

Encompass® 4 Reader System Guide



TransCore
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Albuquerque, New Mexico 87113

April 2012
P/N 412066-010

Encompass 4 Reader System Guide

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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 FCC to operate this radio frequency identification (RFID) device in the United States. The FCC ID number is FIH05531. Access the FCC Web site at www.fcc.gov/Forms/Form601/601.html or at wireless.fcc.gov/index.htm?job=online_filing 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 from TransCore, LP. Unauthorized modification may void the equipment authorization from the FCC and will void the TransCore warranty.

**USE OF SHIELDED CABLES IS REQUIRED
47 CFR §15.27(a)**

NOTE: Shielded cables must be used with this equipment to comply with FCC regulations.

**TransCore, LP
USA**

Health Limits for Encompass 4 Reader Using Integrated Antenna (902 to 928 MHz)

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

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

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

Frequency (in MHz) **1500**

Thus, the maximum permissible exposure for general population/uncontrolled exposure at 902 MHz is $0.60 \text{ mW}/\text{cm}^2$. The power limit is a six-minute average.

The RF power density generated by the Encompass 4 Reader was calculated using a maximum antenna gain of 9.5 dBi, equivalent to the antenna gain of the integrated antenna.



Warning

At 2 W transmitted power and a distance of 19.3 inches (49 cm) from the reader, the maximum power density calculated was less than $0.60 \text{ mW}/\text{cm}^2$. Install the reader at least 19.3 inches (49 cm) from the general public. Maintenance personnel must remain at least 8.66 inches (22 cm) from reader when system is operating.

The data confirms that the TransCore Encompass 4 Reader effectively meets OSHA requirements and thus does not represent an operating hazard to either the general public or maintenance personnel.

Health Limits for Encompass 4 Reader Using External Antenna (902 to 928 MHz)

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

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

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

Frequency (in MHz) **1500**

Thus, the maximum permissible exposure for general population/uncontrolled exposure at 902 MHz is $0.60 \text{ mW}/\text{cm}^2$. The power limit is a six-minute average.

The RF power density generated by the Encompass 4 Reader was calculated using a maximum antenna gain of 9.5 dBi, equivalent to the antenna gain of the external antenna.



Warning

At 2 W transmitted power and a distance of 19.3 inches (49 cm) from the antenna, the maximum power density calculated was less than $0.60 \text{ mW}/\text{cm}^2$. Install the antenna at least 19.3 inches (49 cm) from the general public. Maintenance personnel must remain at least 8.66 inches (22 cm) from antenna when system is operating.

The data confirms that the TransCore Encompass 4 Reader effectively meets OSHA requirements and thus does not represent an operating hazard to either the general public or maintenance personnel.

Summary of Revisions to Encompass 4 Reader System Guide

Version Number	Date Revised	Summary of Changes
N/A	10/08	Entry for baseline
-002	03/09	Corrected Command #524, technical support phone number, and added grounding text and graphic to chapter 4.
-003	04/09	Revised Chapter 4 graphics, procedure steps, and caution statements to show grounding wire (12-14 AWG) and earth ground. Deleted references to command #6402 because it is factory use only.
-004	09/09	Added multiple commands to reader guide. Added instructions for discharging voltage from antenna before connecting it to the reader
-005	06/10	Updated patent statement and copyright boilerplate
-006	07/10	Minor updates and cover page changed to June 2010. No other changes.
-007	02/11	Added notes regarding power cycling and #00 command. Deleted #06, #43, #6160, and #6161 commands per engineer request. Updated Sales Support and Technical Support phone and fax numbers
-008	04/11	Corrected RS-232 interface signal wiring references in Table 4-4 and Table 4-6. Chapter 6, added Data Inquiry Protocol information. Change to Host Transmission section, page 6-8, "Upon receiving a host command, the E4 Reader replies using the command's sequence number in its response." Original E4 text was "Upon receiving a host command, the E4 Reader echoes the command's sequence number in its response." Multiple changes to Chapter 7, Commands: #410N: deleted "(different from Item ...)" text, deleted note regarding firmware version #524: deleted note that discussed appending time and date to ID codes, etc. #525: added P2 field indicating data inquiry protocol enabled #535: deleted #536: deleted #570: added TMM0 field Appendix D updated to reflect command changes
-009	01/12	Updated TransCore Technical Support phone number
-010	04/12	Added 35- and 45-foot connector cable harness information to Table 2-2. Revised Table 2-3 Power Requirements to match material presented by TransCore Technical Support in Web seminar. Updated Table 2-4 to show additional connector cable harnesses

Contents

Contents

Health Limits for Encompass 4 Reader Using Integrated Antenna (902 to 928 MHz).....	iv
Health Limits for Encompass 4 Reader Using External Antenna (902 to 928 MHz). v	
Summary of Revisions to Encompass 4 Reader System Guide	vi

1 Introduction

Purpose.....	1-3
Audience.....	1-3
System Guide Organization	1-3
Typographical Conventions	1-5
System Description	1-5
Reader.....	1-6
Tags.....	1-6
How It Works.....	1-6
Licensing Requirements	1-7
Technical Support	1-7

2 Developing the Site Plan

Overview.....	2-3
Reading of Mixed Population Tags	2-3
Reader and Tag Alignment	2-4
Polarization	2-5
Unobstructed Line of Sight	2-6
Antenna Selection	2-8
AA3100 Yagi (without radome)	2-8
AA3101 Yagi (with radome).....	2-9
AA3110 Parapanel	2-9
AA3140 PCB Log Periodic	2-9
AA3152 Universal Toll Antenna.....	2-9
AA3153 Toll Antenna.....	2-10

Antenna and Tag Alignment	2-10
Polarization	2-10
Unobstructed Line of Sight	2-11
Site Layout and Traffic Flow	2-11
The Encompass 4 Reader Read Zone	2-11
Other Encompass 4 Readers in the Area	2-12
Lane Configurations	2-12
Gate with Center Island Configuration	2-13
Parking Garage with Ticket Island Configuration	2-14
Overhead Reader Installation Configuration	2-14
Lane Configurations for Encompass 4 Readers Using an External Antenna	2-15
Reflection, Refraction, and Diffraction of RF Signals	2-15
Existing Interference	2-16
Electrical and Communications Requirements	2-16
Junction Box	2-16
Power and Communications Cables	2-16
Electrical Power	2-17
Power Extension	2-17
Host Communications	2-18
RS-232 Interface	2-19
RS-422 Interface	2-19
Wiegand Interface	2-19
Input/Output Circuits	2-19
External Antenna Interface	2-20

3 Choosing, Installing, and Removing Tags

Compatible Tag Types	3-3
Reader and Tag Model Interoperability	3-3
TransCore's eGo Plus Tags	3-4
eGo Plus Sticker Tag	3-4
eGo Plus Security Sticker Tag	3-5
eGo Plus License Plate Tag	3-5
TransCore's eGo Tags	3-6
eGo Windshield Sticker Tag	3-6
eGo License Plate Tag	3-7
Installing eGo Plus Sticker Tags	3-7
Required Materials	3-8
Positioning eGo Plus Sticker Tags	3-8
Mirror Post Attached on Windshield	3-8
Mirror Post Attached on Header	3-8
Large Truck with No Inside Mirror	3-9
eGo Plus Sticker Tag Installation Procedures	3-9
Removing eGo Plus Sticker Tags	3-10

Installing eGo Plus Security Sticker Tags	3-11
eGo Plus Security Sticker Tag Installation Procedures	3-11
Removing eGo Plus Security Sticker Tags	3-12
Installing eGo Plus License Plate Tags	3-13
Required Materials	3-13
Positioning eGo Plus License Plate Tags	3-13
eGo Plus LPT Installation Procedures	3-13
Installing eGo Windshield Sticker Tags	3-15
Required Materials	3-16
Positioning eGo Windshield Sticker Tags	3-16
Mirror Post Attached Low On Windshield	3-16
Mirror Post Attached High on Windshield	3-16
Mirror Post Attached to Headliner	3-17
Mounting the eGo Windshield Sticker Tag	3-17
Removing eGo Windshield Sticker Tags	3-18
Installing eGo LPT	3-18
Installing Interior ATA Tags	3-18
Required Materials	3-18
Positioning ATA Tags	3-19
Interior Driver's or Passenger's Side	3-19
Interior Center Windshield	3-19
ATA Interior Tag Installation Procedures	3-20
Removing Interior ATA Tags	3-21
Installing ATA License Plate Tags	3-21
Required Materials	3-21
Positioning ATA License Plate Tags	3-22
ATA License Plate Tag Installation Procedures	3-22
Types of Bumpers	3-25
Alternate Mounting Locations	3-25
Required Materials	3-25
Installation Procedures Using Tape	3-26
Installation Procedures Using Blind Rivets	3-26
Removing Exterior Tags	3-26

4 Installing the Encompass 4 Reader

Installation Process	4-3
Materials Supplied by TransCore	4-3
Contents of Shipping Carton	4-3

Installation Accessory Options	4-4
Additional Materials Needed for Testing	4-4
Pre-installation Testing of the Encompass 4 Reader	4-5
Testing the Encompass 4 Reader Using an Audible Circuit Tester	4-5
Discharging Voltage from the External Antenna	4-6
Required Equipment	4-6
Discharging the Voltage	4-6
Connecting the External Antenna	4-8
Connecting the AC Power Supply	4-8
Connecting the DC Power Supply	4-9
Connecting Communications for Bench Testing	4-9
Required Materials	4-9
Connecting for Bench Testing with RS-232 Interface	4-10
Connecting the Encompass 4 Reader Colored-Wire Pair Cable	4-11
Connecting for Bench Testing with RS-422 Interface	4-12
Bench Testing the Encompass 4 Reader Before Installation	4-12
Mounting the Encompass 4 Reader	4-14
Mounting the Encompass 4 Reader on a Round Pole	4-14
Required Materials To Be Supplied by Customer	4-14
Procedures	4-14
Mounting the Encompass 4 Reader to a Wall or Flat Surface	4-18
Required Materials	4-18
Procedures	4-18
Mounting the Antenna	4-22
Discharging Voltage from the External Antenna	4-22
Required Equipment	4-22
Discharging the Voltage	4-22
Mounting the Antenna Curb-Side	4-23
Procedures	4-24
Mounting the Antenna Overhead	4-26
Procedures	4-26
Connecting the Power Supply	4-27
Reader Cable Grounding	4-27
Connecting Communications	4-28
Required Materials	4-28
Connecting the Encompass 4 Reader to the PC	4-28
RS-232 Interface	4-28
Connecting the Encompass 4 Reader Colored-Wire Pair Cable	4-29
RS-422 Interface	4-30
Wiegand Interface	4-30
Connecting Sense Input and Sense Output Circuits	4-31
Sense Input Circuits	4-32
Sense Output Circuits	4-33

Marking the Read Zone	4-35
Required Materials	4-36
Procedures	4-36

5 General Software Information

Command Entry Conventions	5-3
Command Response Conventions	5-4
Operating Parameters	5-4
Power Fail	5-5
Program Download	5-5
Download Considerations	5-5
Download Procedures	5-5
Startup	5-5
Sign-On Message	5-6
Boot Failure Message	5-6
Tag/Message Buffer	5-6

6 Communications Protocols

Introduction	6-3
Basic Protocol	6-4
Error Correcting Protocol	6-4
Data Inquiry Protocol	6-5
Basic Protocol and ECP Format	6-5
Reader Transmissions	6-5
ECP Host ACK/NAK Response	6-6
Switch to Command Mode Request	6-7
Host Transmission	6-8
Reader Command Response	6-9
Sample Messages	6-10
Reader Transmissions	6-10
Host Command Transmissions	6-11
Timing and Synchronization	6-12
Reader-Addressed Failure Conditions	6-13
Illegal Sequence Number (not in the range 0–9, A–F)	6-13
Wrong Sequence Number	6-13
Incorrect CRC	6-13

Illegal Command	6-13
Transmission Timeout	6-14
Receive Timeout	6-14
Asynchronous Message/Command Message Collision	6-14
Host-Addressed Failure Conditions	6-14
Illegal or Wrong Sequence Number	6-14
Incorrect CRC	6-14
Transmission Timeout	6-14
Receive Timeout	6-14
Asynchronous Message/Command Message Collision	6-14
ECP Reliability	6-15
CRC Calculation	6-15
Manually Disabling ECP for Maintenance	6-18

7 Commands

Introduction	7-3
Operating Modes	7-3
Data Mode	7-3
Command Mode	7-4
Download Mode	7-4
Command List	7-5
Reader Mode Control — Command Group 0	7-5
00 Switch to Data Mode (Factory Default)	7-5
01 Switch to Command Mode	7-5
Communications Port Control — Command Group 1	7-5
100N Select Baud Rate	7-6
101N Select Stop Bits	7-6
102N Select Parity	7-6
Command Group 2	7-7
20 Set Time	7-7
21 Set Date	7-7
22 Display Time and Date	7-8
Append Information — Command Group 3	7-8
30N Append Time and Date Selection	7-8
31N Append Auxiliary Information Selection	7-9
#320 Disable EAC Page Append (Factory Default)	7-10
#321 Enable EAC Page Append	7-10
ID Filtering — Command Group 4	7-10
40 Transmit All ID Codes	7-10
410N Select Unique ID Code Criteria (Anti-passback Feature)	7-11
420N Select Valid ID Code Criteria	7-12
440 Reset Uniqueness	7-12
44N Set Uniqueness Timeout	7-12
450 Disable Wiegand Mode (Factory Default)	7-13

451 Enable Wiegand Mode	7-13
452 Disable Tag Translation Mode (Factory Default)	7-13
453 Enable Tag Translation Mode	7-13
454 Disable Multi-tag Sort (Factory Default)	7-13
455 Enable Multi-tag Sort	7-14
456 Enable eGo Plus Tag Initialization During Multi-tag Sort (Factory Default)	7-14
457 Disable eGo Plus Tag Initialization During Multi-tag Sort	7-14
458 Disable Second Alternate Group Select (Factory Default)	7-14
459 Enable Second Alternate Group Select	7-14
46NN Set Wiegand Retransmit Interval	7-15
480 Disable ATA	7-15
481 Enable ATA	7-15
482 Disable eGo	7-15
483 Enable eGo	7-15
484 Disable SeGo	7-15
485 Enable SeGo	7-15
486 Disable IAG	7-15
487 Enable IAG	7-15
488 Disable eATA	7-15
489 Enable eATA	7-16
490 Disable Third Alternate Group Select (Factory Default)	7-16
491 Enable Third Alternate Group Select	7-16
492 Disable Fourth Alternate Group Select (Factory Default)	7-16
493 Enable Fourth Alternate Group Select	7-16
494 Disable Fifth Alternate Group Select (Factory Default)	7-16
495 Enable Fifth Alternate Group Select	7-17
496 Disable Alternate Group Select (Factory Default)	7-17
497 Enable Alternate Group Select	7-17
Reader Status — Command Group 5	7-17
505 Display Software Version	7-17
506 Display Hardware Configuration Information	7-17
510 Display RF Transceiver FPGA Version	7-18
511 Display RF Transceiver I Filter Chip Version	7-18
512 Display RF Transceiver Q Filter Chip Version	7-18
513 Display DSP Board Actel Version	7-18
520 Display Power Fail Bit	7-18
521 Display Reader ID Number	7-18
522 Display Communications Port Parameters	7-18
524 Display Appended Information Status	7-19
525 Display Communications Protocol Status	7-20
526 Display I/O Status	7-20
527 Display RF Status	7-23
529 Display Presence Input Status	7-24
530 Display RF0 Filter Status	7-25
532 Display Wiegand Mode Status	7-26
533 Display Wiegand Retransmit Interval	7-26
534 Display Tag Translation Mode Status	7-27
537 Display Echo Status	7-27
540 Display Flash Checksum	7-27

543 Display Boot Checksum	7-27
549 Display User-Programmable Group Select Equals (GSE) Filter Data	7-28
560 Request Sensor Status Change	7-28
570 Display Tag Protocols	7-28
577 Report Buffered Handshakes	7-29
#582 Display Synchronization Values	7-29
Reader Control Functions — Command Group 6	7-29
60NN Set Reader ID Number	7-29
610 Select Basic Communication Protocol (Factory Default)	7-30
611 Select Error Correcting Protocol	7-30
612NN Select Error Correcting Protocol Timeout	7-30
613 Enable Data Inquiry Protocol	7-30
614N Select Flow Control Option	7-31
6170 Disable Echo Mode	7-31
6171 Enable Echo Mode (Factory Default)	7-31
620N Set Output Control	7-32
621 Select Predefined Output Control (Factory Default)	7-32
63 Reset Reader	7-32
640N RF Control	7-33
641 Select RF-by-Input Control (Factory Default)	7-33
642NN Select RF Operating Frequency	7-33
643NN Select ATA Operating Range (Distance)	7-36
644NN Set RF Attenuation	7-36
645NN Set eGo and eGo Plus Operating Range (Distance)	7-36
646XX Set IAG RF Attenuation	7-37
647XXX Select RF Operating Frequency	7-37
#648NN Set Synchronization Output Delay Time	7-38
#649NN Set Synchronization Hold Off Time	7-39
65 Reset Power Fail Bit	7-40
66F Load Default Operating Parameters	7-40
67N Set Output Pulse Duration	7-40
690N Select Presence Without Tag Report Option	7-41
692N Select RF Control Algorithm	7-42
693N Select RF Timeout Period	7-42
694N Select Input Inversion Option	7-43
695S...S Set Serial Number	7-44
696S...S Store Hardware Configuration String	7-44
697 Set User-Programmable Group Select Equals (GSE) Filter	7-45
Auxiliary Reader Control — Command Group 8	7-46
82N Select Input Status Change Report Option	7-46
830 Disable Automatic Periodic RF Status Report (Factory Default)	7-46
831 Enable Automatic Periodic RF Status Report	7-46

8 Configuring the Encompass 4 Reader

Configuring the Reader	8-3
General Configuration Labeling	8-3
Default Operating Parameter Settings	8-4

Configuring Parameters with Terminal Emulation Software	8-5
Starting the Terminal Emulation Software	8-6
Verifying Communications	8-8
Verifying Tag Read Capability	8-10
Configuring Encompass 4 Parameters	8-12
Appended Tag Data	8-13
ID Separation	8-13
Reports	8-13
Reset Reader	8-14
Radio Frequency	8-15
RF Transmission	8-15
Vehicle Detector Controlling RF Transmission	8-16
Host Controlling RF Transmission	8-16
Continuous RF Transmission	8-16
Sense Inputs	8-17
Sense Output Devices	8-17
Serial Port Communications	8-18
Port Configuration Parameters	8-18
Communications Protocol	8-19
Software Flow Control	8-19
Fine-Tuning and Verifying the Read Zone	8-19
Physically Orienting the Encompass 4 Reader	8-20
Physically Orienting the Encompass 4 Reader Antenna	8-20
Fine-Tuning the Read Zone by Lowering Output Power	8-20
Fine-tuning the Read Zone by Adjusting Sensitivity Range	8-21

9 Troubleshooting and Maintenance

Error Messages	9-3
Troubleshooting	9-4
Encompass 4 Reader Repair	9-6
Technical Support	9-6
Marketing Support	9-7
Find a Problem with the Encompass 4 Reader or Have Suggestions?	9-7

A Glossary

B Technical Specifications

Reader Specifications	B-3
Communications	B-3

<i>Hardware Features</i>	<i>B-3</i>
<i>Power Requirements</i>	<i>B-3</i>
<i>Physical Attributes</i>	<i>B-3</i>
<i>Environmental Parameters</i>	<i>B-4</i>
<i>Options</i>	<i>B-4</i>

C Wiring Tables

Communications Interfaces	C-3
Cable Supplied with the Encompass 4 Reader	C-4
<i>RS-232 Interface</i>	<i>C-5</i>
<i>RS-422 Interface</i>	<i>C-6</i>
<i>Wiegand Interface</i>	<i>C-7</i>
Power Supply Connections	C-7
<i>AC Power</i>	<i>C-7</i>
<i>Low-Voltage DC Power</i>	<i>C-8</i>
Input/Output Cabling Assignments	C-9
<i>Summary Table</i>	<i>C-13</i>

D Command Quick Reference

Command Syntax	D-3
Factory Default Settings	D-3
Numerical Command List	D-5
Alphabetical Command List	D-16

E Compatible Tag Information

Tag Configurations	E-3
<i>Tag Data Formats</i>	<i>E-6</i>

List of Figures

Figure 1-1 Encompass 4 Reader System Front and Side Views	1-6
Figure 2-1 Tag and Reader Orientation	2-5
Figure 2-2 Encompass 4 Reader Location Relative to Tag Position	2-6
Figure 2-3 Typical Tag Positions for U.S. Driver's Side Reader	2-7
Figure 2-4 Typical Tag Positions for U.S. Passenger's Side Reader	2-7
Figure 2-5 Typical Tag Positions Used with Overhead Reader	2-8
Figure 2-6 Gate Application with Center Island	2-13
Figure 2-7 Parking Garage Application	2-14
Figure 2-8 Overhead Installation	2-15
Figure 3-1 eGo Plus Windshield Sticker Tag	3-5
Figure 3-2 eGo Plus Security Sticker Tag	3-5
Figure 3-3 eGo Plus License Plate Tag	3-6
Figure 3-4 eGo Windshield Sticker Tag	3-7
Figure 3-5 eGo License Plate Tag	3-7
Figure 3-6 eGo Plus Sticker Tag Placement	3-8
Figure 3-7 eGo Plus Sticker Tag Placement	3-9
Figure 3-8 eGo Plus Sticker Tag Placement in Large Truck	3-9
Figure 3-9 Applying eGo Plus Sticker Tag to Windshield	3-10
Figure 3-10 Second Step of eGo Plus Sticker Tag Application	3-10
Figure 3-11 Applying eGo Plus Security Sticker Tag to Windshield	3-12
Figure 3-12 Second Step of eGo Plus Security Sticker Tag Application	3-12
Figure 3-13 Correct Mounting Location for LPT	3-14
Figure 3-14 Correct Tag Orientation	3-14
Figure 3-15 Upper Placement Over the Top Area of the License Plate	3-15
Figure 3-16 eGo Windshield Sticker Tag Placement Option A	3-16
Figure 3-17 eGo Windshield Sticker Tag Placement Option B	3-17
Figure 3-18 eGo Windshield Sticker Tag Placement Option C	3-17
Figure 3-19 Driver's or Passenger's Side (U.S.) Interior Windshield Tag Location	3-19
Figure 3-20 Upper Center Interior Windshield Tag Location	3-20
Figure 3-21 Hook-and-Loop Material on Interior Tag	3-20
Figure 3-22 Proper Tag Orientation	3-22
Figure 3-23 Correct Exterior Tag Placement	3-23
Figure 3-24 Upper Placement In License Plate Area	3-24
Figure 3-25 Obstruction-Free Area	3-24
Figure 3-26 Spacer Positioned Behind Tag	3-25
Figure 3-27 Exterior Tag with Double-Sided Tape	3-26
Figure 4-1 Wiring for Audible Circuit Tester	4-5
Figure 4-2 Connect RF N-type Load or Attenuator to Reader Cable End	4-6
Figure 4-3 Short Load to Earth Ground	4-7
Figure 4-4 Back of Encompass 4 Reader Showing Antenna Connector	4-8
Figure 4-5 Pin Assignments for Signal to Host Connectors	4-10
Figure 4-6 Back of the Encompass 4 Reader (reader shown has integrated antenna)	4-15
Figure 4-7 Factory-Mounted Bracket	4-15
Figure 4-8 Pole-Mount Bracket Assembly	4-15
Figure 4-9 The Encompass 4 Reader Attached to the Pole Mount Bracket	4-16
Figure 4-10 Front and Top Views of the Encompass 4 Reader Position	4-17
Figure 4-11 Wall Mount Bracket Accessory (part number 54-1620-001)	4-18

Figure 4-12 Wall Mount Bracket Attached to the Encompass 4 Reader	4-19
Figure 4-13 Factory-Mounted Bracket Attached to Wall Mount Bracket	4-20
Figure 4-14 Pole Mount Bracket Attached to Wall	4-20
Figure 4-15 Connecting the Encompass 4 Assembly to Pole Mount Bracket	4-21
Figure 4-16 Connect RF N-type Load or Attenuator to Reader Cable End	4-22
Figure 4-17 Short Load to Earth Ground	4-23
Figure 4-18 Front and Top Views of the Curb-Side Antenna Position	4-25
Figure 4-19 Encompass 4 Reader Installation with Overhead Antenna	4-26
Figure 4-20 Recommended Reader Cable Grounding	4-27
Figure 4-21 Sample Circuit Connections	4-32
Figure 4-22 Sample Circuit Connections for IAG Installations	4-33
Figure 4-23 Sample Read Zone Marking Pattern	4-38
Figure 7-1 Example of Synchronization Bus Wiring	7-39
Figure 8-1 Connection Description Dialog Box	8-6
Figure 8-2 Phone Number Dialog Box	8-7
Figure 8-3 COM 1 Properties Dialog Box	8-7
Figure 8-4 Hyper Terminal Main Screen	8-8
Figure 8-5 Sign-on Message	8-9
Figure 8-6 Successful Tag Read	8-11
Figure 8-7 Second Successful Tag Read	8-12
Figure 8-8 Encompass 4 Reader RF Control Options	8-16
Figure C-1 DB9 and DB25 Connector Pin Assignments for Signal to Host	C-4

List of Tables

Table 1-1	Typographical Conventions	1-5
Table 2-1	Examples of Staggered Reader Frequencies	2-12
Table 2-2	Connector Cabling Accessory Kits	2-16
Table 2-3	Power Supply Current Requirements	2-17
Table 2-4	Recommended Cable Length from Transformer to the Encompass 4 Reader	2-18
Table 2-5	Communications Interfaces and Conductor Requirements	2-18
Table 2-6	Reader to Antenna Cable Performance	2-20
Table 3-1	Tags Read by the Encompass 4 Reader	3-3
Table 3-2	eGo Plus Tag Features	3-4
Table 3-3	eGo Tag Features	3-6
Table 4-1	Installation Accessories	4-4
Table 4-2	AC Transformer Connections for Colored-Wire Pair Cable	4-8
Table 4-3	Low Voltage DC Cable Connections for the Colored-Wire Pair Cable	4-9
Table 4-4	RS-232 Interface Signal Wiring for Colored-Wire Pair Cable	4-11
Table 4-5	Commands for Bench Testing	4-13
Table 4-6	RS-232 Interface Signal Wiring for Colored-Wire Pair Cable	4-29
Table 4-7	RS-422 Interface Signal Wiring for Colored-Wire Pair Cable	4-30
Table 4-8	Wiegand Interface Signal Wiring for Colored-Wire Pair Cable	4-31
Table 4-9	Sense Input/Output Cabling Assignments	4-34
Table 5-1	Four-Character Command Structure	5-3
Table 5-2	Sample Command Sequence	5-4
Table 7-1	Select Baud Rate Commands	7-6
Table 7-2	Select Stop Bits Commands	7-6
Table 7-3	Select Parity Commands	7-7
Table 7-4	Append Time and Date Commands	7-9
Table 7-5	Append Auxiliary Information Commands	7-9
Table 7-6	Unique ID Code Criteria	7-11
Table 7-7	Select Valid Code Commands and Frames	7-12
Table 7-8	Open/Closed Conditions for Output Status	7-22
Table 7-9	Open/Closed Conditions for Output Status (IAG Applications)	7-22
Table 7-10	Open/Closed Conditions for Input Status	7-23
Table 7-11	Flow Control Commands	7-31
Table 7-12	Output Control Commands	7-32
Table 7-13	RF Control Commands	7-33
Table 7-14	RF Frequency Commands	7-34
Table 7-15	RF Attenuation Command Variables	7-36
Table 7-16	Select RF Operating Frequency Commands	7-37
Table 7-17	Example of Encompass 4 Reader Plaza Synchronization Bus Settings	7-40
Table 7-18	Output Pulse Duration Commands	7-41
Table 7-19	Presence Without Tag Report Commands	7-42
Table 7-20	RF Control Algorithm Commands	7-42
Table 7-21	Timeout Period Values	7-43
Table 7-22	Input Inversion Options	7-44
Table 7-23	Input Status Change Report Options	7-46
Table 8-1	Encompass 4 Reader Configuration Label Fields	8-3
Table 8-2	Encompass 4 Reader Default Configuration Settings	8-4
Table 8-3	Command Sequence to Verify Communications	8-10
Table 9-1	Error Messages	9-3
Table 9-2	Symptoms and Remedies	9-4

Table C-1 Communications Interfaces and Conductor Requirements	C-3
Table C-2 RS-232 Interface Signal Wiring for Colored-Wire Pair Cable	C-5
Table C-3 RS-232 Interface Signal Wiring for Alternate Wire Cable	C-5
Table C-4 RS-422 Interface Signal Wiring for Colored-Wire Pair Cable	C-6
Table C-5 RS-422 Interface Signal Wiring for Alternate Wire Cable	C-6
Table C-6 Wiegand Interface Signal Wiring for Colored-Wire Pair Cable	C-7
Table C-7 Wiegand Interface Signal Wiring for Alternate Wire Cable	C-7
Table C-8 AC Transformer Connections for Colored-Wire Pair Cable	C-7
Table C-9 AC Transformer Connections for Alternate Wire Cable	C-8
Table C-10 Low Voltage DC Cable Connections for Colored-Wire Pair Cable	C-8
Table C-11 Low Voltage DC Cable Connections for Alternate Wire Cable	C-8
Table C-12 Sense Input/Output Cabling Assignments for Colored-Wire Pair Cable	C-9
Table C-13 Sense Input/Output Cabling Assignments for Alternate Wire Cable	C-11
Table C-14 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable	C-13
Table D-1 Encompass 4 Reader Default Configuration Settings	D-3
Table D-2 Encompass 4 Reader Commands Listed Numerically	D-5
Table D-3 Encompass 4 Reader Commands Listed Alphabetically	D-16
Table E-1 SeGo Protocol Tags	E-3
Table E-2 eGo Protocol Tags	E-4
Table E-3 ATA Protocol Tags	E-4

Introduction

Chapter 1

Introduction

This chapter is the introduction to this manual and provides information pertaining to the audience, organization, document conventions, system description, and license information for the Encompass® 4 Reader System.

Purpose

This guide provides site planning and testing, installing, and operating instructions for TransCore's Encompass 4 Reader System, a dual-protocol reader that reads TransCore Super eGo® (SeGo), Intellitag®-based eGo, American Trucking Associations (ATA)/International Organization for Standardization (ISO), and Inter-Agency Group (IAG) tag protocols. Before you begin installing the Encompass 4 Reader System, TransCore recommends that you read this entire manual.

Audience

This document is intended to be used by authorized TransCore Encompass 4 Reader System dealers, installers, and service personnel. Because the Encompass 4 Reader System has no operator- or end-user serviceable components or features, no end-user manual or operator guide exists. Once the system is set up and tested by the *authorized* installer, Encompass 4 Reader System operation requires no end-user intervention.

System Guide Organization

Note: TransCore offers the Encompass 4 Reader in two models: one with an integrated antenna and one that requires connection to an external antenna. In this system guide, information and instructions for both Encompass 4 Reader models are presented. Where separate instructions dictate, a section detailing one Encompass 4 Reader model is followed immediately with a section detailing the other reader model. In this system guide, the reader with an integrated antenna is listed first. In cases where the information does not warrant a separate section, the addition of "...or antenna" distinguishes between the Encompass 4 Reader models.

The chapters of this guide and a description of the contents are listed here.



- Chapter 1, "Introduction," explains the purpose and describes the audience for the guide, outlines the manual's organization, provides a brief description of the Encompass 4 Reader system, and discusses Federal Communications Commission (FCC) licensing requirements.

- Chapter 2, “Developing the Site Plan,” discusses factors to be considered when developing the site plan and before ordering equipment and installing the Encompass 4 Reader System. These considerations include reader or antenna and tag alignment, site layout and traffic flow, and electrical and communications requirements.
- Chapter 3, “Choosing, Installing, and Removing Tags,” contains information on compatible tag models and provides procedures for installing tags onto, and removing tags from, vehicles that use the facility where the Encompass 4 Reader System is installed.
- Chapter 4, “Installing the Encompass 4 Reader System,” lists the materials needed and provides procedures to install the Encompass 4 Reader System. Steps include:
 - Pre-testing
 - Installing the Encompass 4 Reader System on a round pole or flat surface
 - Connecting power and communications
 - Marking the read zone.
- Chapter 5, “General Software Information,” and Chapter 6, “Communications Protocols,” provide reference information on various software-related topics and communications protocols.
- Chapter 7, “Commands,” discusses the host-transmitted commands that are used to control Encompass 4 Reader System configuration and operation.
- Chapter 8, “Configuring the Encompass 4 Reader System,” provides procedures for configuring and fine-tuning the Encompass 4 Reader System after installing it at the site.
- Chapter 9, “Troubleshooting and Maintenance,” answers the most commonly asked questions about installing and maintaining the Encompass 4 Reader System.
- Appendix A, “Glossary,” contains frequently used terms.
- Appendix B, “Technical Specifications,” provides the Encompass 4 Reader System specifications.
- Appendix C, “Wiring Tables,” shows the wiring connections for the communications interfaces, electrical cable connections, and the external interface signal wiring.
- Appendix D, “Command Quick Reference,” lists the Encompass 4 Reader System factory default configuration settings and provides host software commands in numerical and alphabetical order.
- Appendix E, “Compatible Tag Information,” provides helpful information about tags that are compatible with the Encompass 4 Reader System.
- Index provides an alphabetical listing of guide topics.

Typographical Conventions

The conventions listed in [Table 1-1](#) are used in this manual:

Table 1-1 *Typographical Conventions*

Convention	Indication
	Concerns about a procedure.
Code	Code, including keywords and variables within text and as separate paragraphs, and user-defined program elements within text appear in courier typeface.
Dialog Box Title	Title of a dialog box as it appears on screen.
Menu Item	Appears on a menu. Capitalization follows the interface.
<i>Note</i>	Auxiliary information that further clarifies the current discussion. These important points require the user's attention. The paragraph is in italics and the word Note is bold.
NUL	Zero-value ASCII character or a zero-value byte.
NULL	Zero-value pointers. Null-terminated string refers to strings of printable ASCII characters with a zero-value byte placed in memory directly after the last printable character of the string.
	This procedure might cause harm to the equipment and/or the user.

System Description

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

The Encompass 4 Reader System is a high-power unit that can read both half-frame and full-frame tags. The reader output power can be adjusted using reader commands.

Reader

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

A second version of the Encompass 4 Reader is designed to be used with a high-performance external antenna. These Encompass 4 Reader System components are contained in a highly reliable, compact, and easy-to-install environmentally-sealed package. [Figure 1-1](#) shows the front and side views of an Encompass 4 Reader System.

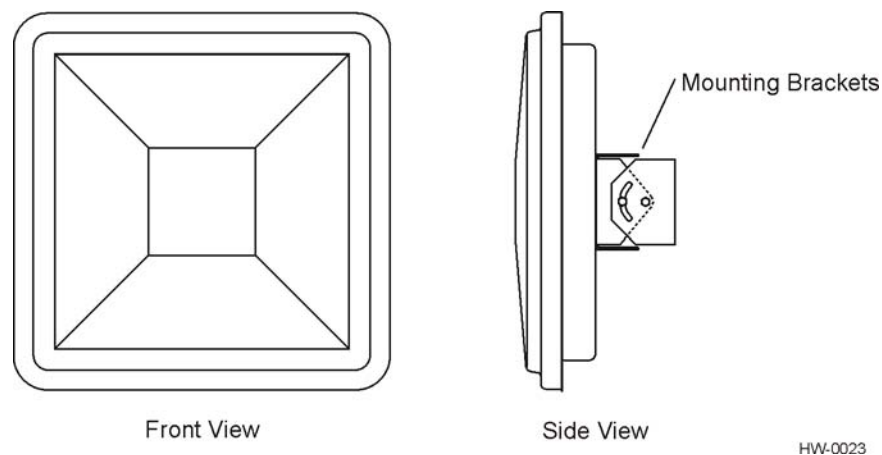


Figure 1-1 Encompass 4 Reader System Front and Side Views

Tags

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

How It Works

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

Licensing Requirements

An FCC license provides the user with the legal authorization to operate the Encompass 4 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 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 equipment is installed.

Users of the Encompass 4 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.

The user is responsible for filing the FCC license according to FCC regulations, but the TransCore dealer will provide assistance and support as necessary to complete these forms. Forms are available online at the FCC internet site www.fcc.gov/Forms/Form601/601.html or you can file online at wireless.fcc.gov/index.htm?job=online_filing. For further information on obtaining the license contact TransCore.

Technical Support

Authorized dealers and distributors are responsible for the direct support of all customers. Authorized dealers and distributors needing technical support can contact:

Technical Support

Phone: (505) 856-8007

Web: transcore.com/rfidsupport

Please be prepared to answer a series of questions that are designed to direct you to the best support resource available.

Developing the Site Plan

Developing the Site Plan

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

Overview

Note: In this section, unless specifically stated, "Encompass 4 Reader" applies both to the Encompass 4 Reader with integrated antenna and Encompass 4 Reader with external antenna.

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 Reader(s) and tags.

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

- Type of tags used in the facility
- Reader and/or antenna and tag alignment
- Site layout and traffic flow
- Encompass 4 Reader and/or antenna mounting requirements
- Encompass 4 Reader electrical requirements
- Encompass 4 Reader communications 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 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, application-specific integrated circuit (ASIC)-based tags with Intellitag technology, or Inter-Agency

Group (IAG) tags. The reader can read the ATA or ISO read-only tags in the presence of Intellitag-based tags; however, attempting to read an Intellitag-based tag in the presence of an ATA or ISO read-only tag is not recommended.



Caution

Attempting to read an Intellitag-based tag in the presence of an ATA or ISO read-only tag may provide unreliable results.

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

Reader and Tag Alignment

The position of the Encompass 4 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 Reader location and orientation at the site.

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

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

- Polarization of the tag and the Encompass 4 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 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 Reader, as shown in [Figure 2-1](#).

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

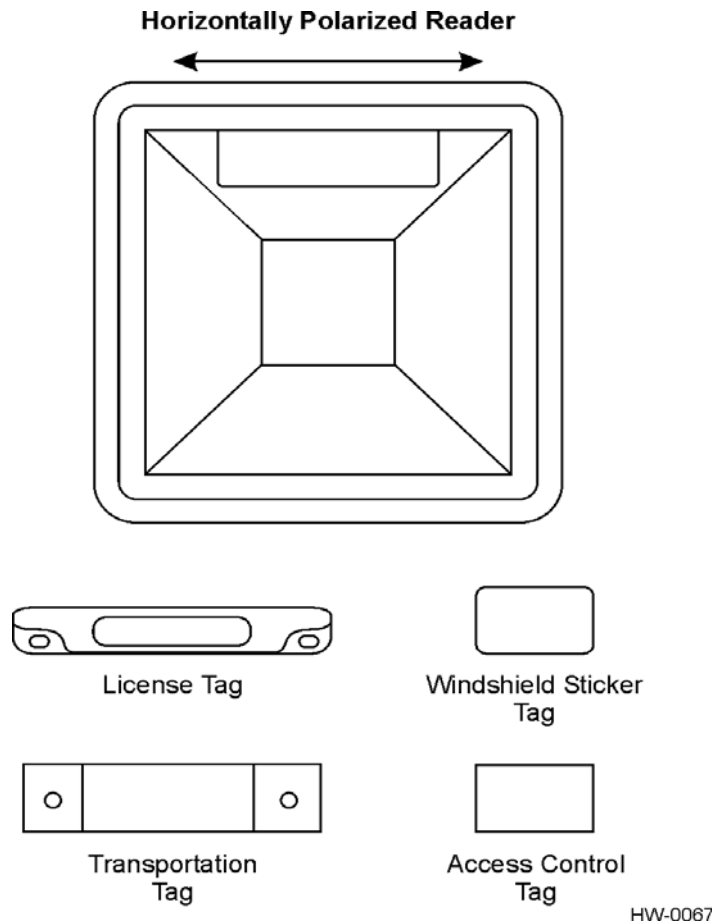
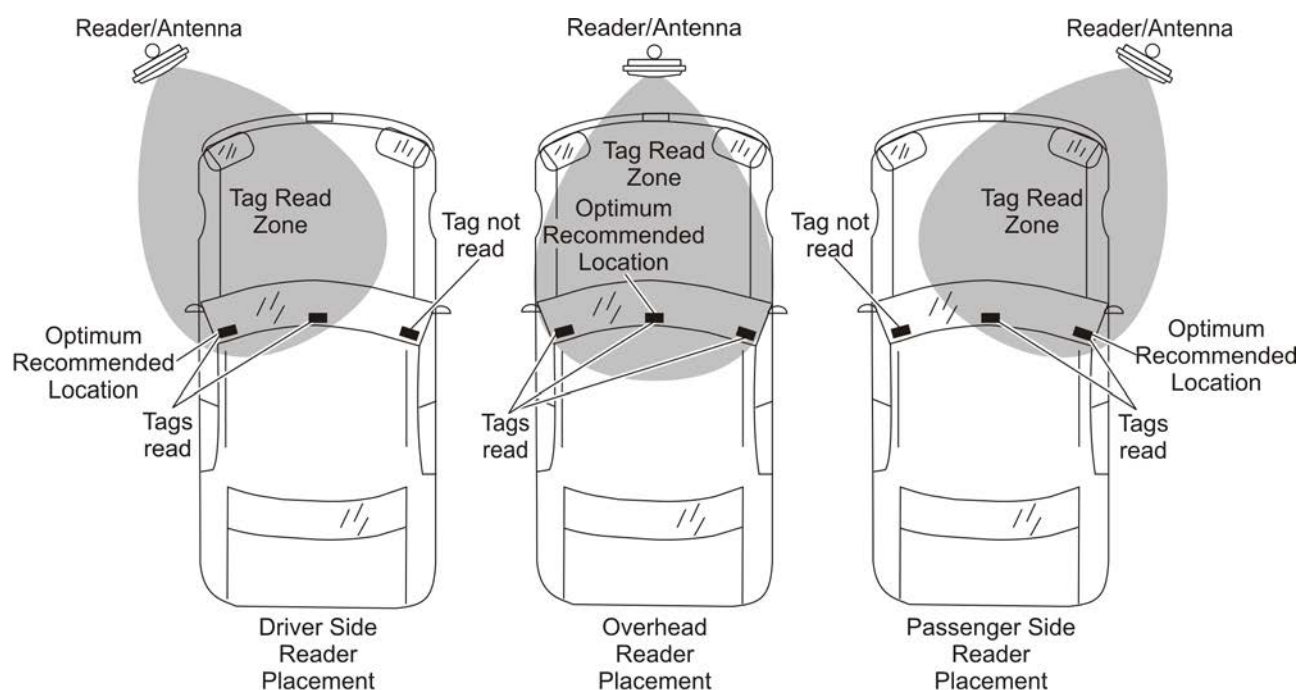


Figure 2-1 Tag and Reader Orientation

Unobstructed Line of Sight

For optimum readability, install the Encompass 4 Reader and the vehicle's tag so that when the vehicle approaches the Encompass 4 Reader, the tag is directly facing the reader and the line of sight is clear between the Encompass 4 Reader and the tag. If a fence or barrier is between the tag and the reader, the Encompass 4 Reader cannot reliably read the tags. [Figure 2-2](#) illustrates possible installation locations of an Encompass 4 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.



TA-0202

Figure 2-2 Encompass 4 Reader Location Relative to Tag Position

If the Encompass 4 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 2-3](#).

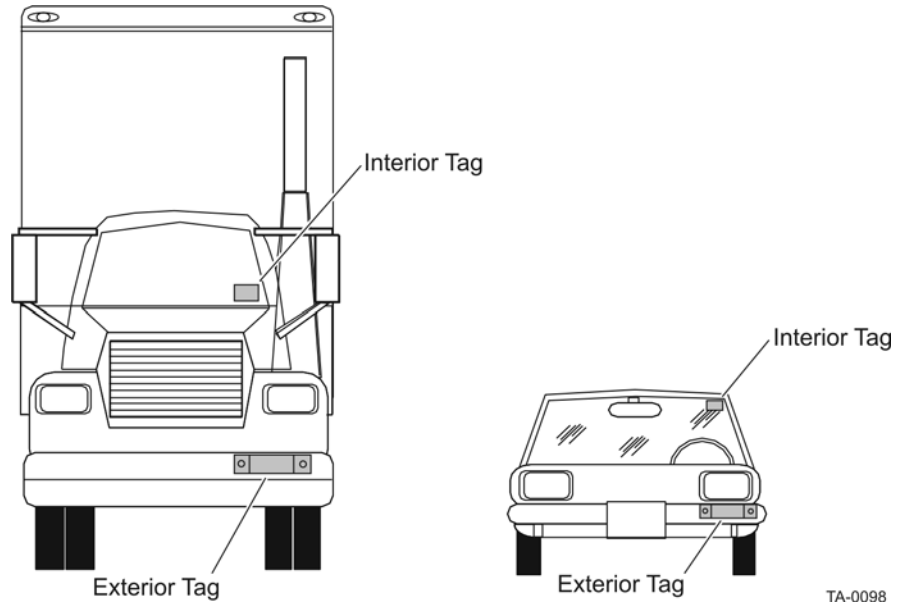


Figure 2-3 Typical Tag Positions for U.S. Driver's Side Reader

If an Encompass 4 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 2-4](#).

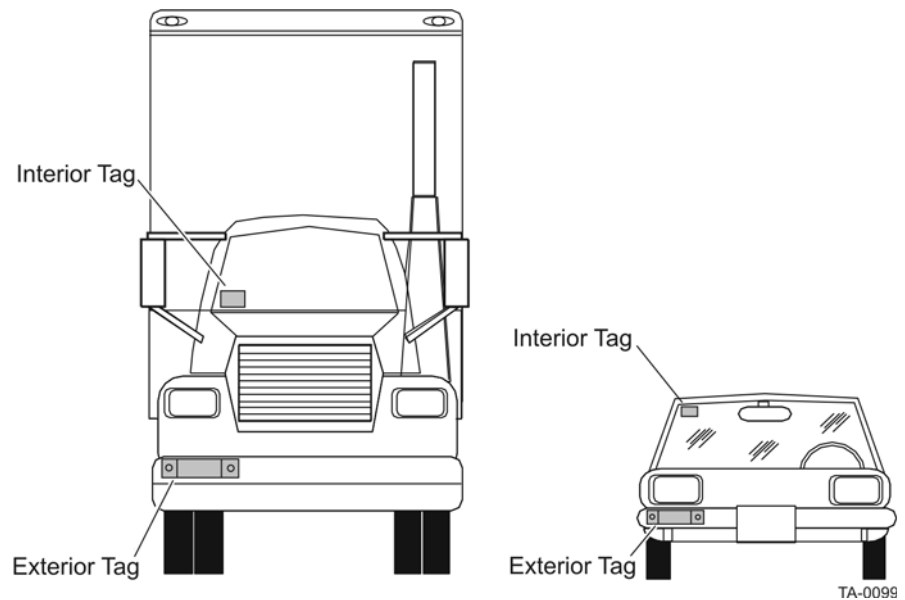


Figure 2-4 Typical Tag Positions for U.S. Passenger's Side Reader

If the Encompass 4 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 2-5](#).

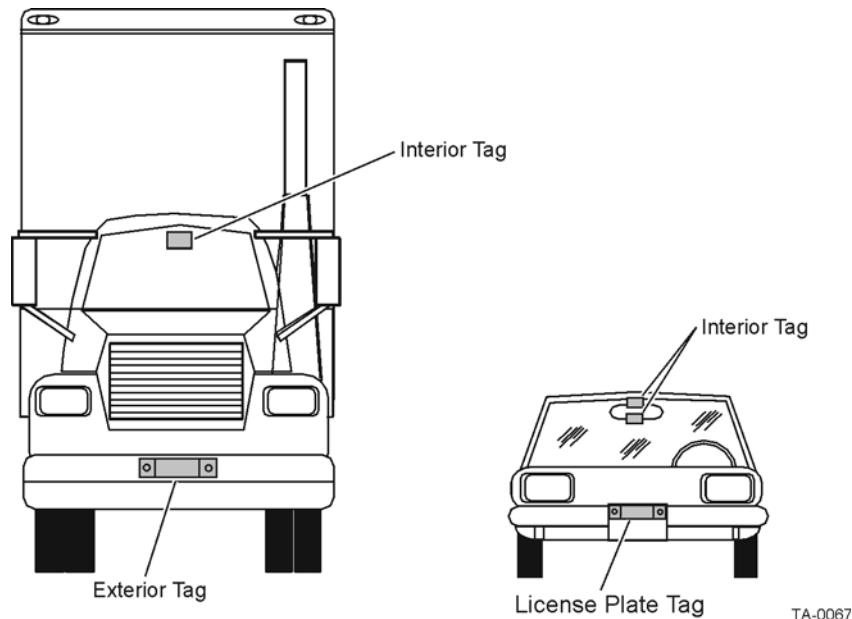


Figure 2-5 Typical Tag Positions Used with Overhead Reader

Note: Metallized coatings on some vehicle windshields and windows shield the RF energy emitted by the Encompass 4 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 [Chapter 3, "Choosing, Installing, and Removing Tags"](#) for more detailed information on tag positioning.

Antenna Selection

This section contains guidelines that assist in antenna selection for an Encompass 4 Reader installation that uses an external antenna. The following antennas are compatible with the Encompass 4 Reader installation.

AA3100 Yagi (without radome)

Appropriate for installations with the following requirements and conditions:

- 902 to 928 MHz operation
- Non-icing environments
- Relatively symmetrical reading range
- Antenna profile not a major consideration

AA3101 Yagi (with radome)

Appropriate for installations with the following requirements and conditions:

- 902 to 928 MHz operation
- Exposure to harsh environments
- Relatively symmetrical reading range
- Antenna profile not a major consideration

AA3110 Parapanel

Appropriate for installations with the following requirements and conditions:

- 902 to 928 MHz operation
- Exposure to harsh environments
- Broad radiation pattern in one dimension, narrow in the other
- Low antenna profile
- Horizontal polarization

AA3140 PCB Log Periodic

Appropriate for installations with the following requirements and conditions:

- 845 to 950 MHz operation
- Exposure to harsh environments
- Maximum coverage at close range (<20 ft [6.1 m])
- Vertical or horizontal polarization

AA3152 Universal Toll Antenna

Appropriate for installations with the following requirements and conditions:

- 902 to 928 MHz operation
- Exposure to harsh environments
- Broadcast pattern of similar size and shape in both horizontal and vertical planes
- Low antenna profile

Note: Do not use an AA3152 Universal Toll Antenna for side-fire application.

AA3153 Toll Antenna

Appropriate for installations with the following requirements and conditions:

- 902 to 928 MHz operation
- Exposure to harsh environments
- Broadcast pattern with virtually no side or back lobes, which helps confine coverage to a single lane width
- Low antenna profile

Antenna and Tag Alignment

The position of the antenna connected to the Encompass 4 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 Reader antenna location and orientation at the site.

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

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

- Polarization of the tag and the Encompass 4 Reader antenna must be aligned horizontally.
- The installed tag must be in a direct, unobstructed line of sight to the Encompass 4 Reader antenna.
- 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 antenna connected to the Encompass 4 Reader.

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

Unobstructed Line of Sight

For optimum readability, install the Encompass 4 Reader antenna and the vehicle's tag so that when the vehicle approaches the antenna, the tag is directly facing the antenna and the line of sight is clear between the antenna and the tag. If a fence or barrier is between the tag and the antenna, the antenna cannot reliably read the tags. [Figure 2-2](#) illustrates possible installation locations of an Encompass 4 Reader antenna 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.

Site Layout and Traffic Flow

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

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

The Encompass 4 Reader Read Zone

The Encompass 4 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 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 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.

The external antenna 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, see [“Fine-Tuning and Verifying the Read Zone” on page 8-19](#).

Other Encompass 4 Readers in the Area

Sites with more than one Encompass 4 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 Reader and antenna is in a side-by-side or multiple lane application, the frequencies should be staggered. Also, Encompass 4 Readers may not operate accurately if they directly face each other or are positioned back-to-back.

[Table 2-1](#) shows examples of staggered reader frequencies in a site with up to 14 readers.

Table 2-1 Examples of Staggered Reader Frequencies

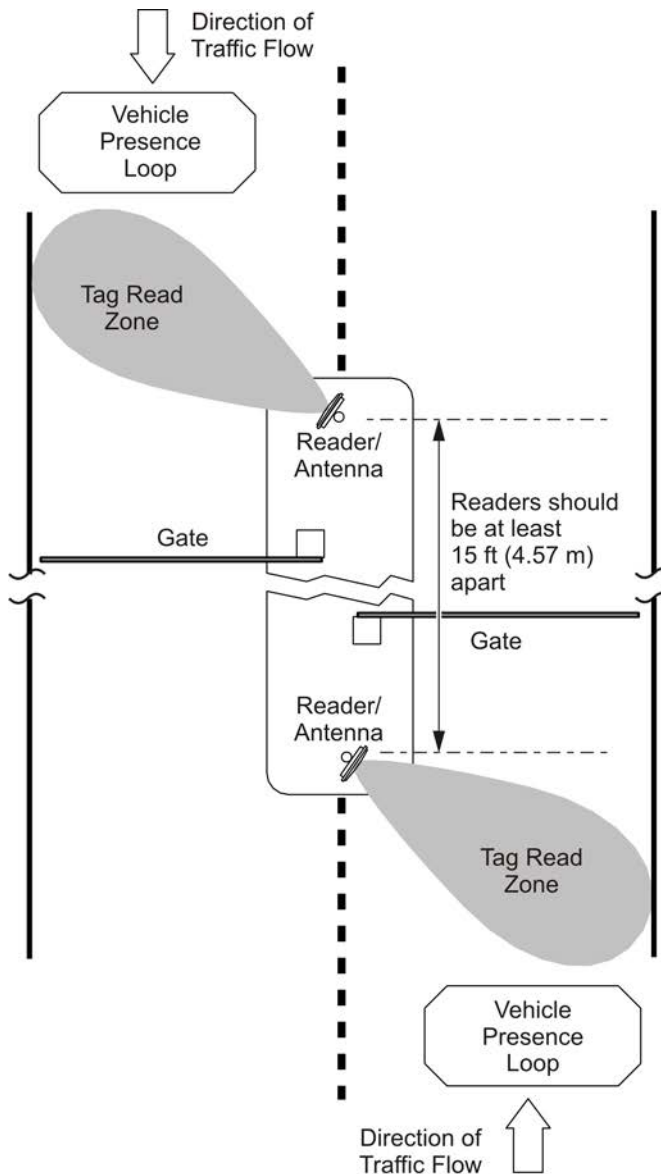
Lane Number	Reader Frequency	Lane Number	Reader Frequency
1	912.5	2	915
3	917.5	4	913.5
5	916	6	918.5
7	914.5	8	917
9	913	10	915.5
11	918	12	914
13	916.5	14	919

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

Gate with Center Island Configuration

Figure 2-6 illustrates a typical gate application with the Encompass 4 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.

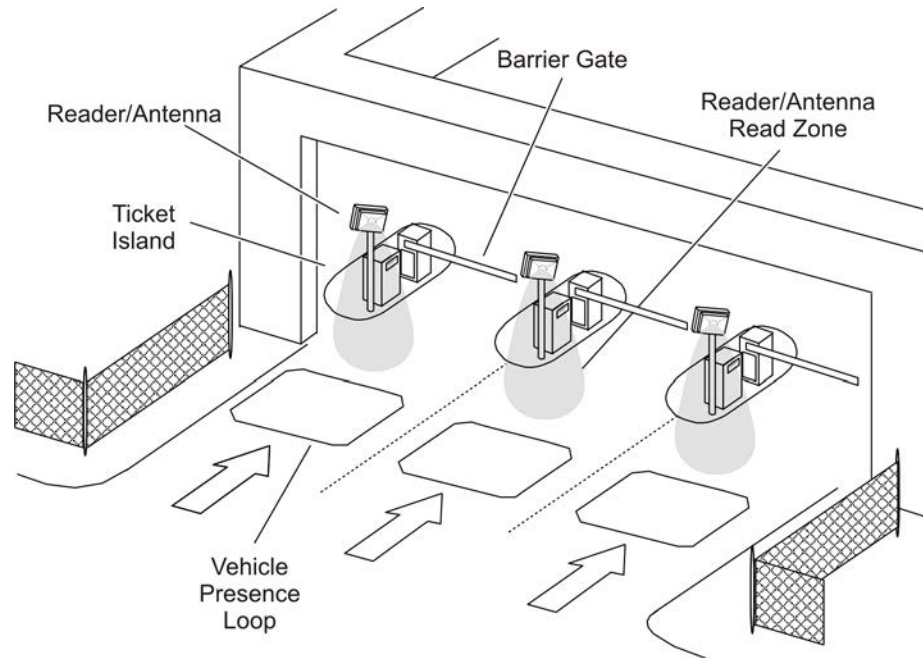


SD-0145

Figure 2-6 Gate Application with Center Island

Parking Garage with Ticket Island Configuration

Figure 2-7 illustrates a parking garage application with each Encompass 4 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 Reader placement may require the vehicle to stop before the gate opens.

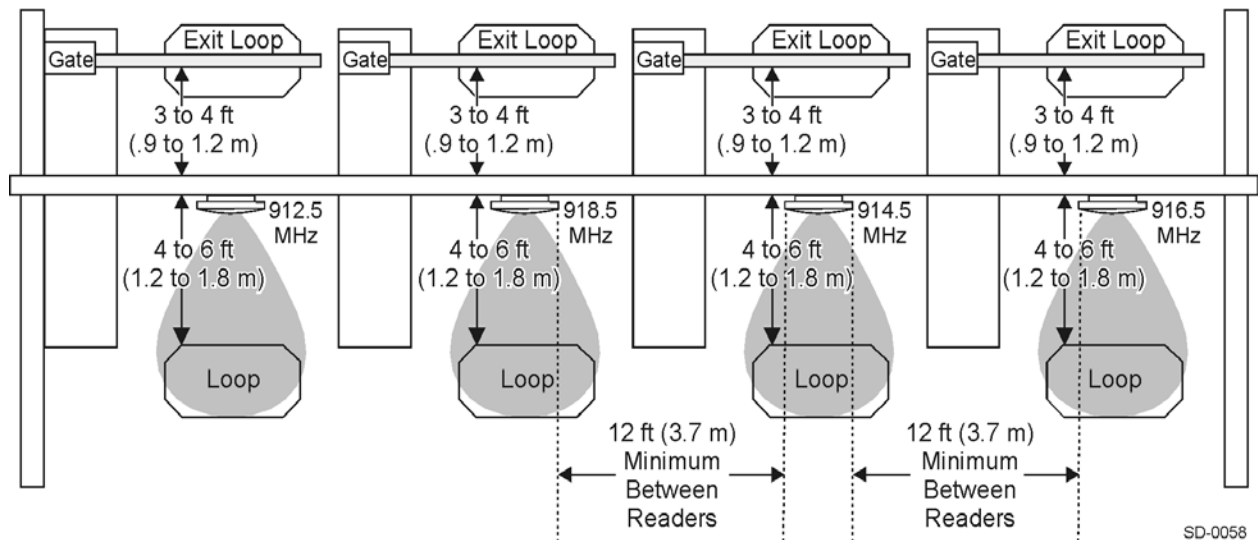


SD-0146

Figure 2-7 Parking Garage Application

Overhead Reader Installation Configuration

Another option for Encompass 4 Reader placement is to mount it overhead in each lane as illustrated in Figure 2-8. This illustration assumes that tags are mounted on the inside center windshield or center bumper of the vehicle.



SD-0058

Figure 2-8 Overhead Installation

Lane Configurations for Encompass 4 Readers 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 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 your site plan, you must consider permanent structures and transient factors in the vicinity that may affect RF signals being generated by the Encompass 4 Reader. Permanent structures include buildings, chain link fences, guard shacks, and gates. Transient factors include passing traffic and local weather conditions, such as rain or snow. Symptoms of reflection, refraction, and diffraction include reading tags that are out of the desired read zone or tags being read from another lane.

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

The Encompass 4 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. See [Chapter 9, "Troubleshooting and Maintenance"](#) for more information.

Existing Interference

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

Interference may degrade both reader and tag performance. Existing interference at the site may be shielded, removed, or positioned further from the Encompass 4 Reader and/or antenna. In some cases, changing the operating frequency of the Encompass 4 Reader may provide a simple solution. Readers in proximity should have at least a 2 MHz frequency separation. See [“Other Encompass 4 Readers in the Area” on page 2-12](#). Strong RF sources of any frequency, in proximity to the tag, can preclude the tag receiving the reader interrogation (see [Chapter 9, “Troubleshooting and Maintenance”](#)).

Electrical and Communications Requirements

All construction work at the site must be completed before installing the Encompass 4 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 Reader are discussed in [Chapter 4, “Installing the Encompass 4 Reader”](#)

Junction Box

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

Power and Communications Cables

Cable length for power and communications depends on the physical characteristics of the Encompass 4 Reader installation site. [Table 2-2](#) lists accessory kits available for cabling options based on your site’s requirements.

Table 2-2 Connector Cabling Accessory Kits

Part Number	Description
58-1620-001	5-ft connector cable harness
58-1620-002	20-ft connector cable harness
58-1620-006	35-ft connector cable harness
58-1620-007	45-ft connector cable harness

Table 2-2 Connector Cabling Accessory Kits (continued)

Part Number	Description
20-1620-003	Connector kit only
56-1620-004	13-pair cable (sold by the foot)
76-1620-005	110V AC to 18V AC Class C transformer
76-1620-006	12V AC to 18V AC step-up transformer

Electrical Power

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

Note: *Encompass 4 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 2-3](#) contains power supply current requirements.

Table 2-3 Power Supply Requirements

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

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

Power circuits are protected internally against power surges.

Power Extension

Use [Table 2-4](#) to determine the correct cable size according to the American Wire Gauge (AWG) standard for the necessary length of extension cable. The numbers in the first row of the table indicate cable size for the approximate cable length.

Note: *If the cable is close to the maximum length, measure voltage at the Encompass 4 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 2-4 Recommended Cable Length from Transformer to the Encompass 4 Reader

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

- a. Use two pair (two conductors for power and two for return). TransCore cable is 22 AWG.
b. Direct current resistance (DCR) information is from the Belden catalog.
c. Based on a 1.0V drop at 1200 mA (RF ON) with 15% margin.

Host Communications

Your site design must include communications between the Encompass 4 Reader and a host computer. The Encompass 4 Reader communicates with the host computer through an asynchronous serial line or through a Wiegand interface. This serial line can be an RS-232 interface or an RS-422 interface. The host computer must be able to accept one of the interfaces shown in [Table 2-5](#).

Table 2-5 Communications Interfaces and Conductor Requirements

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

RS-232 Interface

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

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

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

RS-422 Interface

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

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

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

Wiegand Interface

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

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

***Note:** You must order tags programmed with Wiegand-formatted data when using a Wiegand-compatible reader.*

Input/Output Circuits

To connect the Encompass 4 Reader to external equipment such as a treadle or traffic control light, install wires from these devices at the junction box. The Encompass 4 Reader input circuit is designed to connect to a dry contact closure. The Encompass 4 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 noninductive 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 Reader output circuits should be used to drive a secondary, appropriately rated high-power relay.

External Antenna Interface

For sites using an Encompass 4 Reader with external antenna, the design must include an interface cable between the Encompass 4 Reader and the compatible antenna chosen for the site. The antenna interface is RF coaxial cable with male Type N sockets on each end.

Table 2-6 is a summary of coaxial cable performance. Figures indicate maximum lengths of cable in feet.

Table 2-6 Reader to Antenna Cable Performance

Cable Type ^a	Overall Diameter (in.)	915MHz	
		Low Loss ^b	Medium Loss ^c
RG-223	0.216	6	18
RG-214	0.425	12	37
FHJ1-50	0.250	16	48
FSJ1-50	0.250	15	45
LDF2-50	0.375	28	85
FSJ4-50B	0.500	27	83
LDF4-50A	0.500	42	128
LDF5-50A	0.875	76	229
LDF6-50	1.125	103	310
LDF7-50A	1.625	122	366

a. Suffixes 50, 50A, and 50B indicate 50-ohm cables available from the Andrew Corporation.

b. These cable lengths ensure optimal system performance (1 dB loss).

c. These cable lengths ensure adequate, but not optimal, system performance (3 dB loss).

Choosing, Installing, and Removing Tags

Choosing, Installing, and Removing Tags

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

Compatible Tag Types

The Encompass 4 Reader provides the capability to read the various TransCore eGo® Plus-type tags employing Super eGo (SeGo) protocol and eGo-style tags and other American National Standards Institute (ANSI) ANS INCITS 256-2001-compliant tags with Intellitag technology. Depending on options ordered, the Encompass 4 Reader can read eGo Plus and eGo tags as well as TransCore IT2000 (in optional ATA/ISO mode), ATA-protocol, ISO-compliant tags, and Inter-Agency (IAG) tags. It can also read tags formatted to a wide range of industry-standard proprietary formats, including SIA Wiegand 26-bit standard format.

See [Appendix E](#) for information about the numerous tag models.

Reader and Tag Model Interoperability

[Table 3-1](#) lists the tags that are read by the Encompass 4 Reader. See www.transcore.com/pdf/Tag-Reader-Matrix.pdf for most current information concerning readers and supported tag protocols.

Table 3-1 Tags Read by the Encompass 4 Reader

Reader	Beam Tags	Battery Tags
Encompass 4 Reader	eGo Plus Sticker Tag*; eGo Plus Security Sticker Tag*, eGo Plus License Plate Tag* eGo Windshield Sticker Tag; eGo Tamper Resistant Tag; eGo License Plate Tag other ANS INCITS 256-2001-compliant tags with Intellitag technology AT5100; AT5102; AT5110; AT5112; AT5125; AT5145; AT5146; AT5715	AT5105; AT5114; AT5140; AT5147; AT5510; AT5540; AT5541; AT5542; AT5543; AT5544; AT5545; AT5547; AT5704; AT5707; IT2221**; IT2235**

* in SeGo, eGo, and/or ATA modes

** When used in optional ATA/ISO mode

TransCore's eGo Plus Tags

TransCore's eGo Plus tags are offered to complete your Encompass 4 Reader System.

Table 3-2 lists some of the features of the TransCore eGo Plus tags.

Table 3-2 eGo Plus Tag Features

Tag	Part Number	Used For	Special Features	Power Source	Number of 6-bit ASCII Characters	Number of 128-Bit Frames	Number of Wiegand Bits
Sticker Tag	13-07xx-nnn [#]	Toll, Electronic vehicle registration (EVR), Parking, Security access	Very thin, flexible, multi-layer lamination	Beam	20	1	N/A
					10	1/2	26 to 54
Security Sticker Tag	13-07xy-zzz ^{##}		Very thin, flexible, multi-layer lamination, tamper detection		20	1	N/A
					10	1/2	26 to 54
License Plate Tag (LPT)	13-0700-90x ^{###}		Water-resistant, exterior-mounted		20	1	N/A
					10	1/2	26 to 54

[#] the first "x" in the sticker tag listing defines which protocol is dominant (e.g., ATA or eGo/SeGo) in the tag; the second "x" further defines other active protocol configurations; and "nnn" is a unique identifier that differentiates between tags that are programmed similarly but that have different graphics or labels).

^{##} the "x" in the security sticker tag listing defines which protocol is dominant (e.g., ATA or eGo/SeGo) in the tag; the "y" further defines other active protocol configurations; and "zzz" is a unique identifier that differentiates between tags that are programmed similarly but that have different graphics or labels)

^{###} the "x" in the LPT listing determines whether the LPT is a standard eGo Plus LPT or a motorcycle version.

eGo Plus Sticker Tag

The Encompass 4 Reader reads the eGo Plus Sticker Tag (Figure 3-1) configured to support SeGo mode.



Figure 3-1 eGo Plus Windshield Sticker Tag

eGo Plus Security Sticker Tag

The Encompass 4 Reader reads the eGo Plus Security Sticker Tag ([Figure 3-2](#)) configured to support SeGo mode.



Figure 3-2 eGo Plus Security Sticker Tag

eGo Plus License Plate Tag

The eGo Plus LPT ([Figure 3-3](#)) is a water-resistant tag used in applications requiring an exterior-mounted tag.



Figure 3-3 eGo Plus License Plate Tag

TransCore's eGo Tags

TransCore's various eGo tags are offered to complete your Encompass 4 Reader System. [Table 3-3](#) lists some of the features of the TransCore eGo tags.

Table 3-3 eGo Tag Features

Tag	Part Number	Used For	Special Features	Power Source	Number of 6-bit ASCII Characters	Number of 128-Bit Frames	Number of Wiegand Bits
Windshield Sticker Tag	13-0510-004	Toll, Electronic vehicle registration (EVR), Parking, Security access	Very thin, flexible, multi-layer lamination	Beam	20	1	NA
					10	1/2	26 to 54
License Plate Tag	13-0510-900		Water-resistant, exterior-mounted		20	1	NA
					10	1/2	26 to 54

eGo Windshield Sticker Tag

The TransCore eGo WST ([Figure 3-4](#)) is offered to complete your Encompass 4 Reader System. It is a flexible sticker much like a vehicle registration sticker.



Figure 3-4 eGo Windshield Sticker Tag

eGo License Plate Tag

The eGo LPT (Figure 3-5) is a water-resistant tag used in applications requiring an exterior-mounted tag.



Figure 3-5 eGo License Plate Tag

Installing eGo Plus Sticker Tags

eGo Plus Sticker Tags are designed to be attached by a semi-permanent adhesive to the interior surface of nonmetallic windshields 0.190 to 0.230 inches (4.82 to 5.84 mm) in thickness. For optimum performance, you must install the tag at least 2 inches (5 cm) from the metal in the windshield frame and 0.75 inch (1.9 cm) from the rear-view mirror support post. Detailed instructions for installing the eGo® Plus Sticker Tag are found in the pocket guide “Quick and Easy Installation Instructions for the eGo® Plus Sticker Tag.”

Some vehicles have a tinted area across the top of the windshield. If the tint is conductive, it can interfere with reading the tag. If a windshield has this conductive tint, the tag must be installed at least 2 inches (5 cm) below this tinted area.

Some vehicle windshields contain a metallic treatment that could prevent an interior windshield-mounted tag from being read. However, many of these metallized windshields have areas that are not metallized. On a vehicle without open areas in its metallized windshield, you might need to install an Encompass 4 Reader-compatible LPT on the vehicle. See the section “[Installing eGo Plus License Plate Tags](#)” on page 3-13. Contact TransCore for more information. See the section “[Technical Support](#)” on page 9-6.

Required Materials

You need the following supplies to install an eGo Plus Sticker Tag:

- Glass cleaner, mild detergent and water, or any cleaning solution appropriate for your windshield
- Clean, dry cloth
- eGo Plus Sticker Tag

Positioning eGo Plus Sticker Tags

TransCore designed the eGo Plus Sticker Tag to be installed on the upper center or upper corner portion of the windshield. [Figure 3-6](#), [Figure 3-7](#), and [Figure 3-8](#) illustrate possible upper center tag placement locations. **If the upper portion of the windshield is tinted with an aftermarket conductive tint, use placement shown in [Figure 3-7](#).**

Mirror Post Attached on Windshield

Choose this placement option as shown in [Figure 3-6](#) if the mirror post is attached on the windshield.



Figure 3-6 eGo Plus Sticker Tag Placement

Mirror Post Attached on Header

Choose this placement option if the mirror post is attached on the header as shown in [Figure 3-7](#) or if the upper portion of the windshield is tinted with a conductive tint.



Figure 3-7 eGo Plus Sticker Tag Placement

Large Truck with No Inside Mirror

Choose this option for a large truck that uses exterior mirrors only (Figure 3-8).

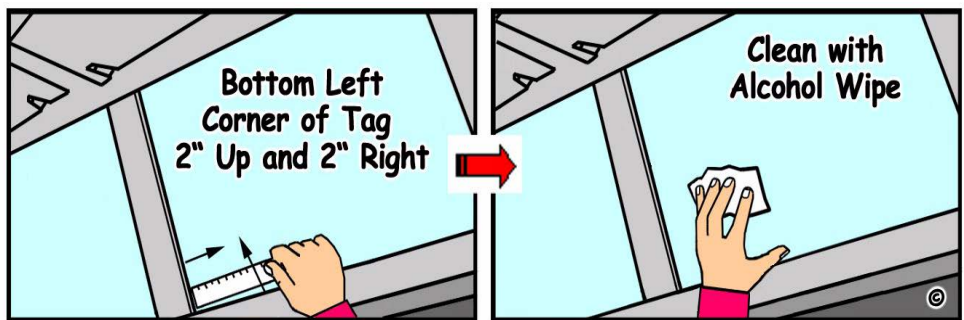


Figure 3-8 eGo Plus Sticker Tag Placement in Large Truck

eGo Plus Sticker Tag Installation Procedures



Caution

Confirm that the outside temperature is above 50°F (10°C). The sticker tag may not adhere correctly if the temperature is below this temperature.

To install the eGo Plus Sticker Tag

1. Determine the tag installation location for the vehicle using the placement guidelines in the section “Positioning eGo Plus Sticker Tags” on page 3-8.
2. Thoroughly clean the interior surface of the windshield behind and around the rearview mirror where the tag will be located.
3. Dry the tag location area thoroughly using a clean, dry cloth.
4. Remove the backing from the tag to expose the adhesive.



Caution

Ensure that the tag is correctly located before touching it to the glass. Once the sticker tag is applied to the glass, it cannot be moved without damage to the tag.

5. Holding the sticker tag by its edges (Figure 3-9), position the tag in the correct area of the windshield (determined in Step 1), making sure the tag is oriented horizontally and is at least two inches (5 cm) from the windshield frame and 0.75 inch (1.9 cm) from the mirror post.

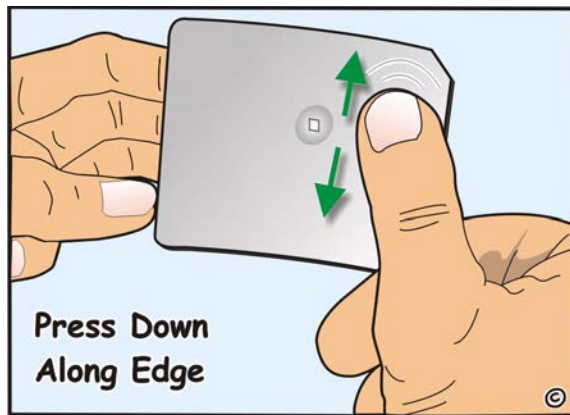


Figure 3-9 Applying eGo Plus Sticker Tag to Windshield

6. Press the sticker tag firmly against the glass and gently rub over the entire tag surface. Ensure that no air bubbles remain between the sticker tag and the windshield (Figure 3-10).

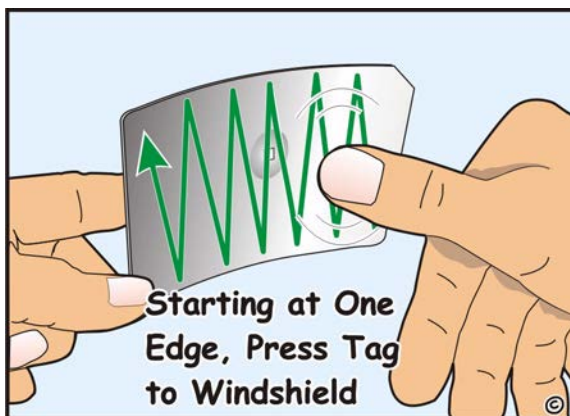


Figure 3-10 Second Step of eGo Plus Sticker Tag Application

Removing eGo Plus Sticker Tags

Peel the eGo Plus Sticker Tags from the windshield and clean any residue using isopropyl alcohol or commercial glass cleaner. The tag is inoperable once removed.

Installing eGo Plus Security Sticker Tags

An eGo Plus Security Sticker Tag is located in the same area on the windshield as the eGo Plus Sticker Tags. See [“Positioning eGo Plus Sticker Tags” on page 3-8](#) for this information. The eGo Plus Security Sticker Tag is slightly less flexible than the eGo Plus Sticker Tag so the installation instructions differ. Detailed instructions for installing the eGo® Plus Security Sticker Tag are found in the pocket guide “Quick and Easy Installation Instructions for the eGo® Plus Security Sticker Tag.”

eGo Plus Security Sticker Tag Installation Procedures



Caution

Confirm that the outside temperature is above 50°F (10°C). The security sticker tag may not adhere correctly if the temperature is below this temperature.

To install the eGo Plus Security Sticker Tag

1. Determine the tag installation location for the vehicle using the placement guidelines in the section [“Positioning eGo Plus Sticker Tags” on page 3-8](#).
2. Thoroughly clean the interior surface of the windshield behind and around the rearview mirror where the tag will be located.
3. Dry the tag location area thoroughly using a clean, dry cloth.
4. Remove the backing from the tag to expose the adhesive.



Caution

Ensure that the tag is correctly located before touching it to the glass. Once the security sticker tag is applied to the glass, it cannot be moved without damage to the tag.

5. Holding the sticker tag by its edges ([Figure 3-11](#)), position the tag in the correct area of the windshield (determined in Step 1), making sure the tag is oriented horizontally and is at least two inches (5 cm) from the windshield frame and 0.75 inch (1.9 cm) from the mirror post.



Figure 3-11 Applying eGo Plus Security Sticker Tag to Windshield

6. Press the security sticker tag firmly against the glass. Gently rub over the entire tag surface removing as much air from underneath the tag (Figure 3-12). The security sticker tag's rigid case may prevent you from forcing out all of the air trapped between the tag and windshield. A minimal amount of air will not affect tag performance.



Figure 3-12 Second Step of eGo Plus Security Sticker Tag Application

Removing eGo Plus Security Sticker Tags

Locate the tapered edge under the lower right corner of the eGo Plus Security Sticker Tags and carefully pull the tag from the windshield. If you cannot lift the tag using your fingers, insert a plastic scraper underneath the corner and lift the tag. Once you have removed the tag from the windshield, clean any residue using isopropyl alcohol or commercial glass cleaner. The tag is destroyed upon removal and cannot be reused.

Installing eGo Plus License Plate Tags

Metallized coatings on some vehicle windshields and windows absorb the RF energy emitted by the Encompass 4 Reader, thus causing tags to be misread. You must use exterior LPTs on vehicles with metallized coatings on their windshields and windows.

Use license plate installation techniques to install tags on the exterior of vehicles that have this type of window coating.

Note: The read zone of an overhead Encompass 4 Reader should be adjusted accordingly when an exterior tag is installed on a license plate, or the read zone will be reduced.

Required Materials

- 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.
- eGo Plus LPT

Positioning eGo Plus License Plate Tags

The eGo Plus LPT is installed over the license plate at the upper part of the vehicle's front license plate area.

Note: If your state does not require a front license plate, install the LPT in the area where the license plate would normally be mounted. If your vehicle does not have a front license plate area, contact your tag agency for other tag options.

The orientation of the tag is important. The tag must be mounted so that the holes on the tag base plate are on the top edge.

eGo Plus LPT Installation Procedures

To mount the eGo Plus LPT

1. Remove the screws from the license plate area of your front bumper (Figure 3-13). If your vehicle does not have mounting screws you will need two self-tapping threaded screws. You can also contact the tag agency to inquire about the optional TransCore Exterior Tag Accessory Kit.

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

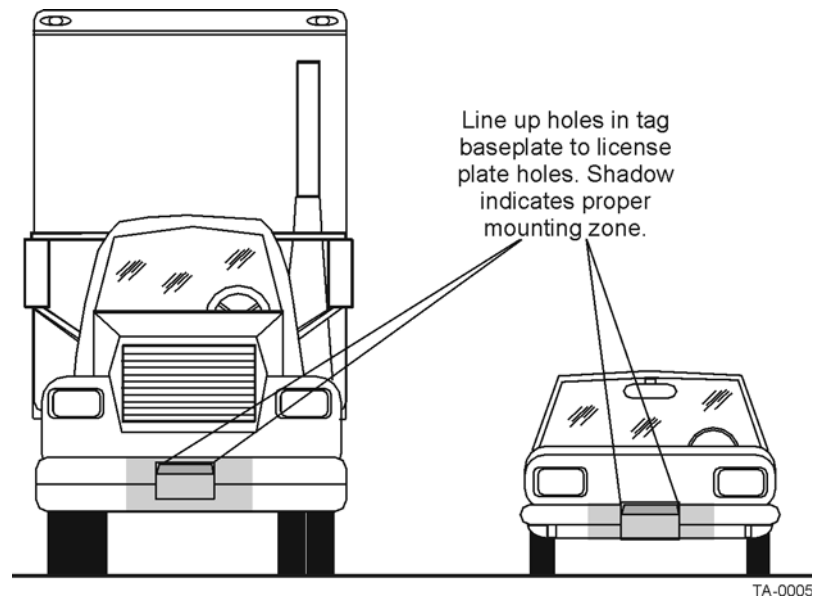


Figure 3-13 Correct Mounting Location for LPT

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 3-13](#). If your vehicle's license plate mounting area is more than 18 inches (46 cm) from the center, you may need to select an alternate location to mount the tag. Contact your tag agency if your vehicle requires an alternate mounting location for the LPT.
3. Hold the LPT so that the etched lettering is facing you with the mounting holes to the top as shown in [Figure 3-14](#).

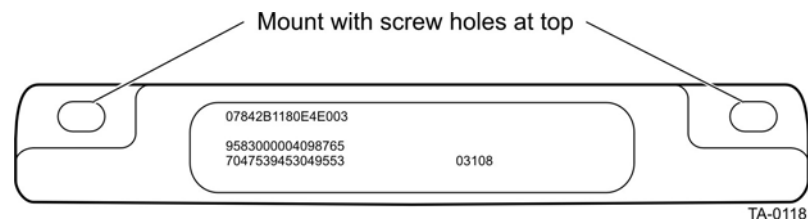


Figure 3-14 Correct Tag Orientation

4. Fasten the LPT to the bumper using the license plate mounting screws ([Figure 3-15](#)). Install the LPT over the top area of the vehicle's license plate if your vehicle has a front license plate. If your state does not require a front license plate, install the LPT in the area where a license plate would normally be mounted.

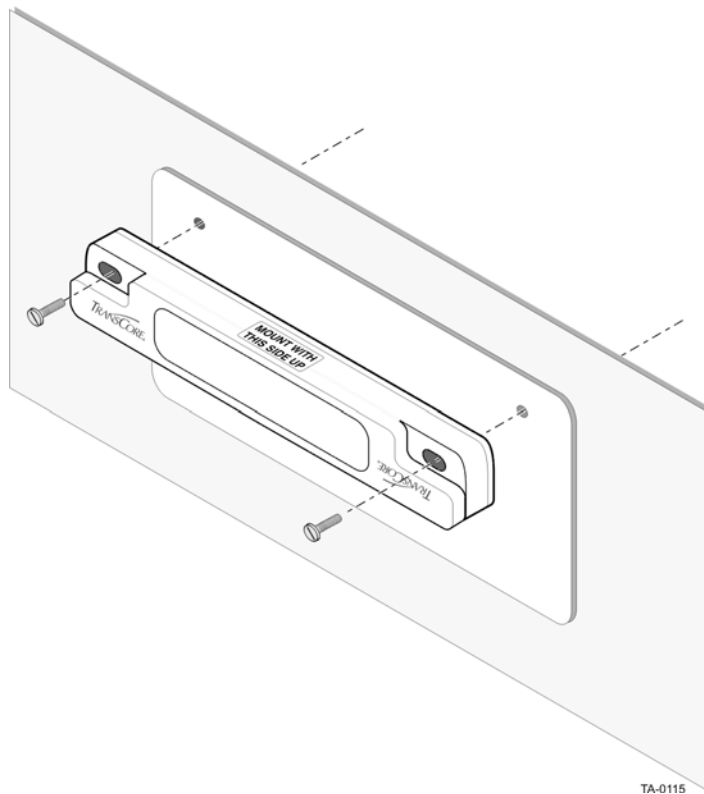


Figure 3-15 Upper Placement Over the Top Area of the License Plate

Installing eGo Windshield Sticker Tags

eGo WSTs are designed to be attached by a semi-permanent adhesive to the interior surface of nonmetallic windshields 0.190 to 0.230 inches (4.82 to 5.84 mm) in thickness. For optimum performance, you must install the tag at least 2 inches (5 cm) from the metal in the windshield frame and 0.75 inch (1.9 cm) from the rearview mirror support post. Detailed instructions are found in the pocket guide “Quick and Easy Installation Instructions for Windshield Sticker Tag.”

Some vehicles have a tinted area across the top of the windshield. If the tint is conductive, it can interfere with reading the tag. If a windshield has this conductive tint, the tag must be installed at least 2 inches (5 cm) below this tinted area.

Some vehicle windshields contain a metallic treatment that could prevent an interior windshield-mounted tag from being read. However, many of these metallized windshields have areas that are not metallized. On a vehicle without open areas in its metallized windshield, you might need to install an Encompass 4 Reader-compatible LPT on the vehicle. See the section “[Installing eGo Plus License Plate Tags](#)” on page 3-13 and the section “[Installing ATA License Plate Tags](#)” on page 3-21. Contact TransCore for more information. See the section “[Technical Support](#)” on page 9-6.

Required Materials

You need the following supplies to install an eGo WSTs:

- Glass cleaner, mild detergent and water, or any cleaning solution appropriate for your windshield
- Clean, dry cloth
- eGo WST

Positioning eGo Windshield Sticker Tags

TransCore designed the eGo WST to be installed on the upper center or upper corner portion of the windshield. [Figure 3-16](#), [Figure 3-17](#), and [Figure 3-18](#) illustrate possible upper center tag placement locations. **If the upper portion of the windshield is tinted with an aftermarket conductive tint, use placement Option B as shown in [Figure 3-17](#).**

Mirror Post Attached Low On Windshield

Choose placement Option A shown in [Figure 3-16](#) if the mirror post is attached low on the windshield.

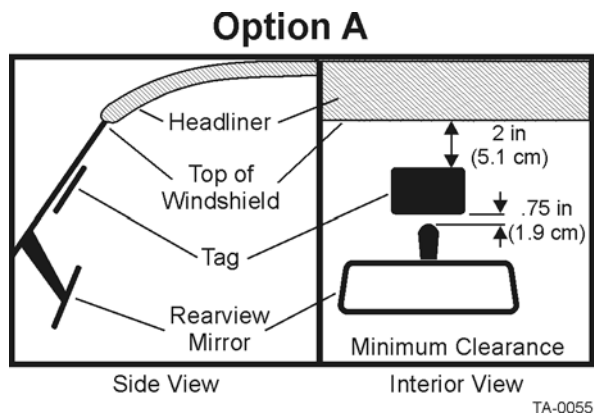


Figure 3-16 eGo Windshield Sticker Tag Placement Option A

Mirror Post Attached High on Windshield

Choose placement Option B if the mirror post is attached high on the windshield as shown in [Figure 3-17](#) or if the upper portion of the windshield is tinted with a conductive tint.

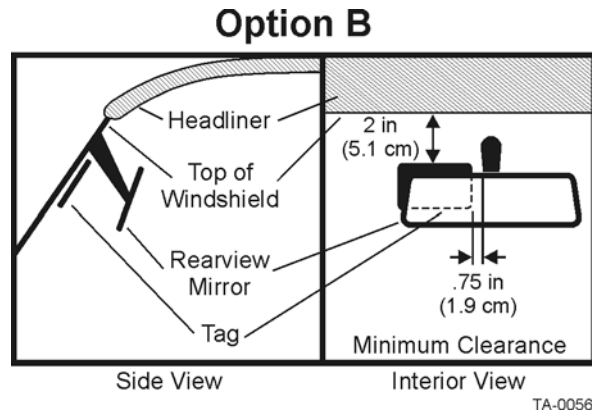


Figure 3-17 eGo Windshield Sticker Tag Placement Option B

Mirror Post Attached to Headliner

Choose placement Option C if the mirror post is attached to the headliner as shown in [Figure 3-18](#). If the upper portion of the windshield is tinted with an aftermarket conductive tint, place the tag two inches (5 cm) below the tinted area.

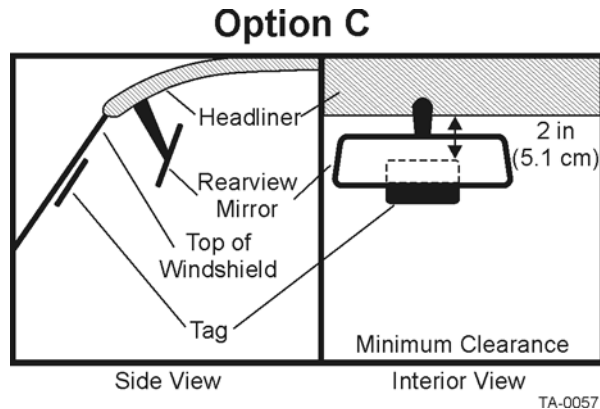


Figure 3-18 eGo Windshield Sticker Tag Placement Option C

Mounting the eGo Windshield Sticker Tag



Caution

Confirm that the outside temperature is above 50°F (10°C). The sticker tag may not adhere correctly if the temperature is below this temperature.

To install the eGo WST

1. Determine the tag installation location for the vehicle using the placement guidelines in the section [“Positioning eGo Windshield Sticker Tags”](#) on page 3-16.
2. Thoroughly clean the interior surface of the windshield behind and around the rearview mirror where the tag will be located.

3. Dry the tag location area thoroughly using a clean, dry cloth.
4. Remove the paper backing from the tag to expose the adhesive.



Caution

Ensure that the tag is correctly located before touching it to the glass. Once the sticker tag is applied to the glass, it cannot be moved without damage to the tag.

5. Holding the sticker tag by its edges, position the tag in the correct area of the windshield (determined in Step 1), making sure the tag is oriented horizontally and is at least two inches (5 cm) from the windshield frame and 0.75 inch (1.9 cm) from the mirror post.
6. Press the sticker tag firmly against the glass and gently rub over the entire tag surface. Ensure that no air bubbles remain between the sticker tag and the windshield.

Removing eGo Windshield Sticker Tags

Removing eGo WSTs requires the use of a plastic scraper or equivalent tool. The tag is inoperable once removed.

Installing eGo LPT

Follow the instructions presented in [“eGo Plus License Plate Tag”](#) on page 3-5 when installing an eGo LPT.

Installing Interior ATA Tags

Interior ATA-protocol tags are installed using hook-and-loop material or double-sided tape attached to the tag and to the windshield. When using hook-and-loop material, the loop material should be applied to the back of the tag and the hook material should be applied to the windshield. After the tag is installed, it can be removed easily and used in any vehicle that has corresponding hook material affixed to the windshield.

***Note:** Installing interior tags using double-sided tape results in a semipermanent attachment; the tag will be more difficult to remove than one installed using hook and loop material.*

Interior ATA-protocol tags may be ordered from the factory with hook-and-loop material or double-sided tape already applied to the tag. The adhesive on this material is specially formulated for temperature extremes inside vehicles.

Required Materials

You will need the following materials to install interior tags:

- Rubbing alcohol or 50/50 isopropyl alcohol and water

- Sponge and dry cloth
- Interior tags with two strips of factory-installed hook-and-loop material or factory-installed double-sided tape attached

Positioning ATA Tags

Interior ATA-protocol tags can be installed on the driver's side, passenger's side, or upper center of the vehicle's windshield, depending on the Encompass 4 Reader's position. See [“Reader and Tag Alignment” on page 2-4](#).

Tags should be mounted consistently in all vehicles using a particular Encompass 4 Reader facility.

Interior Driver's or Passenger's Side

TransCore designed interior ATA-protocol tags for installation inside the vehicle, typically on the driver's side of the windshield. Install the tag in the upper corner, at least two inches (5 cm) from the metal window post, as shown in [Figure 3-19](#).

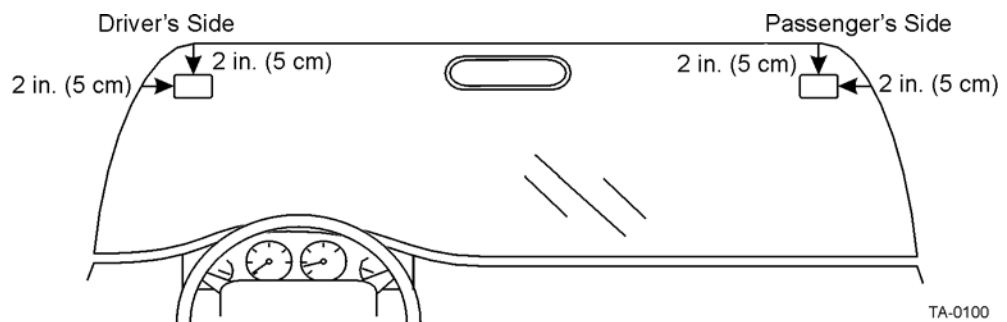


Figure 3-19 Driver's or Passenger's Side (U.S.) Interior Windshield Tag Location

Interior Center Windshield

You may also install ATA tags on the upper center portion of the windshield. Position the tag as closely as possible to the windshield's upper center, behind the rearview mirror. The top edge of the tag should be approximately one inch (2.5 cm) below the base of the mirror, or above the base if enough room is available for the tag to be two inches (five cm) from metal around the windshield, as shown in [Figure 3-20](#).

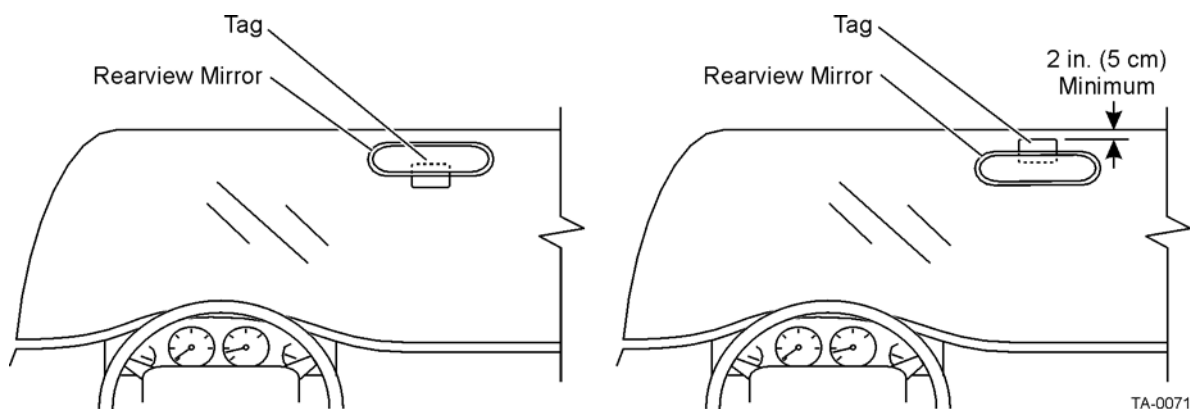


Figure 3-20 Upper Center Interior Windshield Tag Location

ATA Interior Tag Installation Procedures

Perform the following steps to install interior tags:

1. Clean the tag installation area on the interior surface of the windshield with rubbing alcohol.
2. Dry the area thoroughly using a clean, dry cloth.
3. Remove the clear backing from the two strips of hook-and-loop material on the back of the tag (Figure 3-21) or from the double-sided tape.

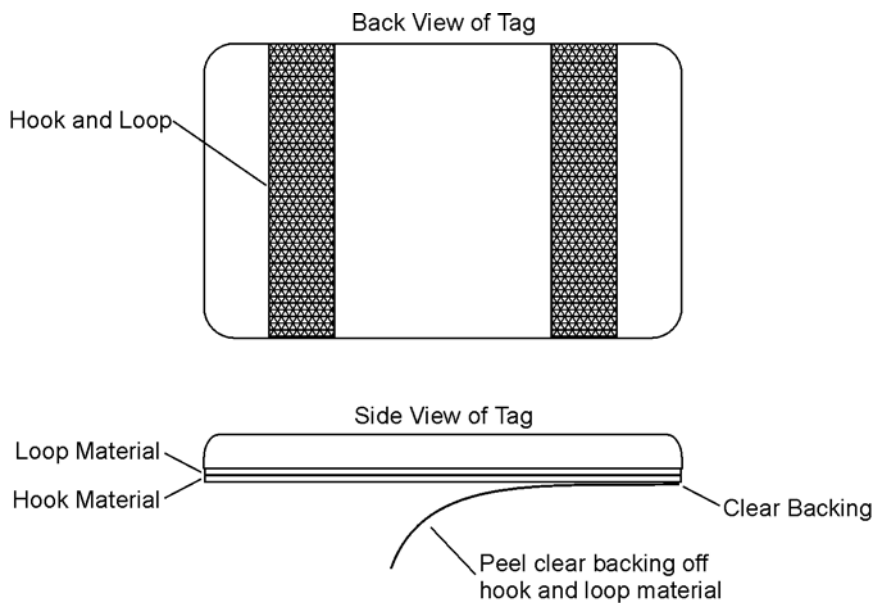


Figure 3-21 Hook-and-Loop Material on Interior Tag

4. Position the tag over the correct area of the windshield, making sure that the tag and reader orientation are the same (horizontal or vertical).
5. Press the tag firmly against the glass.

Removing Interior ATA Tags

To remove an interior ATA-protocol tag installed using hook-and-loop material, simply pull the tag away from the windshield.

To remove an interior ATA-protocol tag installed using double-sided tape, slowly pry off the tag with a thin tool, such as a putty knife.

Installing ATA License Plate Tags

Metallized coatings on some vehicle windshields and windows absorb the RF energy emitted by the Encompass 4 Reader, thus causing tags to be misread. Use exterior LPTs on vehicles with metallized coatings on windshields and windows.

Use license plate installation techniques to install tags on the exterior of vehicles that have this type of window coating.

***Note:** The read zone of an overhead Encompass 4 Reader should be adjusted accordingly when an exterior tag is installed on a license plate, or the read zone will be reduced.*

Exterior tags may be installed on metal or plastic bumpers using the existing license plate bracket and hardware.

The tag can be mounted on the front bumper where the license plate is normally located or mounted directly to the front license plate or license plate bracket. Once installed, the face of the tag should be pointing directly forward or slightly upward. If the bumper, license plate, or license plate bracket has any material that overhangs the tag, the tag will not function properly.

Required Materials

You need the following supplies to install license-plate mounted tags:

- Exterior LPT
- Two 0.25-inch (.63 cm) bolts and nuts (user-supplied). Length of the bolts can vary depending on vehicle model.
- Screwdriver and wrench (user-supplied)
- 0.25-inch (.63 cm) spacers or washers (if needed). Thickness of spacers can vary depending on vehicle model.

Positioning ATA License Plate Tags

The orientation of the tag is important. The tag must be mounted so that the holes on the tag base plate are on the bottom edge. See [Figure 3-22](#).

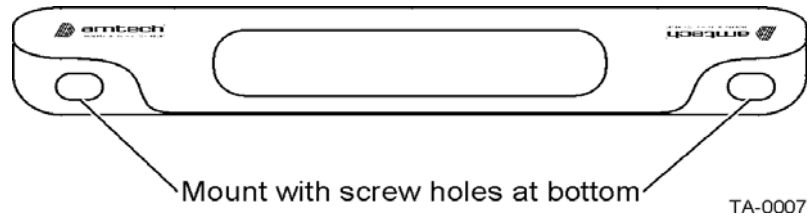


Figure 3-22 Proper Tag Orientation

When positioning the tag, observe the following guidelines:

- The tag should be horizontal and parallel to the ground.
- The tag face should be perpendicular or tilted *slightly* upward.
 - The tag may lean to the rear a maximum of 30 degrees.
 - The tag may lean to the front a maximum of 10 degrees.

ATA License Plate Tag Installation Procedures

To mount the LPT

1. Position the tag so that the holes in the tag are on the bottom edge and the tag is within 18 inches (.45 m) of the center of the front bumper as illustrated by the shaded area in [Figure 3-23](#).

Note: When mounting an exterior tag on heavy trucks or tractors, the tag must be mounted within 1.5 inches (3.81 cm) of the top of the bumper.

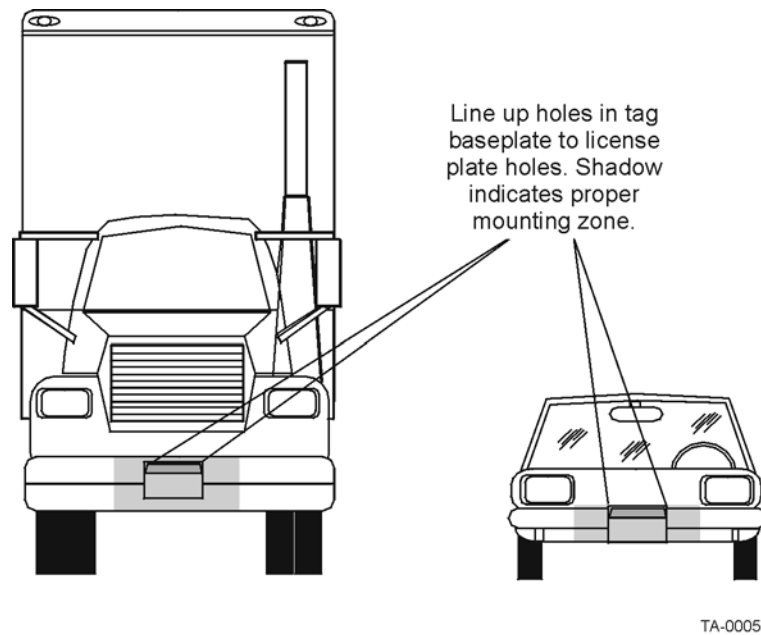


Figure 3-23 Correct Exterior Tag Placement

2. Line up the holes in the tag as follows:

- If mounting the tag to a license plate or license plate bracket, line up the holes in the tag to the *upper* holes of the license plate or license plate bracket.

Note: *Do not* mount the tag to the bottom holes of the license plate or license plate bracket. The reflective material on the license plate may interfere with the proper functioning of the tag.

- If mounting the tag to the bumper, line up the holes in the tag with the holes in the front bumper where the license plate would normally be located. See [Figure 3-23](#).
3. Insert bolts through the tag base plate holes and the holes in the bumper or the holes in the *upper* portion of the license plate area. See [Figure 3-24](#).

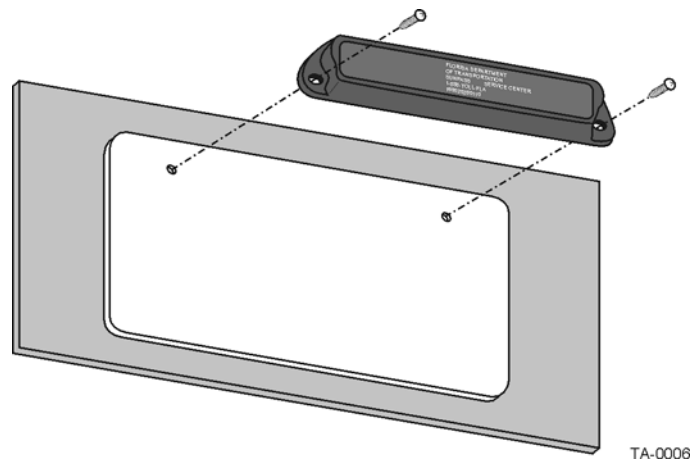


Figure 3-24 Upper Placement In License Plate Area

4. Make sure the area within 45 degrees of the center of the tag is free of obstructions. See [Figure 3-25](#).

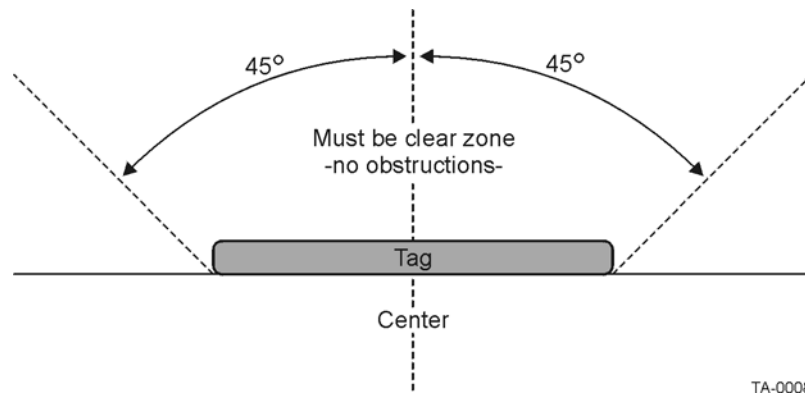


Figure 3-25 Obstruction-Free Area

5. Make sure that no material overhangs 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. See [Figure 3-26](#).

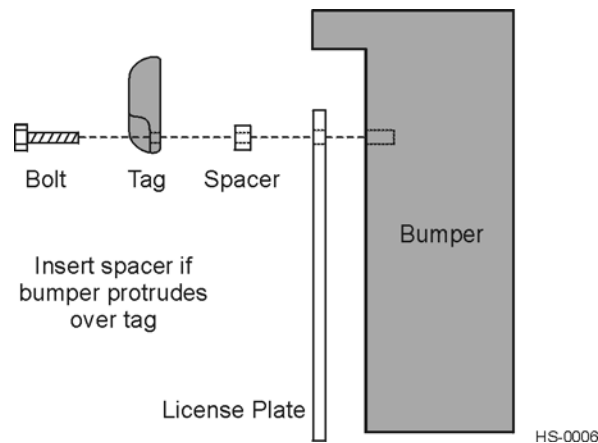


Figure 3-26 Spacer Positioned Behind Tag

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

Types of Bumpers

When mounting tags directly to a bumper, consider the following factors:

- 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.

Alternate Mounting Locations

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

Required Materials

Exterior tags need to be installed on a relatively flat surface. You need the following materials to install exterior tags:

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

Installation Procedures Using Tape

To install the tag on a metal or plastic bumper

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, as shown in Figure 3-27.

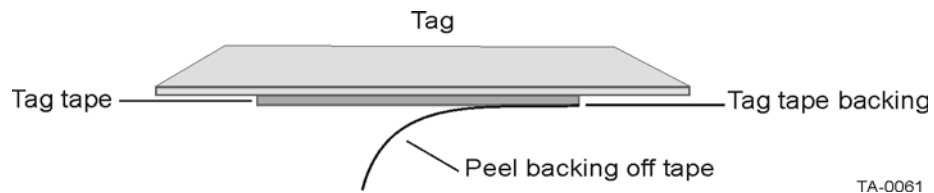


Figure 3-27 Exterior Tag with Double-Sided Tape

4. Position the tag over the installation area, making sure that the tag and Encompass 4 Reader are horizontally polarized.
5. Press the tag firmly against the bumper.

Installation Procedures Using Blind Rivets

To install an exterior tag using blind rivets through the tag's installation tabs

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.

Removing Exterior Tags

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

Installing the Encompass 4 Reader

Installing the Encompass 4 Reader

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

Installation Process

Note: *In this section, unless specifically stated, “Encompass 4 Reader” applies both to the Encompass 4 Reader with integrated antenna and Encompass 4 Reader with external antenna.*

After you have developed the site plan and identified the location to install the Encompass 4 Reader and antenna¹, if required, you are ready to install the equipment. Installation involves the following tasks:

- Pre-installation testing of Encompass 4 Reader power and tag read capability
- Mounting the Encompass 4 Reader, and antenna if required, on a pole, ceiling, or wall
- Discharging voltage from an external antenna
- Connecting the antenna
- Connecting the Encompass 4 Reader power
- Marking the read zone
- Connecting the Encompass 4 host and sense input/sense output and communications

Materials Supplied by TransCore

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

Contents of Shipping Carton

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

-
1. The Encompass 4 Reader is designed with an integrated patch antenna or with a RF cable connector for use with an external antenna. Unless noted in the text, “antenna” refers to an “external antenna.”

- One Encompass 4 Reader
- One mounting bracket and the mounting hardware
- One *Encompass 4 Reader Quick Start Guide*
- Any accessories ordered as options as shown in [Table 4-1](#)

Required accessories are a power/communications cable harness and a 110V AC wall transformer or a 12V AC to 18V AC step-up transformer. If you are using an antenna with the Encompass 4, you also require an Encompass 4 Reader-compatible antenna and an antenna RF interface. These may be ordered as accessories from TransCore or obtained from other sources.

Installation Accessory Options

[Table 4-1](#) lists optional TransCore Encompass 4 Reader installation accessory items.

Table 4-1 Installation Accessories

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

Note: The Encompass 4 Reader may be ordered with a multewire cable harness (part number 58-1620-001 or 58-1620-002 in [Table 4-1](#)) as a separate accessory. One end has a waterproof connector for the Encompass 4 Reader, and the other end has 13 pairs of color-coded wires.

Additional Materials Needed for Testing

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

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

- Wire stripper
- One Encompass 4 Reader-compatible antenna (if required)
- Suitable RF interface coaxial cable (if using antenna)

Pre-installation Testing of the Encompass 4 Reader

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

You also need to ensure that the Encompass 4 Reader-compatible antenna has had any voltage properly discharged prior to connecting it to the reader.

Testing the Encompass 4 Reader Using an Audible Circuit Tester

An audible circuit tester is also called a buzz box. These boxes are available at some electronic parts supply stores, or you can make a buzz box, as shown in [Figure 4-1](#). The buzz box is powered by a 9V DC battery and is equipped with two alligator-clip leads. When you touch the leads together, the box makes an audible sound.

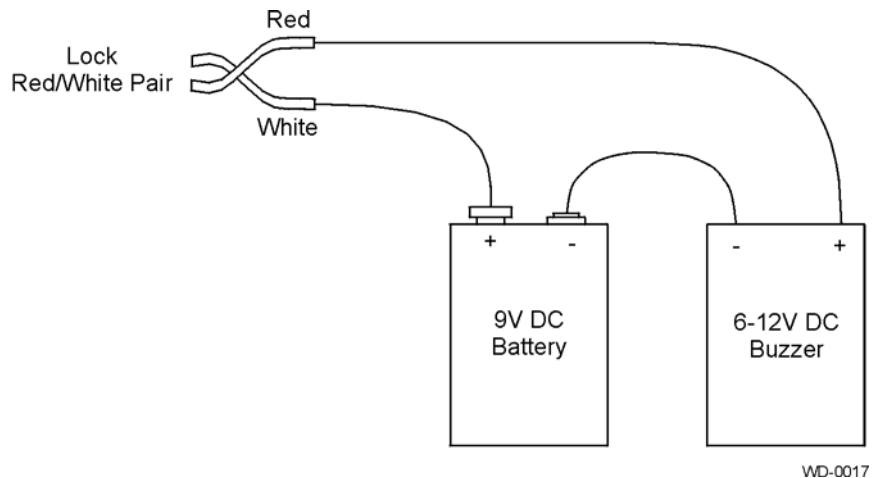


Figure 4-1 Wiring for Audible Circuit Tester

To test the Encompass 4 Reader that uses an integrated antenna, connect the power supply as described in the appropriate section below, and then test as described in the section [“Bench Testing the Encompass 4 Reader Before Installation”](#) on page 4-12.



Caution

During shipping and installation, an external antenna can build up a very high voltage charge. The voltage needs to be discharged before connecting the antenna to the reader.

To test the Encompass 4 Reader that uses an external antenna, connect the antenna and power supply as described in the appropriate section below, and then test as described in the section [“Bench Testing the Encompass 4 Reader Before Installation” on page 4-12](#).

Discharging Voltage from the External Antenna

Use these instructions to discharge high voltage from the external antenna before proceeding with further pre-installation testing of the reader connected to an external antenna.

Required Equipment

This procedure requires the following equipment.

- TransCore Encompass 4 Reader (external antenna models only)
- External antenna
- RF cable
- N-type load (e.g., 50 Ω) or RF attenuator (e.g., 20 dB)

Discharging the Voltage

1. Terminate the reader end of the RF cable with any N-type load or RF attenuator ([Figure 4-2](#)).

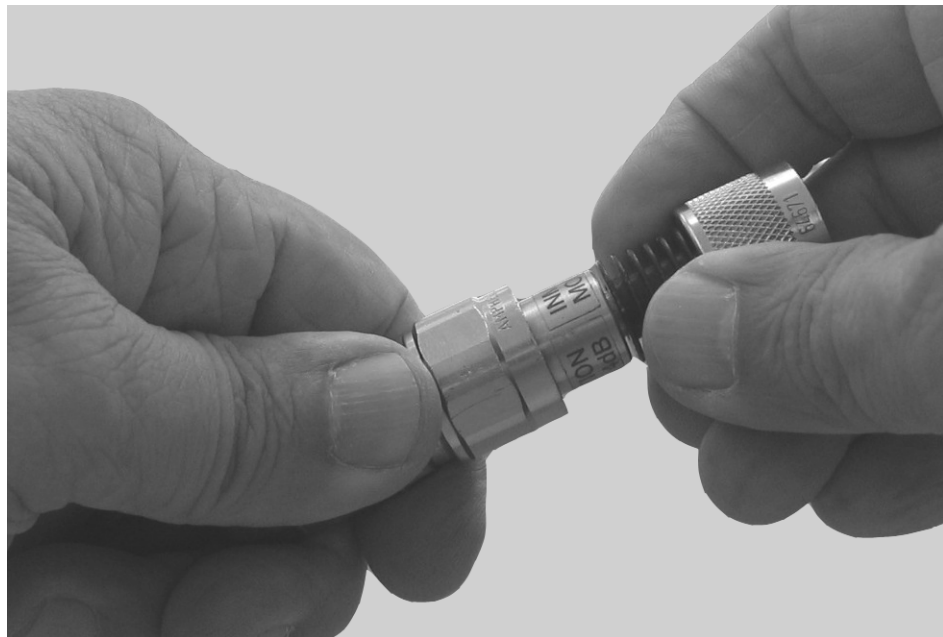


Figure 4-2 Connect RF N-type Load or Attenuator to Reader Cable End

2. Connect the RF cable to the antenna (see item 1 in Figure 4-3).



Figure 4-3 Short Load to Earth Ground

3. Short the outer metal case of the load or attenuator to Earth Ground for approximately 10 seconds (see item 2 in [Figure 4-3](#)). In this example, the operator is using the mounting screw of the electrical outlet faceplate for Earth Ground.
4. Remove the load or attenuator from the RF cable and connect cable to reader.
Once the antenna is discharged and properly connected to the reader, the reader circuitry provides a DC path to keep any further charge from building up in the antenna.



Caution

TransCore does not recommend using a screwdriver or other tool to short the RF cable center conductor to the outer ground of the cable. This grounding method can damage the center pin or the threads of the connector.

TransCore strongly advises that you use adequate Earth Ground for this voltage discharge procedure in accordance with the National Electric Code for the locale where you are installing the Encompass 4 Reader.

Connecting the External Antenna

Use these instructions to connect the Encompass 4 Reader and external antenna.



Figure 4-4 Back of Encompass 4 Reader Showing Antenna Connector

To connect the reader and antenna

1. Ensure the reader is turned off and unplugged.
2. Connect one end of the RF interface cable to the antenna.
3. Connect the other end of the RF interface cable to the antenna connector on the back of the Encompass 4 Reader. See [Figure 4-4](#).

Connecting the AC Power Supply



Caution

If you are using an external antenna, to avoid damage to the Encompass 4 Reader, you must connect the antenna before applying power to the reader.

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

1. Connect the Encompass 4 power wires from the cable to the transformer using the color coding as described in [Table 4-2](#).

Table 4-2 AC Transformer Connections for Colored-Wire Pair Cable

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

2. Complete the power connections at the power supply.

Connecting the DC Power Supply

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



Caution

If you are using an external antenna, to avoid damage to the Encompass 4 Reader, you must connect the antenna before applying power to the reader.

1. Connect the Encompass 4 Reader power wires from the cable to the low-voltage terminals using the connection designations shown in [Table 4-3](#).

Table 4-3 Low Voltage DC Cable Connections for the Colored-Wire Pair Cable

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

Connecting Communications for Bench Testing

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

Required Materials

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

- PC or laptop
- Any terminal emulation program such as Procomm Plus™ or Hyper Terminal™ running on a PC
- Communications cable to connect to the COM1 port on your PC

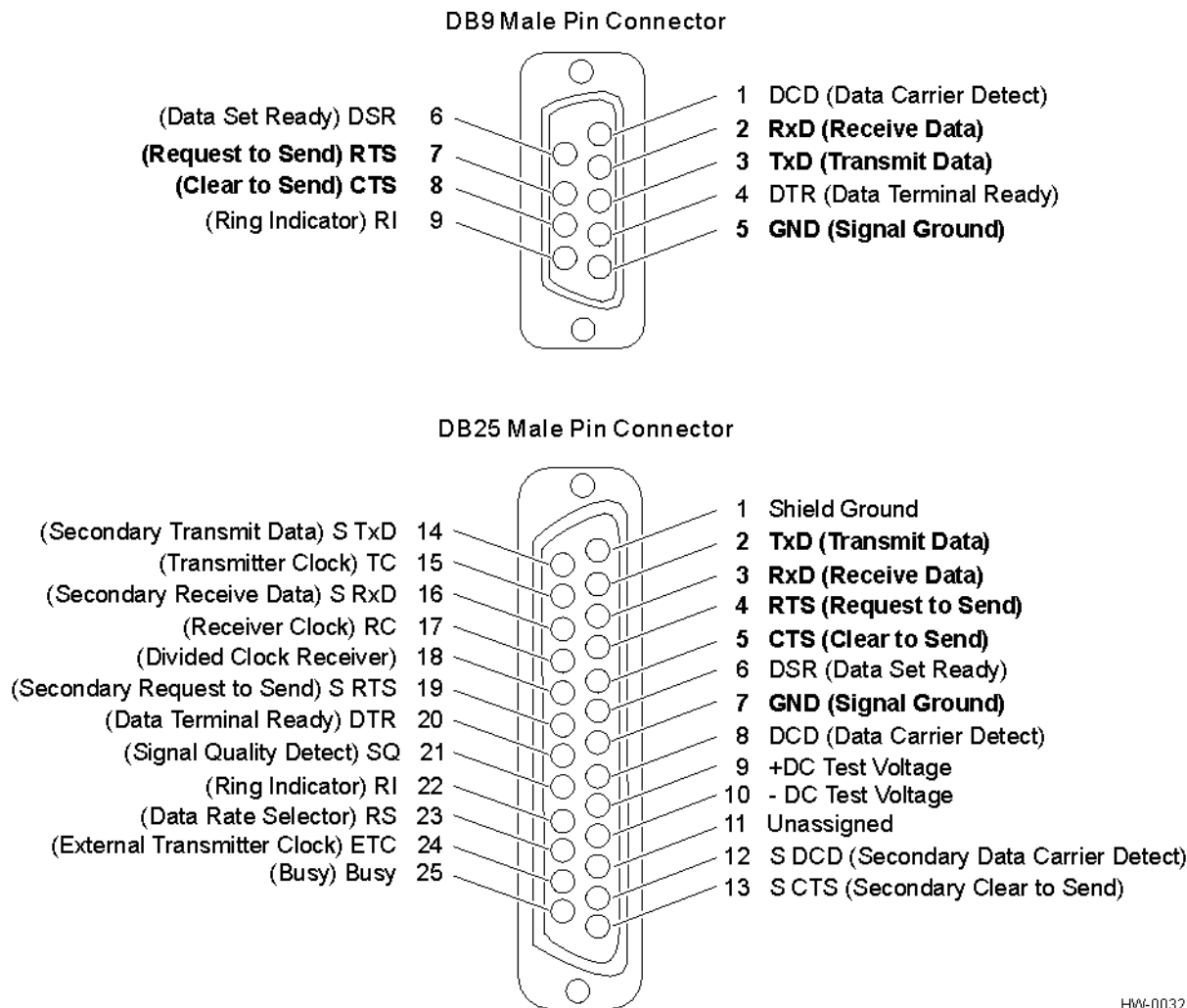
Encompass 4 Reader communications and customer interface signals are supplied from the Encompass 4 Reader to the host through a multiwire cable, which is a 13-pair pigtail. The connector for this cable is located on the back of the Encompass 4 Reader. Refer to the following sections to connect the appropriate communications wires from the cable to the PC.

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

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

Connecting for Bench Testing with RS-232 Interface

RS-232 interface signals are supplied by three or five wires from the Encompass 4 communications cable. The pin assignments for the signal to the host male DB9 and DB25 connectors are shown in boldface in [Figure 4-5](#).



HW-0032

Figure 4-5 Pin Assignments for Signal to Host Connectors

Note: In [Figure 4-5](#) supported pin assignments are in boldface.

Connecting the Encompass 4 Reader Colored-Wire Pair Cable

Table 4-4 shows the RS-232 colored wire assignments.

Table 4-4 RS-232 Interface Signal Wiring for Colored-Wire Pair Cable

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

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

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

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

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

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

Connecting for Bench Testing with RS-422 Interface

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

***Note:** For temporary bench testing purposes only, you will need to connect the RS-422 interface signal wires by following the pin-outs of your interface device. For permanent installations, follow the RS-422 connection instructions on page 4-30.*

Bench Testing the Encompass 4 Reader Before Installation

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

***Note:** Test tags should match the protocol(s) selected for your reader. These tags can be ATA-protocol, ISO-compliant tags, or Inter-Agency Group tags affixed to a plastic or wooden yardstick, or eGo Plus Sticker Tag or eGo 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 and eGo Plus sticker tags have a reduced read range when not attached to glass.*

To test that the Encompass 4 Reader has power and can read a tag presented in the read zone

1. Confirm that the Encompass 4 Reader colored-wire pair cable is correctly connected to a suitable AC or DC low-voltage power supply as discussed on page 4-8 and page 4-9 and that the transformer is connected to a power outlet.

If you are using an external antenna, confirm that the antenna is connected to the Encompass 4 Reader.



Caution

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

2. Confirm that the Encompass 4 Reader colored-wire pair cable communications are connected correctly as described in the section [“Connecting Communications for Bench Testing”](#) on page 4-9.
3. Connect the two leads from the audible circuit tester to the white and red wire pair (pair #8, lock/lock return) from the Encompass 4 Reader power/communications cable.
4. Start the terminal emulation application Microsoft HyperTerminal by selecting **Programs>Accessories>Communications>HyperTerminal** and press **ENTER**.

5. In the HyperTerminal dialog boxes 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
6. Cycle the power on the Encompass 4 Reader and ensure that the sign-on message displays.
7. Input the following commands in the order provided in [Table 4-5](#). Commands include those to switch to command mode, set radio frequency (RF), turn on RF, and return the reader to data mode.

Table 4-5 Commands for Bench Testing

Entry	Reader Response	Notes
#01 <CR>	#Done <CR/LF>	Switches Encompass 4 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 Reader to data mode.

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

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

Mounting the Encompass 4 Reader

This section lists procedures and materials required for mounting the Encompass 4 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 Reader should be positioned as close as possible to the antenna. Long cable runs increase system sensitivity to noise. See [Table 2-6 on page 2-20](#) for maximum RF cable lengths.

Mounting the Encompass 4 Reader on a Round Pole

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

Required Materials To Be Supplied by Customer

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

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

Procedures

To mount the Encompass 4 Reader to a pole

1. Unpack the Encompass 4 Reader. A factory-mounted bracket ([Figure 4-6](#) and [Figure 4-7](#)) is attached to the back of the Encompass 4 Reader. A pole mount bracket assembly ([Figure 4-8](#)) is bubble-wrapped separately and contains a plastic bag of four Allen screws and washers.
2. Using the two 0.5 inch (1.3 cm) stainless steel hose clamps, attach the pole mount bracket assembly to the pole approximately 8 feet (2.4m) above the pavement surface. Tighten slightly so you can adjust the Encompass 4 Reader left or right, but not so slightly the straps slide down the pole.

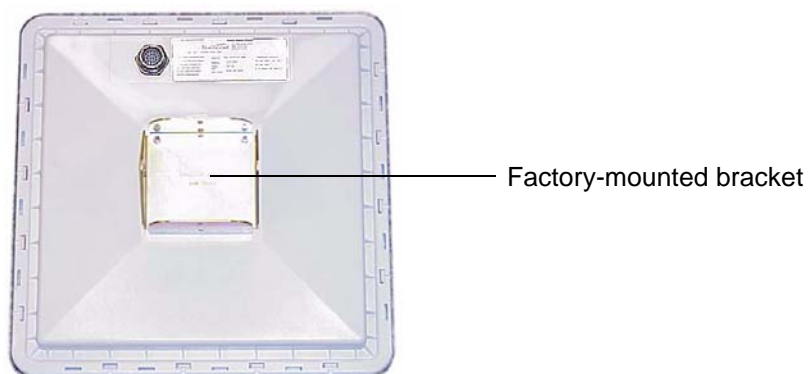
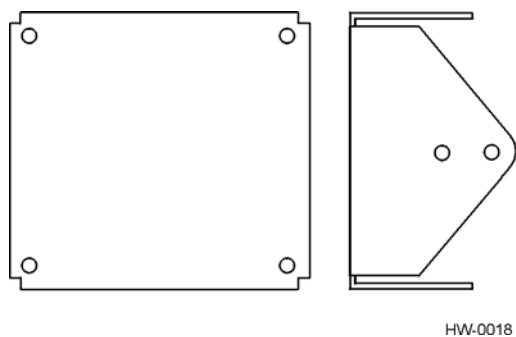
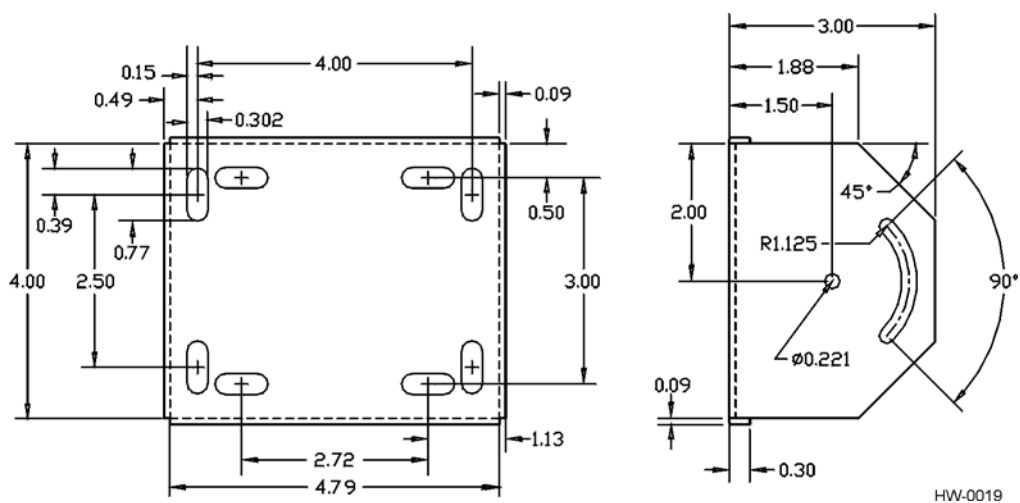


Figure 4-6 Back of the Encompass 4 Reader (reader shown has integrated antenna)



HW-0018

Figure 4-7 Factory-Mounted Bracket



HW-0019

Figure 4-8 Pole-Mount Bracket Assembly

- Using the four Allen screws and washers, attach the Encompass 4 Reader to the pole mount bracket as shown in [Figure 4-9](#). Tighten the screws slightly so that the Encompass 4 Reader can be adjusted up or down, but not so slightly the mounting assembly slips.

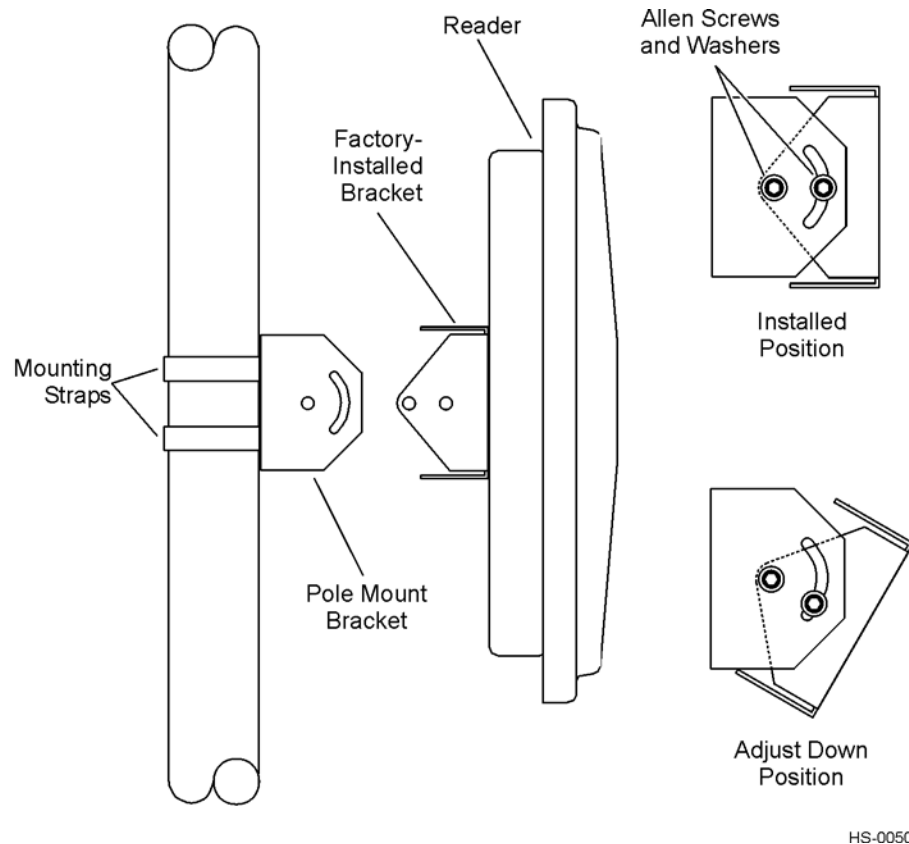


Figure 4-9 The Encompass 4 Reader Attached to the Pole Mount Bracket

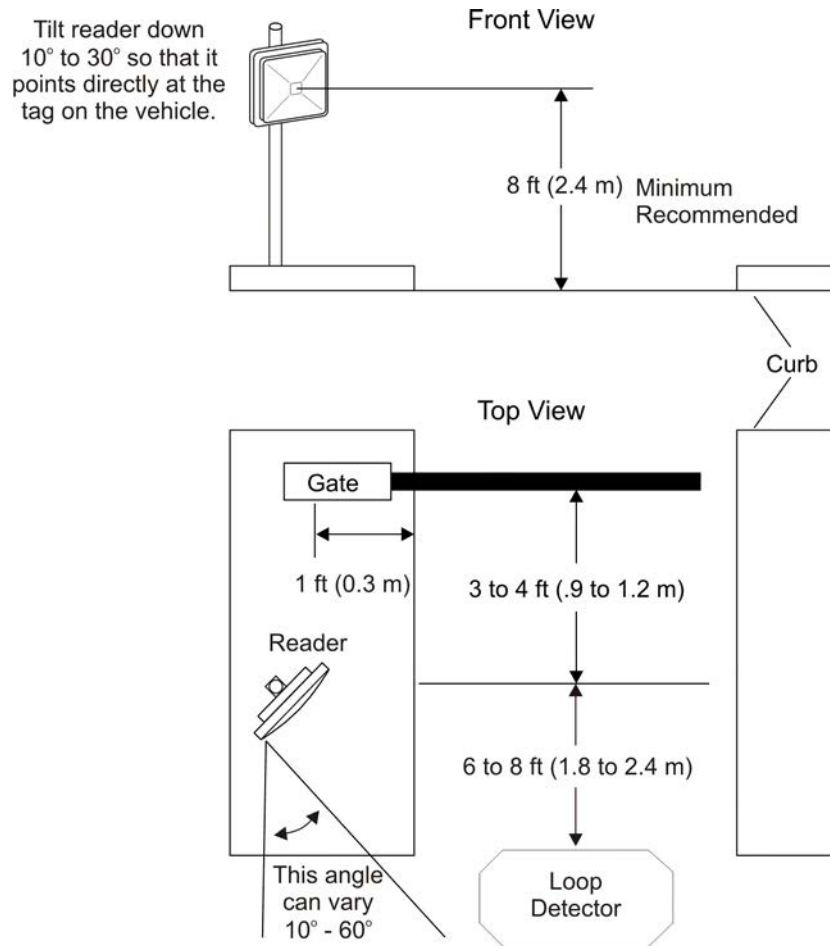
- Adjust the assembly by pointing the Encompass 4 Reader to the middle of the area where tags will be read, and tighten all screws and straps slightly.

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

[Figure 4-10](#) illustrates front and top views of a pole-mounted Encompass 4 Reader with the approximate measurements for sites where tags would be mounted on the interior driver-side windshield. eGo WSTs may be mounted on the interior upper center or upper corner of the windshield, eGo Plus Sticker and Security Sticker tags may be mounted on the interior upper center of the windshield.



Note: Determine the read zone before you tighten all screws and straps permanently. Refer to the section [“Marking the Read Zone”](#) on page 4-35.



SD-0145

Figure 4-10 Front and Top Views of the Encompass 4 Reader Position

Note: The dimensions in Figure 4-10 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 Reader matching site and tag mounting positions to provide the most direct line of sight to the tags.



Caution

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

Mounting the Encompass 4 Reader to a Wall or Flat Surface

The basic Encompass 4 Reader is supplied with a pole-mount bracket assembly (Figure 4-8) that allows you to adjust the Encompass 4 Reader up and down. TransCore recommends using the wall-mount bracket accessory kit (Figure 4-11) in addition to the pole-mount bracket to provide additional horizontal aiming flexibility when attaching the Encompass 4 Reader to a pole with flat sides or to a wall or ceiling where other structures can interfere with accurately aiming the Encompass 4 Reader toward the tags.

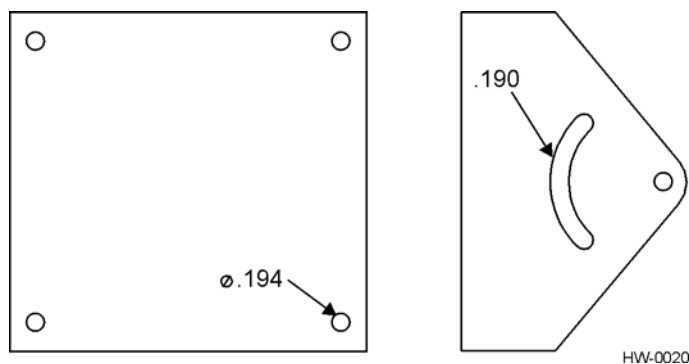


Figure 4-11 Wall Mount Bracket Accessory (part number 54-1620-001)

Required Materials

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

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

Procedures

To mount the Encompass 4 Reader to a wall or ceiling

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

2. Using the 5/32-inch Allen wrench, remove the factory-mounted bracket attached to the back of the Encompass 4 Reader. Remove all four Allen screws and lock washers from the bracket and set aside.
3. Unpack the wall-mount bracket accessory kit.
4. Using the Allen screws and lock washers set aside in Step 2, attach the wall-mount bracket to the back of the Encompass 4 Reader, as shown in [Figure 4-12](#).

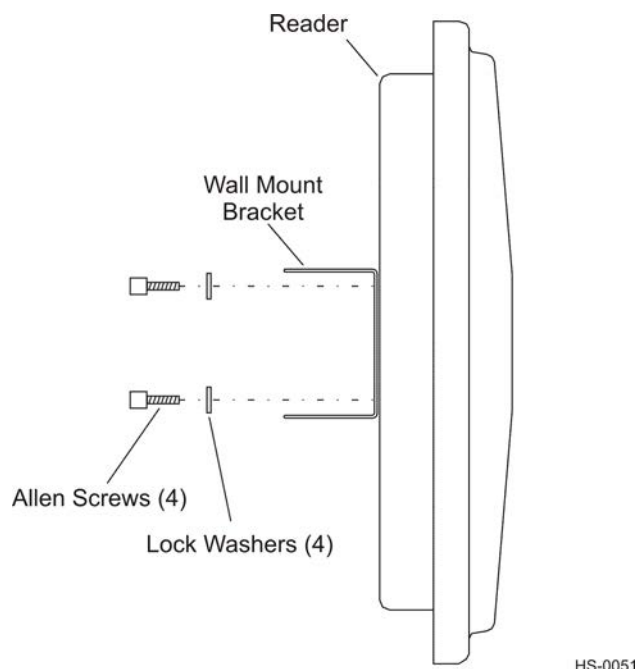


Figure 4-12 Wall Mount Bracket Attached to the Encompass 4 Reader

5. 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 4-13](#).

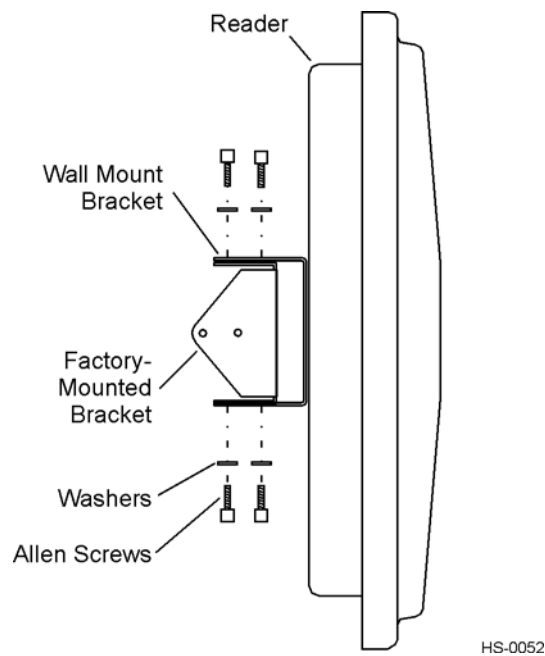


Figure 4-13 Factory-Mounted Bracket Attached to Wall Mount Bracket

7. Tighten lightly, since you will want to adjust the bracket later. This subassembly allows you to aim the Encompass 4 Reader 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 4-14](#).

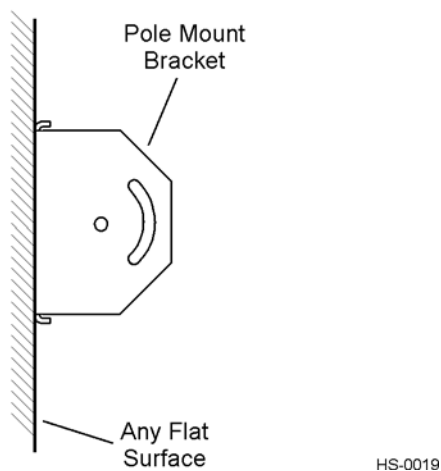
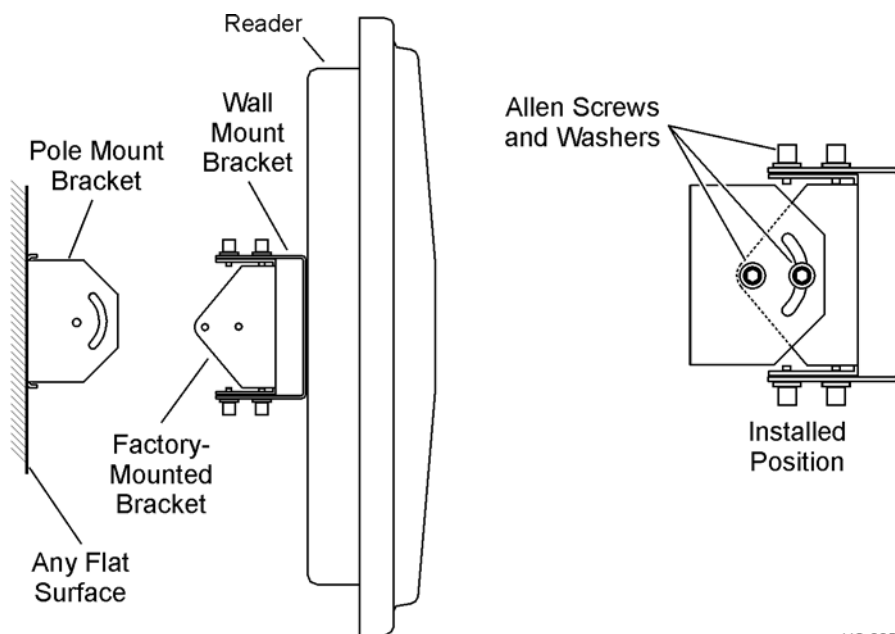


Figure 4-14 Pole Mount Bracket Attached to Wall

9. Mount the Encompass 4 Reader to the pole-mount bracket using Allen screws, as shown in Figure 4-15.



HS-0053

Figure 4-15 Connecting the Encompass 4 Assembly to Pole Mount Bracket

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

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



Caution

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

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



Caution

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

Mounting the Antenna

If you are using the Encompass 4 Reader that requires an external antenna in permanent installations, the antenna should be positioned as close as possible to the Encompass 4 Reader. Long cable runs increase system sensitivity to noise. See [Table 2-6 on page 2-20](#) for maximum RF cable lengths.

Before you connect the external antenna to the Encompass 4 Reader, you must perform the following voltage discharge procedure.

Discharging Voltage from the External Antenna

Use these instructions to discharge high voltage from the external antenna before proceeding with further pre-installation testing of the reader connected to an external antenna.

Required Equipment

This procedure requires the following equipment.

- TransCore Encompass 4 Reader (external antenna models only)
- External antenna
- RF cable
- N-type load (e.g., 50 Ω) or RF attenuator (e.g., 20 dB)

Discharging the Voltage

1. Terminate the reader end of the RF cable with any N-type load or RF attenuator (Figure 4-16).

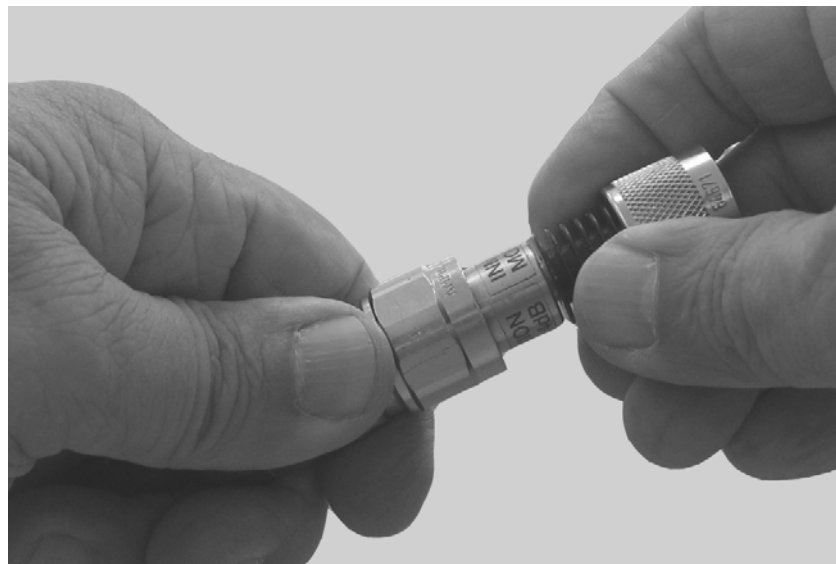


Figure 4-16 Connect RF N-type Load or Attenuator to Reader Cable End

2. Connect the RF cable to the antenna (see item 1 in Figure 4-17).

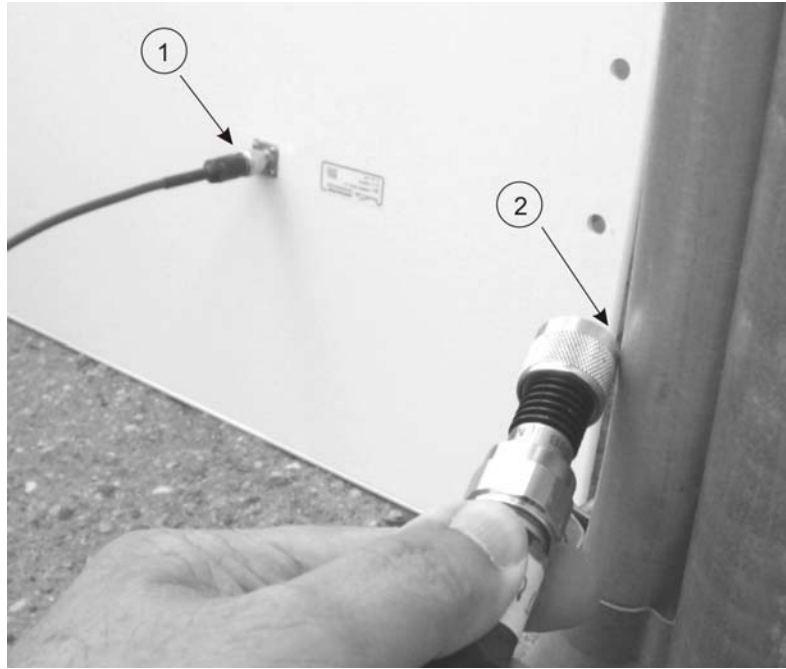


Figure 4-17 Short Load to Earth Ground

3. Short the outer metal case of the load or attenuator to Earth Ground for approximately 10 seconds (see item 2 in Figure 4-17). In this example, the installer is using the electrical conduit for Earth Ground.
4. Remove the load or attenuator from the RF cable and connect cable to reader.

Once the antenna is discharged and properly connected to the reader, the reader circuitry provides a DC path to keep any further charge from building up in the antenna.



Caution

TransCore does not recommend using a screwdriver or other tool to short the RF cable center conductor to the outer ground of the cable. This grounding method can damage the center pin or the threads of the connector.

TransCore strongly advises that you use adequate Earth Ground for this voltage discharge procedure in accordance with the National Electric Code for the locale where you are installing the Encompass 4 Reader.

Mounting the Antenna Curb-Side

Some site designs, for example those with curb-side antennas, require that the antenna be mounted on a round pole. The pole must be a minimum of 2 inches (5 cm) in diameter and should extend approximately 8 feet (2.4 m) above the pavement level. The pole must be installed according to local building codes.

Note: Do not use an AA3152 Universal Toll Antenna for side-fire application.

Procedures

Use the following guidelines to mount an antenna on a curb-side round pole.

To mount the antenna to a curb-side pole

1. Follow the manufacturer's directions to attach the antenna assembly to the pole approximately 8 feet (2.4 m) above the pavement surface.
2. Tighten slightly so that you can adjust the antenna left or right but not so slightly that the antenna slides down the pole.
3. Adjust the assembly by pointing the antenna to the middle of the area where tags will be read, and while in this position, tighten all screws and fastenings slightly.

***Note:** Adjust the antenna to provide the most direct line of sight to the tags.*

[Figure 4-18](#) illustrates front and top views of a pole-mounted antenna with the approximate measurements for sites where tags would be mounted on the interior driver-side windshield.

***Note:** Determine the read zone before you tighten all screws and straps permanently. Refer to the section [“Marking the Read Zone”](#) on page 4-35.*

After mounting the antenna, you must connect it to the Encompass 4 Reader. Follow the procedures described previously in the section [“Connecting the External Antenna”](#) on page 4-8.



Caution

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

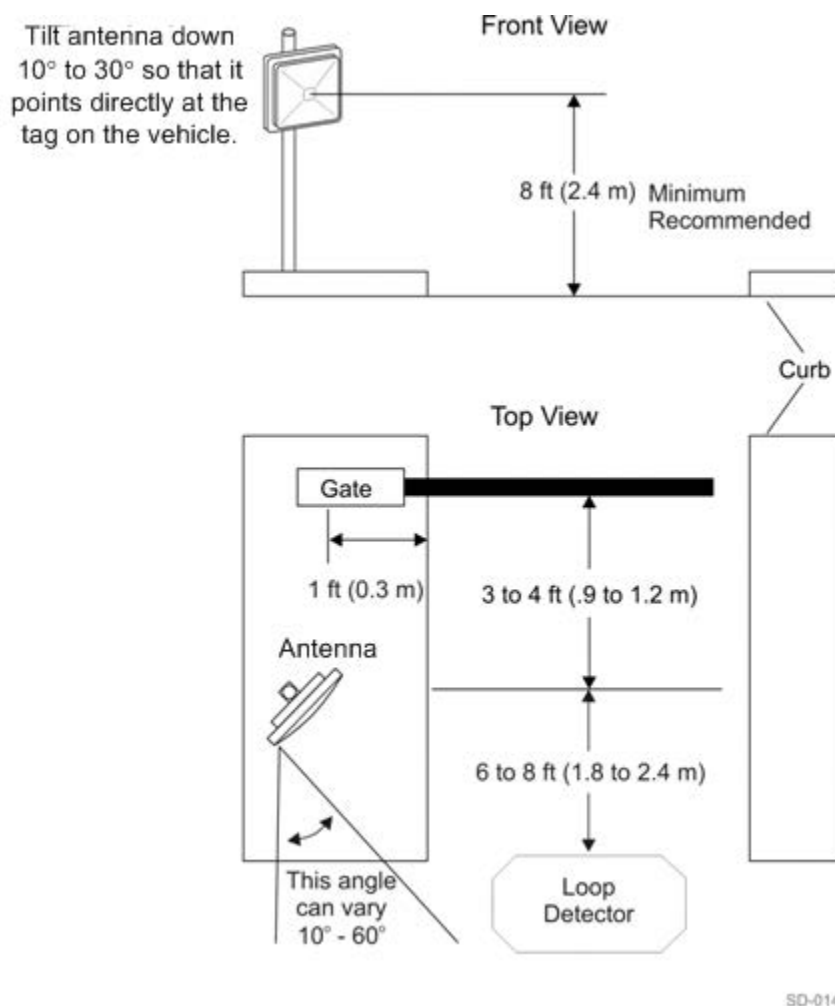


Figure 4-18 Front and Top Views of the Curb-Side Antenna Position

Note: The dimensions in Figure 4-18 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 antenna to match site and tag mounting positions to provide the most direct line of sight to the tags.

Mounting the Antenna Overhead

Some site designs require that the antenna be mounted in an overhead location.

Procedures

To mount the antenna in an overhead location

1. Follow the manufacturer's directions to attach the antenna assembly to the overhead location at approximately 18 feet above the pavement surface.
2. Tighten slightly so that you can adjust the antenna up and down but not so slightly that there is a risk of the antenna falling.
3. Adjust the assembly by pointing the antenna to the middle of the area where tags will be read, and while in this position, tighten all screws and fastenings slightly.

Note: Adjust the antenna to provide the most direct line of sight to the tags.

For example, in toll lanes the Universal Toll Antenna (UTA) would be installed approximately 15 degrees from the vertical.

Figure 4-19 illustrates an overhead-mounted antenna with approximate measurements for the read zone.

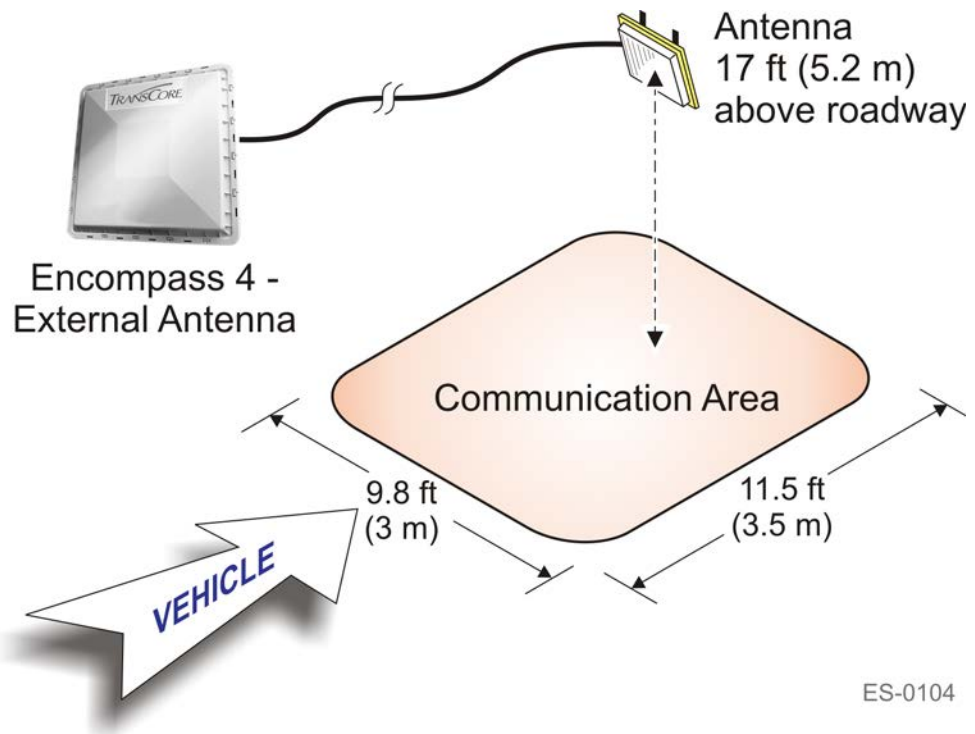


Figure 4-19 Encompass 4 Reader Installation with Overhead Antenna

Note: Determine the read zone before you tighten all screws and straps permanently. Refer to the section [“Marking the Read Zone”](#) on page 4-35.

After mounting the antenna, you must connect it to the Encompass 4 Reader. Follow the procedures described previously in the section “[Connecting the External Antenna](#)” on page 4-8.

Connecting the Power Supply

To connect the Encompass 4 Reader to a low-voltage AC power supply follow the procedures described previously in the section “Connecting the AC Power Supply” on page 4-8.

To connect the Encompass 4 Reader to a low-voltage DC power supply follow the procedures described previously in the section “Connecting the DC Power Supply” on page 4-9.

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

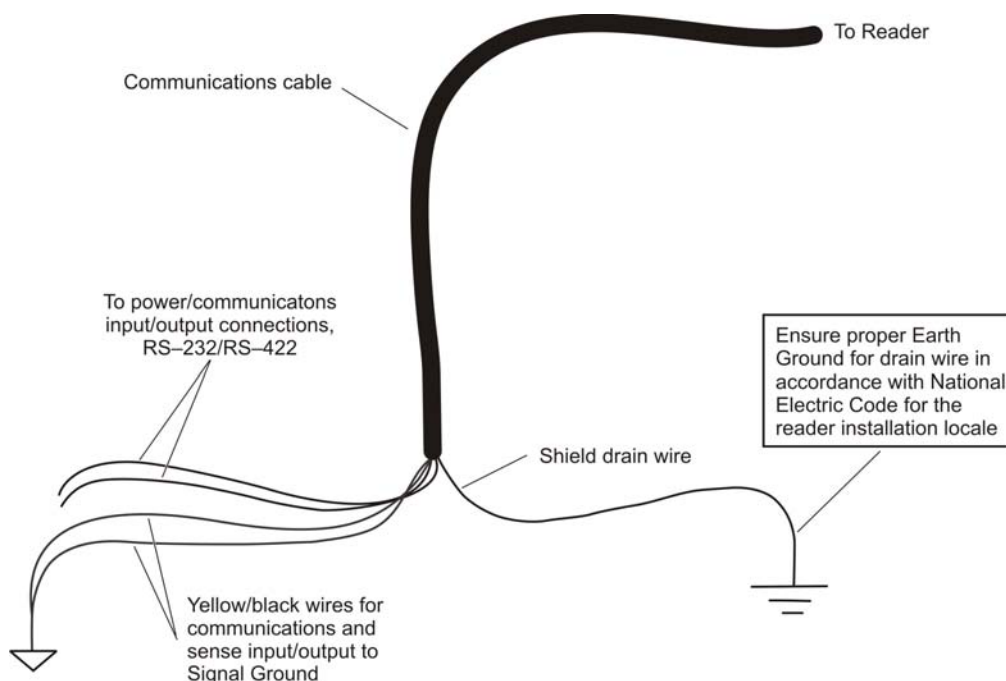


Caution

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

Reader Cable Grounding

Ensure that you connect the communications cable shield drain wire to Earth Ground and the yellow/black wires to Signal Ground ([Figure 4-20](#)).



WD-0082

Figure 4-20 Recommended Reader Cable Grounding



Caution

Do not ground the input power supply.



Caution

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

Connecting Communications

TransCore offers reader models that communicate through RS–232, RS–422, and Wiegand interface protocols. This section describes the procedures and materials required for connecting the communications to the junction box and to the sense input and sense output circuits.

Required Materials

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

- PC or laptop
- Any terminal emulation program such as Procomm Plus™ or Hyper Terminal™ running on a PC
- Communications cable to connect to the COM1 port on your PC

Connecting the Encompass 4 Reader to the PC

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

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

The Encompass 4 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 Reader communications cable. The pin assignments for the signal to the host male DB9 and DB25 connectors are shown in boldface in [Figure 4-5](#).

Connecting the Encompass 4 Reader Colored-Wire Pair Cable

Table 4-6 shows the RS-232 colored wire assignments.

Table 4-6 RS-232 Interface Signal Wiring for Colored-Wire Pair Cable

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

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

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

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

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

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

RS-422 Interface

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

Table 4-7 shows the RS-422 signals and their interface wires.

Table 4-7 RS-422 Interface Signal Wiring for Colored-Wire Pair Cable

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

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

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

Wiegand Interface

Wiegand interface signals are supplied by three wires from the Encompass 4 Reader communications cable. The Encompass 4 Reader with RS-232 or RS-422 comes with the Wiegand option built in. The Wiegand interface can only be used by the reader to output valid Wiegand tag reads. All reader commands and responses are issued through the serial interface.

Table 4-8 shows the Wiegand signals and the interface wires.

Table 4-8 Wiegand Interface Signal Wiring for Colored-Wire Pair Cable

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

To connect Wiegand interface

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

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



Warning

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

Connecting Sense Input and Sense Output Circuits

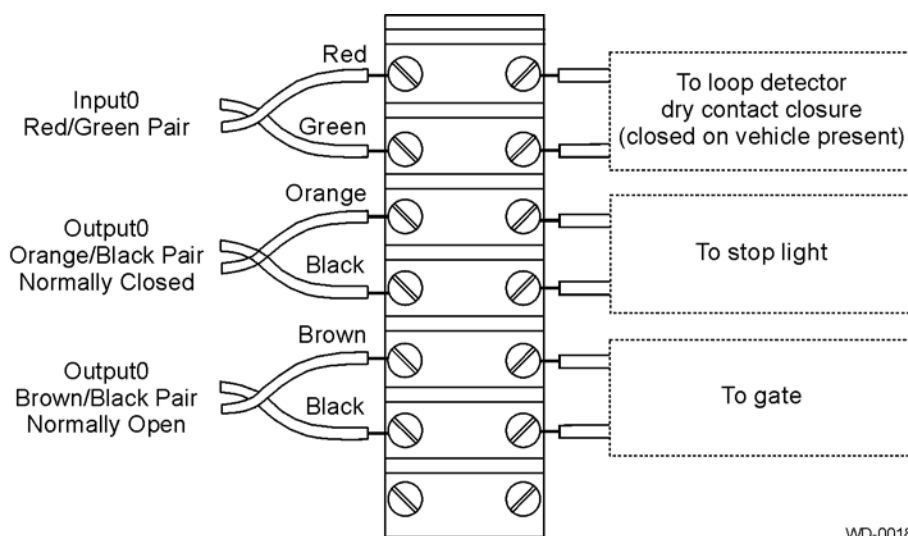
The Encompass 4 Reader has two sense input circuits and three sense output circuits available. The sense input circuits can be used to notify the Encompass 4 Reader of external events and are designed to be connected to a free-of-voltage dry contact. Sense output circuits are single-pole, double-throw 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 Reader supports two sense inputs – sense input0 and sense input1 – which requires two sense input lines for each loop sense or a total of four sense input connections. Sense input0 is the presence detection device line and is used to control RF power. As shown in [Figure 4-21](#), sense input0 is through the red/green wire pair on the I/O pigtail. The Encompass 4 Reader expects the sense input0 circuit to close when a vehicle is present (i.e., a NO condition). The minimum presence true period is fixed at 0 ms, which indicates that no delay occurs in closing the circuit when a vehicle is present.

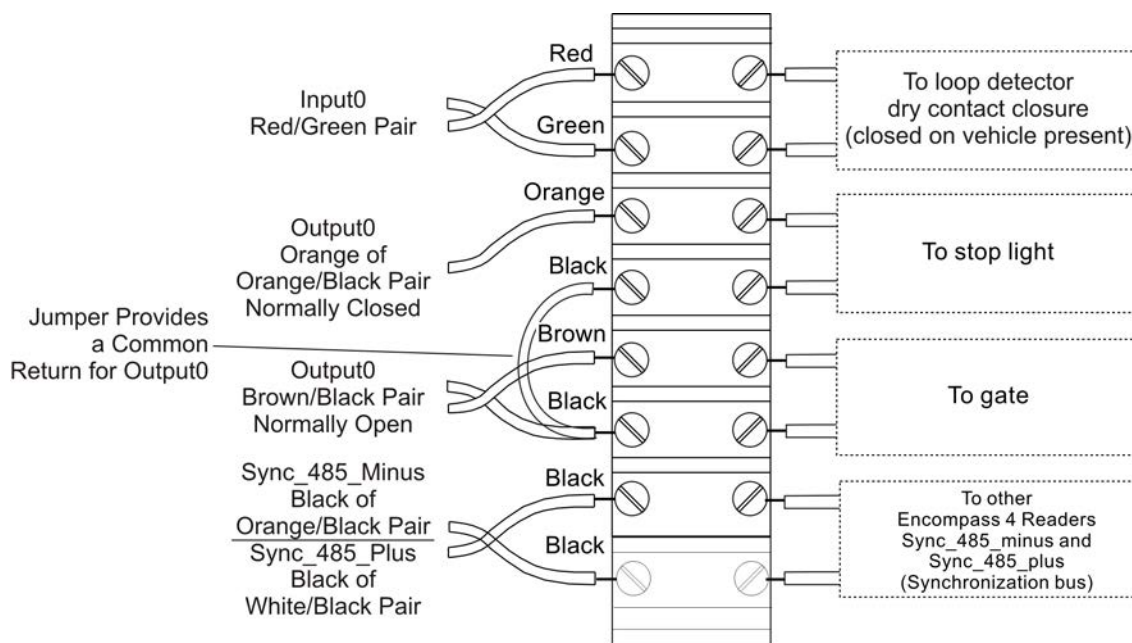
Sense input1 allows the Encompass 4 Reader to monitor the status of a peripheral device. The host computer can then check the status by polling the Encompass 4 Reader.



WD-0018

Figure 4-21 Sample Circuit Connections

For Encompass 4 Readers that are used with IAG protocols, the NC sense output0 common is connected to the NO sense output0 common via a jumper providing a return for sense output0 NC. [Figure 4-22](#) shows this wiring.



WD-0088

Figure 4-22 Sample Circuit Connections for IAG Installations

Sense Output Circuits

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

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

As illustrated in [Figure 4-21](#), sense output0, NC, is located on the orange/black pair. Sense output0, NO, is located on the brown/black pair.

As shown in [Figure 4-22](#), for IAG applications, Sense output0 NC, shares a common return with sense output0 NO.

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

[Table 4-9](#) lists the cable descriptions and functions for the interface signals. These wire pairs can be used or terminated based on the specific project applications and site requirements.

Using [Table 4-9](#) as a guide to the functions of each of the wire signals, connect the remaining wires to the appropriate terminal blocks on the terminal strip in the junction box.

Table 4-9 Sense Input/Output Cabling Assignments

Pair	Pin	Color	Signal	Description	Typical Function
Blue/Red	E	Blue	WGND0	Wiegand data0	Parking/access control applications
	F	Red	WGND1	Wiegand data1	Parking/access control applications
White/Red	L	White	Lock	Tag lock output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Green/Red	N	Green	Sense Input0	Sense Input0 (loop)	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection
Blue/Black	R	Blue	Sense Input1	Sense Input1	General-purpose sense input, not used for detecting presence
	S	Black	Sense Input1_RTN	Sense Input1 return; not isolated from signal ground	General-purpose sense input, not used for detecting presence
Brown/Black	T	Black	Sense Output0_COM	Sense Output0 (tag detect), common terminal	Switched output to control gate
	U	Brown	Sense Output0_NO	Sense Output0 NO terminal	Switched output to control gate
Orange/Black	V	Black	Sense Output0_COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Orange/Black	V**	Black	Sync_485_N	RS-485 bus negative	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus

Table 4-9 Sense Input/Output Cabling Assignments (continued)

Pair	Pin	Color	Signal	Description	Typical Function
	W	Orange	Sense Output0_NC	Sense Output0 NC terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/Black	X	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
	Y	Green	Sense Output1_NO	Sense Output1 NO terminal	Switched sense output
White/Black	Z	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
White/Black	Z**	Black	Sync_485_P	RS-485 bus positive	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	a	White	Sense Output1_NC	Sense Output1 NC terminal	Switched sense output
Yellow/Black	b	Yellow	GND	Logic ground	Signal ground used with RS-232 and Wiegand
	c	Black	GND	Logic ground	Signal ground used with RS-232 and Wiegand
**Use this synchronization pin designation if installing an Encompass 4 Reader that reads IAG protocol tags. The part numbers for these readers are as follows: 10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019; 10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019;					

**Caution**

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

Marking the Read Zone

The area where the Encompass 4 reads tags at the current RF range is called the read zone. The antenna pattern, or read zone, of the Encompass 4 Reader would look roughly like a pear-shaped balloon if you were able to see it. When installing the Encompass 4 Reader, you should first mark the unit's read zone using the RF range set at the factory-default maximum. You can later adjust the read zone using the techniques discussed in [“Fine-Tuning and Verifying the Read Zone” on page 8-19](#).

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

Required Materials

You need the following materials to mark the read zone:

- Test tags, supplied by the TransCore dealer or distributor
- Piece of windshield-type glass 0.190 to 0.230 inches (4.82 to 5.84 mm) in thickness and approximately 12 inches (30.48 cm) square on which to attach the eGo Plus Sticker Tag, eGo Plus Security Sticker Tag, or eGo WST



Caution

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

- Audible circuit tester and 9V DC battery for circuit tester power as described in the section [“Bench Testing the Encompass 4 Reader Before Installation”](#) on page 4-12.
- Piece of chalk or roll of tape
- Plastic or wooden yardstick for ATA or IAG tags
- Vinyl electrical tape or hook-and-loop material

Procedures

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

To mark the read zone

1. Confirm the following:
 - You have correctly connected the power supply as described [“Connecting the AC Power Supply”](#) on page 4-8 and [“Connecting the DC Power Supply”](#) on page 4-9.
 - You have correctly connected communications as described in [“Connecting Communications”](#) on page 4-28.
 - You have correctly connected sense input and sense output circuits as described in [“Connecting Sense Input and Sense Output Circuits”](#) on page 4-31.
2. Connect the red and white leads from the audible tester to the red and white pair of wires from the Encompass 4 Reader power/communications cable.

3. Start the terminal emulation application Microsoft HyperTerminal by selecting **Programs>Accessories>Communications>HyperTerminal** and press **ENTER**.
4. In the HyperTerminal dialog boxes choose the com port to which the communications interface is attached and set the properties as:
 - Bits per second: 9600 baud
 - Data bits: 8
 - Parity: none
 - Stop bits: 1
 - Flow control: none
5. Cycle the power on the Encompass 4 Reader and ensure that the sign-on message displays.
6. Input the following commands in the order provided in [Table 4-5](#). Commands include those to switch to command mode, set operational mode, turn on RF, and return the reader to data mode.
7. Secure the ATA or IAG test tag to the end of the yardstick using electrical tape or hook-and-loop material or affix the test eGo Plus or eGo WST to the glass. Be sure the tag polarization (horizontal or vertical alignment) matches that of the Encompass 4 Reader or antenna used. If using an eGo Plus-type test tag or eGo WST, the glass should be in front of the tag (between the tag and the reader or antenna).
8. Stand directly in front of and about 5 feet (1.5 m) away (see [Figure 4-23](#)) from the Encompass 4 Reader or antenna. Hold the stick or the piece of glass so that the tag is positioned at a height and angle consistent with a tag installed on a vehicle. The test tag should cause the audible tester to sound.

***Note:** If you hold the test tag in your hand, your hand absorbs the RF signal and the test results are not accurate.*
9. Mark the spot with chalk or tape.
10. Move to the left until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
11. Return to the center and then move to the right until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
12. Return to the center and step backward 2 feet (0.6m) and repeat steps 5 through 7.
13. Continue moving the tag in this manner, placing marks on the ground to identify the boundary of the read zone each time the sound stops. Continue moving the tag to various locations until the read zone is fully marked.
14. You can now connect the outer marks to draw the outer boundary of the read zone.

[Figure 4-23](#) is a view of a sample read zone within a controlled lane. The outer X marks show the outside edges of the read zone.

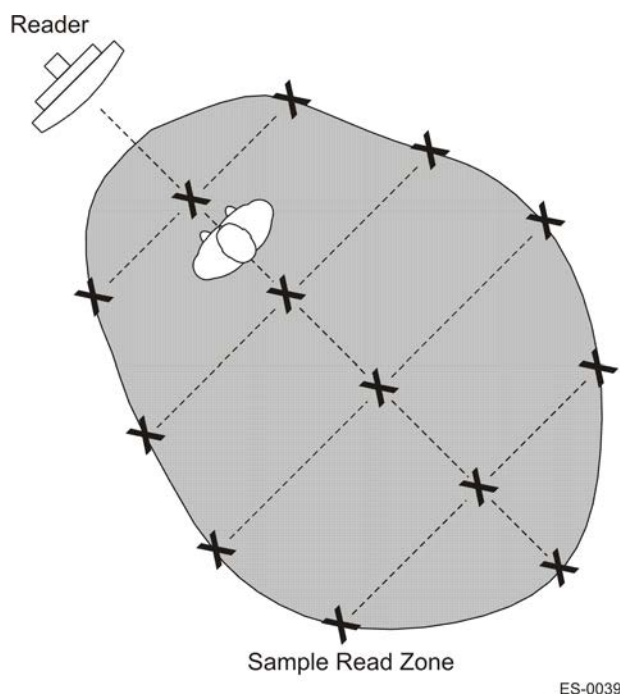


Figure 4-23 Sample Read Zone Marking Pattern

15. Standing at the farthest point of the pattern, walk toward the Encompass 4 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. See [“Fine-Tuning and Verifying the Read Zone” on page 8-19](#) to adjust the read zone.

General Software Information

General Software Information

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

This chapter presents various software-related topics arranged in alphabetical order by subject. In addition to this chapter, see Chapter [Chapter 6, “Communications Protocols,”](#) and [Chapter 7, “Commands](#) for more information.

Command Entry Conventions

All Encompass 4 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 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 5-1](#) shows the basic structure of a four-character command.

Table 5-1 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 Reader commands, responses are preceded by the # character. Many Encompass 4 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 5-2 shows an example of a command/reply sequence. This example assumes that an Encompass 4 Reader with serial number SN97001P running version X.XX software is connected to a PC running a terminal emulation software package such as Windows Hyper Terminal or Procomm Plus. The command sequence verifies that communications are working correctly.

Table 5-2 Sample Command Sequence

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

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

Operating Parameters

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



Caution

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

Power Fail

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

Program Download

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

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

Download Considerations

You should consider the following factors when performing program download:

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

Startup

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

Sign-On Message

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

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

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

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

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

```
Model [E4] Ver 0.00x  
[Copyright notice]
```

Boot Failure Message

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

If the failure message version number equals 0.00 and no serial number exists, the flash memory checksum has failed, and the Encompass 4 Reader is operating out of boot ROM. In this case, the Encompass 4 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 5-5](#) to download a new program.

Tag/Message Buffer

In basic communication protocol, the Encompass 4 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 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.

Communications Protocols

Communications Protocols

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

Introduction

The Encompass 4 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 is when using ECP. This interchange is completed by the message recipient returning a message acknowledgement to the message sender.

With ECP, all transmissions require a message. If a message is not received, the sender will time out with the same effect as if it had received a negative acknowledgment (from the host) or an `ERROR` message from the Encompass 4 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 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 8-19](#).

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

When the host computer is physically close to the Encompass 4 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 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 for flow control information.

Error Correcting Protocol

When the quality of data communications is imperative or may be suspect, you can invoke ECP to ensure the integrity of data transmitted between the Encompass 4 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 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 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 Reader acquires tags, it buffers them but does not transmit them. Instead, the host must poll the Encompass 4 Reader for each tag by sending a CTRL-E character (hex 5 digit). The Encompass 4 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 Reader data transmission (tag ID and report data) format is the same as for basic protocol.

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

Basic Protocol and ECP Format

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

Reader Transmissions

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

<som><data><eom>

The ECP format is as follows:

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

where

<som>	Start-of-message (ASCII # character)
<seq>	Sequence number (ASCII hex) that represents an even number in the range 0–9, A–F (0, 2, 4, 6, 8, A, C, E). The Encompass 4 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 Reader. The Encompass 4 Reader updates its sequence number upon receipt of a valid host ACK. If an ACK is not received, the Encompass 4 Reader retransmits the message. A reader transmission sequence is not considered complete until the Encompass 4 Reader receives an ACK and updates its sequence number.
<data>	An ASCII string up to 72 characters long. This string may contain tag data, a presence without tag report; an input status change report; an Error06, Error07, Error08, or Error11

message; or a sign-on message. Auxiliary data may also be included.

<crc> Field containing four ASCII digits that represent the 16-bit CRC value calculated on the message. The CRC value is calculated on bytes between the **som** character and the first **<crc>** byte.

When the host receives a properly framed message, it can calculate a 16-bit CRC value. The calculation is applied to the character string that immediately follows the **<som>** and that ends with the character immediately preceding the first **<crc>** character.

The transmitted CRC value can then be compared with the binary equivalent of the received **<crc>** characters. If the transmitted and received CRC values do not match, the recipient assumes the message was received in error, and transmits a NAK message response.

<eom> End-of-message characters (ASCII CR and LF). The system includes both a carriage return (CR) and line feed (LF) to facilitate the use of terminals and printers.

If the host receives a **<som>** character in the middle of a data message, the message in progress is aborted. The assumption is that an **<eom>** was lost and the Encompass 4 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 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 Reader. The sequence number should correspond to the data message that is being positively or negatively acknowledged by the host. If the Encompass 4 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 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 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 Reader receives an ACK or NAK message from the host, a logical NAK condition will be declared. If the Encompass 4 Reader receives a NAK or timeout, the reader retransmits the data message.

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

Reader response

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

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

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

Timing and Synchronization

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

The Encompass 4 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

$$T_{char} \text{ (ms)} = 1000 \times [B_c / R_b]$$

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 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 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 Reader receives new communications parameters, the Encompass 4 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 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 acknowledgement 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 acknowledgement message is received.

The message recipient, such as the host computer in data mode and the Encompass 4 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 Reader remains in command mode to avoid losing tag IDs. RF is off in command mode and no tags can be read.*

Reader-Addressed Failure Conditions

The Encompass 4 Reader addresses the following failure conditions.

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

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

Transmission Timeout

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

Receive Timeout

If the Encompass 4 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 Reader transmits asynchronous data at the same time that the host sends a command, the Encompass 4 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 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 Reader's response. The Encompass 4 Reader retransmits asynchronous data after it transmits the command message.

ECP Reliability

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

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

CRC Calculation

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

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

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

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

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

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

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

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

```
#define updcrc(cp, crc)( crctab[((crc >> 8) & 255)] ^ (crc << 8) ^ cp
static unsigned short crctab [256] = {
0x0000,  0x1021,  0x2042,  0x3063,  0x4048,  0x50a5,  0x60c6,  0x70e7,
0x8108,  0x9129,  0xa14a,  0xb16b,  0xc18c,  0xd1ad,  0xe1ce,  0xf1ef,
0x1231,  0x0210,  0x3273,  0x2252,  0x52b5,  0x4294,  0x72f7,  0x62d6,
0x9339,  0x8318,  0xb37b,  0xa35a,  0xd3bd,  0xc39c,  0xf3ff,  0xe3de,
0x2462,  0x3443,  0x0420,  0x1401,  0x64e6,  0x74c7,  0x44a4,  0x5485,
0xa56a,  0xb54b,  0x8528,  0x9509,  0xe5ee,  0xf5cf,  0xc5ac,  0xd58d,
0x3653,  0x2672,  0x1611,  0x0630,  0x76d7,  0x66f6,  0x5695,  0x46b4,
0xb75b,  0xa77a,  0x9719,  0x8738,  0xf7df,  0xe7fe,  0xd79d,  0xc7bc,
0x48c4,  0x58e5,  0x6886,  0x78a7,  0x0840,  0x1861,  0x2802,  0x3823,
0xc9cc,  0xd9ed,  0xe98e,  0xf9af,  0x8948,  0x9969,  0xa90a,  0xb92b,
0x5af5,  0x4ad4,  0x7ab7,  0x6a96,  0x1a71,  0x0a50,  0x3a33,  0x2a12,
0xdbfd,  0xcbdc,  0xfbbf,  0xeb9e,  0x9b79,  0x8b58,  0xbb3b,  0xab1a,
0x6ca6,  0x7c87,  0x4ce4,  0x5cc5,  0x2c22,  0x3c03,  0x0c60,  0x1c41,
0xedae,  0xfd8f,  0xcdec,  0xddcd,  0xad2a,  0xbd0b,  0x8d68,  0x9d49,
0x7e97,  0x6eb6,  0x5ed5,  0x4ef4,  0x3e13,  0x2e32,  0x1e51,  0x0e70,
0xff9f,  0xefbe,  0xdfdd,  0xcffc,  0xbf1b,  0xaf3a,  0x9f59,  0x8f78,
0x9188,  0x81a9,  0xb1ca,  0xaleb,  0xd10c,  0xc12d,  0xf14e,  0xe16f,
0x1080,  0x00a1,  0x30c2,  0x20e3,  0x5004,  0x4025,  0x7046,  0x6067,
0x83b9,  0x9398,  0xa3fb,  0xb3da,  0xc33d,  0xd31c,  0xe37f,  0xf35e,
```



```

0x02b1, 0x1290, 0x22f3, 0x32d2, 0x4235, 0x5214, 0x6277, 0x7256,
0xb5ea, 0xa5cb, 0x95a8, 0x8589, 0xf56e, 0xe54f, 0xd52c, 0xc50d,
0x34e2, 0x24c3, 0x14a0, 0x0481, 0x7466, 0x6447, 0x5424, 0x4405,
0xa7db, 0xb7fa, 0x8799, 0x97b8, 0xe75f, 0xf77e, 0xc71d, 0xd73c,
0x26d3, 0x36f2, 0x0691, 0x16b0, 0x6657, 0x7676, 0x4615, 0x5634,
0xd94c, 0xc96d, 0xf90e, 0xe92f, 0x99c8, 0x89e9, 0xb98a, 0xa9ab,
0x5844, 0x4865, 0x7806, 0x6827, 0x18c0, 0x08e1, 0x3882, 0x28a3,
0xcb7d, 0xdb5c, 0xeb3f, 0xfb1e, 0x8bf9, 0x9bd8, 0xabbb, 0xbb9a,
0x4a75, 0x5a54, 0x6a37, 0x7a16, 0x0af1, 0x1ad0, 0x2ab3, 0x3a92,
0xfd2e, 0xed0f, 0xdd6c, 0xcd4d, 0xbdaa, 0xad8b, 0x9de8, 0x8dc9,
0x7c26, 0x6c07, 0x5c64, 0x4c45, 0x3ca2, 0x2c83, 0x1ce0, 0x0cc1,
0xef1f, 0xff3e, 0xcf5d, 0xdf7c, 0xaf9b, 0xbfba, 0x8fd9, 0x9ff8,
0x6e17, 0x7e36, 0x4e55, 0x5e74, 0x2e93, 0x3eb2, 0x0ed1, 0x1ef0,
};

```

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

```

#include <stdio.h>

#define MAX_CHAR      256
#define BITS_CHAR     8
#define SIGN_BIT      0x8000
#define POLY          0x1021
unsigned short crctab [MAX_CHAR];
main ()
{
    unsigned short ch;
    unsigned short workval;
    unsigned short bit;
    unsigned short carry;
    for (ch = 0; ch != MAX_CHAR; ch++) {
        workval = ch << BITS_CHAR;
        for (bit = BITS_CHAR; bit != 0; bit--) {
            carry = (workval & SIGN_BIT);
            workval <= 1;
            if (carry)
                workval ^= POLY;
        }
        crctab[ch] = workval;
    }
    for (ch = 0; ch != MAX_CHAR; ch++)
        printf("0x%04x\n", crctab[ch]);
}

```

Manually Disabling ECP for Maintenance

Under certain conditions, communications between the host and Encompass 4 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 Reader software is in an ECP “loop” is when the user/technician sees a recurring display of the same message repeated over and over again on the monitor. The procedure described in the following paragraphs enables the maintenance technician to change configuration or test tag reading manually.

Assuming that the ECP timeout is at the factory default of 12.7 seconds (or other value that allows enough time for the commands to be manually entered) the following command sequence may be used to break out of an ECP loop. This command sequence uses four ASCII <`> characters (60 hex) as wild card CRC values.

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

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

#x@` `` `

where

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

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

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



Caution

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

Reader transmission on power-up:

#0 Model ... SN <crc><eom>

Manually enter: **#0@` `` `` <eom>**

Reader transmission **#2 Copyright 2008 TransCore <crc><eom>**

Manually enter: **#2@` `` `` <eom>**

Manually enter: **#101` `` `` <eom>** this puts reader into command mode

Reader response: **#1Done<crc><eom>**

Manually enter: **#3610` `` `` <eom>** this puts reader into basic protocol, disabling ECP

reader response: Done

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

#00 to return the reader to data mode

or

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

Commands

Chapter 7

Commands

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

Introduction

The Encompass 4 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 Reader can also communicate with ASCII terminals.

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

Operating Modes

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

Data Mode

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

- Command #01 Switch To Command Mode changes the Encompass 4 Reader from the data mode to the command mode. See [“01 Switch to Command Mode” on page 7-5](#).

Note: *The Encompass 4 Reader transmits ID codes to the host computer when the Encompass 4 Reader is in data mode. If the Encompass 4 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 Reader is in the command mode, the host computer sends commands to the Encompass 4 Reader that can be used to control the operation and configuration of the reader. After the Encompass 4 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 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 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.*

Note: *The Encompass 4 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 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 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 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 D for listings of commands in numerical and alphabetical order.

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

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

Reader Mode Control — Command Group 0

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

00 Switch to Data Mode (Factory Default)

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



Caution

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

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

- Command #01 Switch to Command Mode

Reader response:

Done

01 Switch to Command Mode

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

Reader response:

Done

Communications Port Control — Command Group 1

Group 1 commands configure the parameters used by the Encompass 4 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

Command #100N selects the reader baud rate. The factory-default setting is 9600 baud. The N variable specifies the baud rate shown in [Table 7-1](#).

Table 7-1 Select Baud Rate Commands

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



Caution

If ECP is enabled, ensure that the ECP timeout is sufficient for the new baud rate. See “[Timing and Synchronization](#)” on page 6-12.

Reader response:

Done

101N Select Stop Bits

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 7-2](#).

Table 7-2 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 7-3](#).

Table 7-3 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

Group 2 commands control the real-time clock which maintains the Encompass 4 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

<i>MM</i>	represents the month (01 to 12).
<i>DD</i>	represents the day (01 to 31).
<i>YY</i>	represents the last two digits of the year (00 to 99).
<i>/</i>	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

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

Append Information — Command Group 3

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.

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 7-4](#)

Table 7-4 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 7-5](#).

Table 7-5 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 7-20 . 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:** Note: This functionality was added to the Encompass® 2 Reader to handle a special unique customer requirement, and is retained in the Encompass 4 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 multitag 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

ID Filtering — Command Group 4

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 Reader.

40 Transmit All ID Codes

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.

After diagnostics are complete, you may want to reinstate the uniqueness check using command #410N Select Unique ID Code Criteria.

Reader response:

Done

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

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 7-6](#).

Table 7-6 Unique ID Code Criteria

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

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

- Item 1 Most recently acquired ID
- Item 2 Second-most recently acquired ID
- Item 3 Third-most recently acquired ID
- Item 4 Fourth-most recently acquired ID

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

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

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

Reader response:

Done

420N Select Valid ID Code Criteria

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 7-7). The factory setting is one acquisition (N = 0).

Table 7-7 Select Valid Code Commands and Frames

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

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

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

440 Reset Uniqueness

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

44N Set Uniqueness Timeout

Places a time limit on the uniqueness criterion set by Select Unique ID Code Criteria (#410N). The parameter N sets the number of minutes on the timeout clock. The factory setting is two minutes (N = 1).

Command Timeout Clock

#441	2 minutes (<i>factory setting</i>)
#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 continually reset (does not expire) as long as the reader receives the same tag ID. For example, assume that the timeout clock is set for 2 minutes and

there is a railcar parked on a siding in front of the reader. Without this continual reset feature, the railcar's ID would be reported every 2 minutes (each time the timeout clock expired).

450 Disable Wiegand Mode (Factory Default)

Command #450 is a default set in the factory to disable Wiegand mode.

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.

In Wiegand mode, the reader transmits Wiegand-formatted tag data through the Wiegand interface and ASCII data (the reader accepts reader commands and responds) through the serial port interface. The reader outputs data from Wiegand-programmed tags via the Wiegand interface (the red/blue pair for data1/data0; yellow/black pair for logic ground). Tags that are not Wiegand-formatted are not transmitted through the Wiegand interface or 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 message:

Done

453 Enable Tag Translation Mode

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.

Reader message:

Done

454 Disable Multi-tag Sort (Factory Default)

Command #454 is a default set in the factory to disable the multi-tag sort function.

Reader response:

Done

455 Enable Multi-tag Sort

Command #455 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.

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 Intellitag-based tag in the vehicles of the target population, multi-tag sort should be disabled.*

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.



Caution

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

Reader response:

Done

46NN Set Wiegand Retransmit Interval

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

Note: The actual value of the Wiegand retransmit interval may vary depending on the operative tag read mode and the type of tag in the read field.

For example, 10 = 16 seconds and FF = 255 seconds. The factory default is 4601 (1 second).

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

Reader response:

Done

480 Disable ATA

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

481 Enable ATA

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

482 Disable eGo

Command #482 disables the reader from reading protocol eGo 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

Command #487 enables the reader to read IAG protocol data from tags *if the reader is programmed to read this tag protocol.*

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.



Caution

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

Reader response:

Done

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.



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.

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

Reader Status — Command Group 5

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

505 Display Software Version

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

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

you set the information to any 20 character ASCII string desired using command #696S...S.

Reader response:

An ASCII string from 1 to 20 characters in length

510 Display RF Transceiver FPGA Version

Command #510 displays RF FPGA VER = XX.XX

511 Display RF Transceiver I Filter Chip Version

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

512 Display RF Transceiver Q Filter Chip Version

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

513 Display DSP Board Actel Version

Command #513 displays DSP FPGA VER = XX.XX

520 Display Power Fail Bit

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

Reader message:

PWRB P<0 to 1>R0

where

P0	No power failure detected
P1	Power failure detected
R0	Not applicable to Encompass 4 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
B3	2400 baud
B4	4800 baud
B5	9600 baud (factory default)
B6	19.2 kbps
B7	38.4 kbps
S0	one stop bit (factory default)
S1	two stop bits
P0	no parity (factory default)
P1	even parity
P2	odd parity
D0	00 ms end-of-line delay (fixed)

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

```
MAIN B5 S0 P0 D0
```

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

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

524 Display Appended Information Status

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

Reader message:

```
IDAP T<0> D<0> X<0> t o 1>
```

where

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

D1	Date appended (not valid for the Encompass 4 Reader)
X0	Auxiliary information not appended (factory default)
X1	Auxiliary information appended

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

IDAP T0 D0 X0

indicating time, date, and auxiliary information not appended.

525 Display Communications Protocol Status

Command #525 displays the status of command #61N Selected Communications Protocol, command #614N Selected Mode of Flow Control, and command #612NN ECP 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

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:

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

where

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 7-8 shows the output0 and output1 open/closed conditions for the output status displays.

Table 7-8 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 7-9 shows the output0 and output1 open/closed conditions for the output status displays for readers in IAG applications.

Table 7-9 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 7-10 shows the input0 and input1 open/closed conditions for the input status displays.

Table 7-10 Open/Closed Conditions for Input Status

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

527 Display RF Status

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

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

Reader message:

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

where

C0	RF controlled by host
C1	RF controlled by presence sensor on input0, the red/green pair (factory default)
O0	RF off
O1	RF on
T1	Uniqueness timeout of two minutes
T2	Uniqueness timeout of 15 seconds
T3	Uniqueness timeout of 30 seconds
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.

Rxx	Tag decoder range (distance) for ATA tags, xx = 00 to 1F hexadecimal range value
Gxx	Tag decoder range (distance) for eGo and eGo Plus tags, xx = 00 to 1F hexadecimal range value
Axx	RF power attenuation, where 00 is maximum output power and 0A is minimum output power (10dB less than maximum power).
Ixx	IAG RF power attenuation, where 00 is maximum output power and 0F is minimum output power (15 dB less than maximum power)

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

```
RFST C1 00 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)
P1	Presence without tag reports enabled
D0	Minimum presence true period of 0 ms (fixed)
A0	RF off on timeout only
A1	RF off on timeout or tag
A2	RF off on timeout or presence condition false (factory default)

T0	RF timeout of 0 ms (always expired)
T1	4 ms
T2	8 ms
T3	12 ms
T4	20 ms
T5	24 ms
T6	32 ms
T7	48 ms
T8	60 ms
T9	92 ms
TA	152 ms
TB	300 ms
TC	452 ms
TD	600 ms
TE	752 ms
TF	RF timeout infinite, never expires (factory default)
I0	input inversion disabled (factory default)
I1	input inversion enabled

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

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

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

530 Display RF0 Filter Status

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

Reader message:

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

where

U0	One ID separation (factory default)
U1	Two ID separations
U2	Three ID separations
U3	Four ID separations
U4	Transmit all IDs
V0	Valid ID code criteria of one acquisition
V1	Valid ID code criteria of two acquisitions
V2	Valid ID code criteria of three acquisitions
V3	Valid ID code criteria of four acquisitions

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

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

Reader message:

TOF <0 to 1>

where

0	Wiegand mode disabled
1	Wiegand mode enabled

533 Display Wiegand Retransmit Interval

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

Reader message:

WTI <01 to FF>

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

Note: The actual value of the Wiegand retransmit interval may vary depending on the operative tag read mode and the type of tag in the read field.

For example, 10 = 16 seconds and FF = 255 seconds. The retransmit interval in ATA tag read mode is about twice these values.

534 Display Tag Translation Mode Status

Command #534 displays tag translation mode status, enabled or disabled. If tag translation mode is enabled, incoming full-frame tags in AAR or ATA format are translated according to ISO standards. Refer to [“452 Disable Tag Translation Mode \(Factory Default\)” on page 7-13](#) and [“453 Enable Tag Translation Mode” on page 7-13](#) for more information.

Reader message:

TT <0 to 1>

where

0	tag translation mode disabled
1	tag translation mode enabled

537 Display Echo Status

Command #537 displays echo mode status. In basic protocol (#610 Select Basic Protocol), the reader may be configured to enable (#6171 Enable Echo Mode) or disable (#6170 Disable Echo Mode) the echo of received commands. Refer to sections [6170 Disable Echo Mode](#) and [“6171 Enable Echo Mode \(Factory Default\)” on page 7-31](#) 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 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

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

For example, if the command string shown in command #697 (see [“697 Set User-Programmable Group Select Equals \(GSE\) Filter” on page 7-45](#)) 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

I	ID (64 bits)
E	Enabled
F	Full transaction (eATA)
D	Disabled
TMM0	Fixed

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

Reader Control Functions — Command Group 6

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)

Command #610 enables the basic communications protocol. Refer to [“Basic Protocol” on page 6-4](#) for more information.

Reader response:

Done

611 Select Error Correcting Protocol

Command #611 enables the error correcting protocol. Refer to [“Error Correcting Protocol” on page 6-4](#) 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

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



Caution

Ensure that the ECP timeout is sufficient for a given baud rate. See [“Timing and Synchronization” on page 6-12](#).

613 Enable Data Inquiry Protocol

Command #613 enable the data inquiry protocol. Refer to [“Data Inquiry Protocol” on page 6-5](#) for more information.

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 7-11](#).

Table 7-11 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

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 7-12. Receipt of any #620N command automatically disables command #621 Predefined Output Control.

Table 7-12 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)

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

Reader response:

Done

63 Reset Reader

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

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

Reader response:

Model E4 Series Ver X.XX SNSSSSSS
Copyright 2008 TransCore

where

X.XXD Version number

SSSSSS Serial number of the unit, skipping the 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 7-13](#).

Table 7-13 RF Control Commands

Command	RF Power
6400	Turns off RF
6401	Turns on RF

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

Reader response:

Done

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

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

Reader response:

Done

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 7-14](#).

Table 7-14 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
6420F	909.5	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

Table 7-14 RF Frequency Commands (continued)

Command	RF Frequency (MHz)	Approved for Use in the U.S. (ATA only)	Approved for Use in the U.S. (modulated)
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
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 message:

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 10 dB of attenuation from the maximum power setting of two watts at 0-dB attenuation to a minimum power level of 200 milliwatts at 10-dB attenuation.

The Set RF Attenuation command NN variables and corresponding attenuation settings are shown in [Table 7-15](#).

Table 7-15 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

646XX Set IAG RF Attenuation

Command #646XX sets the IAG attenuation control for the output RF power where XX 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.

647XXX Select RF Operating Frequency

Command #647XXX sets the reader RF from 860 to 930 MHz in 250-kHz steps, where XXX 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 #647XXX, 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 7-16](#).

Table 7-16 Select RF Operating Frequency Commands

Command	RF Frequency (MHz)
647000	860.00
.	.
.	.
.	.
6470CF	911.75
6470D0	912.00
6470D1	912.25
6470D2	912.50
6470D3	912.75
6470D4	913.00
.	.
.	.
.	.
6470EA	918.50

Table 7-16 Select RF Operating Frequency Commands (continued)

Command	RF Frequency (MHz)
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

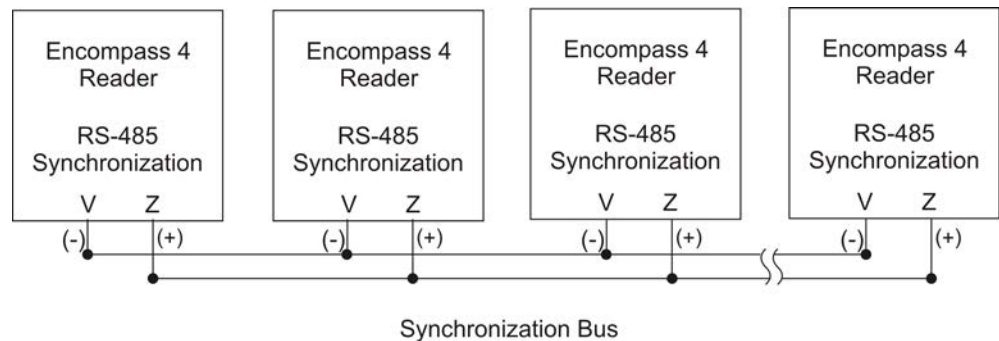
#648NN Set Synchronization Output Delay Time

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 and 255 milliseconds. If the reader gets a pulse from another reader before its own time period expires, it first executes all of the enabled tag protocols, then restarts its countdown timer. The reader on the bus with the smallest entered value becomes the master and all readers with a larger entered number become slaves. Any reader on the bus can become the master. The master does not necessarily have to be on one of the ends of the synchronization bus, but the installer must exercise caution to ensure that every reader on the bus has a different value.

When the master sends out the synchronization pulse all of the connected readers begin the RF tag protocol transactions that have been enabled. This synchronization feature primarily is designed to overcome some of the system-design RF interference issues in reading IAG tags at locations having a dense population of readers and tags. All readers on the bus require the same enabled tag protocols for synchronization to work. Entering increasing values to all readers on the bus is required so that should a break occur in the bus that is connecting all the readers, the next reader will take over

as master for the rest of the readers that are connected, and the system may work reasonably well until the cabling is fixed. Do not set the synchronization times too short, as IAG tags are battery powered and their useful life can be diminished if the typical traffic flow is slow moving, and the tag is activated continuously in the reader pattern. Command #582 displays the synchronization output time.

The synchronization bus is wired by connecting all of the readers' "V" (RS-485 synchronization minus) pins together and all of the readers' "Z" (RS-485 synchronization plus) pins together (Figure 7-1).



WD-0087

Figure 7-1 Example of 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 7-17 lists an example of a plaza having five Encompass 4 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 (see Figure 7-1). The example timing for #648NN is appropriate assuming IAG is the only protocol enabled

in all readers. The RF for all readers is set to 915.75 (#6470DF) and in this example it is determined that an IAG attenuation setting of 9 dB (#64609) prevents a reader from activating a tag in an adjacent lane.

Table 7-17 Example of Encompass 4 Reader Plaza Synchronization Bus Settings

Reader Lane	Set Synchronization Output Delay Time (#648NN)	Set Synchronization Hold-Off Time (#649NN)
1*	#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

* 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 7-18](#) for more information.

Reader response:

Done

66F Load Default Operating Parameters

Command #66F loads all the factory default operating parameters except RF operating frequency. Refer to [Table 8-2, Encompass 4 Reader Default Configuration Settings](#) for a listing of the defaults.

Reader response:

Done All parameters loaded OK
Error A parameter load failed

67N Set Output Pulse Duration

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 7-18](#).

Table 7-18 Output Pulse Duration Commands

Command	Duration
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 7-19](#).

Table 7-19 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 [“Basic Protocol and ECP Format” on page 6-5](#) 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 7-20](#).

Table 7-20 RF Control Algorithm Commands

Command	RF Power Off
6920	On timeout only
6921	Timeout or tag ID acquired
6922	Timeout or presence false (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 7-21](#).

Table 7-21 Timeout Period Values

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

Reader response:

Done or Error

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

694N Select Input Inversion Option

Command #694N enables or disables input inversion. When inversion is enabled, an open circuit input is interpreted as a closed circuit, and a closed circuit input is interpreted as an open circuit. This feature allows greater flexibility in the attachment of external equipment to the reader inputs. For example, some proximity sensors indicate presence with an open circuit. In this instance, command #6941 can enable input inversion so that an open circuit input indicates a presence. The values for N represent the two inversion options as shown in [Table 7-22](#).

Table 7-22 Input Inversion Options

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

Reader response:

Done

695S...S Set Serial Number

Command #695 assigns the reader serial number according to the format:

695SSSSSS

where SSSSSS is the serial number.

The serial number may contain as many as six uppercase or lowercase ASCII alphanumeric characters.

***Note:** The factory-assigned serial number of the reader contains seven characters. However, to maintain backward compatibility, the reader software allows only six characters to be entered. When setting the serial number, skip the fourth (middle) character of the seven-character number shown on the reader product label.*

***Note:** Once assigned, the serial number is preserved during power-down and the loading of default parameters.*

Reader response:

Done

696S...S Store Hardware Configuration String

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 is 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

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.

AA = This field is used by the tag to determine the start address in the tag memory for the comparison data.

DD...DD = Comparison Data: an 8-byte field (16 characters) used by the tag as the comparison data for the Group Select 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 GSE Mask is used for this comparison.

As an example, to configure a reader to have only tags with data in byte locations 10, 12, and 15 (decimal) with hexadecimal values “00,” “01,” and “02,” the following command is used:

```
#697 A4 0A 0005014202024133
```

To understand how the data is interpreted, it is necessary to break down the GSE Mask field, A4, into binary:

A4 = 1010 0100

This mask equates to the tag comparing the first, third, and sixth bytes of the Comparison Data to data in the tag beginning at address location 0A (10 decimal).

The Comparison Data field is broken down in bytes with the bytes corresponding to the mask underlined in bold (for clarification):

Address: 0A 0B 0C 0D 0E 0F 10 11

Data: 00 05 01 42 02 02 41 33

where

0A (10 decimal) must be equal to “00” hexadecimal, the first byte in the Comparison Data field

0C (12 decimal) must be equal to “01” hexadecimal, the third byte in the Comparison Data field

0F (15 decimal) must be equal to “02” hexadecimal, the sixth byte in the Comparison Data field

Reader response:

Done

Auxiliary Reader Control — Command Group 8

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 7-23](#).

Table 7-23 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

Configuring the Encompass 4 Reader

Configuring the Encompass 4 Reader

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

Configuring the Reader

After installing the Encompass 4 Reader, you need to configure its operating parameters. Terminal settings should be initially set at 9600 baud, 8 data bits, no parity, 1 stop bit, and no flow control.

General Configuration Labeling

Each Encompass 4 Reader and its shipping carton are labeled to indicate the unit's general configuration. [Table 8-1](#) contains explanations of the Encompass 4 Reader label fields.

Table 8-1 Encompass 4 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 Reader is configured with an integrated antenna, RS-232 and Wiegand communications, and reads SeGo and IAG protocol tags.

Default Operating Parameter Settings

Table 8-2 contains the factory default configuration settings for the Encompass 4 Reader operating parameters. The default configuration settings may not be the correct operating configuration settings for a specific site. Changes to the configuration settings may have to be made, depending on the site plan, as described in [Chapter 2, "Developing the Site Plan"](#).

Review the default configurations shown in [Table 8-2](#) to determine which parameters, in addition to operating frequency and operating range, need to be adjusted. Refer to [Chapter 7, "Commands"](#) for a complete list of parameters and the corresponding commands.

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

Table 8-2 Encompass 4 Reader Default Configuration Settings

Parameter	Setting	Command
Operating mode	Data	00
Baud rate	9600	1005
Stop bits	1	1010
Parity	None	1020
Time and data appended	Enabled	302
Auxiliary information appended	Disabled	310
Unique ID code criteria	Separation of 1 ID	4100
Wiegand mode	Disabled	450
Tag translation mode	Disabled	452
Multi-tag sort	Disabled	454
eGo and eGo Plus tag initialization during multi-tag sort	Enabled	456
Second alternative group select	Disabled	458
Wiegand transmit mode	1 second	4601
Third alternative group select	Disabled	490
Fourth alternative group select	Disabled	492
Fifth alternative group select	Disabled	494
Alternate group select	Disabled	496
Reader ID number	00	6000

Table 8-2 Encompass 4 Reader Default Configuration Settings (continued)

Parameter	Setting	Command
Communications protocol	Basic	610
Error correcting protocol (ECP) timeout	12.7 sec	612FE
Flow control	Software (XON/XOFF)	6141
Echo mode	Enabled	6171
Sense output control	Predefined	621
RF-by-input control	Enabled	641
ATA operating range	Maximum	6431F
RF attenuation	Full power	64400
eGo and eGo Plus Tag operating range	Maximum	6451F
Sense output pulse duration	228 ms	67C
Presence without tag reports	Disabled	6900
RF-off control	Timeout or no presence	6922
RF timeout	Never true	693F
Input inversion	Disabled	6940
Serial number	NNNNNN	695
Store hardware configuration	Hardware configuration not known	696
Input status change reports	Disabled	820
Automatic periodic RF status report	Disabled	830

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

Configuring Parameters with Terminal Emulation Software

To configure the Encompass 4 Reader using a PC and terminal emulation software to manually enter Encompass 4 Reader host commands, follow the instructions in the section [“Connecting the Encompass 4 Reader to the PC” on page 4-28](#). Then, enter the appropriate configuration commands through the terminal emulation software on your PC.

See [Chapter 7, "Commands"](#) for a detailed description of all available configuration commands.

Starting the Terminal Emulation Software

You can use a PC and any terminal emulation software to enter the host commands to download flash software, configure reader operating parameters, perform diagnostics, and retrieve tag data. The following procedures show examples using Hyper Terminal™, an application included with Microsoft Windows. Most terminal emulation applications have a similar sequence for launching.

To start the terminal emulation software

1. At the command prompt, type your terminal emulation start command; or if using Windows Hyper Terminal, select:
Programs>Accessories>Hyperterm
and press **ENTER**.

The application displays the Connection Description dialog box as shown in [Figure 8-1](#).

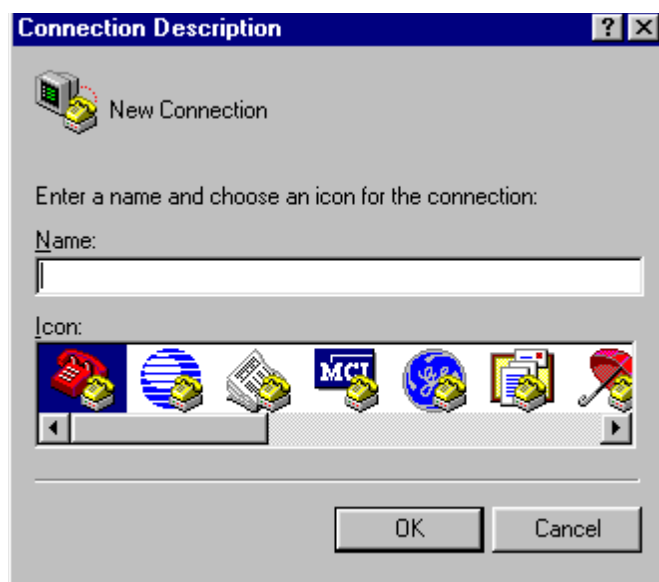


Figure 8-1 Connection Description Dialog Box

2. Enter a name for the session and click **OK**.

The application displays the **Phone Number** dialog box as shown in [Figure 8-2](#).



Figure 8-2 Phone Number Dialog Box

3. From the **Connect using** pull-down list, 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 as shown in [Figure 8-3](#).

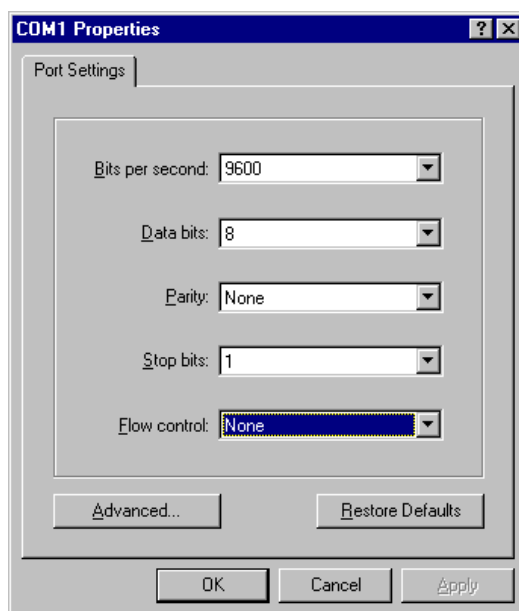


Figure 8-3 COM 1 Properties Dialog Box

4. In the pull-down lists on the **COM1 Properties** dialog box, choose the following values:
 - Bits per second: 9600 baud
 - Data bits: 8

- Parity: None
- Stop bits: 1
- Flow control: None

Click **OK**.

The application displays the **configparms - Hyper Terminal** main screen as shown in [Figure 8-4](#).

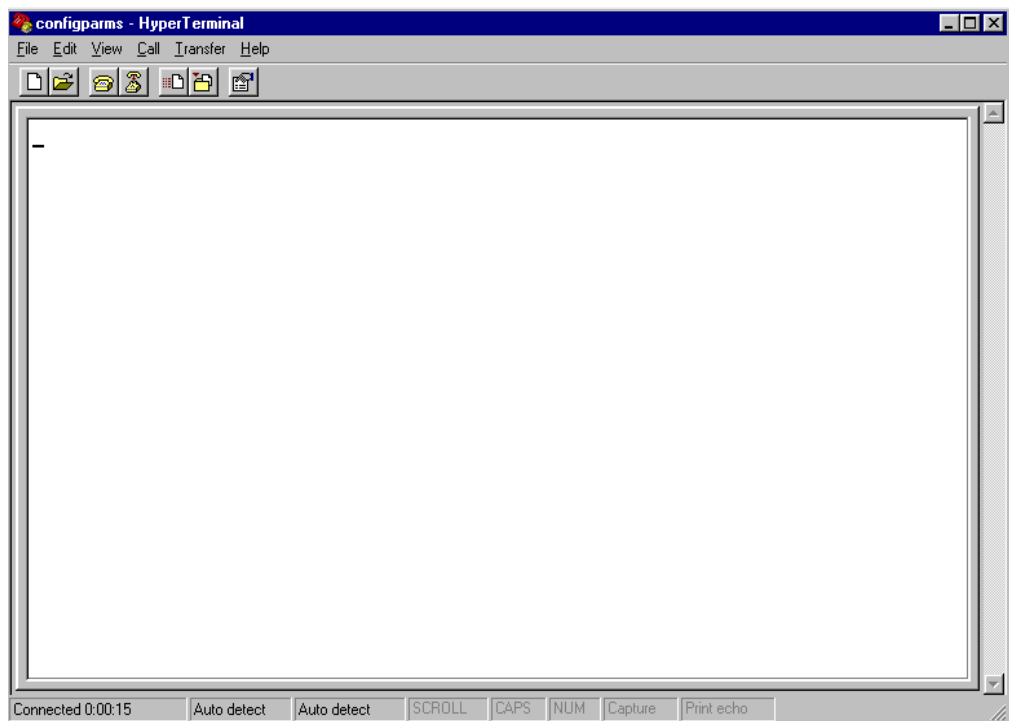


Figure 8-4 Hyper Terminal Main Screen

Verifying Communications

You must verify that the Encompass 4 Reader and the PC or laptop are communicating.

To verify communications

1. Start the terminal emulation application as described previously in [“Starting the Terminal Emulation Software”](#) on page 8-6.

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

2. Cycle the power on the Encompass 4 Reader.

Upon startup, the Encompass 4 Reader transmits a sign-on message, displayed on the terminal emulation screen as shown in [Figure 8-5](#), or a boot ROM failure message.

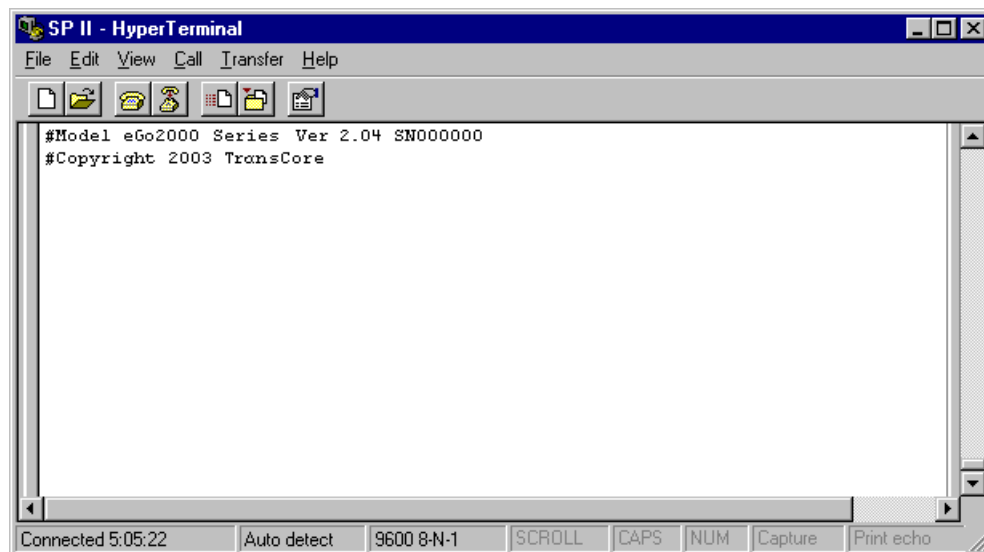


Figure 8-5 Sign-on Message

The sign-on message appears as follows:

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

where YYYYYY is the serial number assigned to the Encompass 4 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 Reader is operating out of boot ROM. In this case, the Encompass 4 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 5-5](#).

Communications can also be verified by using the command sequence in [Table 8-3](#).

Table 8-3 Command Sequence to Verify Communications

Entry	Encompass 4 Reader Response	Notes
#01 <CR>	#Done <CR/LF>	Switches the Encompass 4 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 Reader to data mode.

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

To check connections and communications factors

1. Confirm that the Encompass 4 Reader has power.
2. Verify the connections between the PC and the Encompass 4 Reader.
3. Verify the receive (Rx) and transmit (Tx) connections.
4. If using handshaking, verify the RTS and CTS connections.
5. Verify the COM port settings for the Encompass 4 Reader using the instructions in [“Serial Port Communications” on page 8-18](#).

Repeat the procedures in [“Verifying Communications” on page 8-8](#).

If you still cannot verify the Encompass 4 Reader and PC communications, use the information in [“Technical Support” on page 9-6](#) to contact TransCore.

Verifying Tag Read Capability

After verifying communications between the Encompass 4 Reader and the PC, verify the capability to read tags.

***Note:** The default tag read mode of the reader is the protocol(s) programmed into the reader. [Table 8-1](#) shows how to determine which tag protocol(s) your Encompass 4 reader supports. Use only those test tags programmed with the correct protocol(s) for the reader.*



Caution

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

To verify tag read capability

1. Once communications are verified as described in [“Verifying Communications” on page 8-8](#), enter the following sequence of commands to turn on continuous RF:
 - #01
 - #6401

- #40
 - #00
2. Pass one test tag in front of the unit. If the Encompass 4 Reader reads the tag, the terminal emulation application displays the tag information on the screen as shown in [Figure 8-6](#).

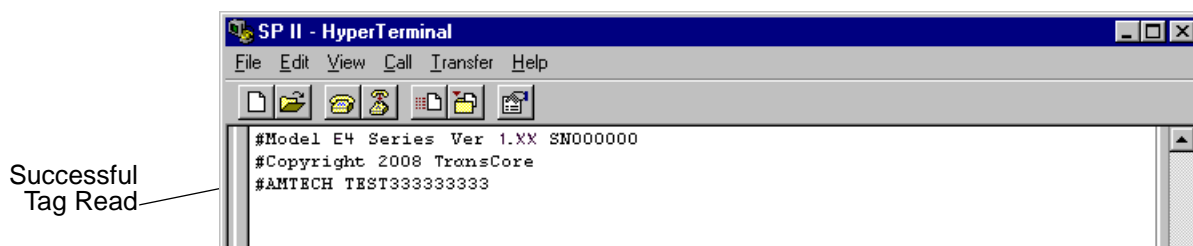


Figure 8-6 Successful Tag Read

If the tag ID is not displayed, perform the following actions:

- Verify that the Encompass 4 Reader is in data mode (command #00 Switch to Data Mode).
 - Ensure that the tag you are using is compatible with the Encompass 4 Reader. The Encompass 4 Reader can read tag types that are compatible with the reader model.
 - An Encompass 4 Reader displays the tag read for any tag that is compatible with the reader programming. [Table 8-1](#) shows how to determine which tag protocol(s) your Encompass 4 reader supports.
 - Using the audible circuit tester as described in “[Testing the Encompass 4 Reader Using an Audible Circuit Tester](#)” on page 4-5, 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 Reader and the host.
3. Pass a different reader-compatible test tag in front of your Encompass 4 Reader.
 4. When the Encompass 4 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, as shown in [Figure 8-7](#).

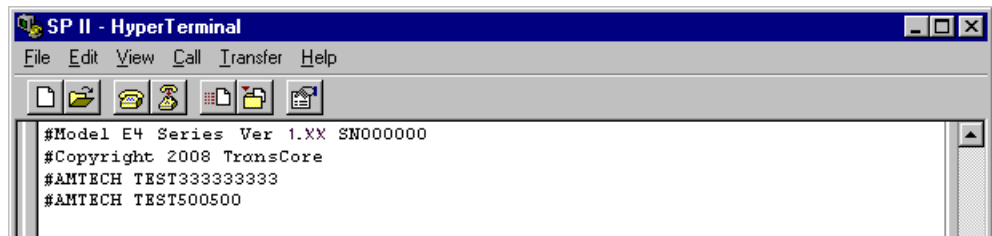


Figure 8-7 Second Successful Tag Read

If the read is unsuccessful, perform the following actions:

- Ensure the tag you are using is compatible with the Encompass 4 Reader.
- Using the audible circuit tester as described in [“Testing the Encompass 4 Reader Using an Audible Circuit Tester” on page 4-5](#), 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 Reader and the host computer.

Configuring Encompass 4 Parameters

Follow the procedures in this section to configure Encompass 4 parameters using a PC, laptop, or terminal emulator. The PC or laptop must be connected to and communicating with the Encompass 4 Reader, and the terminal emulation application must be configured correctly, as described in the section [“Verifying Communications” on page 8-8](#).

Note: If you are using Wiegand mode, you must connect the PC or laptop to the Encompass 4 Reader using the RS-232 or RS-422 interface before attempting to send commands to the reader. You can leave the Wiegand interface connected during this procedure.

To configure parameters

1. Switch to command mode by typing **#01** at the prompt on the terminal emulation screen, and pressing **ENTER**.

Note: All Encompass 4 Reader commands are preceded by the start-of-message character (#).

2. To meet requirements of your site, make changes to default operating parameters as described in the following sections.

The following sections contain procedures to set some of the parameters that are commonly changed to meet the requirements of a specific site. Procedures are listed in alphabetical order by parameter.

Appended Tag Data

Use this procedure to set appended tag data parameters using the terminal emulation application. See [“31N Append Auxiliary Information Selection” on page 7-9](#) for more information.

To set appended tag data parameters

1. Ensure that the host computer is in command mode.
2. Enter command **#311** to append auxiliary information or command **#310** to have no auxiliary information appended (factory default). Press **ENTER**.

ID Separation

The host can select a unique ID separation of one ID or two IDs. The reader default operation is for a unique ID separation of one ID and a uniqueness timeout of two minutes. You can disable the uniqueness check using command #40 Transmit All ID Codes. In this case, every tag ID received is transmitted without regard to uniqueness. You can reinstate uniqueness checking with commands #4100 or #4101 Select ID Separation.

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

See section [“40 Transmit All ID Codes” on page 7-10](#) and section [“410N Select Unique ID Code Criteria \(Anti-passback Feature\)” on page 7-11](#).

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 Reader can be configured to transmit presence without tag reports and input status change reports. A presence without tag report is transmitted in data mode only, *and only if the system has a presence detector*. This report is sent if a presence is detected without the detection of a valid tag ID. See sections [“529 Display Presence Input Status” on page 7-24](#) and [“690N Select Presence Without Tag Report Option” on page 7-41](#).

If configured with command #82N Select Input Status Change Report Option to transmit input status change reports, the reader will transmit a message to the host computer any time the inputs change state. Input status change reports are transmitted in data mode only. Input status change reporting is disabled by default. See sections [“560 Request Sensor Status Change” on page 7-28](#) and [“82N Select Input Status Change Report Option” on page 7-46](#). Also refer to [Chapter 6, “Communications Protocols”](#) 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**.
 - EO = input status change reports disabled (factory default)
 - E1 = input status change reports enabled
 - M0 = reporting disabled (factory default)
 - M1 = changes on input0 reported
 - M2 = changes on input1 reported
 - M3 = changes on either input reported
3. Enter command **#821** to report any change on input0, command **#822** to report any change on input 1, command **#823** to report changes on input0 and input1, or command **#820** to disable status change reports (factory default). Press **ENTER**.

Reset Reader

Command #63 Reset Reader resets uniqueness, clears the power fail bit, and transmits the sign-on message. The reader returns to data mode following the completion of this command.

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

See [“63 Reset Reader” on page 7-32](#).

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 as shown in [Figure 8-5 on page 8-9](#).

Radio Frequency

**Caution**

The authorized continuous wave (CW) frequency band for the Encompass 4 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 Reader in the U.S. is 911.75 to 919.75 MHz. The RF for each Encompass 4 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 Reader an authorized person can set the frequency within the range from 902 to 928 MHz in 0.25 MHz steps. You can set the frequency by using a terminal emulation program and issuing the frequency command, as discussed in section [“647XXX Select RF Operating Frequency” on page 7-37](#).

***Note:** For backward compatibility to existing controllers, you can 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 [“647XXX Select RF Operating Frequency” on page 7-37](#) 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 7-33](#).
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 your 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 Reader

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

[Figure 8-8](#) illustrates the methods of controlling RF sense output.

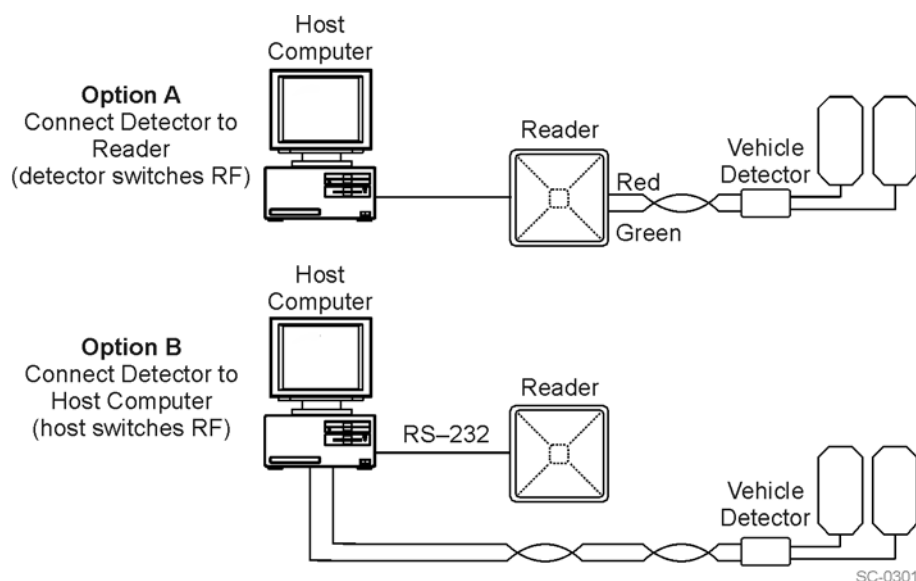


Figure 8-8 Encompass 4 Reader RF Control Options

Vehicle Detector Controlling RF Transmission

The vehicle detector can be a loop detector, an infrared sensor, or an ultrasonic detector that is connected to sense input0 to turn on the Encompass 4 Reader RF transmitter. In [Figure 8-8](#), Option A shows a vehicle detector controlling the RF transmitter. This operation is preferred because the RF transmits only when a vehicle is in the Encompass 4 Reader read zone. Command #641 Select RF-by-Input Control (factory default) must be enabled.

To set the option of the vehicle detector controlling the Encompass 4 Reader

1. Ensure that the host computer is in command mode.
2. Enter command **#641**. Press **ENTER**.

Leave the setting on RF-by-input control for normal operation.

Host Controlling RF Transmission

In [Figure 8-8](#), Option B shows the host controlling the RF transmitter.

If the vehicle detector is connected to the host computer, as shown in Option B, commands #6400 RF Off and #6401 RF On sent from the host computer turn on and off the Encompass 4 Reader RF transmitter.

Continuous RF Transmission

In [Figure 8-8](#), Option C shows the test configuration controlling the RF transmitter. To test the Encompass 4 Reader, as described in [“Testing the Encompass 4 Reader Using an Audible Circuit Tester”](#) on page 4-5, you can turn on the Encompass 4 Reader RF transmitter continuously by issuing command #6401.

You may also use command #6402 to turn on CW RF for diagnostic purposes. Entering this command transmits a continuous RF signal at the output frequency and attenuation level as specified in the respective associated commands until command #6400 RF Off, #6401 RF On, or #641 Select RF-by-Input Control is received by the reader. Tags are not read in CW mode. See [“640N RF Control” on page 7-33](#) for more information.

Sense Inputs

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

You can configure the Encompass 4 Reader to generate input status change reports, which are transmitted like tag IDs. The host can then respond based on the true/false (closed/open) status of the sense inputs. See the section [“Reports” on page 8-13](#).

The following procedures describe how to set sense inputs using the terminal emulation software. See commands [“526 Display I/O Status” on page 7-20](#), [“694N Select Input Inversion Option” on page 7-43](#), and [“82N Select Input Status Change Report Option” on page 7-46](#) 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 Reader have two sense output circuits – sense output0 and sense output1.

By default, the Encompass 4 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 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, or #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 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 Reader maintains the following three sets of parameters that affect serial port communications:

- Port configuration parameters (baud rate, data bits, stop bits, parity)
- Communications protocols (basic, error correcting)
- Flow control scheme (none, software, hardware)

The default serial port configuration for each of these three parameters is as follows:

- 9600 baud, 8 data bits, 1 stop bit, no parity
- Basic communications protocol
- Software flow control (XON/XOFF)

You can change these parameters in data mode and command mode operation by issuing commands with the host computer. Use the following procedures to set serial port communications parameters using the terminal emulation program.

Port Configuration Parameters

Use this procedure to set port configuration parameters using the terminal emulation program. Consult sections [“100N Select Baud Rate”](#) through [“102N Select Parity”](#) on [page 7-6](#).

To set baud rate

1. Ensure that the host computer is in command mode.
2. Enter command **#100N** and press **ENTER**.

To set stop bits

1. Ensure that the host computer is in command mode.
2. Enter command **#101N** and press **ENTER**.

To set parity

1. Ensure that the host computer is in command mode.
2. Enter command **#102N** and press **ENTER**.

Communications Protocol

Use the following procedures to set communications protocol. Consult sections “[610 Select Basic Communication Protocol \(Factory Default\)](#)” through “[612NN Select Error Correcting Protocol Timeout](#)” on page 7-30 for more information.



Caution

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

To select a communications protocol

1. Ensure that the host computer is in command mode.
2. Enter command **#610** to select basic protocol (factory default) or command **#611** to select ECP and press **ENTER**.

Software Flow Control

Two modes of flow control are supported — software (XON/XOFF) and hardware (CTS - clear to send). The host can enable or disable flow control with command **#614N** Select Flow Control Option.

The host can use software control characters (XON/XOFF) or the hardware CTS handshake line to interrupt reader transmissions. When the reader is configured for software flow control, it stops transmitting if it receives the XOFF character from the host (host software command 13H). It resumes transmitting only when it receives the XON character (host software command 11H) from the host. Likewise, when the reader is configured for hardware flow control, it stops transmitting if it detects that the CTS line is no longer asserted. It resumes transmitting when this line is asserted. If flow control is not needed, the reader should be configured for no flow control (**#6140** Disable Flow Control).

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

Use the following procedure to set flow control parameters using the terminal emulation program. See section “[614N Select Flow Control Option](#)” on page 7-31.

To select flow control

1. Ensure that the host computer is in command mode.
2. Enter command **#6140** to disable flow control, command **#6141** to enable software flow control (factory default), or command **#6142** to enable hardware flow control and press **ENTER**.

Fine-Tuning and Verifying the Read Zone

If the read zone is too wide or too deep for your application, it can be fine-tuned by physically adjusting the Encompass 4 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.

See sections “643NN Select ATA Operating Range (Distance)” on page 7-36, “645NN Set eGo and eGo Plus Operating Range (Distance)” on page 7-36, and “644NN Set RF Attenuation” on page 7-36 for more information.

***Note:** As described in “Marking the Read Zone” on page 4-35, 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 Reader

You can manually adjust the location of the read zone by loosening the Encompass 4 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 Reader Antenna

You can 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

You can make the read zone smaller by adjusting the Encompass 4 Reader RF power output from a maximum of 2 watts to a minimum of 200 milliwatts using command #644NN Set RF Attenuation. Lowering the RF power has the added benefit of reducing RF interference with adjacent lanes.

To adjust the read zone by lowering output power

1. Ensure that your PC is communicating with the Encompass 4 Reader using a terminal emulation program as described in section “Verifying Communications” on page 8-8.
2. Mark the current read zone as described in section “Marking the Read Zone” on page 4-35.



Caution

Test tags should be compatible with your Encompass 4 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 [“Procedures” on page 4-36](#) 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 Reader is in data mode.
2. With the Encompass 4 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. If both tags are read, you have successfully adjusted the read range.
4. If one or both tags did not read, follow the suggestions in [“Verifying Tag Read Capability” on page 8-10](#).
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 Reader read zone can be fine-tuned by using command #643NN for ATA tag read mode or #645NN for eGo and eGo Plus tag read mode to reprogram the RF sensitivity range. Sensitivity range adjustments have less impact on the read pattern than RF power adjustment, thus RF power adjustment should be used as the main read pattern adjustment tool. Sensitivity range control may be helpful in stopping some tag reads on the very edges of the read pattern. To produce a noticeable change in the read pattern, you must decrease the range sensitivity by more than one increment.

To adjust the read zone by adjusting sensitivity range

1. Ensure that your PC is communicating with the Encompass 4 Reader using a terminal emulation program as described in [“Verifying Communications” on page 8-8](#).
2. Mark the current read zone as described in [“Marking the Read Zone” on page 4-35](#).

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 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.*

5. 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.
6. Follow the steps in section [“Procedures” on page 4-36](#) 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.

To test the read zone

1. Ensure that the Encompass 4 Reader is in data mode.
2. With the Encompass 4 Reader running, place one tag behind your back while you hold another tag in the new read zone. If a valid read, the data from the tag held in the read zone displays on the PC screen.
3. Switch tags, placing the other tag behind your back and holding the first tag in the read zone. If a valid read, the data from this tag held in the read zone displays on the PC screen.
4. If both tags are read, you have successfully adjusted the read range. If one or both tags did not read, follow the suggestions in [“Verifying Tag Read Capability” on page 8-10](#).
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.

Troubleshooting and Maintenance

Troubleshooting and Maintenance

This chapter contains information for troubleshooting an Encompass® 4 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 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 9-1](#) contains a list of error messages.

Table 9-1 Error Messages

Error Message	Description	Corrective Action
Error06	NVRAM parameters have been lost. The Encompass 4 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 Reader attempts to reset the PLL.	Reset the RF frequency. Refer to “Radio Frequency” on page 8-15 for instructions.
Error08	The RF PLL has successfully regained lock and has been reset to its proper operating frequency. The RF section is returned to its state prior to losing lock (enabled/disabled). <i>Error08</i> will only be issued after <i>Error07</i> 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 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 9-1 Error Messages (continued)

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. You may want to track this error message if it should occur again. If the reader indicates repeated ErrorRF1 warning messages then return the reader to the factory.
ErrorRF2	Warning message that the RF module did not return an INIT DONE signal	If the reader indicates a single ErrorRF2 event and recovers from the error, no corrective action is required. You may want to track this error message if it should occur again. If the reader indicates repeated ErrorRF2 warning messages then return the reader to the factory.
ErrorRF3	Warning message of unexpected status read, including status byte, from RF module	If the reader indicates a single ErrorRF3 event and recovers from the error, no corrective action is required. You may want to track this error message if it should occur again. If the reader indicates repeated ErrorRF3 warning messages then return the reader to the factory.

Troubleshooting

You can use the following table for troubleshooting. Should problems continue, contact TransCore for return and replacement procedures. If you contact Technical Support, use the symptom number in [Table 9-2](#) to reference the problem that you are having with the Encompass 4 Reader.

Table 9-2 Symptoms and Remedies

Symptom Number ^a	Symptom	Remedy
1	When performing a quick test of the Encompass 4 Reader, the buzz box does not buzz.	<p>Check all your wiring connections and antenna connections (if using external antenna), and ensure that your buzz box is functioning.</p> <p>The wires from the Encompass 4 Reader are grouped in pairs. You could find more than one red wire, more than one black wire, and so on. You must connect the correct red and white wire pair to the leads from the battery.</p> <p>Verify that RF is on as described in “Bench Testing the Encompass 4 Reader Before Installation” on page 4-12. Using a terminal emulation program, you may switch to command mode and issue command #527 to determine RF status. See page 7-23 for more information.</p>

Table 9-2 Symptoms and Remedies (continued)

Symptom Number ^a	Symptom	Remedy
2	The baud rate is selected correctly but nothing happens.	The Encompass 4 Reader is not communicating with your PC. Check the power supply to your 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 Reader, all the wires are connected correctly but the unit does not respond.	The Encompass 4 Reader may not have the software loaded inside the unit. Contact Technical Support as described on page 9-6. If you are using a terminal emulation program, check that the terminal emulation setting on the Encompass 4 Reader is VT100. Check that the Encompass 4 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 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. If using hyperterminal, Wiegand tag data may display as unintelligible characters. 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 Reader.	The Encompass 4 Reader works. The sound is the relay inside the Encompass 4 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 Reader or external antenna.	Ensure that the Encompass 4 Reader is powered on and is in predefined output mode. (#621) Verify that the reader is set to RF ON (#6401). Verify that the external antenna is connected correctly. Verify that the reader mode matches the test tag.
7	The Encompass 4 Reader came from another site and does not work the way the factory defaults indicate that it should.	Different commands were probably used to support the other site's specific configuration. You can restore the factory defaults by using a terminal emulation program to switch to command mode and issuing command #66F Load Default Operating Parameters. 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 Reader displays one of the following messages: #Model E4 Series X.XX SNYYYYYY #[Copyright notice]	The Encompass 4 Reader works. The software is now loaded. YYYYYY is the TransCore-assigned serial number for this Encompass 4 Reader. However, if YYYYYY = 000000, a serial number has never been assigned. If a serial number has not been assigned to your Encompass 4 Reader, contact TransCore Technical Support.

Table 9-2 Symptoms and Remedies (continued)

Symptom Number ^a	Symptom	Remedy
9	The read zone is too small, even before the RF power and range control have been adjusted.	<p>If another Encompass 4 Reader is in the same area, ensure that it is operating on another frequency that is at least 2 MHz different.</p> <p>Check for possible interference from another nearby RF source: fluorescent lights, neon signs, high voltage power lines, nearby cellular telephone, or radio stations. Lights will need to be removed or shielded. Point the Encompass 4 Reader or external antenna in a different direction to see if interference comes from only one direction. You may require a different Encompass 4 Reader that uses another frequency.</p> <p>Verify that the RF power is set to an appropriate value.</p> <p>Verify that the range adjustment is set to the maximum.</p> <p>Verify that the reader is getting at least 16V.</p>
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.	<p>The angle of the Encompass 4 Reader or external antenna may need adjustment. Slightly tilt the Encompass 4 Reader or external antenna to a different angle to change either the length or width of the read zone.</p> <p>Check the range control adjustment. See “Radio Frequency” on page 8-15.</p>
11	The Encompass 4 Reader is reading tags out of the desired read zone, or cross-lane reads are occurring.	<p>Some interference from other RF or electrical sources may be occurring. See “Reflection, Refraction, and Diffraction of RF Signals” on page 2-15.</p> <p>Verify that the read zone has been properly set up. See “Fine-Tuning and Verifying the Read Zone” on page 8-19.</p>
12	The Encompass 4 Reader is not providing any output to the Wiegand interface.	<p>Ensure that the Encompass 4 Reader is in Wiegand mode (#451). The default is either RS-232 or RS-422 mode. Refer to “Wiegand Interface” on page 4-30.</p> <p>Ensure the tags are properly programmed with Wiegand data.</p>

^aUse this number to reference the problem you are having with the Encompass 4 Reader if you contact TransCore for Technical Support.

Encompass 4 Reader Repair

The Encompass 4 Reader is designed for whole-unit replacement and is manufactured with surface-mounted components. It requires sophisticated testing and repair equipment. All testing and repairs are performed at TransCore’s factory. Please contact TransCore to obtain a Return Materials Authorization (RMA) for returning the reader.

Technical Support

Authorized dealers and distributors are responsible for the direct support of all customers. Authorized dealers and distributors needing support can contact Technical

Support at (505) 856-8007. 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.*

Marketing Support

Dealers requiring marketing support may call TransCore Marketing at (214) 461-6443, 9:00 a.m. to 5:00 p.m. Central Standard Time, Monday through Friday. Send faxes to (214) 461-6445 ATTN: TransCore Marketing.

Find a Problem with the Encompass 4 Reader or Have Suggestions?

Call (214) 461-6443 and ask for the TransCore Encompass 4 Reader product manager. Send faxes to (214) 461-6445 ATTN: Encompass 4 Reader product manager.

A

Glossary

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
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 use 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 TC IP, Ltd.
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 Reader through the communications port

I

I/O or IO circuits	input/output circuits
ID	identification; encoded information unique to a particular tag
INCITS	American National Standards Institute International Committee for Information Technology standards
Intellitag	Proprietary name for ANS INCITS 256-2001 compliant Intermec products. A registered trademark of Intermec Technologies Corporation, a UNOVA Company.
interface	connection point for communication with another device
IOST	I/O status
ISO	International Standardization Organization

L

LF	line feed
-----------	-----------

M

m	meter
MHz	megahertz

mode method of operation
ms milliseconds

N

NAK negative acknowledgment (data not valid)

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

P

passback used to refer to a tag ID that is not passed on to the tag buffer

PC personal computer

PCKS EPROM flash checksum

protocol specified convention for the format of data messages communicated between devices

PRST presence status

PWRB power fail bit

R

RAM random access memory

RDID reader ID

read process of acquiring data from a device; for example, from a tag or from computer memory

reader controlled interrogating device capable of acquiring data from a device; for example, acquiring and interrupting data from a tag

read zone the physical area in which a tag can be read by the reader

RF radio frequency

RFID radio frequency identification

RFST RF status

ROM read-only memory

RTC real-time clock

RTS request-to-send

S

SeGo Super eGo (SeGo) is a superset of the eGo protocol

SN serial number

som start of message

SSTC input status change reporting options

T

tag small self-contained device acting as an identifying transponder

Tau timeout delay

TT tag translation

V

V volts

Ver version (software)

W

Wiegand the trade name for a technology used in card readers and sensors, particularly for access control applications. Wiegand devices were originally developed by HID Corporation.

write process of recording data; for example, writing to computer memory or to a tag's memory. Writing writes over (erases) previous data stored at the specified memory locations.

WTI Wiegand retransmit interval

X

XON/XOFF protocol for controlling the flow of data between computers and other devices on an asynchronous serial connection. XON and XOFF are signals to turn a transmitter on or off. The actual signal for XON is the same bit configuration as the ASCII Ctrl-Q keyboard combination (11 hexadecimal). The XOFF signal is the Ctrl-S character (13 hexadecimal).

B

Technical Specifications

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). Typical read range should be 12 to 17 ft (3.7 to 5.2 m). ^a

a. Reading range depends on reader or external antenna configuration, tag type, tag read mode, and operating environment.

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
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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)

Environmental Parameters

Operating Temperature	-40°F to +131°F (-40°C to +55°C)
Humidity	100% noncondensing
Vibration Tolerance	0.5 G _{rms} , 10 to 500 Hz

Options

Communications Interface	RS-232 and Wiegand or RS-422 and Wiegand
Cable Accessory Kits	58-1620-001: Connector with 5 ft (1.5 m) cable 58-1620-002: Connector with 20 ft (6.1 m) cable 58-1620-006: Connector with 35 ft (10.7 m) cable 58-1620-007: Connector with 45 ft (13.7 m) cable
Wall Mount Bracket	Allows adjustment in all planes when used to install the Encompass 4 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.

C

Wiring Tables

Appendix C

Wiring Tables

This appendix contains tables that show the wiring connections used to test and install the Encompass® 4 Reader.

Communications Interfaces

Table C-1 lists the interfaces available with the Encompass 4 Reader.

Table C-1 Communications Interfaces and Conductor Requirements

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

Figure C-1 shows the pin assignments for the RS-232 interface signal to the host male DB9 and DB25 connectors.

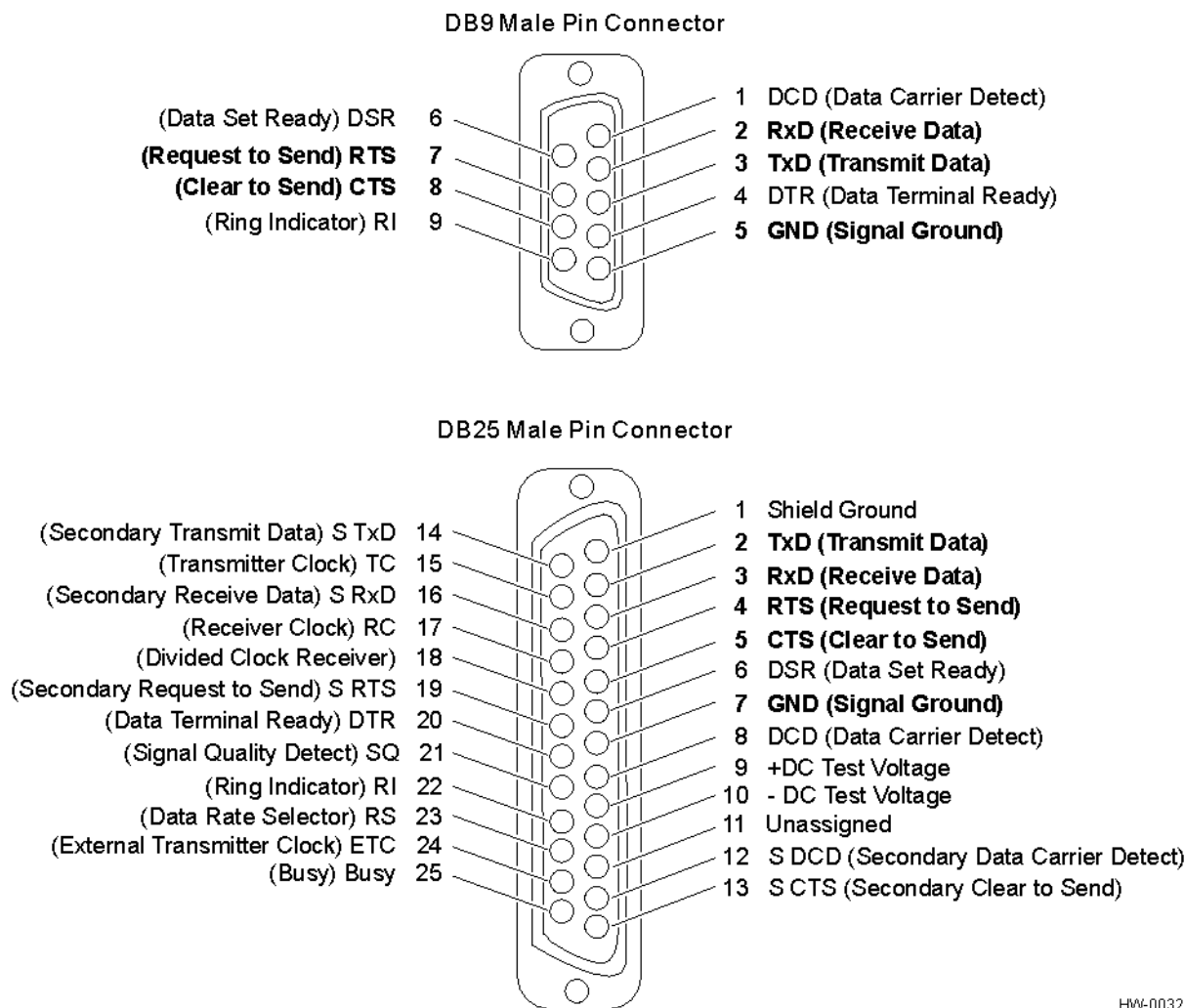


Figure C-1 DB9 and DB25 Connector Pin Assignments for Signal to Host

Note: In Figure C-1, supported pin assignments are boldface.

Cable Supplied with the Encompass 4 Reader

The Encompass 4 Reader is delivered with a multiwire cable (ordered as a separate accessory), which is a 13-pair pigtail. An alternate 15-pair pigtail may be substituted. The 13-pair pigtail is a colored-wire pair cable, with different colors denoting the individual pairs, one pair of which is red/black. The alternate 15-pair pigtail is a red/black-wire pair cable, with numbers on the pairs to denote the individual pairs. Two pairs of the 15-pair pigtail, numbers 14 and 15, are not used.

The following tables show the colored-wire pair (13-pair) and alternate wire pair (15-pair) assignments for the various interfaces, power, and input/output connections.

RS-232 Interface

Table C-2 shows the RS-232 assignments for colored-wire pair (13-pair) cable.

Table C-2 RS-232 Interface Signal Wiring for Colored-Wire Pair Cable

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

Table C-3 shows the RS-232 assignments for alternate wire (15-pair) cable.

Table C-3 RS-232 Interface Signal Wiring for Alternate Wire Cable

Signal from Encompass 4 Reader	Alternate Wire Cable		Connect Wire to Host DB9 Pin	Connect Wire to Host DB25 Pin
	Pairing	Color		
TxD — Encompass 4 Reader output	Pair 1	Black	Pin 2	Pin 3
RxD — Encompass 4 Reader input		Red	Pin 3	Pin 2
Signal ground	Pair 5	Black or Red	Pin 5	Pin 7

Table C-3 RS-232 Interface Signal Wiring for Alternate Wire Cable (continued)

Optional for hardware handshaking				
RTS — Encompass 4 Reader output	Pair 11	Black	Pin 8	Pin 5
CTS — Encompass 4 Reader input		Red	Pin 7	Pin 4

RS-422 Interface

Table C-4 shows the RS-422 assignments for colored-wire pair (13-pair) cable.

Table C-4 RS-422 Interface Signal Wiring for Colored-Wire Pair Cable

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

Table C-5 shows the RS-422 assignments for alternate wire (15-pair) cable.

Table C-5 RS-422 Interface Signal Wiring for Alternate Wire Cable

Signal from Encompass 4 Reader	Alternate Wire Cable		Connect to Signal from Host
	Pairing	Color	
RS-422 Transmit positive	Pair 11	Black	Receive (+)
RS-422 Transmit negative		Red	Receive (–)
RS-422 Receive positive	Pair 1	Black	Transmit (+)
RS-422 Receive negative		Red	Transmit (–)

Wiegand Interface

Table C-6 shows the Wiegand assignments for colored-wire pair (13-pair) cable.

Table C-6 Wiegand Interface Signal Wiring for Colored-Wire Pair Cable

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

Table C-7 shows the Wiegand assignments for alternate wire (15-pair) cable.

Table C-7 Wiegand Interface Signal Wiring for Alternate Wire Cable

Signal from Encompass 4 Reader	Alternate Wire Cable		Connect to Signal from Host
	PairingColor		
Wiegand Zero output	Pair 10	Black	Data0
Wiegand One output		Red	Data1
Signal Ground	Pair 5	Black or Red	Ground

Power Supply Connections

AC Power

Table C-8 shows the colored-wire pair (13-pair) assignments for connection to a low-voltage AC power supply.

Table C-8 AC Transformer Connections for Colored-Wire Pair Cable

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

Table C-9 shows the alternate wire (15-pair) assignments for connection to a low-voltage AC power supply.

Table C-9 AC Transformer Connections for Alternate Wire Cable

Signal from Encompass 4 Reader	Alternate Wire Cable		Connect to Transformer Terminal Strip
	Pairing	Color	
Main power input	Pair 12 and Pair 13	Black/Black	L1 16-20V AC
Main power return		Red/Red	L2 16-20V AC

Low-Voltage DC Power

Table C-10 shows the colored-wire pair (13-pair) assignments for connection to a low-voltage DC power supply.

Table C-10 Low Voltage DC Cable Connections for Colored-Wire Pair Cable

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

Table C-11 shows the alternate wire (15-pair) assignments for connection to a low-voltage DC power supply.

Table C-11 Low Voltage DC Cable Connections for Alternate Wire Cable

Signal from Encompass 4 Reader	Alternate Wire Cable		Connection Use
	Pairing	Color	
Main power input	Pair 12 and Pair 13	Black and Black	16 to 28V DC + terminal
Main power return		Red and Red	16 to 28V DC – terminal

Input/Output Cabling Assignments

Table C-12 shows the sense input/output assignments for colored-wire pair (13-pair) cable.

Table C-12 Sense Input/Output Cabling Assignments for Colored-Wire Pair Cable

Pair	Pin	Color	Signal	Description	Typical Function
Blue/ Red	E	Blue	WGND0	Wiegand data0	Parking/access control applications
	F	Red	WGND1	Wiegand data1	Parking/access control applications
White/ Red	L	White	Lock	Tag lock output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Green/ Red	N	Green	Sense Input0	Sense Input0 (loop), active-closed	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection
Blue/ Black	R	Blue	Sense Input1	Sense Input1, active-closed	General-purpose sense input, not used to detect presence
	S	Black	Sense Input1_RTN	Sense Input1 return; not isolated from signal ground	General-purpose sense input, not used to detect presence
Brown/ Black	T	Black	Sense Output0_COM	Sense Output0 (tag detect), common terminal	Switched output to control gate
	U	Brown	Sense Output0_NO	Sense Output0, normally open terminal	Switched output to control gate
Orange/ Black	V	Black	Sense Output0_COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)

Table C-12 Sense Input/Output Cabling Assignments for Colored-Wire Pair Cable

Pair	Pin	Color	Signal	Description	Typical Function
Orange/ Black	V**	Black	Sync_485_N	RS-485 bus negative	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	W	Orange	Sense Output 0_NC	Sense Output0, normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/ Black	X	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
	Y	Green	Sense Output1_NO	Sense Output1, normally open terminal	Switched sense output
White/ Black	Z	Black	Sense Output1_COM	Sense Output1, common	Switched sense output
White/ Black	Z**	Black	Sync_485_P	RS-485 bus positive	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	a	White	Sense Output1_NC	Sense Output1, normally closed terminal	Switched sense output
Yellow/ Black	b	Yellow	GND	logic ground	Signal ground (used with RS- 232 and Wiegand communications)
	c	Black	GND	logic ground	Signal ground (used with RS- 232 and Wiegand communications)
<p>**Use this synchronization pin designation if installing an Encompass 4 Reader that reads IAG protocol tags. The part numbers for these readers are as follows: 10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019; 10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019</p>					

Table C-13 shows the sense input/output assignments for alternate wire (15-pair) cable.

Table C-13 Sense Input/Output Cabling Assignments for Alternate Wire Cable

Alternate Wire Cable			Signal	Description	Typical Function
Pairing	Pin	Color			
Pair 10	E	Black	WGND0	Wiegand data0	Parking/access control applications
	F	Red	WGND1	Wiegand data1	Parking/access control applications
Pair 8	L	Black	Lock	Tag lock sense output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Pair 9	N	Black	Sense Input0	Sense Input0 (loop), active-closed	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection
Pair 4	R	Black	Sense Input1	Sense Input1, active-closed	General-purpose sense input, not used to detect presence
	S	Red	Sense Input1_RTN	Sense Input1 return; not isolated from signal ground	General-purpose sense input, not used to detect presence
Pair 6	T	Black	Sense Output0_COM	Sense Output0 (tag detect), common terminal	Switched sense output to control gate
	U	Red	Sense Output0_NO	Sense Output0, normally open terminal	Switched sense output to control gate
Pair 7	V	Black	Sense Output0_COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
or	V**	Black	Sync_485_N	RS-485 bus negative	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	W	Red	Sense Output0_NC	Sense Output0, normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)

Table C-13 Sense Input/Output Cabling Assignments for Alternate Wire Cable

Alternate Wire			Signal	Description	Typical Function
Pairing	Pin	Color			
Pair 3	X	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
	Y	Red	Sense Output1_NO	Sense Output1, normally open terminal	Switched sense output
Pair 2	Z	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
or	Z**	Black	Sync_485_P	RS-485 bus positive	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	a	Red	Sense Output1_NO	Sense Output1, normally closed terminal	Switched sense output
Pair 5	b	Black	GND	logic ground	Signal ground (used with RS-232 and Wiegand communications)
	c	Red	GND	logic ground	Signal ground (used with RS-232 and Wiegand communications)
<p>**Use this synchronization pin designation if installing an Encompass 4 Reader that reads IAG protocol tags. The part numbers for these readers are as follows: 10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019; 10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019</p>					

Summary Table

Table C-14 shows all assignments for both colored-wire pair (13-pair) and alternate wire (15-pair) cables.

Table C-14 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	Pin	Color	Pair	Color			
Red/Black	A	Black	Pair 1	Black	TX232, RX422+, IF485-	RS-232 transmit, RS-422 receive positive, RS-485 negative	Encompass 4 Reader output, host input
	B	Red		Red	RX232, RX422-, IF485+	RS-232 receive, RS-422 receive negative, RS-485 positive	Encompass 4 Reader input, host output
Yellow/Red	C	Yellow	Pair 11	Black	RTS232, TX422	RS-232 request to send or RS-422 transmit positive	Encompass 4 Reader output, host input for hardware handshaking
	D	Red		Red	CTS232, TX422	RS-232 clear to send or RS-422 transmit negative	Encompass 4 Reader input, host output for hardware handshaking
Blue/Red	E	Blue	Pair 10	Black	WGND0	Wiegand data0	Parking/access control applications
	F	Red		Red	WGND1	Wiegand data1	Parking/access control applications
Orange/Red	G	Orange	Pair 13	Black	18V	Main power input	
	H	Red		Red	18V_RTN	Main power return	
Brown/Red	J	Brown	Pair 12	Black	18V	Main power input	
	K	Red		Red	18V_RTN	Main power return	
White/Red	L	White	Pair 8	Black	Lock	Tag lock sense output, active-closed	Testing maintenance
	M	Red		Red	Lock_RTN	Tag lock return	Testing maintenance

Table C-14 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable (continued)

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	Pin	Color	Pair	Color			
Green/ Red	N	Green	Pair 9	Black	Sense Input0	Sense input0 (loop), active-closed	Loop and presence detect
	P	Red		Red	Sense Input0_RTN	Sense input0 return; not isolated from signal ground	Loop and presence detect
Blue/ Black	R	Blue	Pair 4	Black	Sense Input1	Sense input1, active-closed	General-purpose sense input, not used to detect presence.
	S	Black		Red	Sense Input1_RTN	Sense input1 return; not isolated from signal ground	General-purpose sense input, not used to detect presence.
Brown/ Black	T	Black	Pair 6	Black	Sense Output0_COM	Sense output0 (tag detect), common terminal	Switched sense output to control gate
	U	Brown		Red	Sense Output0_NO	Sense output0, normally open terminal	Switched sense output to control gate
Orange /Black	V	Black	Pair 7	Black	Sense Output0_COM	Sense output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
	V**	Black		Black	Sync_485_N	RS-485 bus negative	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	W	Orange		Red	Sense Output0_NC	Sense output0, normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/ Black	X	Black	Pair 3	Black	Sense Output1_COM	Sense output1, common terminal	Switched sense output.
	Y	Green		Red	Sense Output1_NO	Sense output1, normally open terminal	Switched sense output

Table C-14 All Cabling Assignments for Colored-Wire Pair Cable or Alternate Wire Cable (continued)

Colored-Wire Pair Cable			Alternate Wire Cable		Signal	Description	Typical Function
Pair	Pin	Color	Pair	Color			
White/ Black	Z	Black	Pair 2	Black	Sense Output1_COM	Sense output1, common terminal	Switched sense output
	Z**	Black		Black	Sync_485_P	RS-485 bus positive	Used to connect Encompass 4 Readers with IAG capability on a synchronization bus
	a	White		Red	Sense Output1_NC	Sense output1, normally closed terminal	Switched sense output
Yellow/ Black	b	Yellow	Pair 5	Black	GND	logic ground	Signal ground (used with RS-232 and Wiegand communications)
	c	Black		Red	GND	logic ground	Signal ground (used with RS-232 and Wiegand communications)

**Use this synchronization pin designation if installing an Encompass 4 Reader that reads IAG protocol tags. The part numbers for these readers are as follows:

10-4002-004; 10-4002-010; 10-4002-019; 10-4004-004; 10-4004-010; 10-4004-019;
10-4012-004; 10-4012-010; 10-4012-019; 10-4014-004; 10-4014-010; 10-4014-019

D

Command Quick Reference

Command Quick Reference

This appendix lists the default configuration settings for the Encompass® 4 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](#).

[Table D-1](#) lists factory default settings. [Table D-2 on page D-5](#) lists, in numerical order, all of the commands available to users. [Table D-3 on page D-16](#) lists the same commands by command name.

Factory Default Settings

Note: [Table D-1](#) lists the factory default settings for the Encompass 4 Reader.

Table D-1 Encompass 4 Reader Default Configuration Settings

Parameter	Setting	Command
Operating mode	Data	00
Baud rate	9600	1005
Stop bits	1	1010
Parity	None	1020
Time and data appended	Enabled	302
Auxiliary information appended	Disabled	310
Disable 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

Table D-1 Encompass 4 Reader Default Configuration Settings (continued)

Parameter	Setting	Command
Wiegand mode	Disabled	450
Tag translation mode	Disabled	452
Multi-tag sort	Disabled	454
eGo or 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
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
Set output control	Turn off both outputs	6200
Sense 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
Sense output pulse duration	228 ms	67C
Synchronization output delay time	Disabled	64800
Synchronization hold off time	Disabled	64900
Presence without tag reports	Disabled	6900
RF-off control	Timeout or no presence	6922
RF timeout	Never true	693F
Input inversion	Disabled	6940

Table D-1 Encompass 4 Reader Default Configuration Settings (continued)

Parameter	Setting	Command
Input status change reports	Disabled	820
Automatic periodic RF status report	Disabled	830

Numerical Command List

The following conventions are used in [Table D-2](#):

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

Refer to [Chapter 6, “Communications Protocols](#) for the complete syntax of commands and messages.

Table D-2 Encompass 4 Reader Commands Listed Numerically

Number	Command Name	Reader Message
<i>00</i>	<i>Switch to data mode</i>	<i>Done</i>
01	Switch to command mode	Done
1002	Set baud rate = 1200 baud	Done
1003	Set baud rate = 2400 baud	Done
1004	Set baud rate = 4800 baud	Done
<i>1005</i>	<i>Set baud rate = 9600 baud</i>	<i>Done</i>
1006	Set baud rate = 19.2 K baud	Done
1007	Set baud rate = 38.4 K baud	Done
<i>1010</i>	<i>Use one stop bit</i>	<i>Done</i>
1011	Use two stop bits	Done
<i>1020</i>	<i>Disable parity</i>	<i>Done</i>
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

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
300	No time and date appended	Done
302	<i>Time and date appended</i>	<i>Done</i>
310	<i>Disable aux info append</i>	<i>Done</i>
311	Enable aux info append	Done
320	<i>Disable EAC page append</i>	<i>Done</i>
321	Enable EAC page append	Done
40	Transmit all IDs	Done
4100	<i>Select one ID separation</i>	<i>Done</i>
4101	Select two ID separation	Done
4102	Select three ID separation	Done
4103	Select four ID separation	Done
4200	<i>Select 1 valid ID code</i>	<i>Done</i>
4201	Select 2 valid ID codes	Done
4202	Select 3 valid ID codes	Done
4203	Select 4 valid ID codes	Done
440	Reset uniqueness	Done
441	<i>Set uniqueness timeout to 2 minutes</i>	<i>Done</i>
442	Set uniqueness timeout to 15 seconds	Done
443	Set uniqueness timeout to 30 seconds	Done
450	<i>Disable Wiegand mode</i>	<i>Done</i>
451	Enable Wiegand mode	Done
452	<i>Disable translation mode</i>	<i>Done</i>
454	<i>Disable multi-tag sort</i>	<i>Done</i>
455	Enable multi-tag sort	Done
456	<i>Enable eGo or eGo Plus Tag initialization during multi-tag sort</i>	<i>Done</i>

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
457	Disable eGo or eGo Plus Tag initialization during multi-tag sort	Done
458	<i>Disable second alternate group select</i>	<i>Done</i>
459	Enable second alternate group select	Done
46NN	Set Wiegand retransmit interval NN = 01 to FF seconds	Done
4601	<i>Set Wiegand retransmit interval to 1 second</i>	<i>Done</i>
480	Disable ATA	Done
481	Enable ATA	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.
482	Disable eGo	Done
483	Enable eGo	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.
484	Disable SeGo	Done
485	Enable SeGo	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.
486	Disable IAG	Done
487	Enable IAG	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.
488	Disable eATA	Done
489	Enable eATA	Done
490	<i>Disable third alternate group select</i>	<i>Done</i>
491	Enable third alternate group select	Done
492	<i>Disable fourth alternate group select</i>	<i>Done</i>

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
493	Enable fourth alternate group select	Done
494	<i>Disable fifth alternate group select</i>	<i>Done</i>
495	Enable fifth alternate group select	Done
496	<i>Disable alternate group select</i>	<i>Done</i>
497	Enable alternate group select	Done
505	Display version	Model [model] Ver [version no.] SN [serial no.]
506	Display hardware configuration information	S...S S...S = ASCII string (maximum length of 20 characters)
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 Px R0 P0 = no power fail has occurred P1 = power fail has occurred R0 = not applicable
521	Display reader ID number	RDID xx xx = 00–FF
522	Display comm port parameters	MAIN Bx Sx Px D0 B2 = 1200 B3 = 2400 B4 = 4800 B5 = 9600 B6 = 19.2 B7 = 38.4 S0 = one stop bit S1 = two stop bits P0 = no parity P1 = even P2 = odd D0 = EOL delay of 0 ms

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
524	Display appended info status	IDAP T1 D1 X0 T0 = time not appended T1 = time appended D0 = date not appended D1 = date appended X0 = aux info not appended X1 = aux info appended
525	Display comm protocol	ECPS Px Txx Xx S0 P0 = basic P1 = ECP P2 = echo Inquiry Txx = ECP timeout ms = 50 * xx FF = disabled ECP timeout X0 = no flow control X1 = software flow control X2 = hardware flow control S0 = som character is #
526	Display I/O status	IOST Cx Ox lx Dx 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 to DF = output pulse duration where D0 = 4 ms D1 = 8 ms D2 = 12 ms D3 = 16 ms D4 = 20 ms D5 = 24 ms D6 = 32 ms D7 = 40 ms D8 = 48 ms D9 = 60 ms DA = 76 ms DB = 152 ms DC = 228 ms DD = 300 ms DE = 376 ms DF = 752 ms

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
527	Display RF status	<p>RFST Cx Ox Tx Fxxx Rxx Gxx Axx lxx C0 = RF controlled by host C1 = RF-by-presence sensor O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min T2 = uniqueness timeout of 15 sec T3 = uniqueness timeout of 30 sec Fxxx = RF output frequency, xxx = 000 to 118 Rxx = Tag decoder range (distance) for ATA tags, 00 to 1F hexadecimal range value Gxx = Tag decoder range (distance) for eGo Plus Tags, 00 to 1F hexadecimal range value Axx = RF power attenuation, 00 max to 0A min (10 dB less than max) lxx = IAG RF power attenuation, 00 max to 0F min (15 dB less than max)</p> <p>Note If you enter RF settings using command #642NN, the display command for RF output frequency, F is "Fxx" and indicates use of the backward-compatible frequency entry method.</p>

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
529	Display presence input status	<p>PRST Px D0 Ax Tx Ix P0 = disable presence w/o tag reports P1 = enable presence w/o tag reports D0 = min presence true period of 0 ms A0 = RF off on timeout A1 = RF off on timeout or tag A2 = RF off on timeout or no presence T0: RF timeout of 0 ms (always expired) T1: RF timeout of 4 ms T2: RF timeout of 8 ms T3: RF timeout of 12 ms T4: RF timeout of 20 ms T5: RF timeout of 24 ms T6: RF timeout of 32 ms T7: RF timeout of 48 ms T8: RF timeout of 60 ms T9: RF timeout of 92 ms TA: RF timeout of 152 ms TB: RF timeout of 300 ms TC: RF timeout of 452 ms TD: RF timeout of 600 ms TE: RF timeout of 752 ms TF: RF timeout infinite, never expires (factory default) I0 = Input inversion disabled (factory default) I1 = Input inversion enabled</p>
530	Display RF0 filter status	<p>RF0S Ux Vx U0 = one ID separation U1 = two ID separations U2 = three ID separations U3 = four ID separations U4 = transmit all IDs V0 = valid ID code criteria of one acquisition (fixed) V1 = valid ID code criteria of two acquisitions V2 = valid ID code criteria of three acquisitions V3 = valid ID code criteria of four acquisitions</p>
532	Display Wiegand mode status	<p>T0F x 0 = disabled 1 = enabled</p>
533	Display Wiegand retransmit interval	<p>WTI xx xx = 01–FF seconds</p>

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
534	Display tag translation mode status	TT <0 to 1> 0 = tag translation mode disabled 1 = tag translation mode enabled
537	Display echo status	ECHO x 0 = disabled 1 = enabled
540	Display flash checksum	PCKS I0000 Exxxx xxxx = 4-byte ASCII checksum
543	Display boot checksum	BCKS xxxx xxxx = 4-byte ASCII checksum
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 Ex Mx E0 = status change reports disabled E1 = status change reports enabled M0 = no reporting M1 = report change on input0 M2 = report change on input1 M3 = report change on either input
570	Display tag protocols	ATA:<E, D> eGo:<I, F, D> SeGo:<I, F, D> IAG:<E, D> Sort:<E, D> I = ID (64 bits) E = Enabled F = Full transaction (eATA) D = Disabled
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	Done
610	Select basic protocol	Done
611	Select ECP protocol	Done
612NN	Set ECP timeout NN = 01–FE (1–255) timeout = 50 ms * NN (if NN = FF, timeout is disabled)	Done

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
612FE	Set ECP timeout = 12.7 sec	Done
613	Enable data inquiry protocol	Done
6140	Disable flow control	Done
6141	Enable software flow control	Done
6142	Enable hardware flow control	Done
6170	Disable echo	Done
6171	Enable echo	Done
6200	Turn both outputs off	Done
6201	Turn output0 on	Done
6202	Turn output1 on	Done
6203	Turn both outputs on	Done
621	Select predefined output mode	Done
63	Reset reader	Model [model] Ver [version no.] SN [serial no.] Copyright [date] TransCore
6400	Turn off RF	Done
6401	Turn on RF	Done
641	Select RF-by-input control	Done
642NN	Select RF operating frequency	Done
643NN	Set ATA operating range NN = 00 (shortest) to 1F (longest)	Done
6431F	Set ATA operating range to longest range	Done
644NN	Set RF attenuation NN = 00 to 0A	Done
64400	Set RF attenuation to 0 dB (full power)	Done
645NN	Set eGo or eGo Plus operating range NN = 00 (shortest) to 1F (longest)	Done
6451F	Set eGo or eGo Plus operating range to longest range	Done

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
646XX	Set IAG RF attenuation XX = 00 to 0F	Done
647XXX	Select RF operating frequency from 860 to 930 in 250 kHz steps XXX = 000 to 118 (hexadecimal)	Done
648NN	Set synchronization output delay time NN = 01 to FF, where 01 = 1 ms and FF = 255 ms.	Done
64800	Disable synchronization output delay	Done
649NN	Set synchronization hold-off time NN = 01 to 0A, where 01 = 1 ms and 0A = 10 ms.	Done
64900	Disable synchronization hold off time	Done
65	Reset power fail bit	Done
66F	Load default operating parameters (except RF operating frequency)	Done
67N	Set output pulse duration N = 0 to F (4,8,12,16,20,24,32,40,48,60,76, 152, 228,300,376,752 ms)	Done
67C	Output pulse duration set to 228 ms	Done
6900	Disable presence without tag reports	Done
6901	Enable presence without tag reports	Done
6920	Turn RF off on timeout	Done
6921	Turn RF off on timeout/tag	Done
6922	Turn RF off on timeout/no presence	Done
693N	Set RF timeout N = 0–F (always expired, 4,8,12,20,24, 32,48,60,92,152, 300,452, 600,752, infinite)	Done
693F	Set RF timeout to infinite	Done
6940	Disable input inversion	Done

Table D-2 Encompass 4 Reader Commands Listed Numerically (continued)

Number	Command Name	Reader Message
6941	Enable input inversion	Done
695S...S	Set serial number S...S = ASCII string (maximum length of 6 characters)	Done
696S...S	Store hardware configuration string S...S = ASCII string (maximum length of 20 characters)	Done
697	Set user-programmable group select equals (GSE) filter 697 MM AA DDDDDDDDDDDDDDD where MM = determines which of the eight comparison data bytes are to be compared for the Group Se- lect filter AA = determines the start ad- dress in the tag memory for the comparison data D...D = 8-byte field (16 charac- ters) used by the tag as the com- parison data for the group select filter	Done
820	Disable input status change reports	Done
821	Report change on input0	Done
822	Report change on input1	Done
823	Report changes on both	Done
830	Disable automatic periodic RF status report	Done
831	Enable automatic periodic RF status report	Done

Alphabetical Command List

The following conventions are used in [Table D-3](#):

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

Refer to [Chapter 7, “Commands](#) for the complete syntax of commands and messages.

Table D-3 Encompass 4 Reader Commands Listed Alphabetically

Command Name	Code	Reader Message
All IDs transmit	40	Done
<i>Alternate fifth group select disable</i>	<i>494</i>	<i>Done</i>
Alternate fifth group select enable	495	Done
<i>Alternate fourth group select disable</i>	<i>492</i>	<i>Done</i>
Alternate fourth group select enable	493	Done
<i>Alternate group select disable</i>	<i>496</i>	<i>Done</i>
Alternate group select enable	497	Done
<i>Alternate second group select disable</i>	<i>458</i>	<i>Done</i>
Alternate second group select enable	459	Done
<i>Alternate third group select disable</i>	<i>490</i>	<i>Done</i>
Alternate third group select enable	491	Done
Appended info status display	524	IDAP T1 D1 X0 T0 = time not appended T1 = time appended D0 = date not appended D1 = date appended X0 = aux info not appended X1 = aux info appended
ATA disable	480	Done
ATA enable	481	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
ATA operating range set NN = 00 (shortest) to 1F (longest)	643NN	Done
ATA operating range set to longest range	6431F	Done
Automatic periodic RF status report disable	830	Done
Automatic periodic RF status report enable	831	Done
Aux info append disable	310	Done
Aux info append enable	311	Done
Basic protocol select	610	Done
Baud rate = 1200 baud set	1002	Done
Baud rate = 19.2 K baud set	1006	Done
Baud rate = 2400 baud set	1003	Done
Baud rate = 38.4 K baud set	1007	Done
Baud rate = 4800 baud set	1004	Done
Baud rate = 9600 baud set	1005	Done
Boot checksum display	543	BCKS xxxx xxxx = 4-byte ASCII checksum
Buffered handshake report	577	XX = number of handshakes
Comm port parameters display	522	MAIN Bx Sx Px D0 B0 = 110 B1 = 300 B2 = 1200 B3 = 2400 B4 = 4800 B5 = 9600 B6 = 19.2 B7 = 38.4 S0 = one stop bit S1 = two stop bits P0 = no parity P1 = even P2 = odd D0 = EOL delay of 0 ms

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
Comm protocol display	525	ECPS Px Txx Xx S0 P0 = basic P1 = ECP P2 = data inquiry Txx = ECP timeout ms = 50 * xx TFF = disabled ECP timeout X0 = no flow control X1 = software flow control X2 = hardware flow control S0 = SOM character is #
Command mode switch	01	Done
Data inquiry protocol enable	613	Done
Data mode switch	00	Done
Date set	21	Done
Default operating parameters load (except RF operating frequency)	66F	Done
Disable EAC page append	320	Done
DSP board Actel version display	513	DSP FPGA VER = XX.XX
eATA disable	488	Done
eATA enable	489	Done.
Echo disable	6170	Done
Echo enable	6171	Done
Echo status display	537	ECHO x 0 = disabled 1 = enabled
ECP protocol select	611	Done
ECP timeout set NN = 01–FE (1–255) timeout = 50 ms * NN (if NN = FF, timeout is disabled)	612NN	Done
ECP timeout set to 12.7 sec	612FE	Done
eGo disable	482	Done
eGo enable	483	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
eGo Plus operating range set NN = 00 (shortest) to 1F (longest)	645NN	Done
eGo or eGo Plus operating range set to longest range	6451F	Done
eGo or eGo Plus Tag initialization during multi-tag sort	456	Done
eGo or eGo Plus Tag initialization during multi-tag sort disable	457	Done
Enable EAC page append	321	Done
Even parity select	1021	Done
Flash checksum display	540	PCKS I0000 Exxxx xxxx = 4-byte ASCII checksum
Flow control disable	6140	Done
Hardware configuration information display	506	S...S S...S = ASCII string (maximum length of 20 characters)
Hardware configuration string store S...S = ASCII string (maximum length of 20 characters)	696S...S	Done
Hardware flow control enable	6142	Done

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
I/O status display	526	IOST Cx Ox lx Dx 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 - DF = output pulse duration where D0 = 4 ms D1 = 8 ms D2 = 12 ms D3 = 16 ms D4 = 20 ms D5 = 24 ms D6 = 32 ms D7 = 40 ms D8 = 48 ms D9 = 60 ms DA = 76 ms DB = 152 ms DC = 228 ms DD = 300 ms DE = 376 ms DF = 752 ms
IAG disable	486	Done
IAG enable	487	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.
IAG RF attenuation set XX = 00 to 0F	646XX	Done
Input inversion disable	6940	Done
Input inversion enable	6941	Done
Input status change display	560	SSTC Ex Mx E0 = status change reports disabled E1 = status change reports enabled M0 = no reporting M1 = report change on input0 M2 = report change on input1 M3 = report change on either input

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
Input0 change report	821	Done
Input1 change report	822	Done
Input status change reports disable	820	Done
Multi-tag sort disable	454	Done
Multi-tag sort enable	455	Done
Odd parity select	1022	Done
Tag protocols display	570	ATA:<E, D> eGo:<I, F, D> SeGo:<I, F, D> IAG:<E, D> Sort:<E, D> I = ID (64 bits) E = Enabled F = Full transaction (eATA) D = Disabled
Output pulse duration set N = 0–F (4,8,12,16,20,24,32,40,48,60,76, 152, 228,300,376,752 ms)	67N	Done
Output pulse duration set to 228 ms	67C	Done
Output0 turn on	6201	Done
Output1 turn on	6202	Done
Outputs turn off both	6200	Done
Outputs turn on both	6203	Done
Parity disable	1020	Done
Power fail bit display	520	PWRB Px R0 P0 = no power fail has occurred P1 = power fail has occurred R0 = not applicable
Power fail bit reset	65	Done
Predefined output mode select	621	Done

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
Presence input status display	529	PRST Px D0 Ax Tx lx P0 = disable presence w/o tag reports P1 = enable presence w/o tag reports D0 = min presence true period of 0 ms A0 = RF off on timeout A1 = RF off on timeout or tag A2 = RF off on timeout or no presence T0: RF timeout of 0 ms (always expired) T1: RF timeout of 4 ms T2: RF timeout of 8 ms T3: RF timeout of 12 ms T4: RF timeout of 20 ms T5: RF timeout of 24 ms T6: RF timeout of 32 ms T7: RF timeout of 48 ms T8: RF timeout of 60 ms T9: RF timeout of 92 ms TA: RF timeout of 152 ms TB: RF timeout of 300 ms TC: RF timeout of 452 ms TD: RF timeout of 600 ms TE: RF timeout of 752 ms TF: RF timeout infinite, never expires (factory default) I0 = Input inversion disabled (factory default) I1 = Input inversion enabled
Presence without tag reports disable	6900	Done
Presence without tag reports enable	6901	Done
Reader ID number display	521	RDID xx xx = 00–FF
Reader ID number set NN = 00 to FF	60NN	Done
Reader ID number set to 00	6000	Done
Reader reset	63	Model [model] Ver [version no.] SN [serial no.] Copyright [date] TransCore
Report changes both	823	Done
RF attenuation set NN = 00 to 0A	644NN	Done

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
Set RF attenuation to 0 dB (full power)	64400	Done
RF off on timeout	6920	Done
RF off on timeout/no presence	6922	Done
RF off on timeout/tag	6921	Done
RF turn off	6400	Done
RF turn on	6401	Done
RF on by input control	641	Done
RF operating frequency from 860 to 930 in 250 kHz steps select XXX = 000 to 118 (hexadecimal)	647XXX	Done
RF operating frequency select	642NN	Done
RF status display	527	<p>RFST Cx Ox Tx Fxxx Rxx Gxx Axx lxx C0 = RF controlled by host C1 = RF-by-presence sensor O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min T2 = uniqueness timeout of 15 sec T3 = uniqueness timeout of 30 sec Fxxx = RF output frequency, xxx = 000 to 118 Rxx = Tag decoder range (distance) for ATA tags, 00 to 1F hexadecimal range value Gxx = Tag decoder range (distance) for eGo Plus Tags, 00 to 1F hexadecimal range value Axx = RF power attenuation, 00 max to 0A min (10 dB less than max) lxx = IAG RF power attenuation, 00 max to 0F min (15 dB less than max)</p> <p>If you enter RF settings using command #642NN, the display command for RF output frequency, F is "Fxx" and indicates use of the backward- compatible frequency entry method.</p>

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
RF timeout set N = 0 to F (always expired, 4,8,12,20,24,32, 48,60,92,152,300,452,600,752 ms, infinite)	693N	Done
RF timeout set to infinite	693F	Done
RF transceiver FPGA version display	510	RF FPGA VER = XX.XX
RF transceiver I filter chip version display	511	FIL IC I VER = XX.XX
RF transceiver Q filter chip version display	512	FIL IC Q VER = XX.XX
RF0 filter status display	530	RF0S Ux Vx U0 = one ID separation U1 = two ID separations U2 = three ID separations U3 = four ID separations U4 = transmit all IDs V0 = valid ID code criteria of one acquisition (fixed) V1 = valid ID code criteria of two acquisitions V2 = valid ID code criteria of three acquisitions V3 = valid ID code criteria of four acquisitions
SeGo disable	484	Done
SeGo enable	485	Done if Encompass 4 Reader model supports this tag protocol. Error if tag protocol is unsupported.
Serial number set S...S = ASCII string (maximum length of 6 characters)	695S...S	Done
Software flow control enable	6141	Done
Stop bit use one	1010	Done
Stop bit use two	1011	Done
Synchronization hold off time disable	64900	Done
Synchronization hold-off time set NN = 01 to 0A, where 01 = 1 ms and 0A = 10 ms.	649NN	Done

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
<i>Synchronization output delay time disable</i>	64800	Done
Synchronization output delay time set NN = 01 to FF, where 01 = 1 ms and FF = 255 ms.	648NN	Done
Synchronization values display	582	SYNC T<00 to FF> H<00 to 0A>
Tag ID separation select four	4103	Done
<i>Tag ID separation select one</i>	4100	Done
Tag ID separation select three	4102	Done
Tag ID separation select two	4101	Done
Tag translation mode status display	534	TT <0 to 1> 0 = tag translation mode disabled 1 = tag translation mode enabled
<i>Time and date appended</i>	302	Done
Time and date display	22	Time and date
Time and date not appended	300	Done
Time set	20	Done
<i>Translation mode disabled</i>	452	Done
Uniqueness reset	440	Done
<i>Uniqueness timeout set to 2 minutes</i>	441	Done
Uniqueness timeout set to 15 seconds	442	Done
Uniqueness timeout set to 30 seconds	443	Done
User-programmable group select equals (GSE) filter data display	549	The response data is formatted similar to the data in the configuration command.

Table D-3 Encompass 4 Reader Commands Listed Alphabetically (continued)

Command Name	Code	Reader Message
<p>User-programmable group select equals (GSE) filter set</p> <p>697 MM AA DDDDDDDDDDDDDDDDD</p> <p>where</p> <p>MM = determines which of the eight comparison data bytes are to be compared for the Group Select filter</p> <p>AA = determines the start address in the tag memory for the comparison data</p> <p>D...D = 8-byte field (16 characters) used by the tag as the comparison data for the group select filter</p>	697	Done
Valid ID code select four	4203	Done
Valid ID code select one	4200	Done
Valid ID code select three	4202	Done
Valid ID code select two	4201	Done
Version display	505	Model [model] Ver [ver no.] SN [serial no.]
Wiegand mode disable	450	Done
Wiegand mode enable	451	Done
Wiegand mode status display	532	T0F x 0 = disabled 1 = enabled
Wiegand retransmit interval display	533	WTI xx xx = 01–FF seconds
Wiegand retransmit interval set NN = 01 to FF seconds	46NN	Done
Wiegand retransmit interval set to 1 second	4601	Done

E

Compatible Tag Information

Appendix E

Compatible Tag Information

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

Tag Configurations

Table E-1 lists the TransCore Super eGo® (SeGo) protocol tags that are compatible with the Encompass 4 Reader.

Table E-1 SeGo Protocol Tags

Tag	Tag Type	Power Source	Number of 6-bit ASCII Characters ^a	Number of 128-Bit Frames ^a	Number of Wiegand Bits	Special Features
eGo Plus Sticker Tag	Toll, electronic vehicle registration (EVR), parking, security access	Beam	20	1	NA	Very thin, flexible, multi-layer lamination
			10	1/2	26 to 54	
eGo Plus Security Sticker Tag			20	1	NA	Very thin, flexible, multi-layer lamination, tamper detection
			10	1/2	26 to 54	
eGo Plus License Plate Tag			20	1	NA	Water-resistant, exterior-mounted
			10	1/2	26 to 54	

a. These fields apply to eATA-programmed tags only. Contact TransCore for information regarding tags programmed with these features.

[Table E-2](#) lists the Intellitag-programmed tags that are compatible with the Encompass 4 Reader.

Table E-2 eGo Protocol Tags

Tag	Tag Type	Power Source	Number of 6-bit ASCII Characters	Number of 128-Bit Frames	Number of Wiegand Bits	Special Features
Windshield Sticker Tag	Toll, EVR, parking, security access	Beam	20	1	NA	Very thin, flexible, multi-layer lamination
			10	1/2	26 to 54	
License Plate Tag			20	1	NA	Water-resistant, exterior-mounted
			10	1/2	26 to 54	

[Table E-3](#) lists most ATA tag models that are compatible with the Encompass 4 Reader.

Table E-3 ATA Protocol Tags

Tag Model Number	TagType	Power Source	Number of 6-Bit ASCII Characters	Number of 128-Bit Frames	Number of Wiegand Bits	Special Features
AT5100	Toll	Beam	20	1	N/A	915 MHz, thin case, non-metal window install
AT5102	Access control	Beam	10	1/2	26 to 54	915 MHz, thin case, non-metal window install
AT5105	Access control	5-yr battery	10	1/2	26 to 54	Multifrequency, thin case, non-metal window install
AT5106	Access control	10-yr battery	10	1/2	26 to 54	Multifrequency, sealed case, non-metal window install or non-metal external install
AT5107	Access control	10-yr battery	10	1/2	26 to 54	Multifrequency, sealed case, metal external install
AT5110	Transportation	Beam	20	1	N/A	915 MHz frequency, metal external install

Table E-3 ATA Protocol Tags (continued)

Tag Model Number	TagType	Power Source	Number of 6-Bit ASCII Characters	Number of 128-Bit Frames	Number of Wiegand Bits	Special Features
AT5112	Access control, transportation	Beam	10	1/2	26 to 54	915 MHz frequency, metal external install
AT5114	Access control, transportation	10-yr battery	10	1/2	26 to 54	Multifrequency, metal external install
AT5125	Transportation	Beam	20	1	N/A	915 MHz frequency; high-temperature chemical-resistant case, metal external install
AT5140	Toll	10-yr battery	20	1	N/A	915 MHz frequency, license plate install
AT5145	Toll	Beam	20	1	N/A	915 MHz frequency, license plate install
AT5146	Access control	Beam	10	1/2	26 to 54	915 MHz, license plate install
AT5147	Access control	10-yr battery	10	1/2	26 to 54	915 MHz, license plate install
AT5510	Transportation	10-yr battery	20	1	N/A	Multifrequency, metal external install
AT5544	Toll	10-yr battery	20	1	N/A	Multifrequency, sealed case, non-metal window or external install
AT5545	Toll	10-yr battery	20	1	N/A	Multifrequency, sealed case, metal external install

Table E-3 ATA Protocol Tags (continued)

Tag Model Number	TagType	Power Source	Number of 6-Bit ASCII Characters	Number of 128-Bit Frames	Number of Wiegand Bits	Special Features
AT5547	Toll	5-yr battery	20	1	N/A	Multifrequency, thin case, non-metal window install
AT5704	Transportation	External	4608	256	N/A	Multifrequency, dynamic tag, metal external install
AT5707	Transportation	8-yr battery	40 ^a	2	N/A	915 MHz frequency, dynamic tag, metal external install

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. See [Table E-1](#) through [Table E-3](#) 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*.

Index

Index

A

- AA3100 Yagi 2-8
- AA3101 Yagi 2-9
- AA3110 Parapanel 2-9
- AA3140 PCB Log Periodic 2-9
- AA3152 Universal Toll Antenna 2-9
- AA3153 Toll Antenna 2-10
- AC power 4-8
- ACK/NAK response 6-6
- alignment
 - antenna and tag 2-10
 - reader and tag 2-4
- American Trucking Associations 1-3
- ANS NCITS 256-2001 3-3
- antenna
 - mounting 4-22
 - selection 2-8
- antenna interface 2-20
- antenna mounting
 - curb-side 4-23
- anti-pass back 7-11
- append
 - auxiliary information 7-9
- append information commands 7-8–7-10
- appended information
 - status 7-19
- appended tag data 8-13
- ASCII terminals 7-3
- assignments
 - colored-wire pair for RS-232 4-11, 4-29
 - pin 4-10, 4-28
- asynchronous message/command message collision 6-14
- ATA 1-3, 3-3
 - operating range 7-36
- audible circuit tester 4-5
- audience, system guide 1-3
- automatic periodic RF status report 7-46
- auxiliary information 7-9
- auxiliary reader control commands 7-46

B

- basic protocol 7-30
- baud rate 7-5, 7-6
- blind rivet installation 3-26
- boot checksum 7-27
- boot failure message 5-6
- bracket
 - factory-mounted 4-15

- pole mount 4-15
 - wall mount 4-18
- buffer
 - tag/message 5-6
- buffered handshakes 7-29
- bumper types 3-25
- buzz box
 - See audible circuit tester

C

- cable
 - length 2-18
 - power and communications 2-16
 - power extension 2-17
- cable length 2-16
- cabling accessory kits 2-16
- center island 2-13
- coaxial cable performance 2-20
- COM 1 properties dialog box 8-7
- command entry conventions 5-3
- Command Group 0
 - See reader mode control commands
- Command Group 1
 - See communication port control commands
- Command Group 2
 - See real-time clock commands
- Command Group 3
 - See append information commands
- Command Group 4
 - See ID filtering commands
- Command Group 5
 - See reader status commands
- Command Group 6
 - See reader control function commands
- Command Group 8
 - See auxiliary reader control commands
- command mode 7-4, 7-5
 - host transmission formats 6-8
 - sample messages 6-10
 - switch to 6-7
- command response conventions 5-4
- commands, list of 7-5–7-46
- communication protocols 6-3
- communications
 - verifying 8-8
- communications interfaces 2-18
 - RS-232 2-19
 - RS-422 2-19
 - Wiegand 2-19

Encompass 4 Reader System Guide

- communications port control commands 7-5–7-7
- communications port parameters 7-18
- communications protocol 8-19
 - status 7-20
- communications protocols
 - basic protocol 6-4
 - basic protocol command response 6-9
 - basic protocol reader transmission 6-5
 - ECP host response 6-5
 - error correcting protocol 6-4
 - error correcting protocol format 6-5
- communications requirements 2-16
 - communications cables
 - host
- computer cables 2-20
- configuration label 8-3
- configuration labeling 8-3
- configuring
 - appended tag data 8-13
 - communications protocol 8-19
 - ID separation 8-13
 - parameters 8-12–8-19
 - port communication parameters 8-18
 - radio frequency 8-15
 - reports 8-13
 - reset reader 8-14
 - RF transmission 8-15
 - continuous 8-16
 - host controlling 8-16
 - vehicle detector controlling 8-15
 - sense inputs 8-17
 - sense output devices 8-17
 - serial port communications 8-18
- configuring the Encompass 4 Reader 8-3–8-21
- connecting
 - AC power 4-8
 - colored-wire pair cable 4-11, 4-29
 - colored-wire pair cable for RS-422 4-30
 - colored-wire pair cable for Wiegand 4-31
 - communications 4-28
 - bench testing 4-9
 - required materials 4-9, 4-28
 - DC power 4-9
 - Encompass 4 Reader to the PC 4-28
 - power supply 4-27
 - reader to PC 4-28
 - RS-232 interface 4-10, 4-28
 - RS-422 interface 4-12, 4-30
 - sense input circuits 4-32
 - sense output circuits 4-33
 - Wiegand interface 4-30
- connecting sense input 4-31
- connecting sense output 4-31
- connection description dialog box 8-6
- conventions
 - typographical 1-5

CRC

- See cyclic redundancy check
- CRC calculation 6-15–6-18
- current requirements 2-17
- current, standby operating 2-17
- current, worst case maximum 2-17
- cyclic redundancy check 6-4

D

- data inquiry protocol 7-30
- data mode 7-3, 7-5
- date
 - set 7-7
- DB25 connector 4-10, 4-28
- DB9 connector 4-10, 4-28
- DC power supply 4-9
- default operating parameters 7-40
- default parameters 8-4
- disable
 - ATA 7-15
 - automatic periodic RF status report 7-46
 - eATA 7-15
 - echo mode 7-31
 - eGo 7-15
 - eGo Plus Tag initialization during multi-tag sort 7-14
 - eGo tag initialization 7-14
 - fifth alternate group select 7-16
 - fifth alternative group select 7-16
 - fourth alternate group select 7-16
 - IAG 7-15
 - multi-tag sort 7-13
 - second alternate group select 7-14
 - SeGo 7-15
 - tag translation mode 7-13
 - third alternate group select 7-16
 - Wiegand mode 7-13
- Discharging voltage
 - procedure 4-6, 4-22
 - required equipment 4-6, 4-22
- display
 - appended information status 7-19
 - boot checksum 7-27
 - communications port parameters 7-18
 - communications protocol status 7-20
 - DSP board Actel version 7-18
 - echo status 7-27
 - flash checksum 7-27
 - hardware configuration information 7-17
 - input status change report options 7-28
 - operating mode status 7-28
 - power fail bit 7-18
 - presence input status 7-24
 - reader ID number 7-18
 - RF status 7-23
 - RF transceiver FPGA version 7-18
 - RF transceiver I filter chip version 7-18

- RF transceiver Q filter chip version 7-18
- RF0 filter status 7-25
- software version 7-17
- Wiegand mode status 7-26
- Wiegand retransmit interval 7-26
- display tag translation mode status 7-27
- display time and date 7-8
- download mode 7-4
- dry contact closure 2-19
- DSP board Actel version 7-18
- dual-protocol 1-3

E

- echo mode 7-31
- echo status 7-27
- ECP
 - reliability 6-15
 - timeout 6-12
 - See also error correcting protocol
- eGo License Plate Tag 3-7
- eGo Plus License Plate Tag 3-5
- eGo Plus LPT installation procedures 3-13
- eGo Plus Security Sticker Tag 3-5
- eGo Plus Sticker Tag 1-5, 3-4
- eGo Plus Tag 3-3
- eGo Windshield Sticker Tag 3-6
- eGo/eGo Plus
 - operating range 7-36
- electrical requirements 2-16
 - current
 - power cables
- enable
 - ATA 7-15
 - automatic periodic RF status report 7-46
 - data inquiry protocol 7-30
 - eATA 7-16
 - echo mode 7-31
 - eGo 7-15
 - eGo Plus Tag initialization during multi-tag sort 7-14
 - eGo Tag initialization 7-14
 - fifth alternate group select 7-17
 - fifth alternative group select 7-17
 - fourth alternate group select 7-16
 - IAG 7-15
 - multi-tag sort 7-14
 - second alternate group select 7-14
 - SeGo 7-15
 - tag translation mode 7-13
 - third alternate group select 7-16
 - Wiegand mode 7-13
- Encompass 4 1-3
- Encompass 4 Reader
 - back of 4-15
 - description 1-6
- end-of-line delay 7-5
- error correcting protocol 7-30

- See also ECP
- error correcting protocol format
 - reader transmissions 6-5
- error correcting protocol timeout 7-30
- error messages 9-3
- error transaction 6-15

F

- failure conditions
 - host addressed 6-14
 - reader addressed 6-13
- failure conditions, host-addressed
 - asynchronous message/command message collision 6-14
 - illegal or wrong sequence number 6-14
 - receive timeout 6-14
 - transmission timeout 6-14
- failure conditions, reader addressed
 - asynchronous message/command message collision 6-14
 - illegal command 6-13
 - illegal sequence number 6-13
 - receive timeout 6-14
 - transmission timeout 6-14
 - wrong sequence number 6-13
- fax number, support 9-7
- FCC internet site 1-7
- FCC license
 - See licensing requirements
- flash checksum 7-27
- flow control option 7-31
- frequency separation 2-12

G

- gate 2-13

H

- hardware configuration information 7-17
- hardware configuration string 7-44
- Hyper Terminal 4-9, 4-28
- Hyper Terminal main screen 8-8

I

- IAG 1-3, 3-3
- IAG RF attenuation 7-37
- ID filtering commands 7-10–7-17
- ID separation 8-13
- illegal sequence number 6-14
- input inversion option 7-43
- input status 7-23
- input status change report options 7-46
- input/output circuits 2-19
- input/output module 1-6
- installation procedures
 - blind rivets 3-26
 - eGo Plus LPT 3-13
 - eGo Plus Security Sticker Tag 3-11
 - eGo Plus Sticker Tag 3-9

Encompass 4 Reader System Guide

- eGo Windshield Sticker Tag 3-17
- installing antenna
 - on a round pole
 - procedures 4-24
 - overhead 4-26
 - procedures 4-26
- installing reader 4-3–4-28
 - additional testing materials 4-4
 - on a round pole 4-14
 - procedures 4-14
 - on wall or ceiling 4-18
 - procedures 4-18
 - optional accessories 4-4
 - required materials 4-3
 - wall or ceiling 4-18
- installing tags
 - alternate mounting locations 3-25
 - installation procedures 3-26
 - eGo Plus Security Sticker Tag 3-11
 - eGo Plus Sticker Tag 3-7
 - eGo Windshield Sticker Tag 3-15
 - license plate-mount tag 3-21
- Intellitag 1-3
- Inter-Agency Group 1-3, 3-3
- International Organization for Standardization 1-3
- ISO 1-3, 3-3
- IT2000 3-3

J

- junction box 2-16

L

- lane configuration 2-12, 2-15
 - center island 2-13
 - overhead 2-14
 - parking garage with ticket island 2-14
- large truck, no inside mirror 3-9
- licensing requirements 1-7
- line of sight 2-6, 2-11
- load default operating parameters 7-40

M

- marketing support 9-7
- metallized coating 2-8, 3-8, 3-15
- metallized coating on windshield 3-13, 3-21
- mirror post, attached to headliner 3-17
- mirror post, high 3-8, 3-16
- mirror post, low 3-8, 3-16
- mixed population tags 2-3
- mounting antenna 4-22
 - discharging voltage from external antenna 4-22
- mounting reader 4-14
- multiple reader sites 2-12

N

- NEMA 2-16

O

- operating mode status 7-28
- operating modes
 - command mode 7-4
 - data mode 7-3
 - download mode 7-4
- organization, system guide 1-3
- output control 7-32
- output control, predefined 7-32
- output pulse duration 7-40
- output status 7-22

P

- parameters
 - configuring 8-12
 - default operating 8-4
 - operating 5-4
- parity 7-5, 7-6
- patch antenna 1-6
- periodic RF status report 7-46
- phone number dialog box 8-7
- pin assignments, signal to host 4-10, 4-28
- polarization 2-5, 2-10
 - See also alignment
- port configuration parameters 8-18
- power cables 2-16
- power fail bit 7-18, 7-40
- power failure flag 5-5
- power supply 1-6
- presence input status 7-24
- presence without tag report option 7-41
- Procomm Plus 4-9, 4-28
- program download 5-5
 - considerations 5-5
 - procedures 5-5
- purpose, system guide 1-3

R

- radio frequency 8-15
 - See also RF
- read zone 2-11, 4-35
 - fine-tuning 8-19
 - adjusting sensitivity range 8-21
 - lowering output power 8-20
 - physically adjust antenna 8-20
 - physically adjust reader 8-20
 - marking 4-35
 - sample 4-37
- reader
 - configuring 8-3
 - description 1-6
 - how it works 1-6
 - installing
 - on a round pole
 - required materials 4-14
 - on wall or ceiling

- required materials 4-18
 - operating modes 7-3
 - repair 9-6
 - specifications B-3
- reader cable grounding 4-27
- reader control function commands 7-29–7-44
- reader ID number 7-18, 7-29
- reader logic board 1-6
- reader mode control commands 7-5
- reader status commands 7-17–7-29
- real-time clock commands 7-7–7-8
- receive timeout 6-14
- removing eGo Plus Security Sticker Tag 3-12
- removing tags
 - eGo Plus Sticker Tag 3-10
 - eGo Windshield Sticker Tag 3-18
 - exterior 3-26
- report
 - buffered handshakes 7-29
- reports 8-13
- reset
 - power fail bit 7-40
 - reader 7-32
 - uniqueness 7-12
- reset reader 8-14
- RF
 - attenuation 7-36
 - control 7-33
 - control algorithm 7-42
 - operating frequency 7-37
 - signals
 - existing interference with 2-16
 - reflection, refraction, and diffraction 2-15
 - status 7-23
 - timeout period 7-42
 - See also radio frequency
- RF module 1-6
- RF operating frequency 7-33
- RF signal
 - electrical interference 2-16
 - reflection, refraction, and diffraction 2-15
- RF transceiver FPGA version 7-18
- RF transceiver I filter chip version 7-18
- RF transceiver Q filter chip version 7-18
- RF transmission 8-15
 - continuous 8-16
 - host control 8-16
 - vehicle detector control 8-16
- RF0
 - filter status 7-25
- RF-by-input control 7-33
- RS-232 interface 2-19
- RS-422 interface 2-19

S

- second successful tag read screen 8-12
- Security Sticker Tag
 - removing 3-12
- SeGo 1-3, 3-3
- select
 - ATA operating range 7-36
 - basic protocol 7-30
 - baud rate 7-6
 - eGo/eGo Plus operating range 7-36
 - error correcting protocol 7-30
 - error correcting protocol timeout 7-30
 - flow control option 7-31
 - input inversion option 7-43
 - input status change report option 7-46
 - parity 7-6
 - presence without tag report option 7-41
 - RF control algorithm 7-42
 - RF operating frequency 7-33, 7-37
 - RF timeout period 7-42
 - RF-by-input control 7-33
 - stop bits 7-6
 - unique ID code criteria 7-11
 - valid ID code criteria for RF channel0 7-12
- sense input/output circuits, sample 4-32
- sense inputs 8-17
- sense output devices 8-17
- serial number 7-44
- serial port communications 8-18
- set
 - IAG RF attenuation 7-37
 - output pulse duration 7-40
 - reader ID number 7-29
 - RF attenuation 7-36
 - serial number 7-44
 - uniqueness timeout 7-12
 - Wiegand retransmit interval 7-15
- set date 7-7
- set time 7-7
- shipping carton contents 4-3
- shipping carton label 8-3
- sign-on message 5-6, 8-9
- site layout 2-8
- site plan 2-3
- site plan, developing 2-3–2-20
- software commands 7-3
- software version 7-17
- software-related information 5-3
- startup 5-5
- stop bits 7-5, 7-6
- store hardware configuration string 7-44
- successful tag read screen 8-11
- Super eGo 1-3, 3-3
- switch to
 - command mode 7-5

Encompass 4 Reader System Guide

- data mode 7-5
- system description 1-5
- system guide
 - audience 1-3
 - organization 1-3
 - purpose 1-3

T

- tag
 - choosing, installing, and removing 3-3
 - compatible 1-6
 - compatible types 3-3
 - installing
 - alternate mounting locations
 - required materials 3-25
 - ATA interior tags
 - required materials 3-18
 - ATA license plate tags
 - required materials 3-21
 - ATA-mode tags 3-18
 - eGo Plus License Plate Tag 3-13
 - eGo Plus LPT
 - required materials 3-13
 - eGo Plus Sticker Tags 3-7
 - eGo Windshield Sticker Tags 3-15
 - license-plate mounted 3-21
 - windshield sticker tags
 - required materials 3-16
 - windshield-type sticker tags
 - required materials 3-8
 - models 3-3
 - positioning
 - ATA-mode tag 3-19
 - eGo Plus LPT 3-13
 - eGo Plus Sticker Tag 3-8
 - eGo Windshield Sticker Tag 3-16
 - license plate-mount tag 3-22
 - reading mixed population 2-3
 - removing
 - ATA/ISO tag 3-21
 - types 3-3
- tag decoder 1-6
- tag positions 2-7
- tag read capability
 - verifying 8-10
- tag translation mode
 - status 7-27
- tape installation 3-26
- Technical Support 1-7, 9-6
- terminal emulation software
 - starting 8-6
 - using to configure parameters 8-5
- testing
 - Encompass 4 Reader 4-12

- pre-installation 4-5
 - Discharging voltage from external antenna 4-6
 - using audible circuit tester 4-5
- ticket island 2-14
- time
 - set 7-7
- time and date
 - display 7-8
- timing and synchronization 6-12
- traffic flow 2-11
- transmission formats, 7-8
- transmission timeout 6-14
- transmit all ID codes 7-10
- troubleshooting 9-3, 9-3-9-6
 - remedies 9-4
 - symptoms 9-4
- typographical conventions 1-5

V

- vehicle detector 8-16
- verify
 - communications 8-8
 - tag read capability 8-10

W

- Warning
 - minimum safe distance for maintenance personnel, iv, v
- Web site, support 9-6
- Wiegand 3-3
 - interface 2-19
 - mode 7-13
 - mode status 7-26
 - retransmit interval 7-15, 7-26
- wiring tables C-3
- wrong sequence number 6-13, 6-14