

Encompass® 4 Flex

Reader System Guide

16-0195-001 Rev A 07/25

TransCore's Encompass 4 Flex Reader System is a multi-protocol reader that reads TransCore Super eGo® (SeGo), eGo, American Trucking Associations/International Organization for Standardization (ATA/ISO), or Inter-Agency Group (IAG) tag protocols, and ISO 18000-63 (EPC/6C).



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

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

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WARNING TO USERS IN THE UNITED STATES
FEDERAL COMMUNICATIONS COMMISSION (FCC)
LOCATION AND MONITORING SERVICE STATEMENT
47 CFR §90.351

Note: The user is required to obtain a Part 90 site license from the Federal Communications Commission (FCC) to operate this radio frequency identification (RFID) device in the United States. The FCC ID number is FIHE4FLEXV1. Access the FCC website at www.fcc.gov to obtain additional information concerning licensing requirements.

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

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

Note: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate RF energy and may cause harmful interference to radio communications if not installed and used in accordance with the instruction manual. Operating this equipment in a residential area is likely to cause harmful interference, in which case, depending on the 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 for communications lines 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 §90.351 (CODE DES RÈGLEMENTS FÉDÉRAUX) DE LA FEDERAL COMMUNICATIONS COMMISSION (FCC) SUR LES SERVICES DE LOCALISATION ET DE CONTRÔLE

REMARQUE: L'utilisateur est tenu d'obtenir une licence d'utilisation sur site Partie 90 auprès de la Federal Communications Commission (FCC) afin de pouvoir utiliser ce dispositif RFID (radio-identification) aux États-Unis ou au Canada. Le numéro d'identification de la FCC est FIHE4FLEXV1. Pour obtenir de plus amples informations concernant les exigences relatives aux licences, prière de consulter le site web de la FCC à www.fcc.gov.

REMARQUE: Il est recommandé à tous les utilisateurs, quel que soit leur pays, de consulter les autorités locales compétentes sur les exigences de licence.

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) INDUSTRY CANADA'S RADIO STANDARD SPECIFICATIONS (RSS-137) LOCATION AND MONITORING SERVICE IN THE BAND 902-928 MHZ SECTION 2.1

NOTE: The user is required to obtain a license from Industry Canada (IC), to operate this radio frequency identification (RFID) device in Canada. The IC ID number is 1584A-E4FRSS137V1 access the IC website at www.ic.gc.ca to obtain additional information concerning licensing requirements.

INDUSTRY CANADA (IC) INDUSTRY CANADA'S RADIO STANDARD SPECIFICATIONS GENERAL REQUIREMENTS (RSS-GEN) FOR COMPLIANCE OF RADIO APPARATUS STATEMENT SECTION 8.4

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.

AVERTISSEMENT AUX UTILISATEURS AU CANADA

INDUSTRIE CANADA (IC) INDUSTRIE CANADA RADIO STANDARD SPECIFICATIONS (CNR-137) EMPLACEMENT ET SERVICE DE SURVEILLANCE DANS LA BANDE 902-928 MHZ, SECTION 2.1

Remarque: L'utilisateur est tenu d'obtenir une licence d'Industrie Canada (IC), afin d'exploiter ce dispositif d'identification par radiofréquence au Canada. Le numéro d'identification d'IC est 1584A-E4FRSS137V1. Pour obtenir de plus amples informations concernant les exigences relatives aux licences, prière de consulter le site web de d'IC à www.ic.gc.ca.

RADIO STANDARD SPÉCIFICATIONS EXIGENCES GÉNÉRALES INDUSTRIE CANADA (IC) INDUSTRIE CANADA (CNR- GEN) POUR S'ACQUITTER DU RADIO APPAREIL DÉCLARATION ARTICLE 8.4

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.

RADIO FREQUENCY HEALTH LIMITS FOR ENCOMPASS 4 FLEX READER USING AN EXTERNAL ANTENNA IN FREQUENCY BAND OF 902.25 TO 903.75 AND 910.00 TO 921.50 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 (the lowest frequency in the band of operation of this equipment) of 902 MHz and the internal antenna gain of this equipment, the minimum safe distance was calculated to be 5.5 in (14 cm).

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 (the lowest frequency in the band of operation of this equipment) of 902 MHz and the internal antenna gain of this equipment, the minimum safe distance was calculated. The MPE minimum distances are 9.8 in (25 cm) for the Occupational/ Controlled environment, and 21.7 in (55 cm) 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 915 MHz is $8.77 \text{ W}/\text{m}^2$. The average time is 6 minutes. The maximum permissible exposure (MPE) is the following:

Controlled Environment

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

General Public/Uncontrolled Environment

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

Using the frequency (the lowest frequency in band of operation of this equipment) of 902 MHz and the internal antenna gain that this equipment is certified for use in a final installation, the minimum safe distance was calculated. The MPE minimum distances are 12.2 in (31 cm) for the Controlled environment and 32.3 in (82 cm) 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	5.5	14	6
FCC	3.05	9.8	25	6
IC	2.43	12.2	31	6

General Population/Public/Uncontrolled Environment				
Agency	Power Density (mW/cm ²)	MPE minimum distance		Time (min)
		In	cm	
OSHA	10	5.5	14	6
FCC	0.61	21.7	55	30
IC	0.877	32.3	82	6

With the equipment installed and running at the maximum transmit power of 2.0W (33 dBm), 0dB transmit attenuation, using the internal gain antenna of the equipment, the recommendation for each of the operation environments is as follows:

1. The antenna should be installed at least 32.3 in (82 cm) from the General Population/Public i.e. Uncontrolled Environment.
2. Maintenance personnel (i.e. Occupational/Controlled Environment) must remain at least 12.2 in (31 cm) 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 4 FLEX UTILISANT UNE ANTENNE EXTERNE SUR LA BANDE DE FRÉQUENCES DE 902.25 À 903.75 ET DE 910.00 À 921.50 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 (la fréquence la plus basse dans la bande de fonctionnement de cet équipement) de 902 MHz et le gain d'antenne interne de cet équipement, la distance minimale de sécurité a été calculée à 14 cm (5,5 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 (la fréquence la plus basse dans la bande de fonctionnement de cet équipement) de 902MHz et le gain d'antenne interne de cet équipement, la distance de sécurité minimale a été calculée. Les distances minimales de l'EMT sont de 25 cm (9,8 po) pour l'environnement professionnel ou contrôlé et de 55 cm (21,7 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, 5^e édition, d'Industrie Canada (un ministère du Gouvernement du Canada) établit des recommandations pour une densité de puissance maximale sécuritaire en W/m^2 . Ainsi, l'exposition maximale admissible pour la population générale/non contrôlée à 915 MHz est calculée à $8,77 \text{ W}/\text{m}^2$. La durée moyenne est de 6 minutes.

Les limites d'exposition maximale autorisée (normes MPE) sont les suivantes :

Environnement contrôlé

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

Grand public/environnement non contrôlé

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

En utilisant la fréquence (la fréquence la plus basse dans la bande de fonctionnement de cet équipement) de 902 MHz et le gain d'antenne interne que cet équipement est certifié pour une utilisation dans une installation finale, la distance de sécurité minimale a été calculée. Les distances minimales de l'EMT sont de 31 cm (12,2 po) pour l'environnement 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/ cm ²)	Distance MPE minimale		Durée (en min.)
		po	cm	
OSHA	10	5,3	13,5	6
FCC	3,05	9,6	24,4	6
IC	2,43	12,0	30,5	6

Population générale/environnement non contrôlé				
Organisme	Densité de puissance (mW/ cm ²)	Distance MPE minimale		Durée (en min.)
		po	cm	
OSHA	10	5,3	13,5	6
FCC	0,61	21,5	54,5	30
IC	0,877	31,9	81,0	6

Avec l'équipement installé et fonctionnant à la puissance d'émission maximale de 2,0W (33 dBm), atténuation de transmission 0 dB, en utilisant l'antenne de gain interne de l'équipement, la recommandation pour chacun des environnements d'exploitation est la suivante: 1) L'antenne devrait être installée à au moins 81,0 cm (31,9 po).

1. L'antenne devrait être installée à au moins 81,0 cm (31,9 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 30,5 cm (12 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

Information and instructions for the Encompass 4 Flex Reader models are presented in this system guide.

System Description

The Encompass 4 Flex Reader System is a multi-protocol RFID reader supporting the following transponder protocols:

- American Trucking Associations/International Organization for Standardization (ATA/ISO)
- TransCore Super eGo® (SeGo)/eGo
- Interagency Group (IAG)
- ISO 18000-63 (EPC/6C)

The Encompass 4 Flex Reader system also supports the following communications protocols.

- RS232
- RS422
- 100Mbit/s Ethernet
- Bluetooth Low Energy (Refer to “[Appendix F BLE Configuration Through Direct Communication Port Commands](#)” on page F–184)

Reader

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

Note: *A dedicated electrical power supply must be present at the site and available to the Encompass 4 Flex Reader at all times. Refer to “[Electrical Power](#)” on page 2–29.*

The Encompass 4 Flex Reader System components are contained in a highly reliable, compact, and easy-to-install package. [Figure 1](#) shows the front and back views of an Encompass 4 Flex Reader System. [Figure 2](#) shows a detailed rear access view.



Figure 1 – Encompass 4 Flex reader system front and side views

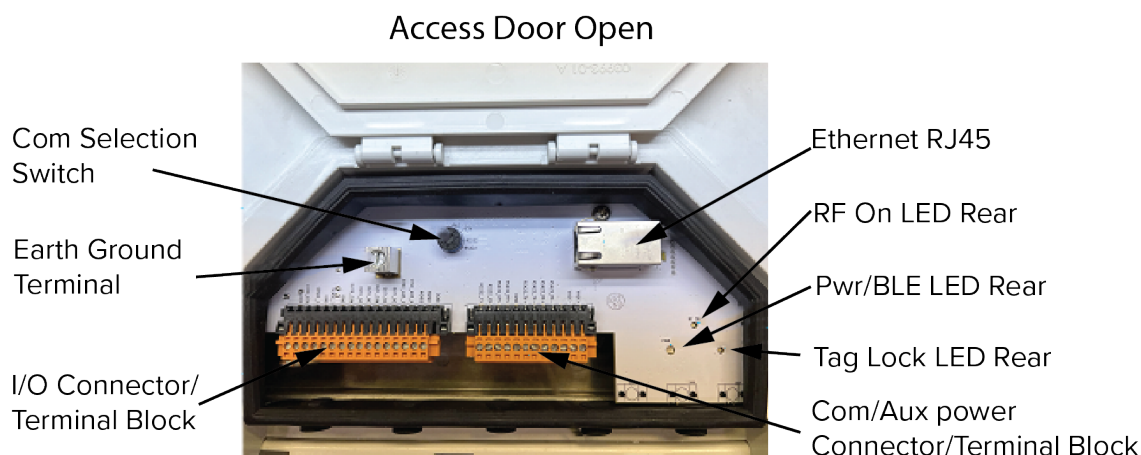


Figure 2 – Detailed rear access view

Note: Refer to “Manual Communication Select Switch (MCSS)” on page 4–63 for information on the function of the COM Selection Switch shown in Figure 2.

Gasket and Cable Gland

The Encompass 4 Flex is equipped with a gasketing and cable gland system designed to maintain water ingress protection while allowing the use of a variety of I/O cables. Cable diameters ranging from .200” to .450” can be accommodated.

Note: Installation of the cable gland and insertion of the cable through the access gasket must be made before the cable is wired to the end connector or terminal block. The access gasket

can easily be removed from the E4 Flex access port for cable and connector installation and then re-installed.

The Encompass 4 Flex access gasket includes five cable access points sized to accommodate the largest diameter cables. In addition, a set of cable glands are included to accommodate smaller cables. A set of four plugs is included for sealing unused access points.

To install a cable:

1. Ensure the input end of the cable is non-terminated.
2. Choose the optimum access point locations to use, considering the number of cables to be used, the end location of the connection points and any cable management needs.
3. Determine whether a cable gland will be needed by testing the fit of the unterminated cable with the chosen access point.
4. To maintain water tightness, the cable should fit snugly through the access point while slightly stretching the surrounding gasketing material. (If the gasket material significantly deforms, the cable is too large to be used with the gasketing system)
5. If the cable slides through the selected access point with no resistance or there is a gap present, a cable gland will be needed.
6. Choose the optimum cable gland using the same criteria as in steps 4 and 5.
7. Install the gland on the cable at roughly the location where it will interface with the gasket and thread the cable through the chosen access point.
8. Once the cable (and gland if used) is through the access point, the end connector can be installed.
9. Once all cables (and glands if required) have been installed through the access gasket and terminated, the gasket/cable assembly can be re-installed onto the E4 Flex access port.
10. Close access port cover and secure by slightly pushing quick turn fasteners down and turning clockwise until a click is felt.

How It Works

The Encompass 4 Flex Reader System transmits an RF wave (i.e. signal) through the integrated antenna towards the area where an RFID tag could be present in the read zone. Once an RFID tag has entered the read zone, the tag adds its programmed identification information to the RF wave and reflects that energy back to the reader. The Encompass 4 Flex Reader receives this modified, or modulated signal, and decodes the tag data carried by the reflected signal and transmits this data to a local host (i.e. controller) through the selected interface for processing.

Licensing Requirements

Users of the Encompass 4 Flex Reader System in the United States must obtain a license from the FCC. In the United States, the authorized modulated frequency band for this product is 911.75 to 919.75 MHz and the authorized continuous wave frequency band is 902.25 to 903.75 MHz and 910.00 to 921.50 MHz.

An FCC license provides the user with the legal authorization to operate the Encompass 4 Flex on the licensed frequencies at the site specified in the license. Only an authorized installer or service technician can set the RF frequency of the Encompass 4 Flex Reader System to the frequency specified in the FCC site license.

The FCC license may provide the user with protection and authorization to maintain the system should any other RFID product be used in the licensed area after the Encompass 4 Flex equipment is installed.

The user is responsible for filing the FCC license application before use. It can take up to two months before the application is granted. The TransCore dealer will provide assistance and support as necessary.

Registration

New users will need to register with the Commission Registration System (CORES). Registration will enable the user to:

- Receive and manage a 10-digit FCC Registration number (FRN)
- View financial status with the FCC and make payments

Online filing is available to submit the application and related technical drawings.

Visit the FCC Universal Licensing System (ULS) webpage at <https://www.fcc.gov/wireless/systems-utilities/universal-licensing-system>.

Application and License

Application and license status can be searched from the ULS home page.

Readers must be installed and in use within a year of the license grant. If the FCC is not notified that the readers are active, the license will be automatically deleted.

An FCC license typically has a 10-year term. Licenses should be renewed 90 days or less before the expiration date.

For further information on obtaining a license from the FCC, contact TransCore technical support.

Note: The FCC continually updates and improves the web interface for online license applications. This information in this section is subject to change.

Chapter 2 Develop the Site Plan

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

Overview

Developing a site plan provides the foundation for the site's system design and establishes the following system configuration parameters:

- Number and general location of primary components
- Number of different radio frequencies required

Gathering relevant site information is crucial before applying for Federal Communications Commission (FCC) approval and ordering and installing Encompass 4 Flex Reader(s) and tags.

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

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

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 4 Flex 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, Inter-Agency Group (IAG) tags, and ISO 18000-63 (EPC/6C).

Note: The Encompass 4 Flex Reader can read ATA or ISO read-only tags in the presence of Intellitag-based tags, however, it is not recommended to read an Intellitag-based 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, Tag, and Antenna Alignment

The position of the Encompass 4 Flex 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 4 Flex Reader, antenna, and tag location and orientation at the site.

Note: If any of the vehicles using the facility already have tags, such as those used in toll

applications, contact TransCore for information about mixed-tag installations before planning tag type, location, and programming.

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

- Polarization of the tag and the Encompass 4 Flex 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 4 Flex 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 4 Flex Reader, as shown in [Figure 3](#).

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

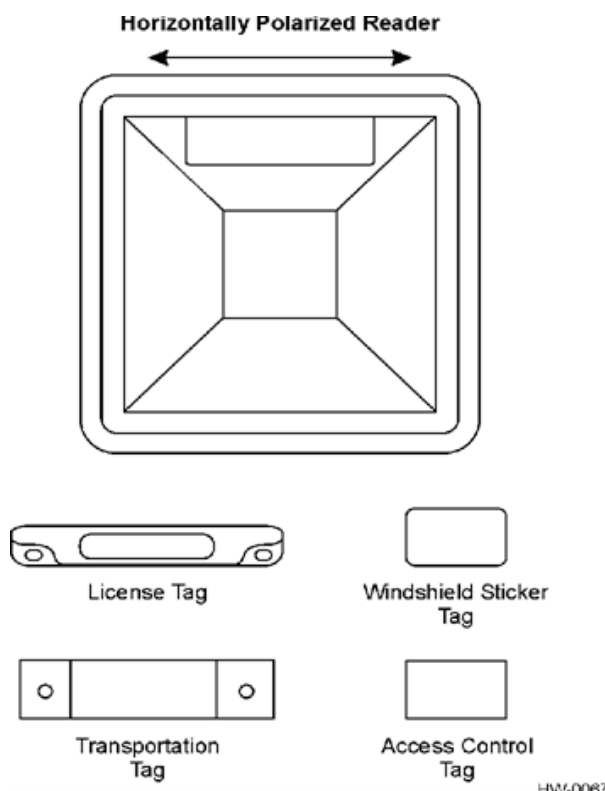


Figure 3 – Tag and reader orientation

Unobstructed Line of Sight

For optimum readability, install the Encompass 4 Flex Reader and the vehicle's tag so that when the vehicle approaches the Encompass 4 Flex Reader, the tag is directly facing the reader and the line of sight is clear between the Encompass 4 Flex Reader and the tag. If a fence or barrier is between the tag and the reader, the Encompass 4 Flex Reader cannot reliably read the tags. [Figure 4](#) illustrates possible installation locations of an Encompass 4 Flex 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.

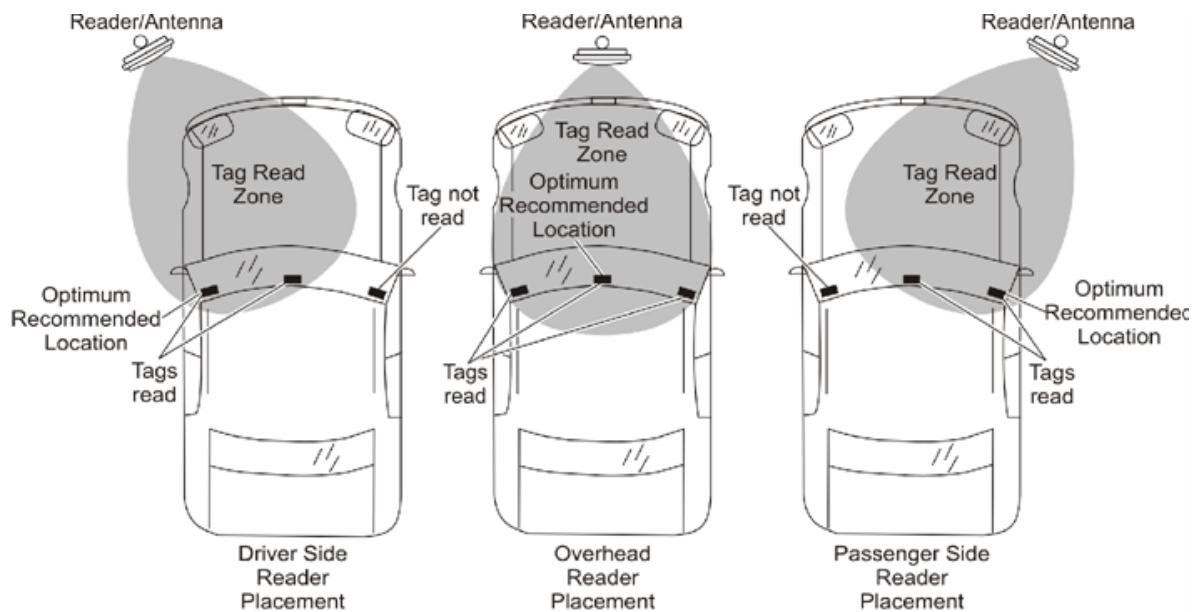


Figure 4 – Encompass 4 Flex Reader location relative to tag position

If the Encompass 4 Flex 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 5](#).

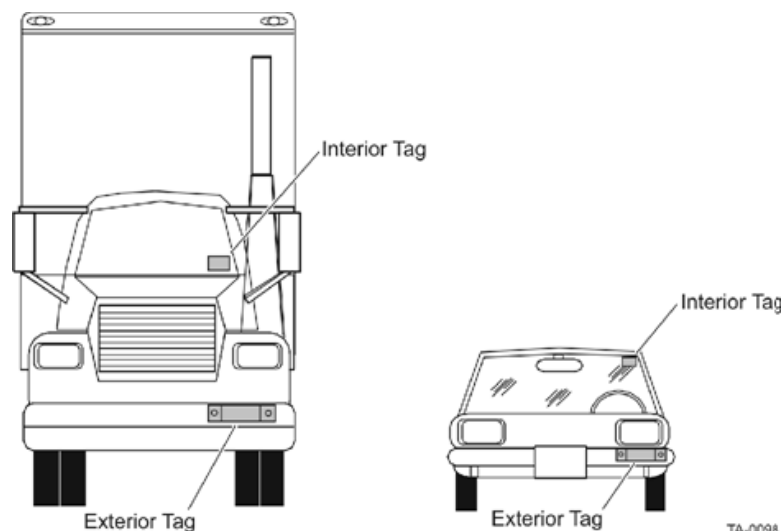


Figure 5 – Typical tag positions for U.S. driver's side reader

If an Encompass 4 Flex 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 6](#).

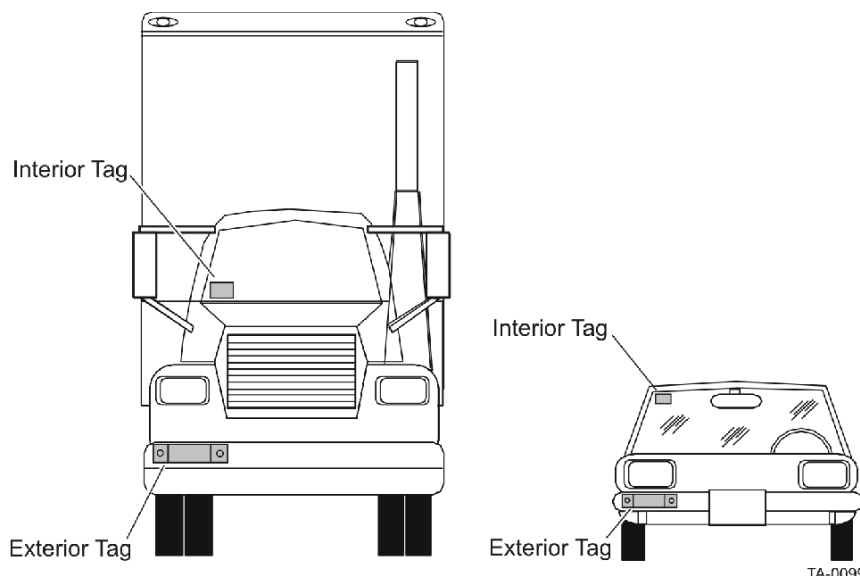


Figure 6 – Typical tag positions for U.S. passenger's side reader

If the Encompass 4 Flex 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 7](#).

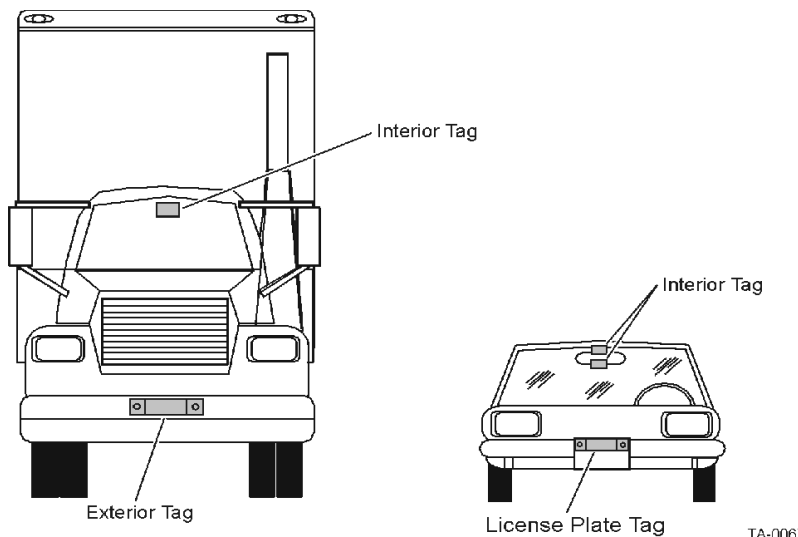


Figure 7 – Typical tag positions used with overhead reader

Note: Metallized coatings on some vehicle windshields and windows shield the RF energy emitted by the Encompass 4 Flex 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 3–35 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 4 Flex Reader installation locations:

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

The Encompass 4 Flex Reader Read Zone

The Encompass 4 Flex 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 4 Flex 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
- Mounting method used (pole or wall mount) of the antenna
- Mounting location (overhead or side mount) of the antenna
- Height from the ground and mounting angle of the antenna
- Indoor or outdoor location
- RF output attenuation
- Range discrimination setting
- Other sources of interference and reflection

The Encompass 4 Flex 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 the antenna becomes misaligned or some 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 8–149.

Other Encompass 4 Flex Readers in the Area

Sites with more than one Encompass 4 Flex Reader in proximity should have them configured with a frequency separation of at least 2 MHz from adjacent readers. If more than one Encompass 4 Flex Reader and antenna is in a side-by-side or multiple lane application, the frequencies should be staggered. Also, Encompass 4 Flex Readers may not operate accurately if they directly face each other or are positioned back-to-back.

Table 1 shows examples of staggered reader frequencies in a site with up to 14 readers.

Table 1 – Examples of staggered reader frequencies

Lane Number	Reader Frequency	Lane Number	Reader Frequency
1	912.5	2	915
3	917.5	4	913.5
5	916	6	918.5
7	914.5	8	917
9	913	10	915.5
11	918	12	914
13	916.5	14	919

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 4 Flex Reader. The following subsections describe some common lane configurations and offer suggestions for positioning the Encompass 4 Flex Reader within the controlled traffic flow.

Gate with Center Island Configuration

Figure 8 illustrates a typical gate application with the Encompass 4 Flex 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.

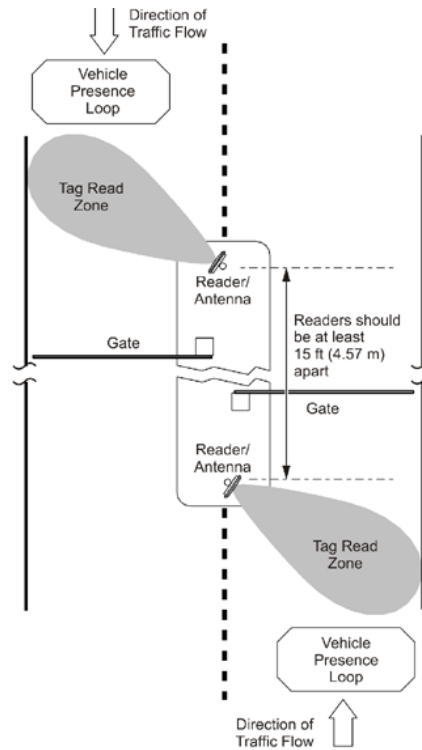


Figure 8 – Gate application with center island

Parking Garage with Ticket Island Configuration

Figure 9 illustrates a parking garage application with each Encompass 4 Flex Reader mounted on the ticket island to read tags mounted on the inside center windshield or on the center front vehicle bumper. The Encompass 4 Flex Reader placement may require the vehicle to stop before the gate opens.

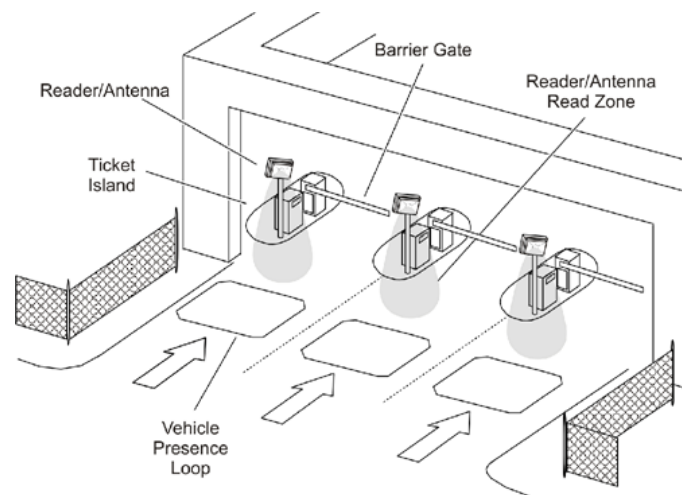


Figure 9 – Parking garage application

Overhead Reader Installation Configuration

Another option for Encompass 4 Flex Reader placement is to mount it overhead in each lane as illustrated in [Figure 10](#). This illustration assumes that tags are mounted on the inside center windshield or center bumper of the vehicle.

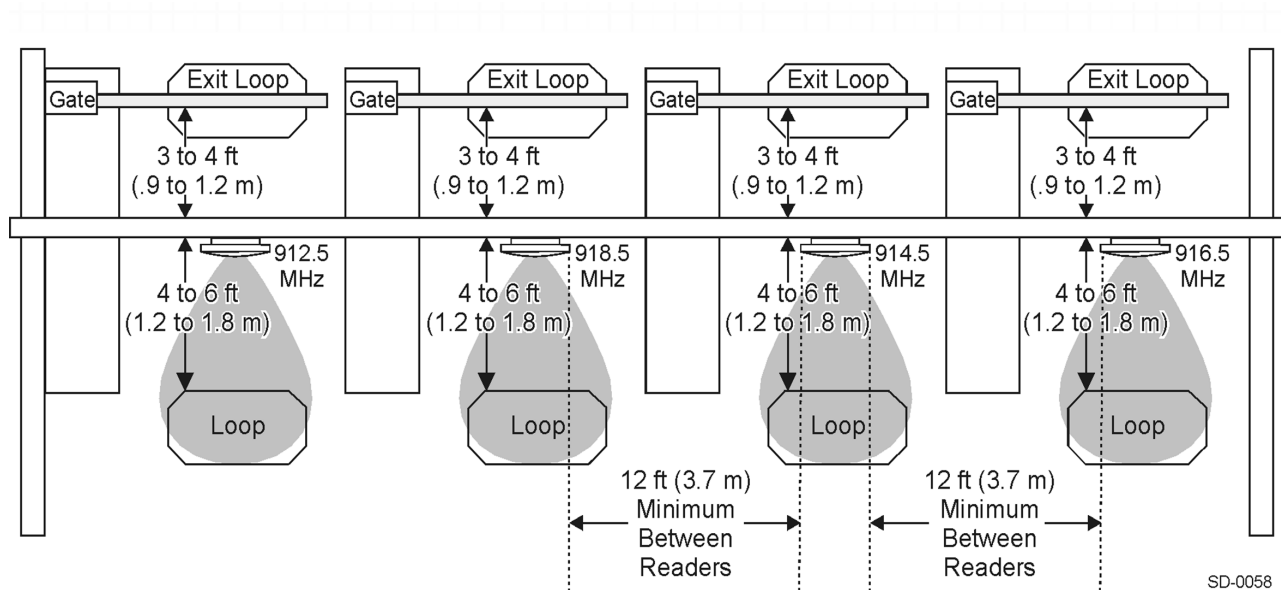


Figure 10 – Overhead installation

Lane Configurations Using an External Antenna

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

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 the site plan, consider permanent structures and transient factors in the vicinity that may affect RF signals being generated by the Encompass 4 Flex Reader. Permanent structures include buildings, chain link fences, guard sheds, 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 4 Flex 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 9–152](#) for more information.

Existing Signal Interference at the Site

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 4 Flex Reader and/or antenna. In some cases, changing the operating frequency of the Encompass 4 Flex Reader may provide a simple solution. Readers in proximity should have at least a 2 MHz frequency separation. Refer to [“Other Encompass 4 Flex Readers in the Area” on page 2–26](#). 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 9–152](#) for more information.

Electrical and Communications Requirements

All construction work at the site must be completed before installing the Encompass 4 Flex 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 4 Flex Reader are discussed in [“Mounting the Encompass 4 Flex Reader” on page 4–55](#).

Junction Box

If a junction box is required for the installation, 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 Wiring

Cable length for power and communications depends on the physical characteristics of the Encompass 4 Flex Reader installation site.

Electrical Power

Power Over Ethernet (POE)

The Encompass 4 Flex Reader can be powered by two methods. The first is through the Ethernet data cable via Power Over Ethernet (POE). Refer to [Figure 11](#). The Encompass 4 Flex has been designed to IEEE 802.3bt using a POE supply (i.e. POE capable switch or POE injector with at least a Type 3 Class 5 rating). With a POE supply the power current is kept separate from the data source. The supply power enters the Ethernet cable via the POE switch or injector and is delivered to the Encompass 4 Flex by the Ethernet port on the reader. A 4-pair Cat 5 or better cable with a length no longer than 328 feet (100 meters) needs to be used to power the reader.

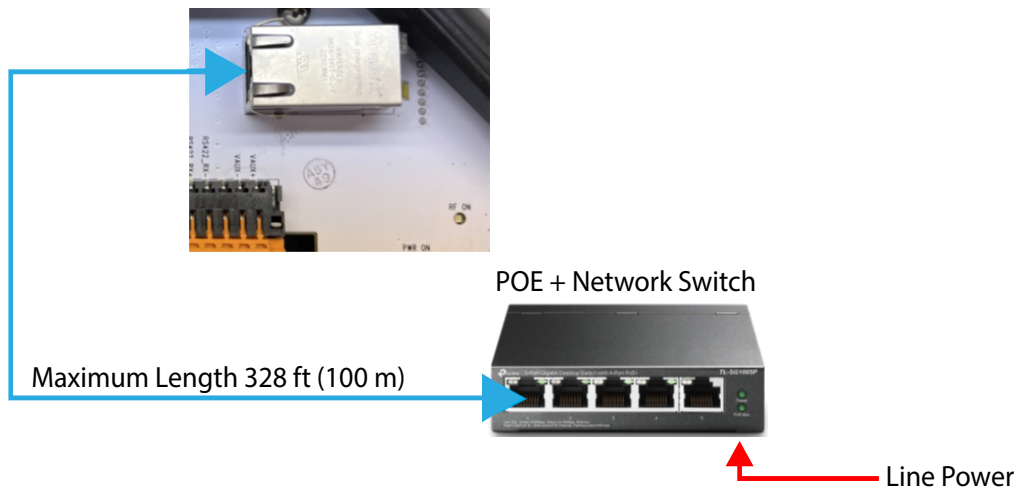


Figure 11 – Power over Ethernet (POE)

Auxiliary Power

The secondary way the Encompass 4 Flex can be powered is through the auxiliary power input (Figure 12). Note that if the auxiliary power input is used the POE input is disabled. The auxiliary 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 local and national electrical codes for installation and safety requirements.

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

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. It is the installer's responsibility to supply conversion equipment and wiring for other voltages.

Table 2 contains power supply current requirements.

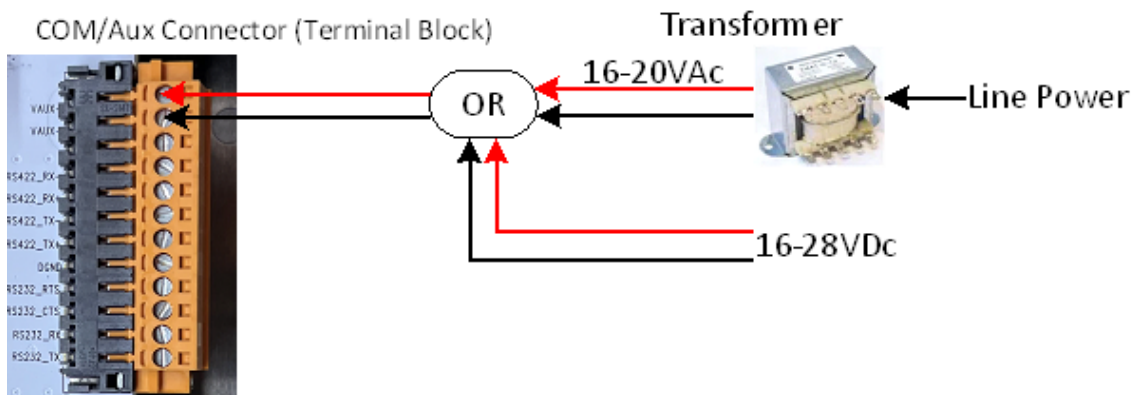


Figure 12 – Auxiliary power

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. Use [Table 3](#) to determine the correct wire 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 4 Flex 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 maximum wire length (in feet) from transformer to reader

Wire Size (AWG)	24	22	20	18	16	14	12
Maximum DCR (Ohms per foot at 68°F)	0.027	0.0175	0.0109	0.0069	0.0044	0.0027	0.0017
Min DC Voltage (16Vdc)	7	11	18	29	45	74	117
Max DC Voltage (20Vdc)	9	14	23	36	56	92	146
Min AC Voltage (16Vac rms)	7	11	18	29	45	74	117
Max AC Voltage (24Vac rms)	11	17	27	43	68	110	175

Host Communications

The site design must include communications between the Encompass 4 Flex Reader and a host computer/system. The Encompass 4 Flex Reader can communicate with various standard interfaces (RS-232, RS-422, Ethernet, and Wiegand). The host computer/systems 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 (with RTS & CTS)	3 (5)
RS-422	5
Ethernet	8
Wiegand	3

Note: Refer to “Figure 54 – Manual communication select switch diagram” on page 4–64.

RS-232 Interface

At 9600 baud, the maximum cabling length between the host computer system and the E4 Flex is 50 feet. If the cabling length must be greater than 50 feet, avoid the RS-232 interface and use RS-422 or Ethernet instead.

Note: When wiring the RS-232 interface, a low capacitance type cable should be used (such as Belden 9832). TransCore recommends using one pair each for the Transmit, Receiver, CTS, RTS, and ground signals (Figure 13), where one part of the pair is use for the signal and the other is reference to ground. The cable shield should be tied to a single-point earth ground on the computer/systems end of the cable.

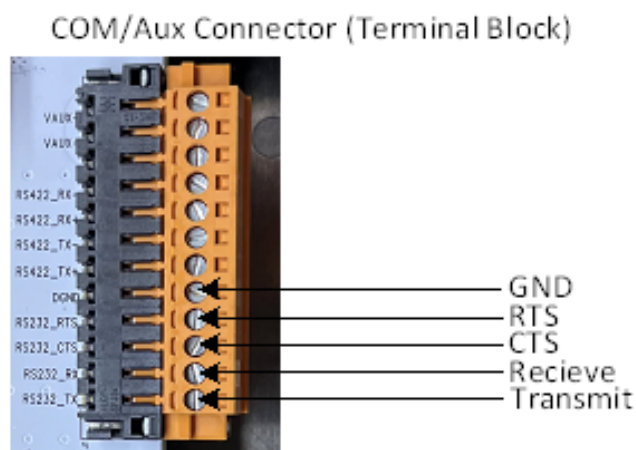


Figure 13 – Com/Aux connector terminal block

RS-422 Interface

The standard RS-422 connection maximum distance depends on the baud rate, cable type, and the RS – 422 device at the other end. If the connection distance is more than 50 feet from the Encompass 4 Flex reader to the PC, TransCore recommends using RS-422 rather than RS-232.

Note: When wiring the RS-422 interface, a low capacitance type cable should be used (such as Belden 9832). The cable shield should be tied to a single-point earth ground on the computer/systems end of the cable (Figure 14).

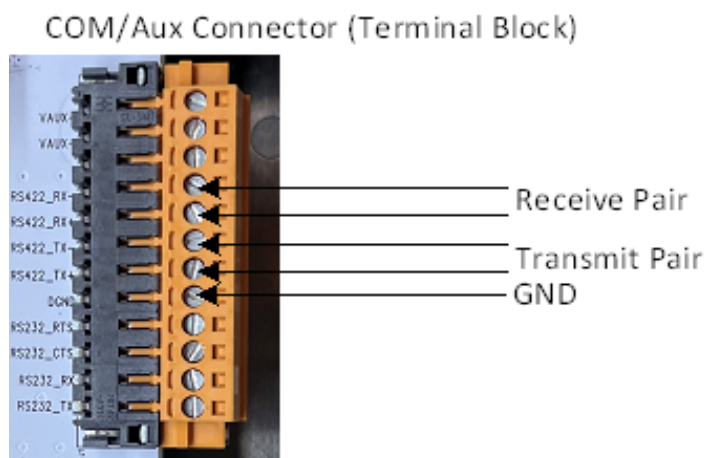


Figure 14 – Wiring the RS-422 interface

Ethernet Interface

When using the Ethernet interface the host computer should be no more than 328 ft (100 meters) from the Encompass 4 Flex Reader - the cabling length must be no more than 100m.

Note: A 4-pair Cat 5 or better cable with a length no longer than 328 feet (100 meters) should be used to be used for communications and if needed to power the reader. The cable should be terminated with an RJ45 at the reader (Figure 15).

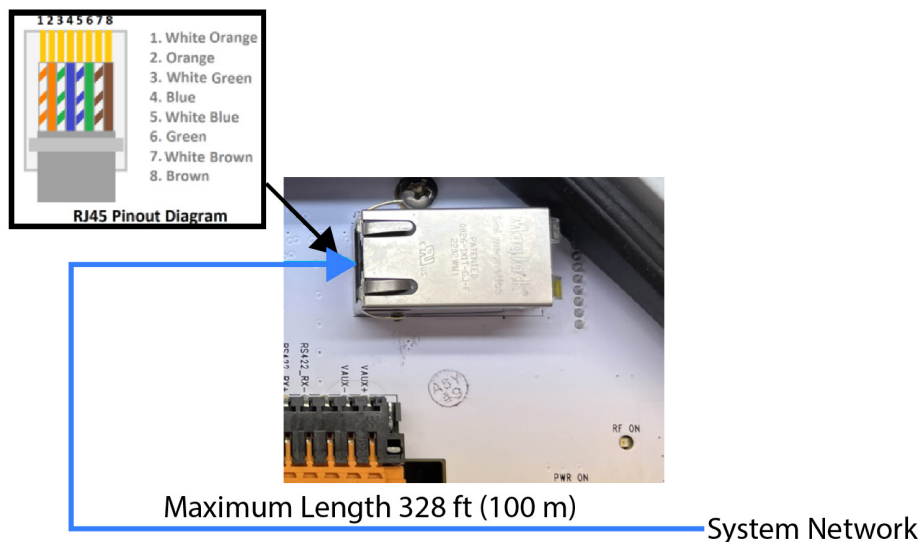


Figure 15 – Ethernet interface

Wiegand Interface

The Encompass 4 Flex Reader can interface with equipment requiring a Wiegand interface (Figure 16).

I/O Connector (Terminal Block)

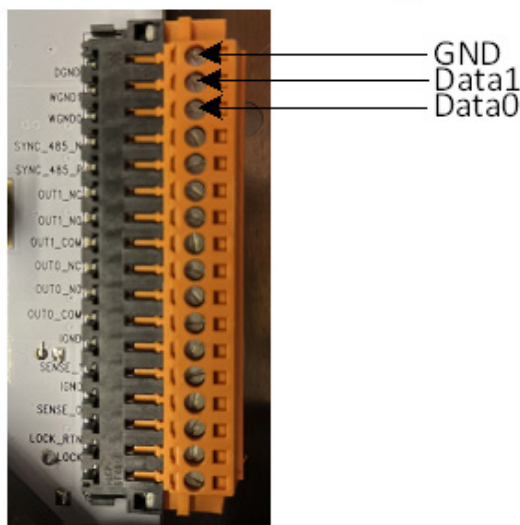


Figure 16 – Wiegand interface

Note: To get Wiegand data from the Encompass 4 Flex Reader it will need to be configured (i.e. enabled) by using one of the communication interfaces (RS–232, RS–422, Ethernet or BLE). Also tags must also be properly programmed with Wiegand-formatted data when using the Wiegand mode of operation.

When connecting the Wiegand interface to the reader, it is suggested to use a 3-pair cable such as Belden 82502. Use one of the twisted pairs for Data1 and the other for Data0. With one part of the pair for the signal (Data1/Data0) and the other for a ground. The cable shield should be tied to a single-point earth ground on the controller (i.e. system) side of the cable.

Input/Output Circuits

To connect the Encompass 4 Flex Reader to external equipment such as a treadle or traffic control light, install wires from these devices at the junction box. The Encompass 4 Flex Reader input circuit is designed to connect to a dry contact closure. The Encompass 4 Flex 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 4 Flex 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® 4 Flex Reader and the procedures for installing and removing compatible internal and external tags.

Compatible Tag Types

The Encompass 4 Flex Reader can read eGo, eGo Plus, ATA-protocol, ISO-compliant tags, Inter-Agency (IAG), and ISO 18000-63 (EPC/6C) 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 D Compatible Tag Information” on page D–178](#) 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 D Compatible Tag Information” on page D–178](#) 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. Products containing button or coin cell batteries are subject to Reese’s Law, a US federal law enacted in 2022 which mandates federal safety requirements. Refer to [Figure 17](#).

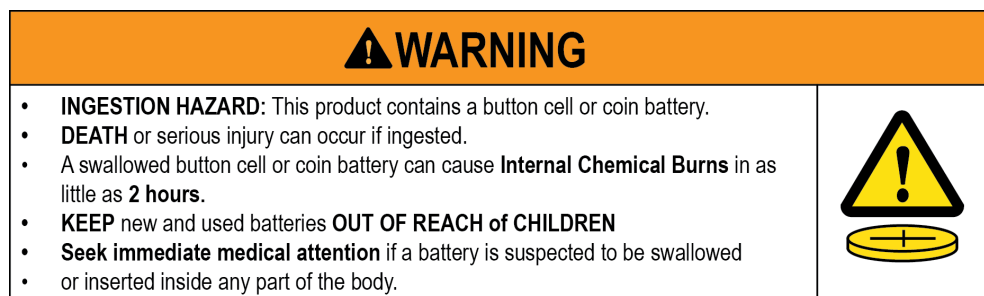


Figure 17 – Coin cell battery warning

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

- The tag must be correctly and permanently installed on the windshield before driving through the toll plaza. Do not attach the tag to the vehicle visor or other temporary location.
- Do not wave the tag or hold it on the inside or outside of the vehicle when approaching the toll plaza.
- If the vehicle has a metalized windshield, the tag should be mounted in the section that is not metalized, usually near the rear-view mirror. Review the vehicle user manual or contact the dealership or manufacturer to identify the location of the non-metalized area.

Choose a location for the windshield sticker tag

Determine where to position the windshield sticker tag. [Figure 18](#) shows the zone where the tag should be located for optimal performance. Tags should be mounted with the long edge oriented horizontally as shown in [Figure 18](#).

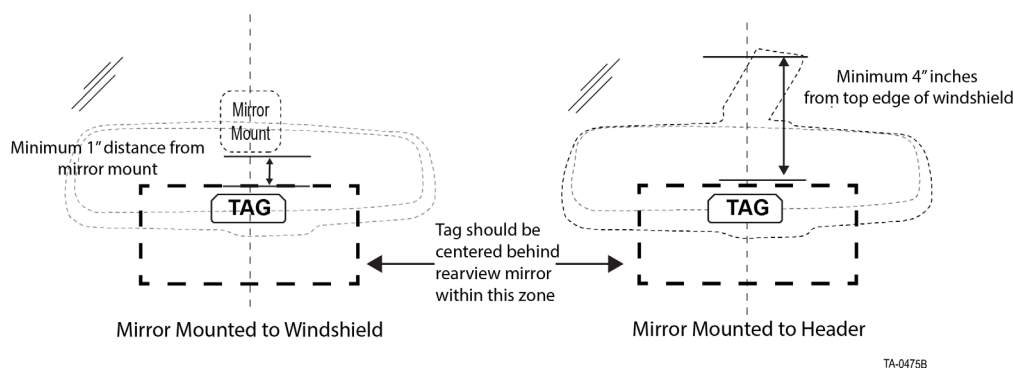


Figure 18 – Windshield sticker tag location for optimal performance

Mirror mounted to windshield

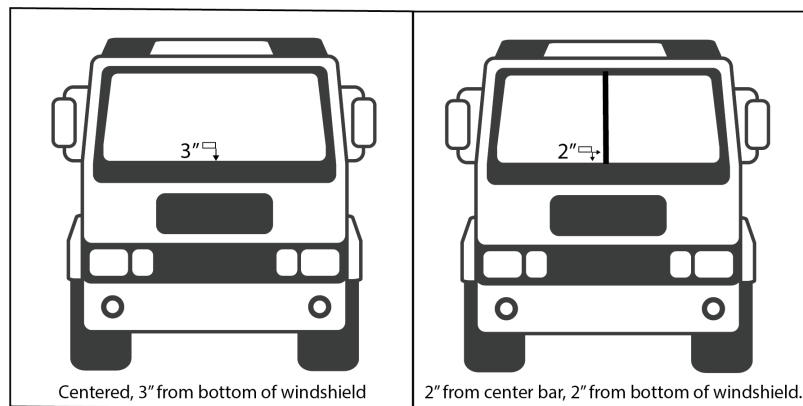
Locate the tag approximately 1" below the rear view mirror mount and center tag on the windshield behind the rear view mirror.

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.

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 19](#)).



TA-0472

Figure 19 – Tag location for large trucks

Install the windshield sticker tag

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

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



Figure 20 – Location of release tab

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 20).
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 21).
5. The tag is installed and ready for use.



Figure 21 – Rub tag to bond adhesive to windshield

Removing the windshield sticker tag

Note: The windshield sticker tag cannot be reused after it is removed from the windshield.

To remove the tag from the 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

- The tag must be correctly and permanently installed on the windshield before driving through the toll plaza. Do not attach the tag to the vehicle visor or other temporary location.
- Do not wave the tag or hold it on the inside or outside of the vehicle when approaching the toll plaza.
- If the vehicle has a metalized windshield, the tag should be mounted in the section that is not metalized, usually near the rear-view mirror. Review the vehicle user manual or contact the dealership or manufacturer to identify the location of the non-metalized area.

Choose a location for the tag

Determine the appropriate location for the hard case tag (Figure 22). The tag should be mounted on the interior windshield, approximately 1 inch (2.54 cm) below the rear-view mirror post.

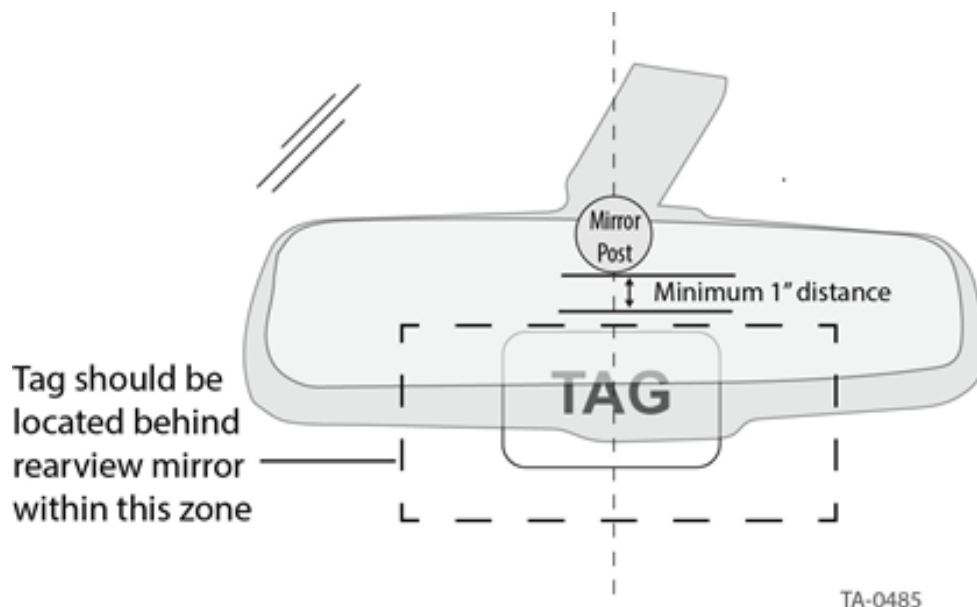


Figure 22 – Hardcase tag location for optimal performance

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 23](#).



Figure 23 – 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 23](#).
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 23](#).
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 constructed 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 24](#)).

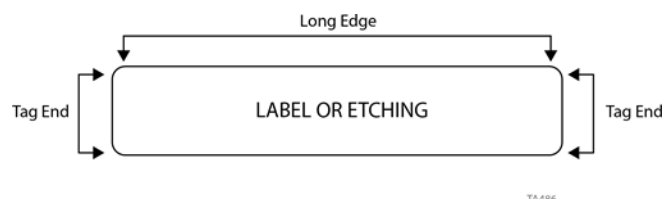


Figure 24 – Correct tag orientation for an exterior-mounted tag

eGo Plus License Plate Tag

The eGo Plus License Plate Tag (LPT) should be installed on the front of the 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 the vehicle is not perpendicular to the ground or is partially obstructed by an overhanging bumper, mount the tag at an alternate location in the vicinity of the license plate.

Note: *If the vehicle does not have a front license plate area or if an alternate location is needed, contact the tag agency for further options.*

Required supplies

- eGo Plus License Plate Tag
- Screwdriver (flat-blade or Phillips depending on the 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 the front bumper. If the vehicle does not have mounting screws use two self-tapping threaded screws or contact the tag agency to inquire about the optional tamper resistant mounting kit (OA 54-7008-000).
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 25](#). If the vehicle's license plate mounting area is more than 18 inches (46 cm) from the center, an alternate mounting location may be needed. Refer to [“Alternate Mounting Methods”](#) on page 3–44.

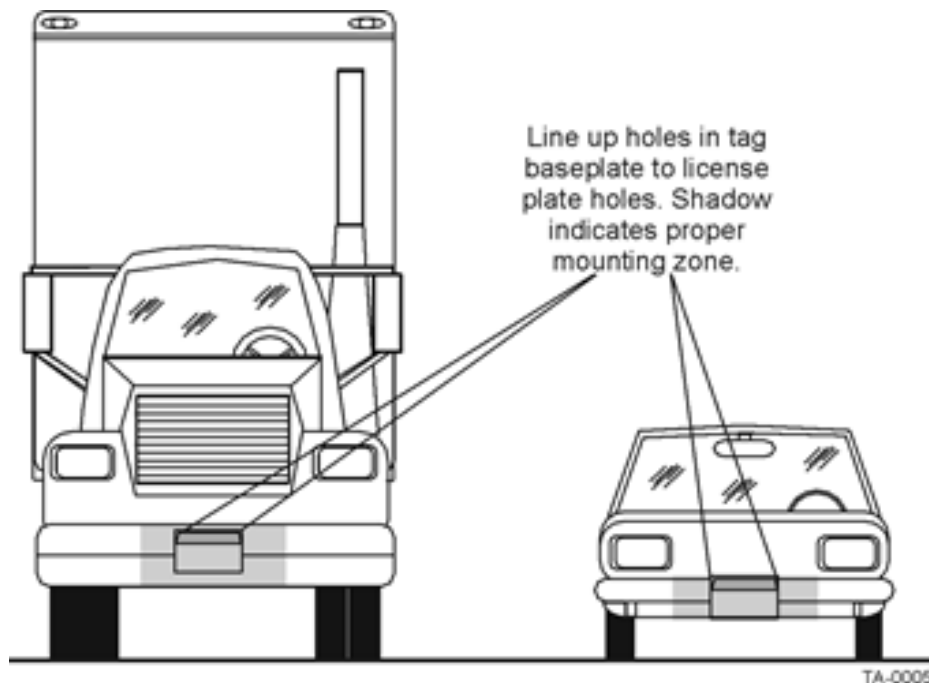


Figure 25 – Mounting locations for the license plate tag

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 26](#).

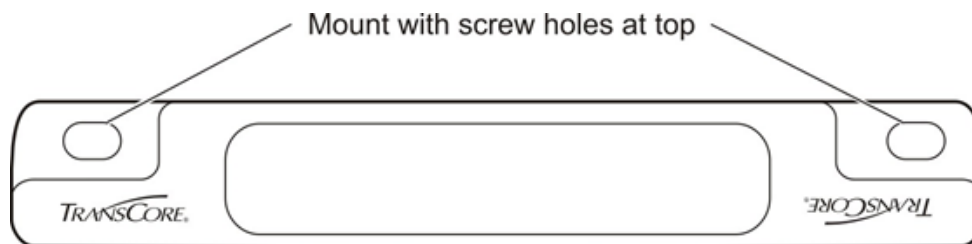


Figure 26 – Correct tag orientation

4. Fasten the LPT to the bumper using the license plate mounting screws ([Figure 27](#)). Install the LPT over the top area of the vehicle's license plate if the 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: Longer screws may be used to fasten the LPT over the top area of the license plate.

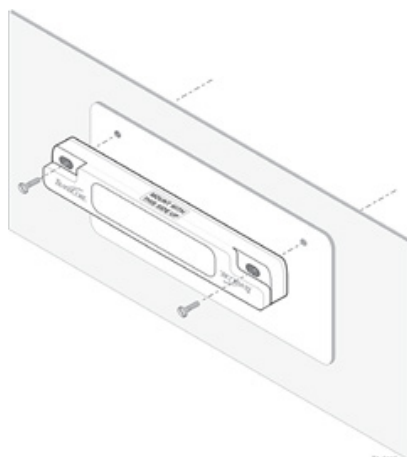


Figure 27 – Upper placement over the top area of the license plate

Tag Placement Guidelines

1. The area within 45 degrees of the center of the tag should be free of obstructions ([Figure 28](#)).

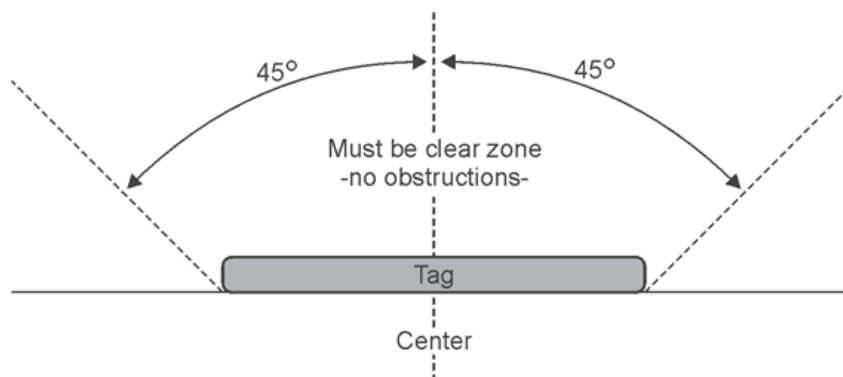


Figure 28 – Obstruction free area (overhead view)

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 29).
3. Tighten the bolts and nuts with a screwdriver and wrench to secure the tag to the vehicle.

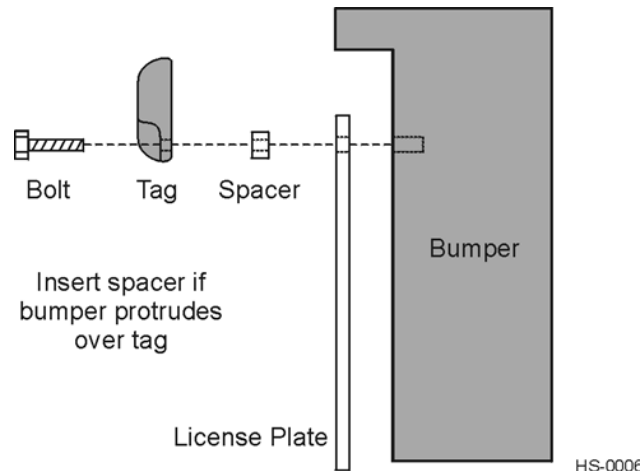


Figure 29 – Spacer positioned behind tag

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

Use 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 30](#) for correct tag placement.



Figure 30 – 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 a location for the tag is identified, 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 31](#).

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.

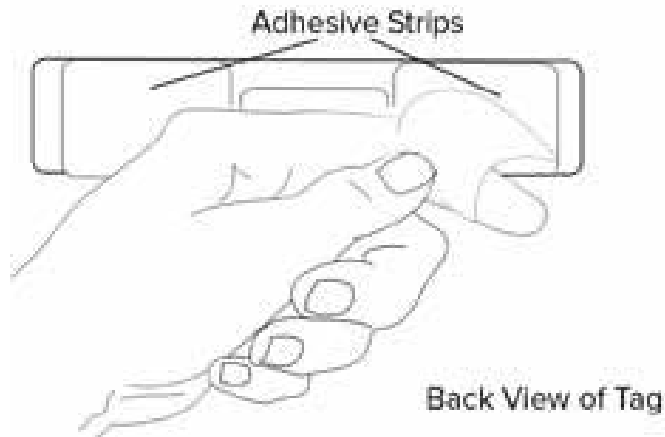


Figure 31 – Removing adhesive strip backing

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 4 Flex Reader

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

Installation Process

After the site plan is developed and the location is identified for the Encompass 4 Flex Reader. Installation involves the following tasks:

- Pre-installation testing of Encompass 4 Flex Reader
- Mounting the Encompass 4 Flex Reader
- Connecting the Power Supply
- Connecting Communications
- Connecting Sense Input and Sense Output Circuits
- Marking the Read Zone

Materials Supplied by TransCore

The following materials are needed to pre-test and install the Encompass 4 Flex Reader. TransCore supplies some of the materials; other materials must be obtained from other sources.

Contents of Shipping Carton

Ensure that all parts are received before beginning the pre-installation Encompass 4 Flex Reader tests. The Encompass 4 Flex Reader is packaged with the following materials:

- One Encompass 4 Flex Reader
- One mounting bracket and the mounting hardware
- One Encompass 4 Flex Reader Quick Start Guide
- Any accessories listed in [Table 5 that are](#) ordered as options

Required accessories

These items may be ordered from TransCore or obtained from other sources:

- Power & communications wiring
- 110V AC wall transformer or a 12V AC to 18V AC step-up transformer or a POE supply if using POE for power

Installation Accessory Options

[Table 5](#) lists optional TransCore Encompass 4 Flex Reader installation accessory items.

Table 5 – Installation accessories

Part No.	Description
76-1620-005	110V AC to 18V AC Class C transformer
76-1620-006	12V AC to 18V AC step-up transformer
16-0195-001	Encompass 4 Flex Reader System Guide (this manual)

Additional Materials Needed for Testing

These additional materials are needed to perform the pre-tests on the Encompass 4 Flex Reader:

- Test tags, supplied by the TransCore dealer or distributor
- If using the auxiliary power, input a suitable 18V AC or 18V DC power
- If using POE, a POE capable switch or POE injector with at least a Type 3 Class 5 rating
- BLE application loaded on a suitable device or an audible circuit tester and 9V DC battery for circuit tester power
- Wire stripper
- Small flat-bladed screwdriver for connector/terminal block wiring

Pre-installation Testing of the Encompass 4 Flex Reader

Before installing the Encompass 4 Flex Reader permanently at the site, the installer should follow one of two methods for setting up the tag read zone. The first method is to use the BLE app and set up for sound. The second method is to use an audible circuit tester or buzzer. Refer to [“Appendix F BLE Configuration Through Direct Communication Port Commands”](#) on page F-184

Using the BLE App buzzer function

Note: *iPhone application is shown in these examples.*

1. Open the BLE application ([Figure 32](#)).

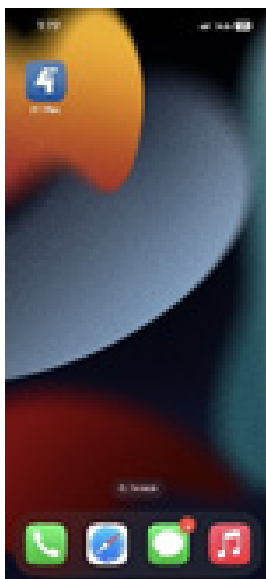


Figure 32 – BLE application

2. Once the application is open, scan for the desired E4 Flex reader and select it. In the example shown in [Figure 33](#), there is only one reader listed.

Note: the power LED should turn from RED to BLUE.



Figure 33 – Select reader

3. The application will open the control page ([Figure 34](#)). On the control page tap the TL (i.e. Tag Lock) indicator.
4. The phone will act as a buzzer box.

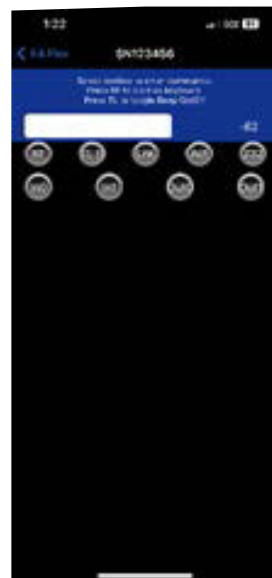


Figure 34 – Control page

Using an Audible Circuit Tester (Buzzer)

An audible circuit tester is also called a buzzer or buzz box. These boxes are available at some electronic parts supply stores, or you can make a buzz box, as shown in [Figure 35](#). The buzz box is powered by a 9V DC battery and is wired to the I/O Connector (Terminal Block).

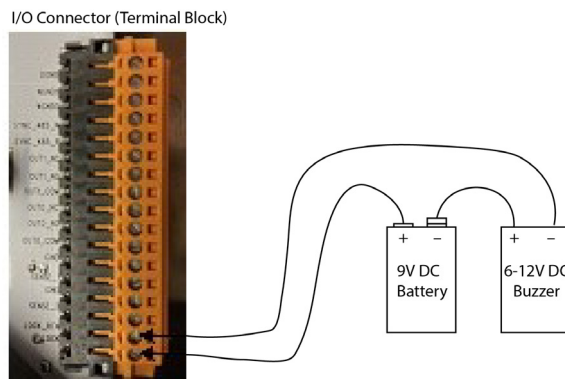


Figure 35 – Wiring for audible circuit tester (buzzer)

Connecting the Encompass 4 Flex reader to Power

The Encompass 4 Flex is capable of being powered by POE or by the auxiliary power input.

Using the POE power input

POE power is supplied through the Ethernet connection (RJ45). For the power supply, use a POE capable switch or POE injector with at least a Type 3 Class 5 rating. A single 4-pair, Cat 5 or better cable is all that is needed to power the reader. The cable must be no longer than 328 feet (100 meters).

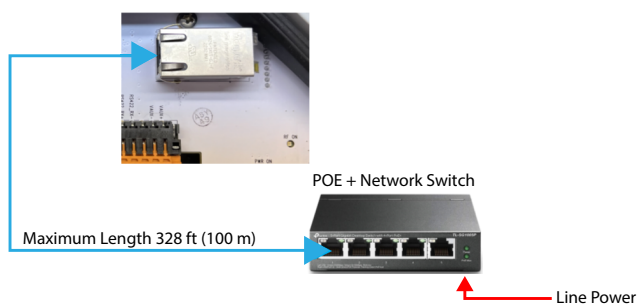


Figure 36 – POE with network switch

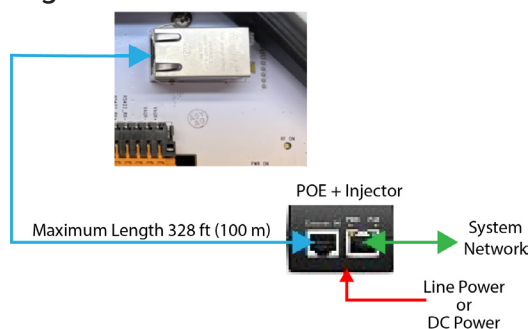


Figure 37 – POE with injector

Using the Auxiliary input

The Encompass 4 Flex can be powered through the auxiliary power input (Figure 38).

Note: if the auxiliary power input is used the POE input is disabled.

The auxiliary 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 local and national electrical codes for installation and safety requirements.

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

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. It is the installer's responsibility to supply conversion equipment and wiring for other voltages.

Table 6 contains power supply current requirements.

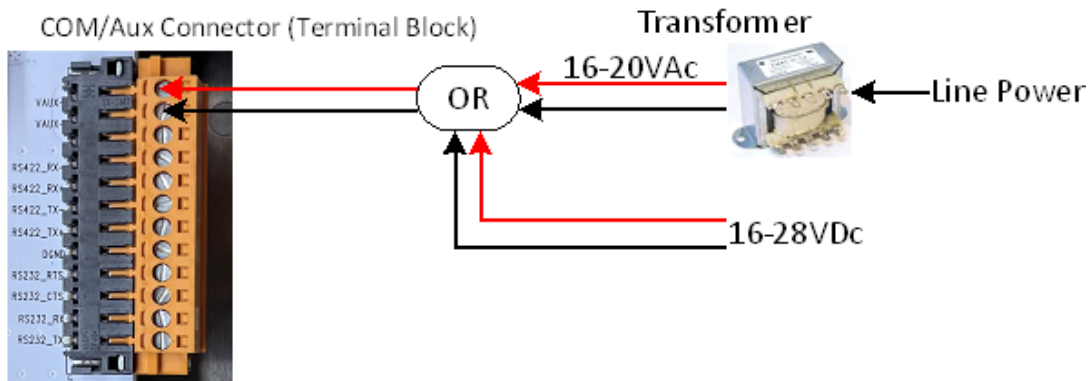


Figure 38 – Auxiliary input

Table 6 – 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 20VAc	20 watts (W)	14 W
16 to 28VDc	20 W	14 W

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

Power circuits are protected internally against power surges. Use Table 7 to determine the correct wire 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 4 Flex 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 7 – Recommended maximum wire length (in feet) from transformer to reader

Wire Size (AWG)	24	22	20	18	16	14	12
Maximum DCR (Ohms per foot at 68°F)	0.027	0.0175	0.0109	0.0069	0.0044	0.0027	0.0017
Min DC Voltage (16Vdc)	7	11	18	29	45	74	117
Max DC Voltage (20Vdc)	9	14	23	36	56	92	146
Min AC Voltage (16Vac rms)	7	11	18	29	45	74	117
Max AC Voltage (24Vac rms)	11	17	27	43	68	110	175

Connecting Communications for Bench Testing

The E4 Flex reader supports communications through RS–232, RS–422, Ethernet, and Wiegand protocols. This section describes the procedures and materials required for connecting the communications to perform pre-installation bench level testing of the Encompass 4 Flex Reader.

Required Materials

The following materials are needed to connect communications to the reader:

- PC or laptop
- Any terminal emulation program running on a PC
- Communications cable to connect to the PC to the E4 Flex
- Wires to connect comm cable to the terminal block on the E4 Flex

The following sections contain specific instructions for connecting RS–232, RS–422, Ethernet communications between the reader and the PC for bench testing purposes. Each section contains wiring instructions and pin assignments followed by step-by-step connection procedures.

Connecting for Bench Testing with RS–232 Interface

RS–232 interface signals are supplied by three (Tx/Rx/Gnd) or five wires (Tx/Rx/CTS/RTS/Gnd) from the reader.

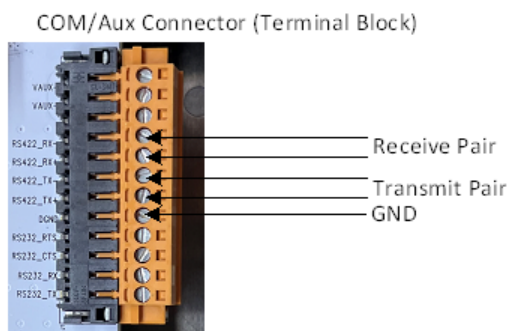


Figure 39 – RS–232 interface

The pin assignments for the signal to the host male DB9 connector is shown in boldface in [Figure 40](#).

Note: Supported pin assignments are in boldface.

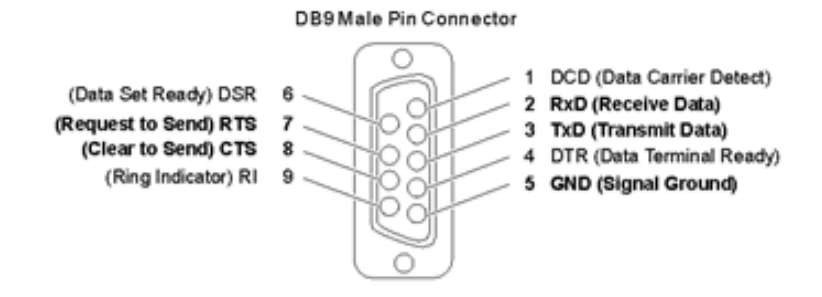


Figure 40 – Pin assignments for signal to host connectors

Note: When wiring the RS–232 interface, a low capacitance type cable should be used (such as Belden 9832). It is also recommended to use one pair each for the Transmit, Receiver, CTS, RTS, and ground signals, where one part of the pair is used for the signal and the other is reference to ground. The cable shield should be tied to a single-point earth ground on the computer/systems end of the cable.

Connecting for Bench Testing with RS–422 Interface

RS–422 interface signals are supplied by four wires (plus a ground for reference) from the reader. The PC/laptop must have an RS–422 interface, or an RS–422 to RS–232 converter will be required (Figure 41).

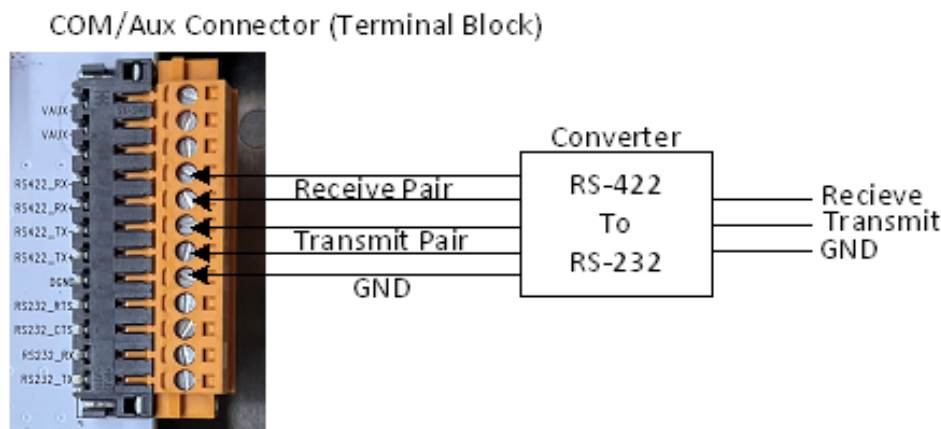


Figure 41 – RS–422 interface

Note: When wiring the RS–422 interface, a low capacitance type cable should be used (such as Belden 9832). The cable shield should be tied to a single-point earth ground on the computer/systems end of the cable.

Bench Testing the Encompass 4 Flex Reader Before Installation

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

Note: Test tags should match the protocol(s) selected for the 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 Encompass 4 Flex Reader has power and can read a tag presented in the read zone.

1. Confirm that the Encompass 4 Flex Reader is correctly connected to a suitable power supply as discussed on [“Connecting the Power Supply” on page 4–62](#).
2. Confirm that the Encompass 4 Flex Reader colored-wire pair cable communications are connected correctly as described in the section [“Connecting Communications for Bench Testing” on page 4–52](#).
3. There are two methods to get buzzer for audio feedback.
 - a. Set up BLE application as in the section [“Using the BLE App buzzer function”](#) for buzzer function.
 - b. Connect the two leads from the audible circuit tester to the reader as in section [“Using an Audible Circuit Tester \(Buzzer\)”](#)
4. Start the terminal emulation application.
5. Set the properties in the terminal emulation application as follows:
 - a. Bits per second: 9600 baud
 - b. Data bits: 8
 - c. Parity: none
 - d. Stop bits: 1
 - e. Flow control: none
6. Cycle the power on the Encompass 4 Flex 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 4 Flex Reader to command mode
#647XXX	#Done <CR/LF>	Sets frequency
#6401	#Done <CR/LF>	Turns on RF
#00 <CR>	#Done <CR/LF>	Returns Encompass 4 Flex Reader to data mode

8. Pass the correct test tag for the reader application in front of the Encompass 4 Flex 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 a compatible tag is used. Repeat steps 6 and 7. If no tone sounds, contact TransCore Technical Support.
9. Disconnect the circuit tester from the Encompass 4 Flex Reader power/communications cable.
10. Disconnect the power and communications connections made for pre-installation testing.

Note: The audible circuit tester will be needed again to determine the read zone when installing the Encompass 4 Flex Reader at the site.

Mounting the Encompass 4 Flex Reader

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

In permanent installations using an antenna, the Encompass 4 Flex Reader should be positioned as close as possible to the antenna. Long cable runs increase system sensitivity to noise. Refer to [Table 3 on page 2–31](#) for maximum RF cable lengths.

The Encompass 4 Flex 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 42](#)).

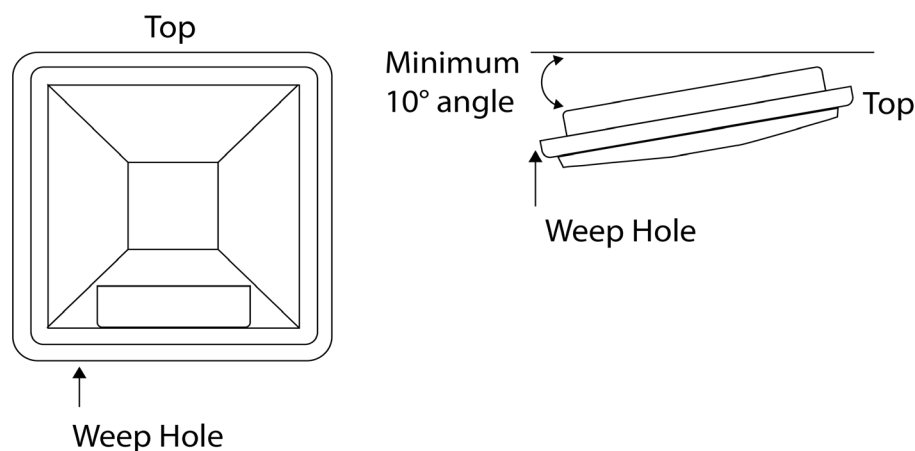


Figure 42 – Correct orientation of reader

Mounting the Encompass 4 Flex Reader on a Round Pole

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

Required Materials To Be Supplied by Customer

The following materials are needed to mount the Encompass 4 Flex Reader on a round pole:

- A 5/32-in Allen wrench to assemble and adjust the mounting brackets
- Two 0.5-in (1.3-cm) wide, stainless steel hose clamp straps that are 12-in (30.5-cm) long for a typical 2-in (5-cm) diameter pole or 24-in (61-cm) long for a 10-in (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 Encompass 4 Flex Reader to a pole

1. Unpack the Encompass 4 Flex Reader. A factory-mounted bracket (Figure 43 and Figure 44) is attached to the back of the Encompass 4 Flex Reader.

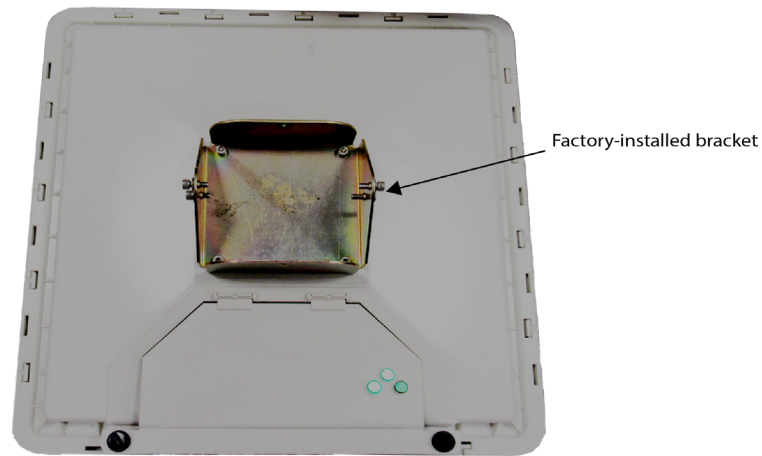


Figure 43 – Back of the Encompass 4 Flex Reader

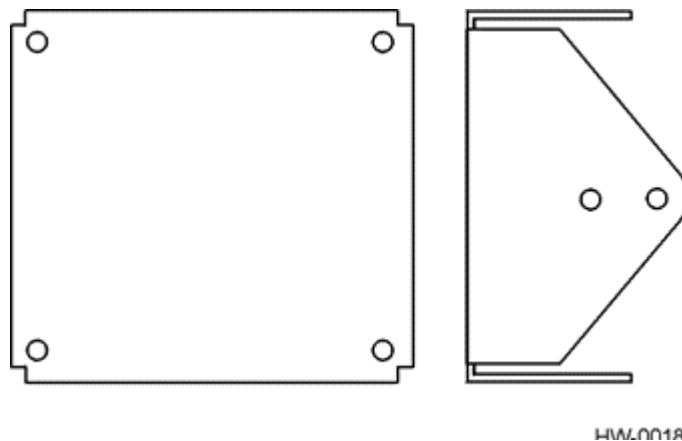


Figure 44 – Factory mounted bracket

- A pole mount bracket assembly (Figure 45) is bubble-wrapped separately and contains a plastic bag with four Allen screws and washers.

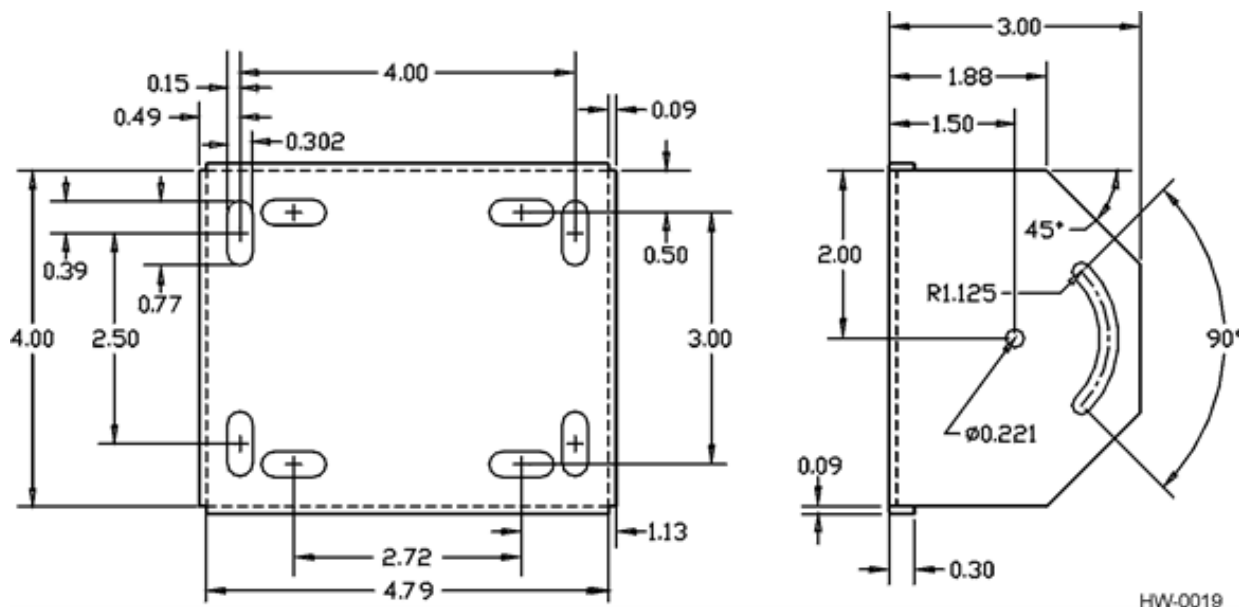


Figure 45 – Pole-mount bracket assembly

- Using the two 0.5 in (1.3 cm) stainless steel hose clamps, attach the pole mount bracket assembly to the pole approximately 8 ft (2.4 m) above the pavement surface. Tighten slightly to adjust the Encompass 4 Flex Reader left or right, but not so slightly the straps slide down the pole.
- Using the four Allen screws and washers, attach the Encompass 4 Flex Reader to the pole mount bracket as shown in Figure 46. Tighten the screws slightly so that the Encompass 4 Flex Reader can be adjusted up or down, but not so slightly that the mounting assembly slips.

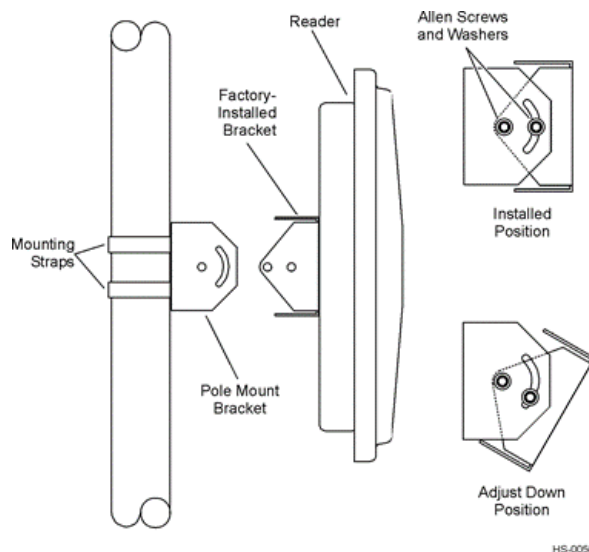


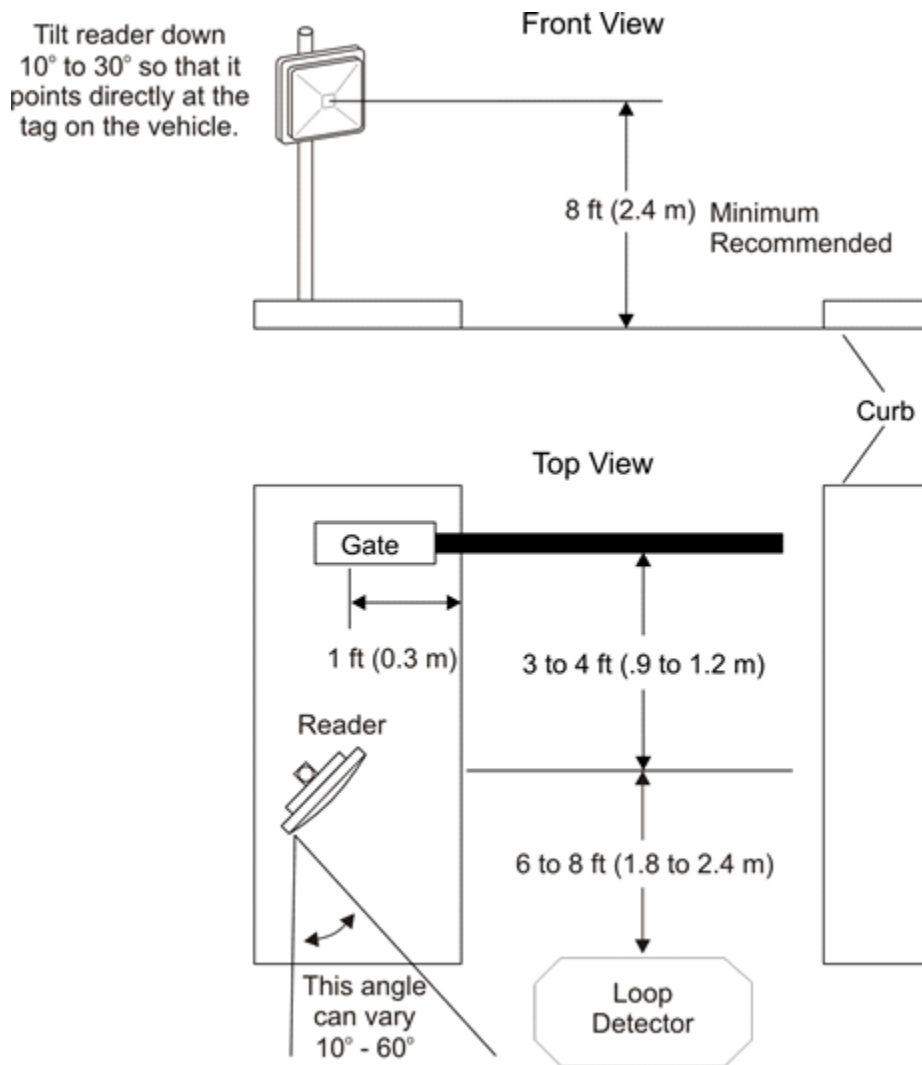
Figure 46 – The Encompass 4 Flex Reader attached to the pole mount bracket

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

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

Figure 47 illustrates front and top views of a pole-mounted Encompass 4 Flex 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 tightening all the screws and straps permanently. Refer to the section “Marking the Read Zone” on page 4–73.



SD-0145

Figure 47 – Front and top views of the Encompass 4 Flex Reader position

Note: The dimensions in Figure 47 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 4 Flex 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 recommends following the National Electric Code for lightning protection for the locale where the Encompass 4 Flex Reader is installed.

Mounting the Encompass 4 Flex Reader to a Wall or Flat Surface

The basic Encompass 4 Flex Reader is supplied with a pole-mount bracket assembly that allows the Encompass 4 Flex Reader to be adjusted up and down. TransCore recommends using the wall-mount bracket accessory kit (Figure 48) in addition to the pole-mount bracket to provide additional horizontal aiming flexibility when attaching the Encompass 4 Flex Reader to a pole with flat sides or to a wall or ceiling where other structures can interfere with accurately aiming the Encompass 4 Flex Reader toward the tags.

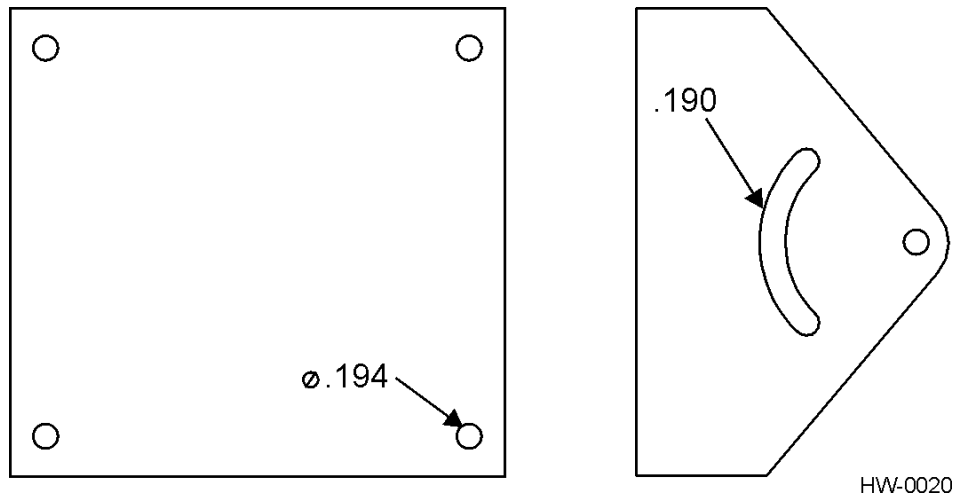


Figure 48 – Wall mount bracket accessory (part number 54-1620-001)

Required Materials

The following materials are needed to install the Encompass 4 Flex 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 the Encompass 4 Flex Reader is mounted. Because the Encompass 4 Flex 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 threaded hex nuts 3/8-16 and four lock washers
- 5/32-inch Allen wrench
- One Encompass 4 Flex wall mount bracket accessory kit (required)

Procedures

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

1. Unpack the Encompass 4 Flex Reader. Set aside the pole mount bracket.
2. Use the bracket in the remaining steps to provide greater adjustment for the Encompass 4 Flex Reader. The pole-mount bracket is wrapped separately from the Encompass 4 Flex Reader and contains a plastic bag with four Allen screws and washers.
3. Using a 5/32-in Allen wrench, remove the factory-mounted bracket attached to the back of the Encompass 4 Flex Reader. Remove all four Allen screws and lock washers from the bracket and set aside.
4. Unpack the wall-mount bracket accessory kit.

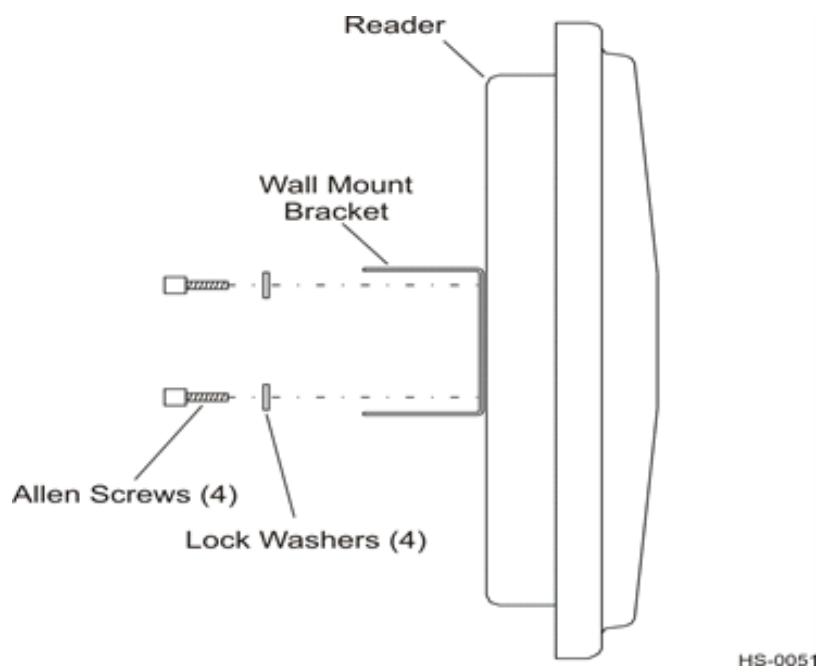


Figure 49 – Wall mount bracket attached to the Encompass 4 Flex Reader

5. Using the Allen screws and lock washers described in Step 2, attach the wall-mount bracket to the back of the Encompass 4 Flex Reader, as shown in [Figure 49](#). Tighten the screws to secure the bracket.

6. 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 50](#).

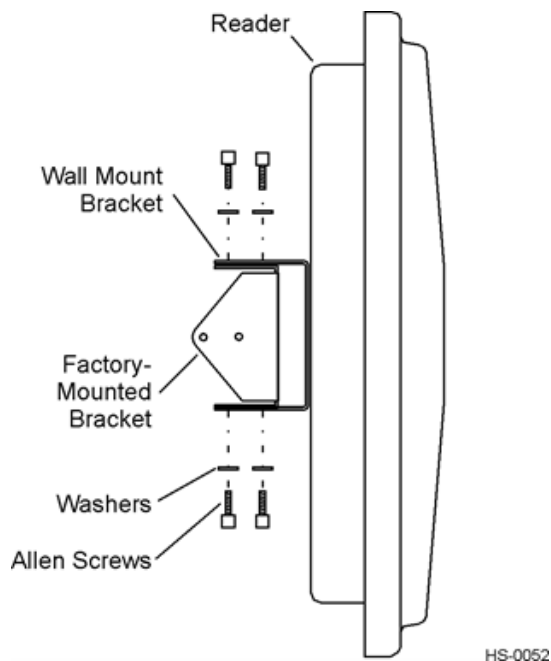


Figure 50 – Factory mounted bracket attached to wall mount bracket

7. Tighten lightly to allow adjustment of the bracket. This subassembly allows the Encompass 4 Flex to be pointed left or right when all three brackets are assembled.
8. Mount the pole-mount bracket to the wall, ceiling, or fixture using appropriate anchors as shown in [Figure 51](#).

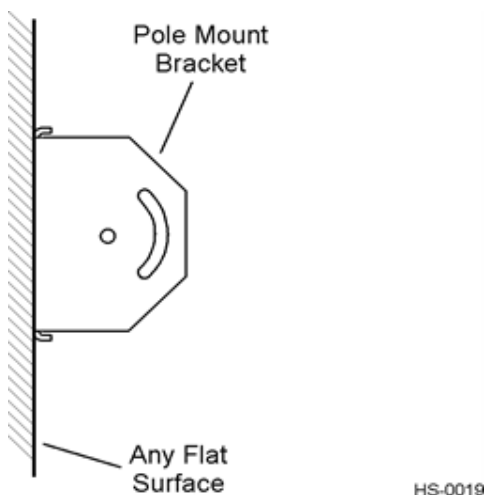


Figure 51 – Pole mount bracket attached to wall

9. Mount the Encompass 4 Flex Reader to the pole-mount bracket using Allen screws, as shown in Figure 52.

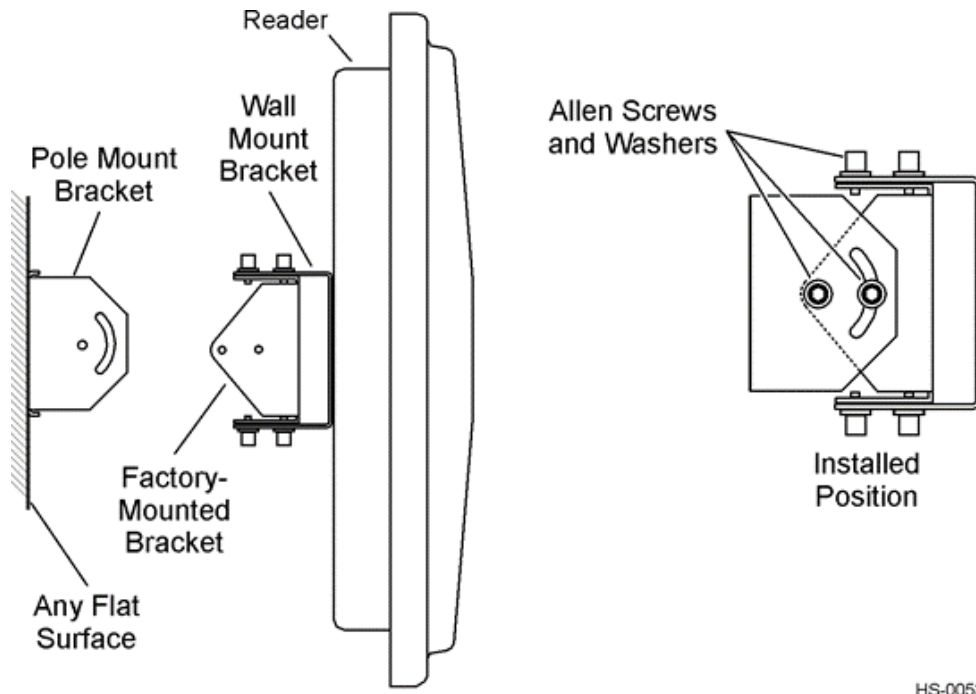


Figure 52 – Connecting the Encompass 4 Flex assembly to pole mount bracket

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

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



Caution

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

Connecting the Power Supply

To power the Encompass 4 Flex Reader follow the procedures described previously in “Connecting the Encompass 4 Flex reader to Power” on page 4–50.

Reader Cable Grounding

Ensure that the proper Earth Ground to the Earth Ground Terminal on the reader is connected (Figure 53).

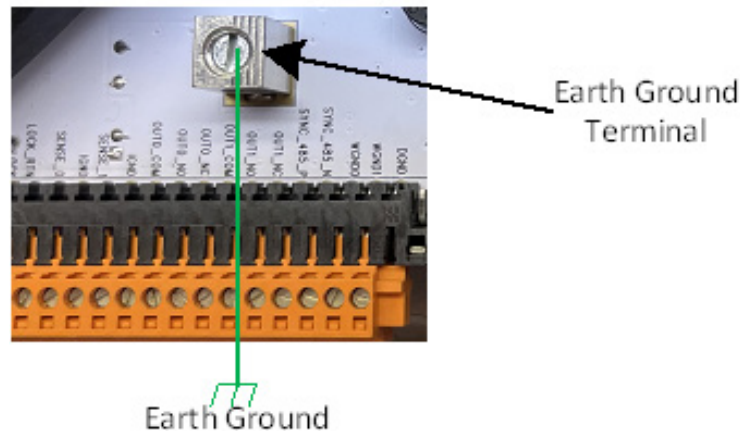


Figure 53 – Earth grounding terminal on reader



Caution

Do not earth ground either side of the auxiliary input power.

Connecting Communications

The E4 Flex reader can communicate through RS-232, RS-422, Ethernet protocols and BLE.

Note: Refer to “Appendix F BLE Configuration Through Direct Communication Port Commands” on page F-184 for BLE information.

This section describes the procedures and materials required for connecting the communications to the reader.

Manual Communication Select Switch (MCSS)

The function of the MCSS has two main purposes: one, to help in troubleshooting communications issues, and two, to force communications to the reader processor from a specific communications port if more than one is connected. When sent to auto the auto detection priority of connections is as follows:

Note: Please reference the block diagram shown in Figure 54 for the discussions:

- First -> Ethernet
- Second -> RS232
- Third -> RS422

Example: If the Ethernet and RS232 ports were connected at the same time the auto detect would send the incoming TX data from the Ethernet port to the reader processor.

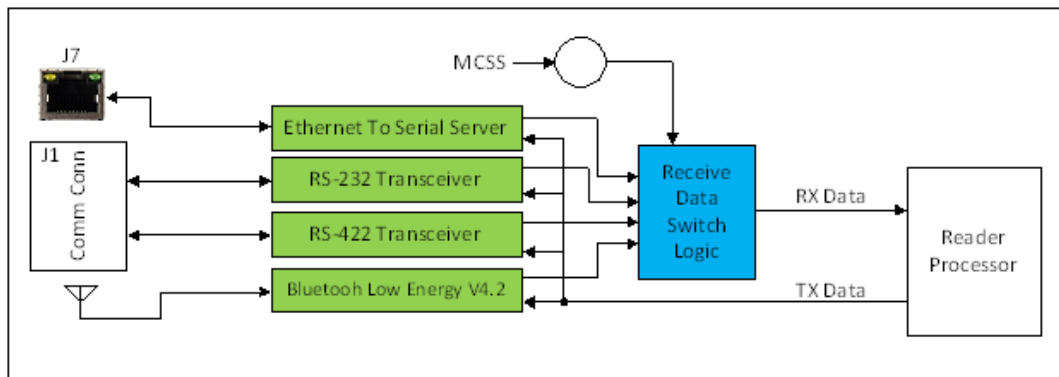


Figure 54 – Manual communication select switch diagram

In normal set up situations there would be only one communications port connected to the reader at a time. The switch was added in cases where there was more than one communication port connected and there were requirements to force the comm to be directed to a specific port. The drawback being that commands sent from the BLE phone app would not be sent to the reader processor. The BLE interface was designed to be a diagnostic interface and able to send any commands to the reader processor no matter what communication port was being used.

Another item is to note that communication data from the reader processor is available at all times on all of the communications ports no matter what the MCSS position.

TransCore recommend that the switch be left in the “Auto” position; if there are specific case they can be analyzed with suggestions made by the TransCore support team.

Required Materials

Use the following materials to connect the communications cable to the PC:

- Computer (PC or laptop) with a standard com (i.e. RS–232) port, if there is not a built-in com port a USB to com port adapter can be used
- A terminal program running on the computer
- If using the RS–232 interface, a standard com cable to connect to the com port on the computer
- If using the RS–422 interface, a RS–422 to RS–232 converter plus a standard com cable to connect to the computer

If using the Ethernet interface there are two ways to connect to the reader:

- The first method is to connect the E4 Flex and the computer to a common network using TransCore’s Reader Network Configuration Tool to establish communication. The Reader Network Configuration Tool can be downloaded from <https://transcore.com/literature>.
- The second method is to connect the E4 Flex directly to the computer. A local Ethernet server needs to be installed on the computer. Using the assigned IP address and the terminal program, communications can be established.

Reader Network Configuration Tool

The Reader Network Configuration Tool discovers E4-based, Ethernet-enabled RFID Readers and allows the user to modify the network settings.

The configuration tool can be downloaded from <https://transcore.com/rfid-downloads>.

This tool is best used in a lab environment prior to installation. The user needs the network parameters (IP Address, Gateway and Subnet) available for each reader.

Note: If the reader is connected to a switch or a hub, it is important for the PC running this tool and the reader to be on the subnet during configuration.

Readers can be configured to acquire an IP Address from the network (DHCP) but this is not recommended unless an IP Address has been reserved for the device on the Network.

If the reader is configured to acquire a dynamic IP Address (DHCP) and the reader is connected to a network that does not have a DHCP server, the tool will not be able to discover the reader. TransCore recommends that the reader be connected to a network that has a DHCP server. This will allow a DHCP configured reader to acquire an IP Address and be discoverable.

The steps to configure the network parameters of the Encompass 4 reader are outlined in this section and include:

- Initialize the network configuration tool
- Find network adapters
- Find reader devices
- Set network configuration
- Static IP address
- Set network parameters
- Tips and tricks

Initialize the Network Configuration Tool

Power the reader on. A steady green light shows that it is connected to the network. A blinking yellow light shows activity.

Open the network configuration tool by clicking on the icon. The initial screen window will open (Figure 55). The process of configuring the network parameters of a reader begins with discovering the network adapters installed on the local PC. Click the 'Find Network Adapters' button.

Note: Contact your network administrator for the correct settings.

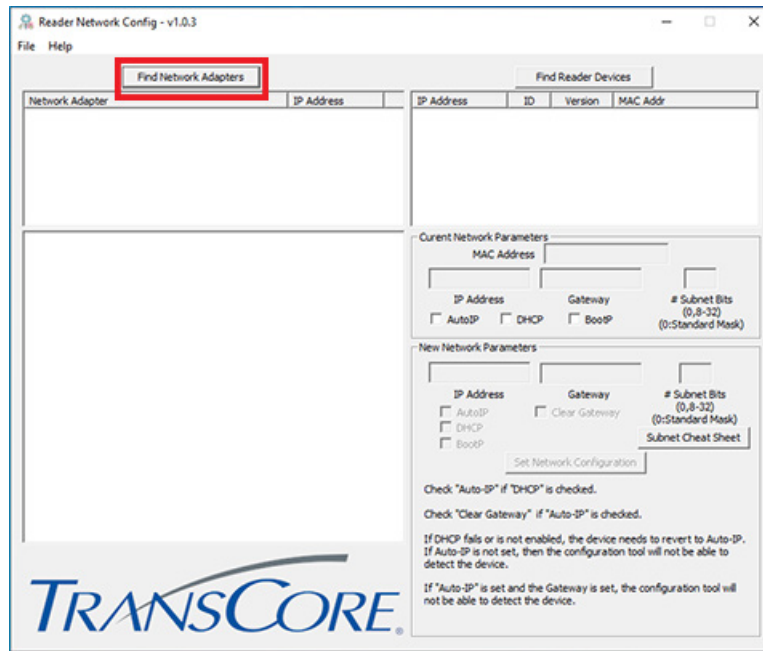


Figure 55 – Initial screen

Find Network Adapters

A list of network adapters and their associated IP addresses will be displayed (Figure 56). Select the network adapter that is associated with the network to which the reader is connected.

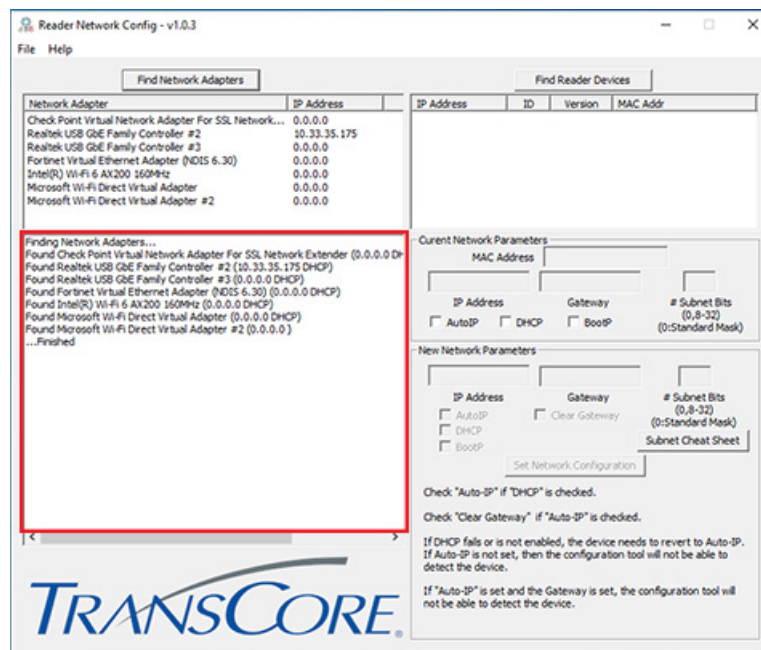


Figure 56 – Find network adapters

Find Reader Devices

Click the 'Find Reader Devices' button (Figure 56).

The tool will broadcast a message to the network and wait for a response. Any reader device that responds will be displayed in the list (Figure 58).

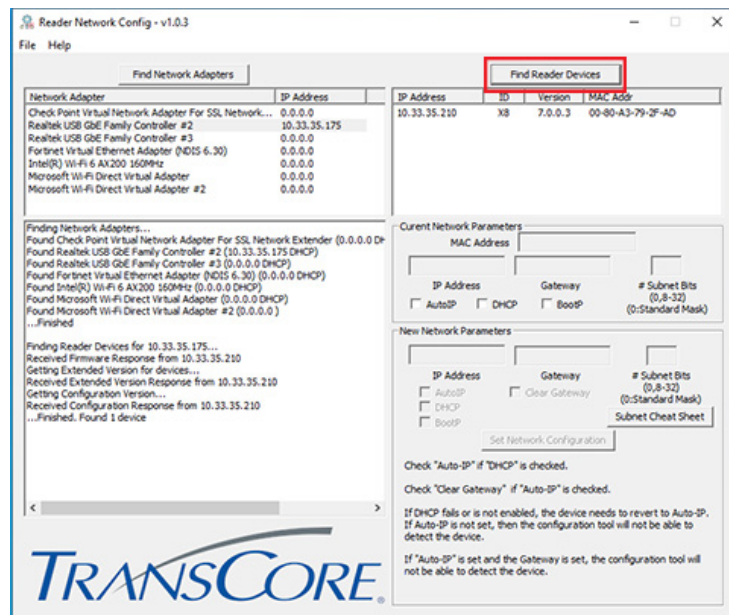


Figure 57 – Find reader devices

Select a reader device to display the current network parameters of that reader.

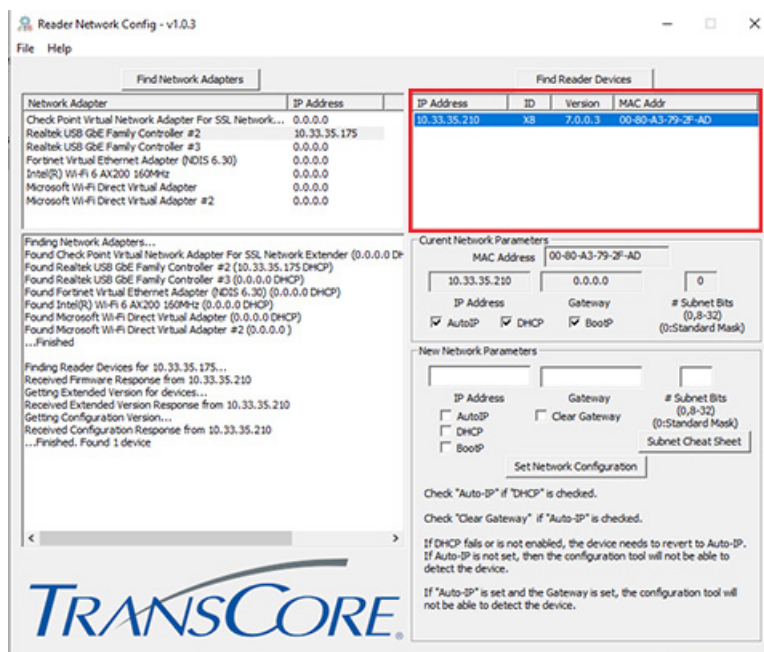


Figure 58 – Select a reader device

Set Network Configuration

DHCP/BootP/AutoIP

If DHCP, BootP or AutoIP are selected, an IP address, gateway or subnet bits are not required. If DHCP is selected and the a DHCP server is not present on the network, the reader will never get an IP address and will not be discovered unless AutoIP is selected.

If there is trouble discovering a reader that is connected to the network, the reader is probably configured as DHCP and there is not DHCP server. The user will need to connect and discover the reader to a network that has a DHCP server.

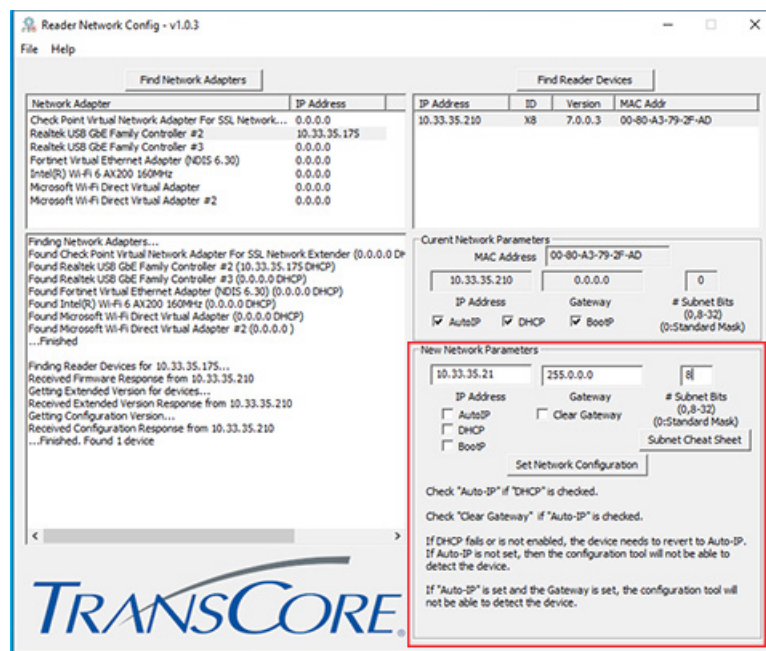


Figure 59 – Select new network settings

Static IP Address

If a static IP address is desired, the only requirement is the IP address. If the gateway field left blank, a gateway of 0.0.0.0 will be assigned. If the number of subnet bits is left blank, a value of 0 will be assigned.

Set the Network Parameters

Set the desired network parameters and press 'Set Network Configuration'. The tool will validate the parameters and send commands to the device to set the network parameters.

The tool will try to discover the Reader after the parameters are set. In some cases, the tool will not find the device immediately. If this is the case, click on 'Find Reader Devices' to search for the reader.

If DHCP was selected, the user may need to power-cycle the reader to force it to request and be assigned an IP address. Figure 60 shows the screen with the newly configured network settings.

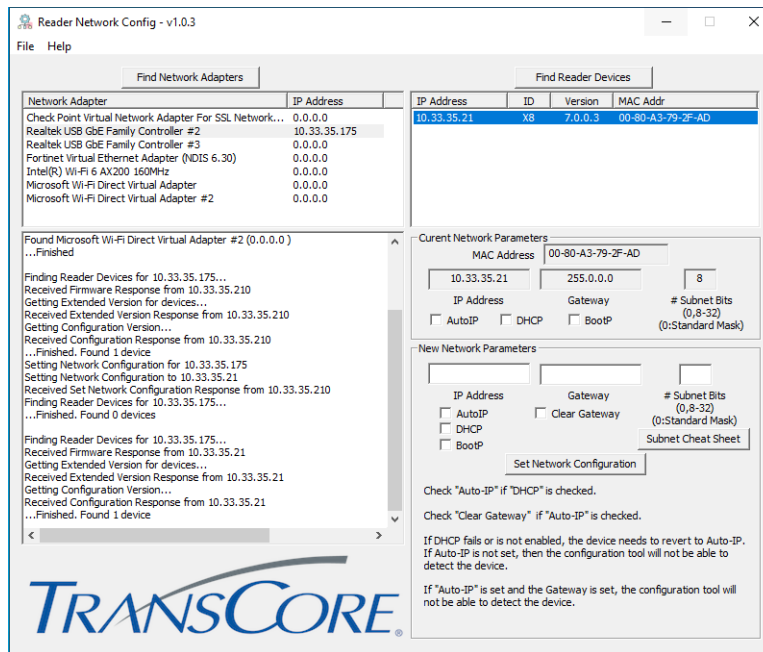


Figure 60 – Final network settings

Tips and Tricks

If the reader is configured as DHCP, it must be connected to a network that has a DHCP server. Otherwise, it will never get a DHCP address and will not regress to assigning itself an AutoIP address (169.254.x.x).

If the gateway or the subnet is undetermined, leave both empty and select 'Clear Gateway'. Both the gateway and the subnet will revert to a default value.

If AutoIP is selected, select 'Clear Gateway'.

Connecting the Encompass 4 Flex Reader to the PC

Encompass 4 Flex Reader communications and interface signals are supplied from the reader to the host system through connectors/terminal blocks. The connector/terminal blocks are accessed from the back of the reader (Figure 61). These sections contain instructions for connecting RS-232, RS-422, and Wiegand communications between the Encompass 4 Flex Reader and the PC. Each section contains wiring instructions and pin assignments followed by step-by-step connection procedures. The Encompass 4 Flex 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 4 Flex Reader communications cable (Figure 61). 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 4-53.

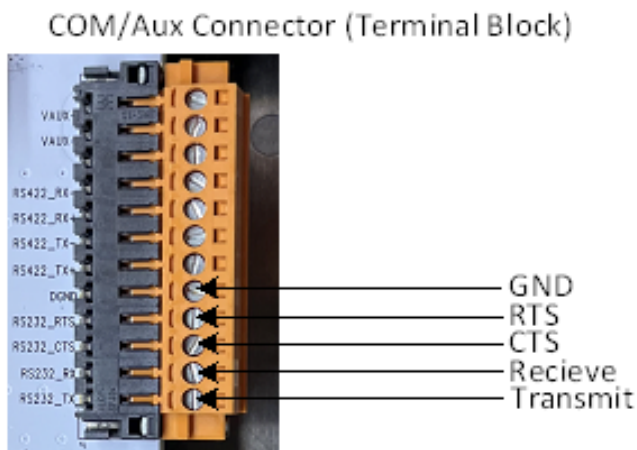


Figure 61 – RS-232 Com/Aux connector

Note: When wiring the RS-232 interface, a low capacitance type cable should be used (such as Belden 9832). TransCore recommends using one pair each for the Transmit, Receiver, CTS, RTS, and ground signals where one part of the pair is use for the signal and the other is reference to ground. The cable shield should be tied to a single-point earth ground on the computer/systems end of the cable.

RS-422 Interface

RS-422 interface signals are supplied by four wires (plus a ground for reference) from the reader (Figure 62). The PC/laptop must have an RS-422 interface or an RS-422 to RS-232 converter will be required.

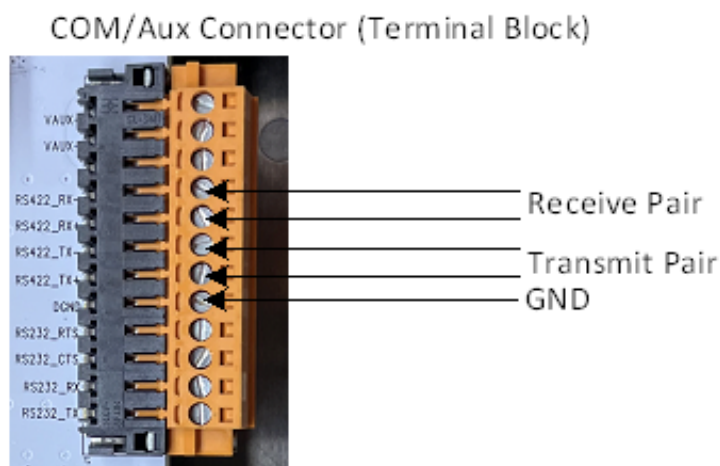


Figure 62 – RS-422 interface

Note: When wiring the RS-422 interface, a low capacitance type cable should be used (such as Belden 9832). The cable shield should be tied to a single-point earth ground on the computer/systems end of the cable.

Wiegand Interface

Wiegand interface signals are supplied by three wires from the Encompass 4 Flex Reader I/O Connector (Figure 63). 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.

I/O Connector (Terminal Block)

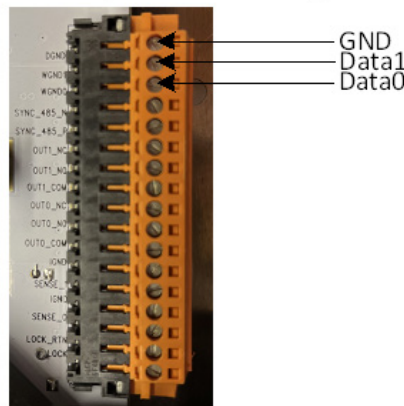


Figure 63 – I/Oconnector

Note: To get Wiegand data from the Encompass 4 Flex Reader it will need to be configured (i.e. enabled) by using one of the communication interfaces (RS-232, RS-422, Ethernet or BLE). Also tags must also be properly programmed with Wiegand-formatted data when using the Wiegand mode of operation.

When connecting the Wiegand interface to the reader, Transcore recommends using a 3-pair cable such as Belden 82502. Use one of the twisted pairs for Data1 and the other for Data0. With one part of the pair for the signal (Data1/Data0) and the other for a ground. The cable shield should be tied to a single-point earth ground on the controller (i.e. system) side of the cable.

Connecting Sense Input and Sense Output Circuits

The Encompass 4 Flex Reader has two sense input circuits and three sense output circuits available. The sense input circuits can be used to notify the Encompass 4 Flex 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 4 Flex Reader supports two sense inputs (Sense_0 and Sense_1). To activate each line they should be referenced to the Sense Ground. Sense_0 is the presence detection device line and is used to control RF power. The Reader expects the Sense_0 circuit to close (i.e. reference to Sense Ground) when a vehicle is present. 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 input 1 allows the reader to monitor the status of a peripheral device. The host computer can then check the status by polling the reader for status of the peripheral device (Figure 64).

I/O Connector (Terminal Block)

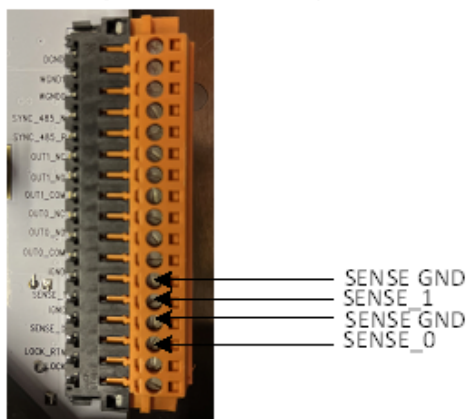


Figure 64 – Sense input circuits

Sense Output Circuits

The Encompass 4 Flex Reader supports three sets of output signals. Two sets – OUT0 and OUT1 – provide NO or NC outputs. The third output is dedicated for testing and set up of the reader, LOCK which indicates a valid tag is in the read field. LOCK is a NO output only (Figure 65).

OUT0 and OUT1 are dry contacts that provide NO and NC 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, a secondary isolation transformer is required.

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

I/O Connector (Terminal Block)

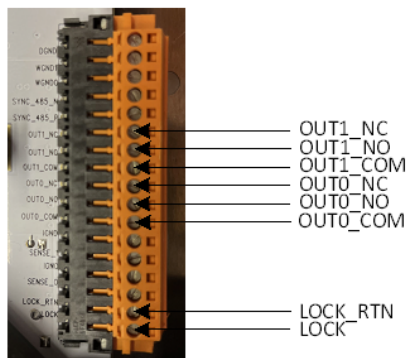


Figure 65 – Sense output circuits

Marking the Read Zone

The area where the Encompass 4 Flex reads tags at the current RF range is called the read zone. The antenna pattern, or read zone, of the Encompass 4 Flex Reader would look roughly like a pear-shaped balloon if you were able to see it. When installing the Encompass 4 Flex Reader, first mark the unit's read zone using the RF range set at the factory-default maximum. The read zone can be adjusted later using the techniques discussed in [“Fine-Tuning and Verifying the Read Zone” on page 8–149](#).

If two Encompass 4 Flex Readers are installed near each other, TransCore recommends fine-tuning each reader for the ideal read zone before connecting it permanently to sense input/sense output and communications cables. A minimum of 2 MHz frequency separation between the two adjacent readers is required for correct operation.

Required Materials

Use 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-in (4.82 to 5.84-mm) in thickness and approximately 12-in (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 Encompass 4 Flex Reader Before Installation”](#).
- 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.

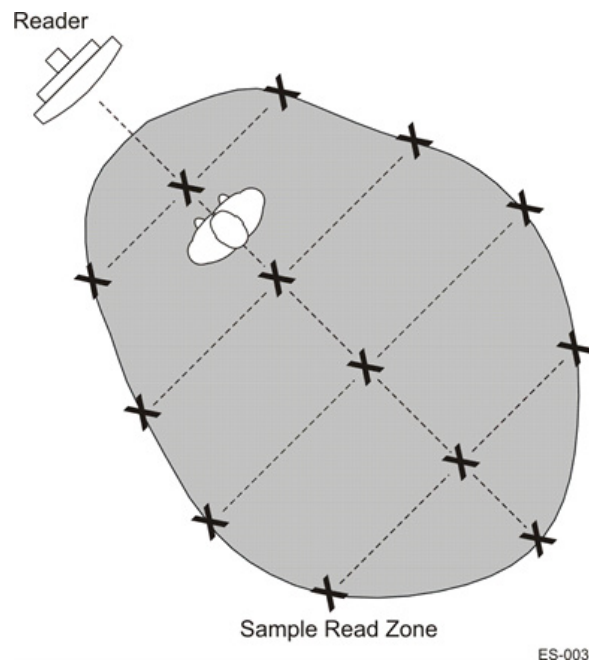
To mark the read zone

1. Confirm the following:
 - The power supply is connected correctly, as described in [“Connecting the Power Supply” on page 4–62](#).
 - Communications are connected correctly, as described in [“Connecting Communications” on page 4–63](#).
 - Sense input and sense output circuits are connected correctly as described in [“Sense Input Circuits” on page 4–72](#) and [“Sense Output Circuits” on page 4–72](#).
 - The red and white leads from the audible tester are connected correctly to the red and white pair

of wires from the Encompass 4 Flex Reader power/communications cable.

2. Start the terminal emulation application.
3. 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
4. Cycle the power on the Encompass 4 Flex Reader and ensure that the sign-on message displays. Input the following commands in the order provided in “[Table 8 – Commands for bench testing](#)”. Commands include those to switch to command mode, set operational mode, turn on RF, and return the reader to data mode.
5. 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 4 Flex 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).
6. Stand directly in front of and about 5 feet (1.5 m) away from the Encompass 4 Flex Reader or antenna (Figure 49). 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. Additionally a tag can be correctly mounted to a vehicle to verify tag read zone performance with the tag on the vehicle since some reflections can enhance the read zone distance.

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



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Figure 66 – Sample read zone marking pattern

7. Mark the spot with chalk or tape.
8. 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.
9. 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.
10. Return to the center and step backward 2 feet (0.6m) and repeat steps 5 through 7.
11. 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.
12. Connect the outer marks to draw the outer boundary of the read zone.

Figure 66 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 4 Flex 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 8–149](#).

Chapter 5 General Software Information

This chapter provides software-related information for the Encompass 4 Flex Reader System. This chapter presents various software-related topics arranged in alphabetical order by subject. In addition to this chapter, refer to “Chapter 6 Communications Protocols” on page 6–80 and “Chapter 7 Commands” on page 7–94 for more information.

Command Entry Conventions

All Encompass 4 Flex 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 4 Flex 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 9 shows the basic structure of a four-character command.

Table 9 – 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 4 Flex Reader commands, responses are preceded by the # character. Many Encompass 4 Flex 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 10 shows an example of a command/reply sequence. This example assumes that an Encompass 4 Flex 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 10 – Sample command sequence

Entry	Encompass 4 Flex Reader Response	Notes
#01 <CR>	#Done <CR/LF>	Switches Encompass 4 Flex Reader to command mode
#505 <CR>	#Model E4 Series Ver X.XX SN07001P <CR/LF>	Reports the software version and serial number
#00 <CR>	#Done <CR/LF>	Returns Encompass 4 Flex Reader to data mode

In command discussions, Encompass 4 Flex 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 4 Flex 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 4 Flex Reader. In this example, one space is between the letter B and the number.

Operating Parameters

The Encompass 4 Flex 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, 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 4 Flex 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

Consider the following factors when performing program download:

- The Encompass 4 Flex Reader does not process tags while in download mode.
- The Encompass 4 Flex 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 4 Flex Reader comes up in data mode. If a flash checksum error is detected, the Encompass 4 Flex 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 4 Flex 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 4 Flex Reader software or if the Encompass 4 Flex Reader seems to not be working properly, you may need to download the software to the Encompass 4 Flex Reader. Contact technical support or your TransCore Encompass 4 Flex Reader sales representative.

Startup

Upon startup, Encompass 4 Flex 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 first and fourth digits of the eight-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 4 Flex Reader is operating out of boot ROM. In this case, the Encompass 4 Flex Reader automatically enters download mode and waits for a new program to be loaded into the flash memory. Follow the instructions in [“Program Download”](#) to download a new program.

Tag/Message Buffer

In basic communication protocol, the Encompass 4 Flex 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 4 Flex 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® 4 Reader.

Introduction

The Encompass 4 Flex 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 timeout with the same effect as if it had received a negative acknowledgment (from the host) or an Error message from the Encompass 4 Flex 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 4 Flex 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 8–149](#).

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 4 Flex Reader and the host are transmitted without error checking. For each host transmission, the Encompass 4 Flex Reader returns a Done or Error message to the host.

When the host computer is physically close to the Encompass 4 Flex 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 4 Flex 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 4 Flex Reader” on page 8–137 for flow control information.

Error Correcting Protocol

When the quality of data communications is imperative or may be suspect, invoke ECP to ensure the integrity of data transmitted between the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex Reader acquires tags, it buffers them but does not transmit them. Instead, the host must poll the Encompass 4 Flex Reader for each tag by sending an ASCII CTRL-E character (hexadecimal 05). The Encompass 4 Flex 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 4 Flex 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

<code><som></code>	Start-of-message (ASCII # character)
<code><seq></code>	Sequence number (ASCII hex) that represents an even number in the range 0–9, A–F (0, 2, 4, 6, 8, A, C, E). The Encompass 4 Flex Reader maintains the number. The host must acknowledge reader transmissions by sending an ACK message with the same sequence number received from the Encompass 4 Flex Reader. The Encompass 4 Flex Reader updates its sequence number upon receipt of a valid host ACK. If an ACK is not received, the Encompass 4 Flex Reader retransmits the message. A reader transmission sequence is not considered complete until the Encompass 4 Flex Reader receives an ACK and updates its sequence number.
<code><data></code>	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.
<code><crc></code>	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 <code><som></code> character and the first <code><crc></code> 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 <code><som></code> and that ends with the character immediately preceding the first <code><crc></code> character. The transmitted CRC value can then be compared with the binary equivalent of the received <code><crc></code> 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.
<code><eom></code>	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 4 Flex 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 4 Flex 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 4 Flex Reader. The sequence number should correspond to the data message that is being positively or negatively acknowledged by the host. If the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex Reader receives an ACK or NAK message from the host, a logical NAK condition will be declared. If the Encompass 4 Flex Reader receives a NAK or timeout, the reader retransmits the data message.

When the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex Reader and the host. The host begins a sequence by issuing a command; the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 IO 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 4 Flex Reader

Reader response

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

For some commands, the Encompass 4 Flex Reader responds with data that relates to the command, such as TOF 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 4 Flex 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:

$$T_{rec} \text{ (ms)} = L \times [T_{char} + T_{idle}]$$

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 4 Flex 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:

$$T_{send} \text{ (ms)} = 9 \times T_{char} + T_{errchk}$$

where

T_{errchk} (ms)	Processing period to perform error checking by receiver
-------------------	---

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

After the Encompass 4 Flex Reader receives new communications parameters, the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex Reader remains in command mode to avoid losing tag IDs. RF is off in command mode and no tags can be read. One technique to enhance the tag reading and avoid having to go into command mode is to enable Command #831 for the automatic periodic RF status report. Refer to “831 Enable Automatic Periodic RF Status Report” on page 7–136.

Reader-Addressed Failure Conditions

The Encompass 4 Flex Reader addresses the following failure conditions:

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

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

Transmission Timeout

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

Receive Timeout

If the Encompass 4 Flex 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 4 Flex Reader transmits asynchronous data at the same time that the host sends a command, the Encompass 4 Flex 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 4 Flex 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 4 Flex Reader's response. The Encompass 4 Flex 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 in [“Timing and Synchronization”](#).

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 4 Flex Reader.

The Encompass 4 Flex 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 4 Flex 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, 0xcdbc, 0xfbbf, 0xeb9e, 0x9b79, 0x8b58, 0xbb3b, 0xab1a,
0x6ca6, 0x7c87, 0x4ce4, 0x5cc5, 0x2c22, 0x3c03, 0x0c60, 0x1c41,
0xedaе, 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, 0xbdaа, 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 4 Flex 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 4 Flex 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.

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 performing this troubleshooting procedure.

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® 4 Flex Reader configuration and operation.

Introduction

The Encompass 4 Flex 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 4 Flex Reader can also communicate with ASCII terminals.

Note: *If using Wiegand mode, connect the PC or laptop to the Encompass 4 Flex Reader using the RS-232 or RS-422 interface and a terminal emulation program to send commands to the reader. Leave the Wiegand interface connected during this procedure.*

Operating Modes

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

Data Mode

The Encompass 4 Flex Reader is in the data mode upon power-up. While in the data mode, the Encompass 4 Flex 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 4 Flex Reader while in data mode:

Command #01 Switch To Command Mode changes the Encompass 4 Flex Reader from the data mode to the command mode. Refer to ["01 Switch to Command Mode" on page 7-96](#).

Refer to commands ["611 Select Error Correcting Protocol" on page 7-120](#) and ["613 Enable Data Inquiry Protocol" on page 7-121](#).

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

Command Mode

While the Encompass 4 Flex Reader is in the command mode, the host computer sends commands to the

Encompass 4 Flex Reader that can be used to control the operation and configuration of the reader. After the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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 ["Appendix C Command Quick Reference" on page C-164](#) 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.

Command Group 0 – Reader Mode Control

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, 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 4 Flex 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

Refer to "[522 Display Communications Port Parameters](#)" on page 7–110.

Command #100N selects the reader baud rate. The factory-default setting is 9600 baud. The N variable specifies the baud rate shown in [Table 11](#).

Table 11 – 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. Refer to "40 Transmit All ID Codes" on page 7–101.

Reader response:

Done

101N Select Stop Bits

Refer to "522 Display Communications Port Parameters" on page 7–110.

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 12.

Table 12 – 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 13. Refer to "522 Display Communications Port Parameters" on page 7–110.

Table 13 – 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 4 Flex 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. Refer to command ["524 Display Appended Information Status" on page 7–111](#).

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 14](#).

Table 14 – 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 15](#).

Table 15 – 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 7–112](#). 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 4 Flex 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 4 Flex Reader.

40 Transmit All ID Codes

Refer to ["530 Display RF0 Filter Status" on page 7–116](#).

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 7–122](#).

After diagnostics are complete, the uniqueness check can be reset using command ["410N Select Unique ID Code Criteria \(Anti-passback Feature\)"](#). This setting will be stored upon entering #00 and will be retained over the power cycle. Refer to ["00 Switch to Data Mode \(Factory Default\)"](#).

For operation using the Cypress Converter, use #40 diagnostics “scroll mode.”

Reader response:

Done

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

Refer to ["530 Display RF0 Filter Status"](#), ["440 Reset Uniqueness"](#), and ["44N Set Uniqueness Timeout"](#).

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 16](#).

Table 16 – 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 four 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

Refer to ["530 Display RF0 Filter Status" on page 7–116](#)

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 17](#)). The factory setting is one acquisition (N = 0).

Table 17 – 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 (["410N Select Unique ID Code Criteria \(Anti-passback Feature\)"](#) 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

Refer to ["440 Reset Uniqueness"](#).

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

Table 18 – Set uniqueness timeout

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 7–116.

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"](#).

Enabling Wiegand inhibits the output relay function. Refer to ["621 Select Predefined Output Control \(Factory Default\)"](#). 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

Refer to ["534 Display Tag Translation Mode Status" on page 7–117](#).

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"](#))

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.

Refer to ["570 Display Tag Protocols"](#).

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

Refer to ["533 Display Wiegand Retransmit Interval" on page 7–116](#).

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.

This command works for non-Wiegand tags with Wiegand Translation Mode enabled.

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

For commands 480 through 489, refer to ["570 Display Tag Protocols" on page 7–118](#)

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

Refer to ["00 Switch to Data Mode \(Factory Default\)" on page 7–96](#)

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"](#).

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 19 – 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								

Refer to "[549 Display User-Programmable Group Select Equals \(GSE\) Filter Data](#)".

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

Refer to ["696S...S Store Hardware Configuration String" on page 7–134](#)

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

Refer to ["696S...S Store Hardware Configuration String" on page 7–134](#).

Command #506 displays hardware configuration information stored in the reader memory by the user. Hardware configuration information is empty by default until the information is set 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 4 Flex 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.

Reader message:

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

where

T0	Time not appended
T1	Time appended (not valid for the Encompass 4 Flex Reader)
D0	Date not appended
D1	Date appended (not valid for the Encompass 4 Flex 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

Refer to Command "[525 Display Communications Protocol Status](#)", "[610 Select Basic Communication Protocol \(Factory Default\)](#)", Command "[614N Select Flow Control Option](#)", and Command "[612NN Select Error Correcting Protocol Timeout](#)".

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

Refer to "620N Set Output Control", "621 Select Predefined Output Control (Factory Default)", "67N Set Output Pulse Duration".

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

Table 20 – 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 21 shows the output0 and output1 open/closed conditions for the output status displays for readers in IAG applications.

Table 21 – 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 22 shows the input0 and input1 open/closed conditions for the input status displays.

Table 22 – 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 the RF frequency settings are set 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	RF output frequency, xxx = 000 to 118 hexadecimal offset in 250 kHz from 860 MHz. If an invalid frequency value is stored (corrupted NVRAM), then xxx = “XXX” to indicate an error in the frequency setting (#647xxx or #642NN).
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 00 is maximum output power and 0A is minimum output power (10dB less than maximum power) (#644NN).
Ixx	IAG RF power attenuation, where 00 is maximum output power and 0F is minimum output power (15 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 I04

which means that RF is enabled by presence sensor on input0, RF signal off, uniqueness timeout of two minutes, RF output frequency has not been set, maximum RF output range for ATA tags, maximum RF output 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 \(Anti-passback Feature\)](#)") and the valid ID code criteria (refer to "[420N Select Valid ID Code Criteria](#)").

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

Refer to "[450 Disable Wiegand Mode \(Factory Default\)](#)" and "[451 Enable Wiegand Mode](#)".

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

Refer to command "[46NN Set 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 ["453 Enable Tag Translation Mode"](#).

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"](#) 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 4 Flex 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

Refer to "697 Set User-Programmable Group Select Equals (GSE) Filter".

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 Set User-Programmable Group Select Equals (GSE) Filter" 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 23 – 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 through 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)

Refer to "525 Display Communications Protocol Status".

Command #610 enables the basic communications protocol. Refer to "Basic Protocol" on page 6–80 for more information.

Reader response:

Done

611 Select Error Correcting Protocol

Refer to "525 Display Communications Protocol Status"

Command #611 enables the error correcting protocol. Refer to "Basic Protocol" 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

Refer to "525 Display Communications Protocol Status", "610 Select Basic Communication Protocol (Factory Default)", and "611 Select Error Correcting Protocol".

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 6–86.

613 Enable Data Inquiry Protocol

Command #613 enables the data inquiry protocol. Refer to "[410N Select Unique ID Code Criteria \(Anti-passback Feature\)](#)" 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 24](#).

Table 24 – 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

Refer to "526 Display I/O Status" and "621 Select Predefined Output Control (Factory Default)".

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 25. Receipt of any #620N command automatically disables command "621 Select Predefined Output Control (Factory Default)".

Table 25 – 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)

Refer to "410N Select Unique ID Code Criteria (Anti-passback Feature)".

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 Set 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", "620N Set Output Control", and "67N Set Output Pulse Duration".

Command #63 resets the power fail bit, stores non-volatile memory (NVM) parameters, 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 26](#)

Table 26 – 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 sense 0. The reader turns off RF according to the selected RF control algorithm (#692N Select RF Control Algorithm).

Reader response:

Done

642NN Select RF Operating Frequency



Caution

The authorized bands in the U.S. for CW frequency (i.e., ATA only) is 902.25 to 903.75 MHz and 910.00 to 921.50. The authorized frequency band for modulated frequency is 911.75 to 921.75 MHz.

Note: RF frequency can be set for backward-compatibility using command #642NN or for the newer 250-kHz step method using command #647XXX.

Command #642NN sets the reader RF frequency from 902 to 928 MHz in 500-kHz steps, where NN is a hexadecimal value from 00 to 34. After the reader's frequency is set, the value is stored in battery-backed RAM (non-volatile RAM, NVRAM). This value is NOT altered by power-down, loading default parameters, or a flash download of new software (there is no default frequency value). It can only be changed by issuing command #642NN.

Additionally, if the NVRAM becomes corrupted, the correct operating frequency cannot be guaranteed. In this circumstance, the RF section will shut down and the reader will send an error message to the host

(Error 06). Until the frequency is reset using command #642NN after NVRAM corruption, the unit will display the same error message every time it is powered up or if an attempt is made to enable the RF (by host or by external sensor). The commands to set the RF frequency are listed in Table 32.

Table 27 – RF frequency commands

Command	RF Frequency (MHz)	Approved for Use in the U.S. (ATA only)	Approved for Use in the U.S. (modulated)
64200	902	No	No
64201	902.5	Yes	No
64202	903	Yes	No
64203	903.5	Yes	No
64204	904	No	No
64205	904.5	No	No
64206	905	No	No
64207	905.5	No	No
64208	906	No	No
64209	906.5	No	No
6420A	907	No	No
6420B	907.5	No	No
6420C	908	No	No
6420D	908.5	No	No
6420E	909	No	No
64210	910	Yes	No
64211	910.5	Yes	No
64212	911	Yes	No
64213	911.5	Yes	No
64214	912	Yes	Yes
64215	912.5	Yes	Yes
64216	913	Yes	Yes
64217	913.5	Yes	Yes
64218	914	Yes	Yes
64219	914.5	Yes	Yes
6421A	915 (factory default)	Yes	Yes
6421B	915.5	Yes	Yes
6421C	916	Yes	Yes
6421D	916.5	Yes	Yes
6421E	917	Yes	Yes
6421F	917.5	Yes	Yes
64220	918	Yes	Yes

Table 27 – RF frequency commands

Command	RF Frequency (MHz)	Approved for Use in the U.S. (ATA only)	Approved for Use in the U.S. (modulated)
64221	918.5	Yes	Yes
64222	919	Yes	Yes
64223	919.5	Yes	Yes
64224	920	Yes	No
64225	920.5	Yes	No
64226	921	Yes	No
64227	921.5	Yes	No
64228	922	No	No
64229	922.5	No	No
6422A	923	No	No
6422B	923.5	No	No
6422C	924	No	No
6422D	924.5	No	No
6422E	925	No	No
6422F	925.5	No	No
64230	926	No	No
64231	926.5	No	No
64232	927	No	No
64233	927.5	No	No
64234	928	No	No

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 00 to 0A. Settings for attenuation are 1.0 dB increments over a range of 10dB of attenuation from the maximum power setting of two watts at 0dB attenuation to a minimum power level of 200 milliwatts at 10dB attenuation.

The Set RF Attenuation command NN variables and corresponding attenuation settings are shown in [Table 28](#).

Table 28 – RF attenuation command variables

Variable (NN)	Attenuation Setting (dB)
00	0 (factory default)
01	1
02	2
03	3
04	4
05	5
06	6
07	7
08	8
09	9
0A	10

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 hexadecimal value from 00 to 0F. Setting 00 (0 dB) is the maximum power setting and 0F (15 dB) is the minimum power setting. The default attenuation value is 04.

647NNN Select RF Operating Frequency

Command #647NNN sets the reader RF from 860 to 930 MHz in 250-kHz steps, where NNN is a hexadecimal value from 000 to 118. After the reader's frequency is set, the value is stored in non-volatile RAM (NVRAM). This value is not altered by power-down.

If the NVRAM becomes corrupted, the correct operating frequency cannot be guaranteed. In this

circumstance, the RF section shuts down and the reader sends an `Error06` message to the host. Until the frequency is reset using command `#647NNN`, the unit displays the same error message every time it is powered up or if an attempt is made to enable the RF by host or by external sensor.

The commands to set the RF operating frequency are presented in [Table 29](#).

Table 29 – Select RF operating frequency commands

Command	RF Frequency (MHz)
647000	860.00
.	.
6470C8	910.00
.	.
6470CF	911.75
6470D0	912.00
6470D1	912.25
6470D2	912.50
6470D3	912.75
6470D4	913.00
.	.
6740DC	915.00
.	.
6470EA	918.50
6470EB	918.75
6470EC	919.00
6470ED	919.25
6470EE	919.50
6470EF	919.75
.	.
.	.
.	.
657113	928.75
647114	929.00
647115	929.25
647116	929.50
647117	929.75
647118	930.00

Reader response:

Done

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

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' SYNC_485_N (RS-485 synchronization minus) pins together and all of the readers' SYNC_485_P (RS-485 synchronization plus) pins together.

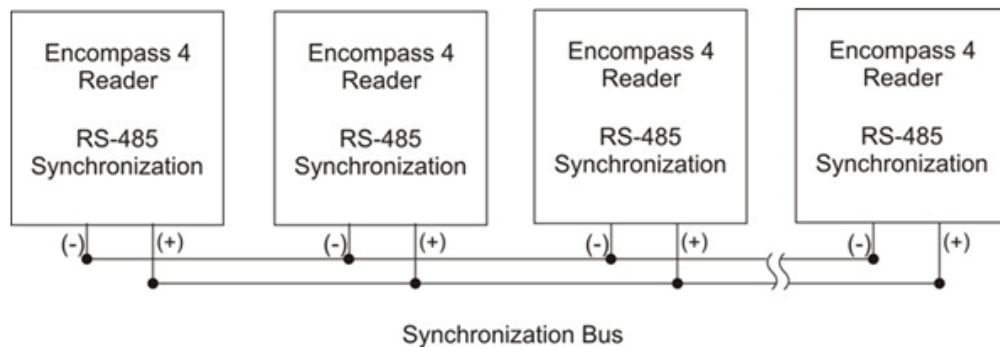


Figure 67 – Synchronization bus wiring diagram

I/O Connector (Terminal Block)

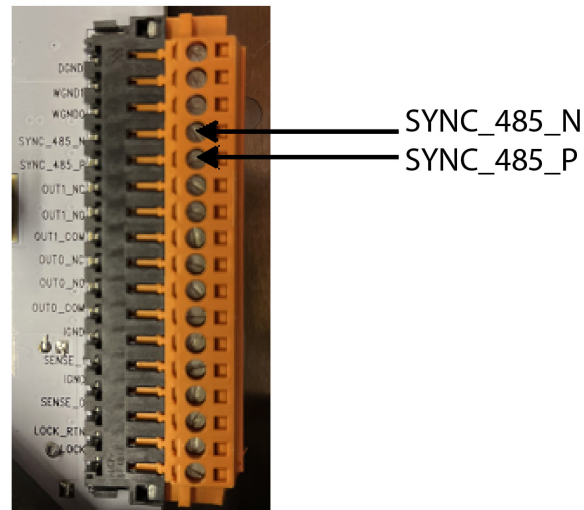


Figure 68 – Synchronization bus wiring

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 30 lists an example of a plaza having five Encompass 4 Flex 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 67). 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 (#6470DE) 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 30 – Example of Encompass 4 Flex 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 7–109](#).

Reader response:

Done

66F Load Default Operating Parameters

Command #66F loads all the factory default operating parameters except RF operating frequency. Refer to ["456 Enable eGo Plus Tag Initialization During Multi-tag Sort \(Factory Default\)" on page 7–104](#).

Reader response:

Done	All parameters loaded OK
Error	A parameter load failed

67N Set Output Pulse Duration

Refer to ["526 Display I/O Status"](#), ["620N Set Output Control"](#), and ["621 Select Predefined Output Control \(Factory Default\)"](#).

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 31](#).

Table 31 – 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 32](#).

Table 32 – 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 \(Anti-passback Feature\)](#)" 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 33](#).

Table 33 – 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.

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. 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 once and only once per presence on both serial and Wiegand ports.

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 34](#).

Table 34 – 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

Table 34 – Timeout period values

Command	Timeout (ms)
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 35.

Table 35 – Input inversion options

Command	Option
6940	Disable input inversion (factory default)
6941	Enable input inversion

Reader response:

Done

695S...S Set Serial Number

Refer to "505 Display Software Version" on page 7–109.

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 eight characters. However, to maintain backward compatibility, the reader software allows only six characters to be entered.

When setting the serial number, skip the first and fourth character of the seven-character number shown on the reader product label.

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

Refer to "506 Display Hardware Configuration Information" on page 7–109.

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".

Command #697 assigns the user-programmable GSE filter.

The command string is assigned according to the following format:

#697 MM AA DDDDDDDDDDDDDDDDD

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: 0011 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:

E	0	2	2	6	3	B	4	0	0	2	C	9	2	3	2	–	SeGo ID
<u>T</u>		<u>T</u>		<u>T</u>		<u>T</u>		<u>T</u>		<u>T</u>		<u>T</u>		<u>T</u>			
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: E02263B4002C9232

SeGo ID: E02263B4002D8132

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 000063B400000000

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 36](#).

Table 36 – 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.

Reader response:

Done

844 Disable Retransmit (Factory Default)

The function causes tag data to be retransmitted after the retransmit time as defined by "[46NN Set Wiegand Retransmit Interval](#)", if the tag is in the read zone at that time or afterward. The function is implemented by resetting the tag ID uniqueness filter once the Wiegand retransmit interval time is expired.

RS-232 Retransmit for ATA or eATA data only.

845 Enable Retransmit

Use #46NN for setting time. For example: #4605 = 5 second retransmit time.

This function sends data again, even if the uniqueness is enabled. The uniqueness filter is reset after the retransmit interval.

Chapter 8 Configuring the Encompass 4 Flex Reader

This chapter provides instructions for configuring the Encompass® 4 Flex Reader, including factory configuration parameter defaults and instructions for using terminal emulation software to check and change the Encompass 4 Flex Reader factory configuration defaults.

Configuring the Reader

After installing the Encompass 4 Flex Reader, 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 4 Flex Reader and its shipping carton are labeled to indicate the unit's ordering configuration. [Table 37](#) contains explanations of the Encompass 4 Flex Reader label fields.

Table 37 – Encompass 4 Flex 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 4 Flex Reader is configured with an integrated antenna, RS–232 and Wiegand communications, and reads SeGo and IAG protocol tags.

Default Operating Parameter Settings

[Table 38](#) contains the factory default configuration settings for the Encompass 4 Flex 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 Develop the Site Plan” on page 2–21](#).

Review the default configurations shown in [Table 38](#) to determine which parameters, in addition to operating frequency and operating range, need to be adjusted. Refer to [“Chapter 7 Commands” on page 7–94](#) for a complete list of parameters and the corresponding commands.

Note: The dual-protocol Encompass 4 Flex Reader internal timing varies depending on the operative tag read mode and the type of tag in the read field.

Table 38 – Encompass 4 Flex 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
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	64400
eGo and eGo Plus Tag operating range	Maximum	6451F
IAG attenuation	4 dBm	64604
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

Table 38 – Encompass 4 Flex Reader default configuration settings

Parameter	Setting	Command
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

a Local laws apply. The authorized frequency band for the TransCore Encompass 4 Flex Reader in the United States is 911.75 MHz to 919.75 MHz. Contact TransCore if the application requires a frequency outside of this range.

Configuring Parameters with Terminal Emulation Software

To configure the Encompass 4 Flex Reader using a PC and terminal emulation software to manually enter Encompass 4 Flex Reader host commands, follow the instructions in the section [“Connecting the Encompass 4 Flex Reader to the PC” on page 4–69](#). Then, enter the appropriate configuration commands through the terminal emulation software on the PC.

Refer to [“Chapter 7 Commands” on page 7–94](#) for a detailed description of all available configuration commands.

Starting the Terminal Emulation Software

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 the 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 configparams.

Verifying Communications

Verify that the Encompass 4 Flex 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”](#).
2. Cycle the power on the Encompass 4 Flex Reader.

Note: When testing the Encompass 4 Flex Reader using a laptop, TransCore recommends configuring the laptop communication parameters to match those of the host computer to which the Encompass 4 Flex Reader will be connected after testing and configuration are completed.

Upon startup, the Encompass 4 Flex 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 4 Flex 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 0.00 E and no serial number exists, the flash memory checksum has failed, and the Encompass 4 Flex Reader is operating out of boot ROM. In this case, the Encompass 4 Flex 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 5–78](#). Communications can also be verified by using the command sequence in [Table 39](#).

3. If a successful sign-on message is not returned, check connections and communications factors and correct any errors.

Table 39 – Command sequence to verify communications

Entry	Encompass 4 Flex Reader Response	Notes
#01 <CR>	#Done <CR/LF>	Switches the Encompass 4 Flex Reader to command mode
#505 <CR>	#Model E4 Series Ver X.XX SN97001P <CR/LF>	Reports the software version and serial number
#00 <CR>	#Done <CR/LF>	Returns the Encompass 4 Flex Reader to data mode

To check connections and communications factors

1. Confirm that the Encompass 4 Flex Reader has power.
2. Verify the connections between the PC and the Encompass 4 Flex Reader.
3. Verify the receive (Rx), transmit (Tx), and signal ground (sig gnd) connections.
4. If using handshaking, verify the RTS and CTS connections.
5. Verify the COM port settings for the Encompass 4 Flex Reader using the instructions in [“Serial Port Communications”](#).
6. Repeat the procedures in [“Verifying Communications”](#).

If the Encompass 4 Flex Reader and PC communications can’t be verified, use the information in [“Chapter 9 Troubleshooting and Maintenance”](#) on page 9–152 to contact TransCore.

Verifying Tag Read Capability

After verifying communications between the Encompass 4 Flex 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. Refer to [“Appendix D Compatible Tag Information”](#) on page D–178 to determine which tag protocol(s) your Encompass 4 Flex reader supports. Use only those test tags programmed with the correct protocol(s) for the reader.*



Caution

To avoid damage to the Encompass 4 Flex Reader using an external antenna, connect the antenna before applying power to the reader.

To verify tag read capability

1. Once communications are verified as described in [“Verifying Communications”](#), 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 4 Flex 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 4 Flex Reader is in data mode (command #00 Switch to Data Mode).
 - Ensure that the tag you are using is compatible with the Encompass 4 Flex Reader. The Encompass 4 Flex Reader can read tag types that are compatible with the reader model.
 - An Encompass 4 Flex Reader displays the tag read for any tag that is compatible with the reader programming.
 - Using the audible circuit tester as described in [“Using an Audible Circuit Tester \(Buzzer\)” on page 4–50](#), 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 4 Flex Reader and the host computer. If it is, the problem is probably in the communications between the Encompass 4 Flex Reader and the host.
3. Pass a different reader-compatible test tag in front of the Encompass 4 Flex Reader.
4. When the Encompass 4 Flex 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, repeat steps 1 through 4.

Configuring Encompass 4 Flex Parameters

Follow the procedures in this section to configure Encompass 4 Flex parameters using a PC, laptop, or terminal emulator. The PC or laptop must be connected to and communicating with the Encompass 4 Flex Reader, and the terminal emulation application must be configured correctly, as described in the section [“Verifying Communications”](#).

Note: *If using Wiegand mode, connect the PC or laptop to the Encompass 4 Flex Reader using the RS–232 or RS–422 interface before attempting to send commands to the reader. 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 4 Flex Reader commands are preceded by the start-of-message*

character (#).

2. To meet requirements of the 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. Refer to [“31N Append Auxiliary Information Selection” on page 7–100](#) 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 to four IDs. The reader default operation is for a unique ID separation of one ID and a uniqueness timeout of two minutes. Disable the uniqueness check using command #40 Transmit All ID Codes. In this case, every tag ID received is transmitted without regard to uniqueness. Reinstate uniqueness checking with commands #4100 through #4103 Select ID Separation ([Table 40](#)).

Table 40 – ID separation commands

Command	Option
#4100	Separation of 1 ID
#4101	Separation of 2 ID
#4102	Separation of 3 ID
#4103	Separation of 4 ID

Note: The dual-protocol Encompass 4 Flex Reader internal timing varies depending on the operative tag read mode and the type of tag in the read field.

Refer to [“610 Select Basic Communication Protocol \(Factory Default\)” on page 7–120](#) and [“410N Select Unique ID Code Criteria \(Anti-passback Feature\)” on page 7–101](#).

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 4 Flex 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. Refer to sections [“529 Display Presence Input Status” on page 7–114](#) and [“690N Select Presence Without Tag Report Option” on page 7–131](#).

If configured with command [“82N Select Input Status Change Report Option” on page 7–135](#) 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 7–118](#) and [“82N Select Input Status Change Report Option”](#). Also refer to [“Chapter 6 Communications Protocols” on page 6–80](#) 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

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. Refer to [“63 Reset Reader” on page 7–122](#).*

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.

Radio Frequency



Caution

The authorized continuous wave (CW) frequency band for the Encompass 4 Flex Reader in the U.S. is 902.25 to 903.75 MHz and 910.00 to 921.50 MHz and the authorized modulated frequency band for the Encompass 4 Flex Reader in the U.S. is 911.75 to 919.75 MHz. The RF for each Encompass 4 Flex Reader at the site must be set according to the frequency specified in the FCC site license. Only trained, authorized installation and maintenance personnel are permitted by FCC to set the RF.

By using the Encompass 4 Flex Reader, an authorized person can set the frequency within the range from 902 to 928 MHz in 0.25 MHz steps. Set the frequency by using a terminal emulation program and issuing the frequency command, as discussed in section [“647NNN Select RF Operating Frequency” on page 7–126](#).

Note: For backward compatibility to existing controllers, set the RF operating frequency in 500-kHz steps using command #642NN.

To set the frequency range

1. Ensure that the host computer is in command mode.
2. Enter command #647XXX – where XXX is a hexadecimal value from 000 to 118 – and press ENTER. See command [“647NNN Select RF Operating Frequency” on page 7–126](#) for a complete listing of the hexadecimal values and the corresponding frequencies. For backward compatible frequency selection, see command [“642NN Select RF Operating Frequency” on page 7–123](#).
3. To verify that the RF has been changed to the proper setting, type in command #527 to see the current frequency setting.



Caution

Contact TransCore if the application requires a frequency outside of the authorized frequency range.

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 4 Flex Reader

As a factory default, the Encompass 4 Flex Reader is configured to control the RF power with a vehicle detector.

[Figure 69](#) illustrates the methods of controlling RF sense output.

Vehicle Detector Controlling RF Transmission

The vehicle detector can be a loop detector, an infrared sensor, or an ultrasonic detector which can be connected to the sense input0 to turn on the Encompass 4 Flex Reader RF. [Figure 69](#) shows a vehicle detector controlling the RF. This operation is preferred because the RF transmits only when a vehicle is in the read zone. Command #641 Select RF-by-Input Control (factory default) must be enabled.

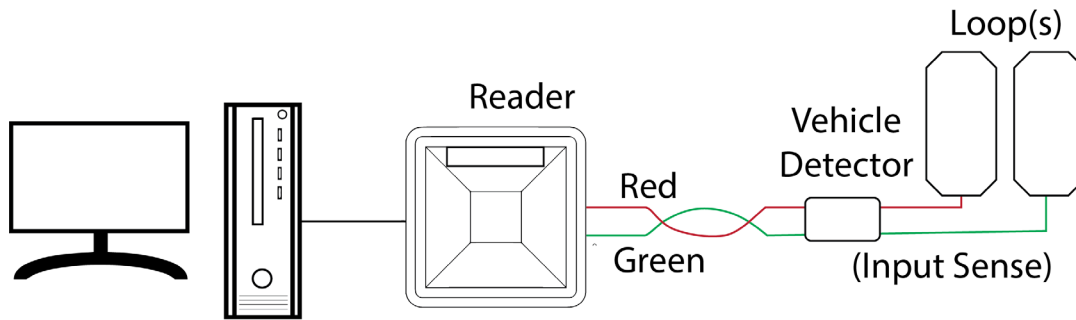


Figure 69 – RF ON by sense input (641 factory default)

SC-0301c

Host Controlling RF Transmission

Alternately, RF output can be controlled by commands sent to the reader.

Commands #6400 RF Off and #6401 RF On turn RF on and off.

Sense Inputs

Both the RS-232 and RS-422 configurations used by the Encompass 4 Flex 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 4 Flex Reader sense inputs are designed to connect to a dry contact closure.

Configure the Encompass 4 Flex 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”](#).

The following procedures describe how to set sense inputs using the terminal emulation software. Refer to commands [“526 Display I/O Status”](#) on page 7-112, [“694N Select Input Inversion Option”](#) on page 7-133, and [“82N Select Input Status Change Report Option”](#) on page 7-135 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 4 Flex Reader have two sense output circuits – sense output0 and sense output1.

By default, the Encompass 4 Flex 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 4 Flex 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 4 Flex 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 4 Flex 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)

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 7–96](#) through [“00 Switch to Data Mode \(Factory Default\)” on page 7–96](#).

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 Protocols

Use the following procedures to set communications protocol. Refer to sections [“610 Select Basic Communication Protocol \(Factory Default\)” on page 7–120](#) through [“612NN Select Error Correcting Protocol Timeout” on page 7–120](#) 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. Refer to “614N Select Flow Control Option” on page 7–121.

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 the application, it can be fine-tuned by physically adjusting the Encompass 4 Flex Reader or external antenna mounting orientation, 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.

Refer to sections “643NN Select ATA Operating Range (Distance)” on page 7–125, “645NN Set eGo and eGo Plus Operating Range (Distance)” on page 7–126 , and “644NN Set RF Attenuation” on page 7–125 for more information.

Note: *As described in “Marking the Read Zone” on page 4–73, 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 4 Flex Reader

Manually adjust the location of the read zone by loosening the Encompass 4 Flex 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.

Physically Orienting the Encompass 4 Flex Reader Antenna

Manually adjust the location of the read zone by loosening the antenna mounting brackets and pointing the antenna 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

Make the read zone smaller by adjusting the Encompass 4 Flex 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 the PC is communicating with the Encompass 4 Flex Reader using a terminal emulation program as described in the section [“Verifying Communications”](#).
2. Mark the current read zone as described in section [“Marking the Read Zone” on page 4–73](#).



Caution

Test tags should be compatible with the Encompass 4 Flex 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 0A. Settings for attenuation are 1.0 dB increments over a range of 10 dB of attenuation from the maximum power setting of 2 watts at 0 dB attenuation to a minimum power level of 200 milliwatts at 10 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 4–73](#) 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 4 Flex Reader is in data mode.
2. With the Encompass 4 Flex 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, the read range is successfully adjusted. If one or both tags did not read, follow the suggestions in [“To verify tag read capability” on page 8–142](#).
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 4 Flex 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, decrease the range sensitivity by more than one increment.

To adjust the read zone by adjusting sensitivity range

1. Ensure that the PC is communicating with the Encompass 4 Flex Reader using a terminal emulation program as described in [“Verifying Communications”](#).
2. Mark the current read zone as described in [“Marking the Read Zone” on page 4–73](#). 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 4–73](#) to mark the new read zone on the ground with the tape or chalk.

When the desired read zone is established, test the read zone with simulated and real traffic by performing the following procedures.

Chapter 9 Troubleshooting and Maintenance

This chapter contains information for troubleshooting an Encompass® 4 Flex 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 4 Flex 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
Error06	NVRAM parameters have been lost. The Encompass 4 Flex Reader will not function properly because the RF section is shut off until the frequency is reset.	Reset the frequency using command #647XXX.
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 4 Flex Reader attempts to reset the PLL.	Reset the RF frequency. Refer to “Radio Frequency” on page 8–145 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 4 Flex Reader is in ID-only mode, thus Wiegand compatibility issues.	Enable eATA mode using command #489 if Wiegand operation is needed and the tags are programmed with Wiegand data.

Table 41 – Error messages

Error Message	Description	Corrective Action
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. Track this error message if it occurs again. If the reader indicates repeated ErrorRF1 warning messages, return the reader to the factory.
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. Track this error message if it occurs again. If the reader indicates repeated ErrorRF2 warning messages, 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. Track this error message if it occurs again. If the reader indicates repeated ErrorRF3 warning messages, return the reader to the factory.

Troubleshooting

Refer to [Table 42](#) for troubleshooting. Should problems continue, contact TransCore for return and replacement procedures. When contacting Technical Support, use the symptom number in [Table 42](#) to reference the problem that you are having with the Encompass 4 Flex Reader.

Table 42 – Symptoms and remedies

Symptom Number ^a	Symptom	Remedy
1	When performing a quick test of the Encompass 4 Flex Reader, the buzz box does not buzz.	<p>Check all wiring connections and antenna connections (if using external antenna), and ensure that the buzz box is functioning.</p> <p>The wires from the Encompass 4 Flex Reader are grouped in pairs. There may be more than one red wire, more than one black wire, and so on. Connect the correct red and white wire pair to the leads from the battery.</p> <p>Verify that RF is on as described in “Bench Testing the Encompass 4 Flex Reader Before Installation” on page 4–53. Using a terminal emulation program, switch to command mode and issue command #527 to determine RF status. Refer to “527 Display RF Status” on page 7–114 for more information.</p>
2	The baud rate is selected correctly but nothing happens.	The Encompass 4 Flex Reader is not communicating with the PC. Check the power supply to the PC, and check the connections between the PC and the Encompass 4 Reader. Try reversing the receive and transmit connections.
3	When testing the Encompass 4 Flex Reader, all the wires are connected correctly but the unit does not respond.	The Encompass 4 Flex Reader may not have the software loaded inside the unit. Contact TransCore technical support. If using a terminal emulation program, check that the terminal emulation setting on the Encompass 4 Flex Reader is VT100. Check that the Encompass 4 Flex communication cable is connected to the correct COM port. Verify that the external antenna is connected correctly.
4	Strange signal responses come from the Encompass 4 Flex 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 or external antenna, a clicking sound comes from the Encompass 4 Flex Reader.	The Encompass 4 Flex Reader works. The sound is the relay inside the Encompass 4 Flex Reader that is controlled by a lock signal. The relay is actuated when a tag is in the read zone.
6	Nothing happens when the test tag is passed in front of the Encompass 4 Flex Reader or external antenna	<p>Ensure that the Encompass 4 Flex Reader is powered on and is in predefined output mode. (#621)</p> <p>Verify that the reader is set to RF ON (#6401).</p> <p>Verify that the external antenna is connected correctly.</p> <p>Verify that the reader mode matches the test tag.</p>

Table 42 – Symptoms and remedies

Symptom Number ^a	Symptom	Remedy
7	The Encompass 4 Flex 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. 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 7–130 . 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 4 Flex Reader displays one of the following messages: #Model E4 Series VER X.XX SNYYYYYY #[Copyright notice]	The Encompass 4 Flex Reader works. The software is now loaded. YYYYYY is the TransCore-assigned serial number for this Encompass 4 Flex Reader. However, if YYYYYY = 000000, a serial number has never been assigned. If a serial number has not been assigned to your Encompass 4 Flex Reader, contact TransCore Technical Support.
9	The read zone is too small, even before the RF power and range control have been adjusted.	If another Encompass 4 Flex Reader is in the same area, ensure that it is operating on another frequency that is at least 2 MHz different.
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 4 Flex Reader or external antenna may need adjustment. Slightly tilt the Encompass 4 Flex Reader or external antenna to a different angle to change either the length or width of the read zone. Check the range control adjustment. Refer to “Radio Frequency” on page 8–145 .
11	The Encompass 4 Flex 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 2–28 . Verify that the read zone has been properly set up. Refer to “Fine-Tuning and Verifying the Read Zone” on page 8–149 .
12	The Encompass 4 Flex Reader is not providing any output to the Wiegand interface.	Ensure that the Encompass 4 Flex Reader is in Wiegand mode (#451). The default is either RS–232 or RS–422 mode. Refer to “Wiegand Interface” on page 4–71 . Ensure the tags are properly programmed with Wiegand data.

^a Use this number to reference the problem you are having with the Encompass 4 Flex Reader if you contact Transcore for Technical Support.

Encompass 4 Flex Reader Repair

The Encompass 4 Flex 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 TransCore 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
antenna	passive device that converts RF energy into magnetic energy (RF signal)
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
BLE	Bluetooth Low Energy
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 through 9 and A through F to represent the digits 0 through 16
host	device, generally a computer, that is connected to the Encompass 4 Flex 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
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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	860 to 930 MHz capable
Reading Range	Read performance varies depending on tag, reader, and external antenna (if required) 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 and/or integrated system with connector for external antenna.	RF module, tag decoder, external antenna (if required), 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 Or POE+ 802.3bt Class 5
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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 or external antenna 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 Grms, 10 to 500 Hz

Options

Communications Interface	RS-232, RS-422, Ethernet, and Wiegand
Mounting Bracket	Allows adjustment in all planes when used to install the Encompass 4 Flex 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 Command Quick Reference

This appendix lists the default configuration settings for the Encompass® 4 Flex 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 5–76. [Table 43](#) lists factory default settings. [Table 44](#) lists, in numerical order, all of the commands available to users. [Table 45](#) lists the same commands by command name.

Factory Default Settings

Note: [Table 43](#) lists the factory default settings for the Encompass 4 Flex Reader.

Table 43 – Encompass 4 Flex 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	455
eGo Plus tag initialization during multi-tag sort	Enabled	456
Second alternate group select	Disabled	458
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

Table 43 – Encompass 4 Flex Reader default configuration settings

Parameter	Setting	Command
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 predefined output control	Predefined	621
RF-by-input control	Enabled	641
ATA operating range	Maximum	6431F
RF attenuation	Full power	64400
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 44](#):

- Items in bold identify factory default settings.
- Only the command-related data portion of the reader message is shown.

Refer to [“Chapter 7 Commands” on page 7–94](#) for the complete syntax of commands and messages.

Table 44 – Encompass 4 Flex Reader commands listed numerically

Number	Command Name	Reader Message
00	Switch to data mode (default)	Done
01	Switch to command mode	Done
100N	Select Baud Rate	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
101N	Select Stop Bits	Done
1010	Use one stop bit (default)	Done
1011	Use two stop bits	Done
102N	Select Parity	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
30N	Append time and date selection	Done
300	No time and date appended	Done
302	Time and date appended (default)	Done
31N	Append Auxiliary Information Selection	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
410N	Select unique ID code criteria	Done
4100	Select one ID separation (default)	Done
4101	Select two ID separation	Done
4102	Select three ID separation	Done
4103	Select four ID separation	Done
420N	Select valid ID code criteria	Done
4200	Select 1 valid ID code (default)	Done
4201	Select 2 valid ID codes	Done

Table 44 – Encompass 4 Flex Reader commands listed numerically

Number	Command Name	Reader Message
4202	Select 3 valid ID codes	Done
4203	Select 4 valid ID codes	Done
44N	Set uniqueness timeout	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
453	Enable tag translation mode	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
485	Enable SeGo	Done if tag protocol supported/Error if tag protocol is unsupported
486	Disable IAG	Done

Table 44 – Encompass 4 Flex Reader commands listed numerically

Number	Command Name	Reader Message
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>
527	Display RF status	RFST C<0 to 1> O<0 to 1> T<1 to 3> Fxxx Rxx Gxx Axx lxx
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>

Table 44 – Encompass 4 Flex Reader commands listed numerically

Number	Command Name	Reader Message
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
612FF	Disable ECP timeout	Done
613	Enable data inquiry protocol	Done
614N	Select Flow Control Option	Done
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
620N	Set output control	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

Table 44 – Encompass 4 Flex Reader commands listed numerically

Number	Command Name	Reader Message
640N	RF Control	Done
6400	Turn off RF	Done
6401	Turn on RF	Done
641	Select RF-by-input control (default)	Done
642NN	Select RF operating frequency	Done
643NN	Set ATA operating range (Distance)	Done
6431F	Set ATA operating range to longest range (default)	Done
644NN	Set RF attenuation NN = 00 to 0A	Done
64400	Set RF attenuation to 0 dB (full power) (default)	Done
645NN	Set eGo or eGo Plus operating range	Done
6451F	Set eGo or eGo Plus operating range to longest range (default)	Done
646NN	Set IAG RF attenuation	Done
64604	Set IAG RF attenuation (default)	Done
647NNN	Select RF operating frequency	Done
648NN	Set synchronization output delay time	Done
64800	Disable synchronization output delay (default)	Done
649NN	Set synchronization hold-off time	Done
64900	Disable synchronization hold-off time (default)	Done
65	Reset power fail bit	Done
66F	Load default operating parameters	Done
67N	Set output pulse duration	Done or Error
67C	Output pulse duration set to 228 ms (default)	Done
690N	Select presence without tag report option	Done
6900	Disable presence without tag reports (default)	Done
6901	Enable presence without tag reports	Done
692N	Select RF Control Algorithm	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 period	Done
693F	Set RF timeout to infinite (default)	Done
694N	Select Input Inversion Option	Done
6940	Disable input inversion (default)	Done
6941	Enable input inversion	Done

Table 44 – Encompass 4 Flex Reader commands listed numerically

Number	Command Name	Reader Message
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
82N	Select Input Status Change Report Option	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
844	Disable Retransmit (default)	
845	Enable Retransmit	

Alphabetical Command List

The following conventions are used in Table 45:

- Items in bold identify factory default settings.
- Only the command-related data portion of the reader message is shown.

Refer to “Chapter 7 Commands” on page 7–94 for the complete syntax of commands and messages.

Table 45 – Encompass 4 Flex Reader commands listed alphabetically

Command Name	Number	Reader Message
Append Auxiliary Information Selection	31N	Done
Append time and date selection	30N	Done
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 ECP timeout	612FF	Done

Table 45 – Encompass 4 Flex Reader commands listed alphabetically

Command Name	Number	Reader Message
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 Retransmit (default)	844	
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
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>

Table 45 – Encompass 4 Flex Reader commands listed alphabetically

Command Name	Number	Reader Message
Display flash checksum	540	PCKS I0000 Exxxx
Display hardware configuration information	506	1-20 character ASCII string
Display I/O status to 3> D<0 to F>	526	C<0 to 1> O<0 to 3> I<0
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 lxx
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>
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

Table 45 – Encompass 4 Flex Reader commands listed alphabetically

Command Name	Number	Reader Message
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
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

Table 45 – Encompass 4 Flex Reader commands listed alphabetically

Command Name	Number	Reader Message
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
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

Table 45 – Encompass 4 Flex Reader commands listed alphabetically

Command Name	Number	Reader Message
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
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 45 – Encompass 4 Flex 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 D Compatible Tag Information

This appendix gives helpful information about the tags that are compatible with the Encompass® 4 Flex Reader.

Tag Configurations

Table 46 lists the TransCore Super eGo® (SeGo) protocol tags that are compatible with the Encompass 4 Flex Reader.

Table 46 – 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

Table 46 – Compatible TransCore tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
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
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 47 lists most legacy tag models that are compatible with the Encompass 4 Flex Reader.

Table 47 – Legacy tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5100	Toll	915	Full	Beam	Interior	ATA
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 47 – Legacy tags

Model No	Description	MHz	Frame	Power	Mounting Type	Supported Protocols
AT5707 ^a	Transportation	915	256	bits	8-year battery	Exterior metal
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 58 and Table 59 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.

Appendix E Wire End Ferrules with Plastic Collars

This appendix describes the use of wire-end ferrules with plastic collars when connecting the E4 Flex to the user’s end system. Wire end ferrules with plastic collars offer additional ease of insertion due to the conical shape that is integrated in the inner diameter of the collar. Using ferrules keeps the rough insulation edges of the conductor from getting caught when connecting at the clamping point of the connector. The ferrule plastic collar can be ordered in different colors to help distinguish between various circuit functions.

In order to create an optimal crimped connection, Standard DIN 46228 recommends using tools and ferrules from the same supplier. The examples shown in this appendix are from Weidmüller (weidmuller.com). Other manufacturers can be used if they meet the proper dimensions and electrical properties similar to the Weidmüller part numbers listed in [Table 48](#).

Table 48 – Recommended part numbers	
Weidmüller P/N	Description
9025980000	Wire-end ferrule, Red, AWG 20-7
9025240000	Wire-end ferrule, Black, AWG 20-7
9002650000	Wire cutters
9005000000	Wire strippers
1444050000	Ferrule crimping tool

1. Trim the wire to the proper length with a clean, non-squeezed and burr-free cut, using a pair of Weidmüller P/N 9002650000 or equivalent wire cutters ([Figure 70](#)).



Figure 70 – Trim wire to length

2. Cleanly and precisely remove the insulation to expose the proper amount of wire with a pair of wire strippers (Weidmüller P/N 9005000000 or equivalent) to ensure that the entire cross-section is being crimped in the tube of the ferrule. The wire conductor should not be fanned out (refer to DIN EN 60352). The strands should only be allowed to twist slightly, re-establishing the original condition. Refer to [Figure 71](#).



Figure 71 – Stripped wire with conductor exposed

3. Crimp the ferrule to the wire end and conductor with the proper crimping tool (Weidmüller P/N 1444050000 or equivalent). The conductor should be visible 1/16 of an inch out of the copper tube (Figure 72) This will ensure that there will be enough conductor exposed during the crimping process for a proper crimping. When placing the ferrule into the crimper, the ferrule should be positioned as close as possible to the plastic collar (Figure 73).



Figure 72 – Conductor overhang



Figure 73 – Proper ferrule crimping position

4. It is essential to select a crimping tool with a suitable crimping shape for the connection point. The recommended tool is Weidmüller P/N 1444050000. This tool produces a shape that is compatible with the mating connector of the E4 Flex. If an equivalent crimping tool is going to be used, that tool should match the crimping shapes shown in Figure 74.

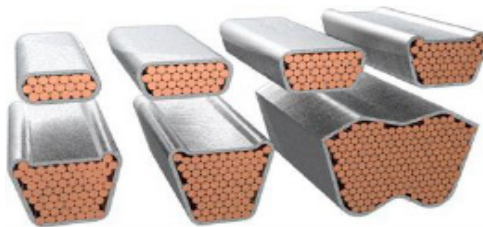


Figure 74 – Crimping shape

Appendix F BLE Configuration Through Direct Communication Port Commands

BLE Direct Communication theory of operation

There are several BLE configurations commands that are only accessible through a direct (i.e. hard) connection to the E4 Flex. Like the start-of-message character (#) for the configuration and control of the RFID part the E4 Flex the BLE radio has start-of-message character (AT). The reader processor will ignore any “AT” commands and the BLE will ignore the “#”. To understand this, process an example is shown in the diagram shown in [Figure 75](#).

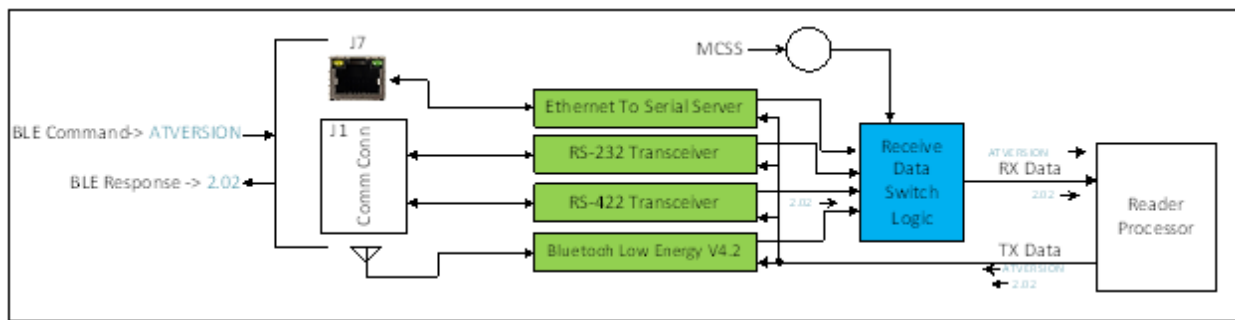


Figure 75 – BLE Configuration Commands

In the example shown in [Figure 75](#), the BLE command “ATVERSION” is sent from the host through any of the available communication ports. The reader processor ignores this BLE command (interpreting it as a text stream) and echoes it back to the communication ports and the BLE module. The BLE module sees the “ATVERSION” command and response with the version number of “2.02”. The reader processor sees this text stream and echoes it back to the communication ports and the response of “2.02” seen to the host. One important note to make about this process is that the echo mode of the E4 Flex needs to be on so the BLE module can see any “AT” commands. If there is a scenario where the E4 Flex needs to have its echo mode off for operation it should be turned on for the configuration of the BLE module and then can be turned off for operation. In a operational mode with echo is off will not have an effect of the BLE operation from the BLE application.

Note that on power up of the E4 Flex the BLE module monitors the output sign on message and automatically determines the baud rate of the reader and gets the serial number of the reader for the BLE advertisement that is used in the BLE application for identification of the reader.

Direct BLE Commands

The following are the available commands that can be used to configure or get the status of the BLE module with in the E4 Flex. Note that all commands must be entered in all CAPS.

ATVERSION

Command Function:

This command will give the host the current revision of the BLE firmware.

Usage:

ATVERSION

Return:

2.02

ATADVSTOP

Command Function:

Stops the BLE module from advertising. Returns ERROR if not already advertising.

Usage:

ATADVSTOP

Return:

OK

ATADVSTART

Command Function:

Starts the BLE module advertising. Returns Error if advertising is already active.

Usage:

ATADVSTART

Return:

OK

ATPIN

Command Function:

The command sets the six-digit code that is needed for added security by setting the passkey (PIN code) to pair with the BLE application. There is no default pin, and the command accepts only one argument which is a six-digit code. If the PIN code is set when the BLE application tries to connect to the reader the application will request the PIN code (of the reader it is trying to connect) for the pairing procedure.

This command can also be used to disable the PIN code pairing (see below).

Note: that the command neither checks nor sanitizes the argument passed to it. For example, ATPIN=123456 would be a valid pin entry whereas ATPIN=1234 would be invalid.

Usage: (To Set PIN)

ATPIN=12345

Return:

OK

Usage: (To disable PIN)

ATPIN=0

Return:

OK

For more information:

Sales Support
800.923.4824

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transcore.com



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