encompass⁴

Quick Start Guide

Two easy ways to contact us:

- Call Dealer Technical Support at 214 461 6449
- Visit us on the Web at www.transcore.com/rfidsupport

TransCore

3410 Midcourt Road,
Suite 102
Carrollton, TX 75006

TransCore

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Driving inefficiencies out of surface transportation through innovative solutions

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FCC Site Licensing

Because Encompass® 4 Readers radiate more than 3 milliwatts of RF power; their use requires licensing under Federal Communications Commission (FCC) Section 90.239.

An FCC license provides the user with the legal authorization to operate the Encompass 4 Reader on the licensed frequencies at the site specified in the license. The FCC license also provides the user with protection and authorization to maintain the system should any other RFID product be used in the licensed area after the Encompass 4 Reader equipment is installed.

The site owner must complete and file form 601, FCC Application for Wireless Telecommunications Bureau Radio Service Authorization. Forms are available online at the FCC internet site *http://www.fcc.gov/formpage.html*.

The authorized frequency band for this product in the United States is 911.75 to 919.75 MHz. Only an authorized installer or service technician should set the RF frequency of the Encompass 4 Reader to the frequency specified in the FCC site license.

More Troubleshooting

When performing a quick test of the Encompass 4 Reader, the buzz box does not buzz.
Check all your wiring connections, and ensure that your buzz box is functioning. You could find more than one red wire, more than one black wire, and so on. You must connect the correct red and white wire pair to the leads from the battery. Verify that RF is on (#6401). Verify that tag uniqueness is NOT on (#40).

When testing the Encompass 4 Reader, all the wires are connected correctly but the unit does not respond.
Check that the Encompass 4 Reader communication cable is connected to the correct COM port. Verify that the reader is in the correct tag read mode (#48N). Contact Technical Support.

Strange signal responses come from the Encompass 4 Reader when tested with the PC.
Ensure that the reader is in the correct interface mode for the test tag, that is, Wiegand mode for a Wiegand tag.

Nothing happens when the test tag is passed in front of the Encompass 4 Reader.
Ensure that the Encompass 4 Reader is powered on and is in predefined output mode. (#621). Verify that the reader is in the correct tag read mode (#48N). Verify that the reader is set to RF ON (#6401)

The Encompass 4 Reader came from another site and does not work the way the factory defaults indicate that it should.
Different commands were probably used to support the other site. You can restore the defaults by issuing command #66F. The factory defaults will be restored except for RF operating frequency.

If using ATA-only version (10-40xy-008) of the Encompass 4 Reader, use continuous wave frequencies. These are 902.25 – 903.75 MHz and 910.00 – 921.50 MHz.

NOTE: *The Encompass 4 Reader's #642NN command, Set RF Operating Frequency can be used where backward compatibility with Encompass 2 or AI1620 Readers is necessary. The #642NN command sets RF in 0.5 MHz steps.*

Common Problems – Potential "Gotchas"

Frequency interference between readers
Frequency interference may be caused by incorrect spacing and angle of readers, incorrect frequency assignment, objects or changes in the environment, incorrect RF power settings, etc. See pages 2, 3, and 4.

Communications problems between the reader and backend host
These problems may be caused by incorrectly wiring the communications cable, using the wrong cable, having a too-long cable run, or incorrectly setting communications parameters between host and reader. See pages 5, 6, and 7.

Cable run for RS–232 exceeds 50 feet in length
Fifty feet exceeds the maximum length for RS–232 interface. The interface should be converted to RS–422, wireless modem, fiber optic, or Wiegand. If in a noisy environment or running long cable lengths, you may need to reduce the baud rate.

Long RF cable runs to antennas
For the external antenna-series Encompass 4 readers, long RF cable runs between the reader and the antenna may cause signal degradation or loss. This scenario may be site-specific, but TransCore recommends limiting antenna cable runs to 35 feet.

RF is not on
The technician must verify that RF is on by presence or on continuously. Command # 527 may be used to verify RF status. See page 14.

Improper grounding
All reader brackets should be earth grounded and cable shielding should be chassis grounded to prevent damage from lightning or power surges.

Mixed tag population
In a mixed tag population, multiple tags in the same vehicle must be separated by at least 2 inches, preferably a greater distance.

Reader not programmed correctly
The technician must verify that all parameters are set appropriately for the reader location. Command # 527 may be used to verify reader parameters. If tags are Wiegand, the technician can use commands # 532 and #533 to verify Wiegand status.

Readers pointed towards each other
Readers must not be "aimed" directly facing each other or be in close proximity back-to-back. See pages 1 through 4.

Tag presentation
Tags must be properly mounted in a location determined by the reader placement. See page 2.

Tag-to-reader polarization
Tag polarization must match reader polarization. Tag and reader must be installed horizontally polarized.

Only authorized TransCore Encompass 4 Reader dealers, installers, or service personnel should attempt to install Encompass 4 Readers. Once the system is set up and tested by the authorized installer, Encompass 4 Reader operation requires no end-user intervention.

Start with Site Design

You should develop your site plan BEFORE applying for FCC approval, ordering equipment, and installing the Encompass 4 Reader. Factors to be considered include tag type, reader and tag alignment, reader mounting requirements, site layout and traffic flow, and electrical and communications requirements. If your site configuration differs significantly from the recommendations below, contact your TransCore sales representative. Reader/tag choice and site planning is discussed in detail in the *Encompass® 4 Reader System Guide*.

Determining Right Reader and Tag Combination

What type of tags are you going to read? If eGo® Plus, eGo, ATA, Inter-Agency Group (IAG), or combinations of two protocols, then the Encompass 4 is the correct reader to use.

How are the tags formatted? Are they ASCII (full or half-frame) or Wiegand tag format? If Wiegand, then is it 26, 37, 54, or other bit configuration? This will determine the tag read mode for your reader.

If an external antenna is required for increased signal strength, you should use the Encompass 4.

Encompass 4 Reader Features

Reader Model	Protocol(s)	Wiegand	Antenna		Communication	
			Internal	External	RS-232	RS-422
10-40xy-008	ATA	✓	✓	✓	✓	✓
10-40xy-001	SeGo	✓	✓	✓	✓	✓
10-40xy-019	IAG	✓	✓	✓	✓	✓
10-40xy-002	ATA/SeGo	✓	✓	✓	✓	✓
10-40xy-010	ATA/IAG	✓	✓	✓	✓	✓
10-40xy-004	SeGo/IAG	✓	✓	✓	✓	✓
10-40xy-009	eGo/ATA	✓	✓	✓	✓	✓
10-40xy-003	eGo/SeGo	✓	✓	✓	✓	✓

Where   x = 0 (internal antenna), x = 1 (external antenna)
        y = 2 (RS–232), y = 4 (RS–422)

Reader Placement

Encompass 4 readers may be mounted on a pole at the side of the lane (side fire) or mounted on a gantry or surface extending over the center of the lane (overhead). You must position the Encompass 4 Reader, which contains an internal antenna, or the antenna for the Encompass 4, so that the RF signal can travel to and return from the tags within the desired read area or "footprint." Locate

the reader where it is not likely to be bumped out of alignment. Encompass 4 Readers should not directly face each other or be positioned back-to-back.

For a pole mount installation, install the reader as high as possible so that you can point the reader down to control the read zone and minimize interference in the adjacent lane.

Tag Placement

Reader location determines tag placement in the windshield. Overhead readers require a center-mounted tag; readers on the side of the lane require that tags are placed on the nearest side of the windshield.

Site Layout, Lane Type, and Traffic Flow

It is important to know the configuration of the site and its proximity to other sites in order to develop a correct site plan as well as a workable frequency plan. Will the lanes be AVI only, or will the lanes also have ticket machines, proximity readers, or other in-lane equipment?

The number of lanes at the site, how they are grouped, and number of total entry and exit points determine the number of readers required and the distance between readers. You must determine the lane widths and the distance between adjacent lanes, taking into account any island/barrier width. TransCore recommends that, for the Encompass 4, the lane width with barrier be at least 12 feet.

Interfaces to External Loops, Gates or Converters

For the best lane layout and transaction framing, the distance from the entry loop to the reader should normally be no more than about 8 feet with the distance from the reader to the gate arm not exceeding an additional 3 to 4 feet. In most cases, the reader will be positioned before the gate.

With this defined read area (frame), it is very difficult for a non-tagged vehicle to sit in front of the gate and be admitted by a following car (the following car won't be read). As well, if the first vehicle is valid, then subsequent vehicles will not be able to follow.

If the read zone is much larger than the distance referenced above, then a following car may be read and allow a non-tagged vehicle to enter the facility. Bigger isn't always better; in RFID systems, long range can create a problem.

The readers are typically configured to be loop activated (on by presence) but may be set to have RF on continuously. The choice depends on traffic volume and possible interaction with the other in-lane components.

Frequency Plan

The Encompass 4 Reader FCC-approved frequency band is 911.75 to 919.75 MHz. Because of this relatively narrow frequency band, it requires careful planning to maintain the desired 2 MHz frequency separation between adjacent readers.

If readers are spread out within a facility (readers ½ mile or so apart), and loops are used, then frequencies may be reused. Special circumstances may necessitate use of multiplexers, especially in installations exceeding 20 readers. The illustration below shows frequency separation for 4 lanes.

Enter	Reader Response	What It Does
#644NN (00 – 0A)	Done	Set attenuation in 1.0 dB increments; 0 to 10 dB
#645NN	Done	Set operating range for eGo and SeGo protocols
#647XXX (000 – 118)	Done	Set frequency from 860 to 930 MHz in new 0.25-MHz steps. The FCC approved range is from 0CF = 911.75 MHz to 0EF = 919.75 MHz
#66F	Done	Load default operating parameters (except RF operating frequency)
#693F	Done	Set RF timeout = infinite

Modulated Frequencies Approved for Use in the U.S.

Command	Frequency (MHz)
6470CF	911.75
6470D0	912
6470D1	912.25
6470D2	912.50
6470D3	912.75
6470D4	913
.	.
.	.
.	.
6470E8	918
6470E9	918.25
6470EA	918.50
6470EB	918.75
6470EC	919
6470ED	919.25
6470EE	919.50
6470EF	919.75

Enter	Reader Response	What It Does
#520	PWRB Px R0 P0 = no power fail has occurred P1 = power fail has occurred	Display power fail bit
#521	RDID xx xx = 00–FF	Display reader ID number
#527	RFST Cx Ox T1 Fxx Rxx Gxx Axx C0 = RF controlled by host C1 = RF-by-input control O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min Fxx = RF output frequency, 00 to 34 Rxx = ATA RF output range, 00 to 1F Gxx = IATA RF output range, 00 to 1F Axx = RF power attenuation, 00 to 0A	Display RF status
#532	TOF <0 to 1> 0 = Wiegand disabled 1 = Wiegand enabled	Display Wiegand mode status
#533	WTI <01 to FF> seconds (1-255) in hex	Display Wiegand retransmit Interval
#570	ATA:_ eGo: _ SeGo: _ IAG: _ SORT: _ I = IT500 ID (64 bits) E = enabled F = full transaction D = disabled	Display tag mode status
#610	Done	Select basic protocol
#6140	Done	Disable flow control
#621	Done	Select predefined output mode
#63	Model [model] Ver [version no.] SN [serial no.] Copyright [date] TransCore	Reset reader
#6400	Done	Turn RF off
#6401	Done	Turn RF on
#641	Done	Select RF-by-input control
#642NN (00 – FF)	Done	Set RF operating frequency. Backward compatible with Encompass 2 and AI1620 readers.
#643	Done	Set operating range for ATA protocol (distance); 00 = shortest

Four Lane Curbside Installation Example
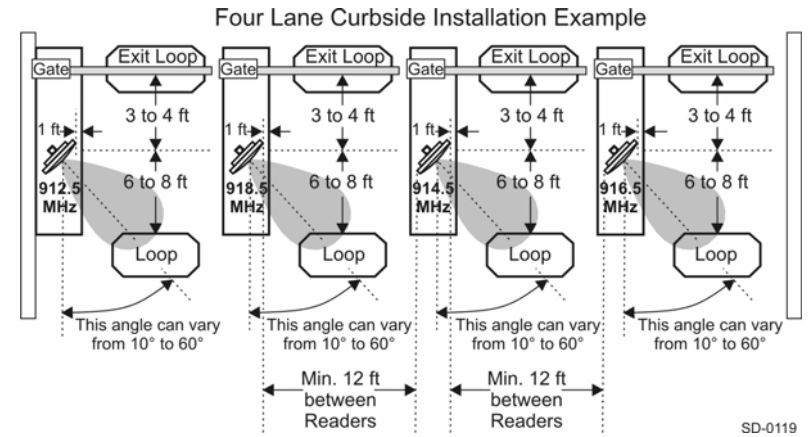
Reader Frequencies Staggered for 14 Lanes

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

Causes of RF Interference or Poor Performance

When designing your site plan, you must consider permanent structures and transient factors in the vicinity that may affect RF signals. Metal objects, walls, and even wet pavement or ice can reflect RF signals, degrading system performance.

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

Existing interference at the site should be shielded, removed, or positioned farther from the Encompass 4 Reader.

METAL SIGN

METAL GRATE

METAL GATE

SLOPE

METAL POLE
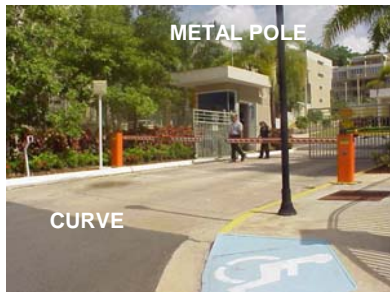
CURVE

Possible Sources of RF Interference or Poor Performance

- Metal fences, gates, posts, signs, grates
- Wet or icy slopes
- Walls, buildings
- Curve at entrance
- Gate relays
- Reader incorrectly located

Electrical and Communications Requirements

Measured voltage at the Encompass 4 Reader MUST be at least 16V for proper operation. It is important to use TransCore approved transformers and cable lengths. TransCore does not endorse or support RF cable lengths greater than 35 feet. See the **Encompass 4 Reader System Guide** for detailed information.

The reader is available as an RS–232 or RS–422 model. The proper configuration depends on the distance between the reader and the computer room. Maximum distance for the RS–232 (3-wire serial) is 50 feet, while RS–422 (4-wire differential signal) maximum distance is up to 4000 feet. You may adjust the baud rate to accommodate noisy environments.

If you wish to use Wiegand format tags, you must first:

- Connect the Encompass 4 Reader using the RS–232 or RS–422 interface,
- Set all necessary operating parameters in the reader,
- Set the Encompass 4 Reader's configuration to Wiegand,
- Then connect the Encompass 4 Reader to the Wiegand interface.

Reader Commands

The following table provides the commands frequently used in testing, setting up, and tuning the Encompass 4 Reader. For a complete list of commands see the *Encompass® 4 Reader System Guide*.

NOTE: *An "Error" reader response indicates that the command was entered incorrectly.*

Frequently Used Reader Commands

Enter	Reader Response	What It Does
#00	Done	Returns reader to data mode.
#01	Done	Switches to command mode.
#1005	Done	Set baud rate = 9600
#1010	Done	Use one stop bit
#1020	Done	Disable parity
#40	Done	Transmits all tag IDs without regard for uniqueness
#450	Done	Disable Wiegand mode
#451	Done	Enable Wiegand mode
#454	Done	Disable multi-tag sort
#455	Done	Enable multi-tag sort
#46NN	Done	Set Wiegand retransmit interval NN = 01–FF seconds
#48N	Done	Select tag mode N = 0–9 0 = disable ATA 1 = enable ATA 2 = disable eGo 3 = enable eGo 4 = disable SeGo 5 = enable SeGo 6 = disable IAG 7 = enable IAG 8 = disable IATA 9 = enable IATA **NOTE**: *Encompass 4 reader will have tag modes specific to your model only*
#505	Model [model] Ver [version no.] SN [serial no.	Display version

Sense Input/Output Cabling Assignments

Pair	Pin	Color	Signal	Description	Typical Function
Blue/ Red	E	Blue	WGND0	Wiegand data0	Parking/access control
	F	Red	WGND1	Wiegand data1	Parking/access control
White/ Red	L	White	Lock	Tag lock output, active-closed	Testing maintenance
	M	Red	Lock_RTN	Tag lock return	Testing maintenance
Green/ Red	N	Green	Sense Input0	Sense Input0 (loop)	Loop and presence detection
	P	Red	Sense Input0_RTN	Sense Input0 return; not isolated from signal ground	Loop and presence detection
Blue/ Black	R	Blue	Sense Input1	Sense Input1	General-purpose sense input, not used for detecting presence
	S	Black	Sense Input1_RTN	Sense Input1 return; not isolated from signal ground	General-purpose sense input, not used for detecting presence
Brown/ Black	T	Black	Sense Output0_COM	Sense Output0 (tag detect), common terminal	Switched output to control gate
	U	Brown	Sense Output0_NO	Sense Output0 normally open terminal	Switched output to control gate
Orange/ Black	V	Black	Sense Output0_COM	Sense Output0 (tag detect output), common terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
	W	Orange	Sense Output0_NC	Sense Output0 normally closed terminal	Switched sense output for any external control (light, gate, buzzer, etc.)
Green/ Black	X	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
	Y	Green	Sense Output1_NO	Sense Output1 normally open terminal	Switched sense output
White/ Black	Z	Black	Sense Output1_COM	Sense Output1, common terminal	Switched sense output
	a	White	Sense Output1_NC	Sense Output1 normally closed terminal	Switched sense output
Yellow/ Black	b	Yellow	GND	Logic ground	Signal ground used with RS–232 and Wiegand
	c	Black	GND	Logic ground	Signal ground used with RS–232 and Wiegand

Pre-Installation Testing

Once you have developed the site plan and frequency plan, you are ready to install the reader and perform pre-installation testing of Encompass 4 Reader output power and tag read capability. The **Encompass® 4 Reader System Guide** discusses pre-installation testing in detail.

Bench Testing the Reader

To bench test your reader you need an **audible circuit tester**, a compatible **power/communications cable**, and a **PC**. A laptop using a terminal emulation program such as Microsoft HyperTerminal can be used for most diagnostic test and reader command entry.

The Encompass 4 reader uses a single 26-pin (13 twisted pair) round Souriau connector to interface to all external components. Power, I/O interface, and communications signals are transmitted through this cable. The reader cable is directly connected to external devices or may be routed to other components via an external junction box.

1. **Connect all hardware as directed below.**

   A. Connect the power wires from the cable to the transformer using the color coding as described below. (Do not apply power to transformer at this time.)

   Power Connections

Colored-Wire Pair	Use These Colors	Connect to Transformer Terminal Strip
Brown/Red	Orange and Brown	L1 (16 to 20V AC)
Orange/Red	Red and Red	L2 (16 to 20V AC)

   The Encompass 4 Reader system is powered by an 18V AC transformer. Normally, one 10 amp circuit will be sufficient for powering the reader and all associated electronics.

   B. For the Encompass 4 that requires an external antenna, you must next connect the external antenna using an N-type connector. THE EXTERNAL ANTENNA MUST BE CONNECTED before powering up the external antenna-series readers.

   C. Connect the red and white leads from the audible tester to the red and white pair of wires from the power/communications cable.

   D. Connect the appropriate communications wires from the cable to an appropriate connector.

RS–232 Interface

Colored Wire Pair	User This Color	Connect to Host DB9 Pin	Connect to Host DB25 Pin
Red/Black	Black	Pin 2	Pin 3
	Red	Pin 3	Pin 2
Yellow/Black	Yellow or Black	Pin 5	Pin 7

RS–422 Interface
(Your host must have an RS–422 interface with either an internal or external converter)

Colored Wire Pair	Use This Color	Connect to Host Signal
Yellow/Red	Yellow	Receive (+)
	Red	Receive (-)
Red/Black	Black	Transmit (+)
	Red	Transmit (-)

2. **Start the terminal emulation application Microsoft HyperTerminal by selecting Programs>Accessories> Communications>HyperTerminal and pressing ENTER.**

   In the dialog boxes choose the com port to which the communications interface is attached and set the properties as follows:

   - Bits per second: 9600 baud
   - Data bits: 8
   - Parity: None
   - Stop bits: 1
   - Flow control: None

3. **Power up the reader by plugging the transformer into an approved outlet. Verify reader sign-on message appears on laptop/computer display**

   Once the reader has been wired up and turned on (with the laptop connected), a sign-on message will appear signifying that the reader is talking to the laptop. If startup is successful, the sign-on message appears as follows:

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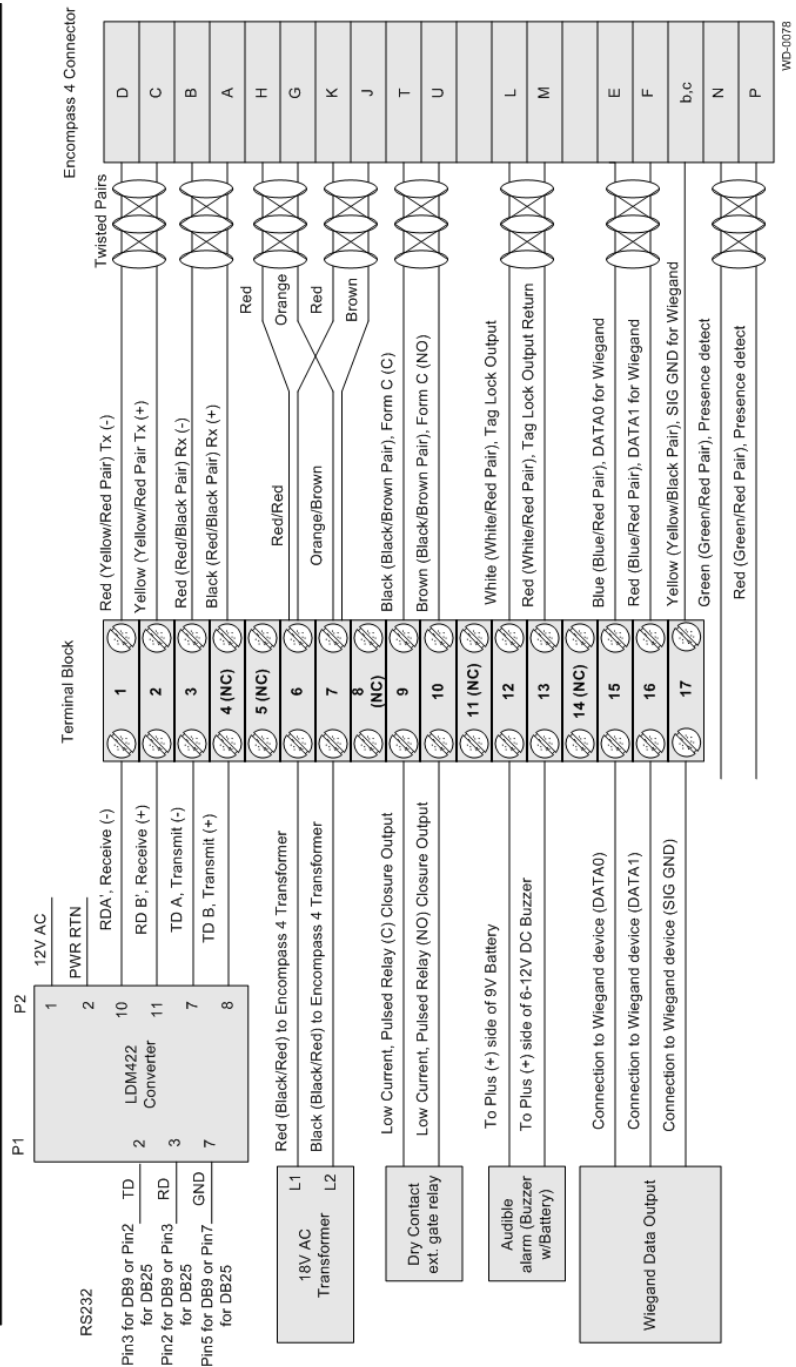   [Copyright notice]

   where YYYYYY is the serial number of the Encompass 4 Reader unit being used.

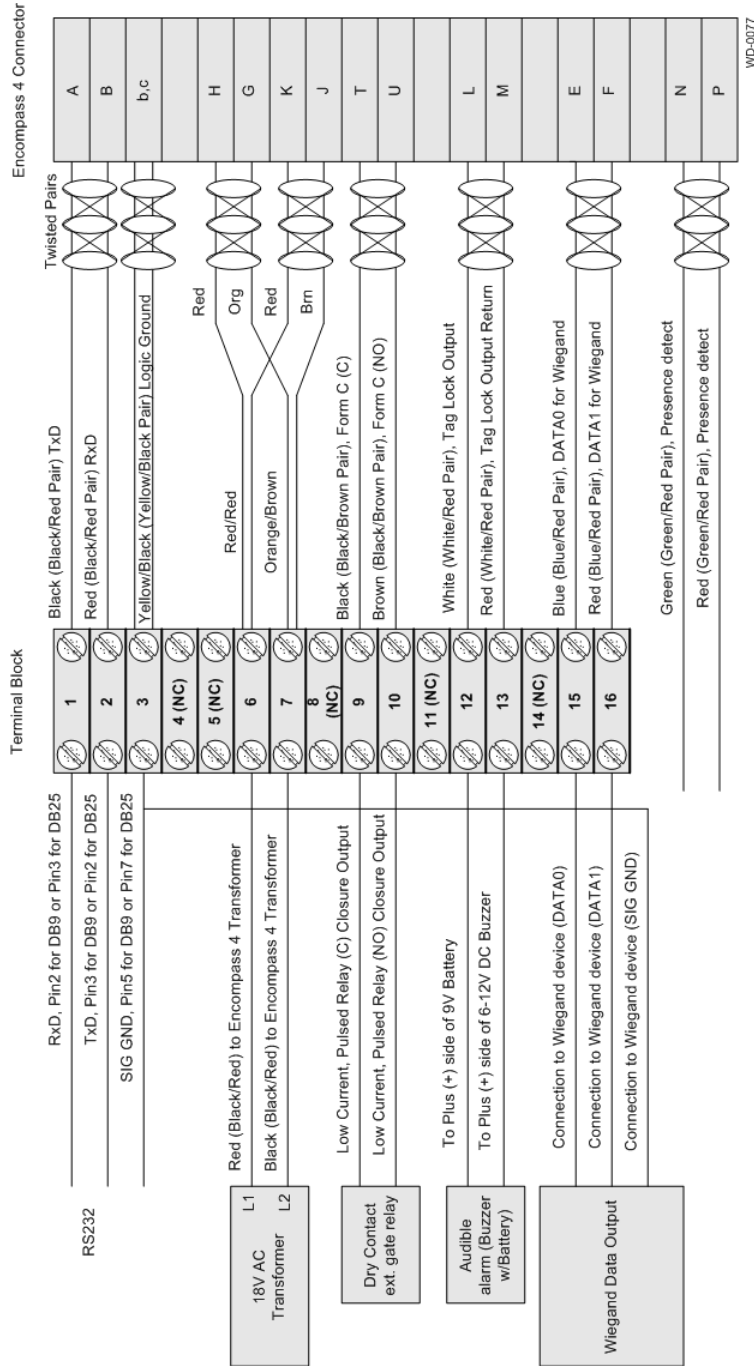   At this point, you can enter commands into the reader for testing, set up, and tuning.

4. **Input proper commands in order to test the reader. Commands will include those to set the tag read mode and turn RF ON.**

Wiring Diagram for an Encompass® 4 (RS422) Unit

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Wiring Diagram for an Encompass® 4 (RS232) Unit

Encompass 4 Connector — Twisted Pairs — Terminal Block

WD-0077

RS232:
- RxD, Pin2 for DB9 or Pin3 for DB25 — Black (Black/Red Pair) TxD — A
- TxD, Pin3 for DB9 or Pin2 for DB25 — Red (Black/Red Pair) RxD — B
- SIG GND, Pin5 for DB9 or Pin7 for DB25 — Yellow/Black (Yellow/Black Pair) Logic Ground — b,c

18V AC Transformer:
- L1 — Red (Black/Red) to Encompass 4 Transformer — Red
- L2 — Black (Black/Red) to Encompass 4 Transformer

- Red/Red — Org — H
- Orange/Brown — Red — G
- Brn — K

Dry Contact ext. gate relay:
- Low Current, Pulsed Relay (C) Closure Output — Black (Black/Brown Pair), Form C (C) — J
- Low Current, Pulsed Relay (NO) Closure Output — Brown (Black/Brown Pair), Form C (NO) — T, U

Audible alarm (Buzzer w/Battery):
- To Plus (+) side of 9V Battery — White (White/Red Pair), Tag Lock Output — L
- To Plus (+) side of 6-12V DC Buzzer — Red (White/Red Pair), Tag Lock Output Return — M

Wiegand Data Output:
- Connection to Wiegand device (DATA0) — Blue (Blue/Red Pair), DATA0 for Wiegand — E
- Connection to Wiegand device (DATA1) — Red (Blue/Red Pair), DATA1 for Wiegand — F
- Connection to Wiegand device (SIG GND) — Green (Green/Red Pair), Presence detect — N
- Red (Green/Red Pair), Presence detect — P

Terminal Block numbers: 1, 2, 3, 4 (NC), 5 (NC), 6, 7, 8 (NC), 9, 10, 11 (NC), 12, 13, 14 (NC), 15, 16

Testing Commands

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode.
#481	#Done <CR/LF>	Sets operational mode to read ATA tags.
#40	#Done <CR/LF>	Transmits all tag IDs without regard for uniqueness.
#6401	#Done <CR/LF>	Turns RF ON.
#00 <CR>	#Done <CR/LF>	Returns reader to data mode.

5. **If not using Wiegand tags, skip to Step 6. If using Wiegand tags, configure the reader for Wiegand operation and connect the Wiegand interface.**

Wiegand Testing Commands

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode.
#481	#Done <CR/LF>	Sets operational mode.
#451	#Done <CR/LF>	Switches reader to Wiegand mode.
#6401	#Done <CR/LF>	Turns RF ON.
#00 <CR>	#Done <CR/LF>	Returns reader to data mode.

Wiegand Interface

Colored Wire Pair	Use This Color	Connect to data wire of Wiegand device
Blue/Red	Blue	Data0
	Red	Data1
Yellow/Black	Yellow or Black	Ground

6. **Hold a tag in front of the reader and make sure its data is read out on the computer screen or on the Wiegand interface.**

7. **If desired, input the following commands to return reader to factory defaults.**

Return to Factory Default Commands

Enter	Reader Response	What It Does
#01 <CR>	#Done <CR/LF>	Switches reader to command mode.
#66F	#Done <CR/LF>	Loads all factory default operating parameters except operating frequency.
#00 <CR>	#Done <CR/LF>	Returns reader to data mode.

Installation at the Site

After pre-installation testing, using the site plan and frequency plan previously developed, you are ready to install the reader on site.

1. **Confirm the following:**

   - All construction is complete and electrical and communications cables of the appropriate length are in place.
   - A watertight junction box with terminal strip is present.
   - A dedicated power supply of the appropriate voltage is present.
   - The placement of the readers follows the site plan.
   - The readers are the correct distance apart, side fire or overhead.

   Normally readers (or antennas) are installed either on the side of the lane, pointing into the lane (side fire) or directly over the lane, pointed downward (center fire or overhead).

   Overhead installations normally are used within parking garages and other areas where a mounting surface already exists.

   Side-fire installations normally are used where the lanes are out in the open and the installation of a pole is sufficient to mount a reader.

   For side-fire reader placement, optimum tag placement is on the side of the windshield nearest the reader; for overhead reader placement, the optimum tag placement is in the upper center of the windshield.

2. **Mount the reader on a round pole or flat surface.**

   Proper reader angle may require both up-down and right-left adjustment. Ensure that the correct wall-mount or pole-mount bracket is used in the reader installation.

   Connect the reader bracket to earth ground using a ground cable and stake. TransCore recommends that you follow the National Electric Code for lightning protection for the locale where you are installing the Encompass 4 Reader.

3. **Connect all wiring as described in Pre-Installation Testing Step 1 on page 5 using the appropriate RS–232 or RS–422 Wiring Diagram on pages 10 and 11 as a guide.**

   Also connect sense input and sense output circuits using the Sense Input/Output Cabling Assignments table on page 12 as a guide.

   After connecting the wires in the communications cable, ground all drain wires from the communications cable to the chassis ground in the junction box.

4. **Start the terminal emulation application Microsoft HyperTerminal by selecting Programs>Accessories> Communications>HyperTerminal and press ENTER as described in Pre-Installation Testing Step 2 on page 6.**

5. **Apply power and verify reader sign-on message appears on laptop/computer display as described in Pre-Installation Testing Step 3 on page 6.**

6. **Use reader commands to query status and set up the system to ensure the following:**

   - If multiple readers are used, ensure that the frequency separation between readers is sufficient and make sure that each reader is set up to the proper settings
   - Adjust reader angle/power to optimize read zone for each reader.
   - Check for interference by each reader (or by the environment).

7. **If using Wiegand tags configure the reader for Wiegand operation and connect the Wiegand interface. See Step 5 on page 7.**

8. **Disconnect the laptop and connect reader to back end devices and recheck read zone and for interference between readers.**

9. **System-test the reader.**

   Once all in lane testing is complete, perform a system test using tagged vehicles passing through numerous lanes. The tag reads are sent to the back end system and evaluated for validity.