage 12V AC outlet to 18V AC. Consult your local and national electrical codes for installation and safety requirements.

Note: *Encompass 4H Readers installed outside North America require a locally supplied transformer.*

For *IEC60950 compliance, this unit must be used in conjunction with a certified limited power source (LPS). The LPS should be rated for 16-20VAC output voltage, 3 Amps maximum output current or 16-28VDC 3 Amps maximum output current, and limited to less than 100VA apparent power.*

If 18V AC or 18V DC power is available, the transformer option is unnecessary.

TransCore offers a Class C transformer accessory kit (part number 76-1620-005) for sites where 110V AC is available. For sites with 220V AC, an accessory kit (part number 76-1620-008) is also available (Table 1).

It is the installer's responsibility to supply conversion equipment and wiring for other voltages It is the installer's responsibility to supply conversion equipment and wiring for other voltages. Table 2 contains power supply current requirements.

Table 2 Power Supply Requirements

Supply	(RF On)[a] Maximum Power at 68°F (20°C)	(RF Off)[a] Standby Operating Power at 68°F (20°C)
16 to 20V AC	20 watts (W)	14 W
16 to 28V DC	20 W	14 W

a 1700 milliamp (mA) initial rush-in current at startup

Power circuits are protected internally against power surges.

Power Extension

Use Table 3 to determine the correct cable size according to the American Wire Gauge (AWG) standard for the necessary length of extension cable. The numbers in the first row of the table indicate cable size for the approximate cable length.

Note: *If the cable is close to the maximum length, measure voltage at the Encompass 4H Reader with RF ON to ensure voltage does not drop below 16V. A drop in voltage below 16V causes a reduction in read range and possible damage to internal electronics as well as unreliable operation.*

Table 3 Recommended Cable Length from Transformer to the Encompass 4H Reader

Cable Size (AWG)[a]	24	22	20	18	16	14	12
Maximum DCR (Ohms per foot at 68°F)[b]	0.0270	0.0175	0.0109	0.0069	0.0044	0.0027	0.0017
TransCore 5-ft cable (P/N 58-1620-001)[c]	23 ft	36 ft	58 ft	92 ft	144 ft	235 ft	373 ft
TransCore 20-ft cable (P/N 58-1620-002)[c]	15 ft	23 ft	38 ft	60 ft	93 ft	152 ft	242 ft
TransCore 35-ft cable (P/N 58-1620-006)[c]	7 ft	11 ft	17 ft	27 ft	43 ft	70 ft	110 ft
TransCore 45-ft cable (P/N 58-1620-007)[c]	1 ft	2 ft	4 ft	6 ft	9 ft	14 ft	23 ft

a Use two pair (two conductors for power and two for return). TransCore cable is 22AWG.

b Direct current resistance (DCR) information is from the Belden catalog.

c Based on a 1.0V drop at 1200 mA (RF ON) with 15% margin.

Host Communications

Your site design must include communications between the Encompass 4H Reader and a host computer. The Encompass 4H Reader communicates with the host computer through an asynchronous serial line or through a Wiegand interface. This serial line can be an RS–232 interface or an RS–422 interface. The host computer must be able to accept one of the interfaces shown in Table 4.

Table 4 Communications Interfaces and Conductor Requirements

Interface	Number of Conductors
RS–232	3
RS–232 with RTS and CTS hardware and handshake signals	5
RS–422	4
Wiegand	3

RS–232 Interface

Use an RS–232 interface if one or more of the following conditions apply to your site:

- The host computer system is 50 ft (15.2 m) or less from the Encompass 4H Reader.
- The host computer system is more than 50 ft (15.2 m) from the Encompass 4H Reader and a pair of RF modems or limited distance modem/line drivers over copper wire are used for communications between the Encompass 4H Reader and the host. The distance from the RF modem to the Encompass 4H Reader should not exceed 50 ft (15.2 m).
- Other common communications devices that can extend the RS–232 distance, such as fiber optic modems, have been selected.

The standard RS—232 connection maximum distance depends on the baud rate, cable type, and the RS—232 device at the other end.

Note: *When extending the RS-232 interface, use a three-pair cable such as Belden 2919. Use a twisted pair for the black (RxD) with ground (black of the black/yellow pair), and a twisted pair for red (TxD) with ground (black of the black/yellow pair). The third pair of the three-pair cable can be used for a spare in the event either of the other two pair are damaged or fail. The cable shield should be tied to a single-point earth ground on the controller end of the cable.*

RS–422 Interface

Use an RS—422 interface if one or more of the following conditions apply to your site:

- The host computer is more than 50 ft (15.2 m) from the Encompass 4H Reader
- The host computer has an external limited-distance modem

The standard RS—422 connection maximum distance depends on the baud rate, cable type, and the RS—422 device at the other end.

Wiegand Interface

The Encompass 4H Reader can interface with equipment requiring the Wiegand +5V DC data0-data1-signal-ground interface. The reader uses the Wiegand interface included with the RS—232 or RS—422 option.

Note: *The Encompass 4H Reader comes from the factory with either RS–232 and Wiegand or RS–422 and Wiegand. If you want to use Wiegand, you must first connect the Encompass 4H Reader using the RS–232 or RS–422 interface, set all necessary operating parameters in the reader, then set the Encompass 4H Reader's configuration to Wiegand, and then connect the Encompass 4H Reader to the Wiegand interface.*

Note: *You must order tags programmed with Wiegand-formatted data when using a Wiegand-compatible reader.*
When extending the Wiegand interface, use a three-pair cable such as Belden 2919. Use a twisted pair for the red (Data1) with ground (yellow of the black/yellow pair), and a twisted pair for blue (Data0) with ground (yellow of the black/yellow pair). The third pair of the three-pair cable can be used for a spare in the event either of the other two pair are damaged or fail. The cable shield should be tied to a single-point earth ground on the controller end of the cable.

Input/Output Circuits

To connect the Encompass 4H Reader to external equipment such as a treadle or traffic control light, install wires from these devices at the junction box. The Encompass 4H Reader input circuit is designed to connect to a dry contact closure. The Encompass 4H Reader output circuits are single-pole, double-throw relays providing dry contact closures. These contacts are rated at 42.2V AC peak ($30V_{rms}$) or 60V DC, at 1 A maximum with non-inductive load.

Output circuits are not intended for the direct control of electromechanical devices such as motorized gates and barrier arms. For such applications, the Encompass 4H Reader output circuits should be used to drive a secondary, appropriately rated high-power relay.

Chapter 3 Choosing, Installing, Removing Tags

This chapter describes the various tag types compatible with the Encompass® 4H Reader and the procedures for installing and removing compatible internal and external tags.

Compatible Tag Types

The Encompass 4H Reader provides the capability to read the various TransCore eGo® Plus-type tags employing Super eGo (SeGo) protocol and other American National Standards Institute (ANSI) ANS INCITS 256-2001-compliant tags. Depending on options ordered, the Encompass 4H Reader can read eGo Plus, ATA-protocol, ISO-compliant tags, and Inter-Agency (IAG) tags. It can also read tags formatted to a wide range of industry-standard proprietary formats, including SIA Wiegand 26-bit standard format.

TransCore tags offer security features to prevent data corruption, data alteration, and tag cloning. Tags support factory locked data fields for Tag ID, customer, and user information as well as open data fields for agency use.

Refer to "Appendix E Compatible Tag Information" on page E–1 for information about specific tag models.

Windshield Sticker Tags

TransCore's eGo® Plus windshield sticker tags are beam-powered, radio-frequency identification (RFID) tags, ideal for applications that require low-cost and easy installation. These tags do not require batteries or maintenance. The peel and stick design provides ease of installation on an interior windshield. Tags are constructed from strong, flexible material that can withstand long-term exposure to the sun.

Windshield sticker tags are suitable for a wide variety of automatic vehicle identification (AVI) applications, including electronic toll collection, airport/ground transportation management, parking access, and security access.

Installation is semi-permanent and the tag cannot be reused once it is removed from the windshield.

Hard Case Tags

TransCore's hard case RFID tags offer flexibility, durability, and versatility. Constructed of highly durable, impact resistant, molded plastic, these tags are durable enough for use in commercial environments. Easy installation and removal is assured by a choice of mounting options: 3M™ Dual Lock, hook-and-loop, or suction cups. Double-sided tape strips are an available mounting option for semi-permanent installations.

Hard Case Tags are suitable for a wide variety of automatic vehicle identification (AVI) applications, including electronic toll collection, airport/ground transportation management, parking access, and security access. Features of these tags vary, depending on the model. Refer to "Appendix E Compatible Tag Information" on page E–1 for information about specific tag types.

Many hardcase tags are powered by a lithium battery. Some cases have batteries that are replaceable by the user, while others have long-lasting non-replaceable batteries when a maintenance free tag is required.

Rail/Transportation/Container Tags

The AT Series tags are ideal for external mounting on vehicle chassis, intermodal containers, or any environment that requires a durable, weatherproof tag.

The rugged weatherproof, sealed, UV-stabilized gray case can withstand harsher environments such as railyards.

Many of the AT Series tags are beam-powered, requiring no internal battery, for an unlimited service life.

Exterior-Mounted Tags

Packaged in a water-resistant case, TransCore's exterior mounted tags are ideal for applications that require exterior-mounted, easily installed tags. Exterior tags feature rugged cases that are water, weather, and impact resistant. They are beam-powered, eliminating the need for batteries or maintenance. They are suitable for a wide variety of automatic vehicle identification (AVI) applications, including electronic toll collection, airport/ground transportation management, parking access, and security access.

TransCore's License Plate tags are designed to fit over a vehicle license plate and are typically mounted on the vehicle using existing license plate brackets and hardware.

TransCore's Mini External tag can be mounted on any flat or slightly curved glass, plastic, or metal surface with two semi-permanent adhesive strips. Its compact size is ideal for applications requiring exterior mounting and easy installation.

Hang Tags

Hang tags are designed to hang on a vehicle's rear-view mirror. When a tag is not needed, it can be easily removed and stored for later use.

Hang tags have the same features as eGo Plus Windshield Sticker tags. They are suitable for temporary applications that require a robust, yet easily removable tag, such as electronic toll collection.

Windshield Sticker Tag General Installation Instructions

Required supplies

- eGo Plus Windshield Sticker Tag
- Commercial glass cleaner and paper towels

General instructions and guidelines

- You MUST correctly and permanently install the tag on the windshield before driving to the toll plaza. Do not attach the tag to your visor or other temporary location.
- Do not wave the tag or hold it on the inside or outside of your vehicle as you approach the toll plaza.
- If your vehicle has a metallized windshield, the tag should be mounted in the section that is not metallized, usually near the rear-view mirror. Contact the customer service center for support.

Choose a location for your windshield sticker tag

Determine where you will position the windshield sticker tag. Figure 10 shows the zone where your tag should be located for optimal performance. Tags should be mounted with the long edge oriented horizontally as shown in Figure 10.

Mirror mounted to windshield

Locate the tag approximately 1" below the rear view mirror mount and center tag on the windshield behind the rear view mirror.

Mirror mounted to header

Measure down approximately 4" from the top edge of the interior windshield and center the tag on the windshield behind the rear view mirror.

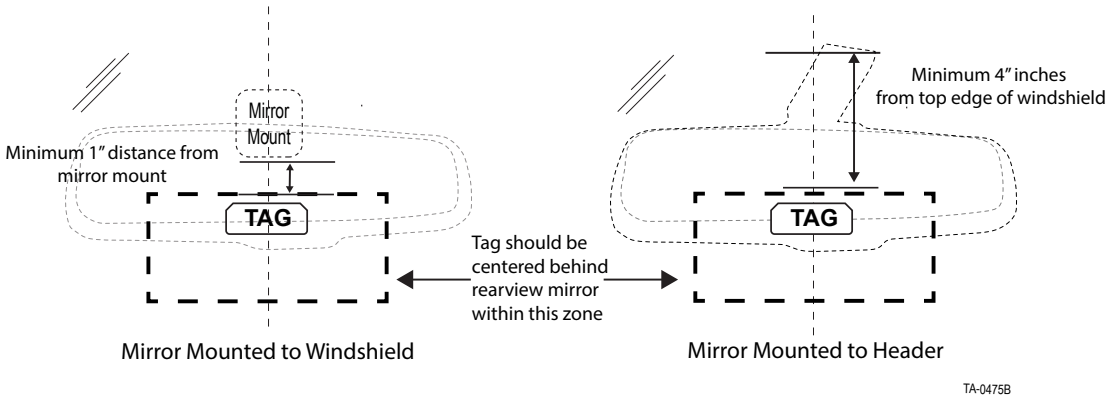

Figure 10 WST Tag Location for Optimal Performance

Large truck

If the truck does not have a center bar, the tag should be centered 3" from the bottom of the windshield. If the truck has a center bar, position the tag 2" to the right of the center bar (looking from the inside of the vehicle), and 2" from the bottom of the windshield. (Figure 11).

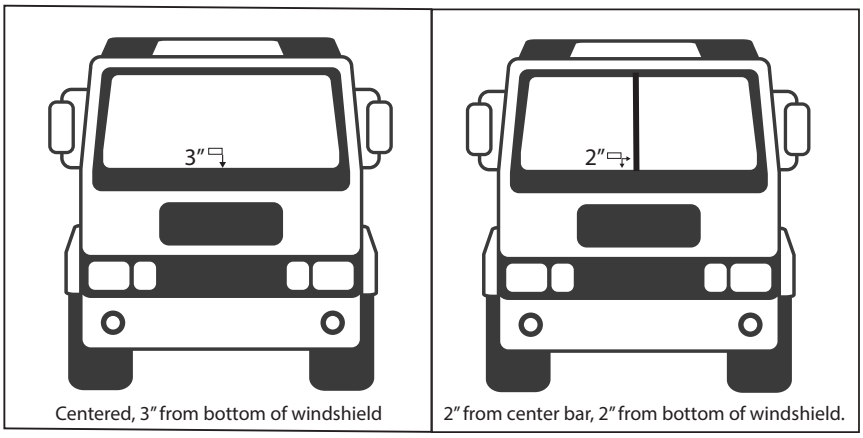

Figure 11 Tag Location for Large Trucks

Install your windshield sticker tag

Install the tag when the windshield's temperature is above 50°F (10°C). In colder climates, use your heater/defroster to warm the windshield before installing the tag.

Note: *Once the tag is installed, it cannot be repositioned or moved.*

1. Clean and dry the area where the tag will be installed with commercial glass cleaner and paper towels.
2. Hold the tag so that the release liner is facing you. Starting at the upper right corner of the tag, peel the release liner to expose the adhesive (Figure 12).

Figure 12 Location of Release Tab

3. With the adhesive side facing toward the windshield but not touching the glass, move the tag to the desired location, and then press one edge to the glass.
4. Adhere the tag to the glass by rubbing your thumb up and down in a zigzag motion across the entire tag surface (Figure 13).

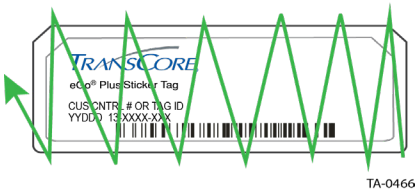

Figure 13 Rub Tag to Bond Adhesive to Windshield

5. The tag is installed and ready for use.

Removing the windshield sticker tag

Note: *Once you remove the windshield sticker tag, you cannot reuse it.*

If you need to remove the tag from your windshield, peel off the tag starting at one corner, then clean any adhesive residue remaining on the windshield using isopropyl alcohol. Discard the used tag.

Hard Case Tag General Installation Instructions

TransCore's eGo Plus hard case tags are designed for mounting to a vehicle's interior windshield surface. They are constructed of highly durable, impact-resistant, molded plastic. Customers may choose among four different mounting options: 3M™ Dual Lock™, hook-and-loop, double-sided tape strips, or suction cups.

Required Supplies

- eGo Plus Hard Case Tag
- Commercial glass cleaner and paper towels

General Instructions and Guidelines

- You MUST correctly and permanently install the tag on the windshield before driving to the toll plaza. Do not attach the tag to your visor or other temporary location.
- Do not wave the tag or hold it on the inside or outside of your vehicle as you approach the toll plaza.
- If your vehicle has a metallized windshield, the tag should be mounted in the section that is not metallized, usually near the rear-view mirror. Contact the customer service center for support.

Choose a location for your tag

Determine the appropriate location for your hard case tag (Figure 14). The tag should be mounted on the interior windshield, approximately 1 inch (2.54 cm) below the rear-view mirror post.

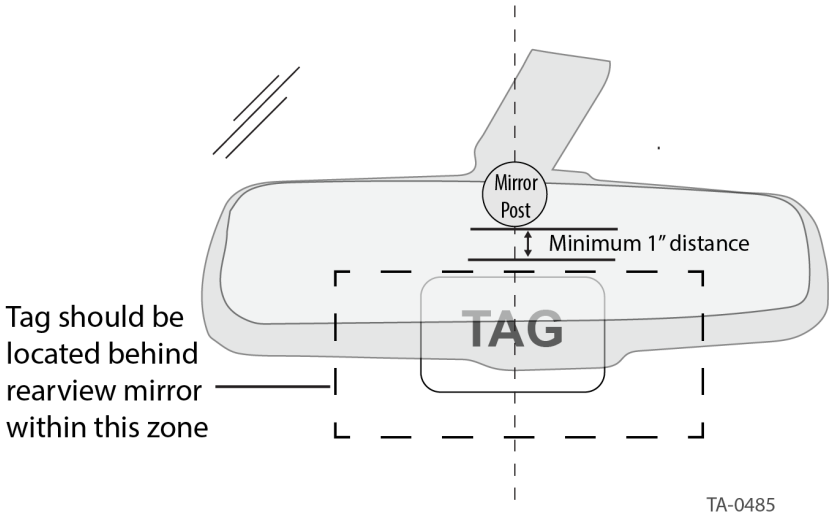

Figure 14 HC Tag Location for Optimal Performance

Clean and dry the interior windshield surface completely before mounting the tag. The windshield temperature must be at least 68°F (20°C) for optimum bonding.

Hard Case Tag Mounting Options

Dual Lock, hook-and-loop, and suction cups are viable mounting options if tag portability is desired. Double-sided tape strips are the best mounting option for semi-permanent installation.

Dual Lock or Hook and Loop Installation

1. Peel the backing off of the Dual Lock or hook-and-loop strips to expose adhesive. Note that the tag should be oriented as shown in Figure 15.

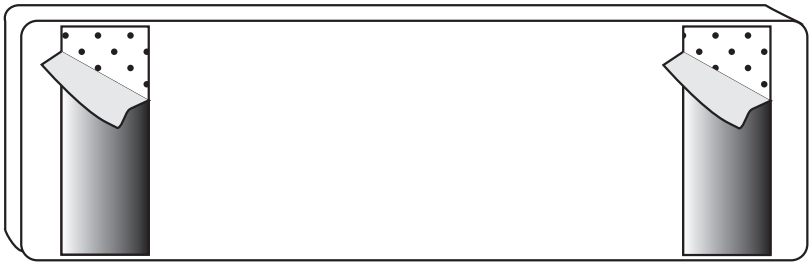

Figure 15 Remove backing to expose adhesive

2. Leave both sides of the strips pressed together to ensure the strips will align between the tag and the windshield. Hold the tag so that the printed text or image is right side up and facing toward you. Apply the tag to the windshield using moderate pressure and hold for approximately 10 seconds.

Note: *When installing the tag using Dual Lock or hook-and-loop for the first time, the manufacturer recommends leaving the tag in place for at least 24 hours to allow the adhesive to cure.*

Double-Sided Tape Strips

1. Peel the backing off of the tape strips to expose adhesive. Note that the tag should be oriented as shown in Figure 15.
2. Hold the tag so that the printed text or image is right side up and facing toward you. Apply the tag to the windshield using moderate pressure and hold for approximately 10 seconds.

Note: *Mounting with double-sided tape strips is semi-permanent. The tag cannot be moved or repositioned after installation.*

Suction Cups

1. Orient the tag in the same direction as shown in Figure 15.
2. Hold the tag so that the printed text or image is right side up and facing toward you.
3. Moisten the cups and stick the tag to the windshield.
4. Press the tag against the windshield until the tag is secure (approximately 10 seconds).

Removing the Tag

To remove a tag mounted with Dual Lock or hook-and-loop, grip the tag at the top and bottom sides. Gently lift the tag away from the windshield on one end until the tag is free from the windshield.

To remove a tag mounted with suction cups, slide a finger under the tab on the suction cup to loosen it from the windshield surface.

To remove a tag mounted with double-sided tape, lift the tag away from the windshield working from one end to the other until the tag comes free. Clean any adhesive residue remaining on the windshield using isopropyl alcohol. The tape strips cannot be reused.

Installing eGo Plus Exterior-Mounted Tags

This section describes general installation guidelines for TransCore's eGo Plus Exterior-Mounted tags. Contact TransCore sales for installation instructions for specific tags.

TransCore's eGo Plus exterior-mounted tags are constucted from highly durable molded plastic. Designed for outdoor environments, these rugged tags are water and weather resistant. Beam-powered tags do not use batteries and require little to no maintenance after installation.

Tags should be mounted with the long edge oriented horizontally (Figure 16).

Figure 16 Correct Tag Orientation for an Exterior-Mounted Tag

eGo Plus License Plate Tag

The eGo Plus License Plate Tag (LPT) should be installed on the front of your vehicle on a flat surface. The LPT is typically screw-mounted in the area of the front bumper where the license plate is located. If the license plate area of your vehicle is not perpendicular to the ground or is partially obstructed by an overhanging bumper, you will need to mount the tag at an alternate location in the vicinity of the license plate.

Note: *If your vehicle does not have a front license plate area or if you need to mount the LPT in an alternate location, contact your tag agency for further options.*

Required supplies

- eGo Plus License Plate Tag
- Screwdriver (flat-blade or Phillips depending on your vehicle's license plate mounting screws)
- Optional TransCore Exterior Tag Accessory Kit (19077-01). This kit contains tamper-resistant mounting screws and wrench.

Mounting the LPT to the Vehicle

1. Remove the screws from the license plate area of your front bumper. If your vehicle does not have mounting screws you will need two self-tapping threaded screws. You can also contact the tag agency to inquire about the optional TransCore Exterior Tag Accessory Kit.
2. Position the LPT so that it is within 18 inches (46 cm) of the center of the front bumper as shown by the shaded area in Figure 17. If your vehicle's license plate mounting area is more than 18 inches (46 cm) from the center, you may need to select an alternate location to mount the tag. Contact your tag agency if your vehicle requires an alternate mounting location for the LPT.

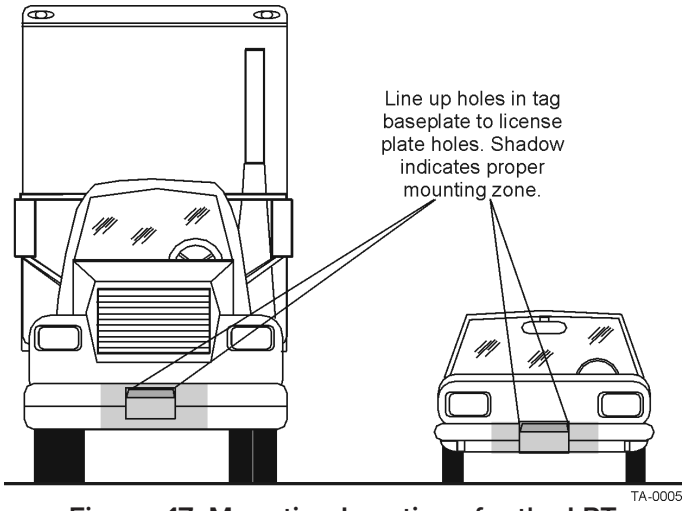

Figure 17 Mounting Locations for the LPT

3. Hold the LPT so that the etched lettering is facing you, the mounting holes are to the top, and the TransCore logos are at the bottom as shown in Figure 18.

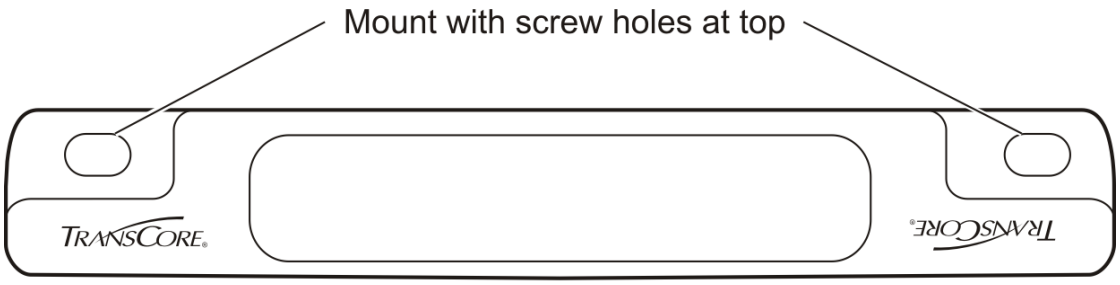

Figure 18 Correct Tag Orientation

4. Fasten the LPT to the bumper using the license plate mounting screws (Figure 19). Install the LPT over the top area of the vehicle's license plate if your vehicle has a front license plate. If your state does not require a front license plate, install the LPT in the area where a license plate would normally be mounted.

Note: *You may need to use longer screws to fasten the LPT over the top area of your license plate.*

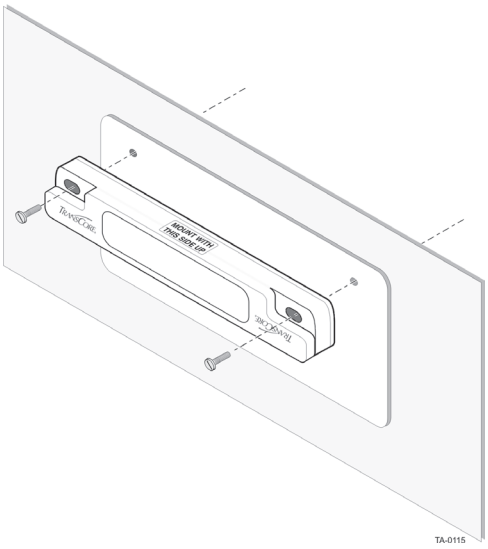

Figure 19 Upper Placement over the Top Area of the License Plate

Tag Placement Guidelines

1. The area within 45 degrees of the center of the tag should be free of obstructions (Figure 20).

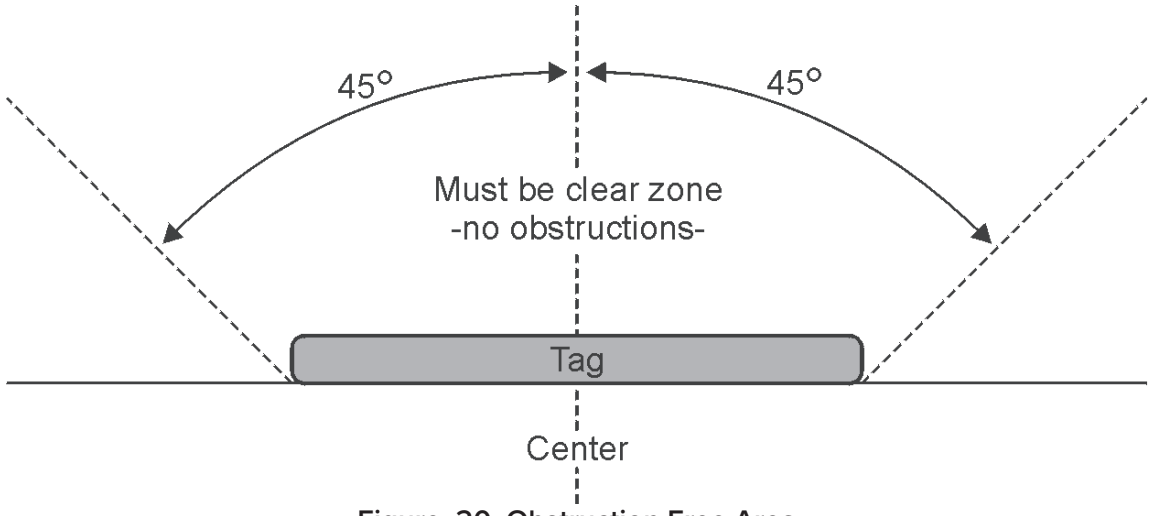

Figure 20 Obstruction Free Area

2. No material should overhang the tag. If overhang is more than ½ inch (1.27 cm), insert spacers or washers directly behind the tag so that the tag is clear of any overhanging obstruction. Secure the bolts with a nut (Figure 21).

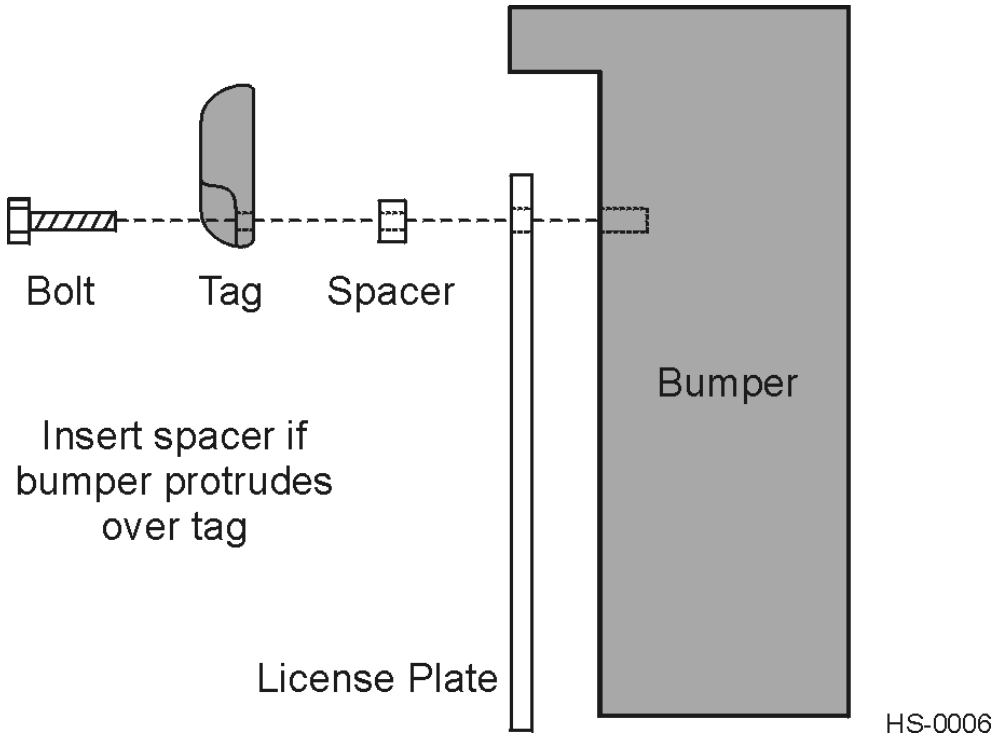

Figure 21 Spacer Positioned Behind Tag

3. Tighten the bolts and nuts with a screwdriver and wrench to secure the tag to the vehicle.

Alternate Mounting Methods

If the LPT cannot be mounted on the license plate bracket, the tag may be mounted directly on the bumper or on a relatively vertical front surface of the vehicle. The LPT should be mounted as close to the bumper as possible, following all guidelines regarding orientation, obstruction, and overhang. For applications where the integrity of the mounting surface cannot be compromised, the LPT can be mounted on a smooth flat surface using double-sided tape.

Mounting on a Front Bumper

- Tags can be mounted on any metal or non-metallic surface; composition of bumper does not matter.
- Tags can be mounted to plastic bumpers using self-threading screws.
- Metal bumpers should be pre-drilled; self-threading screws may be used.

Double-sided Tape

You need the following materials to install the LPT with double-sided tape:

- Rubbing alcohol, 50/50 isopropyl alcohol and water, or solvent/cleaner for metal
- Sponge and dry cloth
- LPT with the double-sided adhesive tape attached

1. Clean and degrease the tag installation area of the vehicle bumper with solvent/cleaner.
2. Dry the area thoroughly using a clean, dry cloth.
3. Remove the backing from the double-sided tape on the back of the tag.
4. Position the tag over the installation area, making sure that the tag and the reader orientation are the same (horizontal or vertical).
5. Press the tag firmly against the bumper.

Blind Rivets

1. Position the tag on the bumper in the installation area and mark the hole positions of the tag's installation tabs on the bumper.
2. Follow the rivet manufacturer's instructions to drill holes in the bumper for rivets.
3. If the rivet head is smaller than the tag installation holes and can be pulled through the holes, use a small washer to secure the rivet through the tag.

Note: *To remove an exterior tag installed with rivets, follow the rivet manufacturer's instructions to remove the rivets.*

eGo Plus Mini External Tag

The eGo Plus Mini External Tag can be installed on any flat or slightly curved glass, plastic, or metal surface. The tag is attached with two strips of durable non-removable adhesive.

1. The outward-facing side of the tag should be pointed toward the front of the vehicle. Position the tag so that no part of the vehicle hangs over the tag. The tag should have a minimum field-of-view of 90 degrees. Refer to Figure 22 for correct tag placement.

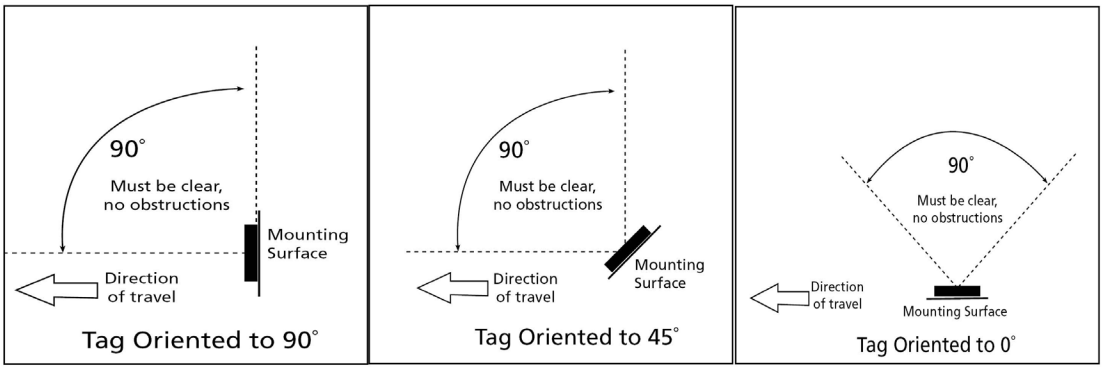

Figure 22 Guidelines for exterior tag placement

2. The tag can be attached to any flat or slightly curved surface made of glass, metal, or plastic. For best results, find a location where the back of the tag makes maximum contact with the surface, close to the centerline of the vehicle.
3. Once you have identified a location for the tag, prepare the area where the tag will be installed. The ideal temperature range for mounting the tag is between 70°F to 100°F. Dust, grime, or greasy residue can adversely affect the bond strength of the adhesive on the tag.
4. Clean and degrease the tag installation area with solvent or cleaner. Dry the area thoroughly using a clean, dry cloth.
5. Remove the backing from both of the adhesive strips located on the back of the tag, as shown in Figure 23.

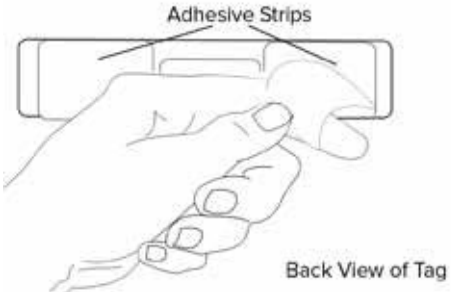

Figure 23 Removing adhesive strip backing

6. Position the tag over the installation area.
7. Press both ends of the tag firmly against the mounting surface.
8. Allow the adhesive to cure for a minimum of one hour to ensure a firm bond.

Hang Tags

Hang tags are designed to hook over a rear-view mirror post. The tag must be displayed on the post in order for it to function correctly. The tag may not be read if it is placed on the dashboard or held or taped against the interior windshield.

Store the hang tag in the glovebox any time it is not in use.

Chapter 4 Installing the Encompass 4H Reader

This chapter lists the materials needed and presents the procedures to pre-test and install the Encompass 4H Reader.

Installation Process

After you have developed the site plan and identified the location to install the Encompass 4H Reader, you are ready to install the equipment. Installation involves the following tasks:

- Pre-installation testing
- Mounting the Encompass 4H Reader
- Connecting the power supply
- Connecting communications
- Connecting sense input and sense output circuits
- Marking the read zone

Materials Supplied by TransCore

You need the following materials to pre-test and install the Encompass 4H Reader. TransCore supplies some of the materials; other materials must be obtained from other sources.

Contents of Shipping Carton

Ensure that you have received all parts before beginning your pre-installation Encompass 4H Reader tests. Your Encompass 4H Reader is packaged with the following materials:

- One Encompass 4H Reader
- One mounting bracket and the mounting hardware
- One Encompass 4H Reader Quick Start Guide
- Any accessories ordered as options as listed in Table 5.

Required accessories

These may be ordered as accessories from TransCore or obtained from other sources.

- Power/communications cable harness
- 110V AC wall transformer or a 12V AC to 18V AC step-up transformer

Installation Accessory Options

Table 5 lists optional TransCore Encompass 4H Reader installation accessory items.

Table 5 Installation Accessories

Part No.	Description
16-4000-002	Encompass 4H Reader System Guide (this manual)
20-1620-003	Connector kit only
54-1620-001	Wall or ceiling mount kit
56-1620-004	13-pair cable (sold by the foot)
58-1620-001	5-ft connector cable harness
58-1620-002	20-ft connector cable harness
76-1620-005	110V AC to 18V AC Class C transformer
76-1620-006	12V AC to 18V AC step-up transformer
76-1620-008	220V AC to 18V AC Class C transformer

Note: *The Encompass 4H Reader may be ordered with a multi-wire cable harness (part number 58-1620-001 or 58-1620-002 shown in Table 5) as a separate accessory. One end has a waterproof connector for the Encompass 4H Reader, and the other end has 13 pairs of color-coded wires.*

Additional Materials Needed for Testing

You need these additional materials to perform the pre-tests on the Encompass 4H Reader:

- Test tags, supplied by the TransCore dealer or distributor
- Suitable 18V AC or 18V DC power wiring for the Encompass 4H Reader
- Audible circuit tester and 9V DC battery for circuit tester power
- Wire stripper

Pre-installation Testing

Before installing the Encompass 4H Reader permanently at the site, you should use an audible circuit tester to confirm that the Encompass 4H Reader has power and can read a tag presented in the tag read zone.

Testing Using an Audible Circuit Tester

An audible circuit tester is also called a buzz box. These boxes are available at some electronic parts supply stores, or you can make a buzz box, as shown in Figure 24. The buzz box is powered by a 9V DC battery and is equipped with two alligator-clip leads. When you touch the leads together, the box makes an audible sound.

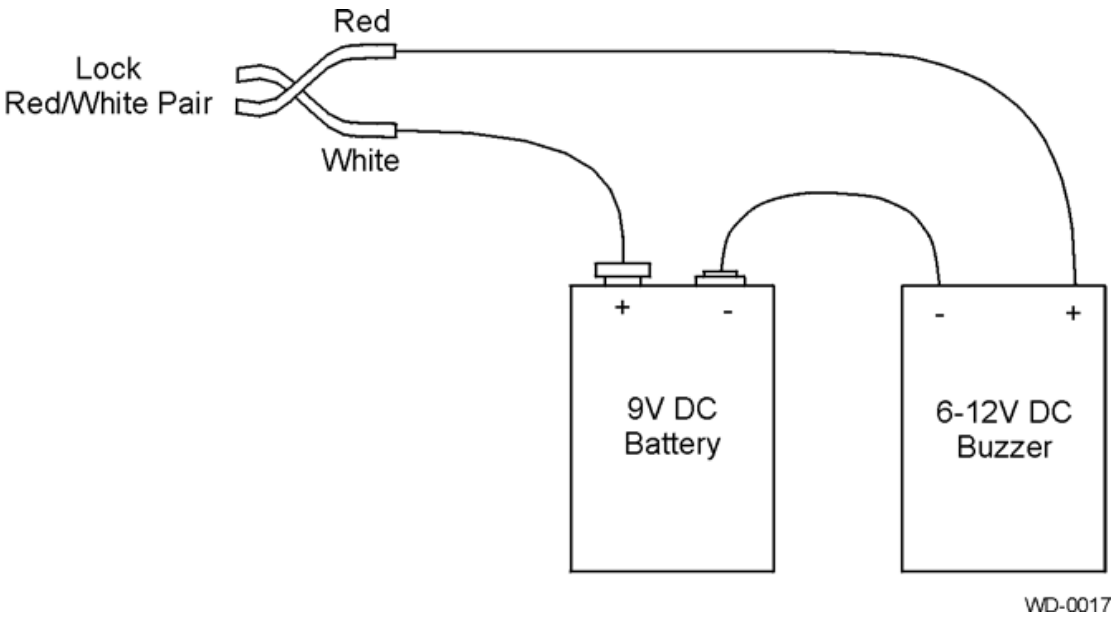

Figure 24 Wiring for Audible Circuit Tester

To test the Encompass 4H Reader, connect the power supply as described in the appropriate section below, and then test as described in the section "Bench Testing the Reader Before Installation" on page 4-33.

Connecting the AC Power Supply

To connect the Encompass 4H Reader to a low-voltage AC power supply

1. Connect the Encompass 4H power wires from the cable to the transformer using the color coding as described in Table 6. To see the alternate wire (15-pair) assignments for connection to a low-voltage AC power supply, refer to "Table 45 Wiegand Interface Signal Wiring for Alternate Wire 15-Pair Cable" on page C–2.

Table 6 AC Transformer Connections for Colored-Wire 13-Pair Cable

Signal from Encompass 4H	Colored-Wire Pair Cable		Connect to Transformer Terminal Strip
	Wire Pair from Encompass 4H Reader Cable	Color Used	
Main power input	Brown/Red and Orange/Red	Orange and Brown	L1 (16 to 20V AC)
Main power return		Red and Red	L2 (16 to 20V AC)

2. Complete the power connections at the power supply.

Connecting the DC Power Supply

To connect the Reader to a low-voltage DC power supply

Connect the Encompass 4H Reader power wires from the cable to the low-voltage terminals using the connection designations shown in Table 7. To see the alternate wire (15-pair) assignments for connection to a low-voltage AC power supply, refer to “Table 47 Low Voltage DC Cable Connections for Alternate Wire 15-Pair Cable” on page C–3.

Table 7 Low Voltage DC Cable Connections for the Colored-Wire 13-Pair Cable

Signal from Encompass 4H	Colored-Wire Pair Cable		Connection Use
	Wire Pair from Encompass 4H Reader Cable	Color Used	
Main power input	Brown/Red and Orange/Red	Orange and brown	16 to 28V DC+ terminal
Main power return		Red and red	16 to 28V DC- terminal

Connecting Communications for Bench Testing

TransCore offers reader models that communicate through RS–232, RS–422, and Wiegand interface protocols. This section describes the procedures and materials required for connecting the communications to perform pre-installation bench testing of the Encompass 4H Reader.

Required Materials

You need the following materials to connect the communications cable to the PC:

- PC or laptop
- Any terminal emulation program running on a PC
- Communications cable to connect to the COM1 port on your PC

Encompass 4H Reader communications and customer interface signals are supplied from the Encompass 4H Reader to the host through a multi-wire cable, which is a 13-pair pigtail. The connector for this cable

is located on the back of the Encompass 4H Reader. Refer to the following sections to connect the appropriate communications wires from the cable to the PC.

These sections contain instructions for connecting RS–232 and RS–422 communications between the Encompass 4H Reader and the PC for bench testing purposes. Each section contains wiring instructions and pin assignments followed by step-by-step connection procedures.

The Encompass 4H Reader can remain powered up while connecting reader-to-host PC communications.

Connecting for Bench Testing with RS–232 Interface

RS–232 interface signals are supplied by three or five wires from the Encompass 4H communications cable. The pin assignments for the signal to the host male DB9 and DB25 connectors are shown in boldface in Figure 25.

Note: *Supported pin assignments are in boldface.*

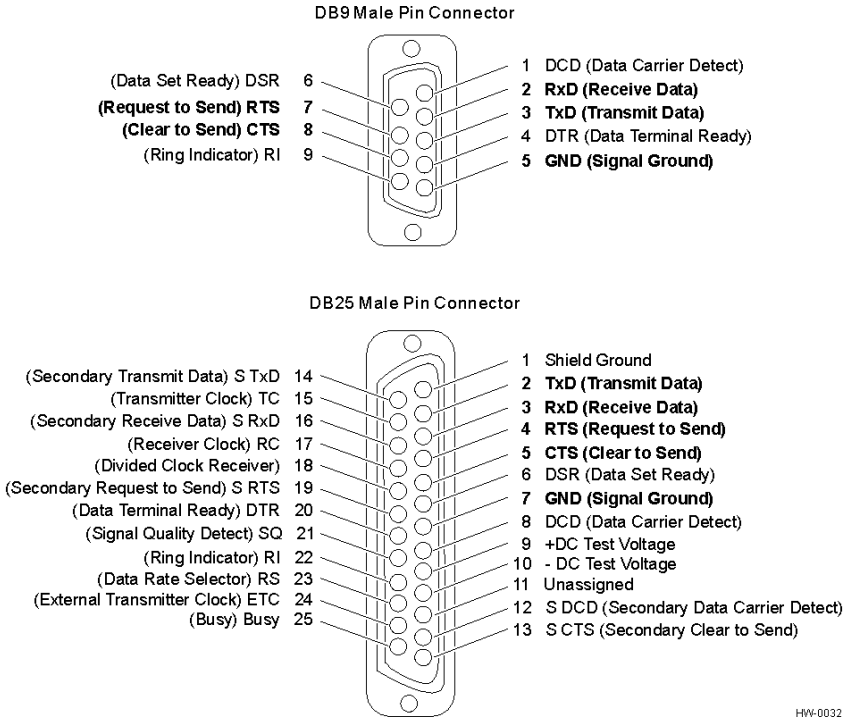

Figure 25 Pin Assignments for Signal to Host Connectors

Connecting for Bench Testing with Colored-Wire Pair Cable

For temporary bench testing purposes only, you will need to connect the RS–232 interface signal wires by following the pin-outs of your interface device. For permanent installations, follow the instructions listed under “To connect the colored-wire cable using RS–232 interface” on page 4-45.

Connecting for Bench Testing with RS–422 Interface

RS–422 interface signals are supplied by four wires from the Encompass 4H Reader communications cable. Your host must have an RS–422 interface with either an internal or external converter.

Note: *For temporary bench testing purposes only, you will need to connect the RS–422 interface signal wires by following the pin-outs of your interface device. For permanent installations, follow the instructions listed under* "To connect the colored-wire cable using RS–422 interface" on page 4-47.

Bench Testing the Reader Before Installation

The Encompass 4H Reader is set to read the tag protocol(s) programmed into your reader.

Note: *Test tags should match the protocol(s) selected for your reader. These tags can be ATA-protocol, ISO-compliant tags, or Inter-Agency Group tags affixed to a plastic or wooden yardstick, or eGo Plus Windshield Sticker Tags (WSTs) affixed to a piece of nonmetallic windshield-type glass 0.190 to 0.230 in (4.82 to 5.84 mm) in thickness. The eGo Plus sticker tags have a reduced read range when not attached to glass.*

Test that the Reader has power and can read a tag presented in the read zone

1. Confirm that the Encompass 4H Reader colored-wire pair cable is correctly connected to a suitable AC or DC low-voltage power supply as discussed on "Connecting the AC Power Supply" on page 4-30 and "Connecting the DC Power Supply" on page 4-31, and that the transformer is connected to a power outlet.
2. Confirm that the Encompass 4H Reader colored-wire pair cable communications are connected correctly as described in the section "Connecting Communications for Bench Testing" on page 4-31.
3. Connect the two leads from the audible circuit tester to the white and red wire pair (pair #8, lock/lock return) from the Encompass 4H Reader power/communications cable.
4. Start the terminal emulation application**.**
5. Set the properties in the terminal emulation application as follows:
   - Bits per second: 9600 baud
   - Data bits: 8
   - Parity: none
   - Stop bits: 1
   - Flow control: none
6. Cycle the power on the Encompass 4H Reader and ensure that the sign-on message displays.
7. Input the following commands in the order provided in Table 8. Commands include those to switch to command mode, set radio frequency (RF), turn on RF, and return the reader to data mode.

Table 8 Commands for Bench Testing

Entry	Reader Response	Notes
#01 <CR>	#Done <CR/LF>	Switches Encompass 4H Reader to command mode
#6401	#Done <CR/LF>	Turns on RF
#00 <CR>	#Done <CR/LF>	Returns Encompass 4H Reader to data mode

8. Pass the correct test tag for your reader application in front of the Encompass 4H Reader or antenna. The audible circuit tester should sound a tone when the tag is read. If no tone sounds, ensure that steps 1 through 5 were performed correctly and that you are using a compatible tag. Repeat steps 6 and 7. If no tone sounds, contact TransCore Technical Support.
9. Disconnect the circuit tester from the Encompass 4H Reader power/communications cable.
10. Disconnect the power and communications connections made for pre-installation testing.

Note: *You will need the audible circuit tester again to determine the read zone when installing the Encompass 4H Reader at the site.*

Mounting the Encompass 4H Reader

This section lists procedures and materials required for mounting the Encompass 4H Reader on a round pole or on a ceiling, wall, or other flat surface based on the site's requirements.

The Encompass 4H reader has a weep hole located on the bottom left side to allow moisture to escape. The reader should always be positioned so that the side with the weep hole is lower than the top. For overhead mounting, the reader angle should be at least 10° (Figure 26).

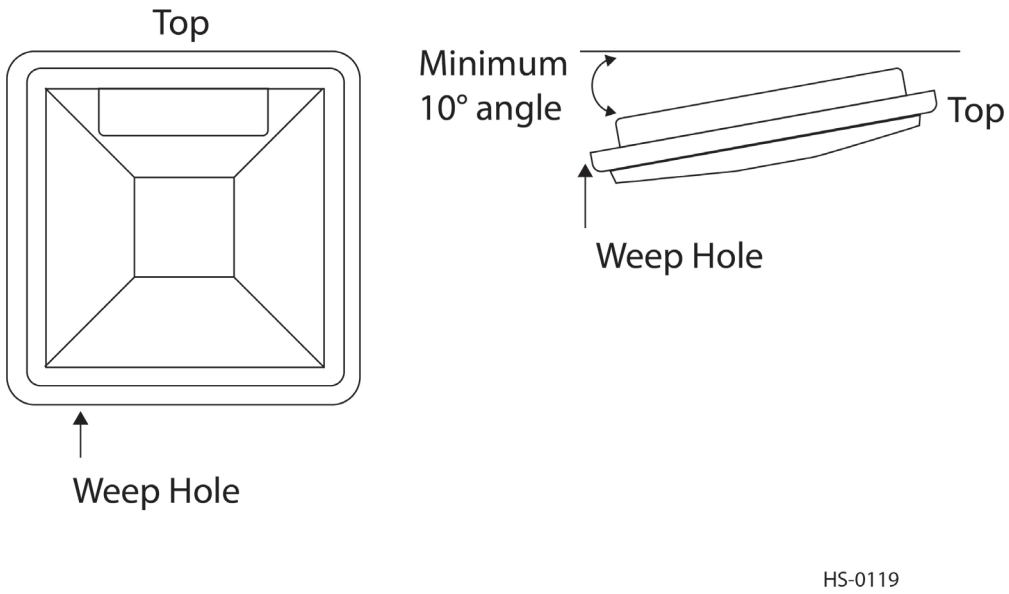

Figure 26 Correct Orientation of Reader

Mounting the Reader on a Round Pole

The Encompass 4H Reader can be mounted on a round pole. The pole must be a minimum of 2 inches (5 cm) in diameter and should extend approximately 8 feet (2.4 m) above the pavement level. The pole must be installed according to local building codes.

Required Materials To Be Supplied by Customer

You need the following materials to mount the Encompass 4H Reader on a round pole:

- A 5/32-inch Allen wrench to assemble and adjust the mounting brackets
- Two 0.5-inch (1.3-cm) wide, stainless steel hose clamp straps that are 12 inches (30.5-cm) long for a typical 2-inch (5-cm) diameter pole or 24 inches (61-cm) long for a 10-inch (25-cm) diameter pole
- Flat-tip screwdriver or adjustable wrench to tighten hose clamp straps
- Length of 12-14 AWG wire, stake, and clamps to connect reader to earth ground

Procedures

To mount the Reader to a pole

1. Unpack the Encompass 4H Reader. A factory-mounted bracket (Figure 27 and Figure 28) is attached to the back of the Encompass 4H Reader.

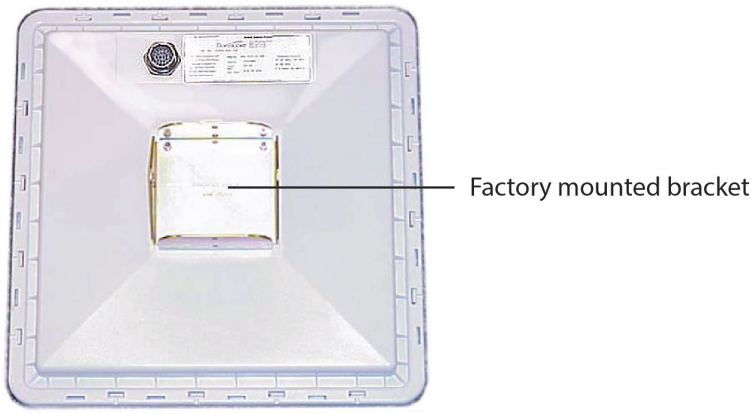

Figure 27 Back of the Encompass 4 Reader

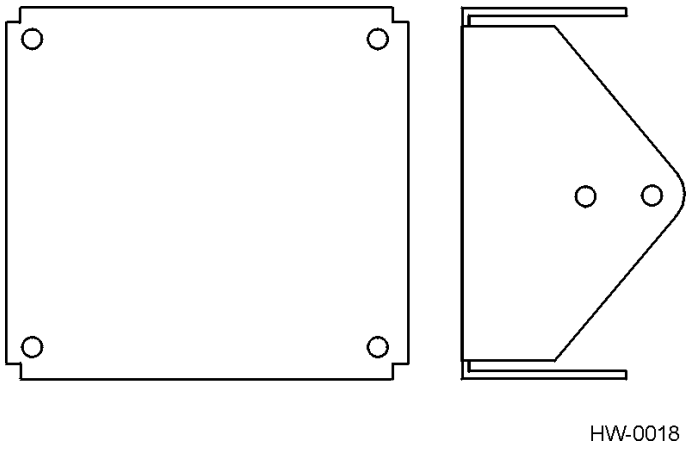

Figure 28 Factory Mounted Bracket

2. A pole mount bracket assembly (Figure 29) is bubble-wrapped separately and contains a plastic bag of four Allen screws and washers.

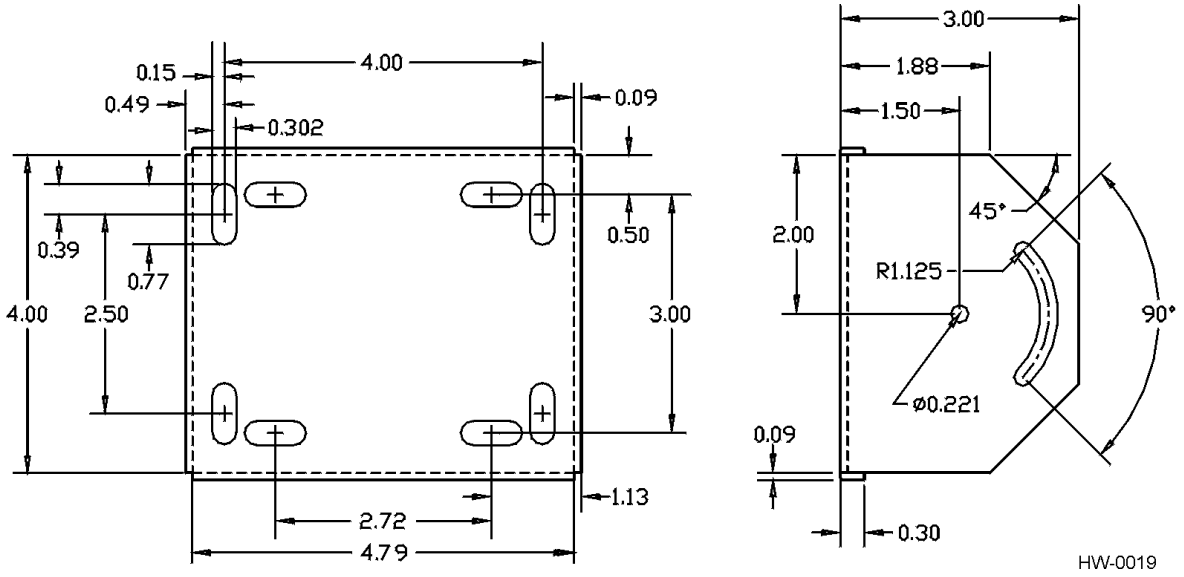

Figure 29 Pole-Mount Bracket Assembly

3. Using the two 0.5-inch (1.3-cm) stainless steel hose clamps, attach the pole mount bracket assembly to the pole approximately 8-feet (2.4-m) above the pavement surface. Tighten slightly so you can adjust the Encompass 4H Reader left or right, but not so slightly the straps slide down the pole.
4. Using the four Allen screws and washers, attach the Encompass 4H Reader to the pole mount bracket as shown in Figure 30. Tighten the screws slightly so that the Encompass 4H Reader can be adjusted up or down, but not so slightly the mounting assembly slips.

Adjust the assembly by pointing the Encompass 4H Reader to the middle of the area where tags will be read, and tighten all screws and straps slightly.

Note: *Adjust the Encompass 4H Reader to provide the most direct line of sight to the tags.*

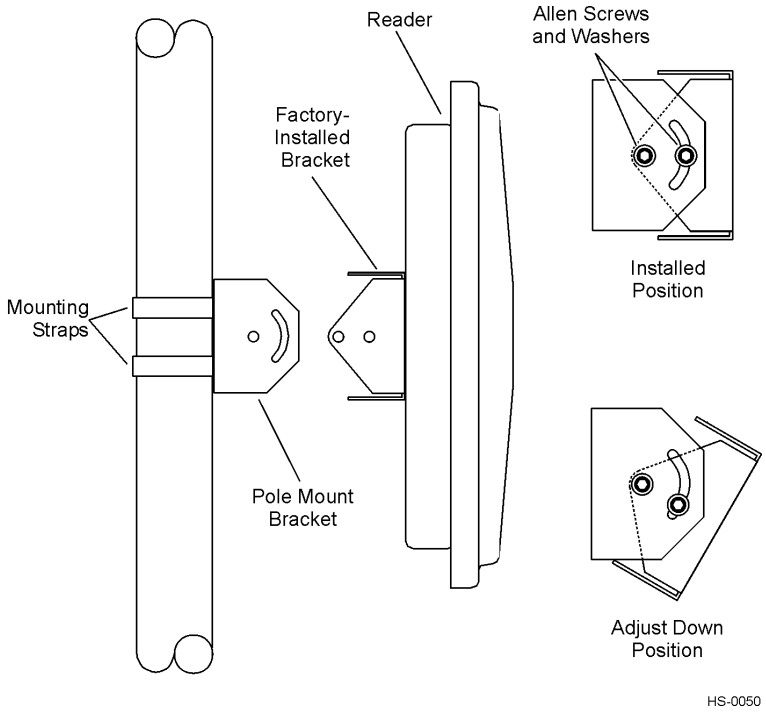

Figure 30 The Encompass 4H Reader Attached to the Pole Mount Bracket

5. Figure 31 illustrates front and top views of a pole-mounted Encompass 4H Reader with the approximate measurements for sites where tags would be mounted on the interior driver-side windshield. eGo Plus Sticker tags may be mounted on the interior upper center of the windshield.

Note: *Determine the read zone before you tighten all screws and straps permanently. Refer to the section* “Marking the Read Zone” on page 4-52.

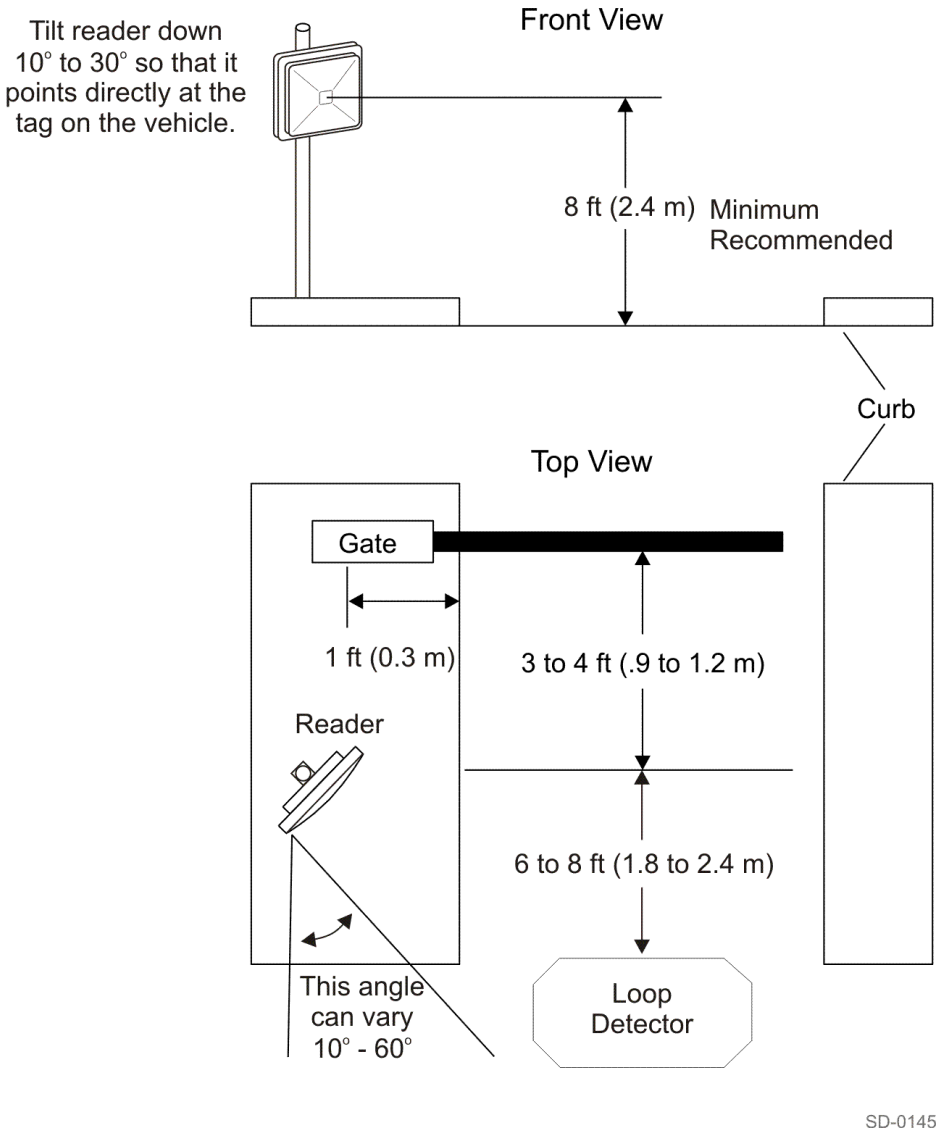

Figure 31 Front and Top Views of the Encompass 4H Reader Position

Note: *The dimensions in* Figure 31 *are for demonstration purposes only and are approximations for sites using the older ATA-type tags. Actual dimensions vary as lane geometry and tag style varies from site to site. Adjust the Encompass 4H Reader matching site and tag mounting positions to provide the most direct line of sight to the tags.*

Caution

To ensure reliable reader operation, TransCore strongly advises following the National Electric Code for lightning protection for the locale where the Encompass 4H Reader is installed.

Mounting the Reader to a Wall or Flat Surface

The basic Encompass 4H Reader is supplied with a pole-mount bracket assembly that allows you to adjust the Encompass 4H Reader up and down. TransCore recommends using the wall-mount bracket accessory kit (Figure 32) in addition to the pole-mount bracket to provide additional horizontal aiming flexibility when attaching the Encompass 4H Reader to a pole with flat sides or to a wall or ceiling where other structures can interfere with accurately aiming the Encompass 4H Reader toward the tags.

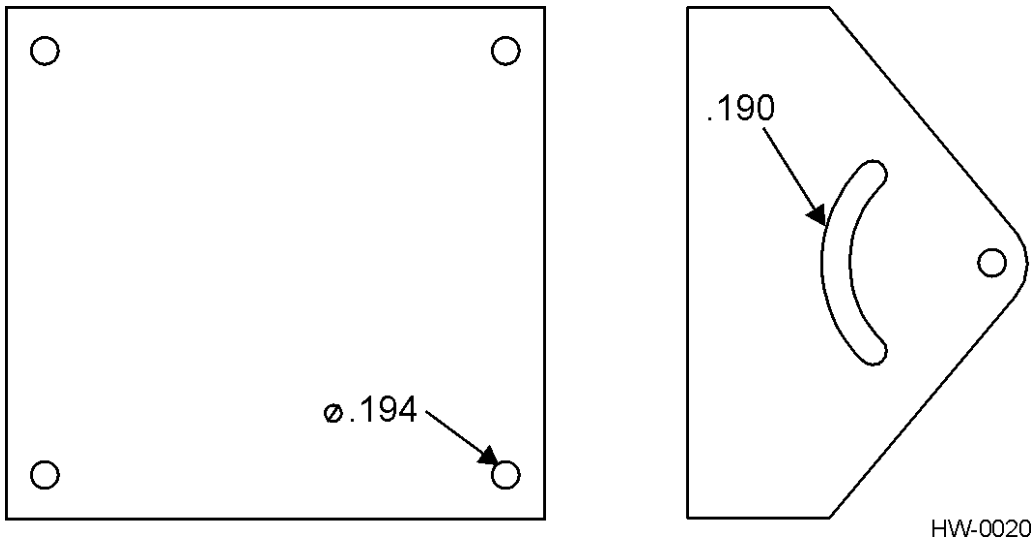

Figure 32 Wall Mount Bracket Accessory (part number 54-1620-001)

Required Materials

You need the following materials to install the Encompass 4H Reader on a wall or flat surface. Ensure the use of high-quality, corrosion-resistant anchor hardware.

- Anchor hardware suitable for the surface on which you mount the Encompass 4H Reader. Because the Encompass 4H Reader weighs only 9 1/2-lbs (4.3-kg), 0.25-in (0.6-cm) bolt hardware is adequate to secure the unit to a wall or ceiling.
- Four hex nuts 3/8-16 threaded and four lock washers
- 5/32-inch Allen wrench
- One Encompass 4H wall mount bracket accessory kit (required)

Procedures

To mount the Encompass 4H Reader to a wall or ceiling

1. Unpack the Encompass 4H Reader. Set aside the pole mount bracket.

Use the bracket in the remaining steps to provide greater adjustment for the Encompass 4H Reader. The pole-mount bracket is wrapped separately from the Encompass 4H Reader and contains a plastic bag of four Allen screws and washers.

2. Using the 5/32-inch Allen wrench, remove the factory-mounted bracket attached to the back of the Encompass 4H Reader. Remove all four Allen screws and lock washers from the bracket and set aside.
3. Unpack the wall-mount bracket accessory kit.
4. Using the Allen screws and lock washers set aside in Step 2, attach the wall-mount bracket to the back of the Encompass 4H Reader, as shown in Figure 33. Tighten the screws to secure the bracket.

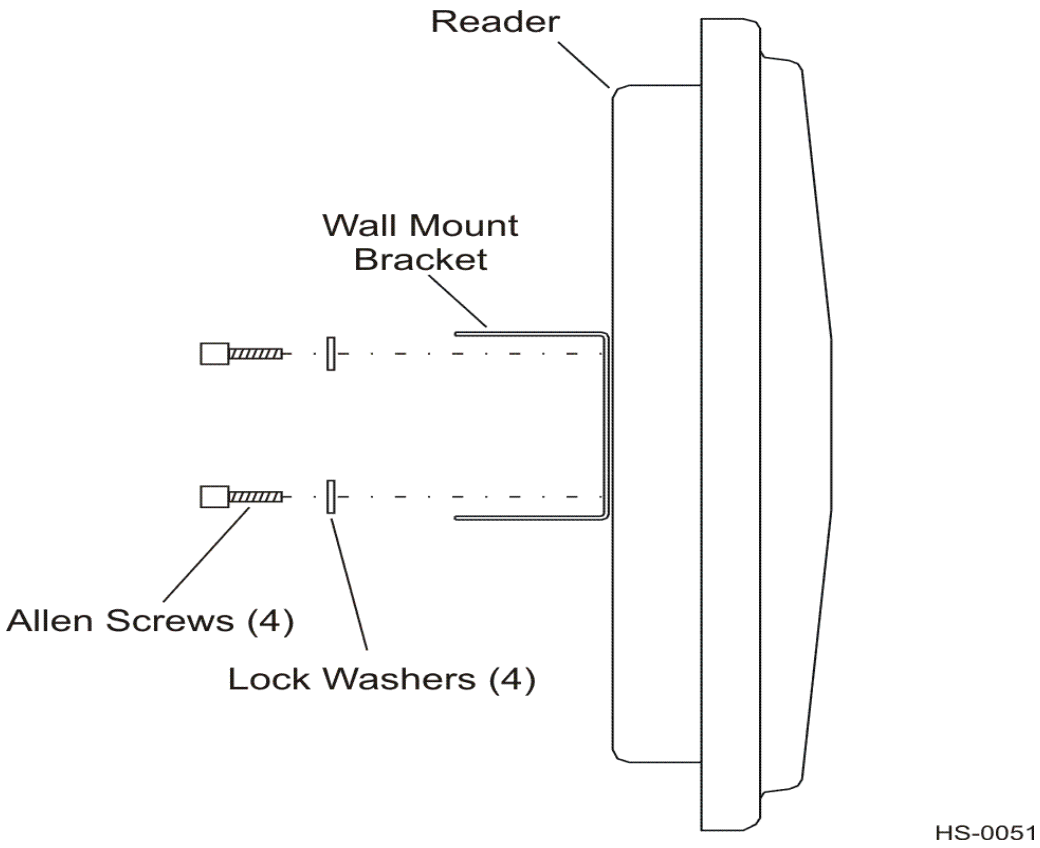

Figure 33 Wall Mount Bracket Attached to the Encompass 4H Reader

5. Using the four screws and washers supplied with the wall-mount bracket, attach the factory-mounted bracket to the wall mount bracket, lining up the four outside screw holes as shown in Figure 34.

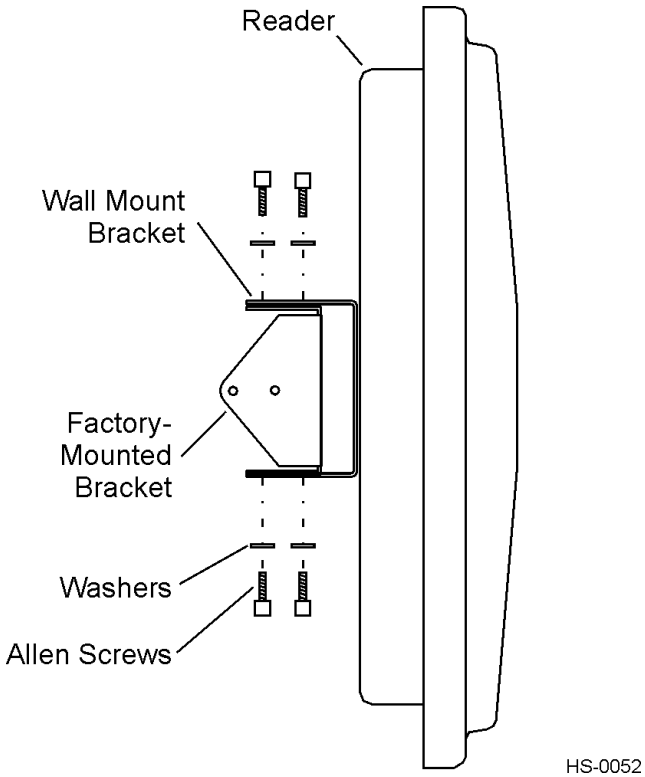

Figure 34 Factory-Mounted Bracket Attached to Wall Mount Bracket

6. Tighten lightly, since you will want to adjust the bracket later. This subassembly allows you to aim the Encompass 4H Reader left or right when all three brackets are assembled.
7. Mount the pole-mount bracket to the wall, ceiling, or fixture using appropriate anchors as shown in Figure 35.

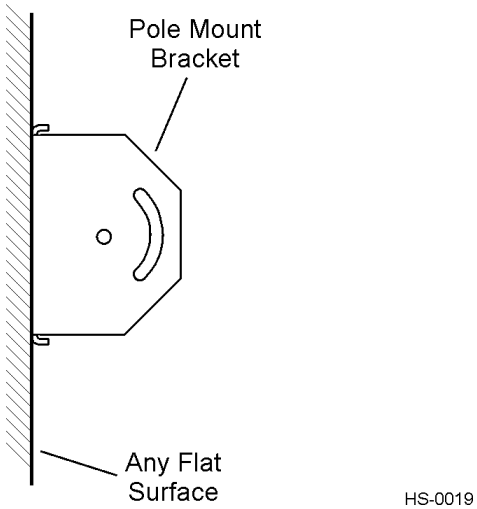

Figure 35 Pole Mount Bracket Attached to Wall

8. Mount the Encompass 4H Reader to the pole-mount bracket using Allen screws, as shown in Figure 36.

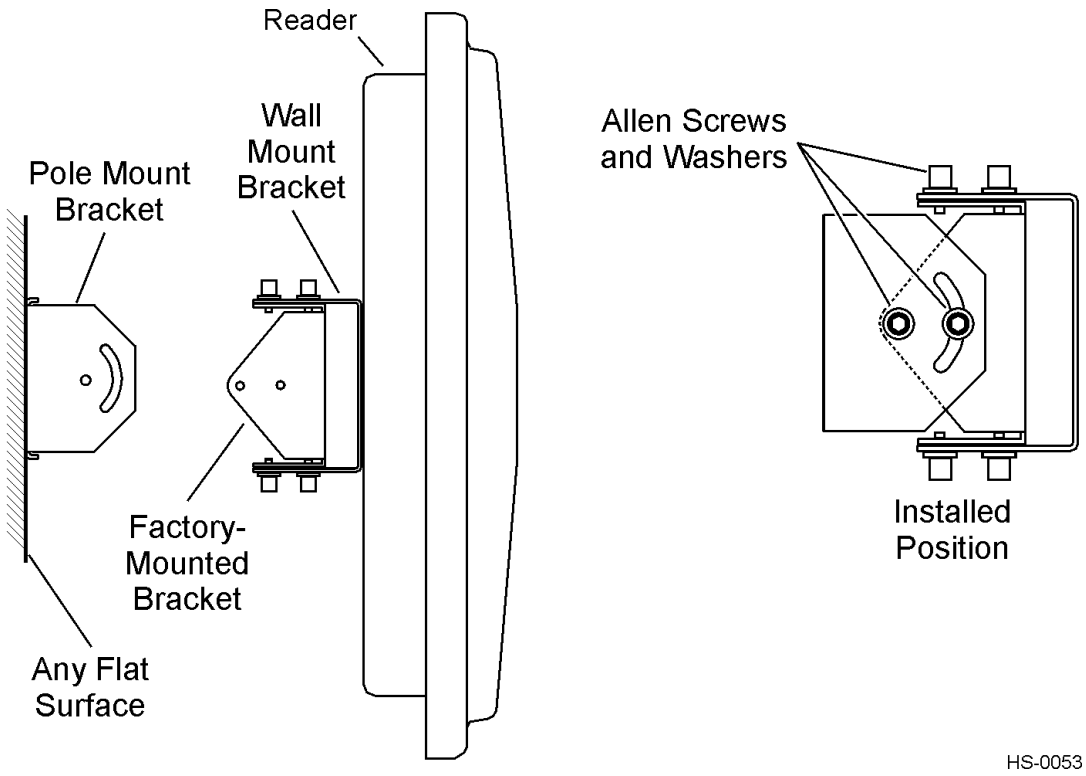

Figure 36 Connecting the Encompass 4H Assembly to Pole Mount Bracket

9. Adjust the assembly by pointing the Encompass 4H Reader to the middle of the area where tags will be read and tighten all screws and straps slightly.

Note: *Adjust the Encompass 4H Reader to provide the most direct line of sight to the tags.*

Caution

To ensure reliable reader operation, TransCore strongly advises that you follow the National Electric Code for lightning protection for the locale where you are installing the Encompass 4H Reader.

After mounting the Encompass 4H Reader, you must connect it to a dedicated 16 to 20V AC or 16 to 28V DC power supply.

Connecting the Power Supply

To connect the Encompass 4H Reader to a low-voltage AC power supply follow the procedures described previously in the section "Connecting the AC Power Supply" on page 4-30.

To connect the Encompass 4H Reader to a low-voltage DC power supply follow the procedures described previously in the section "Connecting the DC Power Supply" on page 4-31.

After mounting the Encompass 4H Reader and antenna, if required, you must connect the reader to a dedicated 16 to 20V AC or 16 to 28V DC power supply.

Caution

To avoid damage to the Encompass 4H Reader, you must connect the antenna before applying power to the reader.

Reader Cable Grounding

Ensure that you connect the communications cable shield drain wire to Earth Ground and the yellow/black wires to Signal Ground (Figure 37).

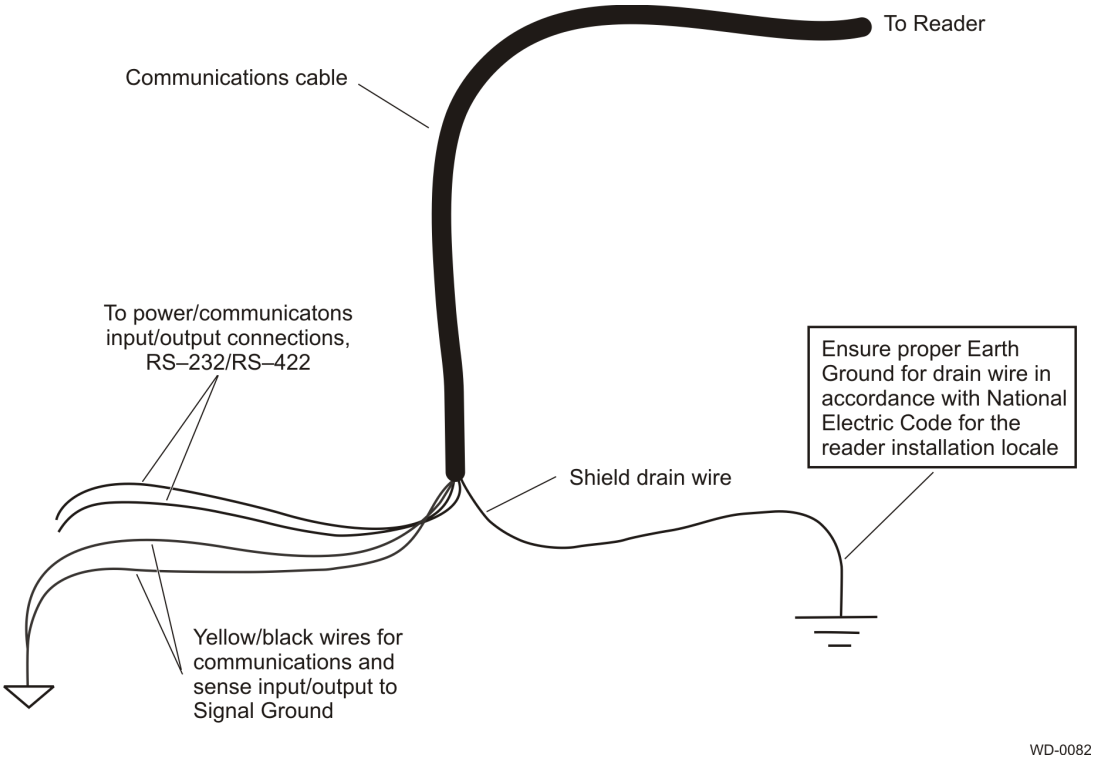

Figure 37 Recommended Reader Cable Grounding

Caution

Do not ground the input power supply.

After connecting the wires in the communications cable, connect the drain wire from the communications cable to Earth Ground. Connect the yellow/black wires to Signal Ground.

Connecting Communications

Required Materials

You need the following materials to connect the communications cable to the PC:

- PC or laptop
- Any terminal emulation program running on a PC
- Communications cable to connect to the COM1 port on your PC

Connecting the Reader to the PC

Encompass 4H Reader communications and customer interface signals are supplied from the Encompass 4H Reader to the host through a multi-wire cable, which is a 13-pair pigtail. The connector for this cable is located on the back of the Encompass 4H Reader. Refer to the following sections to connect the appropriate communications wires from the cable to the terminal strip that is located inside the junction box.

These sections contain instructions for connecting RS–232, RS–422, and Wiegand communications between the Encompass 4H Reader and the PC. Each section contains wiring instructions and pin assignments followed by step-by-step connection procedures.

The Encompass 4H Reader can remain powered up while connecting reader-to-host PC communications.

RS–232 Interface

RS–232 interface signals are supplied by three or five wires from the Encompass 4H Reader communications cable. The pin assignments for the signal to the host male DB9 and DB25 connectors are shown in boldface in “Pin Assignments for Signal to Host Connectors” on page 4-32.

Connecting the Encompass 4H Reader Colored-Wire Pair Cable

Table 9 shows the RS–232 colored wire (13-pair) assignments. To see the alternate wire (15-pair) assignments, refer to "Table 43 RS–232 Interface Signal Wiring for Alternate Wire 15-Pair Cable" on page C–1.

Table 9 RS–232 Interface Signal Wiring for Colored-Wire 13-Pair Cable

Signal from Encompass 4H Reader	Colored-Wire Pair Cable		Connect Wire to Host DB9 Pin	Connect Wire to Host DB25 Pin
	Wire Pair from Encompass 4H Reader	Color Used		
TxD — Encompass 4H Reader output, host input	Red/Black	Black	Pin 2	Pin 3
RxD — Encompass 4H Reader input, host output		Red	Pin 3	Pin 2
Signal ground	Yellow/Black	Yellow[a] or Black	Pin 5	Pin 7
Optional for hardware handshaking				
RTS — Encompass 4H Reader output, host input	Yellow/Red	Yellow	Pin 8	Pin 5
CTS — Encompass 4H Reader input, host output		Red	Pin 7	Pin 4

a *Yellow is recommended to be used with RS-232 connection to avoid confusion with the 2 black wires

To connect the colored-wire cable using RS–232 interface

1. Connect the black wire (transmit data) from the red and black wire pair to pin 2 of the DB9 connector or pin 3 of the DB25 connector.
2. Connect the red wire (receive data) from the red and black wire pair to pin 3 of the DB9 connector or pin 2 of the DB25 connector.
3. Connect either the yellow[1] or black wire (signal ground) from the yellow and black wire pair to pin 5 of the DB9 connector or pin 7 of the DB25 connector.
4. Plug the DB9 connector or DB25 connector into the PC.

If the host is set up for hardware handshaking, use the following procedures:

1. Connect the yellow wire (RTS) from the yellow and red wire pair to pin 8 of the DB9 connector or pin 5 of the DB25 connector.
2. Connect the red wire (CTS) from the yellow and red wire pair to pin 7 of the DB9 connector or pin 4 of the DB25 connector.

1 Yellow is recommended to be used with RS-232 connection to avoid confusion with 2 black wires

Note: *When extending the RS-232 interface, use a three-pair cable such as Belden 2919. Use a twisted pair for the Black (RxD) with ground (Black of the Black and Yellow pair), and a twisted pair for Red (TxD) with ground (Black of the Black and Yellow pair). The third pair of the three-pair cable can be used for a spare in the event either of the other two pair are damaged or fail. The cable shield should be tied to a single-point Earth Ground on the controller end of the cable Refer to* Figure 38.

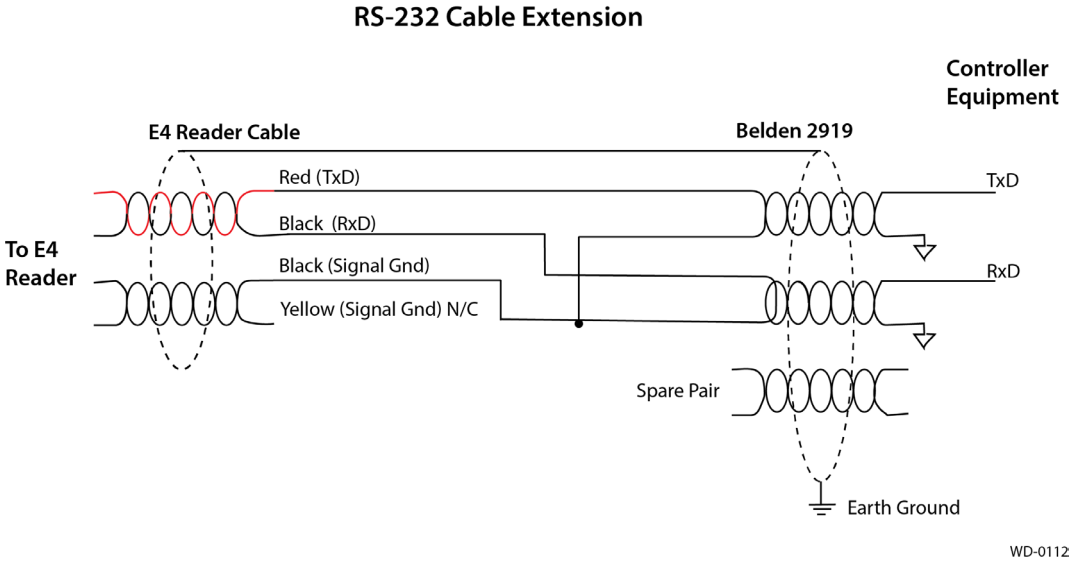

Figure 38 RS-232 Cable Extension Diagram

RS–422 Interface

RS–422 interface signals are supplied by four wires from the Encompass 4H Reader communications cable. Your host must have an RS–422 interface with either an internal or external converter.

Table 10 shows the RS–422 signals and their interface wires. To see the alternate wire (15-pair) assignments, refer to "Table 44 RS–422 Interface Signal Wiring for Alternate Wire 15-Pair Cable" on page C–2.

Table 10 RS–422 Interface Signal Wiring for Colored-Wire 13-Pair Cable

Signal from Encompass 4H Reader	Colored-Wire Pair Cable		Connect to Signal from Host
	Wire Pair from Encompass 4H Reader	Color Used	
RS–422 Transmit positive	Yellow/Red	Yellow	Receive (+)
RS–422 Transmit negative		Red	Receive (–)
RS–422 Receive positive	Red/Black	Black	Transmit (+)
RS–422 Receive negative		Red	Transmit (–)
Signal Ground	Yellow/Black	Yellow or Black	Signal Ground

To connect the colored-wire cable using RS–422 interface

1. Connect t he yellow wire (transmit +) from the yellow and red wire pair to the host receive (+) signal.
2. Connect the red wire (transmit –) from the yellow and red wire pair to the host receive (–) signal.
3. Connect the black wire (receive +) from the red and black wire pair to the host transmit (+) signal.
4. Connect the red wire (receive –) from the red and black wire pair to the host transmit (–) signal.

Wiegand Interface

Wiegand interface signals are supplied by three wires from the Encompass 4H Reader communications cable. The Encompass 4H Reader with RS–232 or RS–422 comes with the Wiegand option built in.

The Wiegand interface can only be used by the reader to output valid Wiegand tag reads. All reader commands and responses are issued through the serial interface.

Table 11 shows the Wiegand signals and the interface wires for the 13-pair cable. To see the alternate wire (15-pair) assignments, refer to "Table 45 Wiegand Interface Signal Wiring for Alternate Wire 15-Pair Cable" on page C–2.

Table 11 Wiegand Interface Signal Wiring for Colored-Wire 13-Pair Cable

Signal from Encompass 4H Reader	Colored-Wire Pair Cable		Connect to Signal from Host
	Wire Pair from Encompass 4H Reader	Color Used	
Wiegand Zero Output	Blue/Red	Blue	Data0
Wiegand One Output		Red	Data1
Signal Ground	Yellow/Black	Yellow or black[a]	Ground

a Black is recommended so that yellow can be used with RS-232. This helps to avoid confusion with having 2 black wires on RS-232

To connect Wiegand interface

1. Connect the blue wire (data0) from the blue and red wire pair to the data0 wire of the Wiegand device.
2. Connect the red wire (data1) from the blue and red wire pair to the data1 wire of the Wiegand device.
3. Connect either the yellow or black[2] wire from the yellow and black pair to the Wiegand device's signal ground.

Note: *The RS–232 or RS–422 interface is still included on the Encompass 4H Reader even when you use the Wiegand configuration. If serial communication is not needed, TransCore recommends leaving the DB9 or DB25 connected to the cable for future use.*

When *extending the Wiegand interface, use a three-pair cable such as Belden 2919. Only one signal ground wire should be used, not both. For example, use a twisted pair for Red (Data1) and Blue (Data0) (Red and Blue twisted pair), and a twisted pair for Black (Signal Ground) of the Yellow*

2 Black is recommended so that yellow can be used with RS-232. This helps to avoid confusion with having 2 blacks on RS-232.

Black *pair.) . Note that the black of the yellow/black is not connected. The third pair of the three-pair cable can be used for a spare in the event either of the other two pair are damaged or fail. The cable shield should be tied to a single-point Earth Ground on the controller end of the cable. Refer to* Figure 39.

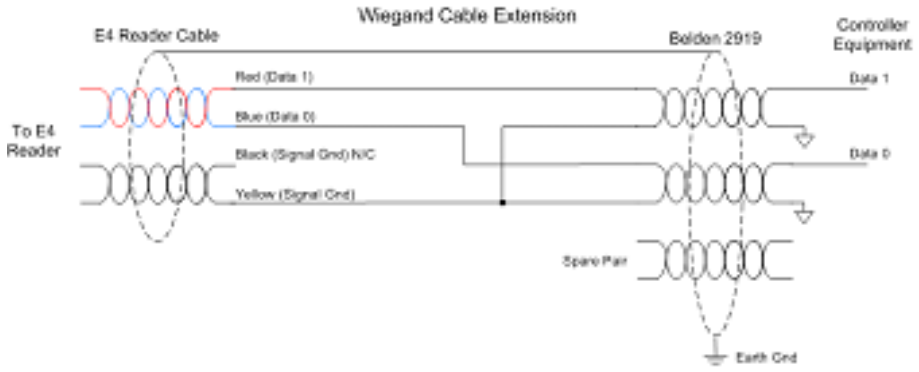

Figure 39 Wiegand Cable Extension Diagram

Warning!

Do not cut the RS–232 red/black wires. If you cut the wires, you may not be able to use them in the future for testing, setting frequency, or adding additional functions.

Connecting Sense Input and Output Circuits

The Encompass 4H Reader has two sense input circuits and three sense output circuits available. The sense input circuits can be used to notify the Encompass 4H Reader of external events and are designed to be connected to a free-of-voltage dry contact. Sense output circuits are single-pole, double-throw relays that provide normally closed (NC) and normally open (NO) dry contacts. The relay contacts are rated at 42.2V AC peak (30 Vrms) or 60V DC at 1 A maximum. If controlling an external gate or device requiring high current, an isolation transformer is required.

The following sections provide information to connect the sense input and sense output circuits.

Sense Input Circuits

The Encompass 4H Reader supports two sense inputs – sense input0 and sense input1– which requires two sense input lines for each loop sense or a total of four sense input connections. Sense input0 is the presence detection device line and is used to control RF power. As shown in Figure 40, sense input0 is through the red/green wire pair on the I/O pigtail. The Encompass 4H Reader expects the sense input0 circuit to close when a vehicle is present (i.e., a NO condition). The minimum presence true period is fixed at 0 ms, which indicates that no delay occurs in closing the circuit when a vehicle is present.

Sense input1 allows the Encompass 4H Reader to monitor the status of a peripheral device. The host computer can then check the status by polling the Encompass 4H Reader.

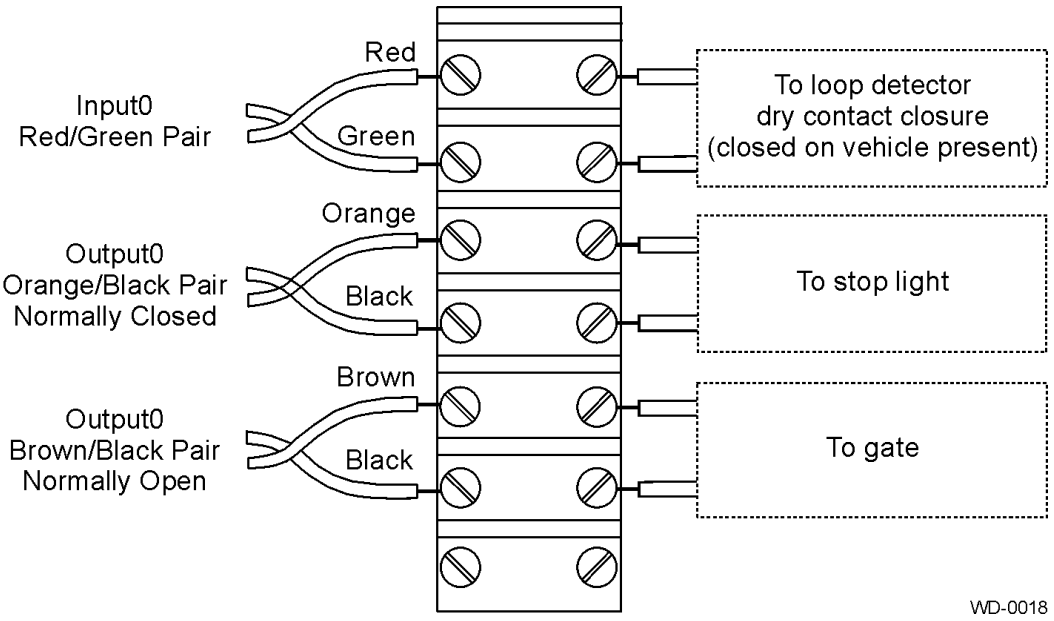

Figure 40 Sample Circuit Connections

For Encompass 4H Readers that are used with IAG protocols, the NC sense output0 common is connected to the NO sense output0 common via a jumper providing a return for sense output0 NC. Figure 41 shows this wiring.

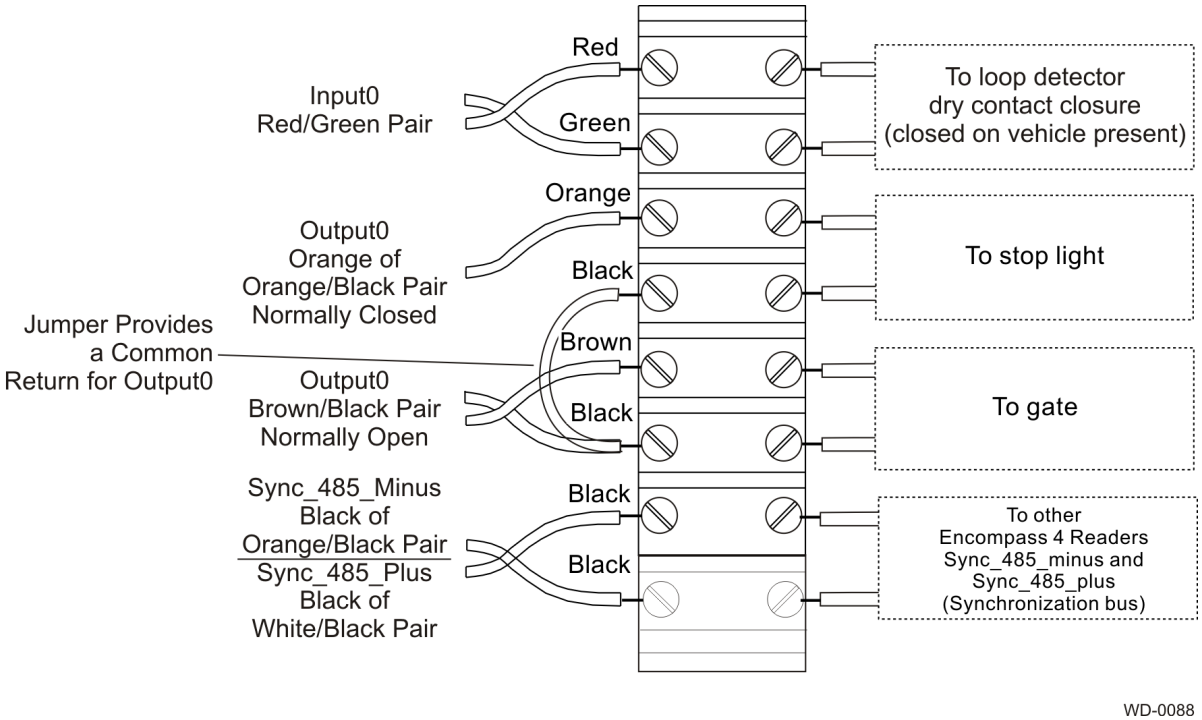

Figure 41 Sample Circuit Connections for IAG Installations

Sense Output Circuits

The Encompass 4H Reader supports three sets of sense output signals. Two sets – sense output0 and sense output1 – provide NO or NC sense outputs. The third sense output set is dedicated for testing and set up of the reader. It is defined as the TAG_LOCK signal, which indicates a valid tag is in the read field.

These sense outputs are dry contacts that provide NO and NC sense outputs. The relay contacts are rated at 42.2V AC peak (30 Vrms) or 60V DC at 1 A maximum. If controlling an external gate or device requiring high current, an isolation transformer is required.

As illustrated in Figure 40, Sense input1 allows the Encompass 4H Reader to monitor the status of a peripheral device. The host computer can then check the status by polling the Encompass 4H Reader. Output0, NC, is located on the orange/black pair. Sense output0, NO, is located on the brown/black pair.

As shown in Figure 41, for IAG applications, Sense output0 NC, shares a common return with sense output0 NO.

In Wiegand mode operation, the sense outputs are not controlled by a predefined output mode.

Table 12 lists the cable descriptions and functions for the interface signals. These wire pairs can be used or terminated based on the specific project applications and site requirements. To see the alternate wire (15-pair) assignments, refer to “Table 48 Sense Input/Output Cabling Assignments for Alternate Wire 15-Pair Cable” on page C–4.

Using Table 12 as a guide to the functions of each of the wire signals, connect the remaining wires to the appropriate terminal blocks on the terminal strip in the junction box.

Table 12 Sense Input/Output Cabling 13-Pair Assignments

Pair	Pin	Color	Signal	Description	Typical Function
Blue/ Red	E	Blue	WGND0	Wiegand data0	Parking/ access control applications
	F	Red	WGND1	Wiegand data1	Parking/ access control applications
White/ Red	L	White	Lock	Tag lock output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Green/ Red	N	Green	Sense Input0	Sense Input0 (loop)	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection

Table 12 Sense Input/Output Cabling 13-Pair Assignments

Pair	Pin	Color	Signal	Description	Typical Function
Blue/ Black	R	Blue	Sense Input1	Sense Input1	General- purpose sense input, not used for detecting presence
	S	Black	Sense Input1_ RTN	Sense Input1 return; not isolated from signal ground	General- purpose sense input, not used for detecting presence
Brown/ Black	T	Black	Sense Output0_ COM	Sense Output0 (tag detect), common terminal	Switched output to control gate
	U	Brown	Sense Output0_NO	Sense Output0 NO terminal	Switched output to control gate
Orange/ Black	V	Black	Sense Output0_ COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Orange/ Black	V[a]	Black	Sync_485_N	RS–485 bus negative	Used to connect Encompass 4H Readers with IAG capability on a synchronization bus
	W	Orange	Sense Output0_NC	Sense Output0 NC terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/ Black	X	Black	Sense Output1_ COM	Sense Output1, common terminal	Switched sense output
	Y	Green	Sense Output1_NO	Sense Output1 NO terminal	Switched sense output

Table 12 Sense Input/Output Cabling 13-Pair Assignments

Pair	Pin	Color	Signal	Description	Typical Function
White/ Black	Z	Black	Sense Output1_ COM	Sense Output1, common terminal	Switched sense output
White/ Black	Z[a]	Black	Sync_485_P	RS–485 bus positive	Used to connect Encompass 4H Readers with IAG capability on a synchronization bus
	a	White	Sense Output1_NC	Sense Output1 NC terminal	Switched sense output
Yellow/ Black	b	Yellow	GND	Logic ground	Signal ground used with RS–232 and Wiegand
	c	Black	GND	Logic ground	Signal ground used with RS–232 and Wiegand

a Use this synchronization pin designation if installing an Encompass 4H Reader that reads IAG protocol tags. The part numbers for these readers are as follows:
10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019; 10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019

Caution

After connecting the wires in the communications cable, ground all drain wires from the communications cable to the chassis ground in the NEMA enclosure.

Marking the Read Zone

The area where the Encompass 4H reads tags at the current RF range is called the read zone. The antenna pattern, or read zone, of the Encompass 4H Reader would look roughly like a pear-shaped balloon if you were able to see it. When installing the Encompass 4H Reader, you should first mark the unit's read zone using the RF range set at the factory-default maximum. You can later adjust the read zone using the techniques discussed in "Fine-Tuning and Verifying the Read Zone" on page 8–127.

If two Encompass 4H Readers are installed near each other, TransCore recommends that you fine-tune each reader for the ideal read zone before connecting it permanently to sense input/sense output and communications cables.

Required Materials

You need the following materials to mark the read zone:

- Test tags, supplied by the TransCore dealer or distributor
- Piece of windshield-type glass 0.190 to 0.230 inches (4.82 to 5.84 mm) in thickness and approximately 12 inches (30.48 cm) square for testing with a sticker tag
- Audible circuit tester and 9V DC battery for circuit tester power as described in the section "Bench Testing the Reader Before Installation" on page 4-33.
- Piece of chalk or roll of tape
- Plastic or wooden yardstick for ATA or IAG tags
- Vinyl electrical tape or hook-and-loop material

Caution

Both the eGo Plus Sticker Tag and eGo WST have a reduced read range when not attached to glass.

Procedures

Note: *Using test tags that are not mounted to vehicles give a general idea of the read pattern but the pattern will vary somewhat when actual vehicles with tags are tested. Final adjustments must be made with tags properly mounted on a variety of vehicles.*

To mark the read zone

1. Confirm the following:
   - You have correctly connected the power supply as described in "Connecting the AC Power Supply" on page 4-30 and "Connecting the DC Power Supply" on page 4-31.
   - You have correctly connected communications as described in "Connecting Communications" on page 4-44.
   - You have correctly connected sense input and sense output circuits as described in "Sense Input Circuits" on page 4-48 and "Sense Output Circuits" on page 4-50.
2. Connect the red and white leads from the audible tester to the red and white pair of wires from the Encompass 4H Reader power/communications cable.
3. Start the terminal emulation application.
4. Choose the com port to which the communications interface is attached and set the properties as:
   - Bits per second: 9600 baud
   - Data bits: 8
   - Parity: none
   - Stop bits: 1
   - Flow control: none
5. Cycle the power on the Encompass 4H Reader and ensure that the sign-on message displays.

6. Input the following commands in the order provided in “Table 8 Commands for Bench Testing” on page 4-34. Commands include those to switch to command mode, set operational mode, turn on RF, and return the reader to data mode.
7. Secure the ATA or IAG test tag to the end of the yardstick using electrical tape or hook-and-loop material or affix the test eGo Plus or eGo WST to the glass. Be sure the tag polarization (horizontal or vertical alignment) matches that of the Encompass 4H Reader or antenna used. If using an eGo Plus-type test tag or eGo WST, the glass should be in front of the tag (between the tag and the reader or antenna).
8. Stand directly in front of and about 5 feet (1.5 m) away from the Encompass 4H Reader or antenna (Figure 42). Hold the stick or the piece of glass so that the tag is positioned at a height and angle consistent with a tag installed on a vehicle. The test tag should cause the audible tester to sound.

NOTE: *If you hold the test tag in your hand, your hand absorbs the RF signal and the test results are not accurate.*

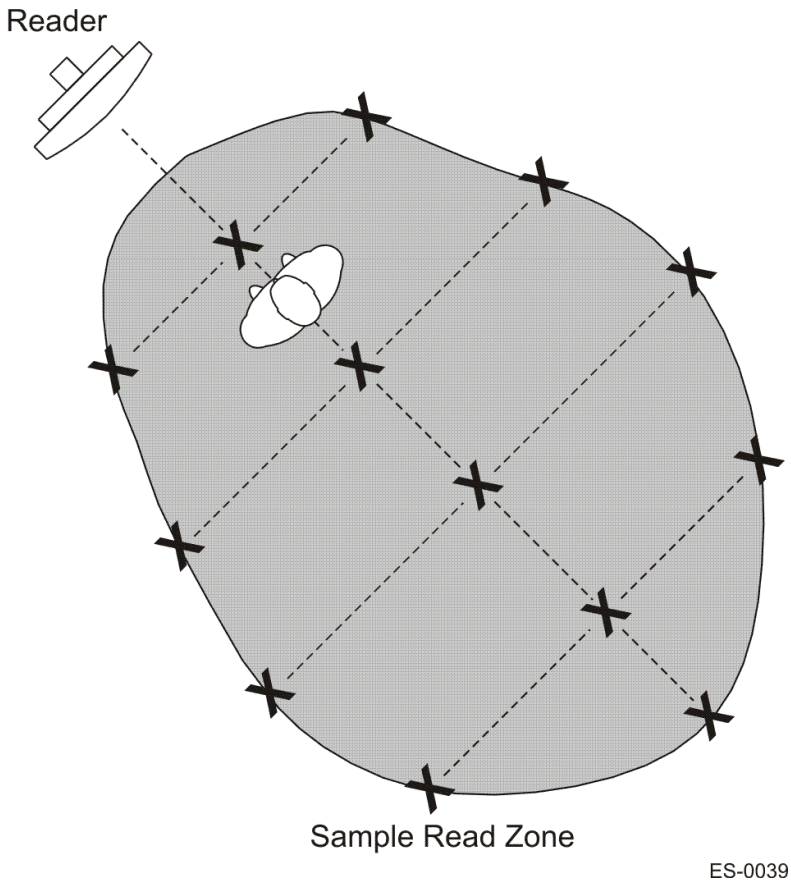

Figure 42 Sample Read Zone Marking Pattern

9. Mark the spot with chalk or tape.
10. Move to the left until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
11. Return to the center and then move to the right until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
12. Return to the center and step backward 2 feet (0.6m) and repeat steps 5 through 7.

13. Continue moving the tag in this manner, placing marks on the ground to identify the boundary of the read zone each time the sound stops. Continue moving the tag to various locations until the read zone is fully marked.
14. You can now connect the outer marks to draw the outer boundary of the read zone.

Figure 42 is a view of a sample read zone within a controlled lane. The outer X marks show the outside edges of the read zone.

Standing at the farthest point of the pattern, walk toward the Encompass 4H Reader or antenna and listen for a continuous sound from the audible tester. If the sound is not continuous, it could indicate a weak or "patchy" RF pattern. Refer to "Fine-Tuning and Verifying the Read Zone" on page 8–127 to adjust the read zone.

Chapter 5 General Software Information

This chapter provides software-related information for the Encompass® 4H Reader System.

This chapter presents various software-related topics arranged in alphabetical order by subject. In addition to this chapter, see “Chapter 6 Communications Protocols” on page 6–60 and “Chapter 7 Commands” on page 7–74 for more information.

Command Entry Conventions

All Encompass 4H Reader 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 4H 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 13 shows the basic structure of a four-character command.

Table 13 Four-Character Command Structure

`#1005` **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.
5	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.

Command Response Conventions

Like the Encompass 4H Reader commands, responses are preceded by the # character. Many Encompass 4H Reader 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 14 shows an example of a command/reply sequence. This example assumes that an Encompass 4H Reader with serial number SN97001P running version X.XX software is connected to a PC running a terminal emulation software package. The command sequence verifies that communications are working correctly.

Table 14 Sample Command Sequence

Entry	Encompass 4H Reader Response	Notes
`#01 <CR>`	`#Done <CR/LF>`	Switches Encompass 4H Reader to command mode
`#505 <CR>`	`#Model E4 Series Ver X.XX SN08001P <CR/LF>`	Reports the software version and serial number
`#00 <CR>`	`#Done <CR/LF>`	Returns Encompass 4H Reader to data mode

In command discussions, Encompass 4H Reader 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. For example, the response to command `#520 Display Power Fail Bit` is either a 0 or a 1. In the command discussion, the response is shown as:

```
#PWRB <0-1>
```

with actual Encompass 4H Reader response being one of the following:

```
#PWRB 0
```

```
#PWRB 1
```

In this example, PWRB is the four-character identifier for power fail bit, and the 0 or 1 is the value. All spaces shown in the response are actual spaces sent from the Encompass 4H Reader. In this example, one space is between the letter B and the number.

Operating Parameters

The Encompass 4H Readers maintain their operating parameters in non-volatile memory (NVRAM) so that the parameters are preserved after a power-down sequence.

Caution:
To save user parameter changes to NVRAM, you must send command #00 before powering down the reader.

Power Fail

The system maintains a power fail flag. The host transmits command `#520 Display Power Fail Bit` to determine if a power down has occurred. This flag is cleared by both command `#63 Reset Reader` and command `#65 Reset Power Fail Bit`.

Program Download

Program download stores the Encompass 4H applications software into the reader's flash memory. Program download is used to install program upgrades, add features, and to recover from corrupted program data.

Note: *Program download is a hosted process. Exercise caution so that you don't inadvertently enter download mode.*

Download Considerations

You should consider the following factors when performing program download:

- The Encompass 4H Reader does not process tags while in download mode.
- The Encompass 4H Reader does not accept any program data unless a successful erase of flash memory has been performed before transmitting the data. Erasing the flash memory typically takes two seconds.
- Exiting from download mode re-executes startup. If the new software has been loaded without errors, the Encompass 4H Reader comes up in data mode. If a flash checksum error is detected, the Encompass 4H Reader reenters download mode and transmits a sign-on message with a boot version of 0.00x and without a serial number.

Note: *The Encompass 4H Reader uses default communications parameters when operating in download mode – 38400 baud, 8 data bits, 1 stop bit, no parity, basic protocol – and does not echo commands.*

Download Procedures

If TransCore releases a new version of the Encompass 4H Reader software or if the Encompass 4H Reader seems not to be working properly, you may need to download the software to the Encompass 4H Reader. Contact technical support or your TransCore Encompass 4H Reader sales representative.

Startup

Upon startup, Encompass 4H Reader's transmit a sign-on message or a boot ROM failure message.

Sign-On Message

If startup is successful, the sign-on message appears as follows:

```
Model E4 Series [software version]
SNYYYYYY [Copyright notice]
```

where YYYYYY is the serial number assigned to the 4800 Reader unit being used.

Serial number 000000 is the default setting and is not a valid number. If this number appears in the sign-on message, the serial number has never been stored into reader memory. The serial number must be assigned by factory-authorized personnel using command `#695S...S Set Serial Number`. Because only six digits are allowed in the software, when setting the serial number skip the fourth (middle) digit of the seven-digit number shown on the reader label.

If the flash memory checksum does not indicate verification, the sign-on message appears as follows:

```
Model [E4] Ver 0.00x

[Copyright notice]
```

Boot Failure Message

The software performs a checksum function on itself. The function returns a specific value for the particular version of software. If the value returned is not correct, the boot ROM checksum assumes that locations have been corrupted and a failure condition exists. If the boot ROM checksum is not correct, a boot failure message is transmitted. If the failure message does not transmit, a communications error has occurred or the boot failed to the extent that it cannot transmit the failure message.

If the failure message version number equals 0.00 and no serial number exists, the flash memory checksum has failed, and the Encompass 4H Reader is operating out of boot ROM. In this case, the Encompass 4H Reader automatically enters download mode and waits for a new program to be loaded into the flash memory. Follow the instructions in "Program Download" on page 5–58 to download a new program.

Tag/Message Buffer

In basic communication protocol, the Encompass 4H Reader does not provide tag memory storage beyond the quantity required for uniqueness checking. This feature allows adequate buffering of tag data under normal operating conditions. The Encompass 4H Reader cannot operate as a stand-alone component. When the buffer fills, subsequent tag IDs will be lost.

In error correcting protocol (ECP), a buffer of up to three additional tag reads will be held in case a host system is unable to acknowledge tag reads in real time.

Chapter 6 Communications Protocols

This chapter describes the communications protocols for the Encompass® 4H Reader.

Introduction

The Encompass 4H Reader supports the following communications protocols:

- Basic
- Error correcting protocol (ECP)
- Data inquiry

The following protocol information provides reference information relevant to developing host software.

Communications are performed using the 7-bit ASCII code with optional parity, thus providing easy setup, testing, and diagnostics with standard ASCII terminals and serial printers. Parity must be enabled to achieve the specified undetected error rate.

Each message is framed within the start-of-message (som) and end-of-message (eom) characters so that the host computer can detect the beginning and end of each message. This convention is most important under marginal communications conditions during which the host may receive extraneous noise-induced characters between reader transmissions. In such instances, the host is capable of ignoring any messages that do not conform to the som...eom frame sequence.

Both data mode and command mode require a two-way message interchange when using ECP. This interchange is completed by the message recipient returning a message acknowledgment to the message sender.

With ECP, all transmissions require a message. If a message is not received, the sender will time out with the same effect as if it had received a negative acknowledgment (from the host) or an `Error` message from the Encompass 4H Reader.

Software (XON/XOFF) flow control is optionally supported. Be careful in the use of XON/XOFF since noise-induced characters may be interpreted by the Encompass 4H Reader as the XOFF character, which would suspend reader output without information reaching the host computer. For more information see “Software Flow Control” on page 8–127.

Note: *TransCore recommends that XON/XOFF flow control be disabled while using ECP.*

Basic Protocol

With basic protocol, messages sent to and from the Encompass 4H Reader and the host are transmitted without error checking. For each host transmission, the Encompass 4H Reader returns a `Done` or `Error` message to the host.

When the host computer is physically close to the Encompass 4H Reader and no sources of interference exist, the basic protocol provides reliable communications.

The host must be ready to receive reader-transmitted messages because in basic protocol the Encompass 4H Reader does not wait for the host to acknowledge a message before transmitting the next message. If necessary, the host may halt reader transmissions by using software or hardware flow control. Refer to "Chapter 8 Configuring the Encompass 4H Reader" on page 8–115 for flow control information.

Error Correcting Protocol

When the quality of data communications is imperative or may be suspect, you can invoke ECP to ensure the integrity of data transmitted between the Encompass 4H Reader and the host.

Note: *TransCore recommends that basic protocol (not ECP) be used when commands are entered manually at the keyboard.*

Wiegand output is automatically disabled when the reader is put into ECP mode.

Error correction is accomplished with the use of a cyclic redundancy check (CRC) value that is based on the message data. The originator (reader or host) calculates the CRC value of a message and includes it in the transmitted message.

The recipient (reader or host) also calculates a CRC value for the received message. If the transmitted message data is correct, the CRC value calculated by the recipient will agree with the CRC value calculated by the originator. If the CRC values do not agree, the recipient rejects the message.

Message sequence numbers are also included when using ECP. These sequence numbers are checked to determine if the message received has the correct sequence number; if not, the recipient rejects the message.

Since the seven-bit ASCII code is used and there are eight data bits per character, the eighth bit can optionally be used to support parity. Where parity is selected, the CRC value calculation includes the parity of each character in the calculation of the CRC value.

Parity is required to achieve the most reliable communications. If parity is enabled, both the Encompass 4H Reader and the host must issue a message if any received character has a parity error. However, the message must not be transmitted before receipt of the eom character. In this case, the Encompass 4H Reader will issue an `Error` message, and the host computer will issue a negative acknowledgment message.

Data Inquiry Protocol

Data inquiry protocol is a basic protocol option that allows the host to control transmission of reader tag data. The selection of data inquiry protocol affects data mode operation. As the Encompass 4H Reader acquires tags, it buffers them but does not transmit them. Instead, the host must poll the Encompass 4H

Reader for each tag by sending an ASCII CRTL-E character (hexadecimal 05). The Encompass 4H Reader transmits one message (tag ID or report data) for each CTRL-E it receives until the buffer is empty.

Each tag request message sent by the host consists only of the CTRL-E character; no som or eom characters are sent. Encompass 4H Reader data transmission (tag ID and report data) format is the same as for basic protocol.

Selection of data inquiry protocol does not affect command mode operation.

Basic Protocol and ECP Format

Note: *In the following text, the symbols < and > are used to represent required variable message data, and the symbols [and] are used to represent optional data. These symbols are not part of the message syntax.*

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) that represents an even numberin the range 0–9, A–F (0, 2, 4, 6, 8, A, C, E). The Encompass 4H Reader maintains the number. The host must acknowledge reader transmissions by sending an `ACK` message with the same sequence number received from the Encompass 4H Reader. The Encompass 4H Reader updates its sequence number upon receipt of a valid host `ACK`. If an `ACK` is not received, the Encompass 4H Reader retransmits the message. A reader transmission sequence is not considered complete until the Encompass 4H Reader receives an `ACK` and updates its sequence number.
`<data>`	An ASCII string up to 72 characters long. This string may contain tag data, a presence without tag report; an input status change report; an `Error06, Error07, Error08,` or `Error11` message; 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 Encompass 4H Reader is in the process of retransmitting the previous message.

ECP Host ACK/NAK Response

With ECP, the host computer responds to all data message transmissions from the Encompass 4H Reader using the following acknowledgment or negative acknowledgment response format.

<som><seq><ack/nak><crc><eom>

where

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

<seq> An echo of the sequence number received from the Encompass 4H Reader. The sequence number should correspond to the data message that is being positively or negatively acknowledged by the host. If the Encompass 4H Reader receives an ACK message with the incorrect sequence number, the data message is retransmitted.

The host computer resets the anticipated data message sequence number to that of the Encompass 4H Reader before communications can resume without error.

<ack/nak> ASCII @ character for ACK response; ASCII ? character for NAK response

<crc> CRC value for the message

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

The Encompass 4H Reader sets a user-programmable timeout delay at the time each message is transmitted based on command #612NN Set Error Correcting Protocol Timeout, where NN = timeout delay. To disable the timeout delay for diagnostic purposes, issue the command #612FF Disable Error Correcting Protocol Timeout.

If the timeout delay expires before the Encompass 4H Reader receives an ACK or NAK message from the host, a logical NAK condition will be declared. If the Encompass 4H Reader receives a NAK or timeout, the reader retransmits the data message.

When the Encompass 4H Reader receives an ACK message, the system software treats the message as having been properly received by the host. The software increments the sequence number, and advances pointers to the next message in the Encompass 4H Reader's message queue to prepare for sending the next message.

Switch to Command Mode Request

The host computer may issue command #01 Switch to Command Mode while in data mode.

The basic protocol format is as follows:

<som><cmd><eom>

The ECP format is as follows:

<som><seq><cmd><crc><eom>

where

<som>	Start-of-message (ASCII # character)
<seq>	Sequence number generated by the host computer separately from that appearing in data messages transmitted by the Encompass 4H Reader
<cmd>	Switch to command mode (ASCII characters 01)
<crc>	CRC value for the message
<eom>	End-of-message character (ASCII CR)

Host Transmission

The host computer initiates synchronous communications between the Encompass 4H Reader and the host. The host begins a sequence by issuing a command; the Encompass 4H Reader responds accordingly.

The data inquiry protocol format is as follows:

<CTRL-E>

The basic protocol format is as follows:

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

The ECP format is as follows:

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

where

<CTRL-E>	ASCII Control E (hex 5 digit). When in data inquiry mode, each transmission of a CTRL-E by the host causes the Encompass 4H Reader to transmit one tag ID.
<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 Encompass 4H 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 in ECP, the Encompass 4H Reader replies using 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 Encompass 4H 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 from two to four ASCII hex characters

[<data>]	Optional data field, an ASCII string of as many as 20 characters in length. For example, the store hardware configuration string command is #696S...S or command #696 Store Hardware Configuration String followed by the data string S...S.
<crc>	CRC value for the message
<eom>	End-of-message character (ASCII CR)

Reader Command Response

The basic protocol format is

<som><resp><eom>

The ECP format is

<som><seq><resp><crc><eom>

where

<som>	Start-of-message (ASCII # character)
<seq>	Echo of sequence number received in host command message
<resp>	Response string. The Encompass 4H Reader returns Done, Error, or another ASCII string depending on the host transmission. This string can be up to 72 characters long.
<crc>	CRC value for the message
<eom>	End-of-message character (ASCII CR and LF)

Sample Messages

This section contains examples of typical messages transmitted between the Encompass 4H Reader and the host computer.

Reader Transmissions

Basic protocol reader transmission

#KING 1302<eom>

Host response:

No host response for non-ECP

ECP reader transmission

#4KING 1302 <crc><eom>

where

#	Start-of-message character
4	Message sequence number
KING 1302	Message data: Tag ID is shown.
	Other sample message data could be as follows: IOST C0 O2 I0 D24 (display I/O status) Error06 (frequency not set)

<crc>	CRC value for the message
<eom>	End-of-message character

Host response

#4@<crc><eom>

where

#	Start-of-message character
4	Message sequence number
@	ACK (acknowledgment character)
	(? returned for a negative acknowledgment)
<crc>	CRC value for the message
<eom>	End-of-message character

Host Command Transmissions

Basic protocol host transmission

#647XXX<eom>

Reader response

#Done<eom> or #Error<eom>

#Error<eom> is returned if the host transmission is not a legal command with legal data.

ECP host transmission

#7647XXX<crc><eom>

where

#	Start-of-message character
7	Message sequence number
647XXX	Select RF Operating Frequency command where 647XXX is the command and XXX is a hexadecimal value from 000 to 118. In this example, XXX sets the RF frequency to 903 MHz.
<crc>	CRC value for the message
<eom>	End-of-message character
Done	Command has been invoked by the Encompass 4H Reader

Reader response

#7Done<crc><eom> or #7Error<eom>

For some commands, the Encompass 4H Reader responds with data that relates to the command, such as T0F 0, to indicate Wiegand mode enabled for a #532 Display Wiegand Mode Status command.

#7Error<eom> will be returned if host transmission is not a legal command with legal data.

Timing and Synchronization

The ECP is largely independent of baud rate. The timeout delays previously described are a function of baud rate.

The Encompass 4H Reader supports an ECP timeout, which applies equally to both transmit and receive.

The receiver's minimum timeout delay equals the time to transmit/receive the longest anticipated message at the current baud rate setting. Additional margin should be included for idle periods between characters; for example, processing overhead, if any. The timeout delay period can be expressed as follows:

`Trec (ms) = L x [Tchar + Tidle]`

where

T_{char} (ms)	$1000 \times [B_c / R_b]$
B_c	Bits per character, typically 10
R_b	Baud rate, 1200–38.4 K
L	Length of message in characters
T_{idle}	Maximum idle period between characters (ms)

Note: *The Encompass 4H Reader supports baud rates between 1200 and 38.4 K.*

Likewise, the sender must set a timeout delay equal to the delay of nine characters at the current baud rate setting. For example, the time required to shift out the <eom> character plus the time to shift in the ACK or NAK message to be received plus a processing allowance for the receiver to process the message and check for error conditions.

Thus, the sending timeout delay can be expressed as follows:

`Tsend (ms) = 9 * Tchar + Terrchk`

where

Terrckh (ms)	Processing period to perform error checking by receiver

The host computer can remotely set the Encompass 4H Reader's communications parameters while in the command mode, but TransCore does not recommend this action if communications conditions are marginal.

After the Encompass 4H Reader receives new communications parameters, the Encompass 4H Reader issues the Done message and switches to the new configuration immediately. The host computer switches its communications parameters immediately after the transaction is complete.

As noted, the message initiator, such as the Encompass 4H Reader in data mode and the host computer in command mode, starts a timeout counter at the time a message is transmitted. If the timeout expires before receiving an acknowledgment message, a logical NAK condition is declared, and the initiator assumes the message was received in error. In this instance, the message is retransmitted until an acknowledgment message is received.

The message recipient, such as the host computer in data mode and the Encompass 4H Reader in command mode, starts a timeout counter when a <som> character is received. If the timeout expires

without the receipt of an <eom>, the message acquisition is aborted (reset), and the receiver waits for the next <som> character.

If the message recipient receives a second <som> character before an <eom> character, the message acquisition is aborted (reset), and retransmission of the previous message is assumed to be underway.

These strategies allow for recovery during periods when communications are marginal or completely lost.

Note: *It is important that the host computer limit the period during which the Encompass 4H Reader remains in command mode to avoid losing tag IDs. RF is off in command mode and no tags can be read.*

Reader-Addressed Failure Conditions

The Encompass 4H Reader addresses the following failure conditions.

Illegal Sequence Number (not in the range 0–9, A–F)

If the Encompass 4H Reader detects an illegal sequence number in a host command message, it discards the received message and sends no response. If it receives an illegal sequence number in an ACK message, it responds as if a NAK had been received and retransmits the data.

Wrong Sequence Number

If the Encompass 4H Reader receives the wrong sequence number in an ACK message, it responds as if a NAK had been received, and it retransmits the data.

Incorrect CRC

If the Encompass 4H Reader detects an incorrect CRC value in a host command message, it discards the received message. No response is sent. If it receives an incorrect CRC value in an ACK message, it responds as if a NAK had been received, and it retransmits the data.

Illegal Command

If the Encompass 4H Reader receives an illegal command, it returns its standard Error message.

Transmission Timeout

If the Encompass 4H Reader transmits an asynchronous message and the host does not send an ACK before the ECP timeout occurs, the Encompass 4H Reader retransmits the message.

Receive Timeout

If the Encompass 4H Reader receives a <som> but does not receive a matching <eom> before the ECP timeout occurs, it discards the incomplete message and resets its receiver.

Asynchronous Message/Command Message Collision

If the Encompass 4H Reader transmits asynchronous data at the same time that the host sends a command, the Encompass 4H Reader gives priority to receiving the command. It processes the command and sends a message before it retransmits the asynchronous data.

Host-Addressed Failure Conditions

The host computer addresses the following failure conditions.

Illegal or Wrong Sequence Number

If the host detects an illegal or wrong sequence number in a reader response, it retransmits the command with the same sequence number. If the host detects an illegal sequence number in an asynchronous reader transmission, it sends a NAK message.

Incorrect CRC

If the host detects an incorrect CRC value in a reader message, it retransmits the command with the same sequence number. If the host detects an incorrect CRC value in an asynchronous reader transmission, it transmits a NAK message.

Transmission Timeout

If the Encompass 4H Reader does not respond to a host command within a specified interval, the host software retransmits the command with the same sequence number.

Receive Timeout

If the host receives a <som> but does not receive a matching <eom> within a specified timeout interval, it discards the incomplete message and resets its receiver.

Asynchronous Message/Command Message Collision

If the host receives an asynchronous reader transmission at the same time it transmits a command, it ignores the asynchronous message and waits for the Encompass 4H Reader's response. The Encompass 4H Reader retransmits asynchronous data after it transmits the command message.

ECP Reliability

An undetected error is defined as a message having incorrect data or status but no parity or CRC errors. An error transaction is defined as a message having either a parity or CRC error. Laboratory testing indicates an undetected error rate of less than one undetected error per 1,000,000 error transactions with parity enabled.

To ensure this error rate is not exceeded, the host must enable parity and adhere closely to the timing specifications discussed previously in this chapter in the "Timing and Synchronization" section.

CRC Calculation

The CRC used by the ECP is based on a 16-bit algorithm. The algorithm, as implemented, operates on eight-bit characters, for example, seven-bit ASCII character plus one optional parity bit. The 16-bit result is converted to four ASCII hex characters and is appended to messages transmitted by the Encompass 4H Reader.

The Encompass 4H Reader accepts four ASCII < ` > characters (60 hex) as a wild card CRC value in lieu of a valid four-character CRC value to facilitate testing and diagnostic checkout.

The Encompass 4H Reader implements the algorithm with a 512-byte lookup table to reduce the processing overhead requirements.

To simplify the implementation of the CRC algorithm by host software developers, several examples of the calculation are provided in C source code on the following pages. The calculation may be performed with or without a lookup table, depending on the trade-off between code memory and processing overhead.

Example 1 presents an example of a function (CALCCRC) that calculates the CRC value through a call to a separate function (UPDCRC).

```
unsigned short calccrc(char *message)
{
unsigned short crc = 0;
for ( ; *message !=
   (char)0;message++) crc =
   updcrc(*message & 0xff, crc);
return (crc)
  }
```

Example 2 shows an example of UPDCRC that does not require a lookup table.

```
#define BITS_PER_CHAR    8
unsigned short updcrc (unsigned short ch, unsigned
short crc)
{
   register short counter = BITS_PER_
   CHAR; register short temp     = crc;
   while (--counter
      >= 0) if (temp &
      0x8000)
      {
  temp <<= 1;
    temp += (((ch <<= 1) & 0x0100) != 0);
  temp ^= 0x1021;
     }
       else
    { temp
    <<= 1;
    temp += (((ch <<= 1) & 0x0100) != 0);
     }
  return(temp);
}
```

Example 3 contains an example of UPDCRC that does require a lookup table.

```
   #define updcrc(cp, crc)( crctab[((crc >> 8) & 255)]^ (crc << 8) ^ cp static
unsigned short crctab [256] = {
0x0000,    0x1021,    0x2042,    0x3063,    0x4048,    0x50a5,    0x60c6,    0x70e7,
0x8108,    0x9129,    0xa14a,    0xb16b,    0xc18c,    0xd1ad,    0xe1ce,    0xf1ef,
0x1231,    0x0210,    0x3273,    0x2252,    0x52b5,    0x4294,    0x72f7,    0x62d6,
0x9339,    0x8318,    0xb37b,    0xa35a,    0xd3bd,    0xc39c,     0xf3ff,    0xe3de,
0x2462,    0x3443,    0x0420,    0x1401,    0x64e6,    0x74c7,    0x44a4,    0x5485,
0xa56a,    0xb54b,    0x8528,    0x9509,    0xe5ee,    0xf5cf,    0xc5ac,    0xd58d,
0x3653,    0x2672,    0x1611,    0x0630,    0x76d7,    0x66f6,    0x5695,    0x46b4,
0xb75b,    0xa77a,    0x9719,    0x8738,    0xf7df,    0xe7fe,    0xd79d,    0xc7bc,
0x48c4,    0x58e5,    0x6886,    0x78a7,    0x0840,    0x1861,    0x2802,    0x3823,
0xc9cc,    0xd9ed,    0xe98e,    0xf9af,    0x8948,    0x9969,    0xa90a,    0xb92b,
0x5af5,    0x4ad4,    0x7ab7,    0x6a96,    0x1a71,    0x0a50,    0x3a33,    0x2a12,
0xdbfd,    0xcbdc,    0xfbbf,    0xeb9e,    0x9b79,    0x8b58,    0xbb3b,    0xab1a,
0x6ca6,    0x7c87,    0x4ce4,    0x5cc5,    0x2c22,    0x3c03,    0x0c60,    0x1c41,
0xedae,    0xfd8f,    0xcdec,    0xddcd,    0xad2a,    0xbd0b,    0x8d68,    0x9d49,
0x7e97,    0x6eb6,    0x5ed5,    0x4ef4,    0x3e13,    0x2e32,    0x1e51,    0x0e70,
 0xff9f,    0xefbe,    0xdfdd,     0xcffc,    0xbf1b,    0xaf3a,    0x9f59,    0x8f78,
0x9188,    0x81a9,    0xb1ca,    0xa1eb,    0xd10c,    0xc12d,    0xf14e,    0xe16f,
 0x1080,   0x00a1,    0x30c2,    0x20e3,    0x5004,    0x4025,    0x7046,    0x6067,
 0x83b9,   0x9398,    0xa3fb,    0xb3da,    0xc33d,    0xd31c,    0xe37f,    0xf35e,
 0x02b1,   0x1290,    0x22f3,    0x32d2,    0x4235,    0x5214,    0x6277,    0x7256,
 0xb5ea,   0xa5cb,    0x95a8,    0x8589,    0xf56e,    0xe54f,    0xd52c,    0xc50d,
 0x34e2,   0x24c3,    0x14a0,    0x0481,    0x7466,    0x6447,    0x5424,    0x4405,
 0xa7db,   0xb7fa,    0x8799,    0x97b8,    0xe75f,    0xf77e,    0xc71d,    0xd73c,
 0x26d3,   0x36f2,    0x0691,    0x16b0,    0x6657,    0x7676,    0x4615,    0x5634,
 0xd94c,   0xc96d,    0xf90e,    0xe92f,    0x99c8,    0x89e9,    0xb98a,    0xa9ab,
 0x5844,   0x4865,    0x7806,    0x6827,    0x18c0,    0x08e1,    0x3882,    0x28a3,
 0xcb7d,   0xdb5c,    0xeb3f,    0xfb1e,    0x8bf9,    0x9bd8,    0xabbb,    0xbb9a,
 0x4a75,   0x5a54,    0x6a37,    0x7a16,    0x0af1,    0x1ad0,    0x2ab3,    0x3a92,
 0xfd2e,   0xed0f,    0xdd6c,    0xcd4d,    0xbdaa,    0xad8b,    0x9de8,    0x8dc9,
 0x7c26,   0x6c07,    0x5c64,    0x4c45,    0x3ca2,    0x2c83,    0x1ce0,    0x0cc1,
 0xef1f,    0xff3e,    0xcf5d,    0xdf7c,    0xaf9b,    0xbfba,    0x8fd9,    0x9ff8,
 0x6e17,   0x7e36,    0x4e55,    0x5e74,    0x2e93,    0x3eb2,    0x0ed1,    0x1ef0,
 };
```

Example 4 shows an example of a function that creates the lookup table.

```
#include <stdio.h>

#define MAX_CHAR      256
#define BITS_CHAR         8
#define SIGN_BIT          0x8000
#define POLY
0x1021 unsigned short crctab
[MAX_CHAR]; main ()
                {
                unsigned short ch;
                unsigned short
                workval; unsigned
                short bit; unsigned
                short carry;
                for (ch = 0; ch != MAX_CHAR;
                ch++)
                { workval = ch << BITS_CHAR;
                for (bit = BITS_CHAR; bit != 0; bit-
                -)
                { carry = (workval & SIGN_BIT);
                workval
                <<= 1; if
                (carry)
                workval ^=
                POLY;
                 }
                crctab[ch] = workval;

                   }
                   for (ch = 0; ch != MAX_CHAR; ch++)
                   printf("0x%04x\n", crctab[ch]);
                   }
```

Manually Disabling ECP for Maintenance

Under certain conditions, communications between the host and Encompass 4H Reader may be lost temporarily and maintenance may be required. The reader or host is sending out a message and waiting for an acknowledgment. When the acknowledgment is not received, the message is sent again. Additional messages are also buffered. Often the first indication that the Encompass 4H Reader software is in an ECP "loop" is when the user/technician sees a recurring display of the same message repeated over and over again on the monitor. The procedure described in the following paragraphs enables the maintenance technician to change configuration or test tag reading manually.

Assuming that the ECP timeout is at the factory default of 12.7 seconds (or other value that allows enough time for the commands to be manually entered) the following command sequence may be used to break

out of an ECP loop. This command sequence uses four ASCII <`> characters (60 hex) as wild card CRC values.

Note: *The ASCII <`> character (60 hex) is commonly located on the ~ key.*

You must acknowledge existing messages by issuing commands with the generic format:

#x@````<eom>

where

#	Start-of-message character
x	Message sequence number. This must be the same as the sequence number of the message being acknowledged
@	ACK (acknowledgment character)
<““>	Wild card CRC value for the message
<eom>	End-of-message character

The following is a typical sequence after power-on limiting buffered messages.

Note: *Ensure that no tags are in the field when you are performing this troubleshooting procedure.*

Caution

To avoid damage to the Encompass 4H Reader that uses an external antenna, ensure that you have connected the antenna or a dummy load to the reader before applying power to the reader.

Reader transmission on power-up:

#0 Model ….	SN <crc><eom>
Manually enter:	**#0@````<eom>**
Reader transmission	#2 Copyright 2008 TransCore <crc><eom>
Manually enter:	**#2@````<eom>**
Manually enter:	**#101````<eom>** this puts reader into command mode
Reader response:	#1Done<crc><eom>
Manually enter:	**#3610````<eom>** this puts reader into basic protocol, disabling ECP
reader response:	Done

Enter any other desired diagnostic or directive commands in basic protocol. After maintenance is complete enter the command:

#00	to return the reader to data mode
	or
#611	to return to error correcting protocol, and then either cycle power or issue #100````<eom> command to return reader to data mode.

Chapter 7 Commands

This chapter discusses the host-transmitted commands that are used to control the Encompass® 4H Reader configuration and operation.

Introduction

The Encompass 4H Reader is delivered from the factory with specified default settings that determine how the reader operates. Commands transmitted by the host computer can change the default settings and control additional features. The commands can be transmitted by manually entering the commands at the host keyboard if the host is in terminal emulation mode. The Encompass 4H Reader can also communicate with ASCII terminals.

Note: *If you are using Wiegand mode, you must connect the PC or laptop to the Encompass 4H Reader using the RS–232 or RS–422 interface and a terminal emulation program to send commands to the reader. You can leave the Wiegand interface connected during this procedure.*

Operating Modes

The Encompass 4H Reader has three modes of operation: data, command, and download. The software for the Encompass 4H Reader contains two separate programs — boot and application. The boot program has control of the Encompass 4H Reader on startup and when operating in download mode. The application program has control of the Encompass 4H Reader during data and command mode operations and holds the application code. Together, they control the Encompass 4H Reader in the three modes of operation.

Data Mode

The Encompass 4H Reader is in the data mode upon power-up. While in the data mode, the Encompass 4H Reader sends all communications as data messages, such as tag IDs and reports, to the host computer. Reports provide information on input status changes (input0 and input1), a presence without tag report, and buffer overflow information. The host computer can send only two commands to the Encompass 4H Reader while in data mode:

Command `#01 Switch To Command Mode` changes the Encompass 4H Reader from the data mode to the command mode. See “01 Switch to Command Mode” on page 7–76.

See commands “611 Select Error Correcting Protocol” on page 7–101 and “613 Enable Data Inquiry Protocol” on page 7–102.

Note: *ID codes are transmitted to the host computer when the Encompass 4H Reader is in data mode. If the Encompass 4H Reader remains in the command mode with tags passing through the read zone, all tag IDs are not reported.*

Command Mode

While the Encompass 4H Reader is in the command mode, the host computer sends commands to the Encompass 4H Reader that can be used to control the operation and configuration of the reader. After the Encompass 4H Reader receives a command, it transmits a command response message. Typically, the command message contains `Error, Done`, or data relating specifically to the command request. These messages may be of variable length since some commands require information as part of the message; for example, `Display Wiegand Mode Status`.

Communications can be lost if the host computer attempts to send certain commands under marginal communications conditions. For example, if the host computer transmits the command request to change the baud rate and the Encompass 4H Reader properly receives the request and transmits the `Done` message, one of the two following conditions may occur:

- If the host computer receives the `Done` message, then both the host and the Encompass 4H Reader switch to the new baud rate, and communications are maintained.

Note: *In many applications, the host must be set to the new baud rate as it will not change automatically. The Encompass 4H Reader changes the baud rate immediately after issuing the* `Done` *message.*

- However, if the host does not receive the `Done` message transmitted by the Encompass 4H Reader, the host assumes that the command was not properly sent and does not switch to the new baud rate, causing a loss of communications.

Caution

The host computer should not attempt to change communications parameters or protocols during marginal communications conditions, otherwise a loss of communications can result.

Download Mode

In download mode, the Encompass 4H Reader allows the host to download new software.

While in download mode, the reader communications port parameters are fixed at the following factory-default settings: 38400 baud, 8 data bits, 1 stop bit, no parity, software flow control (XON/XOFF), basic protocol.

While in download mode, the Encompass 4H Reader turns RF off, does not process tags, and does not echo host commands.

Command List

Reader commands are divided into groups based on primary function. The following sections provide information about each command in command number order. Refer to "Command Group 6 – Reader Control Functions" on page 7–101 for listings of commands in numerical and alphabetical order.

In the following text, the symbols **<** and **>** represent variable message data. These symbols are not part of the message syntax.

Hex digits (0–9, A–F) in either uppercase or lowercase characters may be used in data strings and for hex digits A–F.

Reader Mode Control — Command Group 0

Group 0 commands control reader mode. The mode determines whether the reader is transmitting data to or receiving data from a host computer or terminal.

00 Switch to Data Mode (Factory Default)

Command `#00` switches the reader to data mode, which allows the reader to transmit tag data (ID codes) to the host. In addition to switching the reader to data mode, command `#00` automatically saves to non-volatile memory (NVRAM) any user parameters that had been changed during the command mode session. The reader enters data mode on power up.

Caution

To save user parameter changes to NVRAM, you must send command #00 before powering down the reader.

While operating in data mode, the reader accepts the following commands:

```
Command #01 Switch to Command Mode
```

Reader response:

```
Done
```

01 Switch to Command Mode

Command `#01` switches the reader to command mode, which allows the reader to accept commands from a host or terminal. While in command mode, the reader turns RF off and does not acquire tags.

Reader response:

```
Done
```

Command Group 1 – Communications Port Control

Group 1 commands configure the parameters used by the Encompass 4H Reader to communicate with a host computer or terminal. These commands set baud rate, stop bits, parity, and end-of-line delay.

100N Select Baud Rate

See "522 Display Communications Port Parameters" on page 7–91.

Command `#100N` selects the reader baud rate. The factory-default setting is 9600 baud. The N variable specifies the baud rate shown in Table 15.

Table 15 Select Baud Rate Commands

Command	Baud Rate Selected
1002	1200
1003	2400
1004	4800
1005	**9600 (factory default)**
1006	19.2 K
1007	38.4 K

Caution

If ECP is enabled, ensure that the ECP timeout is sufficient for the new baud rate. See "Command Group 6 – Reader Control Functions" on page 7–101***.***

Reader response:

```
Done
```

101N Select Stop Bits

See "522 Display Communications Port Parameters" on page 7–91

Command `#101N` selects the number of stop bits for reader character transmission. The factory default setting is 1 stop bit. The N variable specifies the number of stop bits as indicated in Table 16.

Table 16 Select Stop Bits Commands

Command	Stop Bits Selected
1010	**1 (factory default)**
1011	2

Reader response:

```
Done
```

102N Select Parity

Command `#102N` selects the reader parity setting. The factory-default setting is parity disabled. The N variable specifies parity as shown in Table 17. See "522 Display Communications Port Parameters" on page 7–91.

Table 17 Select Parity Commands

Command	Data Bits	Parity Selected
1020	**8**	**Disable parity (factory default)**
1021	7	Select even parity
1022	7	Select odd parity

Reader response:

```
Done
```

Command Group 2 – Real-Time Clock

Group 2 commands control the real-time clock which maintains the Encompass 4H internal time and date. This time and date can be appended to IDs, error messages, and sensor input reports. An internal battery supports the clock, so time and date are preserved if main power is lost.

20 Set Time

Command `#20` sets the time. Enter the time in the proper format: two-digit decimal entries with no spaces between characters and using colons as delimiters. The entry format is as follows:

`20HH:MM:SS` or `20HH:MM:SS:hh`

where

HH	represents hours (00 to 23).
MM	represents minutes (00 to 59).
SS	represents seconds (00 to 59).
hh	represents hundredths of a second (00 to 99).
:	is the time delimiter.

If hundredths of a second is not specified, the reader sets the hundredths register to 00.

Reader response:

```
Done
```

21 Set Date

Command `#21` sets the date. Enter the date in the proper format: two-digit decimal entries with no spaces between characters and using forward slashes "/" as delimiters. The entry format is as follows:

`21MM/DD/YY`

where

MM	represents the month (01 to 12).
DD	represents the day (01 to 31).
YY	represents the last two digits of the year (00 to 99).
/	is the date delimiter.

Reader response:

`Done`

22 Display Time and Date

Command `#22` displays the reader's current time and date. One space separates the time and the date output.

Reader message:

`HH:MM:SS:hh MM/DD/YY`

where

HH	represents hours.
MM	represents minutes.
SS	represents seconds.
hh	represents hundredths of seconds.
:	is the time delimiter.
MM	represents the month.
DD	represents the day.
YY	represents the last two digits of the year.
/	is the date delimiter.

Command Group 3 – Append Information

Group 3 commands append useful information to reader transmissions, such as IDs, error messages, and sensor input reports. Auxiliary information such as reader number, antenna number (or manual entry code), number of times the previous tag was read, and sensor input status can be appended to the ID using the Group 3 commands. See command "524 Display Appended Information Status" on page 7–92.

30N Append Time and Date Selection

Command #30N selects the option of appending the time and date to transmitted IDs, error messages, presence without tag reports, and input status change reports. The factory default setting is time and date appended (Command #302).

The reader returns an Error message if its tag buffer contains data. The reset reader command #63 may be transmitted to clear the buffer; however, tag ID data will not be reported. If this is unacceptable, allow the buffer to empty before re-issuing append time and date command #30N. Append Time and Date commands are shown in Table 18.

Table 18 Append Time and Date Commands

Command	Append Option
300	No time and date appended
302	**Time and date appended (factory default)**

The reader transmits messages with time and date appended as follows. One space separates the time from the date.

```
<string>&<HH:MM:SS.hh MM/DD/YY>
```

where

string	is a tag ID, error message, or report.
&	separates <string> from the time and date.
HH:MM:SS	is the time delimiter.
MM/DD/YY	is the date delimiter.

Reader response:

```
Done
```

31N Append Auxiliary Information Selection

Command #31N selects the option of appending auxiliary information to transmitted IDs, presence-without-tag reports, and input status change reports. Auxiliary information is not appended to error messages. The factory-default setting is no auxiliary information appended. The N variable specifies whether or not auxiliary information is to be appended. Append Auxiliary Information commands are shown in Table 19.

Table 19 Append Auxiliary Information Commands

Command	Append Option
310	**No auxiliary information appended (factory default)**
311	Auxiliary information appended

The reader transmits messages with auxiliary information appended as:

```
<message data>%<xx-y-zz-q>
```

where

%	separates the auxiliary information and signals the host computer that auxiliary information is appended
xx	reader ID. Value can be set with command #60NN
-	auxiliary information delimiter
y	antenna number. Value fixed at 0
zz	number of reads (00 to FF hexadecimal) of the previous tag
q	current status of input0 and input1 (0 to 3). Refer to "526 Display I/O Status" on page 7–93. These values are inverted if input inversion is enabled with command 6941.

Reader response:

```
Done
```

320 Disable EAC Page Append (Factory Default)

Command #320 is a factory-set default that disables the EAC (embedded application code) page append.

Reader response:

```
Done
```

321 Enable EAC Page Append

Note: *This functionality was added to the Encompass® 2 Reader to handle a special unique customer requirement and is retained in the Encompass 4H Reader for full backward compatibility.*

Command #321 selects the option to append an additional predefined 8 bytes of data to be read from an eGo® or eGo Plus tag when the reader is in ID only mode (i.e., not eATA) and multi-tag sort is enabled. The additional bytes that are read from the tag are in locations 10 through 17.

The reader transmits the message with EAC page append as follows. The EAC append data occurs before time and date append data and AUX append data if they are enabled.

```
<tag ID>&<EAC page data>
```

Reader response:

```
Done
```

Command Group 4 – ID Filtering

Group 4 commands set criteria for filtering (buffering or discarding) ID codes. These commands are useful for eliminating duplicate ID codes and selecting the type of tags read by the Encompass 4H Reader.

40 Transmit All ID Codes

See also "530 Display RF0 Filter Status" on page 7–97.

Command `#40` instructs the reader to transmit all IDs without regard for uniqueness. This command can be useful when tuning the lane and mapping the footprint or performing diagnostics.

In Diagnostics Mode (`#40`), `#621` still causes the output to go active once for a valid, unique ID "Scroll Mode". Refer to "621 Select Predefined Output Control (Factory Default)" on page 7–104.

After diagnostics are complete, you may want to reinstate the uniqueness check using command "410N Select Unique ID Code Criteria (Anti-passback Feature)" on page 7–82. This setting will be stored upon entering `#00` and will be retained over the power cycle. Refer to "00 Switch to Data Mode (Factory Default)" on page 7–76.

For operation using the Cypress Converter, use `#40` diagnostics "scroll mode."

Reader response:

```
Done
```

410N Select Unique ID Code Criteria (Anti-passback Feature)

See "530 Display RF0 Filter Status" on page 7–97, "440 Reset Uniqueness" on page 7–83, and "44N Set Uniqueness Timeout" on page 7–84.

Command `#410N` instructs the reader to buffer and transmit ID codes according to the following test: an ID is read if previously decoded IDs have changed value at least `N`+1 times since the new ID was last received. IDs that do not pass the test are not read. The factory-default setting is command `#4100`, which selects a separation of one ID. Variable `N` specifies ID separation as shown in Table 20.

Table 20 Unique ID Code Criteria

Command	Uniqueness Criteria
4100	**Separation of 1 ID (factory default)**
4101	Separation of 2 IDs
4102	Separation of 3 IDs
4103	Separation of 4 IDs

Each time the reader receives a tag ID, it compares the ID with the contents of a comparison register. This register contains the following two items:

Item 1 Most recently acquired ID

Item 2 Second-most recently acquired ID

Item 3 Third-most recently acquired ID

Item 4 Fourth-most recently acquired ID

When the uniqueness filter is set to separation of one ID, the newly acquired ID is transmitted only if it is different from the first item. Separation of two IDs allows transmission if the new ID is different from Items 1 and 2 in the comparison register. Separation of three and four IDs transmit the new ID only if it is different from the first three and the first four items, respectively.

Note: *A new ID can fail the filter test and not be transmitted; however, it remains stored in the comparison register.*

The uniqueness test's time limit is set by Command `#441.` If an ID is buffered, it will not be accepted again unless it arrives at the reader more than the programmed time interval from the previous arrival or until the receipt of one or more other IDs reset the uniqueness.

Reader response:

```
Done
```

420N Select Valid ID Code Criteria

See "530 Display RF0 Filter Status" on page 7–97.

Command `#420N` directs the reader to validate an ID received only after it has been obtained a specified number of times in sequence. Values for N are 0 through 3 (Table 21). The factory setting is one acquisition (N = 0).

Table 21 Select Valid Code Commands and Frames

Command	Valid Code Frames
4200	**1 (factory default)**
4201	2
4202	3
4203	4

The validation procedure is executed before the unique ID test (Select Unique ID Code Criteria `[#410N]` commands). IDs that do not pass the validation test are not reported.

For example, command `#4203` specifies that the same ID must be obtained from the antenna/RF module 4 times in succession before it is considered for the uniqueness test. This feature is useful in installations where RF reflections may cause a single tag to be read multiple times or where an occasional ID might be read from fringe areas.

440 Reset Uniqueness

Command `#440` causes the ID filtering process set by `Select Unique ID Code Criteria (#410N)` to restart. It is used in conjunction with the `Variable Timeout #44N)` commands. This command provides a method to end all uniqueness timers.

44N Set Uniqueness Timeout

See "440 Reset Uniqueness" on page 7–83.

Places a time limit on the uniqueness criterion set. Refer to "410N Select Unique ID Code Criteria (Anti-passback Feature)" on page 7–82. The parameter N sets the number of minutes on the timeout clock. The factory setting is two minutes (N = 1).

Command	Timeout Clock
#441	**2 minutes (factory setting)**
#442	15 seconds
#443	30 seconds

Entering these commands effectively expires the timeout clock, which erases all current IDs in the comparison register. In effect, the first ID that is acquired after the clock expires always appears to be new and is stored. Newly acquired IDs are only tested against IDs that are registered after the clock resets.

The timeout clock is held in reset as long as the reader receives the same tag ID. For example, if the timeout is set for 2 minutes (factory default), and a tag is sitting in front of the reader, the reader will not report the same tag ID every 2 minutes. Otherwise, the reader will report the same Tag ID every 2 minutes.

450 Disable Wiegand Mode (Factory Default)

Command #450 is a default set in the factory to disable Wiegand mode. To display status, use Command "532 Display Wiegand Mode Status" on page 7–97.

Reader response:

```
Done
```

451 Enable Wiegand Mode

Command #451 enables Wiegand mode, which allows the reader to transmit data in a format that emulates the output of a magnetic card reader. To display status, use Command "532 Display Wiegand Mode Status" on page 7–97.

Enabling Wiegand inhibits the output relay function. Refer to "621 Select Predefined Output Control (Factory Default)" on page 7–104. Command #621 is inhibited with Wiegand enabled.

In Wiegand mode, the reader transmits Wiegand-formatted tag data through the Wiegand interface and ASCII data.

Note: *The reader will still accept reader commands and responds with tag data through the serial port interface. The reader outputs data from Wiegand-programmed tags via the Wiegand interface (the red/blue pair for data1/data0 and the black of the yellow/black pair for signal ground). Tags that are not Wiegand-formatted are not transmitted through the Wiegand interface nor the serial port when in Wiegand mode, although the tag lock relay is activated on any tag acquired.*

Reader response:

```
Done
```

452 Disable Tag Translation Mode (Factory Default)

Command #452 disables tag translation mode. Incoming full-frame tags will be directly converted to ASCII. They will not be translated from Association of American Railroads (AAR) and American Trucking Associations (ATA) format to ASCII.

Reader response:

```
Done
```

453 Enable Tag Translation Mode

See "534 Display Tag Translation Mode Status" on page 7–98.

Command #453 enables the translation of tags in AAR and ATA formats. Specific data fields, such as owner ID and car number, will be extracted from these tags, translated according to AAR or ATA standards, and converted to ASCII. Tags that are not programmed in AAR or ATA format will be directly converted to ASCII. The reader will not attempt to translate data from half-frame or dual-frame tags.

NOTE: Tag Translation is Inhibited when Command #40 is enabled. (Refer to "40 Transmit All ID Codes" on page 7–82.)

Reader response:

```
Done
```

454 Enable Multi-tag Sort

Command #454 enables the multi-tag sort function that allows the reader to identify unique tags within a group of Intellitag-based tags. Multi-tag sort allows full operation of the tags and reader to be carried out with a limited number of tags in the presence of the reader.

See "570 Display Tag Protocols" on page 7–100.

Reader response:

```
Done
```

Note: *Enabling the multi-tag sort function adversely affects the vehicle speed at which tags may be read. If there is only one tag expected in the vehicles of the target population, multi-tag sort should be disabled.*

455 Disable Multi-tag Sort (Factory Default)

Command #455 is a default set in the factory to disable the multi-tag sort function.

Reader response:

```
Done
```

456 Enable eGo Plus Tag Initialization During Multi-tag Sort (Factory Default)

Command `#456` enables the reader to send the eGo Plus Tag initialize command as part of the multi-tag sort function. When the reader sends the eGo Plus Tag initialize command, all tags in the RF field reenter the sort process.

Reader response:

```
Done
```

457 Disable eGo Plus Tag Initialization During Multi-tag Sort

Command `#457` disables the reader from sending the eGo Plus Tag initialize command as part of the multi-tag sort function. Any eGo Plus Tags already identified by the reader during the sort process will not be re-identified as long as they remain powered in the RF field. The reader will only identify new tags that come into the RF field or tags that do not remain powered in the RF field.

Reader response:

```
Done
```

458 Disable Second Alternate Group Select (Factory Default)

Command `#458` is a default set in the factory to disable the second alternate group select function.

Reader response:

```
Done
```

459 Enable Second Alternate Group Select

Command `#459` enables the second alternate group select function that allows the reader to distinguish tags meeting specific criteria pre-programmed into the tags.

"Macau" 10 = 00, 12 through 17 = 01, 51, 58, 71, 11, 06

Caution

When second alternate group select is enabled, tags not programmed to meet the specified criteria will not be read.

Reader response:

```
Done 46NN Set Wiegand Retransmit Interval
```

Command `#46NN` sets the time delay to control the reader retransmission of Wiegand data of a tag remaining in the read zone where `NN` is a hexadecimal code from 01 to FF.

Note: *The actual value of the Wiegand retransmit interval may vary depending on the operative tag read mode and the type of tag in the read field.*
For example, 10 = 16 seconds and FF = 255 seconds. The factory default is 4601 (1 second).
Uppercase or lowercase characters are allowed for NN; for example, hex digits A through F or a through f.

Reader response:

```
Done
```

480 Disable ATA

Command #480 disables the reader from reading ATA protocol tags.

481 Enable ATA

Command #481 enables the reader to read ATA protocol data from tags if the reader is programmed to read this tag protocol.

482 Disable eGo

Command #482 disables the reader from reading eGo protocol data from tags.

483 Enable eGo

Command #483 enables the reader to read factory-programmed eGo data from tags if the reader is programmed to read this tag protocol.

484 Disable SeGo

Command #484 disables the reader from reading SeGo protocol data from tags.

485 Enable SeGo

Command #485 enables the reader to read SeGo protocol data from tags if the reader is programmed to read this tag protocol.

486 Disable IAG

Command #486 disables the reader from reading IAG protocol data from tags.

487 Enable IAG

"00 Switch to Data Mode (Factory Default)" on page 7–76

Command #487 enables the reader to read IAG protocol data from tags if the reader is programmed to read this tag protocol. This command should be used in conjunction with "648NN Set Synchronization Output Delay Time" on page 7–106 and "648NN Set Synchronization Output Delay Time" on page 7–106.

488 Disable eATA

Command #488 disables the reader from reading factory-programmed eATA data from tags.

489 Enable eATA

Command #489 enables the reader to read factory-programmed eATA data from eGo Plus or eGo tags. This option must be enabled to obtain Wiegand data from eGo Plus or eGo tags.

490 Disable Third Alternate Group Select (Factory Default)

Command `#490` is a default set in the factory to disable the third alternate group select function.

Reader response:

```
Done
```

491 Enable Third Alternate Group Select

`Command #491` enables the third alternate group select function that allows the reader to distinguish tags meeting specific criteria pre-programmed into the tags.

"Fast" 13, 14, 17 = 46,54,06

Caution

When third alternate group select is enabled, tags not programmed to meet the specified criteria will not be read.

Reader response:

```
Done
```

Table 22 Alternate Group Select

	Address (Decimal)		10	11	12	13	14	15	16	17
	Address (Hex)		0A	0B	0C	0D	0E	0F	10	11
	E4 Reader									
Group Select	**Enable**	**Disable**								
Factory Default (Standard)	#452		00	X	01	X	X	41	X	X
Alt 1 (PR)	#497	#496	00	X	01	X	X	41	41	X
Alt 2 (Macau)	#459	#458	00	X	01	51	58	71	11	06
Alt 3 FAST	#491	#490	X	X	X	46	54	X	X	06
Alt 4 Airports	#493	#492	00	X	01	X	X	04	X	X
Alt 5 PR Access Control	#495	#494	00	X	01	X	X	41	00	X
AAR Tag Translation Mode	#453	#452								
Multi Tag Sort	#455	#454								

See "549 Display User-Programmable Group Select Equals (GSE) Filter Data" on page 7–99.

492 Disable Fourth Alternate Group Select (Factory Default)

Command `#492` is a default set in the factory to disable the fourth alternate group select function.

Reader response:

```
Done
```

493 Enable Fourth Alternate Group Select

Command #493 enables the fourth alternate group select function that allows the reader to distinguish tags meeting specific criteria pre-programmed into the tags.

Airports: 10, 12, 15 = 00, 01, 0A

Caution

When fourth alternate group select is enabled, tags not programmed to meet the specified criteria will not be read.

Reader response:

```
Done
```

494 Disable Fifth Alternate Group Select (Factory Default)

Command #494 is a default set in the factory to disable the fifth alternate group select function.

Puerto Rico Access Control: 10, 12, 15, 16 = 00, 01, 41, 00

Reader response:

```
Done
```

495 Enable Fifth Alternate Group Select

Command #495 enables the fifth alternate group select function that allows the reader to distinguish tags meeting specific criteria pre-programmed into the tags.

Caution

When fifth alternate group select is enabled, tags not programmed to meet the specified criteria will not be read.

Reader response:

```
Done
```

496 Disable Alternate Group Select (Factory Default)

Command #496 disables the alternate group select function that allows the reader to distinguish tags meeting specific criteria pre-programmed into the tags.

Reader response:

```
Done
```

497 Enable Alternate Group Select

Command #497 enables the alternate group select function that allows the reader to distinguish tags meeting specific criteria pre-programmed into the tags.

Reader response:

```
Done
```

Command Group 5 – Reader Status

Group 5 commands provide status reports on the parameters and operation of the reader.

505 Display Software Version

See "695S...S Set Serial Number" on page 7–112

Command `#505` displays the reader model number, software version information, and assigned serial number.

Reader message:

```
Model E4 Series Ver X.XX SNSSSSSS
```

where

X.XX	Version number
SSSSSS	Serial number of the unit, skipping the fourth character printed on the reader product label

506 Display Hardware Configuration Information

See "696S...S Store Hardware Configuration String" on page 7–112

Command `#506` displays hardware configuration information stored in the reader memory by the user. Hardware configuration information is empty by default until you set the information to any 20 character ASCII string desired using command

```
#696S...S
```

Reader response:

An ASCII string from 1 to 20 characters in length

510 Display RF Transceiver FPGA Version

Command `#510` displays RF FPGA VER = XX.XX

511 Display RF Transceiver I Filter Chip Version

Command `#511` displays FIL IC I VER = XX.XX

512 Display RF Transceiver Q Filter Chip Version

Command `#512` displays FIL IC Q VER = XX.XX

513 Display DSP Board Actel Version

Command `#513` displays DSP FPGA VER = XX.XX

520 Display Power Fail Bit

Command #520 displays the value of the reader power fail bit. The power fail bit changes from 0 to 1 when power to the reader is interrupted. To reset the bit, use command #63 Reset Reader or command #65 Reset Power Fail Bit. On initial power-up, the host should transmit one of these two commands to clear the power fail bit.

Reader message:

PWRB P<0 to 1>R0

where

P0	No power failure detected
P1	Power failure detected
R0	Not applicable to Encompass 4H Reader

521 Display Reader ID Number

Command #521 displays the reader ID that is sent in the auxiliary data field. Reader message:

RDID xx

where

xx = 01 to FF (hexadecimal)

522 Display Communications Port Parameters

Command #522 displays the selected communications port parameters, including the baud rate (#100N), the number of stop bits (#101N), the parity scheme (#102N), and the end-of-line delay.

Reader message:

MAIN B<2 to 7> S<0 to 1> P<0 to 2> D0

where

B2	1200 baud (#1002)
B3	2400 baud (#1003)
B4	4800 baud (#1004)
B5	**9600 baud (factory default) (#1005)**
B6	19.2 kbps (#1006)
B7	38.4 kbps (#1007)
S0	**one stop bit (factory default) (#1010)**
S1	two stop bits (#1011)
P0	**no parity (factory default)**
P1	even parity (#1020)

P2	odd parity (#2021)
D0	00 ms end-of-line delay (fixed) (#1022)

One space is required between each value. For example, if factory default settings are assigned, the reader message is

```
MAIN B5 S0 P0 D0
```

indicating 9600 baud, one stop bit, no parity, and 0 ms end-of-line delay.

Note: *The information transmitted in response to command #522 applies to data and command mode operation only. While operating in download mode, default communications parameters are always used.*

524 Display Appended Information Status

Command #524 displays the information being appended to the reader transmissions. Command #31N appends information. Append time and date are not available to the Encompass 4H Reader.

Reader message:

```
IDAP T<0> D<0> X<0 to 1>
```

where

T0	Time not appended
T1	Time appended (not valid for the Encompass 4H Reader)
D0	Date not appended
D1	Date appended (not valid for the Encompass 4H Reader)
X0	Auxiliary information not appended (factory default)
X1	Auxiliary information appended

One space is required between each value. For example, if factory-default settings are assigned, the reader response is

```
IDAP T0 D0 X0
```

indicating time, date, and auxiliary information not appended.

525 Display Communications Protocol Status

Command #525 displays the status of command #61N, command #614N, and command #612NN.

Refer to "525 Display Communications Protocol Status" on page 7–92, "610 Select Basic Communication Protocol (Factory Default)" on page 7–101, "614N Select Flow Control Option" on page 7–102, and "612NN Select Error Correcting Protocol Timeout" on page 7–102.

Reader response:

```
ECPS P<0 to 2> T<01 to FF> X<0 to 2> S0
```

where

P0	Basic protocol enabled (factory default)
P1	ECP enabled

P2	data inquiry protocol enabled
Txx	ECP timeout where xx = 01 to FE (hexadecimal) Timeout (ms) = 50 * xx
	If xx = FF timeout disabled
X0	Flow control disabled
X1	Software flow control enabled (factory default)
X2	Hardware flow control enabled
S0	start of message character is #

For example, if factory default settings are assigned, the reader message is:

```
ECPS P0 TFE X1 S0
```

which means basic protocol enabled, an ECP timeout of 254 (12,700 ms, 12.7 sec), software flow control enabled, and start of message character is #.

526 Display I/O Status

See "620N Set Output Control" on page 7–103, "621 Select Predefined Output Control (Factory Default)" on page 7–104, "67N Set Output Pulse Duration" on page 7–108.

Command `#526` displays the current input/output (I/O) status. The reader message indicates whether outputs are being controlled externally by the host through Command `#620N Output Control` or internally through Command `#621 Predefined Output Mode`. It also displays the current status of two outputs, two inputs, and the selected output pulse duration that is set by Command `#67N`.

Reader response:

```
C<0 to 1> O<0 to 3> I<0 to 3> D<0 to F>
```

C0	Host controls outputs
C1	Predefined output mode
O0	Both outputs off
O1	Output0 on
O2	Output1 on
O3	Both outputs on
I0	Both inputs false
I1	Input0 true
I2	Input1 true
I3	Both inputs true
D0	4 ms output pulse duration
D1	8 ms output pulse duration
D2	12 ms output pulse duration
D3	16 ms output pulse duration
D4	20 ms output pulse duration

D5	24 ms output pulse duration
D6	32 ms output pulse duration
D7	40 ms output pulse duration
D8	48 ms output pulse duration
D9	60 ms output pulse duration
DA	76 ms output pulse duration
DB	152 ms output pulse duration
DC	228 ms output pulse duration (factory default)
DD	300 ms output pulse duration
DE	376 ms output pulse duration
DF	752 ms output pulse duration

Note: *The first character of the output pulse duration value is alpha; the second character is numeric.*

Table 23 shows the output0 and output1 open/closed conditions for the output status displays.

Table 23 Open/Closed Conditions for Output Status

Output Status	Output0 Wire Pair		Output1 Wire Pair	
	Orange/ Black	Brown/Black	White/Black	Green/Black
O0	Closed	Open	Closed	Open
O1	Open	Closed	Closed	Open
O2	Closed	Open	Open	Closed
O3	Open	Closed	Open	Closed

Table 24 shows the output0 and output1 open/closed conditions for the output status displays for readers in IAG applications.

Table 24 Open/Closed Conditions for Output Status (IAG Applications)

Output Status	Output0 Wire Pair		Output1 Wire Pair	
	Orange Jumper to Black of Brown/Black	Brown/Black	White Jumper to Black of Green/Black	Green/Black
O0	Closed	Open	Closed	Open
O1	Open	Closed	Closed	Open
O2	Closed	Open	Open	Closed
O3	Open	Closed	Open	Closed

Table 25 shows the input0 and input1 open/closed conditions for the input status displays.

Table 25 Open/Closed Conditions for Input Status

Input Status	Input0 Wire Pair	Input1 Wire Pair
	Green/Red	Blue/Black
I0	Open	Open
I1	Closed	Open
I2	Open	Closed
I3	Closed	Closed

527 Display RF Status

Command `#527` displays the current status of the RF module. The reader response indicates whether RF is controlled externally by the host, set by command `#640N RF Control`, or internally by input set by command `#641`. Command `#527` also displays the current RF status and the uniqueness timeout.

Note: *If you enter RF frequency settings using command* **`#642NN`***, the display command for RF output frequency, F is "Fxx" and indicates use of the backward-compatible frequency entry method.*

Reader message:

RFST C<0 to 1> O<0 to 1> T<1 to 3> Fxxx Rxx Gxx Axx Ixx

where

C0	RF controlled by host (`#6400, #6401`)
C1	**RF controlled by presence sensor on input0, the red/green pair (factory default) (`#641`)**
O0	RF off (`#6400`)
O1	RF on (`#6401`)
T1	Uniqueness timeout of two minutes (`#441`)
T2	Uniqueness timeout of 15 seconds (`#442`)
T3	Uniqueness timeout of 30 seconds (`#443`)
Fxxx	Fixed
Rxx	Tag decoder range (distance) for ATA tags, xx = 00 to 1F hexadecimal range value (`#643NN`, 1F = Max RNG))
Gxx	Tag decoder range (distance) for eGo and eGo Plus tags, xx = 00 to 1F hexadecimal range value (`#645NN`, 1F = Max RNG)
Axx	RF power attenuation, where 09 is maximum output power and 0F is minimum output power (6dB less than maximum power) (`#644NN`).
Ixx	IAG RF power attenuation, where 09 is maximum output power and 0F is minimum output power (6 dB less than maximum power) (`#646NN`)

For example, if factory default settings are assigned, the reader message is

```
RFST C1 O0 T1 Fxx R1F G1F A00 I09
```

which means that RF is enabled by presence sensor on input0, RF signal off, uniqueness timeout of two minutes, maximum range for ATA tags, maximum range for eGo and eGo Plus tags, full RF power, and IAG power set at 4 dB attenuation.

529 Display Presence Input Status

Command `#529` displays the parameters associated with presence detection and RF control. The reader's message indicates if presence without tag reports are enabled/ disabled (`#690N Select Presence without Tag Report` Option), if input inversion is enabled/disabled (`#694N Select Input Inversion` Option), and the minimum presence true period (always true). The reader's message also reports the selected RF timeout (`#693N Select RF Timeout Period`) and the selected means of RF-off control (`#692N` Select RF Control Algorithm). If presence without tag reports is enabled (`#6901 Enable Presence without Tag Reports`), the reader transmits a report if a presence is detected without the subsequent acquisition of a valid tag.

Note: *RF timeout values vary depending on the operative tag read mode and the type of tag in the read field. All times are approximate.*

Reader message:

```
PRST P<0 to 1> D0 A<0 to 2> T<0 to F> I<0 to 1>
```

where

P0	**Presence without tag reports disabled (factory default) (#6900)**
P1	Presence without tag reports enabled `(#6901)`
D0	Minimum presence true period of 0 ms (fixed)
A0 `(#692N)`	RF off on timeout only `(#6920)`
A1 `(#692N)`	RF off on timeout or tag `(#6921)`
A2 `(#692N)`	**RF off on timeout or presence condition false (factory default) `(#6922)`**
T0 N=0	RF timeout of 0 ms (always expired) (`#693N`)
T1	4 ms (`#6931`)
T2	8 ms (`#6932`)
T3	12 ms (`#6933`)
T4	20 ms (`#6934`)
T5	24 ms (`#6935`)
T6	32 ms (`#6936`)
T7	48 ms (`#6937`)
T8	60 ms (`#6938`)
T9	92 ms (`#6939`)
TA	152 ms (`#693A`)
TB	300 ms (`#693B`)

TC	452 ms (#693C)
TD	600 ms (#693D)
TE	752 ms (#693E)
TF	**RF timeout infinite, never expires (factory default) (#693F)**
I0	**input inversion disabled (factory default) (#6940)**
I1	input inversion enabled (#6941)

For example, if factory default settings are assigned, the reader message is

```
PRST P0 D0 A2 TF I0
```

which means that presence without tag reports is disabled, minimum presence true period is 0, RF off control on timeout or presence false, infinite RF timeout, and input inversion disabled.

530 Display RF0 Filter Status

Command #530 displays the parameter set for the RF input, including the selected unique ID code criteria (#410N Select Unique ID Code Criteria) and the valid ID code criteria (see "420N Select Valid ID Code Criteria" on page 7–83).

Reader message:

```
RF0S U<0 to 4> V<0 to 3>
```

where

U0	**One ID separation (factory default) (#4100)**
U1	Two ID separations (#4101)
U2	Three ID separations (#4102)
U3	Four ID separations (#4103)
U4	Transmit all ID Codes (#40)
V0	Valid ID code criteria of one acquisition (#4200)
V1	Valid ID code criteria of two acquisitions (#4201)
V2	Valid ID code criteria of three acquisitions (#4202)
V3	Valid ID code criteria of four acquisitions (#4203)

For example, if factory default settings are assigned, the reader message is

```
RF0S U0 V0
```

which means separation of one ID for uniqueness filtering and a valid ID code criteria of one acquisition.

532 Display Wiegand Mode Status

See "450 Disable Wiegand Mode (Factory Default)" on page 7–84 and "451 Enable Wiegand Mode" on page 7–84.

Command #532 displays the Wiegand mode status as either enabled or disabled. Reader message:

```
TOF <0 to 1>
```

where

0	Wiegand mode disabled (#450)
1	Wiegand mode enabled (#451)

533 Display Wiegand Retransmit Interval

Command #533 displays the Wiegand retransmit interval. This interval specifies the delay in seconds before the reader retransmits Wiegand data for a tag still in the read zone. The factory default is 1 second.

Reader message:

```
WTI <01 to FF>
```

where

01 to FF = seconds (1–255) in hexadecimal.

Note: *The actual value of the Wiegand retransmit interval may vary depending on the operative tag read mode and the type of tag in the read field.*
For example, 10 *= 16 seconds and* FF *= 255 seconds. The retransmit interval in ATA tag read mode is about twice these values.*

534 Display Tag Translation Mode Status

Command #534 displays tag translation mode status, enabled or disabled. If tag translation mode is enabled, incoming full-frame tags in AAR or ATA format are translated according to ISO standards. Refer to "452 Disable Tag Translation Mode (Factory Default)" on page 7–85 and "453 Enable Tag Translation Mode" on page 7–85 for more information.

Reader message:

```
TT <0 to 1>
```

where

0	tag translation mode disabled
1	tag translation mode enabled

537 Display Echo Status

Command #537 displays echo mode status. In basic protocol (#610 Select Basic Protocol), the reader may be configured to enable (#6171 Enable Echo Mode) or disable (#6170 Disable Echo Mode) the echo of received commands. Refer to sections "6170 Disable Echo Mode" on page 7–103 and "6171 Enable Echo Mode (Factory Default)" on page 7–103 for more information.

Reader message:

```
ECHO <0 to 1>
```

where

0	Echo status disabled
1	**Echo status enabled (factory default)**

540 Display Flash Checksum

Command #540 displays the flash memory checksum.

Reader message:

```
PCKS I0000 Exxxx
```

where

0000	Not applicable to the Encompass 4H Reader
xxxx	Represents the four-byte ASCII representation of the flash memory checksum

543 Display Boot Checksum

Command #543 displays the boot ROM checksum.

Reader message:

```
BCKS xxxx
```

where

xxxx represents the four-byte ASCII representation of the boot ROM checksum.

549 Display User-Programmable Group Select Equals (GSE) Filter Data

See "697 Set User-Programmable Group Select Equals (GSE) Filter" on page 7–113.

Command #549 queries the reader for the user-programmable GSE filter data programmed in the reader using command #697. The response data is formatted similar to the data in the configuration command.

For example, if the command string shown in command #697 (see "697 Set User-Programmable Group Select Equals (GSE) Filter" on page 7–113) was sent to a given reader, the response to the #549 query command would be:

```
#A4 0A 0005014202024133
```

The reader response contains all the data fields repeated in the same sequence as displayed in the User-Programmable GSE configuration command.

560 Request Sensor Status Change

Command #560 displays the sensor status change reporting. Status change reporting may be disabled by command #82N Select Input Status Change Report Option.

Reader message:

```
SSTC E<0 to 1>M<0 to 3>
```

where

E0	Input status change reports disabled (factory default)
E1	Input status change reports enabled
M0	Reporting disabled (factory default)
M1	Changes on input0 reported

M2	Changes on input1 reported
M3	Changes on either input reported

For example, if factory default settings are assigned, the reader message is

```
SSTC E0 M0
```

which means that input status change reports are disabled on both input0 and input1.

570 Display Tag Protocols

Command `#570` displays the currently selected tag protocol. Reader response:

```
ATA:<E, D> eGo:<I, F, D> SeGo:<I, F, D> IAG:<E, D> Sort:<E, D> TMM0
```

where

D	Disabled
E	Enabled
I	ID (64 bits) eGo or Sego Tag ID only, no ATA data
F	Full transaction (ATA emulation with either eGo or SeGo protocols)
TMM0	Fixed

Table 26 Display Operating Status Mode

	Disable	Enable
ATA	#480	#481
eGo	#482	#483
SeGo	#484	#485
IAG	#486	#487
eATA	#488	#489
Multi-tag Sort	#454	#455

577 Report Buffered Handshakes

Command `#577` reports the buffered handshakes.

Reader message:

```
XX
```

where

`XX` is number of handshakes

582 Display Synchronization Values

Command `#582` displays the synchronization values, which are typically used to alleviate interference issues in dense populations of Interagency Group (IAG) readers. The values are set with commands `#648NN` and `#649NN`.

Reader Response:

```
SYNC T<00 to FF> H<00 to 0A>
```

Where

T	the number of milliseconds (ms) before the reader sends a synchronization pulse to all other readers on the RS–485 bus
H	the number of milliseconds that the reader holds off starting IAG tag protocol once it receives the synchronization pulse.

Command Group 6 – Reader Control Functions

Group 6 commands set reader control functions such as reader ID, communication protocol, output pulse, and RF control.

60NN Set Reader ID Number

Command `#60NN` sets the reader ID that will be sent in the auxiliary data field (command `#311`). Uppercase or lowercase characters are allowed for `NN`; for example, hex digits A though F or a through f

where

`NN` = `00` to `FF` (hex for 0 to 255, **factory default = 00).**

Reader response:

```
Done
```

610 Select Basic Communication Protocol (Factory Default)

See “525 Display Communications Protocol Status” on page 7–92.

Command `#610` enables the basic communications protocol. Refer to “Basic Protocol” on page 6–61 for more information.

Reader response:

```
Done
```

611 Select Error Correcting Protocol

See “525 Display Communications Protocol Status” on page 7–92.

Command `#611` enables the error correcting protocol. Refer to “Basic Protocol” on page 6–61 for more information.

Reader response:

```
Done
```

Caution

Do not switch to ECP (command #611 Select Error Correcting Protocol) unless the host is prepared to acknowledge each reader transmission.

612NN Select Error Correcting Protocol Timeout

See "525 Display Communications Protocol Status" on page 7–92, "610 Select Basic Communication Protocol (Factory Default)" on page 7–101, and "611 Select Error Correcting Protocol" on page 7–101.

Command `#612NN` selects the timeout interval for ECP. This timeout applies to the transmission of tag, report, and error messages and to the receipt of host commands. The transmit timeout is initiated immediately after the end-of-message sequence CR/LF is transmitted. If the host does not acknowledge the message within the specified interval, the reader times out and retransmits the message.

The receive timeout is initiated upon receipt of the start-of-message character (#). If the end-of-message character (CR) is not received within the specified interval, the reader discards the partially received message and resets its receiver.

Uppercase or lowercase characters are allowed for NN; for example, hex digits A through F or a through f.

The value for `NN` specifies the timeout interval as follows:

ms	50 * NN for NN = 01 to FE (1–254)
FE	**Factory default (12,700 ms, 12.7 seconds)**
FF	Disables the ECP timeout

Reader response:

```
Done
```

Enter **CTRL_E** to get data.

Caution

Ensure that the ECP timeout is sufficient for a given baud rate. See "Timing and Synchronization" on page 6–67**.**

613 Enable Data Inquiry Protocol

Command `#613` enables the data inquiry protocol. Refer to "456 Enable eGo Plus Tag Initialization During Multi-tag Sort (Factory Default)" on page 7–86, "Command Group 6 – Reader Control Functions" on page 7–101 for more information.

In order to receive data from the reader, it is necessary to send the "Ctrl e" character (hexadecimal 5).

Reader response:

```
Done
```

614N Select Flow Control Option

Command `#614N` selects the flow control option for reader-to-host communications. The factory default setting is software flow control (XON/XOFF) enabled. In download mode, flow control is not host-selectable; it is fixed at the default setting. However, during data mode and command mode operation, the following flow control options are available. The `N` variable specifies flow control as shown in Table 27.

Table 27 Flow Control Commands

Command	Flow Control Option
6140	Disable flow control
6141	**Enable software flow control (factory default)**
6142	Enable hardware flow control

Reader response:

```
Done
```

If the reader is configured for software flow control (XON/XOFF), it stops transmitting if it receives an XOFF character (host software command 13H). It does not resume transmitting until it receives an XON character (host software command 11H). If the reader is configured for hardware flow control (RTS/CTS, request to send/clear to send), it stops transmission if it detects that the CTS line is no longer asserted. It resumes transmission when this line is asserted again.

Note: *TransCore recommends that XON/XOFF flow control be disabled while using the ECP.*

6170 Disable Echo Mode

Command `#6170` disables the reader's echo of received host commands. If operating in basic protocol or data inquiry protocol, the reader echoes by default. As the reader receives a host command, it echoes each character of the command. Once the entire command has been received and processed, the reader transmits its response. If echoing is disabled with command `#6170`, the reader does not echo the command, but only transmits its response. The reader never echoes while in ECP or download mode operation.

Reader response:

```
Done
```

6171 Enable Echo Mode (Factory Default)

Command `#6171` enables the reader to echo received host commands. Command `#6170` disables echo mode.

Reader response:

```
Done
```

620N Set Output Control

See "526 Display I/O Status" on page 7–93 and "621 Select Predefined Output Control (Factory Default)" on page 7–104.

Command `#620N` provides direct control of two output lines that may be used to operate external hardware, such as gates or traffic lights. The value for `N` specifies the output status requested as shown in Table 28. Receipt of any `#620N` command automatically disables command `#621` Predefined Output Control.

Table 28 Output Control Commands

Command	Output Control Option
6200	**Turn off both output ports (factory default)**
6201	Turn off output1, Turn on output0
6202	Turn off output0, Turn on output1
6203	Turn on both output ports

Reader response:

```
Done
```

621 Select Predefined Output Control (Factory Default)

See "410N Select Unique ID Code Criteria (Anti-passback Feature)" on page 7–82.

Command `#621` configures the reader for predefined output mode. In this mode, both output lines – output0 and output1 – are automatically asserted upon receipt of a valid unique tag ID. The output line remains asserted for the time specified by output pulse duration (`#67N Set Output Pulse Duration`). Any direct control command (`#620N Output Control`) automatically disables the predefined output mode.

Note: *In Wiegand mode operation, the sense outputs are not controlled by a predefined output mode.*

Reader response:

```
Done
```

63 Reset Reader

See "526 Display I/O Status" on page 7–93, "620N Set Output Control" on page 7–103, and "67N Set Output Pulse Duration" on page 7–108.

Command `#63` resets the power fail bit, clears all buffers, resets tag uniqueness, turns off both output lines, transmits the sign-on message, and returns to the data mode.

Note: *This command does not reset any other configuration parameters.*

Reader response:

```
Model E4 Series Ver X.XX SNSSSSSS
Copyright 2008 TransCore
```

where

X.XX	Version number
SSSSSS	Serial number of the unit, skipping the first and fourth character printed on the reader product label.

640N RF Control

Command `#640N` directly controls the RF module. The `N` value controls the RF power as shown in Table 29.

Table 29 RF Control Commands

Command	RF State
6400	Turns off RF
6401	Turns on RF

Command `#6400` disables RF-by-input control command `#641 Select RF-by-Input Control`.

Reader response:

```
Done
```

641 Select RF-by-Input Control (Factory Default)

Command `#641` configures the reader for RF-by-input control. The reader automatically turns on RF when it detects a presence through sense0. The reader turns off RF according to the selected RF control algorithm (`#692N Select RF Control Algorithm`).

Reader response:

```
Done
```

Reader response:

```
Done
```

643NN Select ATA Operating Range (Distance)

Command `#643NN` selects the read range for ATA tags where `NN` is a hexadecimal value from 00 to 1F; the range increases with increasing `NN` value. The range can be adjusted for 32 discrete values where 00 is the shortest range and 1F is the longest range. **The default range value is 1F**.

Reader response:

```
Done
```

644NN Set RF Attenuation

Command `#644NN` sets the attenuation control for the output RF power where NN is a hexadecimal value from 09 to 0F. Settings for attenuation are 1.0 dB increments over a range of 6dB of attenuation from the maximum power setting of 24 dBm at 0 dB attenuation to a minimum power level of 18 dBm.

The Set RF Attenuation command NN variables and corresponding attenuation settings are shown in Table 30.

Table 30 RF Attenuation Command Variables

Variable (NN)	Attenuation Setting (dB)
09	0
0A	1
0B	2
0C	3
0D	4
0E	5
0F	6

Reader response:

```
Done
```

645NN Set eGo and eGo Plus Operating Range (Distance)

Command `#645NN` sets the read range for eGo and eGo Plus Tags where `NN` is a hexadecimal value from 00 to 1F; the range increases with increasing `NN` value. The range can be adjusted for 32 discrete values where 00 is the shortest range and 1F is the longest range. **The default range value is 1F.**

Reader response:

```
Done
```

646NN Set IAG RF Attenuation

Command `#646NN` sets the IAG attenuation control for the output RF power where NN is a hexidecimal value from 09 to 0F. Setting 09 (0 dB) is the maximum power setting and 0F (6 dB) is the minimum power setting. **The default attenuation value is 09.**

648NN Set Synchronization Output Delay Time

Command `#648NN` sets the time in milliseconds by which the reader is delayed before sending a synchronization pulse on the RS–485 synchronization bus to all other readers connected on the bus. Entering a value of **#64800 (factory default)** disables this feature. Entering `#64801` through `#648FF` sets the reader countdown time from 1 to 255 milliseconds. If the reader gets a pulse from another reader before its own time period expires, it first executes all of the enabled tag protocols, then restarts its countdown timer. The reader on the bus with the smallest entered value becomes the master and all readers with a larger entered number become slaves. Any reader on the bus can become the master. The master does not necessarily have to be on one of the ends of the synchronization bus, but the installer must exercise caution to ensure that every reader on the bus has a different value.

When the master sends out the synchronization pulse all of the connected readers begin the RF tag protocol transactions that have been enabled. This synchronization feature primarily is designed to

overcome some of the system-design RF interference issues in reading IAG tags at locations having a dense population of readers and tags. All readers on the bus require the same enabled tag protocols for synchronization to work. Entering increasing values to all readers on the bus is required so that should a break occur in the bus that is connecting all the readers, the next reader will take over as master for the rest of the readers that are connected, and the system may work reasonably well until the cabling is fixed. Do not set the synchronization times too short, as IAG tags are battery powered and their useful life can be diminished if the typical traffic flow is slow moving, and the tag is activated continuously in the reader pattern. Command `#582` displays the synchronization output time.

The synchronization bus is wired by connecting all of the readers' "V" (RS–485 synchronization minus) pins together and all of the readers' "Z" (RS–485 synchronization plus) pins together.

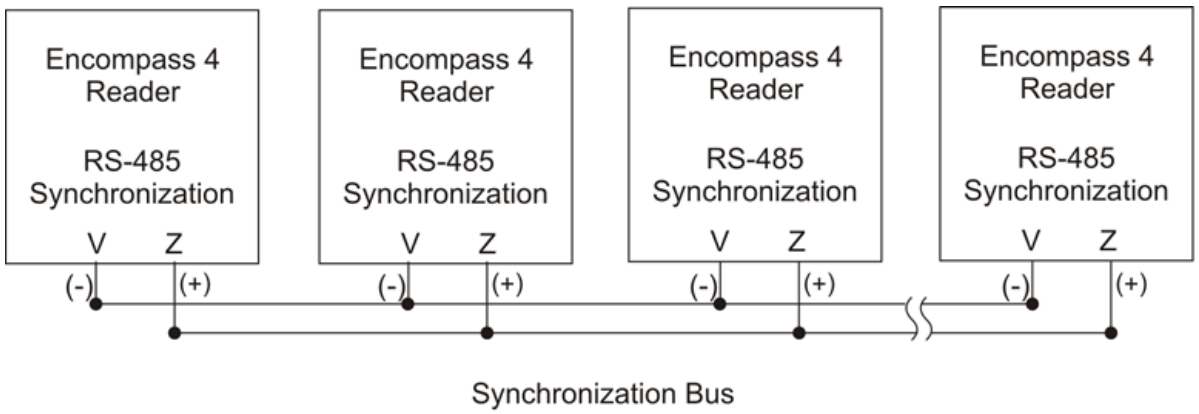

Figure 43 Synchronization Bus Wiring

649NN Set Synchronization Hold-Off Time

Command `#649NN` sets the time in milliseconds that the reader will hold off after getting (or sending if it is the master on the bus) the synchronization pulse before it starts to run its IAG tag sequence. This command is used in close combination with command `#648NN.` Command `#649NN` is applicable only if a value other than `#64800` is entered for `#648NN` and is used only when the IAG tag protocol is enabled. Entering a value of **`#64900` (factory default)** disables this feature. Entering a value between `#64901` and `#6490A` (hex value of 10 decimal) causes the reader to hold off starting its tag protocol transaction for the time set between 1 and 10 milliseconds. This feature is used to lessen the possibility of a reader reading an IAG tag that is activated by another reader in the site. Because IAG tags are battery powered active transmitters, their read zones can be much harder to control than for beam-powered passive tags. The pattern also will vary greatly among tags depending on the condition of the individual tag battery. If this feature is used, each reader on the bus needs a value of between `#64901` and `#6490A` entered for the feature to work. As with the `#648NN` command, the reader's physical location on the bus is not critical, but TransCore recommends that the reader numbering follow a logical sequence. Using this command, more than 1 reader on the bus can have the same value, but TransCore recommends using all 10 slots before reusing them. Command `#582` displays the Synchronization Hold Off Time.

Table 31 lists an example of a plaza having five Encompass 4H Readers in lanes where multiple readers identifying the same tag would present a system problem. All of the readers are cabled together on a synchronization bus (Figure 43). The example timing for #648NN is appropriate assuming IAG is the only protocol enabled in all readers. The RF for all readers is set to 915.75 (#6470DF) and in this example it is determined that an IAG attenuation setting of 9 dB (#64609) prevents a reader from activating a tag in an adjacent lane.

Table 31 Example of Encompass 4H Reader Plaza Synchronization Bus Settings

Reader Lane	Set Synchronization Output Delay Time (#648NN)	Set Synchronization Hold-Off Time (#649NN)
1[a]	#64814 = 20 ms synchronization time	#64901 = 1 ms hold off
2	#64816 = 22 ms synchronization time	#64902 = 2 ms hold off
3	#64818 = 24 ms synchronization time	#64903 = 3 ms hold off
4	#6481A = 26 ms synchronization time	#64904 = 4 ms hold off
5	#6481C = 28 ms synchronization time	#64905 = 5 ms hold off

a *Reader 1 becomes the bus synchronization master.*

65 Reset Power Fail Bit

Command #65 resets the power fail bit to 0. The bit changes from 0 to 1 when power is restored to the reader. Upon reader power-up, the host transmits either command

#65 or #63 Reset Reader to properly initialize this bit. The current state of the power fail bit may be displayed. Refer to "520 Display Power Fail Bit" on page 7–91 for more information.

Reader response:

Done

66F Load Default Operating Parameters

Command #66F loads all the factory default operating parameters except RF operating frequency. Refer to "Command Group 6 – Reader Control Functions" on page 7–101, "456 Enable eGo Plus Tag Initialization During Multi-tag Sort (Factory Default)" on page 7–86 for a listing of the defaults.

Reader response:

Done All parameters loaded OK

Error A parameter load failed

67N Set Output Pulse Duration

See "526 Display I/O Status" on page 7–93, "620N Set Output Control" on page 7–103, and "621 Select Predefined Output Control (Factory Default)" on page 7–104.

Command #67N sets the output pulse duration for the command #621 Predefined Output Control. This command specifies the length of time that output line(s) will be asserted upon receipt of

a valid and unique tag ID. The factory default setting is 228 ms. The variable N specifies an output pulse duration of 48 ms to 752 ms.

Uppercase or lowercase characters are allowed for N; for example, hex digits A through F or a through f. The command numbers and corresponding output pulse durations are shown in Table 32.

Table 32 Output Pulse Duration Commands

Command	Duration (ms)
670	4
671	8
672	12
673	16
674	20
675	24
676	32
677	40
678	48
679	60
67A	76
67B	152
67C	**228 (factory default)**
67D	300
67E	376
67F	752

Additional IDs may be acquired during the selected output pulse duration; however, the timing restarts upon each successive ID acquisition. This command should be used with discretion. For example, when the tag acquisition interval is short compared to the selected pulse duration, distinct pulses may not be generated.

Reader response:

```
Done or Error
```

690N Select Presence Without Tag Report Option

Command `#690N` enables or disables the presence without tag report option. If the presence without tag reporting option is enabled using command `#6901`, input reports are transmitted when a tag presence is detected without the subsequent acquisition of a valid tag. The value for N specifies the reports as shown in Table 33.

Table 33 Presence Without Tag Report Commands

Command	Report Option
6900	**Disable presence without tag reports (factory default)**
6901	Enable presence without tag reports

Reader response:

```
Done
```

Refer to "410N Select Unique ID Code Criteria (Anti-passback Feature)" on page 7–82 for message format information.

692N Select RF Control Algorithm

Command `#692N` selects the algorithm for turning off RF power when RF-by-input control is enabled using command `#641` Select RF-by-Input Control.

The values for `N` specify the RF control algorithms as shown in Table 34.

Table 34 RF Control Algorithm Commands

Command	RF Power Off
6920	On timeout only (`#529A0`)
6921	Timeout or tag ID acquired (`#529A1`)
6922	**Timeout or presence false (#529A2, factory default)**

Command `#6920` turns off RF power based on the timeout established by command `#693N` Set RF Timeout Period.

Command `#6921` allows RF power to be turned off either after the timeout period or upon acquisition of a valid tag ID, whichever occurs first. The reader turns off the RF immediately following the acquisition of a valid tag, whether or not it is unique. This control algorithm may be used in Wiegand mode to ensure that the tag data is transmitted one and only once per presence on both serial and Wiegand ports.

Command `#6922` turns off RF power either after the timeout period or upon the presence false condition, whichever occurs first.

Reader response:

```
Done
```

693N Select RF Timeout Period

Command `#693N` selects the RF timeout period used by command `#692N` Select RF Control Algorithm. Values for `N` range from 0 through F.

Command `#693F` disables the RF timeout.

Uppercase or lowercase characters are allowed for `N`; for example, hex digits A through F or a through f. The commands and corresponding timeouts are shown in Table 35.

Table 35 Timeout Period Values

Command	Timeout (ms)
6930	0 (always expired)
6931	4
6932	8
6933	12
6934	20
6935	24
6936	32
6937	48
6938	60
6939	92
693A	152
693B	300
693C	452
693D	600
693E	752
693F	**Infinite (never expires, factory default)**

Reader response:

`Done or Error`

The reader returns an `Error` message if a valid hexadecimal digit is not substituted for `N` in command `#693N`.

694N Select Input Inversion Option

Command `#694N` enables or disables input inversion. When inversion is enabled, an open circuit input is interpreted as a closed circuit, and a closed circuit input is interpreted as an open circuit. This feature allows greater flexibility in the attachment of external equipment to the reader inputs. For example, some proximity sensors indicate presence with an open circuit. In this instance, command `#6941` can enable input inversion so that an open circuit input indicates a presence. The values for `N` represent the two inversion options as shown in Table 36.

Table 36 Input Inversion Options

Command	Option
6940	**Disable input inversion (factory default)**
6941	Enable input inversion

Reader response:

```
Done
```

695S...S Set Serial Number

See “505 Display Software Version” on page 7–90.

Command `#695` assigns the reader serial number according to the format:

```
695SSSSSS
```

where

`SSSSSS` is the serial number.

The serial number may contain as many as six uppercase or lowercase ASCII alphanumeric characters.

Note: *The factory-assigned serial number of the reader contains seven characters. However, to maintain backward compatibility, the reader software allows only six characters to be entered. When setting the serial number, skip the fourth (middle) character of the seven-character number shown on the reader product label.*

Note: *Once assigned, the serial number is preserved during power-down and the loading of default parameters.*

Reader response:

```
Done
```

696S...S Store Hardware Configuration String

See “506 Display Hardware Configuration Information” on page 7–90.

Command `#696S...S` stores hardware configuration information into reader memory.

The hardware configuration string is assigned according to the following format:

```
696S...S
```

where

`S...S`	the hardware configuration string that may contain as many as 20 uppercase or lowercase ASCII alphanumeric characters.

Note: *Once assigned, configuration information is preserved during power-down and the loading of default parameters.*

Reader response:

```
Done
```

697 Set User-Programmable Group Select Equals (GSE) Filter

Refer to "549 Display User-Programmable Group Select Equals (GSE) Filter Data" on page 7–99.
Command #697 assigns the user-programmable GSE filter.

The command string is assigned according to the following format:

`#697 MM AA DDDDDDDDDDDDDDDD`

Where

MM = The tag uses this mask to determine which of the eight Comparison Data bytes are to be compared for the Group Select filter (1-byte field, 2 characters).

For example:

`#697 **30** 00 000063B400000000`

MM = 30: `00**11** 0000`

In this example, the mask indicates to the tag to compare data in position 02 and 03 after address 00.

AA = This field is used by the tag to determine the start address in the tag memory for the comparison data (1-byte field, 2 characters).

`#697 30 **00** 000063B400000000`

For example, using the SeGo ID `E02263B4002C9232`:

```
E0  22  63  B4  00  2C  92  32 – SeGo ID
00  01  02  03  04  05  06  07 – Byte locations/addresses starting at 0
```

DD...DD: Comparison Data: an 8-byte field (16 characters) used by the tag as the comparison data for the Group Select Equals filter. The tag compares the data in this field to data in tag memory beginning at the Start Address to determine if the tag will respond to a reader Group Select request. Only the bytes having the corresponding bit set in the Mask is used for this comparison.

For example, consider two tags with the following SeGo ID:

SeGo ID: `E022**63B4**002C9232`

SeGo ID: `E022**63B4**002D8132`

These two SeGo IDs have the same information in bytes **02** and **03 (63B4),** so both of these tags will respond to the reader.

The Group Select Equals filter written as follows will cause only tags with 63B4 in bytes 02 and 03 to respond.

`#697 30 00 0000**63B4**00000000`

The 2-character Address indicates where the Group Select filter starts. Anywhere there is a 1 in the binary representation of the 2-character hexadecimal Mask, the tag will compare the values for those bytes. If the corresponding characters in the Data matches the data in the tag for those locations, the tag will respond. If not, the tag will not respond, and thus, will not be read or reported by the reader.

Reader response:

```
Done
```

Command Group 8 – Auxiliary Reader Control

Group 8 commands provide control of reader functions, such as the sense input lines.

82N Select Input Status Change Report Option

Command `#82N` selects the input lines to be monitored to report any change in input status. The enabled input lines are monitored for any changes in the logic states. If a change is detected, the reader generates an input status change message and treats it as a tag ID. If the auxiliary information option is enabled, the input status field displays the current input values. The value for `N` specifies the report options as shown in Table 37.

Table 37 Input Status Change Report Options

Command	Report Option
820	**Disable status change reports (factory default)**
821	Report change on input0
822	Report change on input1
823	Report changes on input0 and input1

Reader response:

```
Done
```

830 Disable Automatic Periodic RF Status Report (Factory Default)

Command **#830 is a default** set in the factory to disable the automatic periodic RF status report.

Reader response:

```
Done
```

831 Enable Automatic Periodic RF Status Report

Command `#831` enables the automatic periodic RF status report. This function sends out a periodic RF status report if no other message (a tag read) is sent from the reader for a period of time. This message is the same message that would be sent in response to the `#527 Display RF Status` command. Enabling this function is helpful in some sites where there may not be much tag activity, and the user wants an automatic way to ensure the communication channel with the reader is still intact. With this function enabled, the host system will get a message from the reader at least every three minutes.

eader response:

```
Done
```

Chapter 8 Configuring the Encompass 4H Reader

This chapter provides instructions for configuring the Encompass® 4HReader, including factory configuration parameter defaults and instructions for using terminal emulation software to check and change the Encompass 4H Reader factory configuration defaults.

Configuring the Reader

After installing the Encompass 4H Reader, you need to configure its operating parameters. Terminal settings should be initially set at 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.

General Configuration Labeling

Each Encompass 4H Reader and its shipping carton are labeled to indicate the unit's general configuration. Table 38 contains explanations of the Encompass 4H Reader label fields.

Table 38 Encompass 4H Reader Configuration Label Fields

Field	Description
1st	TransCore reader designator
2nd	Model number 40 = 915 MHz frequency band
3rd	Interface xy where x = 0 (integrated antenna); x = 1 (external antenna) y = 2 (RS–232 and Wiegand); y = 4 (RS–422 and Wiegand)
4th	0nn where nn = tag protocol(s). Protocol designators are as follows: 001 = Super eGo® (SeGo) protocol 002 = ATA/SeGo protocols 003 = eGo/SeGo protocols 004 = SeGo/Inter-Agency Group (IAG) protocols 008 = ATA protocol 009 = eGo/ATA protocols 010 = ATA/IAG protocols 019 = IAG protocol

As an example, a label reading 10-4002-004 indicates that this 915-MHz Encompass 4H Reader is configured with an integrated antenna, RS–232 and Wiegand communications, and reads SeGo and IAG protocol tags.

Default Operating Parameter Settings

Table 39 contains the factory default configuration settings for the Encompass 4H Reader operating parameters. The default configuration settings may not be the correct operating configuration settings for a specific site. Changes to the configuration settings may have to be made, depending on the site plan, as described in "Chapter 2 Developing the Site Plan" on page 2–3.

Review the default configurations shown in Table 39 to determine which parameters, in addition to operating frequency and operating range, need to be adjusted. Refer to "Chapter 7 Commands" on page 7–74 for a complete list of parameters and the corresponding commands.

Note: *The dual-protocol Encompass 4H Reader internal timing varies depending on the operative tag read mode and the type of tag in the read field.*

Table 39 Encompass 4H Reader Default Configuration Settings

Parameter	Setting	Command
Operating mode	Data	00
Baud rate	9600	1005
Stop bits	1	1010
Parity	None	1020
Time and date appended	Enabled	302
Auxiliary information appended	Disabled	310
Unique ID code criteria	Separation of 1 ID	4100
Wiegand mode	Disabled	450
Tag translation mode	Disabled	452
Multi-tag sort	Disabled	454
eGo and eGo Plus tag initialization during multi-tag sort	Enabled	456
Second alternative group select	Disabled	458
Wiegand transmit mode	1 second	4601
Third alternative group select	Disabled	490
Fourth alternative group select	Disabled	492
Fifth alternative group select	Disabled	494
Alternate group select	Disabled	496
Reader ID number	00	6000

Table 39 Encompass 4H Reader Default Configuration Settings

Parameter	Setting	Command
Communications protocol	Basic	610
Error correcting protocol (ECP) timeout	12.7 sec	612FE
Flow control	Software (XON/XOFF)	6141
Echo mode	Enabled	6171
Sense output control	Predefined	621
RF-by-input control	Enabled	641
ATA operating range	Maximum	6431F
RF attenuation	Full power	64409
eGo and eGo Plus Tag operating range	Maximum	6451F
Set Frequency[a]	915MHz	6470DC
Sense output pulse duration	228 ms	67C
Presence without tag reports	Disabled	6900
RF-off control	Timeout or no presence	6922
RF timeout	Never true	693F
Input inversion	Disabled	6940
Serial number	NNNNNN	695
Store hardware configuration	Hardware configuration not known	696
Input status change reports	Disabled	820
Automatic periodic RF status report	Disabled	830

Configuring Parameters with Terminal Emulation Software

To configure the Encompass 4H Reader using a PC and terminal emulation software to manually enter Encompass 4H Reader host commands, follow the instructions in the section “Connecting the Reader to the PC” on page 4-44. Then, enter the appropriate configuration commands through the terminal emulation software on your PC.

See “Chapter 7 Commands” on page 7–74 for a detailed description of all available configuration commands.

Starting the Terminal Emulation Software

You can use a PC and any terminal emulation software to enter the host commands to download flash software, configure reader operating parameters, perform diagnostics, and retrieve tag data. Most terminal emulation applications have a similar sequence for launching.

To start the terminal emulation software

1. At the command prompt, type your terminal emulation start command. The application displays the **Connection Description** dialog box.
2. Enter a name for the session and click **OK.** The application displays the **Phone Number** dialog box.
3. Choose the **Com 1** option (or whichever com port on the PC to which the RS-232 cable is attached) and click **OK**. The application displays the **COM1 Properties** dialog box.
4. In the pull-down lists on the **COM1 Properties** dialog box, choose the following values:
   - Bits per second: 9600 baud
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

Click **OK.**

The application displays the configparms.

Verifying Communications

You must verify that the Encompass 4H Reader and the PC or laptop are communicating.

To verify communications

1. Start the terminal emulation application as described previously in “Starting the Terminal Emulation Software” on page 8–118.

Note: *When testing the Encompass 4H Reader using a laptop, TransCore recommends that you configure laptop communication parameters to match those of the host computer to which the Encompass 4H Reader will be connected after testing and configuration are completed.*

2. Cycle the power on the Encompass 4H Reader.

Upon startup, the Encompass 4H Reader transmits a sign-on message or a boot ROM failure message.

The sign-on message appears as follows:

```
Model [software version] SNYYYYYY [Copyright notice]
```

where

`YYYYYY` is the serial number assigned to the Encompass 4H Reader skipping the fourth character printed on the reader product label.

Serial number `000000` is the default setting and is not a valid number. If this number appears in the sign-on message, the serial number has never been stored into reader memory. Contact TransCore Technical Support.

If the flash memory checksum is not verifiable, the sign-on message appears as follows:

```
Model [E4 BOOT] Ver 0.00 A
[Copyright notice]
```

If the failure message version number equals `0.00E` and no serial number exists, the flash memory checksum has failed, and the Encompass 4H Reader is operating out of boot ROM. In this case, the Encompass 4H Reader automatically enters download mode and waits for a new program to be loaded into the flash memory. Follow the instructions in "Program Download" on page 5–58.

Communications can also be verified by using the command sequence in Table 40.

Table 40 Command Sequence to Verify Communications

Entry	Encompass 4H Reader Response	Notes
#01 <CR>	#Done <CR/LF>	Switches the Encompass 4H Reader to command mode.
#505 <CR>	#Model E4H Series Ver X.XX SN97001P <CR/LF>	Reports the software version and serial number.
#00 <CR>	#Done <CR/LF>	Returns the Encompass 4H Reader to data mode.

3. If a successful sign-on message is not returned, check connections and communications factors and correct any errors.

To check connections and communications factors

1. Confirm that the Encompass 4H Reader has power.
2. Verify the connections between the PC and the Encompass 4H Reader.
3. Verify the receive (Rx) and transmit (Tx) connections.
4. If using handshaking, verify the RTS and CTS connections.
5. Verify the COM port settings for the Encompass 4H Reader using the instructions in "Serial Port Communications" on page 8–125.
6. Repeat the procedures in "Verifying Communications" on page 8–118.

If you still cannot verify the Encompass 4H Reader and PC communications, use the information in "Chapter 9 Troubleshooting and Maintenance" on page 9–130 to contact TransCore.

Verifying Tag Read Capability

After verifying communications between the Encompass 4H Reader and the PC, verify the capability to read tags.

Note: *The default tag read mode of the reader is the protocol(s) programmed into the reader.* Table 38 *shows how to determine which tag protocol(s) your Encompass 4H reader supports. Use only those test tags programmed with the correct protocol(s) for the reader.*

Caution

To avoid damage to the Encompass 4H Reader using an external antenna, you must connect the antenna before applying power to the reader.

To verify tag read capability

1. Once communications are verified as described in "Verifying Communications" on page 8-8, enter the following sequence of commands to turn on continuous RF:
   - `#01`
   - `#6401`
   - `#40`
   - `#00`
2. Pass one test tag in front of the unit. If the Encompass 4H Reader reads the tag, the terminal emulation application displays the tag information on the screen. If the tag ID is not displayed, perform the following actions:
   - Verify that the Encompass 4H Reader is in data mode (command `#00 Switch to Data Mode`).
   - Ensure that the tag you are using is compatible with the Encompass 4H Reader. The Encompass 4H Reader can read tag types that are compatible with the reader model.
   - An Encompass 4H Reader displays the tag read for any tag that is compatible with the reader programming. Table 38 shows how to determine which tag protocol(s) your Encompass 4H reader supports.
   - Using the audible circuit tester as described in "Testing Using an Audible Circuit Tester" on page 4-30, verify that the reader is capable of reading the tag in the read zone. If it is, the problem is probably in the communications between the Encompass 4H Reader and the host.
3. Pass a different reader-compatible test tag in front of your Encompass 4H Reader.
4. When the Encompass 4H Reader reads the second tag successfully, the terminal emulation application displays that tag's information in the main screen below the information for the first tag.

If the read is unsuccessful, perform the following actions:

- Ensure the tag you are using is compatible with the Encompass 4H Reader.
- Using the audible circuit tester as described in "Testing Using an Audible Circuit Tester" on page 4-30, verify that the reader is capable of reading the tag in the read zone. If it is, the problem is probably in the communications between the Encompass 4H Reader and the host computer.

Configuring Encompass 4H Parameters

Follow the procedures in this section to configure Encompass 4H parameters using a PC, laptop, or terminal emulator. The PC or laptop must be connected to and communicating with the Encompass 4H Reader, and the terminal emulation application must be configured correctly, as described in the section "Verifying Communications" on page 8–118.

Note: *If you are using Wiegand mode, you must connect the PC or laptop to the Encompass 4H Reader using the RS–232 or RS–422 interface before attempting to send commands to the reader. You can leave the Wiegand interface connected during this procedure.*

To configure parameters

1. Switch to command mode by typing `#01` at the prompt on the terminal emulation screen, and pressing **ENTER**.

Note: *All Encompass 4H Reader commands are preceded by the start-of-message character (#).*

2. To meet requirements of your site, make changes to default operating parameters as described in the following sections.

The following sections contain procedures to set some of the parameters that are commonly changed to meet the requirements of a specific site. Procedures are listed in alphabetical order by parameter.

Appended Tag Data

Use this procedure to set appended tag data parameters using the terminal emulation application. See "31N Append Auxiliary Information Selection" on page 7–80 for more information.

To set appended tag data parameters

1. Ensure that the host computer is in command mode.
2. Enter command `#311` to append auxiliary information or command `#310` to have no auxiliary information appended (factory default). Press **ENTER**.

ID Separation

The host can select a unique ID separation of one ID or two IDs. The reader default operation is for a unique ID separation of one ID and a uniqueness timeout of two minutes. You can disable the uniqueness check using command `#40 Transmit All ID Codes`. In this case, every tag ID received is transmitted without regard to uniqueness. You can reinstate uniqueness checking with commands `#4100` or `#4101` Select ID Separation.

Note: *The dual-protocol Encompass 4H Reader internal timing varies depending on the operative tag read mode and the type of tag in the read field.*

See section "610 Select Basic Communication Protocol (Factory Default)" on page 7–101 and section "410N Select Unique ID Code Criteria (Anti-passback Feature)" on page 7–82.

To set ID separation parameters

1. Ensure that the host computer is in command mode.
2. Enter command `#4100` to select a separation of one ID; enter command `#4101` to select a separation of two IDs. Press **ENTER**.

Reports

The Encompass 4H Reader can be configured to transmit presence without tag reports and input status change reports. A presence without tag report is transmitted in data mode only, *and only if the system has a presence detector*. This report is sent if a presence is detected without the detection of a valid tag ID. See sections "529 Display Presence Input Status" on page 7–96 and "690N Select Presence Without Tag Report Option" on page 7–109.

If configured with command `#82N Select Input Status Change Report Option` to transmit input status change reports, the reader will transmit a message to the host computer any time the inputs change state. Input status change reports are transmitted in data mode only. Input status change reporting is disabled by default. See sections "560 Request Sensor Status Change" on page 7–99 and "82N Select Input Status Change Report Option" on page 7–114. Also refer to "Chapter 6 Communications Protocols" on page 6–60 for information on message formats.

To set presence reporting

1. Ensure that the host computer is in command mode.
2. Enter command `#529` to display presence input status and press **ENTER**. P0 indicates presence without tag reports disabled (factory default), and P1 indicates presence without tag reports enabled.
3. Enter command `#6901` to enable presence without tag reports, or enter command `#6900` to disable presence without tag reports (factory default). Press **ENTER**.

To set input status change reporting

1. Ensure that the host computer is in command mode.
2. Enter command `#560` to display input status change report options and press **ENTER**.
   - E0 = input status change reports disabled (factory default)
   - E1 = input status change reports enabled
   - M0 = reporting disabled (factory default)
   - M1 = changes on input0 reported
   - M2 = changes on input1 reported
   - M3 = changes on either input reported

3. Enter command
   - `#821` to report any change on input0
   - `#822` to report any change on input 1
   - `#823`to report changes on input0 and input1
   - **#820** to disable status change reports (factory default)

Press **ENTER**.

Reset Reader

Command `#63 Reset Reader` resets uniqueness, clears the power fail bit, and transmits the sign-on message. The reader returns to data mode following the completion of this command.

Note: *This command does* ***not*** *reset any of the configuration parameters.* See "63 Reset Reader" on page 7–104.

To reset the reader

1. Ensure that the host computer is in command mode.
2. Enter command `#63`. Press **ENTER**.

The terminal emulation screen displays the sign-on message.

RF Transmission

The RF transmission can be controlled by one of the following methods:

- Connecting a vehicle detector to the sense input0 circuit
- The host sending software commands to the Encompass 4H Reader

As a factory default, the Encompass 4H Reader is configured to control the RF power with a vehicle detector.

Figure 44 illust

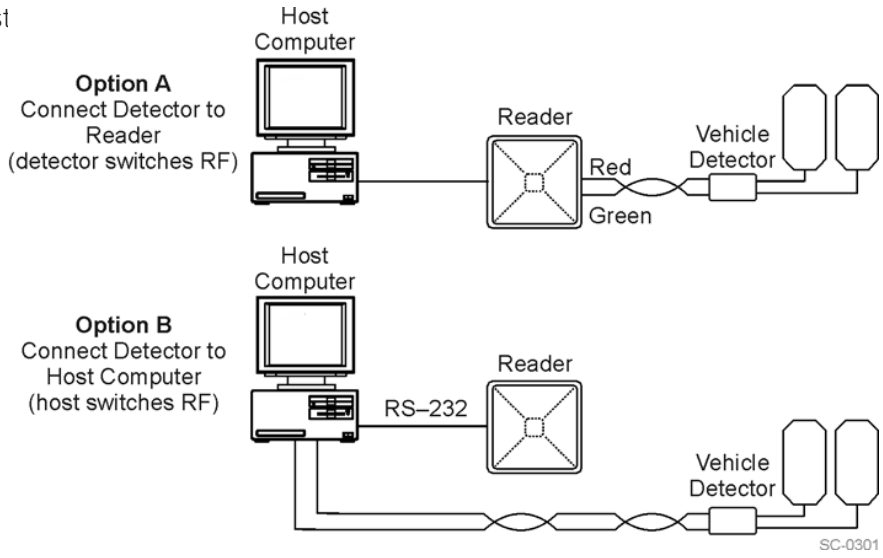

Figure 44 Encompass 4H Reader RF Control Options

Vehicle Detector Controlling RF Transmission

The vehicle detector can be a loop detector, an infrared sensor, or an ultrasonic detector that is connected to sense input0 to turn on the Encompass 4H Reader RF transmitter. In Figure 44, Option A shows a vehicle detector controlling the RF transmitter. This operation is preferred because the RF transmits only when a vehicle is in the Encompass 4H Reader read zone. Command `#641 Select RF-by-Input Control` (factory default) must be enabled.

To set the option of the vehicle detector controlling the Encompass 4H Reader

1. Ensure that the host computer is in command mode.
2. Enter command `#641`. Press **ENTER**.

Leave the setting on RF-by-input control for normal operation.

Host Controlling RF Transmission

In Figure 44, Option B shows the host controlling the RF transmitter.

If the vehicle detector is connected to the host computer, as shown in Option B, commands `#6400 RF Off` and `#6401 RF On` sent from the host computer turn on and off the Encompass 4H Reader RF transmitter.

Continuous RF Transmission

In Figure 44, Option C shows the test configuration controlling the RF transmitter. To test the Encompass 4H Reader, as described in "Testing the Encompass 4H Reader Using an Audible Circuit Tester" on page 4-5, you can turn on the Encompass 4H Reader RF transmitter continuously by issuing command #6401.

Sense Inputs

Both the RS–232 and RS–422 configurations used by the Encompass 4H Reader have two sense inputs — sense input0 and sense input1. The default configuration uses sense input0 as the presence detection device line. RF power is automatically turned on only when the presence detection device (loop detector or other device) detects a presence. Sense input1 is not used directly by the reader; it is used by the host computer to monitor an external device. The Encompass 4H Reader sense inputs are designed to connect to a dry contact closure.

You can configure the Encompass 4H Reader to generate input status change reports, which are transmitted like tag IDs. The host can then respond based on the true/false (closed/open) status of the sense inputs. See the section "Reports" on page 8–122.

The following procedures describe how to set sense inputs using the terminal emulation software. See commands "529 Display Presence Input Status" on page 7–96, "694N Select Input Inversion Option" on page 7–111, and "82N Select Input Status Change Report Option" on page 7–114 for more information.

To set sense inputs

1. Ensure that the host computer is in command mode.
2. Enter command `#526` to display the current input/output status.
   - C0 = host controls outputs

- C1 = predefined output mode
- O0 = both outputs off
- O1 = output0 on
- O2 = output1 on
- O3 = both outputs on
- I0 = both inputs false
- I1 = input0 true
- I2 = input1 true

3. Enter command `#6940` to disable input inversion (factory default) or command

`#6941` to enable input inversion, and press **ENTER**.

Sense Output Devices

Both the RS–232 and RS–422 configurations used by the Encompass 4H Reader have two sense output circuits – sense output0 and sense output1.

By default, the Encompass 4H Reader operates in predefined output mode where sense output0 and sense output1 are asserted every time a unique valid tag is read. Both sense output devices are asserted by issuing command `#621 Predefined Output Control.` The devices are not asserted when tags are acquired in the transmit all or buffer all ID mode or when the Encompass 4H Reader is operating in Wiegand mode. The sense output pulse duration is variable (command `#67N`).

The host computer can disable the predefined sense output control by issuing command `#6201` to turn sense output0 on or by issuing any of the following commands:

- `#6200` Turn Off Both Output Ports
- `#6201` Turn Off Output0, On Output1
- `#6202` Turn Off Output1, On Output0
- `#6203` Turn On Both Output Ports

While under host control, the sense outputs are not automatically asserted when a valid tag is read. The host must issue command `#621 Predefined Output Mode` to return to the pre-defined mode.

Serial Port Communications

The Encompass 4H Reader supports one communications port, which can be ordered as either RS–232/Wiegand or RS–422/Wiegand. For the RS–232 and RS–422 communications specifications, the Encompass 4H Reader maintains the following three sets of parameters that affect serial port communications:

- Port configuration parameters (baud rate, data bits, stop bits, parity)
- Communications protocols (basic, error correcting)
- Flow control scheme (none, software, hardware)

The default serial port configuration for each of these three parameters is as follows:

- 9600 baud, 8 data bits, 1 stop bit, no parity
- Basic communications protocol
- Software flow control (XON/XOFF)

You can change these parameters in data mode and command mode operation by issuing commands with the host computer. Use the following procedures to set serial port communications parameters using the terminal emulation program.

Port Configuration Parameters

Use this procedure to set port configuration parameters using the terminal emulation program. Consult sections "100N Select Baud Rate" on page 7–77 through "00 Switch to Data Mode (Factory Default)" on page 7–76.

To set baud rate

1. Ensure that the host computer is in command mode.
2. Enter command `#100N` and press **ENTER**.

To set stop bits

1. Ensure that the host computer is in command mode.
2. Enter command `#101N` and press **ENTER**.

To set parity

1. Ensure that the host computer is in command mode.
2. Enter command `#102N` and press **ENTER**.

Communications Protocol

Use the following procedures to set communications protocol. Consult sections "610 Select Basic Communication Protocol (Factory Default)" on page 7–101 through "612NN Select Error Correcting Protocol Timeout" on page 7–102 for more information.

Caution

Do not switch to ECP (command `#611`) unless the host is prepared to acknowledge each reader transmission.

To select a communications protocol

1. Ensure that the host computer is in command mode.
2. Enter command **`#610`** to select basic protocol (factory default) or command `#611` to select ECP and press **ENTER**.

Software Flow Control

Two modes of flow control are supported — software (XON/XOFF) and hardware (CTS – clear to send). The host can enable or disable flow control with command #614N Select Flow Control Option.

The host can use software control characters (XON/XOFF) or the hardware CTS handshake line to interrupt reader transmissions. When the reader is configured for software flow control, it stops transmitting if it receives the XOFF character from the host (host software command 13H). It resumes transmitting only when it receives the XON character (host software command 11H) from the host. Likewise, when the reader is configured for hardware flow control, it stops transmitting if it detects that the CTS line is no longer asserted. It resumes transmitting when this line is asserted. If flow control is not needed, the reader should be configured for no flow control (#6140 Disable Flow Control).

Note: *TransCore recommends that XON/XOFF flow control be disabled while using the error correcting protocol.*

Use the following procedure to set flow control parameters using the terminal emulation program. See section "614N Select Flow Control Option" on page 7–102.

To select flow control

1. Ensure that the host computer is in command mode.
2. Enter command #6140 to disable flow control, command #6141 to enable software flow control (factory default), or command #6142 to enable hardware flow control and press **ENTER**.

Fine-Tuning and Verifying the Read Zone

If the read zone is too wide or too deep for your application, it can be fine-tuned by physically adjusting the Encompass 4H Reader, reprogramming the actual RF power output (#644NN Set RF Attenuation), and/ or reprogramming the RF sensitivity range (#643NN Set ATA Operating Range and #645NN Set eGo and eGo Plus Operating Range). The combination of these adjustments allows you to confine the read zone to the area where tagged vehicles pass. This operation also minimizes reading unwanted vehicles in adjacent lanes or parking areas.

See sections "643NN Select ATA Operating Range (Distance)" on page 7–105, "645NN Set eGo and eGo Plus Operating Range (Distance)" on page 7–106 , and "644NN Set RF Attenuation" on page 7–105 for more information.

Note: *As described in* "Marking the Read Zone" on page 4-52*, marking the read pattern using test tags that are not mounted to vehicles give a general idea of the read pattern but the pattern will vary somewhat when actual vehicles with tags are tested. Final adjustments must be made with tags properly mounted on a variety of vehicles.*

Physically Orienting the Encompass 4H Reader

You can manually adjust the location of the read zone by loosening the Encompass 4H Reader mounting brackets and pointing the reader in the desired direction. The unit should be aligned to point directly at the tag as it enters the desired read zone.

Fine-Tuning the Read Zone by Lowering Output Power

You can make the read zone smaller by adjusting the Encompass 4H Reader RF power output from a maximum of 2 watts to a minimum of 200 milliwatts using command `#644NN Set RF Attenuation`. Lowering the RF power has the added benefit of reducing RF interference with adjacent lanes.

To adjust the read zone by lowering output power

1. Ensure that your PC is communicating with the Encompass 4H Reader using a terminal emulation program as described in the section "Verifying Communications" on page 8–118.
2. Mark the current read zone as described in section "Marking the Read Zone" on page 4-52.

Caution

Test tags should be compatible with your Encompass 4H Reader. Test tags can be ATA-protocol, ISO-compliant, or Inter-Agency Group tags affixed to a plastic or wooden yardstick, or eGo or eGo Plus sticker-type tags affixed to a piece of nonmetallic windshield-type glass 0.190 to 0.230 in (4.82 to 5.84 mm) in thickness. The sticker-type tags have a reduced read range when not attached to glass.

3. Enter command `#01` to switch to command mode. You are prompted with `#DONE` from the reader and can now enter reader commands.
4. Enter in command `#64401` to lower the RF power by 1 dB below 2 watts (default). Press **ENTER .**

Note: *In the command* `#644NN`, `NN` *can be any hexadecimal value from 00 to 06. Settings for attenuation are 1.0 dB increments over a range of 6 dB of attenuation from the maximum power setting of 250 miliiwatts (24dBm) at 0 dB attenuation to a minimum power level of 63 milliwatts (18 dBm) at 6 dB attenuation. Increasing the attenuation lowers the output RF power.*

5. Switch to data mode by entering command `#00` and pressing **ENTER**.
6. Verify that the read zone has decreased by moving the tag through the desired read area. If the read zone is still too large, switch to command mode and enter the command `#64402` to lower the output RF power another 1 dB. Continue increasing the `NN` value until the read zone matches the desired read zone.
7. Follow the steps in "Marking the Read Zone" on page 4-52 to mark the new read zone on the ground with tape or chalk.

When the desired read zone is established, test the read zone with simulated and real traffic by performing the following procedures:

To test the read zone

1. Ensure that the Encompass 4H Reader is in data mode.
2. With the Encompass 4H Reader running, place one tag behind your back while you hold another tag in the new read zone. If a valid read, the data from the tag held in the read zone displays on the PC screen.
3. Switch tags, placing the other tag behind your back and holding the first tag in the read zone. If a valid read, the data from this tag held in the read zone displays on the PC screen.

4. If both tags are read, you have successfully adjusted the read range. If one or both tags did not read, follow the suggestions in "Verifying Tag Read Capability" on page 8–119.
5. As a last test, attach test tags to vehicles and simulate traffic going through the read zone to verify that the system performs accurately in a live environment.

Fine-tuning the Read Zone by adjusting sensitivity range

The Encompass 4H Reader read zone can be fine-tuned by using command `#643NN` for ATA tag read mode or `#645NN` for eGo and eGo Plus tag read mode to reprogram the RF sensitivity range. Sensitivity range adjustments have less impact on the read pattern than RF power adjustment, thus RF power adjustment should be used as the main read pattern adjustment tool. Sensitivity range control may be helpful in stopping some tag reads on the very edges of the read pattern. To produce a noticeable change in the read pattern, you must decrease the range sensitivity by more than one increment.

To adjust the read zone by adjusting sensitivity range

1. Ensure that your PC is communicating with the Encompass 4H Reader using a terminal emulation program as described in "Verifying Communications" on page 8–118.
2. Mark the current read zone as described in "Marking the Read Zone" on page 4-52 . Enter command `#01` to switch to command mode. You are prompted with `#DONE` from the reader and can now enter reader commands.
3. Enter command `#64318` or `#64518` to decrease the range sensitivity seven increments below the maximum (default). Press **ENTER**.

Note: *In the command `#643NN` or `#645NN`, `NN` can be any hexadecimal value from 00 to 1F. The reader's receiver becomes less sensitive to tag signals as the value of `NN` is lowered from the maximum sensitivity of `1F` to the minimum sensitivity of `00`.*

4. Verify that the read zone has decreased by moving the tag through the desired read area. If the read zone is still too large, switch to command mode and enter the command `#64317` or `#64517` to decrease the range another increment. Continue increasing the `NN` value until the read zone matches the desired read zone.
5. Follow the steps in section "Marking the Read Zone" on page 4-52 to mark the new read zone on the ground with the tape or chalk.
6. Retest the read zone using the procedures described in the section "To test the read zone" on page 8–128

Chapter 9 Troubleshooting and Maintenance

This chapter contains information for troubleshooting an Encompass® 4H Reader and performing minimal maintenance checks. It also includes information for returning products for repair, obtaining support, and contact information for providing feedback and suggestions to TransCore.

Error Messages

The Encompass 4H Reader transmits an error message if a command received from the host is not a recognized command or if information supplied with the command is not correct. The reader sends this message to diagnostic commands if the reader fails the specified test.

Table 41 contains a list of error messages.

Table 41 Error Messages

Error Message	Description	Corrective Action
`Error07`	The RF phase locked loop (PLL) has lost lock and is unable to operate at its intended frequency. RF output is disabled while the Encompass 4H Reader attempts to reset the PLL.	Reset the RF frequency. Refer to "Radio Frequency" on page 8-15 for instructions.
`Error08`	The RF PLL has successfully regained lock and has been reset to its proper operating frequency. The RF section is returned to its state prior to losing lock (enabled/disabled). `Error08` will only be issued after `Error07` has been issued.	No action necessary; the previous error has been corrected.
`Error11`	The operator is attempting to use an Intellitag-based tag in Wiegand mode while the Encompass 4H Reader is in ID-only mode, resulting in Wiegand compatibility issues.	Enable eATA mode using command `#489` if Wiegand operation is needed and the tags are programmed with Wiegand data.
`ErrorRF1`	Warning message that the RF board did not return an update acknowledge signal	If the reader indicates a single `ErrorRF1` event and recovers from the error, no corrective action is required. You may want to track this error message if it should occur again. If the reader indicates repeated `ErrorRF1` warning messages then return the reader to the factory.

Table 41 Error Messages

Error Message	Description	Corrective Action
`ErrorRF2`	Warning message that the RF module did not return an INIT DONE signal	If the reader indicates a single `ErrorRF2` event and recovers from the error, no corrective action is required. You may want to track this error message if it should occur again. If the reader indicates repeated `ErrorRF2` warning messages then return the reader to the factory.
`ErrorRF3`	Warning message of unexpected status read, including status byte, from RF module	If the reader indicates a single `ErrorRF3` event and recovers from the error, no corrective action is required. You may want to track this error message if it should occur again. If the reader indicates repeated `ErrorRF3` warning messages then return the reader to the factory.

Troubleshooting

You can use the following table for troubleshooting. Should problems continue, contact TransCore for return and replacement procedures. If you contact Technical Support, use the symptom number in Table 42 to reference the problem that you are having with the Encompass 4H Reader.

Table 42 Symptoms and Remedies

Symptom Number[a]	Symptom	Remedy
1	When performing a quick test of the Encompass 4H Reader, the buzz box does not buzz.	Check all your wiring connections and ensure that your buzz box is functioning. The wires from the Encompass 4H Reader are grouped in pairs. You could find more than one red wire, more than one black wire, and so on. You must connect the correct red and white wire pair to the leads from the battery. Verify that RF is on as described in "Bench Testing the Reader Before Installation" on page 4-33. Using a terminal emulation program, you may switch to command mode and issue command `#527` to determine RF status.
2	The baud rate is selected correctly but nothing happens.	The Encompass 4H Reader is not communicating with your PC. Check the power supply to your PC, and check the connections between the PC and the Encompass 4H Reader. Try reversing the receive and transmit connections.
3	When testing the Encompass 4H Reader, all the wires are connected correctly but the unit does not respond.	The Encompass 4H Reader may not have the software loaded inside the unit. Contact Technical Support. If you are using a terminal emulation program, check that the terminal emulation setting on the Encompass 4H Reader is VT100. Check that the Encompass 4H communication cable is connected to the correct COM port.
4	Strange signal responses come from the Encompass 4H Reader when tested with the PC.	Ensure that the reader is in the correct interface mode for the test tag, i.e., Wiegand mode for a Wiegand tag. Check the system defaults using a terminal emulation program. Both PC and reader should be set to 9600 baud, 8 bits, 1 stop bit, and no parity.
5	When a tag is moved in front of the reader, a clicking sound comes from the Encompass 4H Reader.	The Encompass 4H Reader works. The sound is the relay inside the Encompass 4H Reader that is controlled by a lock signal. The relay is actuated when a tag is in the read zone.

Table 42 Symptoms and Remedies

Symptom Number[a]	Symptom	Remedy
6	Nothing happens when the test tag is passed in front of the Encompass 4H Reader.	Ensure that the Encompass 4H Reader is powered on and is in predefined output mode. (#621) Verify that the reader is set to RF ON (#6401). Verify that the reader mode matches the test tag.
7	The Encompass 4H Reader came from another site and does not work the way the factory defaults indicate that it should.	Different commands were probably used to support the other site's specific configuration. You can restore the factory defaults by using a terminal emulation program to switch to command mode and issuing command #66F. Refer to "66F Load Default Operating Parameters" on page 7–108. All factory defaults except RF frequency will be restored.

8	When connected to a PC that is running terminal communications software, a just-powered up Encompass 4H Reader displays one of the following messages:
	`#Model E4 Series VER X.XX SNYYYYYY`
	`#[Copyright notice]`
		The Encompass 4H Reader works. The software is now loaded. YYYYYY is the TransCore-assigned serial number for this Encompass 4H Reader. However, if YYYYYY = 000000, a serial number has never been assigned. If a serial number has not been assigned to your Encompass 4H Reader, contact TransCore Technical Support.

9	The read zone is too small, even before the RF power and range control have been adjusted.	Check for possible interference from another nearby RF source: fluorescent lights, neon signs, high voltage power lines, nearby cellular telephone, or radio stations. Lights will need to be removed or shielded. Point the Encompass 4H Reader in a different direction to see if interference comes from only one direction. Verify that the RF power is set to an appropriate value. Verify that the range adjustment is set to the maximum. Verify that the reader is getting at least 16V.
10	The perimeter of the read zone has been defined, but there is a "hollow" spot in the center of the zone that does not read tags.	The angle of the Encompass 4H Reader may need adjustment. Slightly tilt the Encompass 4H Reader to a different angle to change either the length or width of the read zone.

Table 42 Symptoms and Remedies

Symptom Number[a]	Symptom	Remedy
11	The Encompass 4H Reader is reading tags out of the desired read zone, or cross lane reads are occurring.	Some interference from other RF or electrical sources may be occurring. Refer to "Reflection, Refraction, and Diffraction of RF Signals" on page 2–11. Verify that the read zone has been properly set up. Refer to "Fine-Tuning and Verifying the Read Zone" on page 8–127.
12	The Encompass 4H Reader is not providing any output to the Wiegand interface.	Ensure that the Encompass 4H Reader is in Wiegand mode (#451). The default is either RS–232 or RS–422 mode. Refer to "Wiegand Interface" on page 4-47. Ensure the tags are properly programmed with Wiegand data.

a Use this number to reference the problem you are having with the Encompass 4H Reader if you contact Transcore for Technical Support.

Encompass 4H Reader Repair

The Encompass 4H Reader is designed for whole-unit replacement and is manufactured with surface-mounted components. It requires sophisticated testing and repair equipment. All testing and repairs are performed at TransCore's factory. Please contact TransCore to obtain a Return Materials Authorization (RMA) for returning the reader.

Technical Support

Authorized dealers and distributors are responsible for the direct support of all customers. Authorized dealers and distributors needing support can contact Technical Support. Please be prepared to answer a series of questions that are designed to direct you to the best TransCore support resource available. These questions will relate to symptoms, configuration, model, and tags used.

Note: *End users and facility operators contacting Technical Support will be referred to the dealer responsible for the system sale.*

Appendix A Glossary

A

AAR	Association of American Railroads
AC	alternating current
ACK	acknowledge (data valid)
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ASIC	application-specific integrated circuit
ATA	American Trucking Association
aux	auxiliary
AWG	AWG (American Wire Gauge) is a U.S. standard set of non-ferrous wire conductor sizes

B

backscatter	portion of an RF signal that is modulated by a tag and radiated back to the reader
baud	measure of number of bits per second of a digital signal; for example, 9600 baud = 9600 bits per second
BCKS	boot checksum
BCM	buffer control mode
bps	bits per second
byte	a binary character; for example, one 8-bit ASCII character

C

cmd	command
comm	communications
command	data set that is recognized by the receiving device as intending to elicit a specific response
conduit	flexible steel pipe used for electrical wiring

cps	characters per second
CR	carriage return
CRC	cyclic redundancy check
CTRL	control
CTS	clear to send

D

data	information that is processed by a computing device
DC	direct current
DIAG	diagnostic

E

ECP	error correcting protocol
ECPS	error correcting protocol status
eGo	proprietary name for ANS INCITS 256-2001 compliant TransCore tag products. A registered trademark of TCP IP, Ltd.
eGo Plus	proprietary name for ANS INCITS 256-2001 and ISO 18000-6B compliant TransCore tag products. Super eGo is a superset of the eGo protocol. A registered trademark of TCP IP, Ltd.
Encompass	proprietary name for ANS INCITS 256-2001 compliant TransCore reader products. A trademark of TransCore, LP.
eol	end of line
eom	end of message
EPROM	erasable programmable read-only memory

F

field	physical area/space in which a tag can be read by the reader; also, an element of a data record/frame. For example, division within a tag's data frame.
frames	consecutive bits of data in memory that are read and written as a group
frequency bands	a range of RF frequencies assigned for transmission by an RF device

H

hex	hexadecimal
hexadecimal	base 16 numbering system that uses the characters 0 though 9 and A through F to represent the digits 0 through 16
host	device, generally a computer, that is connected to the Encompass 4 Reader through the communications port

I

I/O or IO circuits	input/output circuits
ID	identification; encoded information unique to a particular tag
INCITS	American National Standards Institute International Committee for Information Technology standards
Intellitag	Proprietary name for ANS INCITS 256-2001 compliant Intermec products. A registered trademark of Intermec Technologies Corporation, a UNOVA Company.
interface	connection point for communication with another device
IOST	I/O status
ISO	International Standardization Organization

L

LF	line feed

M

m	meter
MHz	megahertz
mode	method of operation
ms	milliseconds

N

NAK	negative acknowledgment (data not valid)
NVRAM	non-volatile memory. To save user parameter changes to NVRAM, you must send command #00 before powering down the reader.

P

passback	used to refer to a tag ID that is not passed on to the tag buffer
PC	personal computer
PCKS	EPROM flash checksum
protocol	specified convention for the format of data messages communicated between devices
PRST	presence status
PWRB	power fail bit

R

RAM	random access memory
RDID	reader ID
read	process of acquiring data from a device; for example, from a tag or from computer memory
reader	controlled interrogating device capable of acquiring data from a device; for example, acquiring and interrupting data from a tag
read zone	the physical area in which a tag can be read by the reader
RF	radio frequency
RFID	radio frequency identification
RFST	RF status
ROM	read-only memory
RTC	real-time clock
RTS	request-to-send

S

SeGo	Super eGo (SeGo) is a superset of the eGo protocol
SN	serial number
som	start of message
SSTC	input status change reporting options

T

tag	small self-contained device acting as an identifying transponder
Tau	timeout delay
TT	tag translation

V

V	volts
Ver	version (software)

W

Wiegand	the trade name for a technology used in card readers and sensors, particularly for access control applications. Wiegand devices were originally developed by HID Corporation.
write	process of recording data; for example, writing to computer memory or to a tag's memory. Writing writes over (erases) previous data stored at the specified memory locations.
WTI	Wiegand retransmit interval

X

XON/XOFF	protocol for controlling the flow of data between computers and other devices on an asynchronous serial connection. XON and XOFF are signals to turn a transmitter on or off. The actual signal for XON is the same bit configuration as the ASCII Ctrl-Q keyboard combination (11 hexadecimal). The XOFF signal is the Ctrl-S character (13 hexadecimal).

Appendix B Technical Specifications

Reader Specifications

Communications

Frequency Selection	Hopping controlled by firmware. Not selectable.
Reading Range	Read performance varies depending on tag, reader, configuration, and environment. Optimum read range using the eGo® Plus Sticker Tag is 24.3 ft (7.4 m)[a]. Typical read range should be 12 to 17 ft (3.7 to 5.2 m)[a].

Hardware Features

Integrated System	RF module, tag decoder, power supply, I/O ports, and serial communications interface all housed in a single package
Case	Weatherproof enclosure. The system is sealed in a tamper-proof, polycarbonate housing.

Power Requirements

Input Voltage	16 to 20V AC, 47 to 63 Hz or 16 to 28V DC

Physical Attributes

Size	15.5 x 15.5 x 3.25 in (39.4 x 39.4 x 8.25 cm)
Weight	9.5 lb (4.3 kg)

a Reading range depends on reader configuration, tag type, tag read mode, and operating environment.

Environmental Parameters

Operating Temperature	-40°F to +131°F (-40°C to +55°C)
Humidity	100% noncondensing
Vibration Tolerance	0.5 G_{rms}, 10 to 500 Hz

Options

Communications Interface	RS–232 and Wiegand or RS–422 and Wiegand
Cable Accessory Kits	58-1620-001: Connector with 5 ft (1.5 m) cable 58-1620-002: Connector with 20 ft (6.1 m) cable 58-1620-006: Connector with 35 ft (10.7 m) cable 58-1620-007: Connector with 45 ft (13.7 m) cable
Wall Mount Bracket	Allows adjustment in all planes when used to install the Encompass 4H Reader on a flat surface. Include the part number 54-1620-001 when ordering.
Transformer	A Class C transformer is available to allow 110V AC to 18V AC conversion. Include the part number 76-1620-005 when ordering. A Class C transformer (part number 76-1620-008) to allow 220V AC to 18V AC conversion is available by special request.

Appendix C Wiring Tables

This appendix contains tables that shows alternate wiring connections used to test and install the Encompass® 4H Reader.

Cable Supplied with the Encompass 4H Reader

The Encompass 4 Reader is delivered with a multi-wire cable (ordered as a separate accessory), which is a 13-pair pigtail. An alternate 15-pair pigtail may be substituted. The 13-pair pigtail is a colored-wire pair cable, with different colors denoting the individual pairs, one pair of which is red/black. The alternate 15-pair pigtail is a red/black wire pair cable, with numbers on the pairs to denote the individual pairs. Two pairs of the 15-pair pigtail, numbers 14 and 15, are not used.

The following tables show the alternate wire pair (15-pair) assignments for the various interfaces, power, and input/output connections.

RS–232 Interface

Table 43 shows the RS–232 assignments for alternate wire (15-pair) cable. To see the wire assignments for the 13-pair cable, refer to “Table 6 AC Transformer Connections for Colored-Wire 13-Pair Cable” on page 4-31.

Table 43 RS–232 Interface Signal Wiring for Alternate Wire 15-Pair Cable

Signal from Encompass 4H Reader	Alternate Wire Cable		Connect Wire to Host DB9 Pin	Connect Wire to Host DB25 Pin
	Pairing	Color		
TxD — Encompass 4H Reader output	Pair 1	Black	Pin 2	Pin 3
RxD — Encompass 4H Reader input		Red	Pin 3	Pin 2
Signal ground	Pair 5	Black or Red	Pin 5	Pin 7
Optional for hardware handshaking				
RTS — Encompass 4H Reader output	Pair 11	Black	Pin 8	Pin 5
CTS — Encompass 4H Reader input		Red	Pin 7	Pin 4

RS–422 Interface

Table 44 shows the RS–422 assignments for alternate wire (15-pair) cable. To see the wire assignments for the 13-pair cable, refer to “Table 10 RS–422 Interface Signal Wiring for Colored-Wire 13-Pair Cable” on page 4-46.

Table 44 RS–422 Interface Signal Wiring for Alternate Wire 15-Pair Cable

Signal from Encompass 4H Reader	Alternate Wire Cable		Connect to Signal from Host
	Pairing	Color	
RS–422 Transmit positive	Pair 11	Black	Receive (+)
RS–422 Transmit negative		Red	Receive (–)
RS–422 Receive positive	Pair 1	Black	Transmit (+)
RS–422 Receive negative		Red	Transmit (–)

Wiegand Interface

Table 45 shows the Wiegand assignments for alternate wire (15-pair) cable. To see the wire assignments for the 13-pair cable, refer to”Table 11 Wiegand Interface Signal Wiring for Colored-Wire 13-Pair Cable” on page 4-47.

Table 45 Wiegand Interface Signal Wiring for Alternate Wire 15-Pair Cable

Signal from Encompass 4H Reader	Alternate Wire Cable		Connect to Signal from Host
	Pairing	Color	
Wiegand Zero output	Pair 10	Black	Data0
Wiegand One output		Red	Data1
Signal Ground	Pair 5	Black or Red	Ground

Power Supply Connections

AC Power

Table 46 shows the alternate wire (15-pair) assignments for connection to a low-voltage AC power supply. To see the wire assignments for the 13-pair cable, refer to "Table 6 AC Transformer Connections for Colored-Wire 13-Pair Cable" on page 4-31.

Table 46 AC Transformer Connections for Alternate Wire 15-Pair Cable

Signal from Encompass 4H Reader	Alternate Wire Cable		Connect to Transformer Terminal Strip
	Pairing	Color	
Main power input	Pair 12 and Pair 13	Black/Black	L1: 6-20V AC
Main power return		Red/Red	L2: 16-20V AC

Low-Voltage DC Power

Table 47 shows the alternate wire (15-pair) assignments for connection to a low-voltage DC power supply. To see the wire assignments for the 13-pair cable, refer to "Table 7 Low Voltage DC Cable Connections for the Colored-Wire 13-Pair Cable" on page 4-31.

Table 47 Low Voltage DC Cable Connections for Alternate Wire 15-Pair Cable

Signal from Encompass 4 Reader	Alternate Wire Cable		Connection Use
	Pairing	Color	
Main power input	Pair 12 and Pair 13	Black and Black	16 to 28V DC + terminal
Main power return		Red and Red	16 to 28V DC – terminal

Input/Output Cabling Assignments

Table 48 shows the sense input/output assignments for alternate wire (15-pair) cable. To see the wire assignments for the 13-pair cable, refer to "Table 12 Sense Input/Output Cabling 13-Pair Assignments" on page 4-50.

Table 48 Sense Input/Output Cabling Assignments for Alternate Wire 15-Pair Cable

Alternate Wire Cable			Signal	Description	Typical Function
Pairing	Pin	Color			
Pair 10	E	Black	WGND0	Wiegand data0	Parking/access control applications
	F	Red	WGND1	Wiegand data1	Parking/access control applications
Pair 8	L	Black	Lock	Tag lock sense output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Pair 9	N	Black	Sense Input0	Sense Input0 (loop), active-closed	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection
Pair 4	R	Black	Sense Input1	Sense Input1, active-closed	General-purpose sense input, not used to detect presence
	S	Red	Sense Input1_ RTN	Sense Input1 return; not isolated from signal ground	General-purpose sense input, not used to detect presence
Pair 6	T	Black	Sense Output0_ COM	Sense Output0 (tag detect), common terminal	Switched sense output to control gate
	U	Red	Sense Output0_NO	Sense Output0, normally open terminal	Switched sense output to control gate
Pair 7	V	Black	Sense Output0_ COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
or	V**	Black	Sync_485_N	RS–485 bus negative	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	W	Red	Sense Output0_NC	Sense Output0, normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)

Table 48 Sense Input/Output Cabling Assignments for Alternate Wire 15-Pair Cable

Alternate Wire Cable			Signal	Description	Typical Function
Pairing	Pin	Color			
Pair 3	X	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
	Y	Red	Sense Output1_NO	Sense Output1, normally open terminal	Switched sense output
Pair 2	Z	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
or	Z**	Black	Sync_485_P	RS–485 bus positive	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	a	Red	Sense Output1_NO	Sense Output1, normally closed terminal	Switched sense output
Pair 5	b	Black	GND	logic ground	Signal ground (used with RS–232 and Wiegand communications)
	c	Red	GND	logic ground	Signal ground (used with RS–232 and Wiegand communications)

**Use this synchronization pin designation if installing an Encompass 4 Reader that reads IAG protocol tags. The part numbers for these readers are as follows:
10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019;
10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019

Summary Table

Table 49 shows all assignments for both colored-wire pair (13-pair) and alternate wire (15-pair) cables.

Table 49 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	Pin	Color	Pair	Color			
Red/ Black	A	Black	Pair 1	Black	TX232, RX422+, IF485-	RS–232 transmit, RS–422 receive positive, RS-485 negative	Encompass 4 Reader output, host input
	B	Red		Red	RX232, RX422-, IF485+	RS–232 receive, RS–422 receive negative, RS-485 positive	Encompass 4 Reader input, host output
Yellow/ Red	C	Yellow	Pair 11	Black	RTS232, TX422	RS–232 request to send or RS–422 transmit positive	Encompass 4 Reader output, host input for hardware handshaking
	D	Red		Red	CTS232, TX422	RS–232 clear to send or RS–422 transmit negative	Encompass 4 Reader input, host output for hardware handshaking
Blue/ Red	E	Blue	Pair 10	Black	WGND0	Wiegand data0	Parking/ access control applications
	F	Red		Red	WGND1	Wiegand data1	Parking/ access control applications
Orange/ Red	G	Orange	Pair 13	Black	18V	Main power input	
	H	Red		Red	18V_RTN	Main power return	
Brown/ Red	J	Brown	Pair 12	Black	18V	Main power input	
	K	Red		Red	18V_RTN	Main power return	

Table 49 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	**Pin**	**Color**	**Pair**	**Color**			
White/ Red	L	White	Pair 8	Black	Lock	Tag lock sense output, active-closed	Testing maintenance
	M	Red		Red	Lock_RTN	Tag lock return	Testing maintenance
Green/ Red	N	Green	Pair 9	Black	Sense Input0	Sense input0 (loop), active-closed	Loop and presence detect
	P	Red		Red	Sense Input0_RTN	Sense input0 return; not isolated from signal ground	Loop and presence detect
Blue/ Black	R	Blue	Pair 4	Black	Sense Input1	Sense input1, active-closed	General-purpose sense input, not used to detect presence.
	S	Black		Red	Sense Input1_RTN	Sense input1 return; not isolated from signal ground	General-purpose sense input, not used to detect presence.
Brown/ Black	T	Black	Pair 6	Black	Sense Output0_ COM	Sense output0 (tag detect), common terminal	Switched sense output to control gate
	U	Brown		Red	Sense Output0_NO	Sense output0, normally open terminal	Switched sense output to control gate

Table 49 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	Pin	Color	Pair	Color			
Orange /Black	V	Black	Pair 7	Black	Sense Output0_ COM	Sense output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
	V**	Black		Black	Sync_485_N	RS–485 bus negative	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	W	Orange		Red	Sense Output0_NC	Sense output0, normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/ Black	X	Black	Pair 3	Black	Sense Output1_ COM	Sense output1, common terminal	Switched sense output.
	Y	Green		Red	Sense Output1_NO	Sense output1, normally open terminal	Switched sense output
White/ Black	Z	Black	Pair 2	Black	Sense Output1_ COM	Sense output1, common terminal	Switched sense output
	Z**	Black		Black	Sync_485_P	RS–485 bus positive	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	a	White		Red	Sense Output1_NC	Sense output1, normally closed terminal	Switched sense output

Table 49 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	Pin	Color	Pair	Color			
Yellow/ Black	b	Yellow	Pair 5	Black	GND	logic ground	Signal ground (used with RS–232 and Wiegand communications)
	c	Black		Red	GND	logic ground	Signal ground (used with RS–232 and Wiegand communications)

**Use this synchronization pin designation if installing an Encompass 4 Reader that reads IAG protocol tags. The part numbers for these readers are as follows:
10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019;
10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019

Appendix D Command Quick Reference

This appendix lists the default configuration settings for the Encompass® 4H Reader and its commands. Commands are listed both numerically and alphabetically.

Command Syntax

The command numbers consist of from 2 to 4 hex digits. The letters N or S may follow a command number. The letter N indicates that part of the command number is variable. The letter S indicates the requirement for an alphanumeric data string that is to be included immediately following the command number. Hex digits (0–9, A–F) in either uppercase or lowercase characters may be used in data strings and for hex digits A–F. For more information see "Chapter 5 General Software Information" on page 5–56.

Table 50 lists factory default settings. Table 51 lists, in numerical order, all of the commands available to users. Table 52 lists the same commands by command name.

Factory Default Settings

Note: Table 50 *lists the factory default settings for the Encompass 4 Reader.*

Table 50 Encompass 4H Reader Default Configuration Settings

Parameter	Setting	Command
Switch to data mode	Data	00
Baud rate	9600	1005
Stop bits	1	1010
Disable parity	None	1020
Time and date appended	Enabled	302
No auxiliary information appended	Disabled	310
EAC page append	Disabled	320
Unique ID code criteria	Separation of 1 ID	4100
Valid ID code criteria	Acquisition of 1 ID	4200
Uniqueness timeout	2 minutes	441
Wiegand mode	Disabled	450
Tag translation mode	Disabled	452
Multi-tag sort	Disabled	454
eGo Plus tag initialization during multi-tag sort	Enabled	456
Second alternate group select	Disabled	458

Table 50 Encompass 4H Reader Default Configuration Settings

Parameter	Setting	Command
Wiegand transmit mode	1 second	4601
Third alternate group select	Disabled	490
Fourth alternate group select	Disabled	492
Fifth alternate group select	Disabled	494
Alternate group select	Disabled	496
Set reader ID number	00	6000
Select basic communications protocol	Basic	610
Error correcting protocol (ECP) timeout	12.7 sec	612FE
Software flow control	Software (XON/XOFF)	6141
Echo mode	Enabled	6171
Set output control	Turn off both outputs	6200
Select predefinde output control	Predefined	621
RF-by-input control	Enabled	641
ATA operating range	Maximum	6431F
RF attenuation	Full power	64409
eGo or eGo Plus operating range	Maximum	6451F
Synchronization output delay time	Disabled	64800
Synchronization hold off time	Disabled	64900
Sense output pulse duration	228 ms	67C
Presence without tag reports	Disabled	6900
RF-off control	Timeout or no presence	6922
RF timeout	Never true	693F
Input inversion	Disabled	6940
Input status change reports	Disabled	820
Automatic periodic RF status report	Disabled	830

Numerical Command List

The following conventions are used in Table 51:

- Items in ***bold italics*** identify factory default settings.
- Only the command-related data portion of the reader message is shown.

Refer to "Chapter 7 Commands" on page 7–74 for the complete syntax of commands and messages.

Table 51 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
00	***Switch to data mode (default)***	***Done***
01	Switch to command mode	Done
1002	Set baud rate = 1200 baud	Done
1003	Set baud rate = 2400 baud	Done
1004	Set baud rate = 4800 baud	Done
1005	***Set baud rate = 9600 baud (default)***	***Done***
1006	Set baud rate = 19.2 K baud	Done
1007	Set baud rate = 38.4 K baud	Done
1010	***Use one stop bit (default)***	***Done***
1011	Use two stop bits	Done
1020	***Disable parity (default)***	***Done***
1021	Select even parity	Done
1022	Select odd parity	Done
20	Set time	Done
21	Set date	Done
22	Display time and date	Time and date
300	No time and date appended	Done
302	***Time and date appended (default)***	***Done***
310	***No auxiliary information appended (default)***	***Done***
311	Auxiliary information appended	Done
320	***Disable EAC page append (default)***	***Done***
321	Enable EAC page append	Done
40	Transmit all IDs	Done
4100	***Select one ID separation (default)***	***Done***

Table 51 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
4101	Select two ID separation	Done
4102	Select three ID separation	Done
4103	Select four ID separation	Done
4200	***Select 1 valid ID code (default)***	***Done***
4201	Select 2 valid ID codes	Done
4202	Select 3 valid ID codes	Done
4203	Select 4 valid ID codes	Done
440	Reset uniqueness	Done
441	***Set uniqueness timeout to 2 minutes (default)***	***Done***
442	Set uniqueness timeout to 15 seconds	Done
443	Set uniqueness timeout to 30 seconds	Done
450	***Disable Wiegand mode (default)***	***Done***
451	Enable Wiegand mode	Done
452	***Disable tag translation mode (default)***	***Done***
454	Enable multi-tag sort	Done
455	***Disable multi-tag sort (default)***	***Done***
456	***Enable eGo Plus Tag initialization during multi-tag sort (default)***	***Done***
457	Disable eGo Plus Tag initialization during multi-tag sort	Done
458	***Disable second alternate group select (default)***	***Done***
459	Enable second alternate group select	Done
46NN	Set Wiegand retransmit interval	Done
4601	***Set Wiegand retransmit interval to 1 second (default)***	***Done***
480	Disable ATA	Done
481	Enable ATA	Done if tag protocol supported/Error if tag protocol is unsupported
482	Disable eGo	Done
483	Enable eGo	Done if tag protocol supported/Error if tag protocol is unsupported
484	Disable SeGo	Done

Table 51 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
485	Enable SeGo	Done if tag protocol supported/Error if tag protocol is unsupported
486	Disable IAG	Done
487	Enable IAG	Done if tag protocol supported/Error if tag protocol is unsupported
488	Disable eATA	Done
489	Enable eATA	Done
490	***Disable third alternate group select (default)***	***Done***
491	Enable third alternate group select	Done
492	***Disable fourth alternate group select (default)***	***Done***
493	Enable fourth alternate group select	Done
494	***Disable fifth alternate group select (default)***	***Done***
495	Enable fifth alternate group select	Done
496	***Disable alternate group select (default)***	***Done***
497	Enable alternate group select	Done
505	Display version	`Model E4 Series Ver X.XX SNSSSSSS`
506	Display hardware configuration information	1-20 character ASCII string
510	Display RF transceiver FPGA version	RF FPGA VER = XX.XX
511	Display RF transceiver I filter chip version	FIL IC I VER = XX.XX
512	Display RF transceiver Q filter chip version	FIL IC Q VER = XX.XX
513	Display DSP board Actel version	DSP FPGA VER = XX.XX
520	Display power fail bit	PWRB P <0 to 1> R0
521	Display reader ID number	RDID xx
522	Display comm port parameters	`MAIN B<2 to 7> S<0 to 1> P<0 to 2> D0`
524	Display appended info status	`IDAP T<0> D<0> X<0 to 1>`
525	Display comm protocol	`ECPS P<0 to 2> T<01 to FF> X<0 to 2> S0`
526	Display I/O status	`C<0 to 1> O<0 to 3> I<0 to 3> D<0 to F>`

Table 51 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
527	Display RF status	RFST C<0 to 1> O<0 to 1> T<1 to 3> Fxxx Rxx Gxx Axx Ixx
529	Display presence input status	PRST P<0 to 1> D0 A<0 to 2> T<0 to F> I<0 to 1>
530	Display RF0 filter status	RF0S U<0 to 4> V<0 to 3>
532	Display Wiegand mode status	TOF <0 to 1>
533	Display Wiegand retransmit interval	WTI <01 to FF>
534	Display tag translation mode status	TT <0 to 1>
537	Display echo status	ECHO <0 to 1>
540	Display flash checksum	PCKS I0000 Exxxx
543	Display boot checksum	BCKS xxxx
549	Display user-programmable group select equals (GSE) filter data	The response data is formatted similar to the data in the configuration command.
560	Display input status change	SSTC E<0 to 1>M<0 to 3>
570	Display tag protocols	ATA:<E, D> eGo:<I, F, D> SeGo:<I, F, D> IAG:<E, D> Sort:<E, D> TMM0
577	Report buffered handshakes	XX = number of handshakes
582	Display synchronization values	SYNC T<00 to FF> H<00 to 0A>
60NN	Set reader ID number NN = 00 to FF	Done
6000	***Set reader ID number to 00 (default)***	***Done***
610	***Select basic protocol (default)***	***Done***
611	Select ECP protocol	Done
612NN	Select ECP Timeout	Done
612FE	***Set ECP timeout = 12.7 sec (default)***	***Done***
613	Enable data inquiry protocol	Done

Table 51 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
6140	Disable flow control	Done
6141	***Enable software flow control (default)***	***Done***
6142	Enable hardware flow control	Done
6170	Disable echo mode	Done
6171	**Enable echo mode *(default)***	**Done**
6200	**Turn off both output ports *(default)***	**Done**
6201	Turn off output1, turn on output0	Done
6202	Turn off output 0, turn on output1	Done
6203	Turn on both output ports	Done
621	***Select predefined output mode (default)***	***Done***
63	Reset reader	`Model E4 Series Ver X.XX SNSSSSSS Copyright 2008 TransCore`
6400	Turn off RF	Done
6401	Turn on RF	Done
641	***Select RF-by-input control (default)***	***Done***
643NN	Set ATA operating range (Distance)	Done
6431F	***Set ATA operating range to longest range (default)***	***Done***
644NN	Set RF attenuation NN = 09 to 0F	Done
64409	***Set RF attenuation to 0 dB (full power) (default)***	***Done***
645NN	Set eGo or eGo Plus operating range NN= 00 (shortest) to 1F (longest)	Done
6451F	***Set eGo or eGo Plus operating range to longest range (default)***	***Done***
646NN	Set IAG RF attenuation NN = 09 to 0F	Done
648NN	Set synchronization output delay time NN = 01 to FF, where 01 = 1 ms and FF = 255 ms.	Done
64800	***Disable synchronization output delay (default)***	***Done***
649NN	Set synchronization hold-off time NN = 01 to 0A, where 01 = 1 ms and 0A = 10 ms.	Done
64900	***Disable synchronization hold-off time (default)***	***Done***
65	Reset power fail bit	Done

Table 51 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
66F	Load default operating parameters	Done
67N	Set output pulse duration	Done or Error
67C	***Output pulse duration set to 228 ms (default)***	***Done***
6900	***Disable presence without tag reports (default)***	***Done***
6901	Enable presence without tag reports	Done
6920	Turn RF off on timeout	Done
6921	Turn RF off on timeout/tag	Done
6922	***Timeout or presence false (#529A2, default)***	***Done***
693N	Set RF timeout N = 0–F, (always expired, 4,8,12,20,24, 32,48,60,92,152, 300,452, 600,752, infinite)	Done
693F	***Set RF timeout to infinite (default)***	***Done***
6940	***Disable input inversion (default)***	***Done***
6941	Enable input inversion	Done
695S...S	Set serial number S...S = ASCII string (maximum length of 6 characters)	Done
696S...S	Store hardware configuration string S...S = ASCII string (maximum length of 20 characters)	Done
697	Set user-programmable group select equals (GSE) filter	Done
820	**Disable status change reports *(default)***	**Done**
821	Report change on input0	Done
822	Report change on input1	Done
823	Report changes on input0 and input1	Done
830	***Disable automatic periodic RF status report (default)***	***Done***
831	Enable automatic periodic RF status report	Done

Alphabetical Command List

The following conventions are used in Table 52:

- Items in ***bold italics*** identify factory default settings.
- Only the command-related data portion of the reader message is shown.

Refer to "Chapter 7 Commands" on page 7–74 for the complete syntax of commands and messages.

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Auxiliary information appended	311	Done
Disable alternate group select (default)	***496***	***Done***
Disable ATA	480	Done
Disable automatic periodic RF status report (default)	***830***	***Done***
Disable EAC page append (default)	***320***	***Done***
Disable eATA	488	Done
Disable echo mode	6170	Done
Disable eGo	482	Done
Disable eGo Plus Tag initialization during multi-tag sort	457	Done
Disable fifth alternate group select (default)	***494***	***Done***
Disable flow control	6140	Done
Disable fourth alternate group select (default)	***492***	***Done***
Disable IAG	486	Done
Disable input inversion (default)	***6940***	***Done***
Disable multi-tag sort (default)	***455***	***Done***
Disable parity (default)	***1020***	***Done***
Disable presence without tag reports (default)	***6900***	***Done***
Disable second alternate group select (default)	***458***	***Done***
Disable SeGo	484	Done
Disable status change reports (default)	***820***	***Done***
Disable synchronization hold-off time (default)	***64900***	***Done***
Disable synchronization output delay (default)	***64800***	***Done***

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Disable tag translation mode (default)	***452***	***Done***
Disable third alternate group select (default)	***490***	***Done***
Disable Wiegand mode (default)	***450***	***Done***
Display appended info status	524	IDAP T<0> D<0> X<0 to 1>
Display boot checksum	543	BCKS xxxx
Display comm port parameters	522	MAIN B<2 to 7> S<0 to 1> P<0 to 2> D0
Display comm protocol	525	ECPS P<0 to 2> T<01 to FF> X<0 to 2> S0
Display DSP board Actel version	513	DSP FPGA VER = XX.XX
Display echo status	537	ECHO <0 to 1>
Display flash checksum	540	PCKS I0000 Exxxx
Display hardware configuration information	506	1-20 character ASCII string
Display I/O status	526	C<0 to 1> O<0 to 3> I<0 to 3> D<0 to F>
Display input status change	560	SSTC E<0 to 1>M<0 to 3>
Display power fail bit	520	PWRB P <0 to 1> R0
Display presence input status	529	PRST P<0 to 1> D0 A<0 to 2> T<0 to F> I<0 to 1>
Display reader ID number	521	RDID xx
Display RF status	527	RFST C<0 to 1> O<0 to 1> T<1 to 3> Fxxx Rxx Gxx Axx Ixx
Display RF transceiver FPGA version	510	RF FPGA VER = XX.XX
Display RF transceiver I filter chip version	511	FIL IC I VER = XX.XX
Display RF transceiver Q filter chip version	512	FIL IC Q VER = XX.XX
Display RF0 filter status	530	RF0S U<0 to 4> V<0 to 3>
Display synchronization values	582	SYNC T<00 to FF> H<00 to 0A>

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Display tag protocols	570	ATA:<E, D> eGo:<I, F, D> SeGo:<I, F, D> IAG:<E, D> Sort:<E, D> TMM0
Display tag translation mode status	534	TT <0 to 1>
Display time and date	22	Time and date
Display user-programmable group select equals (GSE) filter data	549	The response data is formatted similar to the data in the configuration command.
Display version	505	Model E4 Series Ver X.XX SNSSSSSS
Display Wiegand mode status	532	TOF <0 to 1>
Display Wiegand retransmit interval	533	WTI <01 to FF>
Enable alternate group select	497	Done
Enable ATA	481	Done if tag protocol supported/Error if tag protocol is unsupported
Enable automatic periodic RF status report	831	Done
Enable data inquiry protocol	613	Done
Enable EAC page append	321	Done
Enable eATA	489	Done
Enable echo mode (default)	***6171***	***Done***
Enable eGo	483	Done if tag protocol supported/Error if tag protocol is unsupported
Enable eGo Plus Tag initialization during multi-tag sort (default)	***456***	***Done***
Enable fifth alternate group select	495	Done
Enable fourth alternate group select	493	Done
Enable hardware flow control	6142	Done
Enable IAG	487	Done if tag protocol supported/Error if tag protocol is unsupported
Enable input inversion	6941	Done

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Enable multi-tag sort	454	Done
Enable presence without tag reports	6901	Done
Enable Retransmit	845	
Enable second alternate group select	459	Done
Enable SeGo	485	Done if tag protocol supported/Error if tag protocol is unsupported
Enable software flow control (default)	***6141***	***Done***
Enable tag translation mode	453	Done
Enable third alternate group select	491	Done
Enable Wiegand mode	451	Done
Load default operating parameters	66F	Done
No auxiliary information appended (default)	***310***	***Done***
No time and date appended	300	Done
Output pulse duration set to 228 ms (default)	***67C***	***Done***
Report buffered handshakes	577	XX = number of handshakes
Report change on input0	821	Done
Report change on input1	822	Done
Report changes on input0 and input1	823	Done
Reset power fail bit	65	Done
Reset reader	63	Model E4 Series Ver X.XX SNSSSSSS
Reset uniqueness	440	Done
RF Control	640N	Done
Select 1 valid ID code (default)	***4200***	***Done***
Select 2 valid ID codes	4201	Done
Select 3 valid ID codes	4202	Done
Select 4 valid ID codes	4203	Done
Select basic protocol (default)	***610***	***Done***

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Select Baud Rate	100N	Done
Select ECP protocol	611	Done
Select ECP Timeout	612NN	Done
Select even parity	1021	Done
Select Flow Control Option	614N	Done
Select four ID separation	4103	Done
Select Input Inversion Option	694N	Done
Select Input Status Change Report Option	82N	Done
Select odd parity	1022	Done
Select one ID separation (default)	***4100***	***Done***
Select Parity	102N	Done
Select predefined output mode (default)	***621***	***Done***
Select presence without tag report option	690N	Done
Select rF Control Algorithm	692N	Done
Select RF operating frequency	642NN	Done
Select RF operating frequency	647NNN	Done
Select RF-by-input control (default)	***641***	***Done***
Select Stop Bits	101N	Done
Select three ID separation	4102	Done
Select two ID separation	4101	Done
Select unique ID code criteria	410N	Done
Select valid ID code criteria	420N	Done
Set ATA operating range (Distance)	643NN	Done
Set ATA operating range to longest range (default)	***6431F***	***Done***
Set baud rate = 1200 baud	1002	Done
Set baud rate = 19.2 K baud	1006	Done
Set baud rate = 2400 baud	1003	Done

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Set baud rate = 38.4 K baud	1007	Done
Set baud rate = 4800 baud	1004	Done
Set baud rate = 9600 baud (default)	***1005***	***Done***
Set date	21	Done
Set ECP timeout = 12.7 sec (default)	***612FE***	***Done***
Set eGo or eGo Plus operating range	645NN	Done
Set eGo or eGo Plus operating range to longest range (default)	***6451F***	***Done***
Set IAG RF attenuation	646NN	Done
Set IAG RF attenuation (default)	***64604***	***Done***
Set output control	620N	Done
Set output pulse duration	67N	Done or Error
Set reader ID number NN = 00 to FF	60NN	Done
Set reader ID number to 00 (default)	***6000***	***Done***
Set RF attenuation NN = 00 to 0A	644NN	Done
Set RF attenuation to 0 dB (full power) (default)	***64400***	***Done***
Set RF timeout period	693N	Done
Set RF timeout to infinite (default)	***693F***	***Done***
Set serial number S...S = ASCII string (maximum length of 6 characters)	695S...S	Done
Set synchronization hold-off time	649NN	Done
Set synchronization output delay time	648NN	Done
Set time	20	Done
Set uniqueness timeout	44N	Done
Set uniqueness timeout to 15 seconds	442	Done
Set uniqueness timeout to 2 minutes (default)	***441***	***Done***
Set uniqueness timeout to 30 seconds	443	Done
Set user-programmable group select equals (GSE) filter	697	Done

Table 52 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Number	Reader Message
Set Wiegand retransmit interval	46NN	Done
Set Wiegand retransmit interval to 1 second (default)	***4601***	***Done***
Store hardware configuration string S...S = ASCII string (maximum length of 20 characters)	696S...S	Done
Switch to command mode	1	Done
Switch to data mode (default)	***0***	***Done***
Time and date appended (default)	***302***	***Done***
Timeout or presence false (#529A2, default)	***6922***	***Done***
Transmit all IDs	40	Done
Turn off both output ports (default)	***6200***	***Done***
Turn off output 0, turn on output1	6202	Done
Turn off output1, turn on output0	6201	Done
Turn off RF	6400	Done
Turn on both output ports	6203	Done
Turn on RF	6401	Done
Turn RF off on timeout	6920	Done
Turn RF off on timeout/tag	6921	Done
Use one stop bit (default)	***1010***	***Done***
Use two stop bits	1011	Done

Appendix E Compatible Tag Information

This appendix gives helpful information about the tags that are compatible with the Encompass® 4H Reader.

Tag Configurations

Table 53 lists the TransCore Super eGo® (SeGo) protocol tags that are compatible with the Encompass 4 Reader.

Table 53 Compatible TransCore Tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5118	Transportation tag	915	Full	Beam	Exterior metal	SeGo read/write, ATA read only
AT5133	Transportation tag, high temperature case	915	Full	Beam	Exterior metal	SeGo read/write, ATA read only
AT5400	TollTag®	915	Full	Beam	Interior windshield	SeGo read/write, ATA and eGo read only
AT5402	Access control tag	915	Half	Beam	Interior windshield	SeGo read/write, ATA and eGo read only, Wiegand
AT5406	Access control tag	915/2450	Half	8-year battery	Interior windshield	SeGo read/write, ATA and eGo read only, Wiegand
AT5412	Transportation tag	915	Half	Beam	Exterior metal	SeGo read/write, ATA read only, Wiegand
AT5413	Hardened rail tag, factory sealed, foam-hardened package	915	Full	Beam	Exterior metal	SeGo read/write, ATA read only
AT5414	Transportation tag	915	Half	8-year battery	Exterior metal	SeGo read/write, ATA read only, Wiegand
AT5415	Hardened rail tag, factory sealed, foam-hardened package	915	Half	Beam	Exterior metal	SeGo read/write, ATA read only, Wiegand
AT5417	Steady-state signal tag	915	Half	External	Exterior metal	AAR, ATA, ISO

Table 53 Compatible TransCore Tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5419	Flashing signal tag	915	Half	External	Exterior metal	AAR, ATA, ISO
AT5549	Transportation tag/ Compact end of train tag (EOT)	915	Full	10-year battery	End of Train	SeGo read/write, ATA read only
AT5704	Transportation tag	915/2450	256 bit	External	Exterior metal	ATA
AT5720	Check tag	915/2450	Full	Beam	Check tag	ATA read only
AT5720	Check tag	915/2450	Full	Beam	Check tag	ATA read only
AT5910	Transportation tag	915	Full	8-year battery	Exterior metal	SeGo read/write, ATA read only
AT5944	TollTag®	915/2450	Full	8-year battery	Interior windshield	SeGo read/write, ATA and eGo read only
AT5944	TollTag®	915/2450	Full	8-year battery	Interior windshield	SeGo read/write, ATA and eGo read only
AT5988	TollTag®	915/2450	Full	5-year battery	Interior windshield	SeGo read/write, ATA and eGo read only
eGo Plus License Plate Tag (LPT)	External tag	915	Full/ Half	Beam	Exterior mount	Sego, eGo, ATA
eGo Plus Mini External Tag	External tag	915	Full/ Half	Beam	Exterior mount	Sego, eGo, ATA
eGo Plus Micro Mini Windshield Sticker Tag	Sticker tag	915	Full	Beam	Interior windshield	Sego/ATA

Table 54 lists most legacy tag models that are compatible with the Encompass 4 Reader.

Table 54 Legacy Tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5100	Toll	915	Full	Beam	Interior	ATA

Table 54 Legacy Tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5102	Access control	915	Half	Beam	Interior	ATA/Wiegand
AT5105	Access control	915	Half	5-year battery	Interior	ATA/Wiegand
AT5106	Access control	915/2450	Half	10-year battery	Non-metal Interior or exterior	ATA/Wiegand
AT5107	Access control	915/2450	Half	10-year battery	Non-metal Interior or exterior	ATA/Wiegand
AT5110	Toll/Transportation	915	Full	Beam	Exterior	ATA
AT5112	Access control, transportation	915	Half	Beam	Exterior	ATA/Wiegand
AT5114	Access control, transportation	915/2450	Half	10-year battery	Exterior	ATA/Wiegand
AT5125	Transportation, high temperature	915	Full	Beam	Exterior	ATA
AT5140	Toll	915	Full	10-year battery	Exterior License Plate	ATA
AT5145	Toll	915	Full	Beam	Exterior License Plate	ATAI
AT5146	Access control	915	Half	Beam	Exterior License Plate	ATA/Wiegand
AT5147	Access control	915	Half	10-year battery	Exterior License Plate	ATA/Wiegand
AT5510	Transportation	915/2450	Full	10-year battery	Exterior, metal	ATA
AT5544	Toll	915/2450	Full	10-year battery	Exterior, non-metal	ATA
AT5545	Toll	915/2450	Full	10-year battery	Exterior, metal	ATA
AT5547	Toll	915	Full	5-year battery	Interior windshield	ATA

Table 54 Legacy Tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5707	Transportation	915	256 bits	8-year battery	Exterior metal	ATAI
eGo Plus Security Sticker Tag	Toll, EVR, parking, security access	915	Full	Beam	Interior windshield	Sego, eGo, ATA
Windshield Sticker Tag	Toll, EVR, parking, security access	915	Full	Beam	Interior windshield	Sego, eGo, ATA
eGo License Plate Tag	Toll, EVR, parking, security access	915	Full	Beam	Exterior	Sego, eGo, ATA

a. If desired, in place of 40 six-bit ASCII characters, the AT5707 can support up to 34 seven-bit ASCII characters.

Tag Data Formats

Tags are programmed at the TransCore factory with the tag model number, date of manufacture, and data format. Contact TransCore for special order entry procedures for the format that applies to your system. The following four tag data formats can be used:

- 10-character alphanumeric ASCII — Four alphanumeric characters are fixed and can be used to identify either the dealer or the user. The remaining six positions are numeric and should be unique for each tag issued. For example, the entry ACME000001 might be specified as the first tag on the order entry form from ACME Parking Garage.
- 20-character alphanumeric ASCII — Four alphanumeric characters are typically fixed and the remaining 16 positions are numbered sequentially.
- Wiegand — Tags can be programmed in Wiegand formats with 26 to 54 bits. If you choose this format, complete a Wiegand format worksheet — attached to the order entry form — indicating the data to be programmed into the tags.

Note: *Security access control tag models can be Wiegand-formatted. Refer to* Table 53 and Table 54 *for Wiegand-compatible tag models.*

- AAR/ISO — For requirements for this format, refer to ISO 10374 and the most recent version of *Association of American Railroads Standard for Automatic Equipment Identification.*

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