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Quick Start Guide for EPCglobal™ Class 1–Generation 2 Reader Module with Antenna Multiplexing Capability

This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.

TransCore

August 2008
412103

Driving inefficiencies out of surface transportation through innovative solutions

Notes

The *Quick Start Guide for EPCglobal™ Class 1-Generation 2 Reader Module with Antenna Multiplexing Capability* describes procedures to install and use the EPCglobal Class 1–Generation 2 reader module and multiplexer assemblies.

This guide does not contain user instructions for TransCore's Encompass® Multiprotocol Reader. That product is covered in detail in the *Encompass® Multiprotocol Reader System Guide*.

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

NOTE: The user is required to obtain a Part 90 site license from the FCC to operate this radio frequency identification (RFID) device in the United States. See product label for FCC ID number. Access the FCC Web site at www.fcc.gov/Forms/Form601/601.html for additional information concerning licensing requirements.

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

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

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate RF energy and may cause harmful interference to radio communications if not installed and used in accordance with the instruction manual. Operating this equipment in a residential area is likely to cause harmful interference, in which case, depending on the regulations in effect, the user may be required to correct the interference at their own expense.

NO UNAUTHORIZED MODIFICATIONS
47 CFR §15.21

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

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

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

TransCore, LP USA

Get Digital I/O Output Host Control

This command gets the digital I/O outputs that the host controls. Table 11 and Table 12 list the command and response data.

Table 11. Get Digital I/O Output Host Control Command (0003H)

Get Digital I/O Output Host Control Data	Data Payload
Get Digital I/O Output Host Control Command	0003H

Table 12. Get Digital I/O Output Host Control Response

Get Digital I/O Output Host Response Data	Data Payload
Get Digital I/O Output Host Control Command	0003H
Output Control	0XH

Output Control — This field specifies the digital outputs that the host controls. In Table 13, OFF = 0 and ON = 1.

Table 13. Output Control Values

Control Value	Output Control 3	Output Control 2	Output Control 1	Output Control 0
00H	OFF	OFF	OFF	OFF
01H	OFF	OFF	OFF	ON
02H	OFF	OFF	ON	OFF
03H	OFF	OFF	ON	ON

Table 7. Digital I/O Port Configuration Values

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
0FH	OUT	OUT	OUT	OUT

Set Digital I/O Output Host Control

This command sets the digital I/O outputs that the host controls. Table 8 and Table 9 list the command and response data.

Table 8. Set Digital I/O Output Host Control Command (0002H)

Set Digital I/O Output Host Control Data	Data Payload
Set Digital I/O Output Host Control Command	0002H
Output Control	0XH

Table 9. Set Digital I/O Output Host Control Response

Set Digital I/O Output Host Response Data	Data Payload
Set Digital I/O Output Host Control Command	0002H

Output Control — This field specifies the digital outputs that the host controls. In Table 10, OFF = 0 and ON = 1.

Table 10. Output Control Values

Control Value	Output Control 3	Output Control 2	Output Control 1	Output Control 0	Antenna
00H	OFF	OFF	OFF	OFF	3
01H	OFF	OFF	OFF	ON	2
02H	OFF	OFF	ON	OFF	1
03H	OFF	OFF	ON	ON	0

Note: *The default value for Antenna 3 is 00. Power cycling the Encompass Multiprotocol Reader restores this default value. See the Encompass Multiprotocol Reader System Guide for instructions for cycling power to the reader.*

Note: *TransCore recommends that Antenna 3 be used for the lane-mounted antenna.*

Health Limits

Within the United States, environmental guidelines regulating safe exposure levels are issued by the Occupational Safety and Health Administration (OSHA). Section 1910.97 of OSHA Safety and Health Standards 2206 legislates a maximum safe exposure limit of 10 milliwatts per square centimeter (mW/cm^2) averaged over 6 minutes at 902 MHz. Although not binding, other organizations such as the American National Standards Institute (ANSI) have issued similar guidelines that are more restrictive than the OSHA limits (ANSI C95.1). ANSI guidelines recommend a maximum safe power density in mW/cm^2 of:

Frequency (in MHz)
1500

Thus, the maximum permissible exposure for general population/uncontrolled exposure at 902 MHz is 0.60 mW/cm^2. The power limit is a six-minute average. The RF power density generated by the EPCglobal Reader Module was calculated using a maximum antenna gain of 14.0 dBi, equivalent to the antenna gain of the external Universal Toll Antenna.

Warning: ***At 1 W transmitted power and a distance of 23 inches (58 cm) from the EPCglobal Reader Module, the maximum power density calculated was less than 0.60 mW/cm^2. Install the EPCglobal Reader Module at least 23 inches (58 cm) from the general public. Maintenance personnel must remain at least 10.25 inches (26 cm) from the EPCglobal Reader Module when system is operating.***

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

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Table 3. Set Digital I/O Port Configuration Response

Set Digital I/O Port Configuration Response Data	Data Payload
Set Digital I/O Port Configuration Command	0010H

Port Configuration — This field specifies the digital port input/output configuration. In Table 4, IN = 0 and OUT = 1.

Table 4. Digital I/O Port Configuration Values

Configuration Value	Digital Port 3	Digital Port 2	Digital Port 1	Digital Port 0
0FH	OUT	OUT	OUT	OUT

Note: *RESET READER command required for changes to take effect. Be sure to reset the reader before sending a Get Digital I/O Port Configuration command.*

Get Digital I/O Port Configuration

This command gets the digital I/O port configuration settings. Table 5 and Table 6 list the command and response data.

Table 5. Get Digital I/O Port Configuration Command (0011H)

Get Digital I/O Port Configuration Response Data	Data Payload
Get Digital I/O Port Configuration Command	0011H

Table 6. Get Digital I/O Port Configuration Response

Get Digital I/O Port Configuration Command Data	Data Payload
Get Digital I/O Port Configuration Command	0011H
Port Configuration	0FH

Port Configuration — This field specifies the digital port input/output configuration. In Table 7, IN = 0 and OUT = 1.

3. Connect the reader multiplexer (READER port) to the antenna multiplexer (READER port) using the flexible RF coaxial cable. Tighten all RF cable connections to 10 in/lb. Connect the antenna multiplexer to Universal Toll Antennas as required for site configuration.

4. Connect and secure the DB9 data cable between the ANT MUX/CHK TAG connector on the Encompass reader and the reader multiplexer.

5. Connect EPCglobal Reader Module to reader multiplexer (ANT1 port) using the RF cable provided. Tighten all RF cable connections to 10 in/lb (Figure 1).

6. Switch on power to the Encompass reader and EPCglobal Reader Module.

Figure 1 shows the properly assembled EPCglobal Reader Module and reader and antenna multiplexer configuration on the Encompass reader.

Operating the EPCglobal Reader Module and Multiplexer Options

Once the Encompass reader, EPCglobal Reader Module, and reader multiplexer and antenna multiplexer assemblies are installed and powered up, follow the system guide instructions to connect the reader to a host computer. Once you have established communication between the reader and host computer, configure the digital I/O as four outputs using the Set Digital I/O Port Configuration command.

Set Digital I/O Port Configuration

This command configures the digital I/O ports. Table 2 and Table *3* list the command and response data.

Table 2. Set Digital I/O Port Configuration Command (0010H)

Set Digital I/O Port Configuration Command Data	Data Payload
Set Digital I/O Port Configuration Command	0010H
Port Configuration	0FH

Before Getting Started

TransCore's Encompass Multiprotocol Reader with EPCglobal Class 1-Generation 2 Reader Module is designed to read from all standard tag protocols in North America, including the EPC protocol tags. This document contains basic reader module setup and user instructions.

Encompass Multiprotocol Reader Setup

Please refer to the Encompass multiprotocol reader system guide for detailed setup and user instructions on that product.

You'll need the following equipment to complete installation:

Torque-limiting wrench (in/lb range)

Standard set of tools (wrenches, screwdrivers, and pliers)

Installing the Reader Module and Reader Multiplexer

The EPCglobal Class 1-Generation 2 Reader Module is designed to operate in conjunction with TransCore's antenna multiplexer assembly used as a reader multiplexer.

To install the EPCglobal Reader Module on the Encompass Reader

1. Install the reader multiplexer assembly on the Encompass reader housing using the four standoffs provided (Figure 1). Secure the module to the reader housing using the Phillips screws provided with the kit.

2. Install the EPCglobal Reader Module on the Encompass reader housing and using the four standoffs provided (Figure 1). Secure the module to the reader housing using the Phillips screws provided with the kit.

3. Connect the EPCglobal Reader Module terminal to the Encompass multiprotocol reader TDM/COM1 port as shown in Figure 2.

4. Connect the reader multiplexer assembly (ANT0 port) to the Encompass reader (RF MONO port) with the RF cable and tighten both SMA connectors to 10 in/lb (Figure 1).

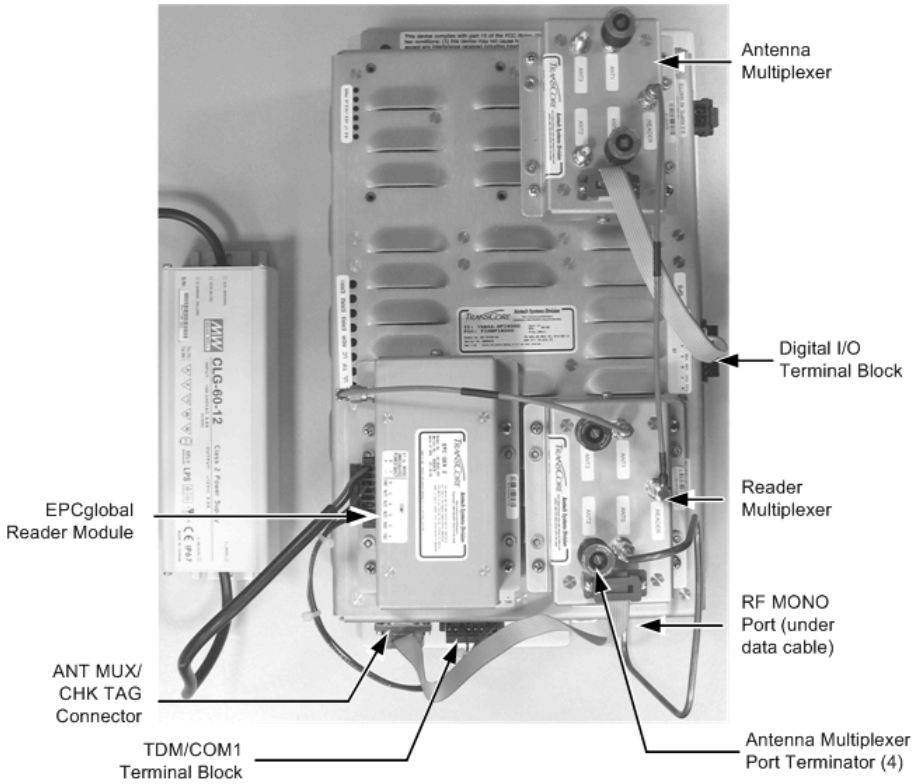

Figure 1. Encompass Multiprotocol Reader Showing EPCglobal Reader Module and Reader and Antenna Multiplexers

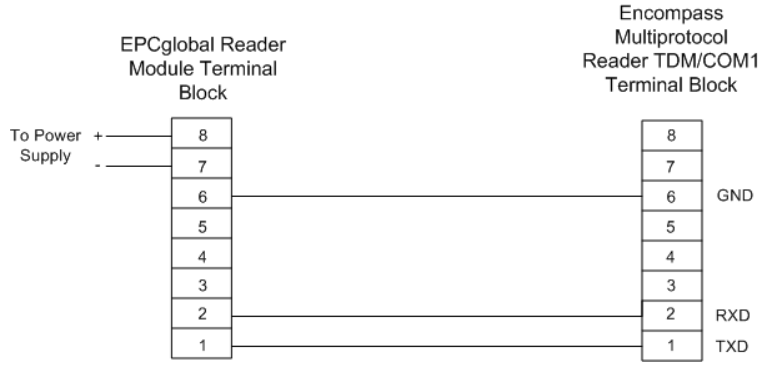

Figure 2. EPC Module-to-Encompass Reader Wiring Diagram

Installing the Antenna Multiplexer

To install the EPCglobal Reader Module on the Encompass Reader

1. Install the antenna multiplexer assembly on the Encompass reader housing using the four standoffs provided (Figure 1). Secure the module to the reader housing using the Phillips screws provided with the kit.

2. Connect the antenna multiplexer to the external digital input/output (I/O) port on the Encompass reader (Figure 1 and Figure 3).

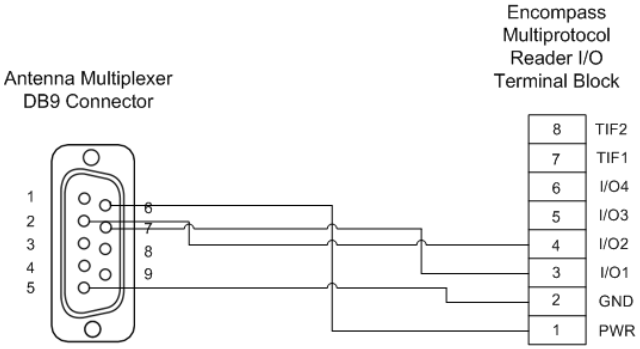

Figure 3. Antenna Multiplexer-to-Digital I/O Wiring Diagram

Table 1 lists the cable terminations for the DB9 connector-to- I/O terminal block.

Table 1. Antenna Multiplexer-to-Encompass Reader I/O Block

DB9 Pin	I/O Pin
1	NC
6	1
2	4
7	3
3	NC
8	NC
4	NC
9	NC
5	2