

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 closely as possible to the Encompass 4 Reader. Long cable runs increase system sensitivity to noise. See “[Table 4 Recommended Cable Length from Transformer to the Encompass 4 Reader](#)” on page 2–17 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 40](#)).

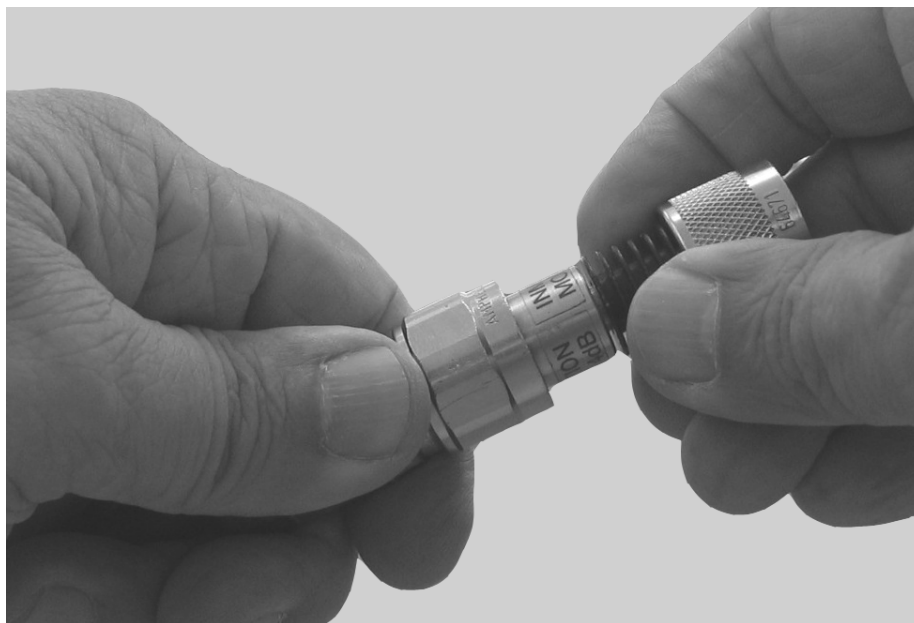


Figure 40 Connect RF N-type Load or Attenuator to Reader Cable End

2. Connect the RF cable to the antenna (see item 1 in [Figure 41](#))
3. Short the outer metal case of the load or attenuator to Earth Ground for approximately 10 seconds (item 2 in [Figure 41](#)). In this example, the installer is using the electrical conduit for Earth Ground.

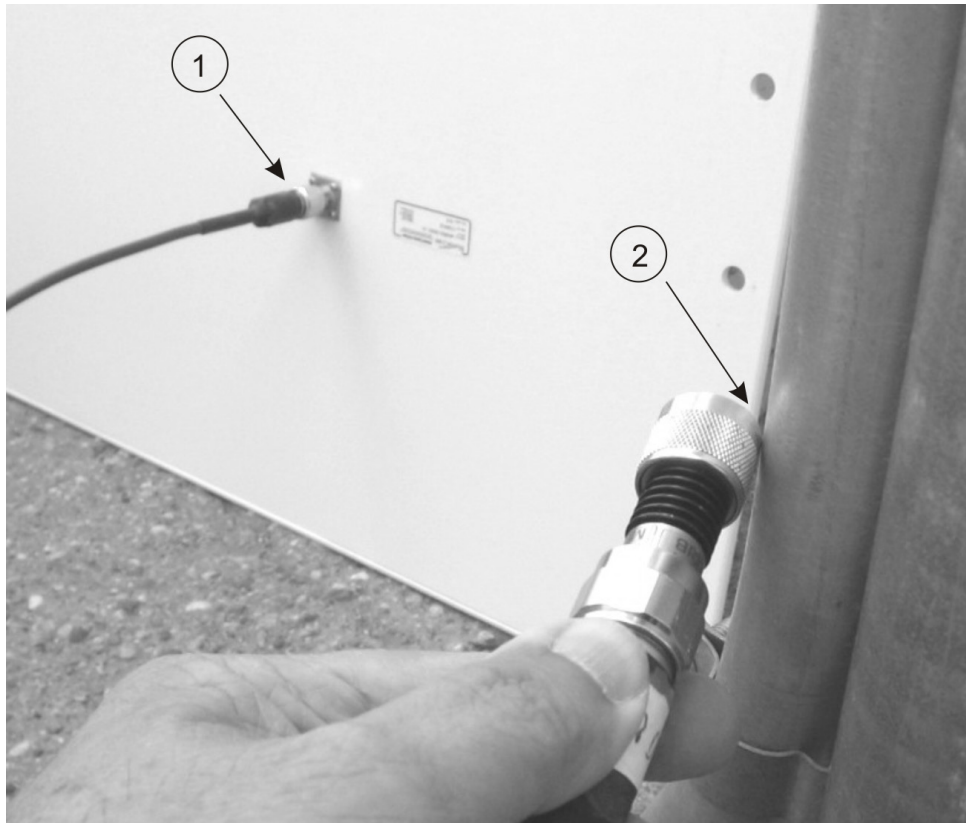


Figure 41 Short Load to Earth Ground

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 using adequate Earth Ground for this voltage discharge procedure in accordance with the National Electric Code for the locale where the Encompass 4 Reader is installed.

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

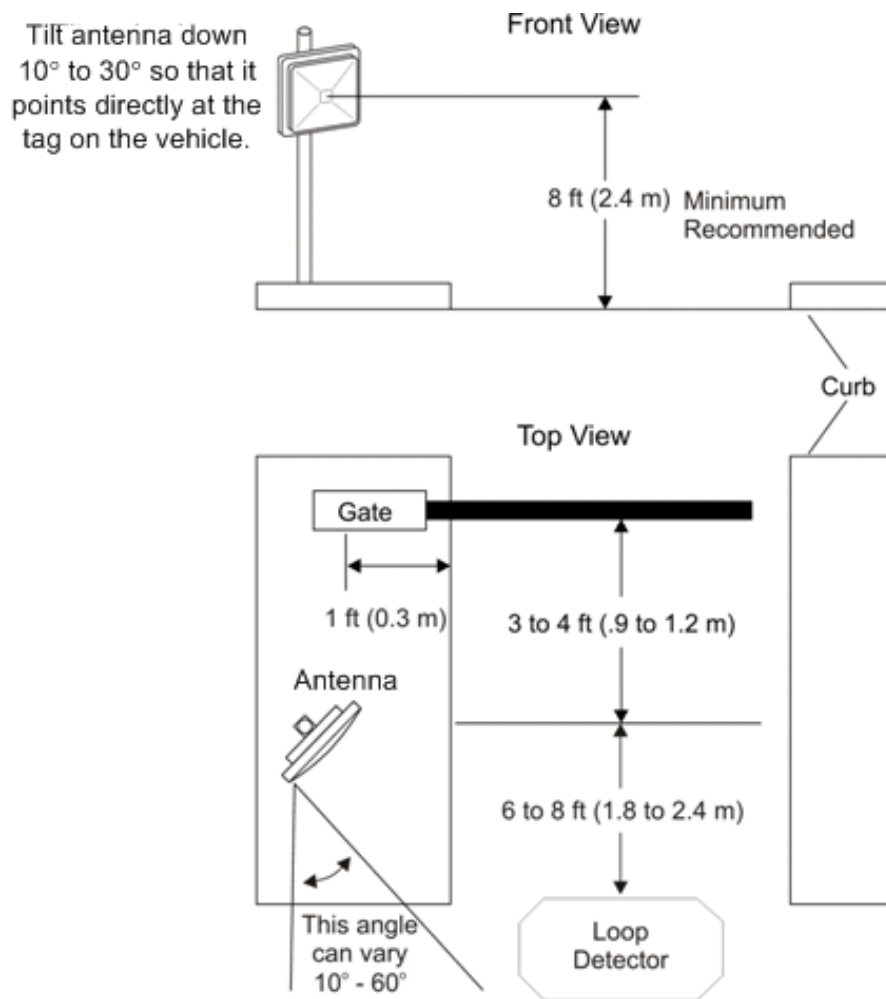
Use the following guidelines to mount an antenna on a curb-side round pole.

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 42 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.



SD-0145

Figure 42 Front and Top Views of the Curb-Side Antenna Position

Note: Determine the read zone before you tighten all screws and straps permanently. Refer to the section “[Marking the Read Zone](#)” on page 4-63.

After mounting the antenna, you must connect it to the Encompass 4 Reader. Follow the procedures described previously in the section “[Mounting the Antenna](#)” on page 4-49.



Caution

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

Note: The dimensions in [Figure 42](#) 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.

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

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

[Figure 43](#) illustrates an overhead-mounted antenna with approximate measurements for the read zone.

Note: Determine the read zone before you tighten all screws and straps permanently. Refer to the section “[Marking the Read Zone](#)” on page 4-63.

After mounting the antenna, you must connect it to the Encompass 4 Reader. Follow the procedures described previously in the section “[Connect the Reader and Antenna](#)” on page 4-36.

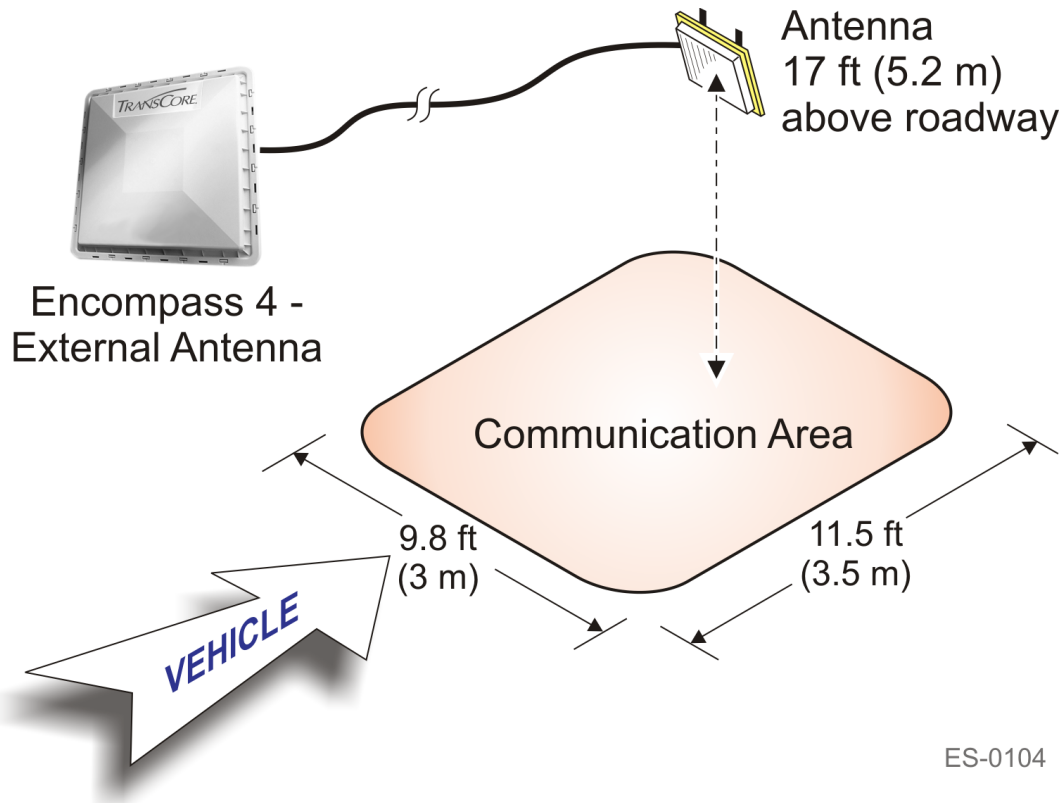


Figure 43 Encompass 4 Reader Installation with Overhead Antenna

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 4-36](#).

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 4-37](#).

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.

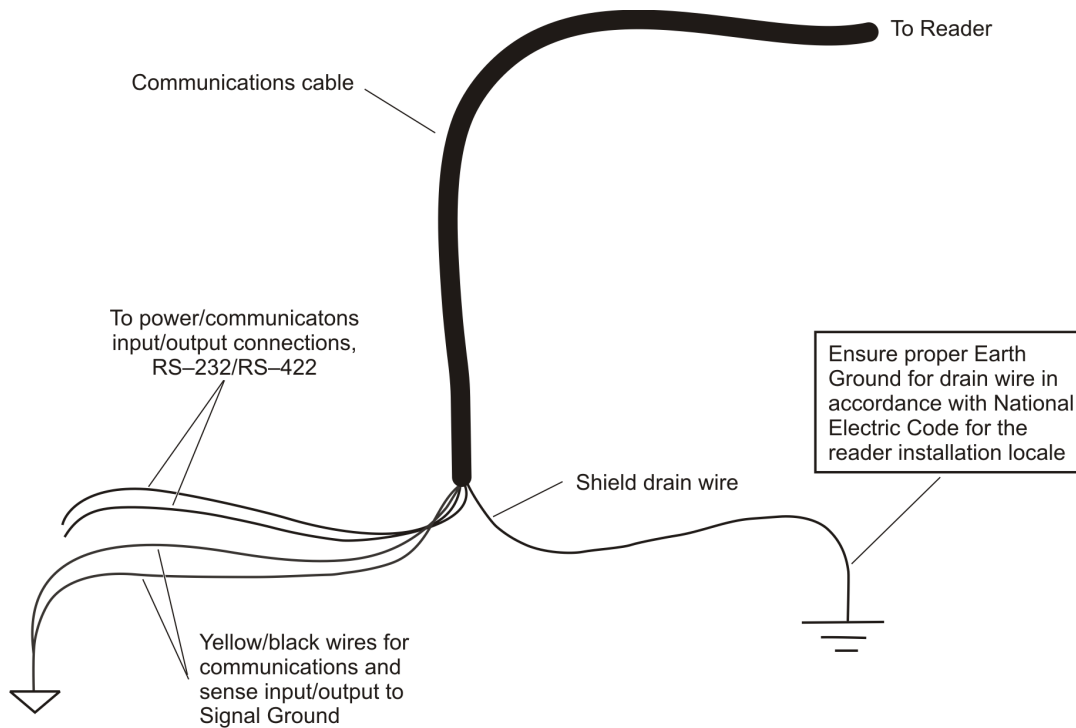


Caution

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 44).



WD-0082

Figure 44 Recommended Reader Cable Grounding



Caution

Do not ground the input power supply.

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

Connecting Communications

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 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 multi-wire 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 [“Pin Assignments for Signal to Host Connectors” on page 4-38](#).

Connecting the Encompass 4 Reader Colored-Wire Pair Cable

Table 11 shows the RS–232 colored wire (13-pair) assignments. To see the alternate wire (15-pair) assignments, refer to “Table 48 RS–232 Interface Signal Wiring for Alternate Wire 15-Pair Cable” on page C–1.

Table 11 RS–232 Interface Signal Wiring for Colored-Wire 13-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		
RxD — Encompass 4 Reader input, host output	Red/Black	Black	Pin 2	Pin 3
TxD — Encompass 4 Reader output, host input		Red	Pin 3	Pin 2
Signal ground	Yellow/Black	Yellow ^a or Black	Pin 5	Pin 7
Optional for hardware handshaking				
RTS — Encompass 4 Reader output, host input	Yellow/Red	Yellow	Pin 7	Pin 4
CTS — Encompass 4 Reader input, host output		Red	Pin 8	Pin 5

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

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

1. Connect the black wire (receive 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 (transmit 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 yellow² 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 7 of the DB9 connector or pin 4 of the DB25 connector.
2. Connect the red wire (CTS) from the yellow and red wire pair to pin 8 of the DB9 connector or pin 5 of the DB25 connector.

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

Note: When extending the RS-232 interface, use a three-pair cable such as Belden 2919. Use a twisted pair for the Black (Rx/D) with ground (Black of the Black and Yellow pair), and a twisted pair for Red (Tx/D) with ground (Black of the Black and Yellow pair). The third pair of the three-pair cable can be used for a spare in the event either of the other two pair are damaged or fail. The cable shield should be tied to a single-point Earth Ground on the controller end of the cable Refer to Figure 45.

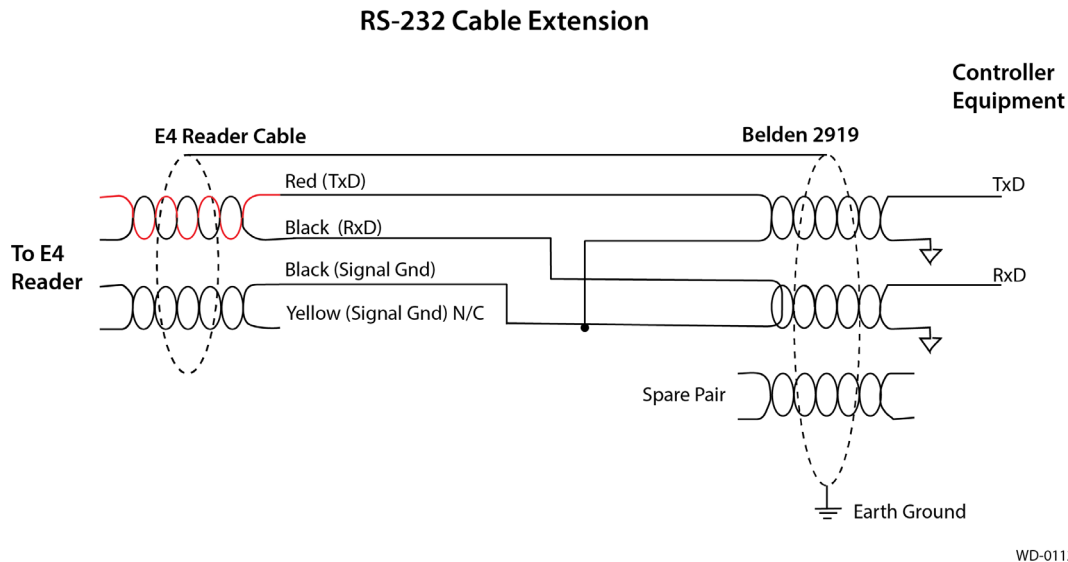


Figure 45 RS-232 Cable Extension Diagram

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 12 shows the RS-422 signals and their interface wires. To see the alternate wire (15-pair) assignments, refer to “Table 49 RS-422 Interface Signal Wiring for Alternate Wire 15-Pair Cable” on page C-2.

Table 12 RS-422 Interface Signal Wiring for Colored-Wire 13-Pair Cable

Signal from Encompass 4 Reader	Colored-Wire Pair Cable		Connect to DB9 Pin
	Wire Pair from Encompass 4 Reader	Color Used	
RS-422 Transmit positive	Yellow/Red	Yellow	Pin 7
RS-422 Transmit negative		Red	Pin 8
RS-422 Receive positive	Red/Black	Black	Pin 2
RS-422 Receive negative		Red	Pin 3
Signal Ground	Yellow/Black	Yellow or Black	Pin 5

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 13 shows the Wiegand signals and the interface wires for the 13-pair cable. To see the alternate wire (15-pair) assignments, refer to “Table 50 Wiegand Interface Signal Wiring for Alternate Wire 15-Pair Cable” on page C–2.

Table 13 Wiegand Interface Signal Wiring for Colored-Wire 13-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 ^a	Ground

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

To connect Wiegand interface

- 1. Connect the blue wire (data0) from the blue and red wire pair to the data0 wire of the Wiegand device.
- 2. Connect the red wire (data1) from the blue and red wire pair to the data1 wire of the Wiegand device.
- 3. Connect either the yellow or black³ 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.

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

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

and Black pair. Note that the black of the yellow/black is not connected. The third pair of the three-pair cable can be used for a spare in the event either of the other two pair are damaged or fail. The cable shield should be tied to a single-point Earth Ground on the controller end of the cable. Refer to Figure 46.

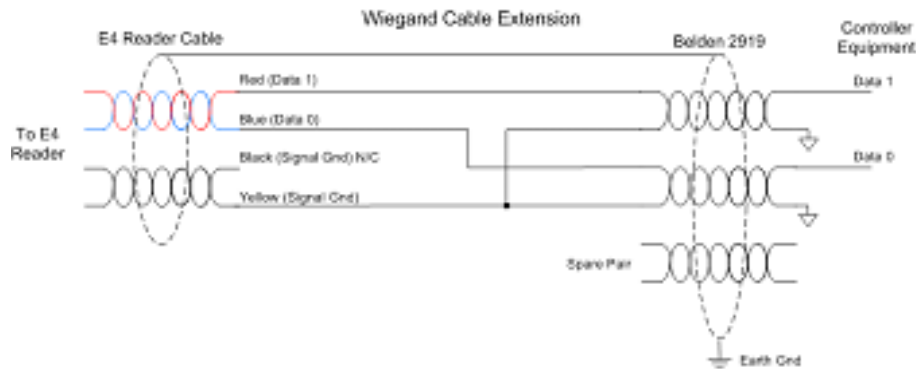


Figure 46 Wiegand Cable Extension Diagram



Warning!

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

Connecting Sense Input and 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 47, 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.

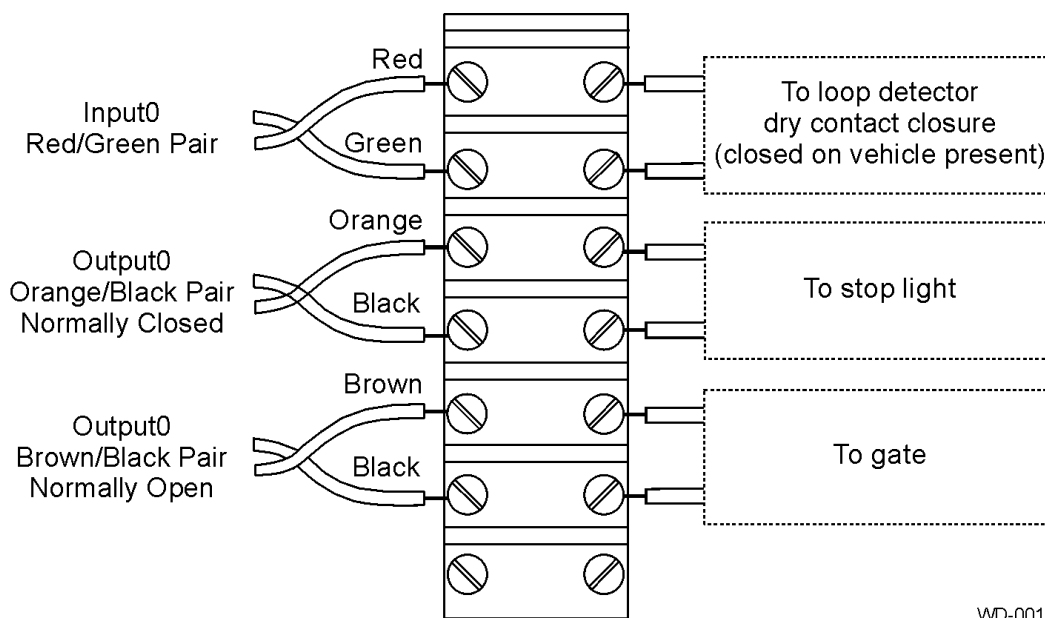


Figure 47 Sample Circuit Connections

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 48](#) shows this wiring.

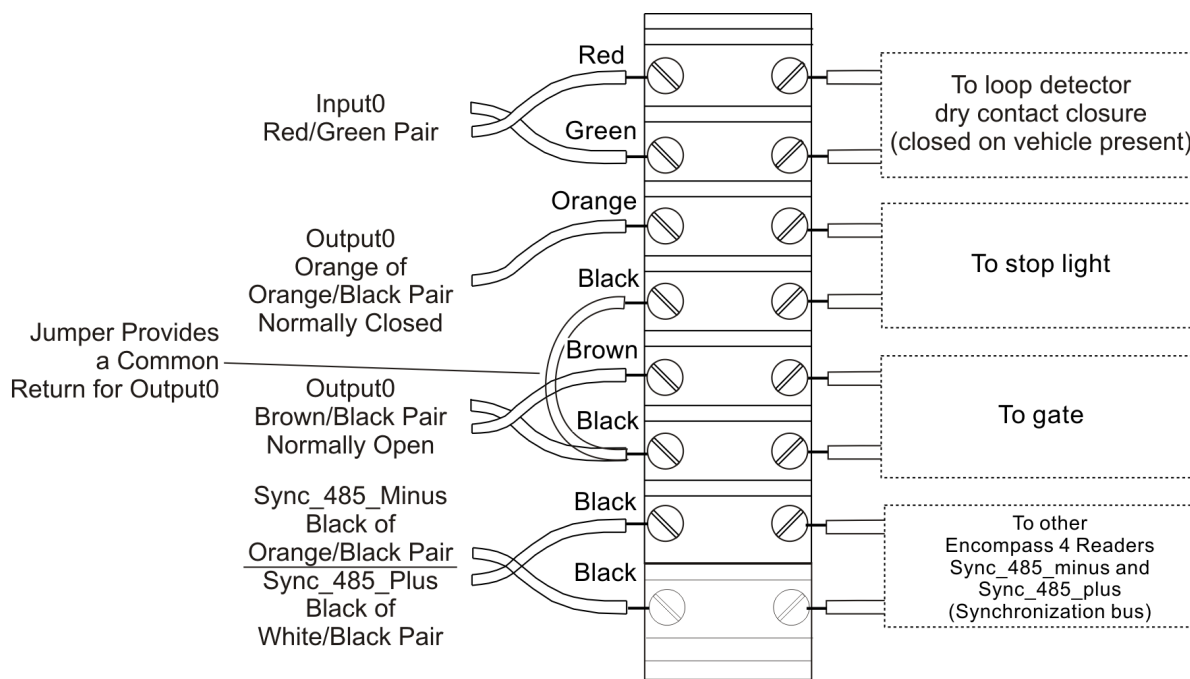


Figure 48 Sample Circuit Connections for IAG Installations

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 Vrms) or 60V DC at 1 A maximum. If controlling an external gate or device requiring high current, an isolation transformer is required.

As illustrated in [Figure 47](#), 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. Output0, NC, is located on the orange/black pair. Sense output0, NO, is located on the brown/black pair.

As shown in [Figure 48](#), 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 14](#) lists the cable descriptions and functions for the interface signals. These wire pairs can be used or terminated based on the specific project applications and site requirements. To see the alternate wire (15-pair) assignments, refer to “[Table 53 Sense Input/Output Cabling Assignments for Alternate Wire 15-Pair Cable](#)” on page C–4.

Using [Table 14](#) 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 14 Sense Input/Output Cabling 13-Pair Assignments

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

Table 14 Sense Input/Output Cabling 13-Pair Assignments

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

Table 14 Sense Input/Output Cabling 13-Pair Assignments

Pair	Pin	Color	Signal	Description	Typical Function
White/ Black	Z	Black	Sense Output1_ COM	Sense Output1, common terminal	Switched sense output
White/ Black	Z ^a	Black	Sync_485_P	RS-485 bus positive	Used to connect Encompass 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

a 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 8–145](#).

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 for testing with a sticker tag
- Audible circuit tester and 9V DC battery for circuit tester power as described in the section [“Bench Testing the Encompass 4 Reader Before Installation” on page 4-39](#).
- Piece of chalk or roll of tape
- Plastic or wooden yardstick for ATA or IAG tags
- Vinyl electrical tape or hook-and-loop material



Caution

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

Procedures

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

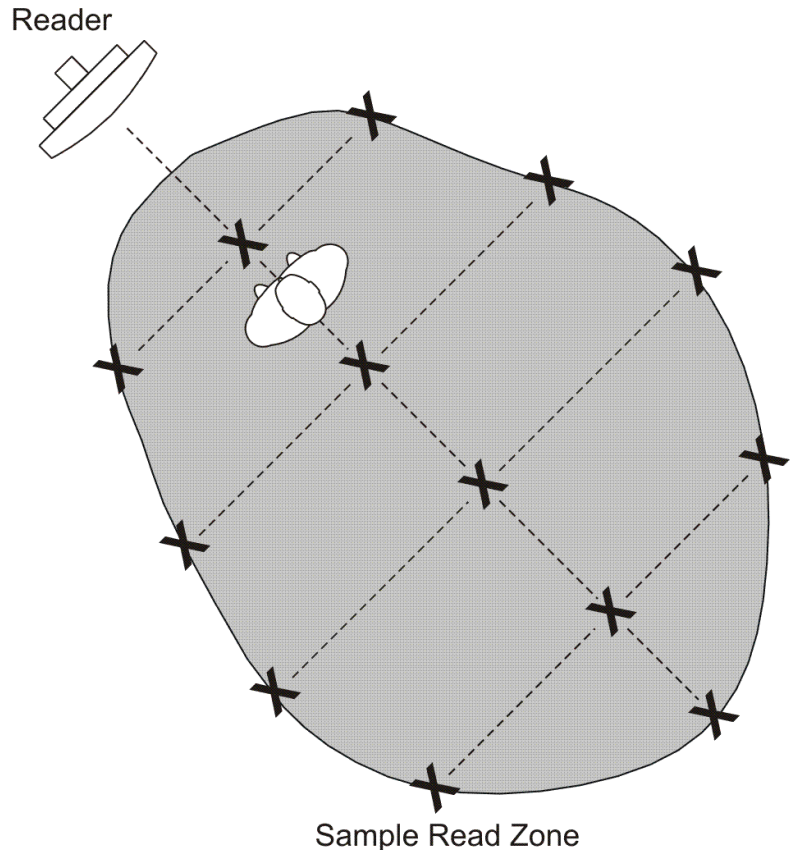
To mark the read zone

1. Confirm the following:
 - You have correctly connected the power supply as described in [“Connecting the AC Power Supply” on page 4-36](#) and [“Connecting the DC Power Supply” on page 4-37](#).
 - You have correctly connected communications as described in [“Connecting Communications” on page 4-55](#).
 - You have correctly connected sense input and sense output circuits as described in [“Sense Input Circuits” on page 4-59](#) and [“Sense Output Circuits” on page 4-61](#).
 - You have correctly connected 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.
2. Start the terminal emulation application.
3. Choose the com port to which the communications interface is attached and set the properties as:
 - Bits per second: 9600 baud
 - Data bits: 8
 - Parity: none
 - Stop bits: 1
 - Flow control: none
4. Cycle the power on the Encompass 4 Reader and ensure that the sign-on message displays.

Input the following commands in the order provided in “Table 10 Commands for Bench Testing” on page 4-40. Commands include those to switch to command mode, set operational mode, turn on RF, and return the reader to data mode.

5. Secure the ATA or IAG test tag to the end of the yardstick using electrical tape or hook-and-loop material or affix the test eGo Plus or eGo WST to the glass. Be sure the tag polarization (horizontal or vertical alignment) matches that of the Encompass 4 Reader or antenna used. If using an eGo Plus-type test tag or eGo WST, the glass should be in front of the tag (between the tag and the reader or antenna).
6. Stand directly in front of and about 5 feet (1.5 m) away from the Encompass 4 Reader or antenna (Figure 49). Hold the stick or the piece of glass so that the tag is positioned at a height and angle consistent with a tag installed on a vehicle. The test tag should cause the audible tester to sound. Additionally you can correctly mount a tag to a vehicle and verify tag read zone performance with the tag on the vehicle since some reflections can enhance the read zone distance.

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



ES-0039

Figure 49 Sample Read Zone Marking Pattern

7. Mark the spot with chalk or tape.
8. Move to the left until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.

9. Return to the center and then move to the right until the sound stops and mark the ground with chalk or tape at the location of the tag when the sound stopped.
10. Return to the center and step backward 2 feet (0.6m) and repeat steps 5 through 7.
11. Continue moving the tag in this manner, placing marks on the ground to identify the boundary of the read zone each time the sound stops. Continue moving the tag to various locations until the read zone is fully marked.
12. You can now connect the outer marks to draw the outer boundary of the read zone.

Figure 49 is a view of a sample read zone within a controlled lane. The outer X marks show the outside edges of the read zone.

Standing at the farthest point of the pattern, walk toward the Encompass 4 Reader or antenna and listen for a continuous sound from the audible tester. If the sound is not continuous, it could indicate a weak or “patchy” RF pattern. Refer to [“Fine-Tuning and Verifying the Read Zone” on page 8–145](#) to adjust the read zone.

Chapter 5 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 6 Communications Protocols](#)” on page 6–71 and “[Chapter 7 Commands](#)” on page 7–86 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 15](#) shows the basic structure of a four-character command.

Table 15 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 16 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. The command sequence verifies that communications are working correctly.

Table 16 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 first and fourth digits of the eight-digit number shown on the reader label.

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

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

Boot Failure Message

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

If the failure message version number equals 0.00 and no serial number exists, the flash memory checksum has failed, and the Encompass 4 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 5–69](#) 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.

Chapter 6 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 when using ECP. This interchange is completed by the message recipient returning a message acknowledgment to the message sender.

With ECP, all transmissions require a message. If a message is not received, the sender will time out with the same effect as if it had received a negative acknowledgment (from the host) or an `ERROR` message from the Encompass 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 8–145](#).

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 Configuring the Encompass 4 Reader](#)" on page 8–133 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 an ASCII CTRL-E character (hexadecimal 05). 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

<code><som></code>	Start-of-message (ASCII # character)
<code><seq></code>	Sequence number (ASCII hex) that represents an even number in the range 0–9, A–F (0, 2, 4, 6, 8, A, C, E). The Encompass 4 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.
<code><data></code>	An ASCII string up to 72 characters long. This string may contain tag data, a presence without tag report; an input status change report; an Error06, Error07, Error08, or Error11 message; or a sign-on message. Auxiliary data may also be included.
<code><crc></code>	Field containing four ASCII digits that represent the 16-bit CRC value calculated on the message. The CRC value is calculated on bytes between the som character and the first <code><crc></code> byte.

When the host receives a properly framed message, it can calculate a 16-bit CRC value. The calculation is applied to the character string that immediately follows the <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 Encompass4 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 TOF 0, to indicate Wiegand mode enabled for a #532 Display Wiegand Mode Status command.

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

Timing and Synchronization

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

The Encompass 4 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 acknowledgment message, a logical NAK condition is declared, and the initiator assumes the message was received in error. In this instance, the message is retransmitted until an acknowledgment message is received.

The message recipient, such as the host computer in data mode and the Encompass 4 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. One Technique to enhance the tag reading and avoid having to go into command mode is to enable Command #831 for the automatic periodic RF status report. Refer to "831 Enable Automatic Periodic RF Status Report" on page 7–131.*

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,    0xa1eb,    0xd10c,    0xc12d,    0xf14e,    0xe16f,
```

```

0x1080, 0x00a1, 0x30c2, 0x20e3, 0x5004, 0x4025, 0x7046, 0x6067,
0x83b9, 0x9398, 0xa3fb, 0xb3da, 0xc33d, 0xd31c, 0xe37f, 0xf35e,
0x02b1, 0x1290, 0x22f3, 0x32d2, 0x4235, 0x5214, 0x6277, 0x7256,
0xb5ea, 0xa5cb, 0x95a8, 0x8589, 0xf56e, 0xe54f, 0xd52c, 0xc50d,
0x34e2, 0x24c3, 0x14a0, 0x0481, 0x7466, 0x6447, 0x5424, 0x4405,
0xa7db, 0xb7fa, 0x8799, 0x97b8, 0xe75f, 0xf77e, 0xc71d, 0xd73c,
0x26d3, 0x36f2, 0x0691, 0x16b0, 0x6657, 0x7676, 0x4615, 0x5634,
0xd94c, 0xc96d, 0xf90e, 0xe92f, 0x99c8, 0x89e9, 0xb98a, 0xa9ab,
0x5844, 0x4865, 0x7806, 0x6827, 0x18c0, 0x08e1, 0x3882, 0x28a3,
0xcb7d, 0xdb5c, 0xeb3f, 0xfb1e, 0x8bf9, 0x9bd8, 0xabbb, 0xbb9a,
0x4a75, 0x5a54, 0x6a37, 0x7a16, 0x0af1, 0x1ad0, 0x2ab3, 0x3a92,
0xfd2e, 0xed0f, 0xdd6c, 0xcd4d, 0xbdaa, 0xad8b, 0x9de8, 0x8dc9,
0x7c26, 0x6c07, 0x5c64, 0x4c45, 0x3ca2, 0x2c83, 0x1ce0, 0x0cc1,
0xef1f, 0xff3e, 0xcf5d, 0xdf7c, 0xaf9b, 0xbfba, 0x8fd9, 0x9ff8,
0x6e17, 0x7e36, 0x4e55, 0x5e74, 0x2e93, 0x3eb2, 0x0ed1, 0x1ef0,
};

```

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

```

#include <stdio.h>

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

```

```

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

```

Manually Disabling ECP for Maintenance

Under certain conditions, communications between the host and Encompass 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@` `` `<eom>

where

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

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

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



Caution

To avoid damage to the Encompass 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

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, command, and download. 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 7-75](#).

See commands [“611 Select Error Correcting Protocol” on page 7-114](#) and [“613 Enable Data Inquiry Protocol” on page 7-115](#).

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. 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 [“Download Mode” on page 7–87](#) for listings of commands in numerical and alphabetical order.

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

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

Reader Mode Control — Command Group 0

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

00 Switch to Data Mode (Factory Default)

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



Caution

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

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

Command #01 Switch to Command Mode

Reader response:

Done

01 Switch to Command Mode

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

Reader response:

Done

Command Group 1 – Communications Port Control

Group 1 commands configure the parameters used by the Encompass 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

See “522 Display Communications Port Parameters” on page 7–103.

Command #100N selects the reader baud rate. The factory-default setting is 9600 baud. The N variable specifies the baud rate shown in [Table 17](#).

Table 17 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 “40 Transmit All ID Codes” on page 7–81.

Reader response:

Done

101N Select Stop Bits

See “522 Display Communications Port Parameters” on page 7–103

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 18](#).

Table 18 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 19](#). See “[522 Display Communications Port Parameters](#)” on [page 7–103](#).

Table 19 Select Parity Commands

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

Reader response:

Done

Command Group 2 – Real-Time Clock

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

20 Set Time

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

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

where

HH represents hours (00 to 23).

MM represents minutes (00 to 59).

SS represents seconds (00 to 59).

hh represents hundredths of a second (00 to 99).

:

is the time delimiter.

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

Reader response:

Done

21 Set Date

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

21MM/DD/YY

where

MM represents the month (01 to 12).

DD represents the day (01 to 31).

YY represents the last two digits of the year (00 to 99).

/ is the date delimiter.

Reader response:

Done

22 Display Time and Date

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

Reader message:

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

where

HH represents hours.

MM represents minutes.

SS represents seconds.

hh represents hundredths of seconds.

: is the time delimiter.

MM represents the month.

DD represents the day.

YY represents the last two digits of the year.

/ is the date delimiter.

Command Group 3 – Append Information

Group 3 commands append useful information to reader transmissions, such as IDs, error messages, and sensor input reports. Auxiliary information such as reader number, antenna number (or manual entry code), number of times the previous tag was read, and sensor input status can be appended to the ID using the Group 3 commands. See command [“524 Display Appended Information Status” on page 7–104](#).

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 20](#).

Table 20 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 21](#).

Table 21 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 7–105 . These values are inverted if input inversion is enabled with command 6941.

Reader response:

Done

320 Disable EAC Page Append (Factory Default)

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

Reader response:

Done

321 Enable EAC Page Append

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

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

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

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

Reader response:

Done

Command Group 4 – ID Filtering

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

40 Transmit All ID Codes

See also “530 Display RF0 Filter Status” on page 7–109.

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

In Diagnostics Mode (#40), #621 still causes the output to go active once for a valid, unique ID “Scroll Mode.” Refer to “621 Select Predefined Output Control (Factory Default)” on page 7–116.

After diagnostics are complete, you may want to reinstate the uniqueness check using command “410N Select Unique ID Code Criteria (Anti-passback Feature)” on page 7–81. This setting will be stored upon entering #00 and will be retained over the power cycle. Refer to “00 Switch to Data Mode (Factory Default)” on page 7–75.

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

Reader response:

Done

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

See “530 Display RF0 Filter Status” on page 7–109, “440 Reset Uniqueness” on page 7–95, and “44N Set Uniqueness Timeout” on page 7–96.

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 22.

Table 22 Unique ID Code Criteria

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

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

Item 1 Most recently acquired ID

Item 2 Second-most recently acquired ID

Item 3 Third-most recently acquired ID

Item 4 Fourth-most recently acquired ID

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

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

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

Reader response:

Done

420N Select Valid ID Code Criteria

See “530 Display RF0 Filter Status” on page 7–109.

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

Table 23 Select Valid Code Commands and Frames

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

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

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

440 Reset Uniqueness

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

44N Set Uniqueness Timeout

See “440 Reset Uniqueness” on page 7–95.

Places a time limit on the uniqueness criterion set. Refer to “410N Select Unique ID Code Criteria (Anti-passback Feature)” on page 7–81. The parameter N sets the number of minutes on the timeout clock. The factory setting is two minutes (N = 1).

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

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

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

450 Disable Wiegand Mode (Factory Default)

Command #450 is a default set in the factory to disable Wiegand mode. To display status, use Command “532 Display Wiegand Mode Status” on page 7–110.

Reader response:

Done

451 Enable Wiegand Mode

Command #451 enables Wiegand mode, which allows the reader to transmit data in a format that emulates the output of a magnetic card reader. To display status, use Command “532 Display Wiegand Mode Status” on page 7–110.

Enabling Wiegand inhibits the output relay function. Refer to “621 Select Predefined Output Control (Factory Default)” on page 7–116. Command #621 is inhibited with Wiegand enabled.

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

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

Reader response:

Done

452 Disable Tag Translation Mode (Factory Default)

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

Reader response:

Done

453 Enable Tag Translation Mode

See [“534 Display Tag Translation Mode Status” on page 7–110](#).

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

NOTE: Tag Translation is Inhibited when Command #40 is enabled. (Refer to [“40 Transmit All ID Codes” on page 7–81](#).)

Reader response:

Done

454 Enable Multi-tag Sort

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

See [“570 Display Tag Protocols” on page 7–112](#).

Reader response:

Done

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

455 Disable Multi-tag Sort (Factory Default)

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

Reader response:

Done

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

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

Reader response:

Done

457 Disable eGo Plus Tag Initialization During Multi-tag Sort

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

Reader response:

Done

458 Disable Second Alternate Group Select (Factory Default)

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

Reader response:

Done

459 Enable Second Alternate Group Select

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

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



Caution

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

Reader response:

Done

46NN Set Wiegand Retransmit Interval

See “533 Display Wiegand Retransmit Interval” on page 7–110.

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

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

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

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

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

Reader response:

Done

For commands 480 through 489, see [“570 Display Tag Protocols” on page 7–112](#).

480 Disable ATA

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

481 Enable ATA

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

482 Disable eGo

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

483 Enable eGo

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

484 Disable SeGo

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

485 Enable SeGo

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

486 Disable IAG

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

487 Enable IAG

[“00 Switch to Data Mode \(Factory Default\)” on page 7–75](#)

Command #487 enables the reader to read IAG protocol data from tags if the reader is programmed to read this tag protocol. This command should be used in conjunction with [“648NN Set Synchronization Output Delay Time” on page 7–123](#) and [“648NN Set Synchronization Output Delay Time” on page 7–123](#).

488 Disable eATA

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

489 Enable eATA

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

490 Disable Third Alternate Group Select (Factory Default)

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

Reader response:

Done

491 Enable Third Alternate Group Select

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

“Fast” 13, 14, 17 = 46,54,06



Caution

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

Reader response:

Done

Table 24 Alternate Group Select

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

See “549 Display User-Programmable Group Select Equals (GSE) Filter Data” on page 7–111.

492 Disable Fourth Alternate Group Select (Factory Default)

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

Reader response:

Done

493 Enable Fourth Alternate Group Select

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

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



Caution

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

Reader response:

Done

494 Disable Fifth Alternate Group Select (Factory Default)

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

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

Reader response:

Done

495 Enable Fifth Alternate Group Select

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



Caution

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

Reader response:

Done

496 Disable Alternate Group Select (Factory Default)

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

Reader response:

Done

497 Enable Alternate Group Select

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

Reader response:

Done

Command Group 5 – Reader Status

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

505 Display Software Version

See “695S...S Set Serial Number” on page 7–129

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

Reader message:

Model E4 Series Ver X.XX SNSSSSSS

where

X.XX Version number

SSSSSS Serial number of the unit, skipping the fourth character printed on the reader product label

506 Display Hardware Configuration Information

See “696S...S Store Hardware Configuration String” on page 7–129

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 (#1002)
B3	2400 baud (#1003)
B4	4800 baud (#1004)
B5	9600 baud (factory default) (#1005)
B6	19.2 kbps (#1006)
B7	38.4 kbps (#1007)
S0	one stop bit (factory default) (#1010)

S1	two stop bits (#1011)
P0	no parity (factory default)
P1	even parity (#1020)
P2	odd parity (#2021)
D0	00 ms end-of-line delay (fixed) (#1022)

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

```
MAIN B5 S0 P0 D0
```

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

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

524 Display Appended Information Status

Command #524 displays the information being appended to the reader transmissions. Command #31N appends information.

Reader message:

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

where

T0	Time not appended
T1	Time appended (not valid for the Encompass 4 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 Display Communications Protocol Status” on page 7–105, “610 Select Basic Communication Protocol (Factory Default)” on page 7–114, Command “614N Select Flow Control Option” on page 7–115, and Command “612NN Select Error Correcting Protocol Timeout” on page 7–114.

Reader response:

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

where

P0	Basic protocol enabled (factory default)
P1	ECP enabled
P2	data inquiry protocol enabled
Txx	ECP timeout where xx = 01 to FE (hexadecimal) Timeout (ms) = 50 * xx If xx = FF timeout disabled
X0	Flow control disabled
X1	Software flow control enabled (factory default)
X2	Hardware flow control enabled
S0	start of message character is #

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

```
ECPS P0 TFE X1 S0
```

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

526 Display I/O Status

See “620N Set Output Control” on page 7–116, “621 Select Predefined Output Control (Factory Default)” on page 7–116, “67N Set Output Pulse Duration” on page 7–125.

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

Reader response:

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

C0	Host controls outputs
C1	Predefined output mode
O0	Both outputs off
O1	Output0 on
O2	Output1 on
O3	Both outputs on

I0	Both inputs false
I1	Input0 true
I2	Input1 true
I3	Both inputs true
D0	4 ms output pulse duration
D1	8 ms output pulse duration
D2	12 ms output pulse duration
D3	16 ms output pulse duration
D4	20 ms output pulse duration
D5	24 ms output pulse duration
D6	32 ms output pulse duration
D7	40 ms output pulse duration
D8	48 ms output pulse duration
D9	60 ms output pulse duration
DA	76 ms output pulse duration
DB	152 ms output pulse duration
DC	228 ms output pulse duration (factory default)
DD	300 ms output pulse duration
DE	376 ms output pulse duration
DF	752 ms output pulse duration

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

Table 25 shows the output0 and output1 open/closed conditions for the output status displays.

Table 25 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 26 shows the output0 and output1 open/closed conditions for the output status displays for readers in IAG applications.

Table 26 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 27 shows the input0 and input1 open/closed conditions for the input status displays.

Table 27 Open/Closed Conditions for Input Status

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

527 Display RF Status

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

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

Reader message:

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

where

C0 RF controlled by host (#6400, #6401)

C1 **RF controlled by presence sensor on input0, the red/green pair (factory default) (#641)**

O0 RF off (#6400)

O1 RF on (#6401)

T1 Uniqueness timeout of two minutes (#441)

T2	Uniqueness timeout of 15 seconds (#442)
T3	Uniqueness timeout of 30 seconds (#443)
Fxxx	RF output frequency, xxx = 000 to 118 hexadecimal offset in 250 kHz from 860 MHz. If an invalid frequency value is stored (corrupted NVRAM), then xxx = “XXX” to indicate an error in the frequency setting (#647xxx or #642NN).
Rxx	Tag decoder range (distance) for ATA tags, xx = 00 to 1F hexadecimal range value (#643NN, 1F = Max RNG)
Gxx	Tag decoder range (distance) for eGo and eGo Plus tags, xx = 00 to 1F hexadecimal range value (#645NN, 1F = Max RNG)
Axx	RF power attenuation, where 00 is maximum output power and 0A is minimum output power (10dB less than maximum power) (#644NN).
Ixx	IAG RF power attenuation, where 00 is maximum output power and 0F is minimum output power (15 dB less than maximum power) (#646NN)

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

```
RFST C1 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) (#6900)
P1	Presence without tag reports enabled (#6901)
D0	Minimum presence true period of 0 ms (fixed)
A0 (#692N)	RF off on timeout only (#6920)
A1 (#692N)	RF off on timeout or tag (#6921)

A2 (#692N)	RF off on timeout or presence condition false (factory default) (#6922)
T0 N=0	RF timeout of 0 ms (always expired) (#693N)
T1	4 ms (#6931)
T2	8 ms (#6932)
T3	12 ms (#6933)
T4	20 ms (#6934)
T5	24 ms (#6935)
T6	32 ms (#6936)
T7	48 ms (#6937)
T8	60 ms (#6938)
T9	92 ms (#6939)
TA	152 ms (#693A)
TB	300 ms (#693B)
TC	452 ms (#693C)
TD	600 ms (#693D)
TE	752 ms (#693E)
TF	RF timeout infinite, never expires (factory default) (#693F)
IO	input inversion disabled (factory default) (#6940)
I1	input inversion enabled (#6941)

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

```
PRST P0 D0 A2 TF IO
```

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

530 Display RF0 Filter Status

Command #530 displays the parameter set for the RF input, including the selected unique ID code criteria (#410N Select Unique ID Code Criteria) and the valid ID code criteria (see “[420N Select Valid ID Code Criteria](#)” on page 7–95).

Reader message:

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

where

U0	One ID separation (factory default) (#4100)
U1	Two ID separations (#4101)
U2	Three ID separations (#4102)
U3	Four ID separations (#4103)
U4	Transmit all ID Codes (#40)

V0	Valid ID code criteria of one acquisition (#4200)
V1	Valid ID code criteria of two acquisitions (#4201)
V2	Valid ID code criteria of three acquisitions (#4202)
V3	Valid ID code criteria of four acquisitions (#4203)

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

```
RF0S U0 V0
```

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

532 Display Wiegand Mode Status

See “[450 Disable Wiegand Mode \(Factory Default\)](#)” on page 7–96 and “[451 Enable Wiegand Mode](#)” on page 7–96.

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

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

where

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

533 Display Wiegand Retransmit Interval

See command “[46NN Set Wiegand Retransmit Interval](#)” on page 7–98, “[46NN Set Wiegand Retransmit Interval](#)” on page 7–98.

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 7–97 and “[453 Enable Tag Translation Mode](#)” on page 7–97 for more information.

Reader message:

TT <0 to 1>

where

0 tag translation mode disabled

1 tag translation mode enabled

537 Display Echo Status

Command #537 displays echo mode status. In basic protocol (#610 Select Basic Protocol), the reader may be configured to enable (#6171 Enable Echo Mode) or disable (#6170 Disable Echo Mode) the echo of received commands. Refer to sections [“6170 Disable Echo Mode” on page 7–115](#) and [“6171 Enable Echo Mode \(Factory Default\)” on page 7–116](#) 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

See [“697 Set User-Programmable Group Select Equals \(GSE\) Filter” on page 7–130](#).

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 7–130](#)) was sent to a given reader, the response to the #549 query command would be:

```
#A4 0A 0005014202024133
```

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

560 Request Sensor Status Change

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

Reader message:

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

where

E0	Input status change reports disabled (factory default)
E1	Input status change reports enabled
M0	Reporting disabled (factory default)
M1	Changes on input0 reported
M2	Changes on input1 reported
M3	Changes on either input reported

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

```
SSTC E0 M0
```

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

570 Display Tag Protocols

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

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

where

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

Table 28 Display Operating Status Mode

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

577 Report Buffered Handshakes

Command #577 reports the buffered handshakes.

Reader message:

XX

where

XX is number of handshakes

582 Display Synchronization Values

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

Reader Response:

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

Where

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

Command Group 6 – Reader Control Functions

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

60NN Set Reader ID Number

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

where

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

Reader response:

Done

610 Select Basic Communication Protocol (Factory Default)

See “525 Display Communications Protocol Status” on page 7–105.

Command #610 enables the basic communications protocol. Refer to “Basic Protocol” on page 6–72 for more information.

Reader response:

Done

611 Select Error Correcting Protocol

See “525 Display Communications Protocol Status” on page 7–105.

Command #611 enables the error correcting protocol. Refer to “Basic Protocol” on page 6–72 for more information.

Reader response:

Done



Caution

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

612NN Select Error Correcting Protocol Timeout

See “525 Display Communications Protocol Status” on page 7–105, “610 Select Basic Communication Protocol (Factory Default)” on page 7–114, and “611 Select Error Correcting Protocol” on page 7–114.

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

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

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

The value for NN specifies the timeout interval as follows:

ms 50 * NN for NN = 01 to FE (1–254)

FE Factory default (12,700 ms, 12.7 seconds)

FF Disables the ECP timeout

Reader response:

Done

Enter **CTRL_E** to get data.



Caution

Ensure that the ECP timeout is sufficient for a given baud rate. See “Timing and Synchronization” on page 6–78.

613 Enable Data Inquiry Protocol

Command #613 enables the data inquiry protocol. Refer to “410N Select Unique ID Code Criteria (Anti-passback Feature)” on page 7–81, “410N Select Unique ID Code Criteria (Anti-passback Feature)” on page 7–94 for more information.

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

Reader response:

Done

614N Select Flow Control Option

Command #614N selects the flow control option for reader-to-host communications. The factory default setting is software flow control (XON/XOFF) enabled. In download mode, flow control is not host-selectable; it is fixed at the default setting. However, during data mode and command mode operation, the following flow control options are available. The N variable specifies flow control as shown in Table 29.

Table 29 Flow Control Commands

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

Reader response:

Done

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

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

6170 Disable Echo Mode

Command #6170 disables the reader’s echo of received host commands. If operating in basic protocol or data inquiry protocol, the reader echoes by default. As the reader receives a host command, it echoes each character of the command. Once the entire command has been received and processed, the reader transmits its response. If echoing is disabled with command #6170, the reader does not echo

the command, but only transmits its response. The reader never echoes while in ECP or download mode operation.

Reader response:

Done

6171 Enable Echo Mode (Factory Default)

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

Reader response:

Done

620N Set Output Control

See “526 Display I/O Status” on page 7–105 and “621 Select Predefined Output Control (Factory Default)” on page 7–116.

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 30. Receipt of any #620N command automatically disables command #621 Predefined Output Control.

Table 30 Output Control Commands

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

Reader response:

Done

621 Select Predefined Output Control (Factory Default)

See “410N Select Unique ID Code Criteria (Anti-passback Feature)” on page 7–81.

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

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

Reader response:

Done

63 Reset Reader

See “526 Display I/O Status” on page 7–105, “620N Set Output Control” on page 7–116, and “67N Set Output Pulse Duration” on page 7–125.

Command #63 resets the power fail bit, stores non-volatile memory (NVM) parameters, clears all buffers, resets tag uniqueness, turns off both output lines, transmits the sign-on message, and returns to the data mode.

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

Reader response:

Model E4 Series Ver X.XX SNSSSSSS

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where

X.XX Version number

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

640N RF Control

Command #640N directly controls the RF module. The N value controls the RF power as shown in Table 31.

Table 31 RF Control Commands

Command	RF State
6400	Turns off RF
6401	Turns on RF

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

Reader response:

Done

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

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

Reader response:

Done