

SmartPass® Integrated Reader 2450 MHz (High Voltage) System Guide



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WARNING TO USERS IN THE UNITED STATES

**FEDERAL COMMUNICATIONS COMMISSION (FCC) RADIO FREQUENCY
INTERFERENCE STATEMENT
47 CFR §2.105**

NOTE: This equipment uses 2450-MHz frequency and thus does NOT comply with FCC U.S. frequency allocation requirements.

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

**TransCore, LP
USA**

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A

Glossary

Appendix A

Glossary

This Appendix provides definitions for terms used throughout the SmartPass® System Guide.

Terms and Definitions

The following table defines special terms used in this document.

AAR	Association of American Railroads
AC	alternating current
ACK	acknowledge (data valid)
antenna	passive device that converts RF energy into magnetic energy (RF signal)
ARC	Amtech Response Center
ASCII	American Standard Code for Information Interchange
ASIC	application-specific integrated circuit
ATA	American Trucking Associations
aux	auxiliary
backscatter	portion of an RF signal that is modulated by a tag and radiated back to the reader
baud	measure of number of bits per second of a digital signal; for example, 9600 baud = 9600 bits per second
BCKS	boot checksum
BCM	buffer control mode
BIT	built-in test
bps	bits per second
byte	a binary character; for example, one 8-bit ASCII character
CCITT	Consultive Committee on International Telegraphy and Telephony
check tag	tag mounted inside SmartPass assembly, or in an external antenna, that is used to check operation of SmartPass.
cmd	command
CTRL	control
comm	communications
command	data set that is recognized by the receiving device as intending to elicit a specific response
conduit	flexible steel pipe use for electrical wiring
cps	characters per second

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CR	carriage return
CRC	cyclic redundancy check
CTS	clear to send
data	information that is processed by a computing device
DC	direct current
DIAG	diagnostic
ECP	error correcting protocol
ECPS	error correcting protocol status
EOL	end of line
EOM	end of message
EPROM	erasable programmable read-only memory
field	physical area/space in which a tag can be read by the reader; also, an element of a data record/frame. For example, division within a tag's data frame.
frames	consecutive bits of data in memory that are read and written as a group
frequency bands	a range of RF frequencies assigned for transmission by an RF device
hex	hexadecimal
hexadecimal	base 16 numbering system that uses the characters 0–9 and A–F to represent the digits 0–16
host	device, generally a computer, that is connected to SmartPass through the communications port
I/O or IO circuits	input/output circuits
ID	identification; encoded information unique to a particular tag
interface	connection/connection point for communication with another device
IOST	I/O status
ISO	International Standards Organization
LF	line feed
m	meter
MHz	megahertz
mode	method of operation
ms	milliseconds
NAK	negative acknowledgment (data not valid)
passback	used to refer to a tag ID that is not passed on to the tag buffer
PC	personal computer
PCKS	EPROM flash checksum
protocol	specified convention for the format of data messages communicated between devices
PRST	presence status
PWRB	power fail bit
RAM	random access memory

RDID	reader ID
read	process of acquiring data from a device; for example, from a tag or from computer memory
reader	controlled interrogating device capable of acquiring data from a device; for example, acquiring and interrupting data from a tag
read zone	the physical area in which a tag can be read by the SmartPass system
RF	radio frequency
RFST	RF status
RFID	radio frequency identification
RMA	return material authorization
ROM	read-only memory
RTC	real-time clock
RTS	request to send
SCTS	status of check tag status
SSTC	input status change reporting options
SOM	start of message
SN	serial number
tag	small self-contained device acting as an identifying transponder
Tau	timeout delay
TT	tag translation
V	volts
Ver	version (software)
write	process of recording data; for example, writing to computer memory or to a tag's memory. Writing writes over (erases) previous data stored at the specified memory locations.
WTI	Wiegand retransmit interval

B

System Specifications

Appendix B

System Specifications

This Appendix provides specifications throughout the SmartPass® System Guide.

Specifications

The following table shows the specifications for SmartPass Model AI1611.

Table B-1 SmartPass System Specifications

Size	38.1 x 41.7 x 10.2 cm (without mounting brackets)
Weight	Less than 7.2 kg (without mounting brackets)
Input power	Less than 25 W
High voltage	90–260 V AC
AC	47–63 Hz
Output power	250–500 mW
Wire sizes	
Power	3 conductors, 18 gauge
Communications	11 twisted, individually shielded pairs, 22 gauge
Frequency (factory adjustable)	2400–2500 MHz
Emission designator	N0N
Antenna gain	10 dBi nominal

C

Wiring Tables

Appendix C

Wiring Tables

This Appendix provides tables showing the wiring connections used in installing and testing SmartPass throughout the SmartPass® System Guide.

Specifications

The following table shows the wiring connections used in installing and testing SmartPass. For more information on testing SmartPass, refer to Chapter 3, “Quick SmartPass Test.” For information on installing SmartPass, refer to Chapter 5, “Installing SmartPass.”

Table C-1 Communications Interfaces and Conductors

Interface	Number of Conductors
RS-232	3
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RS-422	4
Wiegand	3

Table C-2 RS-232 Interface Signal Wiring

Signal	Wire Pair From SmartPass	Wire Color Used From Pair	Connect Wire to PC DB9 Pin	Connect Wire to PC DB25 Pin
Transmit from SmartPass	Red/black	Black	Pin 2	Pin 3
Receive from PC	Red/black	Red	Pin 3	Pin 2
Logic ground	Yellow/black	Yellow or black	Pin 5	Pin 7
Optional for hardware handshaking				
Request to send	Yellow/red	Yellow	Pin 4	Pin 4
Clear to send	Yellow/red	Red	Pin 8	Pin 5

Table C-3 RS-422 Interface Signal Wiring

Signal	Wire Pair From SmartPass	Wire Color Used From Pair	Connect to Signal
Transmit B (+) data from SmartPass	Yellow/red	Yellow	Receive (+)
Transmit A (-) data SmartPass	Yellow/red	Red	Receive (-)
Receive B (+) data to SmartPass	Red/black	Black	Transmit (+)
Receive A (-) data to SmartPass	Red/black	Red	Transmit (-)

Table C-4 Wiegand Interface Signal Wiring

Signal	Wire Pair	Wire Color	Wiegand Signal
Data0	Blue/red	Blue	Data1
Data1	Blue/red	Red	Data0
Logic ground	Yellow/black	Yellow or black	Ground

Table C-5 AC Cable Connections

Cable Colors		
International Colors	U.S. Colors	Connection Use
Blue	White	AC neutral
Brown	Black	AC hot (90–260 V AC)
Green and yellow	Green or red	Safety ground

Table C-6 External Interface Signal Wiring

Wire Pair	Wire Color	Signal	Typical Function
Blue/red	Blue	Wiegand data0	Parking/access control applications
	Red	Wiegand data1	Parking/access control applications
White/red	White	Lock common	Testing maintenance
	Red	Lock normally open	Testing maintenance
Green/red	Green	Input0	Loop and presence detect
	Red	Input0 return	Loop and presence detect
Yellow/black	Yellow	Logic ground	Ground (not used with RS-422)
	Black	Logic ground	Ground (not used with RS-422)
Blue/black	Blue	Input1	A general purpose input; not used to detect presence (not available with Wiegand)
	Black	Input1 return	A general purpose input; not used to detect presence (not available with Wiegand)
Orange/black	Orange	Output0 normally closed	Switches output for any external control (light, gate, buzzer, etc.)
	Black	Output0 common	Switches output for any external control (light, gate, buzzer, etc.)
Brown/black	Brown	Output0 normally open	Switches output to control gate
	Black	Output0 common	Switches output to control gate
White/black	White	Output1 normally closed	Switches output (not available with Wiegand)
	Black	Output1 common	Switches output (not available with Wiegand)
Green/black	Green	Output1 normally open	Switches output (not available with Wiegand)
	Black	Output1 common	Switches output (not available with Wiegand)

Introduction

Chapter 1

Introduction

This SmartPass® System Guide provides you with the information and instructions for installing a SmartPass Integrated Reader System, called SmartPass. TransCore recommends that you read this entire manual. You should also read the READ.ME file that is on the SmartPass software diskette before you begin installing the SmartPass system.

Overview

This chapter provides information for preparing to install SmartPass. This chapter also addresses the most frequently asked questions about SmartPass:

- What is the SmartPass Integrated Reader System?
- Is a license needed to operate SmartPass?
- What equipment should be ordered?

System Description

SmartPass consists of an antenna, a check tag, a radio frequency (RF) transmitter/receiver (called the RF module), a reader logic board (also called a tag decoder), and a power supply. The components of SmartPass are contained in one highly reliable, compact, and easy-to-install package. The integrated reader system is shown in Figure 1-1. Appendix B contains the system specifications.

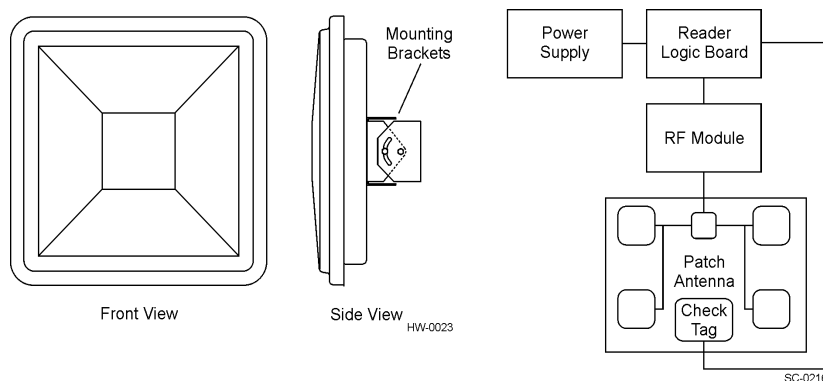


Figure 1-1 SmartPass System Diagram

SmartPass generates an RF signal that is reflected from an TransCore radio frequency identification (RFID) tag. The tag is programmed with identification information. SmartPass receives and decodes the tag data carried by the reflected signal and then transmits this data to a local host computer for processing.

Licenses

You should ask local and national authorities if your company needs to apply for a license to use this product.

Choosing and Ordering Equipment

This section helps you determine the equipment for your site. In addition to SmartPass, you need the appropriate communications interface, input power supply, and power and communications cables. When choosing tags, you need to determine the tag data format and the tag type. Refer to the Order Administration section of your *SmartPass Dealer's Guide* for the information on these topics:

- How to place an order
- How to change an existing order
- TransCore's credit and return policy
- TransCore's warranty and return policy
- *Order Entry Form* for SmartPass reader and tag

SmartPass Model AI1611

SmartPass Model AI1611 uses the 2450 MHz frequency. This model is also available in a European version for customers whose applications must meet CE mark requirements. You must indicate on the SmartPass *Order Entry Form* if you require the CE mark version.

Accessories

TransCore recommends Part No. 54-1600-001, the accessory bracket kit, if you need more flexibility when defining the read zone. The accessory bracket allows SmartPass to be adjusted up, down, left, and right. You can use this kit if SmartPass will be mounted to a flat surface, such as a wall, ceiling, or overhead structure.

Communications Interface

The SmartPass system communicates with the external host computer through an asynchronous serial line or a Wiegand interface. SmartPass receives commands to set up the system configuration and transfers information from the tag to the host computer. This serial line can be an RS-232 interface or an RS-422 interface. Select

one of the following communications interface based on the specific needs of your site.

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

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

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

- The host computer is more than 15.2 m from SmartPass
- The host computer has an external limited-distance modem

The standard RS-422 connection has a maximum distance of 1.2 km.

Use a Wiegand interface, which includes an RS-232 interface, if SmartPass must interface with equipment requiring the Wiegand +5 V DC data0-data1-gnd interface.

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

Input Power Supply

The input power supply configurations should be based on the specific needs of your site. SmartPass Model AI1611 uses 90–260 V AC, 47–63 Hz power.

Communications Cables

The appropriate communications cable length depends on the physical characteristics of the SmartPass installation site. Select one of the following options for SmartPass communications cable length.

- Select the short cable option if SmartPass will be located less than 1.2 m from the junction box.
- Select the long cable option if SmartPass will be located more than 1.2 m from the junction box. This cable is approximately 6.1 m long.

Power Cables

The appropriate power cable length depends on the physical characteristics of the SmartPass installation site. Select one of the following options for SmartPass power cable length.

- Select the short cable option if SmartPass will be located less than 1.2 m from the junction box.

- Select the long cable option if SmartPass will be located more than 1.2 m from the junction box. This cable is approximately 6.1 m long.

Tags

TransCore offers numerous tag models and four tag data formats to complete your SmartPass system. The information below will assist you in determining which tag and the tag data format are best for your system.

Note: *If any of the vehicles already have tags, such as those used in toll applications, contact TransCore at 2142)4613-4031 for information about mixed-tag installations before you plan tag type, location, and programming.*

Tag Models

Use Table 1-1 to determine which tags will be best suited for your site requirements. TransCore recommends battery-powered tags for use with the SmartPass Model AI1611. Interior-mounted tags can be ordered from the factory with hook and loop material already applied to the tag, or they can be ordered with double-sided tape. Exterior-mounted tags can be ordered from the factory with double-sided tape or with blind rivet mounting.

Table 1-1 Tag Models Available with SmartPass AI1611

Tag Model Number	Tag Type	Power Source	Number of 6-Bit ASCII Characters	Number of Wiegand Bits
AT5406	Access control, interior inside window	10-year battery	10	26–54
AT5414	Transportation, exterior	10-year battery	10	26–54
AT5910	Transportation, exterior	10-year battery	20	26–54
AT5944	TollTag, interior	10-year battery	20	Not applicable
AT5988	TollTag, interior	5-year battery	20	Not applicable
AT5704	Dynamic tag, exterior	DC external power	Up to 4608	Not applicable

Tag Data Formats

The TransCore factory programs tags with the tag model number, date of manufacture, and data format. Consult the special order entry procedures in your

SmartPass Dealer's Guide for ordering the format that applies to your system. Four formats can be used for tag data:

- 10-character alphanumeric ASCII — Four alphanumeric characters are fixed and can be used to identify either the dealer or the user. TransCore test tags are typically programmed with *PASS* in these four positions. The remaining six positions are numeric and should be unique for each tag issued. For example, the entry ACME000001 might be used for the first tag in an order for ACME Security.
- 20-character alphanumeric ASCII — A tag formatted with 20-character alphanumeric ASCII data typically has four fixed positions. The remaining 16 positions are numbered sequentially.
- Wiegand — You must indicate the data to be programmed into the tags. A *Wiegand Format Worksheet* is attached to the *SmartPass Order Entry Form* for your use. Wiegand-formatted tags are labeled with a W prefix, followed by a facility code and an identification number. For example, a Wiegand-formatted TransCore tag with a facility code of 10 and an identification number of 253 would be labeled as W10 253.

Note: *Not all tags can be Wiegand-formatted.*

- ISO — For requirements for this format, refer to ISO 10374.

Preparing the Site

Chapter 2

Preparing the Site

Before installing SmartPass, you need to develop a site plan. Several factors to consider when developing this site plan include the following:

- ***SmartPass mounting locations***
- ***Junction box requirements***
- ***Electrical power requirements***
- ***Communications requirements***
- ***Input/output circuit requirements for outside equipment***



Warning

All construction work required for installing SmartPass must be completed before installing SmartPass. Additionally, communications and power cables must be installed through outdoor-grade, flexible steel conduit. Local building code requirements should be followed.

Determining the Location to Install SmartPass

The location of SmartPass and the location of the tags must be compatible. Each tag must be in a direct line of sight to the reader.

You should also consider the following factors when determining a SmartPass installation location:

- Reflection, refraction, and diffraction of RF energy
- Existing interference at the site that may need to be shielded or removed, such as fluorescent lights, neon signs, nearby radio stations, or power lines
- Site area layout and traffic flow
- Location and read zone of other SmartPass units in the area

Reflection, Refraction, and Diffraction of RF Signals

The RF signal can be reflected, refracted, or diffracted by metal objects, walls, and even wet pavement or ice. When designing your site, you must take into account any permanent structures that may reflect RF signals, as well as transient factors.

Transient factors could include passing traffic, local weather conditions, chain link fences, and gates that could temporarily reflect RF signals.

RF Reflectors

The most common RF reflectors are metallic surfaces. RF signals are also somewhat reflected by nonconducting materials such as dirt, wood, ice, asphalt, and cured concrete. When nonconducting materials in the system environment become wet, they reflect more RF signals.

Aiming and placing Smartpass are the two best controls of RF reflections. When these actions alone cannot adequately control reflections, other techniques may be needed. These techniques could include shielding, absorbing, handshake counts, or barriers.

RF Refraction

When an RF signal enters any material, its direction of travel is altered by a few degrees. Refraction of RF signals rarely affects system performance, except when tags are mounted on or under surfaces where nonconducting materials are placed or can accumulate between the tag and the antenna.

RF Diffraction

Diffraction occurs when RF signals are bent around objects allowing RF into areas that would normally receive little or no signal. Metal poles, corners of buildings, and metal housings in industrial environments often diffract signals.

Existing Interference

Interference from RF and electrical sources can degrade system performance. This type of interference must be considered in the site design.

Existing interference at the site may be shielded, removed, or positioned further from the source. Filters may be added to the system. Fluorescent lights, neon signs, nearby radio stations, or power lines can interfere with the optimal functioning of the system. Even the magnetic impulse noise from relays, whose opening and closing control the operation of a gate, can disrupt the RF signal.

SmartPass and Tag Mounting Locations

SmartPass can be installed in many positions to provide the most accurate field, or read zone, for the tags. SmartPass can be mounted to a round pole or to a flat surface, such as a wall, ceiling, flat pole, or an overhead structure. The following sections provide more information for different site configurations and show the preferred tag mounting locations.

Gate Configuration

Figure 2-1 illustrates a gate configuration. Two SmartPass units are located on a center island. SmartPass is placed to allow time for the gate to open so the vehicle can continue without stopping.

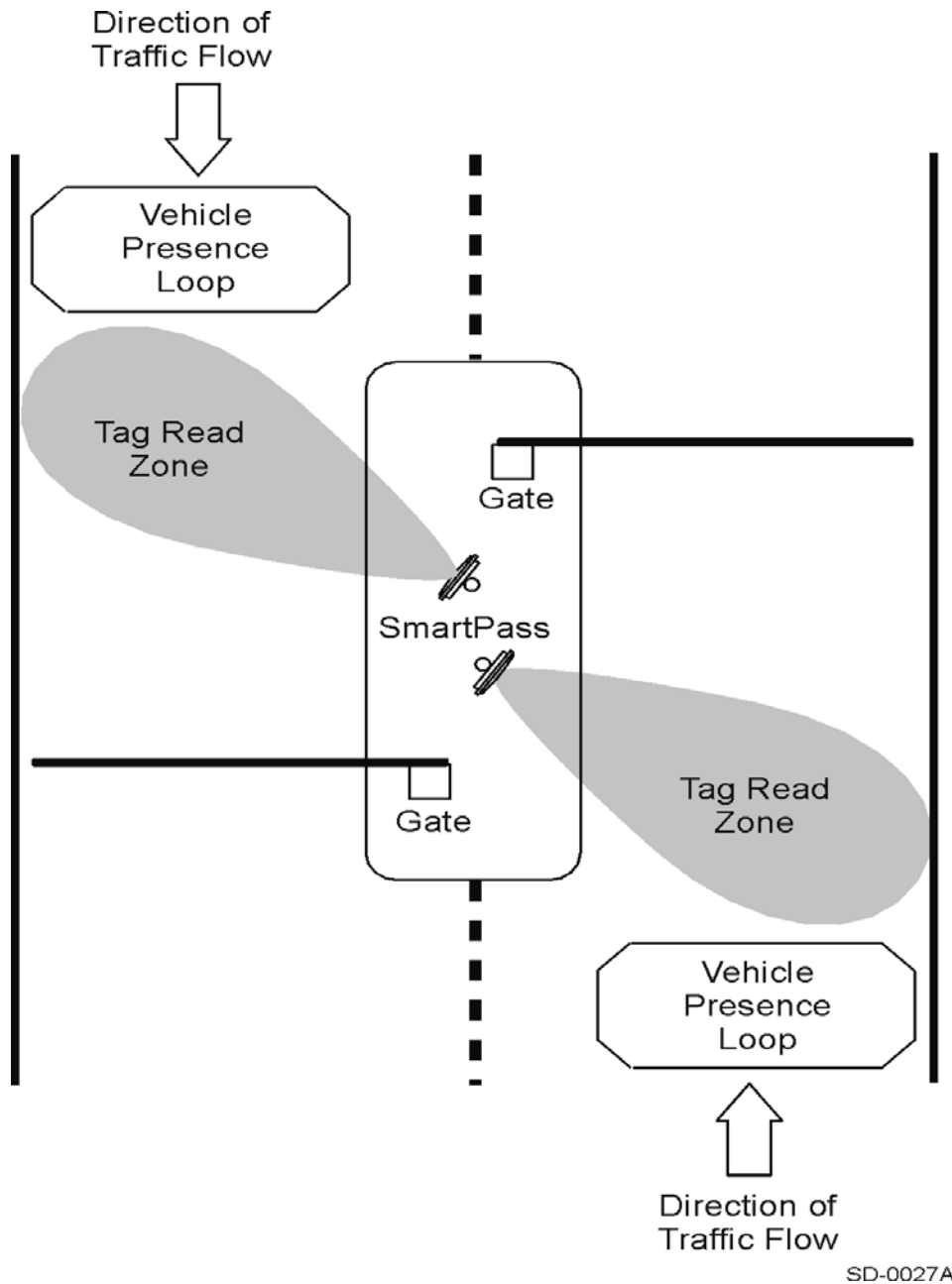


Figure 2-1 Gate Configuration with Center Island

Figure 2-2 shows an incorrect mounting of SmartPass. Do not install SmartPass behind a gate. Vehicles might pull up too close to the gate, damaging the vehicle or the gate.

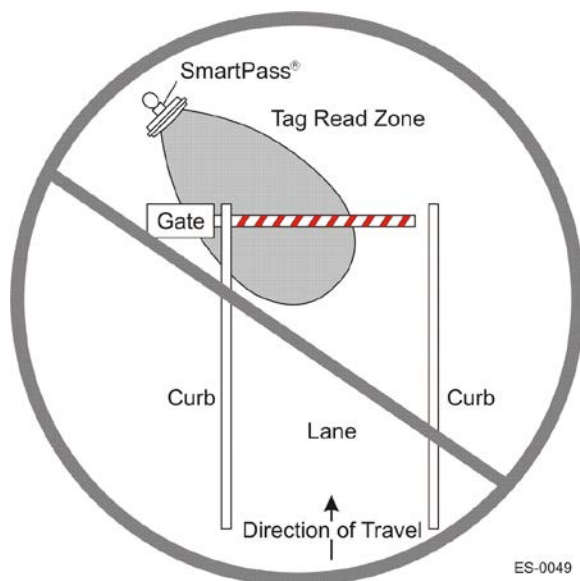


Figure 2-2 Incorrect Mounting of SmartPass

Parking Garage Configuration

Figure 2-3 illustrates a parking garage configuration with each SmartPass on the ticket island. SmartPass is placed so that the vehicle stops before the gate opens.

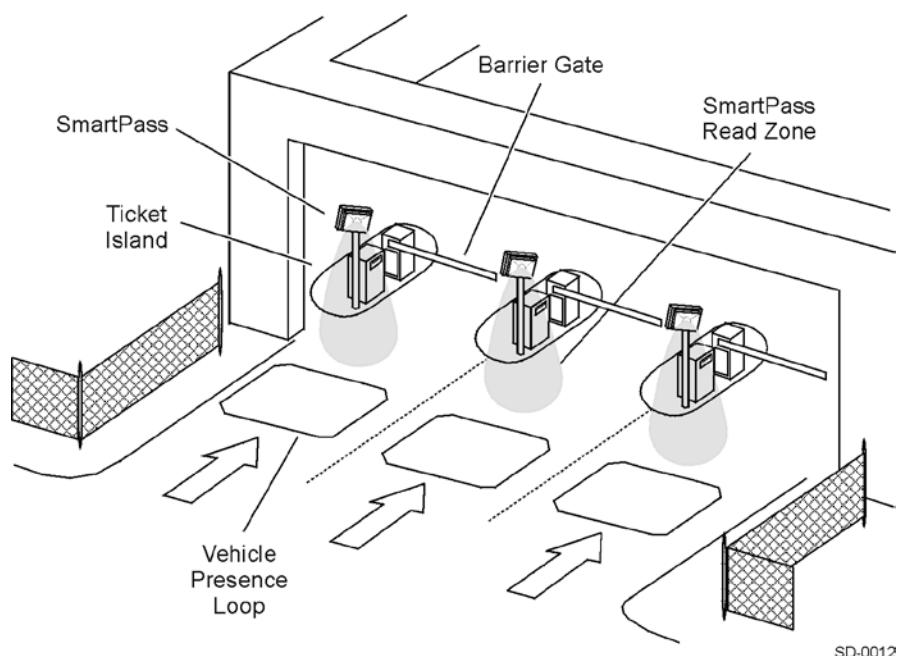


Figure 2-3 Parking Garage Configuration

In the gate configuration and the parking garage, interior tags are mounted on the inside of the windshield on the left side of the vehicle. Exterior tags are mounted on the left side of the bumper. Figure 2-4 shows interior and exterior tag mounting locations for use with a left-side gate configuration and a parking garage configuration.

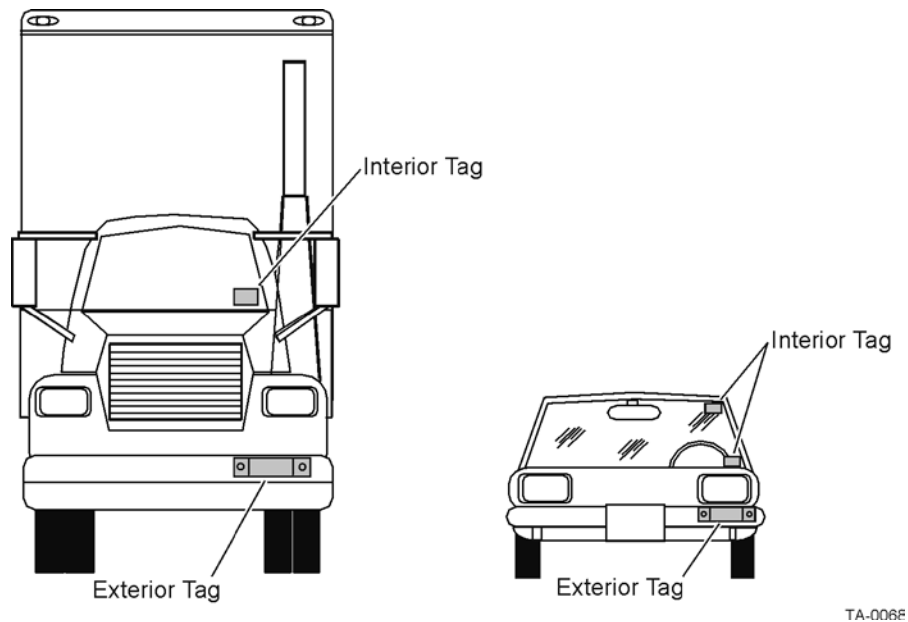


Figure 2-4 Left-Side Tag Mounting Locations

Overhead Mounting Configuration

SmartPass can be mounted to an overhead structure as shown in Figure 2-5.

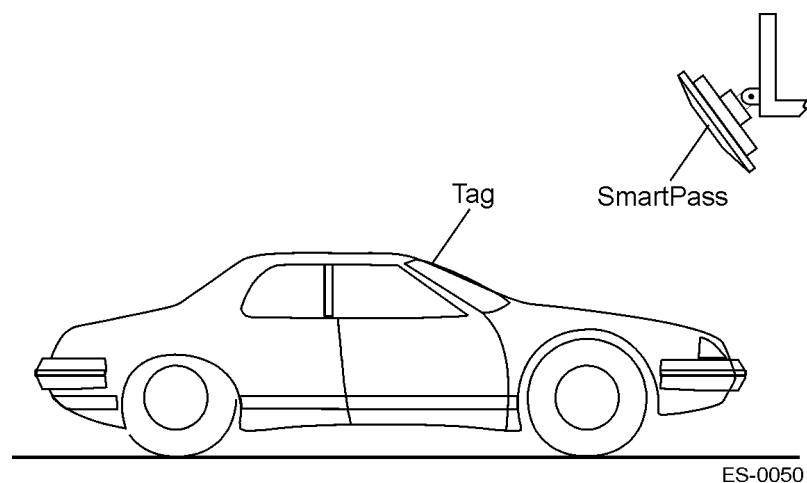


Figure 2-5 SmartPass Mounted Overhead

When SmartPass is mounted overhead, the preferred tag mounting position is inside the windshield, behind the rearview mirror. If an exterior tag must be used when SmartPass is mounted overhead, place the tag on the front bumper in the center. Figure 2-6 illustrates interior and exterior positions of tags used with SmartPass mounted overhead.

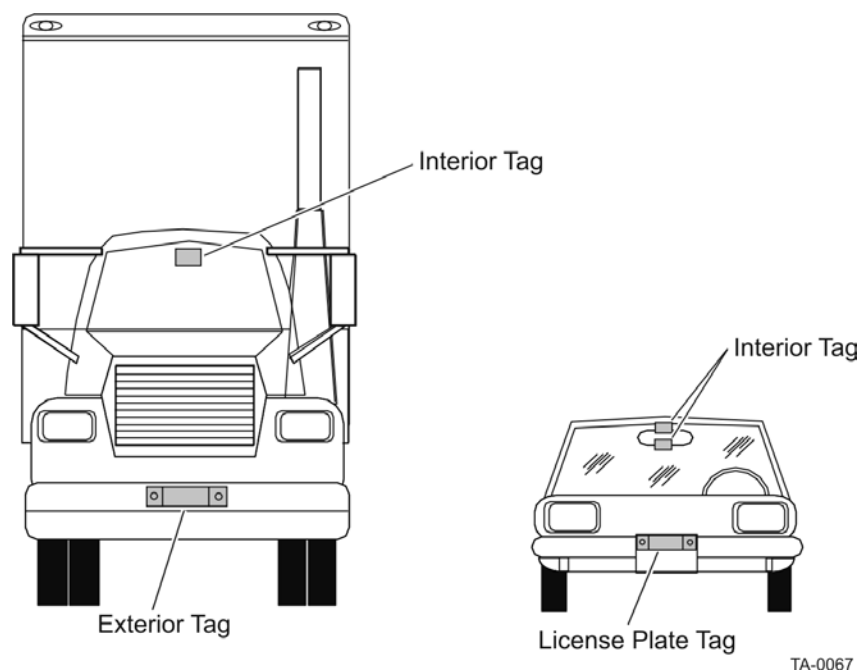


Figure 2-6 Tag Mounting Positions for SmartPass Mounted Overhead

Open Lane Configuration

Figure 2-7 illustrates an open lane configuration. For this configuration, tags are mounted on the inside of the windshield on the right side of the vehicle

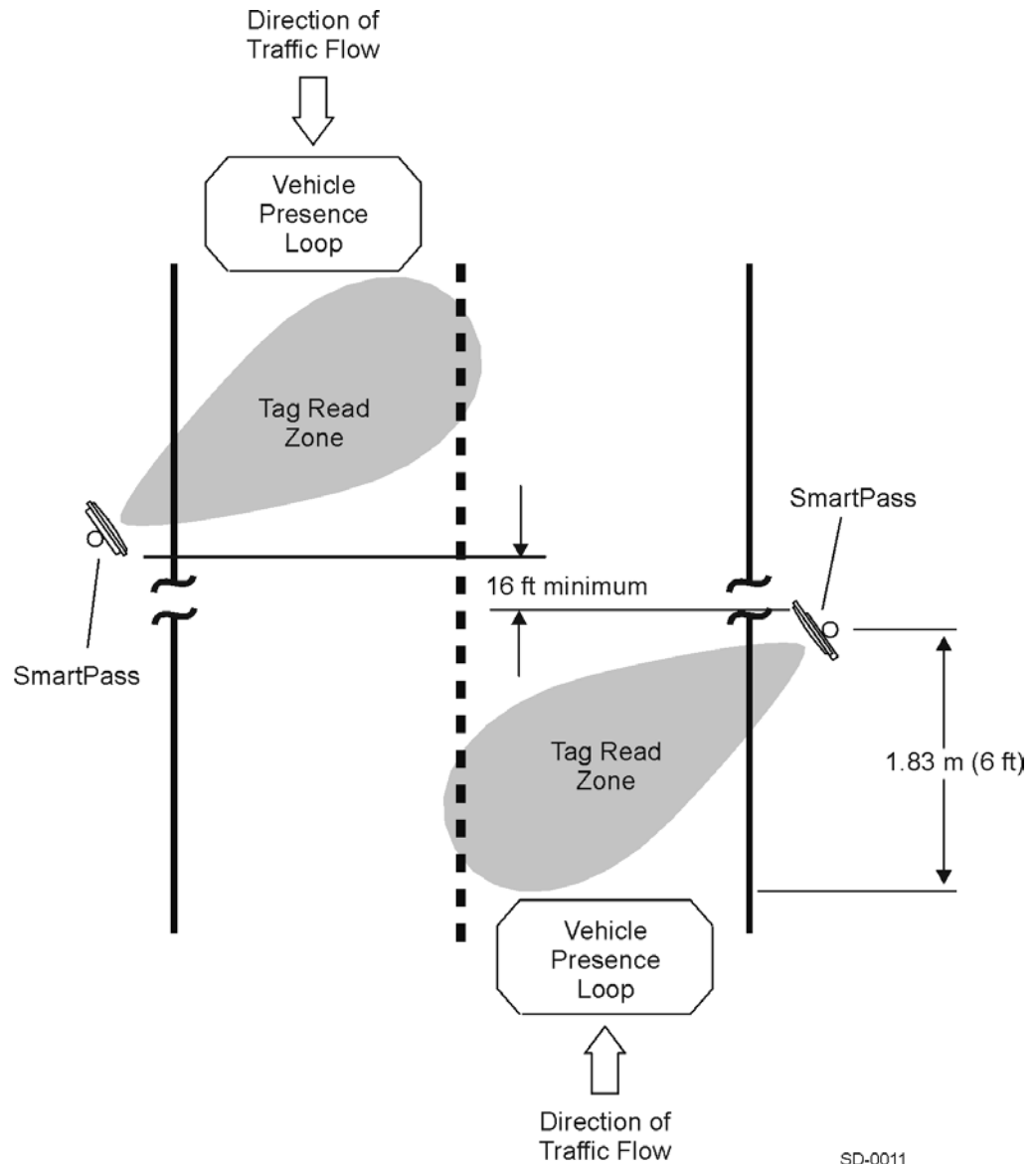


Figure 2-7 Open Lane Configuration

For additional information on installing SmartPass, refer to Chapter 5, “Installing SmartPass.” Chapter 5 has illustrations for mounting SmartPass on a pole or to an overhead structure. Chapter 4, “Installing Tags On Vehicles,” provides additional information on selecting the proper tag mounting location and has examples of tags mounted on vehicles.

Area Layout and Traffic Flow

SmartPass must be able to read a tag’s data properly within the read zone without reading any other tags nearby. SmartPass must be positioned to allow the RF signal

to reach and return from a tag within the designated range. Also, if the antenna becomes misaligned or some nearby permanent structure is added or removed, system operation can be seriously affected. SmartPass should be placed in an area where it is not likely to be bumped out of alignment.

Other SmartPass Units in the Area

If multiple SmartPass readers are installed near each other, they must be configured with a frequency separation of at least 3 MHz.

Note: *Never install two SmartPass reader systems directly facing each other, or SmartPass receiver circuitry and decoder will not operate reliably*

Junction Box

A junction box is needed at the site. TransCore recommends a NEMA Type 4 or IEC IP54 junction box with a back plate. The junction box will house the terminal strip for communications and power.

The junction box must be a watertight box that meets applicable local and national building codes. It must have watertight conduit for any cables that will attach to SmartPass. SmartPass will be used with a 90–260 V AC power supply. The box must have conduit on both the supply and reader sides. SmartPass is fitted with a 1.3-cm pipe NPT-threaded connector that allows watertight conduit to be installed.



Caution

Power and communications lines must use separate conduits.



Vorsicht

Strom- und Kommunikationsleitungen müssen durch getrennte Kabelkanäle geführt werden.



Precaución

Se deben emplear conductos separados para las líneas de alimentación y de comunicaciones.



Précaution

Les lignes d'alimentation et de communications doivent emprunter des conduits différents.



Attenzione

Le linee dell'alimentatore e di comunicazione devono usare condutture separate.

Electrical Power Supply

An electrical power supply must be present at the site. SmartPass Model AI1611 is supplied with 90–260 V AC, 47–63 Hz power, which is less power than a 25 W incandescent light bulb. Consult your local and national electrical codes for installation and safety requirements.

Communications

Your site design must include the communications required for installing SmartPass. Your host computer must be able to accept one of the interfaces shown in Table 2-1.

Consult the requirements for the host interface for the number of conductors, type, and size of cable required for the junction box. The distance between the host computer and SmartPass must also be considered.

Table 2-1 Communications Interfaces and Conductors

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

Input/Output Circuit Requirements for Outside Equipment

You will need input and output circuits if you will use any additional equipment, such as a loop detector or traffic control light. If you are connecting SmartPass to such equipment, wires from these circuits should be installed at the junction box. The input circuit of SmartPass connects to a dry contact closure. SmartPass output circuits are single-pole, double-throw relays providing dry contact closures. These closures are rated at 125 V AC or DC at 1 A.

Quick SmartPass[®] Test

Chapter 3

Quick SmartPass® Test

This chapter provides instructions for testing SmartPass.

Overview

Before installing SmartPass at the site, you should perform two tests on SmartPass to ensure that it will work properly. The first test is done using an audible circuit tester. This test confirms that SmartPass has power, is communicating with the software loaded inside the SmartPass reader, and can read a tag presented in the tag read zone.

The second test uses a personal computer (PC) and the SmartPass software diskette. In this test you will check the factory defaults on your SmartPass and change the defaults if needed. A list of the factory default settings on SmartPass is shown in Table 3-5 located at the end of this chapter.

Materials Supplied

The SmartPass shipping carton is labeled to indicate the reader's configuration. Table 3-1 lists the simple three-letter code used.

Table 3-1 Three-Letter Reader Configuration Code

First Character	Second Character	Third Character
T = RS-232 F = RS-422 W = Wiegand	H = High voltage 90-260 V AC	S = Short cables 1.2 m L = Long cables 6.1 m

This same three-letter code is stamped on the serial number plate on each SmartPass. The code is followed by the frequency rate.

Example: A shipping carton labeled THS2450 contains a SmartPass that is configured with RS-232, high-voltage power supply, and short cables and has an operating frequency of 2450 MHz.

Your SmartPass is packaged with the materials listed below. Ensure you have received all parts before beginning your quick test of SmartPass.

- One SmartPass unit
- One pole-mount bracket
- Four machine screws and washers

Additional Materials Needed

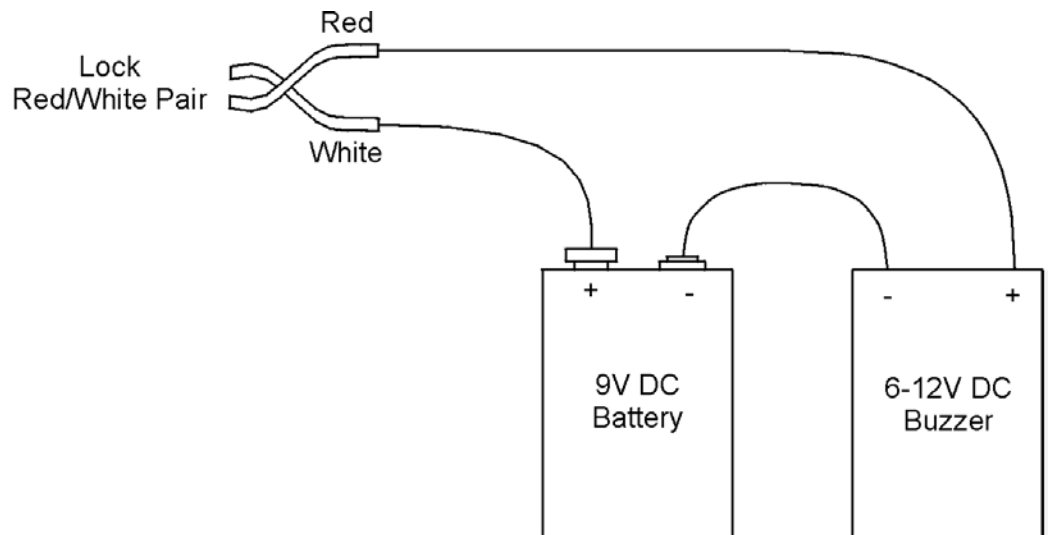
You need these additional materials to perform the two tests on SmartPass:

- SmartPass software diskette, which is supplied to TransCore dealers and distributors
- PC with 1.44 MB floppy disk drive, MS DOS, RS-232 COM1 port, and a communications cable with a DB9 or DB25 connector
- Two test tags, supplied by the TransCore dealer or distributor
- Other materials needed to connect the PC to SmartPass as described in the software diskette READ.ME file

Testing with the Audible Circuit Tester

Testing with an audible circuit tester confirms that your SmartPass has power, is communicating with the software loaded inside the SmartPass reader, and can read a tag if it is in the read zone.

An audible circuit tester is also called a buzz box. These boxes are available at electronic parts supply stores, or you may make a buzz box as shown below. The buzz box is powered by a battery and equipped with two alligator-clip leads. When you touch the leads together, the box makes an audible sound. Figure 3-1 shows the wiring for a buzz box.



WD-0017

Figure 3-1 Wiring for Buzz Box

To test SmartPass

1. Connect SmartPass to a 90–260 V, high-voltage power supply.



Warning

For safety, the power supply should be grounded. Consult your local electrical authorities for proper grounding techniques.



Warning

Aus Sicherheitsgründen sollte die Stromversorgung geerdet sein. Wenden Sie sich bitte an Ihren örtlichen Stromversorger für Informationen bezüglich einer korrekten Erdung.



Advertencia

Por motivos de seguridad, se debe conectar la fuente de energía a tierra. Para averiguar la manera correcta de efectuar la conexión a tierra, póngase en contacto con las autoridades locales competentes en materia de instalaciones eléctricas.



Avertissement

Si ces lignes sont raccordées à des dispositifs externes, elles doivent être isolées d'une façon ou d'une autre. Si elles ne sont pas correctement isolées, la carte logique du lecteur risque d'être gravement endommagée.



Avvertenza

Se queste linee vengono collegate a dispositivi esterni, questi devono essere isolati in qualche modo. Un isolamento sbagliato delle linee può causare gravi danni alla scheda logica del lettore.

2. Connect the two leads from the batteries to the red and white pair of wires from the SmartPass communications cable.
3. Twist the red and green wire pair from the SmartPass cable. Twisting the red and green pair turns the RF on continuously.
4. Pass a tag in front of SmartPass. The buzz box should buzz when it reads the tag.
5. Disconnect the buzz box from SmartPass.

You are ready to proceed with the second test.

Note: Save this buzz box for use when installing SmartPass at the site.

Testing With a PC and the Software Diskette

Testing SmartPass with a PC and the software diskette verifies that SmartPass hardware and software are working and that the communications hardware is operating correctly.

SmartPass can interface with the host computer by using either an RS-232 interface, an RS-422 interface, or with a Wiegand interface. Refer to the appropriate section below to connect the interface you are using with your SmartPass. SmartPass does not need to be powered down before attaching it to the PC. The power-up sequence does not affect communications between SmartPass and the PC.

Connecting an RS-232 Interface

Follow these instructions if your SmartPass uses an RS-232 interface. RS-232 interface signals are supplied by five wires from the SmartPass communications cable. The wire connections are shown in Table 3-2.

Table 3-2 RS-232 Interface Signal Wiring

Signal	Wire Pair From SmartPass	Wire Color Used From Pair	Connect Wire to PC DB9 Pin	Connect Wire to PC DB25 Pin
Transmit from SmartPass	Red/black	Black	Pin 2	Pin 3
Receive from PC	Red/black	Red	Pin 3	Pin 2
Logic ground	Yellow/black	Yellow or black	Pin 5	Pin 7
Optional for hardware handshaking				
Request to send	Yellow/red	Yellow	Pin 4	Pin 4
Clear to send	Yellow/red	Red	Pin 8	Pin 5

To connect an RS-232 Interface

1. Connect the black wire from the red and black wire pair from the SmartPass cable to pin 2 of the DB9 connector or pin 3 of the DB25 connector.
2. Connect the red wire from the red and black wire pair from the SmartPass cable to pin 3 of the DB9 connector or pin 2 of the DB25 connector.
3. Connect either the yellow or black wire from the yellow and black wire pair from the SmartPass cable to pin 5 of the DB9 connector or pin 7 of the DB25 connector.
4. Plug in the DB9 connector or DB25 connector to the PC.

SmartPass is now connected to your PC.

Note: If you are using Windows 95, make sure you connect the DB9 connector or the DB25 connector to COM1 or COM2 before powering up the PC.

Connecting an RS-422 Interface

Follow these instructions if your SmartPass is an RS-422 unit. RS-422 interface signals are supplied by four wires from the SmartPass communications cable. Your host must have an RS-422 interface, with either an internal converter or with an external converter. Table 3-3 lists the RS-422 signals and their interface wires.

Table 3-3 RS-422 Interface Signal Wiring

Signal	Wire Pair From SmartPass	Wire Color Used From Pair	Connect to Signal
Transmit B (+) data from SmartPass	Yellow/red	Yellow	Receive (+)
Transmit A (-) data from SmartPass	Yellow/red	Red	Receive (-)
Receive B (+) data to SmartPass	Red/black	Black	Transmit (+)
Receive A (-) data to SmartPass	Red/black	Red	Transmit (-)

To connect an RS-422 interface

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

SmartPass is now connected to your PC.

Connecting a Wiegand Interface

Follow these instructions if your SmartPass uses a Wiegand interface. Wiegand interface signals are supplied by three wires from the SmartPass communications cable. Table 3-4 lists the Wiegand signals and the interface wires.

Table 3-4 Wiegand Interface Signal Wiring

Signal	Wire Pair	Wire Color	Wiegand Signal
Data0	Blue/red	Blue	Data 1
Data1	Blue/red	Red	Data0
Logic ground	Yellow/black	Yellow or black	Ground

To connect the Wiegand interface

1. Connect the blue data0 wire from the blue and red wire pair from the SmartPass cable to the data1 wire of your Wiegand device.
2. Connect the red data1 wire from the blue and red wire pair from the SmartPass cable to the data0 wire of your Wiegand device.
3. Connect either the yellow or black wire from the yellow and black wire pair from the SmartPass cable to your Wiegand device logic ground.

SmartPass is now connected to your PC.

***Note:** The RS-232 interface is still included on SmartPass even when you order the Wiegand configuration. Pull the RS-232 red/black wire pairs to a convenient location and tape the ends. Do not cut these wires.*

Testing Procedures

Follow these steps for testing your SmartPass using the SmartPass software diskette.

To test your SmartPass using the software diskette

1. If the power is not already on, turn on the power to SmartPass.
2. Insert the SmartPass software diskette into the PC disk drive.
3. Open and print the READ.ME file on the diskette. The READ.ME file tells you what version of software you need to run SmartPass.
4. Select DEMO from the main menu. DEMO will also tell you which version of the software you need to run your SmartPass.

A menu appears with four selections. The selections and their functions are shown below:

- **Set PC Baud Rate Automatically** — automatically sets SmartPass to transmit at 9600 baud
 - **Set PC Baud Rate Manually** — provides steps to manually change baud rate
 - **Change Screen Title** — allows customization of titles on menus
 - **Equipment Setup Diagram** — shows the SmartPass system diagram
5. Select **Set PC Baud Rate Automatically**. This selection will show if SmartPass is set to a 9600 baud rate. If your SmartPass is communicating correctly with your host computer, the following selections appear on your screen:
 - Green Light Demo** — quickly tests communication between SmartPass and the host
 - Tag Logging Demo** — reads all information programmed on your tag
 - Reader Communication Program** — puts SmartPass in the command mode
 6. Select **Green Light Demo** from this menu.

7. Pass one test tag in front of your SmartPass. The green light on the screen illuminates.

Note: *An internal timer in SmartPass causes SmartPass to ignore a specific tag for 2 minutes after a good read unless a different tag is read in the meantime.*

8. Pass a different test tag in front of your SmartPass. The green light on the screen illuminates.

If SmartPass reads both tags, your SmartPass is ready to install.

Table 3-5 shows the factory defaults for SmartPass.

Table 3-5 Factory Defaults for SmartPass

Parameter	Setting	Command
Operating mode	Data	00
Baud rate	9600	1005
Stop bits	1	1010
Parity	None	1020
End-of-line delay	0 ms	1030*
Time and date appended	Enabled	302
Auxiliary information appended	Disabled	310
Unique ID code criteria	Separation of 1 ID	4100
Valid ID code criteria	1 acquisition	4200*
Uniqueness timeout	2 minutes	441*
Wiegand mode	Disabled	450
Tag translation mode	Disabled	452
Wiegand transmit mode	1 second	4601
Dual processing mode	Reset on A Transmit on A	4800
Reader ID number	00	6000
Communications protocol	Basic	610
ECP (error correcting protocol) timeout	12.7 sec	612FE
Flow control	Software (XON/XOFF)	6141
Start-of-message character	# (23 hex)	6150*
Buffer control mode	Disabled	6160
Echo mode	Enabled	6171
Output control	Predefined	621
RF-by-input control	Enabled	641
Output pulse duration	228 ms	67C
Presence without tag reports	Disabled	6900
Minimum presence true period	0 ms	6910*
RF-off control	Timeout or no presence	6922
RF timeout	Never true	693F
Input inversion	Disabled	6940

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Parameter	Setting	Command
Serial number	000000	695*
Store hardware configuration	Hardware configuration not known	696
Periodic system check tag	Disabled	810
Periodic check tag interval	30 min	8135*
Check tag location	Internal	8160
Input status change reports	Disabled	820

* Fixed parameter, not user changeable

Installing Tags on Vehicles

Installing Tags on Vehicles

This chapter provides instructions on how to mount the tag in the interior or on the exterior of the vehicle.

Overview

The site plan should indicate where to locate the tags on the vehicles.

Note: *The TransCore logo on the tag and the logo on the SmartPass® must be aligned in the same direction. Both logos must be horizontal or both logos must be vertical. A SmartPass with a logo horizontal cannot read a tag with the logo vertical.*

To work reliably, tags must directly face SmartPass as the vehicle approaches SmartPass. Tags may not be read reliably if the tag is hand-held, attached to a sun visor, or attached to a metal window post.

Note: *Metallized coatings on some vehicle windshields and windows absorb the RF signal emitted by SmartPass, thus causing tags to be misread. Always mount tags on the exterior of vehicles that have a metallized coating. TransCore recommends that you mount the tag on the bumper.*

Locations for Installing Interior Tags

Install an interior tag inside the vehicle, typically on the driver's side of the windshield. Install the tag in either the upper or lower corner, at least 5 cm from any metal. Figure 4-1 shows the interior location of a tag when SmartPass is mounted by the curb on the left side.

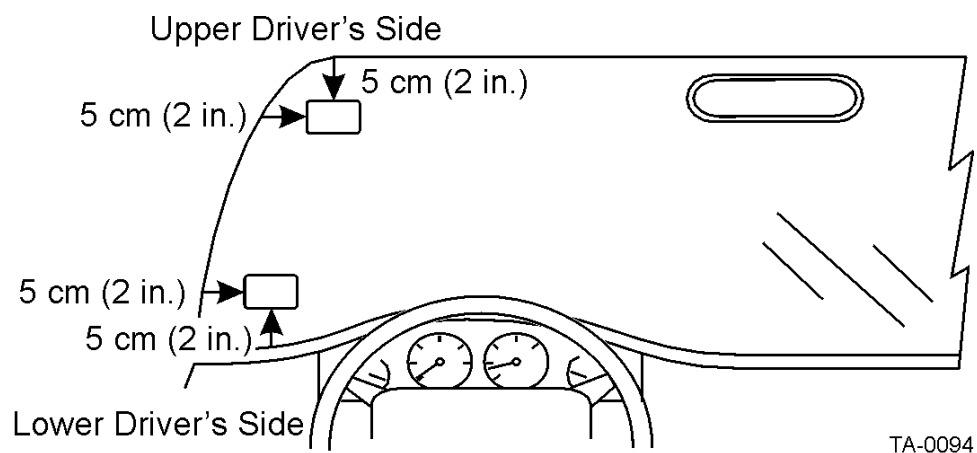


Figure 4-1 Left Side Tag Mounting Locations

If SmartPass will be mounted to an overhead structure, the preferable location for tag mounting is inside the windshield on the upper center portion. The top edge of the tag should be approximately 2.5 cm away from the base of the mirror, as shown in Figure 4-2.

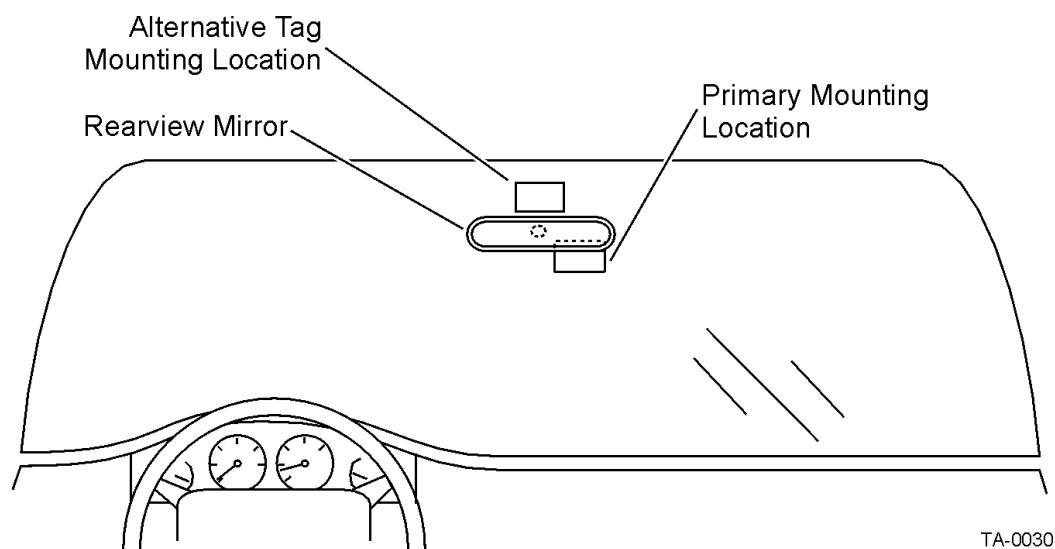


Figure 4-2 Top Center Tag Mounting Location

If a tag is installed on one side of the vehicle's windshield, a SmartPass mounted on the *opposite* curb cannot read the tags reliably. Figure 4-3 illustrates an improper location to install a tag.

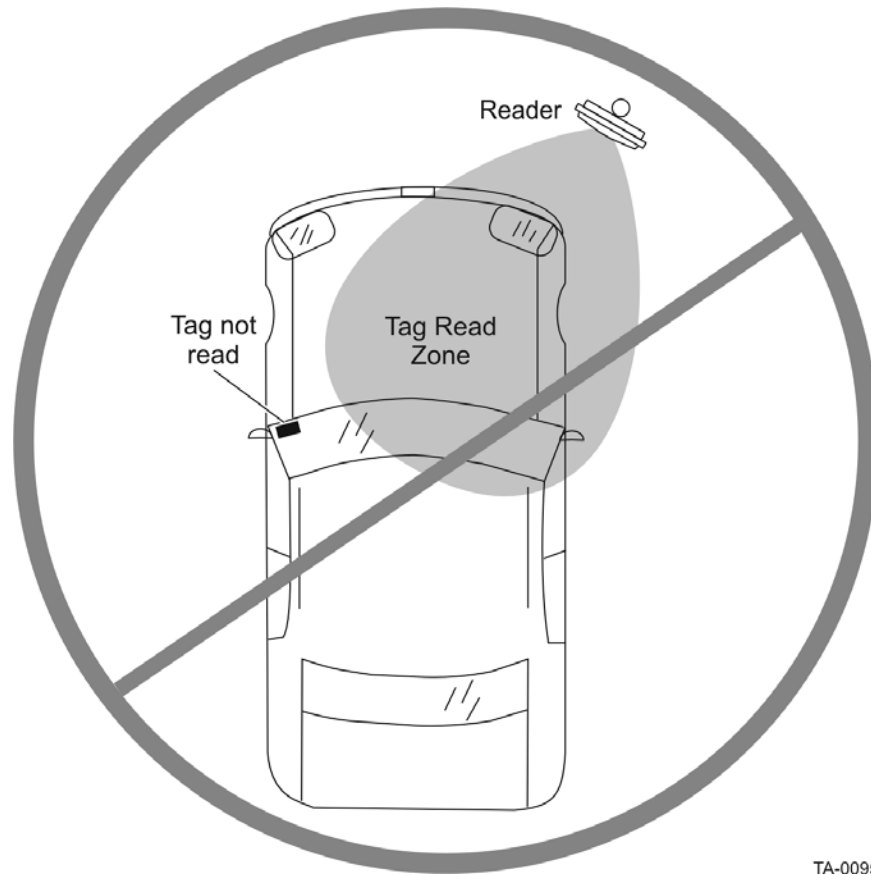


Figure 4-3 Improper Tag Mounting Location

Tag Mounting Instructions

The following sections provide instructions for mounting interior and exterior tags.

Mounting Interior Tags

Interior tags are mounted with hook and loop material that is attached to the tag and to the windshield. Tags may be ordered from the factory with hook and loop material already applied to the tag. Once the tag has loop material applied to its case, the tag can be easily removed and used in any vehicle that has hook material on the windshield.

Interior tags may also be mounted with double-sided tape.

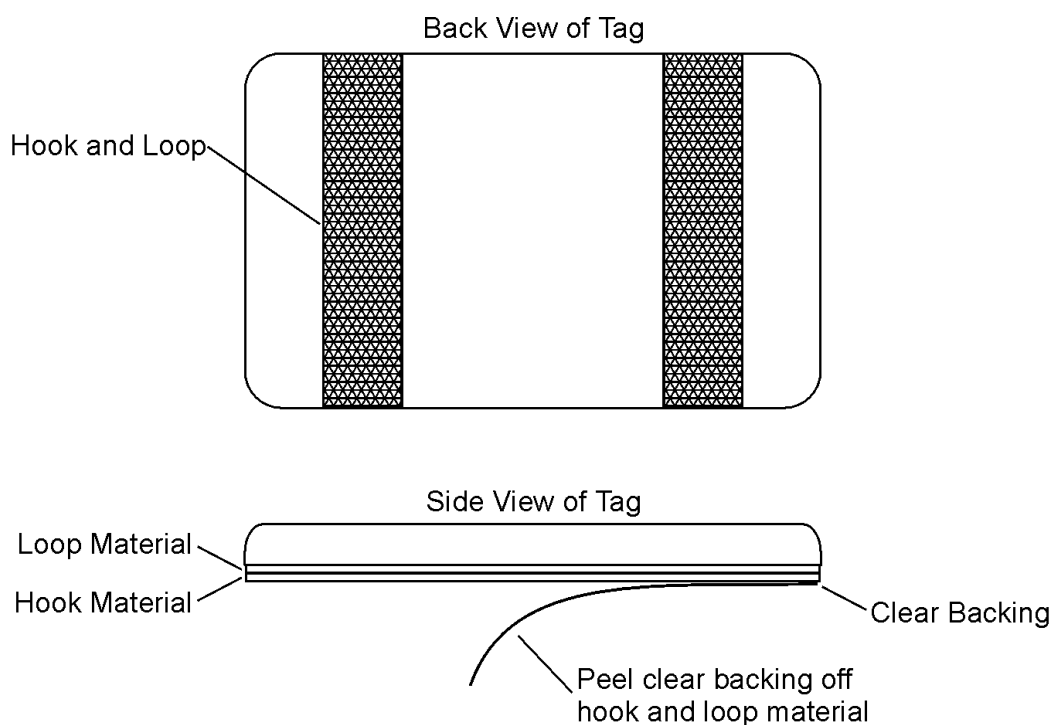
Note: *If you use double-sided tape to install the tags, the tags will be semi-permanently mounted.*

You need the following materials to mount interior tags:

- Rubbing alcohol or 50/50 isopropyl alcohol and water
- Sponge and dry cloth

To mount interior tags

1. Use the sponge and rubbing alcohol to clean the tag mounting area on the interior surface of the windshield.
2. Dry the area thoroughly with a clean, dry cloth.
3. Remove the clear backing from the two strips of hook and loop material on the back of the tag as shown in Figure 4-4 or from the double-sided tape.



TA-0072

Figure 4-4 Interior Tags with Hook and Loop Material

4. Position the tag over the mounting area of the windshield, ensuring that the logo on the tag and the logo on the SmartPass are oriented in the same direction, horizontal or vertical.
5. Press the tag firmly against the glass.

To remove an interior tag mounted with hook and loop material, pull the tag away from the windshield. The hook material will remain on the windshield.

Mounting Exterior Tags

Exterior tags are used in applications that require tags to remain mounted to one vehicle. The read zone of SmartPass installed overhead is reduced when an exterior tag is mounted on a license plate.

TransCore recommends that exterior tags be ordered from the factory with high-tension, double-sided tape already applied to the tag. Exterior tags may be mounted on metal or plastic bumpers. A flat surface is needed.

Exterior tags may also be ordered with blind rivet mounting.

You need the following materials to mount exterior tags:

- Degreasing solvent or cleaner and water
- Sponge and dry cloth
- If mounting tags that have rivet holes, two rivets, each with a 0.48 cm diameter and 1.59 cm head

Mounting Tag to Bumper with Tape

Follow these steps to mount the tag on a flat surface of a plastic or metal bumper with tape.

1. Clean and degrease the tag mounting area on the bumper with solvent or cleaner.
2. Dry the area thoroughly using a clean cloth.
3. Remove the backing from the double-sided tape on the back of the tag, as shown in Figure 4-5.

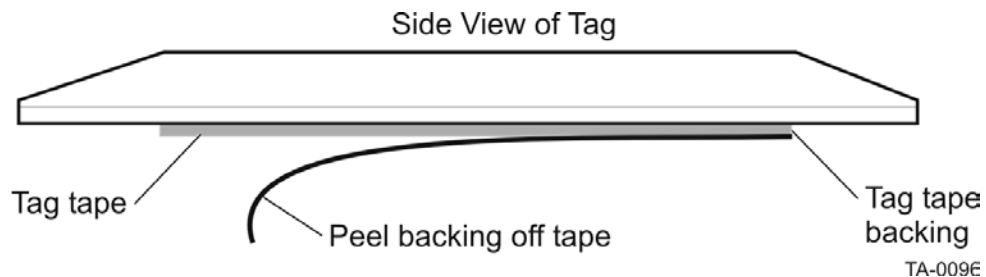


Figure 4-5 Exterior Tag with Adhesive Tape

4. Position the tag over the mounting area, ensuring that the logo on the tag and the logo on the SmartPass are oriented in the same position, horizontal or vertical.
5. Press the tag firmly against the bumper.

To remove an exterior tag mounted with double-sided tape, slowly pry off the tag with a thin tool, such as a putty knife.

Mounting Tag to Metal Bumper with a Blind Rivet

Follow these steps to mount exterior tags with mounting tabs for rivets.

- 1.** Position the tag on the bumper and mark the location of the holes.
- 2.** Follow the riveter manufacturer's instructions for installing the rivets.

If the rivet head is too small and can be pulled through the tag mounting holes, place a small washer behind the rivet head.

To remove an exterior tag mounted with a blind rivet, file the head off the rivet and remove the tag.

Installing SmartPass®

Installing SmartPass[®]

After you determine the location to mount the tags and prepared the site, you are ready to install SmartPass and connect the power and communications. This chapter provides these procedures.

Overview

This unit is intended to be installed using listed outdoor grade conduit in accordance with applicable local electrical and building standards. Installation by a licensed electrician and building inspection may be required.



Warning

A disconnect device is not incorporated in this equipment. Therefore, a readily accessible disconnect device must be incorporated in the fixed wiring that supplies power to the SmartPass. This disconnect device must be in series with the hot power lead, or a double-pole disconnect device must be placed in series if the neutral lead cannot be identified.



Warnung

Ein Trennschalter ist bei diesem Gerät nicht vorhanden. Ein einfach zugänglicher Schalter sollte in die feste Verkabelung, die den Strom SmartPass zuführt, eingebaut werden. Dieser Schalter sollte in Serie mit der stromführenden Leitung angeschlossen sein bzw. ein zweipoliger Schalter muß in Serie angeschlossen werden, falls der Nulleiter nicht identifiziert werden kann.



Advertencia

Debido a que este aparato no incorpora un dispositivo de desconexión, el cableado fijo que alimentará SmartPass debe disponer de un dispositivo de desconexión al cual se pueda acceder con facilidad. Dicho dispositivo de desconexión debe estar conectado en serie al alambre con corriente o, si no resulta posible identificar el alambre neutro, se debe instalar un dispositivo de desconexión bipolar en serie.



Avertissement

Ce matériel n'est pas muni d'un dispositif de mise hors circuit. Un tel dispositif doit être incorporé de façon aisément accessible au câblage fixe qui alimente le SmartPass. Le dispositif en question doit être posé en série avec le conducteur d'alimentation ou, si le conducteur neutre ne peut pas être identifié, connecter en série un dispositif de mise hors circuit bipolaire.



Avvertenza

Un dispositivo di disinserimento non è incorporato nell'apparecchiatura. Un tale dispositivo, facilmente accessibile, deve essere incorporato nel cablaggio fisso che eroga la corrente SmartPass e deve essere in serie con il conduttore isolato sotto tensione. Qualora non fosse possibile identificare il conduttore neutro, deve essere messo in serie un dispositivo di disinserimento bipolare.

Additional Materials Required

You need the following additional materials to install SmartPass:

- Accessory bracket, if additional flexibility in defining the read zone is needed — TransCore recommends the accessory bracket if SmartPass will be installed on any flat surface.
- Number 4 Allen wrench to assemble and adjust the mounting brackets
- Two 1.3-cm wide, stainless-steel hose clamp straps that are 30.5 cm long to use with a 5-cm diameter pole

or

- Two 1.3-cm wide, stainless-steel hose clamp straps that are 61 cm long to use with a 25-cm diameter pole
- Flat tip screwdriver or adjustable wrench to tighten hose clamp straps
- Audible circuit tester (buzz box) — directions for buying or making a buzz box are located in Chapter 3, “Quick SmartPass Test.”
- Tools and supplies for the power and communications connections — these may include 1.3 cm watertight flexible conduit and fittings, terminal strips or wire nuts, wire strippers, tape, and heat-shrinkable tubing.
- SmartPass software diskette, which is supplied to TransCore dealers and distributors
- PC with 1.44 MB floppy disk drive, MS DOS, RS-232 COM1 port, and a communications cable with a DB9 or DB25 connector configured for 9600 baud, 8 bits, 1 stop bit, and no parity
- Two test tags of the same type that will be used in live operation — test tags may be obtained from your TransCore dealer or distributor.

Installation Instructions

SmartPass can be installed on a round pole or on a flat surface, such as a wall, ceiling, or an overhead structure. The location of SmartPass must be compatible with the location of the tag. The tag must be in a direct line of sight to the reader. Refer to

the appropriate section of this chapter for installing SmartPass in the correct location.

Installing SmartPass on a Round Pole

If SmartPass will be installed on a round pole, the pole must be a minimum of 5 cm in diameter and should extend 2.1–3 m above the pavement level. The pole should be installed according to local building codes.

Figure 5-1 illustrates a front view and a top view of a SmartPass that is mounted on the left side of the road on a round pole. The figure shows the approximate measurements used when tags are mounted inside the windshield on the left side.

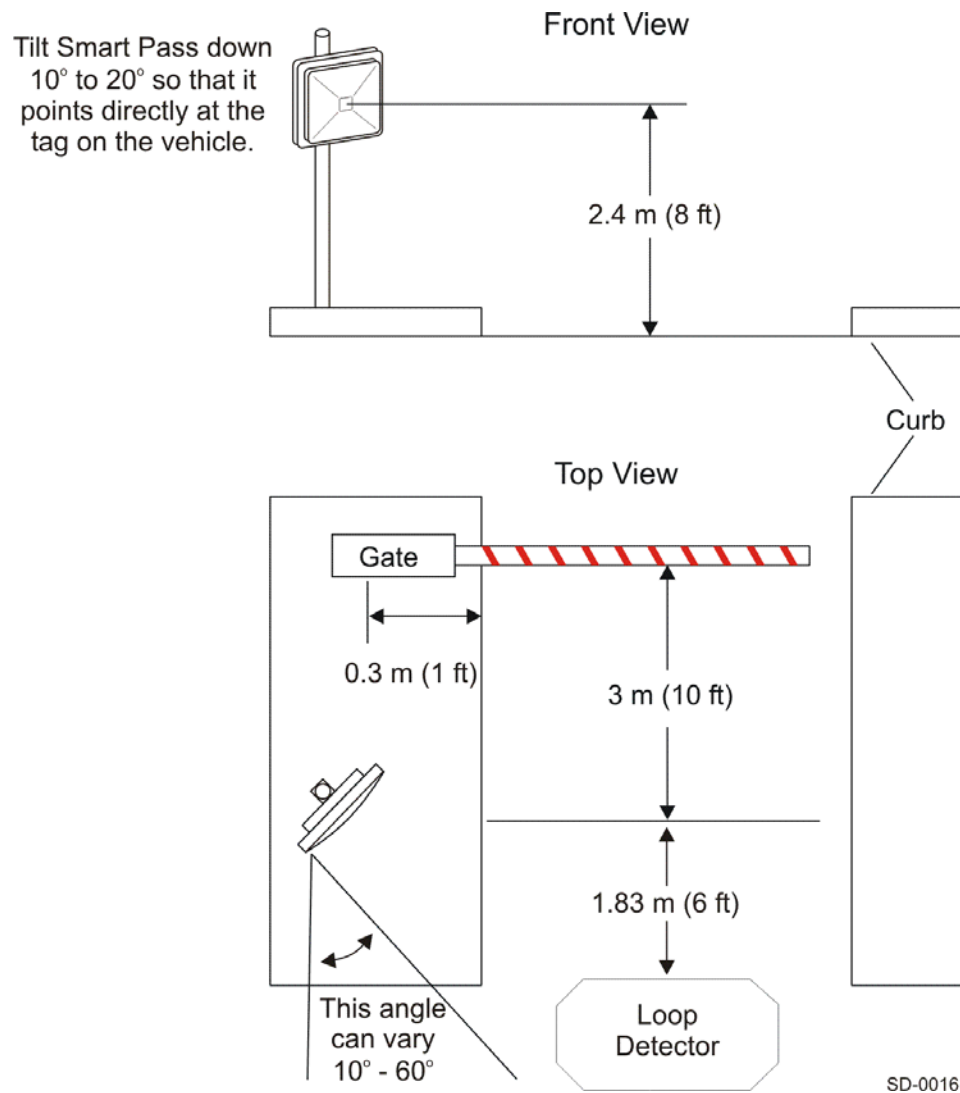


Figure 5-1 Front and Top View of SmartPass

To install SmartPass on a round pole

1. Unpack SmartPass. A factory-mounted bracket is attached to the back of SmartPass. A pole-mount bracket is packaged separately in the SmartPass shipping carton. These two brackets allow you to adjust SmartPass up and down.
2. Using the two 1.3-cm stainless-steel straps, attach the pole-mount bracket to the pole 1.8–2.4 m above the pavement surface. Tighten slightly.
3. Using the four machine screws and washers that come with the pole-mount bracket, attach SmartPass to the pole-mount bracket. The screws should be loose enough that you can adjust SmartPass up or down.

Figure 5-2 shows a side view of SmartPass installed on a round pole using the pole-mount bracket.

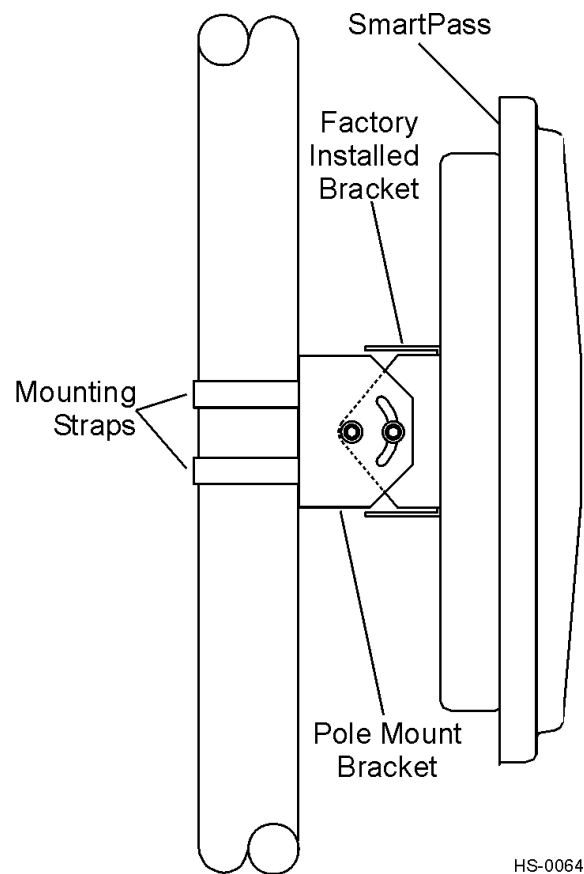


Figure 5-2 Side View of SmartPass

4. Adjust SmartPass to point to the middle of the area where tags must be read.

Note: You should determine the read zone before you tighten all screws and straps. Refer to *Marking the Read Zone* section later in this chapter. You can adjust

SmartPass while determining the read zone. After you have defined the read zone, tighten all screws and straps.

Installing SmartPass on a Flat Surface

You can install SmartPass on a flat surface, such as a wall, ceiling, or overhead structure using the factory-mounted bracket and the pole-mount bracket. This mounting will allow you to adjust SmartPass up or down. However, if you need additional flexibility in aiming your SmartPass, you will need to use the accessory bracket. The accessory bracket allows you to adjust SmartPass up, down, left, and right.

Installing SmartPass on a Flat Surface Without Using the Accessory Bracket

Follow the instructions below to install SmartPass on a flat surface without using the accessory bracket

1. Unpack SmartPass. A factory-mounted bracket is attached to the back of SmartPass. A pole-mount bracket is packaged separately in the SmartPass shipping carton. These two brackets allow you to adjust SmartPass up and down.
2. Using 0.6-cm bolts, attach the pole-mount bracket to the flat surface. Tighten slightly.
3. Using the four machine screws and washers that come with the pole-mount bracket, attach SmartPass to the pole-mount bracket. The screws should be loose enough that you can adjust SmartPass up or down.
4. Adjust SmartPass to point to the area where tags must be read.

Figure 5-3 shows SmartPass installed to an overhead structure. This mounting uses the factory-mounted bracket and the pole-mount bracket. Tags would be mounted on the top center of the windshield interior.

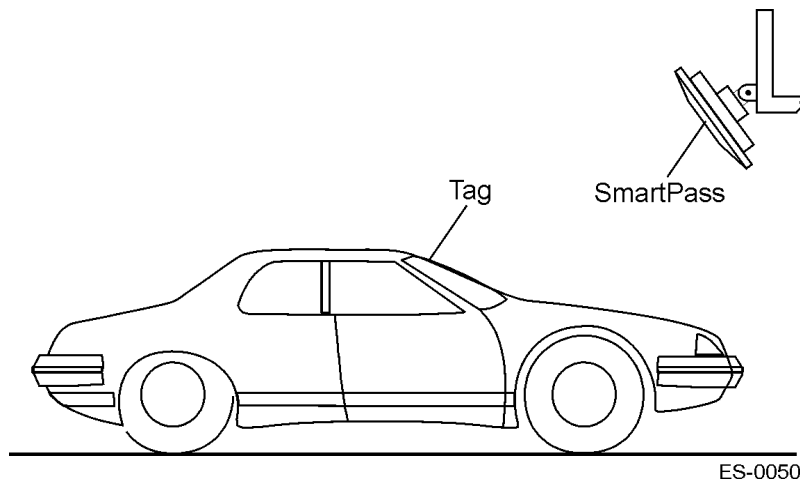


Figure 5-3 SmartPass Installed on a Flat Surface

Note: *You should determine the read zone before you tighten all screws. Refer to “Marking the Read Zone” later in this chapter. You can adjust SmartPass while determining the read zone. After you have defined the read zone, tighten all screws and straps.*

Installing SmartPass on a Flat Surface Using the Accessory Bracket

If you need additional flexibility in aiming SmartPass to determine your read zone, TransCore recommends the accessory bracket kit, Part No. 54-1600-001. The accessory bracket allows up, down, left, and right adjustment. Figure 5-4 shows the accessory bracket

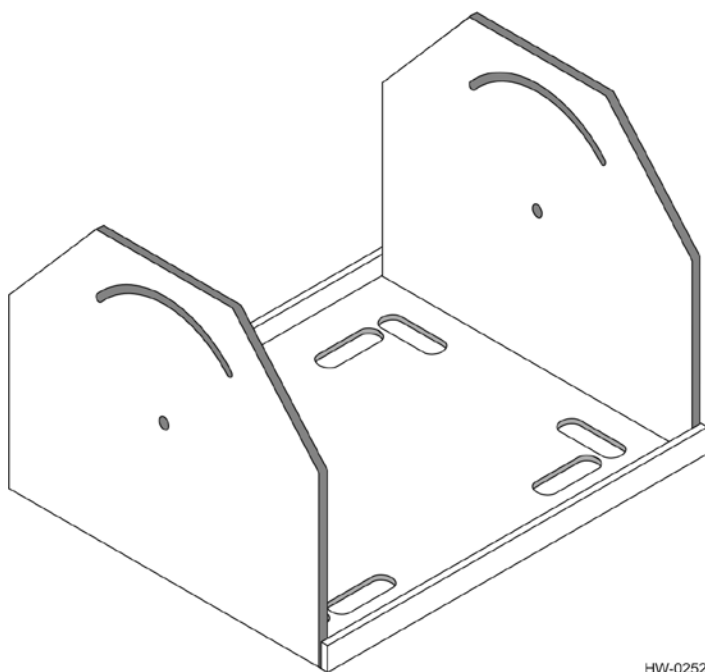


Figure 5-4 Accessory Bracket

The accessory bracket kit includes the following items:

- One bracket, shown in Figure 5-4
- Four machine screws
- Four washers

To install SmartPass using the accessory bracket kit

1. Unpack SmartPass. A factory-mounted bracket is attached to the back of SmartPass. A pole-mount bracket is packaged separately in the SmartPass shipping carton. These two brackets allow for adjusting SmartPass up and down.

2. Using a Number 4 Allen wrench, remove the factory-mounted bracket from the back of SmartPass. Keep the six rubber seals and machine screws that are on the back of the bracket.
3. Using the screws, washers, and rubber seals you kept in Step 2, attach the accessory bracket to the back of SmartPass. Tighten slightly



Caution

Ensure the rubber seals are installed, or SmartPass may be damaged by moisture.



Vorsicht

durch Feuchtigkeit beschädigt werden kann.



Precaución

Para que el SmartPass no quede dañado por la humedad, cerciórese de haber instalado las juntas de caucho.



Précaution

S'assurer que les joints en caoutchouc sont en place afin d'éviter la pénétration d'humidité dans le SmartPass.



Attenzione

Controllare che le guarnizioni di gomma siano installate, altrimenti SmartPass potrebbe venire danneggiato dall'umidità.

4. Using the four machine screws and washers that came with the accessory bracket, attach the factory bracket to the accessory bracket, aligning the six screw holes. Tighten only slightly because you will want to adjust later. This subassembly allows SmartPass to be aimed left or right.
5. Attach the pole-mount bracket to the wall, ceiling, or flat surface using appropriate anchors.
6. Attach the SmartPass assembly to the pole-mount bracket using machine screws. Adjust SmartPass to point at the read zone and tighten the screws slightly.

Figure 5-5 shows SmartPass installed on a flat surface using all three brackets.

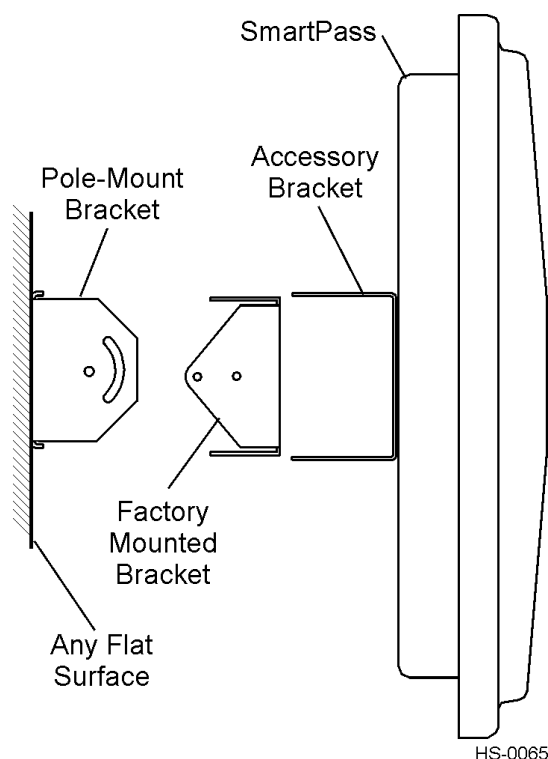


Figure 5-5 SmartPass With Three Mounting Brackets

Note: You should determine the read zone before you tighten all screws. Refer to *Marking the Read Zone* section below. You can adjust SmartPass while determining the read zone. After you have defined the read zone, tighten all screws and straps.

Marking the Read Zone

TransCore recommends that you adjust SmartPass for the ideal read zone before connecting SmartPass to permanent input/output and communications cables.

The antenna pattern of SmartPass looks like a pear-shaped balloon. To mark the read zone, you will need a buzz box, which is described in Chapter 3, “Quick SmartPass Test”; a piece of chalk or roll of tape; and a test tag attached to a yardstick.

Note: If you hold the test tag in your hand, your hand will absorb the RF signal, and the test results will be incorrect.

Use vinyl electrical tape to attach the test tag to the end of the yardstick. Be sure the logo on the tag is level when the yardstick is upright and faces the same direction, horizontally or vertically, as the logo on SmartPass.

To mark the read zone

1. Connect the red and white leads from the buzz box to the red and white pair of wires from the SmartPass cable.
2. Twist the red and green pair of wires from the SmartPass cable together. This turns on the RF power continuously.

The buzz box will buzz when a tag is in the read zone of SmartPass.

3. Stand directly in front of and about 1.5 m away from SmartPass holding the stick so that the tag is positioned at the average height and angle as when it is installed in a vehicle. The test tag will cause the buzz box to sound.
4. Move to the left.
5. When the buzz box sound stops, mark the pavement with chalk or tape at the location of the tag when the sound stopped.
6. Step backward 0.3–0.6 m and repeat Step 5, moving the tag back and forth to find the edge of the read zone and putting marks on the pavement each time the buzz box sound stops. Continue moving the tag to various locations until the read zone is fully marked.

When you finish marking the read zone, the marks on the pavement will indicate the area where SmartPass reads tags, called the read zone. Figure 5-6 is a view of a typical installation. The *x* marks show the outside edges of an ideal read zone.

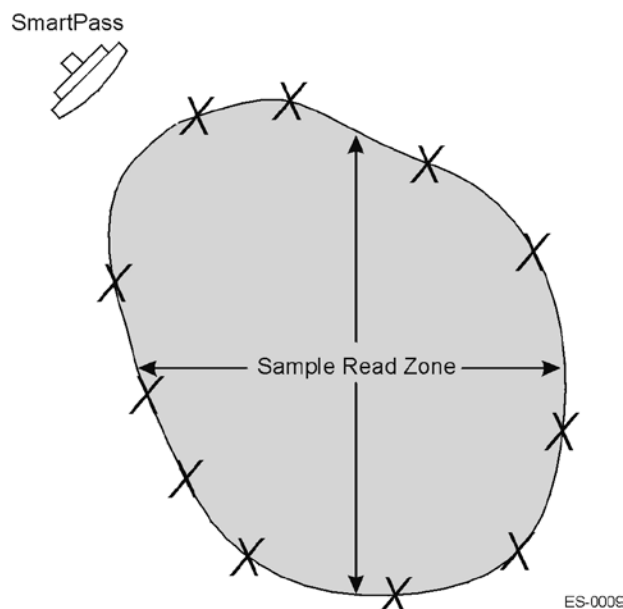


Figure 5-6 Sample Read Zone Marking Pattern

Changing the Read Zone

The shape of the read zone may need to be adjusted if any external devices, such as lights or a gate arm, are being used. The shape of the read zone determines when the external device will be activated. When a tagged vehicle enters the read zone, the external device is activated.

Example: In a gate arm application, ensure that the read zone will provide enough time for the gate to open and allow the vehicle to pass through the gate. The amount of time can be changed by adjusting the angle of SmartPass, which lengthens or shortens the read zone.

If the read zone is too wide or too long, it can be adjusted by loosening the screws on the mounting brackets and adjusting the angle of SmartPass. Changing the angle of SmartPass will change the width or depth of the read zone.

Communications Wiring Tables

Before connecting the SmartPass communications cable to the junction box, TransCore recommends that you perform a quick test of the SmartPass hardware and software using a PC. Select the proper wiring table for your SmartPass interface from the tables shown in Appendix C, Wiring Tables. Instructions for testing SmartPass are located in Chapter 3, “Quick SmartPass Test.” After you test SmartPass with a PC, connect the SmartPass communications cable to the junction box. You are now ready to connect power from SmartPass to the junction box.

Connecting Power from SmartPass to the Junction Box

A 3-conductor, 18-gauge wire pigtail connected to SmartPass provides AC power to the unit.



Caution

The power source to SmartPass must be disconnected before SmartPass is wired to the junction box.



Vorsicht

Die Stromversorgung des SmartPass abtrennen, bevor das SmartPass an die Anschlußdose angeschlossen wird.



Precaución

Debe desconectar la fuente de alimentación al SmartPass antes de cablearlo a la caja de conexión.



Précaution

La source d'alimentation doit être débranchée du SmartPass avant que celui-ci ne soit relié à la boîte de connexion.



Attenzione

L'alimentazione elettrica erogata a SmartPass deve essere disinserita prima che questo venga collegato alla scatola di giunzione.

The power connection is fed through a liquid-tight electrical fitting with a 1.3-cm pipe NPT male thread. This pipe must be acceptable for outdoor use. TransCore recommends that the pipe be flexible.

To connect the power to the junction box

1. Slide the 1.3-cm pipe NPT female thread over the power cord from SmartPass, and thread the pipe firmly onto the male fitting.
2. Slide the 1.3-cm conduit over the power cord and attach to the fitting placed in Step 1.



Caution

Check the voltage from the junction box to ensure there are no electrical surges. Electrical surges can damage SmartPass.



Vorsicht

Die Spannung an der Anschlußdose daraufhin überprüfen, daß keine Spannungsspitzen auftreten. Spannungsspitzen können SmartPass beschädigen.



Precaución

Para garantizar que no se produzcan sobretensiones, compruebe la tensión desde la caja de conexión. Las sobretensiones pueden dañar el SmartPass.



Précaution

Vérifier la tension à la sortie de la boîte de connexion pour s'assurer qu'il n'y a pas de danger de surtensions. SmartPass est vulnérable aux surtensions.



Attenzione

Controllare la tensione proveniente dalla scatola di giunzione per escludere eventuali sovratensioni, che potrebbero danneggiare SmartPass.

3. Bring the power cable from SmartPass and connect to the junction box power terminal strip using the color coding described in Table 5-1.

Table 5-1 AC Cable Connections

Cable Colors		
International Colors	U.S. Colors	Connection Use
Blue	White	AC neutral
Brown	Black	AC hot (90–260 V AC)
Green and yellow	Green or red	Safety ground

Connecting Communications

TransCore offers reader communications through RS–232, RS–422, and Wiegand interface protocols. This section provides the procedures for connecting the communications to the junction box and the input and output circuit connections.

Connecting Communications to the Junction Box

SmartPass communications and customer interface signals are supplied from SmartPass to the host through a multiwire cable, which is an 11-pair pigtail. This cable is fed through a watertight feed-through located on the back of SmartPass near the bottom. Refer to the correct wiring table for your interface connection and connect the appropriate wires from the communications cable to the terminal strip that is located inside the junction box.

Connecting Input and Output Circuits

SmartPass has two input circuits and two output circuits available. The input circuits can be used to notify SmartPass of external events and are designed to be connected to a free of voltage dry contact. Output circuits are single-pole, double-throw relays, which provide normally closed and normally open dry contacts.

Input Circuits

SmartPass supports two input circuits, input0 and input1. The SmartPass software monitors the status of the input circuits.

Input0 is the presence detection device line. It controls the RF power. For more information on RF power, see the following section, *RF Control*. Input0 connects through the green and red wire pair on the input/output pigtail.

By default, SmartPass expects input0 *to close*, called a true presence condition, when a vehicle is present. This condition is also referred to as a normally open configuration. However, SmartPass can be configured to expect input0 *to open* when a vehicle is present, a normally closed configuration. The minimum true presence

period is fixed at 0 ms, which means that the circuit closes instantly when a vehicle is present.

Input1 is available as a general-purpose input circuit.

Note: *The Wiegand interface does not support input1.*

RF Control

The RF power output circuit can be controlled by any of the following:

- A vehicle detector, using one of the two input circuits
- Software, using commands sent to SmartPass by the host
- Twisting the input0 wire pair together

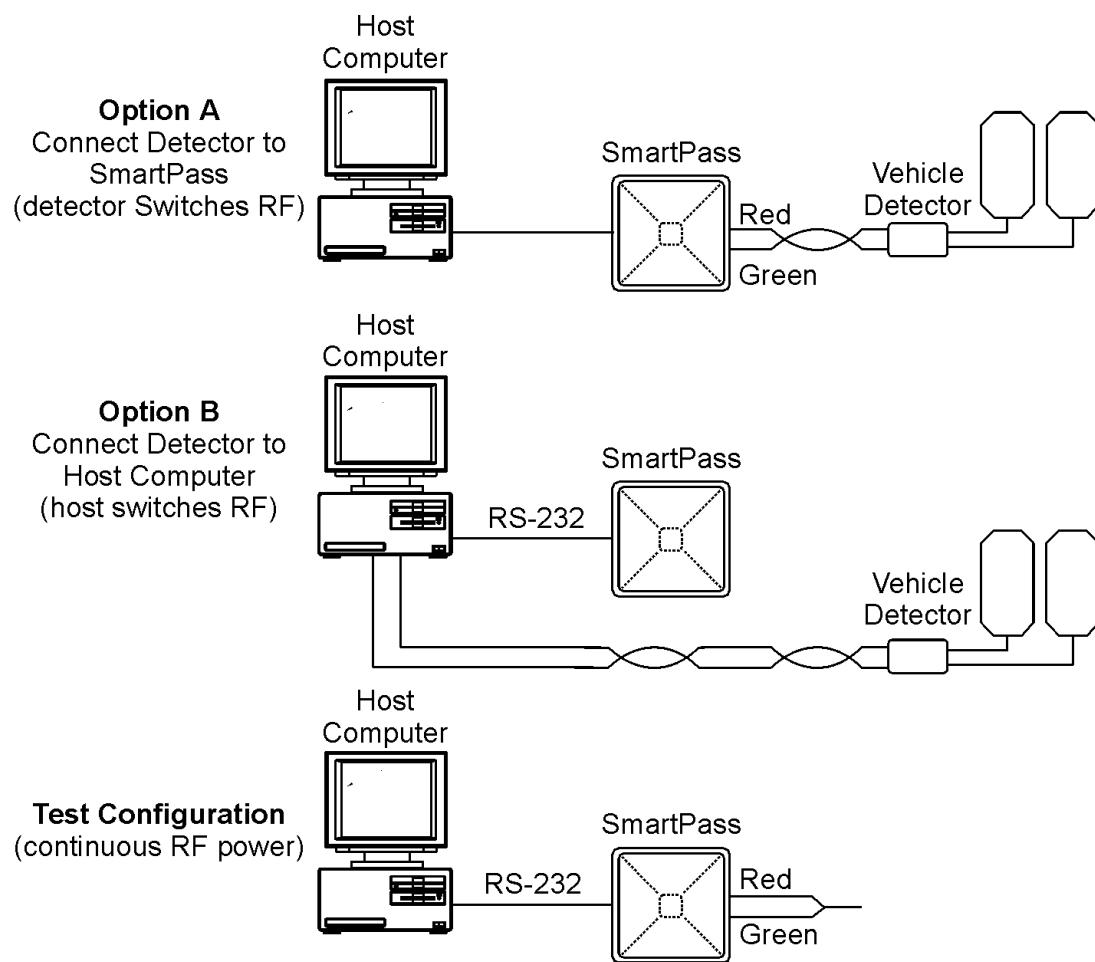
As a factory default, SmartPass is configured to control the RF power output circuit by a vehicle detector. The vehicle detector can be a loop detector, infrared sensor, or ultrasonic detector that is connected to the input0 to turn on the SmartPass RF transmitter. Figure 5-8, Option A, shows a vehicle detector controlling the RF transmitter. This operation is preferred because the RF transmits only when a vehicle is in the SmartPass read zone.

If the vehicle detector is connected to the host computer as shown in Figure 5-8, Option B, commands 6400 and 6401 from the host control the SmartPass RF transmitter. Command 6400 turns the RF transmitter off, and command 6401 turns the RF transmitter on.

Note: *For information and instructions on executing software commands, refer to Chapter 9, "Commands."*

You can turn on the SmartPass RF transmitter all the time by twisting the input0 wire pair conductors together as shown in Figure 5-8, Test Configuration. SmartPass will then transmit continuously.

To return the SmartPass RF control to the external vehicle detector, use command 6401, which selects the RF-by-sensor control.



SC-0028

Figure 5-7 SmartPass RF Control Options

Output Circuits

SmartPass supports two output circuits, output0 and output1. Both the output0 and output1 circuits consist of two wires that supply an AC or DC circuit path. These output circuits are dry contacts that provide normally open and normally closed outputs, as illustrated in Figure 5-9. The relay contacts are rated at 125 V AC or DC at 1 A

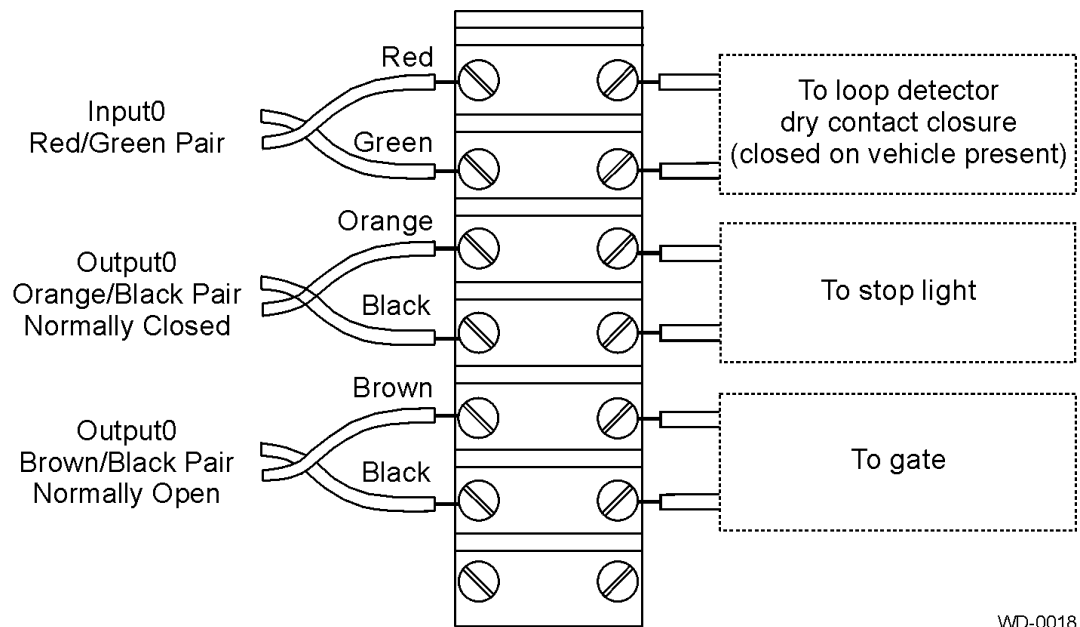


Figure 5-8 Example Circuit Connections

A SmartPass configured with the Wiegand interface does not have the output1 or input1 circuits available. In Wiegand mode operation, output0 is not controlled by predefined output mode.

Output1 is not available when the external check tag function is enabled.

Connect the remaining wires to the appropriate terminal blocks on the terminal strip in the junction box. Table 5-2 lists the cable descriptions and functions for the interface signals.

These wire pairs can be used or terminated as required by the specific application. TransCore strongly recommends that you either terminate or shrink-wrap these wire pairs. If you cut the wires, you may not be able to use them in the future for either testing or for adding additional functions.

Table 5-2 External Interface Signal Wiring

Wire Pair	Wire Color	Signal	Typical Function
Blue/red	Blue	Wiegand data0	Parking/access control applications
	Red	Wiegand data1	Parking/access control applications
White/red	White	Lock common	Testing maintenance
	Red	Lock normally open	Testing maintenance
Green/red	Green	Input0	Loop and presence detect
	Red	Input0 return	Loop and presence detect
Yellow/black	Yellow	Logic ground	Ground (not used with RS-422)
	Black	Logic ground	Ground (not used with RS-422)
Blue/black	Blue	Input1	A general purpose input; not used to detect presence (not available with Wiegand)
	Black	Input1 return	A general purpose input; not used to detect presence (not available with Wiegand)
Orange/black	Orange	Output0 normally closed	Switches output for any external control (light, gate, buzzer, etc.)
	Black	Output0 common	Switches output for any external control (light, gate, buzzer, etc.)
Brown/black	Brown	Output0 normally open	Switches output to control gate
	Black	Output0 common	Switches output to control gate
White/black	White	Output1 normally closed	Switches output (not available with Wiegand)
	Black	Output1 common	Switches output (not available with Wiegand)
Green/black	Green	Output1 normally open	Switches output (not available with Wiegand)
	Black	Output1 common	Switches output (not available with Wiegand)

Grounding the Communications Cable Drain Wires

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

Testing With Host System

As the final step of installing your SmartPass, TransCore suggests that you test the entire system using the SmartPass software diskette. Instructions for testing the system using this diskette are described in Chapter 3, “Quick SmartPass Test.”

General Software Information

Chapter 6

General Software Information

This chapter provides software-related information for SmartPass® AI16XX systems. The information covers version 2.00D of the SmartPass software. Version 2.00D software will execute on all SmartPass models if a D Decoder logic board is installed. Refer to the READ.ME file on the software diskette that is distributed to the dealers for information on the D Decoder. If you do not have a D Decoder, you should use a previous version of the System Guide for software-related information for SmartPass.

Note: *It is strongly recommended that you read the READ.ME file on the SmartPass software diskette before you install or use SmartPass.*

Overview

SmartPass is delivered from the factory with specified default settings. These settings and additional features can be controlled by commands transmitted by the host. The commands can be transmitted with specialized host software or by manually entering the commands at the host keyboard if the host is in terminal emulation mode. Host software is not delivered with SmartPass. SmartPass can also communicate with ASCII terminals and printers.

In addition to this chapter, Chapter 7 covers the operating modes, Chapter 8 covers the communication protocols, and Chapter 9 covers the available user commands.

The information in this chapter is arranged in alphabetical order by subject.

Communications Port

SmartPass supports one communications port (MAIN), which can be ordered as either RS-232 or RS-422. An additional Wiegand interface port can be requested when ordering SmartPass from the factory. See command 451 in Chapter 9, “Commands” for more information on the Wiegand interface.

For the RS-232 and RS-422 communications specifications, SmartPass maintains the following three sets of parameters that affect serial port communications:

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

The default serial port configuration is as follows:

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

You can change these parameters for data mode and command mode operation by issuing commands with the host. Refer to Chapter 9, “Commands”. While operating in download mode, the SmartPass reader always uses the default configuration parameters.

Error Messages

SmartPass supports several error messages.

Error is the standard error message to host commands. It is transmitted if a command received from the host is illegal or if information supplied with the command is illegal. Also, the reader sends this message to diagnostic commands if the reader fails the specified test.

The error messages shown in Table 6-1 are transmitted based on the content level of the tag buffer. These messages are transmitted in data mode and command mode. They will not be transmitted if uniqueness checking has been disabled to transmit all IDs (command 40) or buffer all IDs (command 43).

Table 6-1 Error Codes

Error Message	Buffer Status
Error02	Tag buffer is full. Incoming IDs cannot be buffered. An overflow of the tag buffer can occur if SmartPass is left in command mode or if flow control has disabled transmission. A buffer overflow results in subsequent tag IDs being lost.
Error03	Tag buffer has been partially cleared and new IDs are once again being stored.
Error04	Tag buffer has filled to 75%.
Error05	Tag buffer has emptied to 50%.

If the buffer fills up and then transmission is re-enabled, the sequence of transmitted reports would be as follows:

- Error 04 filled to 75% full
- Error 02 100% full
- Error 03 emptied to less than 100%
- Error 05 emptied to 50%

Flow Control

Two modes of flow control are supported, software (XON/XOFF) and hardware (CTS, clear to send). The host can enable or disable flow control with command 614N.

The host can use software control characters (XON/XOFF) or the hardware handshake line (CTS) to interrupt reader transmissions. If the reader is configured for software flow control, the reader will cease transmitting if it receives the command XOFF (command 13H). It resumes transmission only when it receives the command XON (command 11H). Likewise, if the reader is configured for hardware flow control, it will cease transmission if it detects that the CTS line is no longer asserted. It will resume transmission when this line is asserted again. If flow control is not needed, the reader should be configured for no flow control (command 6140).

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

ID Separation

The host can select a unique ID separation of one ID (command 4100) or two IDs (command 4101). The uniqueness timeout is fixed at 2 minutes. The reader default operation is for a unique ID separation of one ID and a uniqueness timeout of 2 minutes. The host computer can disable the uniqueness check using the transmit all IDs command (40) or buffer all IDs command (43). In this case, every tag ID received will be transmitted without regard to uniqueness. The host can reinstate uniqueness checking with the select ID separation commands (4100/4101).

Input Circuits

Both the RS-232 and RS-422 configurations used by SmartPass have two input circuits, input0 and input1. The default configuration uses input0 as the presence detection device line. RF power is automatically turned on only when the presence detection device (loop detector or other device) detects a presence. Input1 is not used directly by the reader; it is used by the host. The reader can be configured with command 82N to generate input status change reports, which are transmitted like tag IDs. The host can then respond based on the true/false (closed/open) status of the inputs. The input circuits of the reader are designed to connect to a dry contact closure. The input1 circuit is not available on Wiegand-configured SmartPass systems.

Note: *The input circuits may be referred to as sense or sensor inputs in other documentation.*

Operating Parameters

SmartPass readers maintain their operating parameters in battery-powered RAM so that the parameters will be preserved after a power down sequence.

Output Circuits

Both the RS-232 and RS-422 configurations used by SmartPass have two output circuits, output0 and output1. A typical installation may use one of the outputs to control a gate or signal light, turning it on only when the host sends the turn on command (command 620N).

Note: Output1 is not available on Wiegand-configured SmartPass systems.

Power Fail

The system maintains a power fail flag. The host transmits display power fail bit (command 520) to determine if a power down has occurred. This flag is cleared by both reset reader (command 63) and reset power fail bit (command 65).

Program Download

The SmartPass applications software is stored into the reader flash memory by program download. Program download is used to install program upgrades, add features, and to recover from corrupted program data. The download mode supports commands 90, 91, 96, 97, and 99.

Download Considerations

The following items should be considered when performing program download:

- No tags are processed while in download mode
- Only download commands are accepted while in download mode. The reader responds to all other commands with an Error message
- The reader will 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 7 seconds
- Exiting from download mode will re-execute startup. If the new software has been loaded without errors, the reader will come up in data mode. If a flash checksum error is detected, the reader will reenter download mode and transmit a sign-on message with a software version of 0.00 and without a serial number

Note: The reader uses default communication parameters when operating in download mode (9600 baud, 8 data bits, 1 stop bit, no parity, basic protocol). Also, the reader does not echo commands in download mode.

Download Procedure

1. Enter command mode (command 01). The reader will transmit a Done message.
2. Switch to download mode (command 05). The reader will transmit a Done message.
3. Erase the program stored in flash memory (command 96). The reader will transmit a Done message.
4. Transmit the new program file from the host to the reader using command 90, one Intel hex record at a time as shown below:

```
#90<Intel hex data record><CR>
```

The reader will transmit a Done message for each record.

5. Once the download is complete, perform a checksum verification (command 91) on the new program in the flash memory. The reader will transmit a Done message if the flash checksum verified or an Error message if it failed.
6. Exit download mode (command 99). The software will re-execute startup to ensure proper initialization of system parameters. If the flash memory checksum verifies, the reader will come up in data mode and will transmit the sign-on message shown below:

```
Model [Model] Ver [software version] SNYYYYYY
```

```
[Copyright notice]
```

If the flash checksum does not verify, the reader will come up in download mode and will transmit the sign-on message shown below:

```
Model [Model] Ver 0.00
```

```
[Copyright notice]
```

If this happens, repeat steps 1 through 6 above.

Reports

SmartPass can be configured to transmit presence without tag reports and input status change reports. Both report messages are handled the same as incoming tag IDs and are buffered behind previously acquired tag IDs.

A presence without tag report is transmitted in data mode only. This report is sent if a presence is detected without the acquisition of a valid tag ID.

If configured with command 82N to transmit input status change reports, the reader will transmit a message to the host any time the inputs change state. Input status

change reports are transmitted in data mode only. Input status change reporting is disabled by default.

Refer to Chapter 8, “Communication Protocols” for information on message formats.

Reset Command

Reset reader command 63 clears the tag and message buffer. In addition, it resets uniqueness, clears the power fail bit, and transmits the sign-on message. The reader returns to data mode following the completion of this command.

Startup

Upon startup, SmartPass readers transmit a sign-on message or a boot ROM failure message.

Sign-On Message

The sign-on message should appear as shown below:

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

where

YYYYYY serial number assigned to SmartPass

Serial number 000000 is the default setting and is not a valid number. If this number appears in the sign-on message, either the battery has failed or the serial number has never been stored into reader memory. The appropriate serial number is assigned using command 695.

If the flash memory checksum does not verify, the sign-on message appears as shown below:

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

Note: *The version number equals 0.00, and there is no serial number. This indicates that the flash memory checksum has failed and that the reader is operating out of boot ROM. In this case, the reader automatically enters download mode and waits for a new program to be loaded into the flash memory. Follow the instructions in the Program Download section of this chapter.*

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.

Tag/Message Buffer

SmartPass readers maintain a tag buffer in battery-backed RAM to save tag IDs acquired while in the command mode or buffer control mode and when data inquiry protocol is used. This buffer holds up to 195 time-stamped messages. Error messages will be transmitted to the host to provide buffer status as it fills. When the buffer fills, subsequent tag IDs will be lost. For more information on how the buffer works, refer to the Error Messages section in this chapter.

Time and Date

The time and date can be appended to tag ID strings, error messages, presence without tag reports, and input status change reports. A real-time clock maintains the current date and time. This clock can be set using host commands 20 and 21. The date and time can be displayed using command 22.

Modes of Operation

Chapter 7

Modes of Operation

This chapter describes the SmartPass modes of operation.

Overview

SmartPass® readers support the following modes of operation:

- Data mode
- Command mode
- Buffer control mode
- Download mode

Data Mode

Except for three host commands, the reader initiates all communications as data messages (tag IDs and reports) in data mode. The reports provide information on input status changes (input0 and input1), a presence without tag, and buffer overflow.

The host can initiate the following three commands during data mode: switch to command mode (01), switch to download mode (05), and invoke check tag (8110). If error correcting protocol is being used, acknowledgment or negative acknowledgment command messages are returned by the host, depending on whether a properly verified message was received from the reader.

If buffer control mode is disabled (command 6160), the reader will transmit the following messages asynchronously:

- Tag data
- Presence without tag reports
- Input status change reports
- Error0x messages (buffer 50%, 75%, or 100% full)
- Two-line sign-on message

Upon power-up or software reset (command 63), the reader transmits a two-line sign-on message that conforms to the data message format.

Each line of the sign-on message must be acknowledged separately by the host. With error correcting protocol (ECP), the first line of the sign-on message will always

have the sequence number initialized to zero. For more information on ECP, see Chapter 8, “Communication Protocols.”

Note: *The reader cannot be placed in command mode until the sign-on message is properly acknowledged.*

Command Mode

The host is capable of controlling the configuration and operation of the reader remotely by issuing command request messages while in command mode. By default, the reader will echo every byte of the received command (echo enabled, command 6171). Command 6170 can be used to disable the echo function. When the reader receives a command request it transmits a command message. Typically, the command message contains the `Error` string, a `Done` string, or data relating specifically to the command request (e.g., time and date).

Messages returned by the reader in command mode may be of variable length since some commands require information as part of the reader message.

The host computer sets a timeout delay at the time of command transmission. If the timeout delay expires prior to receiving a command message from the reader, a logical NAK (negative acknowledgment) condition is declared. The host then retransmits the command request message.

Communications can be lost if the host computer attempts to invoke certain commands under marginal communication conditions. For example, if the host computer transmits the command request to change baud rate and the reader properly receives the request and transmits the `Done` message, one of the two conditions described below may occur.

If the host receives the `Done` message, then both ends switch to the new baud rate, and communication is maintained.

Note: *The reader changes baud rate immediately after issuing the `Done` message.*

However, if the `Done` message transmitted by the reader is not correctly received by the host, the host would assume that the command was not properly invoked and would not switch to the new baud rate.



Caution

Because this condition would lead to a loss of communications, the host should not attempt to change communications parameters or protocols during marginal communications conditions.



Vorsicht

Da diese Bedingung zum Verlust der Kommunikation führen kann, sollte der Host nicht versuchen, die Kommunikations- oder Protokollparameter während der Kommunikation im Grenzbereich zu ändern.



Precaución

El host no debería intentar cambiar los parámetros o los protocolos de comunicaciones bajo condiciones límite para las comunicaciones, ya que esto causaría la pérdida de las comunicaciones.



Précaution

L'ordinateur central ne doit pas tenter de modifier les paramètres ou protocoles de communication durant des conditions de communications marginales, sous peine de causer la perte des communications.



Attenzione

Poiché questa condizione porterebbe alla perdita di comunicazione, l'host non dovrebbe tentare di cambiare i parametri o i protocolli di comunicazione durante condizioni di comunicazione marginali.

The reader responds to command 611 (change to error correcting protocol) with a Done message in basic protocol and then switches to ECP. Conversely, when switching from ECP back to basic protocol or data inquiry protocols (commands 610 or 613), the Done message is transmitted in ECP format.

Note: TransCore recommends that basic protocol (not ECP) be used when commands will be entered manually at the keyboard.

Buffer Control Mode

When buffer control mode (BCM) is enabled (command 6161), the reader transmits only in response to a host command. The one exception to this rule occurs on start-up when the reader transmits its two-line sign-on message. BCM can only be used with ECP.

The following commands are used for BCM:

Table 7-1 BCM Commands

Number	Command Description	Message
06	Transmit buffer entry	Done, Error, or <message>
535	Display buffer control status where x = 0 for disabled 1 for enabled	BCM x
6160	Disable buffer control mode (default)	Done
6161	Enable buffer control mode	Done

If BCM is enabled, the host must request data (tag IDs and reports) from the reader using the transmit buffer entry command 06. If the reader receives this command and it has data in its buffer, it will transmit the buffered message of highest priority (tag IDs first and then reports). If the reader's buffer is empty, it will transmit the Done message instead. The reader will return an Error message if it receives command 06 when BCM is not enabled.

If BCM is enabled, the reader will not support ECP acknowledgment or negative acknowledgment (ACK/NAK) messages from the host. Since all messages are transmitted in response to a host command, acknowledgment from the host is not required. Instead, the ECP sequence numbers are used to ensure data integrity. If the host receives an erroneous reader message, it should retransmit transmit buffer entry command 06 with the same sequence number. This will cause the reader to search and replace its previous message.

If BCM is enabled, the reader will not use the timeout to trigger re-transmission of data because in BCM, reader data is transmitted only when requested by the host.

Download Mode

Program download is the process through which the SmartPass applications software is stored in the flash memory. The download mode is used to install program upgrades, add features, and recover from corrupted program data. The download mode supports commands 90, 91, 96, 97, and 99.

Communication Protocols

Communication Protocols

This chapter describes the communication protocols used by SmartPass®.

Overview

SmartPass readers support the following communication protocols:

- Basic protocol
- Error correcting protocol
- Data inquiry protocol

The following protocol information provides reference information relevant to developing host interface software.

A two-way message interchange is required in both data mode and command mode with error correcting protocol. This interchange is completed by the message recipient issuing a message.

With error correcting protocol (ECP), all transmissions require a message. If a message is not received, the sender will timeout with the same effect as if it had received a negative acknowledgment (from host) or an `Error` message (from reader).

XON/XOFF flow control is optionally supported. Be careful in the use of XON/XOFF because noise-induced characters may be interpreted by the reader as the XOFF character, which would suspend reader output without the host computer's knowledge.

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

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 with 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 able to ignore any messages that do not conform to the som...eom frame sequence.

Basic Protocol

With basic protocol, messages sent from the reader to the host are transmitted without error checking. Messages sent from the host to the reader are also transmitted without error checking. A Done or Error message is returned to the host by the reader for each host transmission.

The host must be ready to receive reader-transmitted messages because in basic protocol the 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 6, “General Software Information” for flow control information.

When the host computer is physically close to the reader and there are no sources of interference, the basic protocol provides reliable communications.

Error Correcting Protocol

Wherever the quality of data communications is imperative or may be suspect, error correcting protocol (ECP) can be invoked to ensure the integrity of data transmitted between the reader and the host. ECP is selected when the host transmits command 611 to the reader after issuing a switch to command mode request.

***Note:** It is recommended that basic protocol (not error correcting protocol) be used when commands are entered manually at the keyboard.*

Error Correcting Method

Error correction is accomplished with use of a cyclic redundancy check (CRC) value that is based on the message data. The CRC of a message is calculated by the originator (reader or host) and is included in the transmitted message.

The recipient (reader or host) also calculates a CRC for the received message. If the transmitted message data is correct, the CRC calculated by the recipient will agree with the CRC calculated by the originator. If the CRCs do not agree, the message is rejected.

Message sequence numbers are also included when using the ECP. These sequence numbers are checked to determine if the message received has the correct sequence number; if not, the message is rejected.

Since the 7-bit ASCII code is used and there are 8 data bits per character, the eighth bit can optionally be used to support parity. Where parity is selected, the CRC 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 reader and 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. The reader will issue an Error message and the host 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 reader acquires tags, it buffers them but does not transmit them. Instead, the host must poll the reader for each tag by sending a CTRL-E character (hex 5 digit). The reader transmits one message (tag 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. The reader data transmission (tag and report data) format is the same as for basic protocol.

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

Basic and ECP Protocol Formats

***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:

<som><data><eom>

The ECP format is:

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

where

<som> Start-of-message (ASCII # character)

<seq> Sequence number (ASCII hex) that represents an even number in the range 0–9, A–E. This number is maintained by the reader. The host must acknowledge reader transmissions by sending an ACK message with the same sequence number received from the reader. The reader will update its sequence number upon receipt of a valid host ACK. If an ACK is not received, the reader will retransmit the message. A reader transmission sequence is not considered complete until the reader receives a valid 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 Error0x message (buffer level report), or a sign-on message. Time, date, and auxiliary data may also be included.
<code><crc></code>	<p>Cyclic redundancy check (CRC). This field contains 4 ASCII digits that represent the 16-bit CRC calculated on the message. The CRC is calculated on bytes between the som character and the first CRC byte.</p> <p>Once the host receives a properly framed message, it can calculate a 16-bit CRC. The calculation is applied to the character string that immediately follows the <code><som></code> and that ends with the character immediately preceding the first <code><crc></code> character.</p> <p>The calculated CRC can then be compared with the binary equivalent of the received <code><crc></code> characters. If a difference results, the message is assumed to have been received in error and a NAK message response should be transmitted.</p>
<code><eom></code>	<p>End-of-message characters (ASCII CR and LF). Both a CR (carriage return) and LF (line feed) are included to facilitate the use of terminals and printers.</p> <p>If the host receives a <code><som></code> character in the middle of a data message, the message in progress must be aborted. The assumption is that an <code><eom></code> was lost and the reader is in the process of retransmitting the previous message.</p>

ECP Host ACK/NAK Response

With ECP, the host computer responds to all data message transmissions from the reader using the following acknowledgment or negative acknowledgment response format.

`<som><seq><ack/nak><crc><eom>`

where

<code><som></code>	Start-of-message (ASCII # character)
<code><seq></code>	An echo of the sequence number received from the reader. The sequence number should correspond to the data message that is being positively or negatively acknowledged by the host. If the reader receives an ACK message with the incorrect sequence number, the data message is retransmitted.

The host computer is responsible for resetting its anticipated data message sequence number to that of the reader before communications can resume without error.

<ack/nak>	ASCII @ character for ACK response; ASCII ? character for NAK response
<crc>	CRC for the message
<eom>	End-of-message character (ASCII CR)

The reader sets a user-programmable timeout delay at the time each message is transmitted (based on command 612NN, where NN = timeout delay). The timeout delay can be disabled for diagnostic purposes by setting NN = FF.

If the timeout delay expires before the reader receives an ACK or NAK message from the host, a logical NAK condition will be declared. In the event the reader receives a NAK or timeout, the data message is retransmitted.

When the reader receives an ACK message, the message is treated as having been properly received by the host. The sequence number is then incremented and pointers are advanced to the next message in the reader's message queue to prepare for sending the next message.

Switch to Command Mode Request

The host may issue a switch to command mode command (command 01) while in data mode.

The basic protocol format is:

<som><cmd><eom>

The ECP format is:

<som><seq><cmd><crc><eom>

where

<som>	Start-of-message (ASCII # character)
<seq>	The sequence number is generated by the host computer separately from that appearing in data messages transmitted by the reader.
<cmd>	Switch to command mode command code (ASCII characters 01)
<crc>	CRC for the message
<eom>	End-of-message character (ASCII CR)

Host Transmission

Synchronous communications between the reader and the host are initiated by the host. The host begins a sequence by issuing a command; the reader will respond accordingly.

The data inquiry protocol format is:

<CTRL-E>

The basic protocol format is:

<som><cmd>[<data>]<eom>

The ECP format is:

<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 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 1–9, A–F. The host should use odd sequence numbers in its command, because the reader uses even sequence numbers in its transmissions. This eliminates the possibility of a synchronous host command and an asynchronous reader transmission having the same sequence number. Upon receiving a host command, the reader is expected to echo the command's sequence number in its response. Therefore, the host must update its sequence number upon receipt of a valid reader message. If the sequence number is not updated before transmission of the next command, the reader will not service the new command; it will retransmit its previous message. A command/message sequence is not considered complete until the host updates its sequence number.
<cmd>	Command code, a string that contains from 2 to 4 ASCII hex characters
[<data>]	Optional data field, an ASCII string of up to 20 characters in length. For example, the set date command is 21MM/DD/YY (command 21 followed by the data string MM/DD/YY).
<crc>	CRC 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 reader will return Done, Error, or another ASCII string depending on the host transmission. This string can be up to 72 characters long.
<crc>	CRC for the message
<eom>	End-of-message character (ASCII CR and LF)

Sample Messages

Following are examples of typical messages transmitted between the reader and the host.

Reader Transmissions

Basic protocol — reader transmission

#SAN RAFAEL APTS 1302&10:15:42.14 02/24/94<eom>

Host response:

No host response for non-ECP.

ECP — reader transmission

#4SAN RAFAEL APTS 1302&10:15:42.14 02/24/94<crc><eom>

where

Start-of-message character

4 Message sequence number

SAN RAFAEL APTS 1302 Message data

Tag ID shown, other sample message data:

IOST C0 O2 I0 D24 (Display I/O Status)

04:35:42.45 11/26/95 (Display Time and Date)

Error03 (Buffer Status)

&10:15:42.14 02/24/94 Time and date

<eom> End-of-message character
<crc> CRC for the message
@ ACK (acknowledgment character)
(? returned for a negative acknowledgment)

Host response:

#4@<crc><eom>

Host Command Transmissions

Basic protocol — host transmission

#2010:15:00<eom>

Reader response:

#Done<eom> or #Error<eom>

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

ECP — host transmission

#72010:15:00<crc><eom>

where

Start-of-message character

7 Message sequence number

20 Set time command

10:15:00 Set time data

(Not all commands include data. An example of the Turn RF off host transmission is #76400<eom> where 6400 is the command number)

<eom> End-of-message character

<crc> CRC for the message

Done Command has been invoked by the reader.

For some commands the reader will instead respond with data that relates to the command; e.g., TT 1 to indicate tag translation enabled for a 534 display tag translation mode command.

Reader response:

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

#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.

Readers support an ECP timeout on both transmit and receive. In addition, for readers a protection mechanism has been implemented to prevent the assignment of mismatched ECP timeout and baud rate values. Readers will not allow the host to alter the ECP timeout (command 612NN) if the specified timeout is too short for the current baud rate. Conversely, readers will not allow the host to alter the baud rate (command 100N) if the specified baud rate would be too fast for the current ECP timeout.

The receiver's minimum timeout delay should equal the time to transmit the longest anticipated message at the current baud rate setting. Additional margin should be included for idle periods between characters (i.e., processing overhead, if any). The receiving timeout delay period can be expressed as:

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

where

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

B_c Bits per character (typically 10)

R_b Baud rate (110–19.2 K)

L Length of message in characters

Tau_{idle} Maximum idle period between characters (ms)

Likewise, the sender must set a timeout delay equal to the delay of nine characters at the current baud rate setting (i.e., 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

$$\text{Tau}_{\text{send}} \text{ (ms)} = 9 * \text{Tau}_{\text{char}} + \text{Tau}_{\text{errchk}}$$

where

$\text{Tau}_{\text{errchk}} \text{ (ms)}$ Processing period to perform error checking by receiver

The reader supports baud rates between 110 and 19.2 K. The host can remotely set communications parameters of the reader while in the command mode, but TransCore does not recommend this action if communications conditions are marginal.

After the reader receives new communications parameters properly, the reader issues the Done message and switches to the new configuration immediately. It is the responsibility of the host computer to switch its own communications parameters immediately after the transaction is complete.

As noted, the message **initiator** (i.e., the reader in data mode, and the host computer in command mode) starts a timeout counter at the time a message is transmitted. In the event the timeout expires before receiving a message, a logical NAK condition is declared and the message is assumed to have been received in error. In this instance, the message is retransmitted until a message is received.

The message **recipient** (i.e., the host computer in data mode, and the reader in command mode) starts a timeout counter when a <som> character is received. In the event the timeout expires without the receiver's having received an <eom>, the message acquisition is aborted (reset) and the receiver waits for the next <som> character.

In the event a second <som> character is received before an <eom> character, the message acquisition is aborted (reset), and retransmission of the previous message is assumed to be underway.

These strategies are designed to allow for graceful recovery during periods when communications are marginal or completely lost.

It should be noted that while the reader is in command mode, all acquired tag IDs are buffered but not transmitted.

***Note:** It is important that the host limit the period during which the reader remains in command mode in order to avoid overflowing the reader's tag ID buffer and subsequently losing tag IDs.*

Reader Addressed Failure Conditions

The reader addresses the following failure conditions.

Illegal Sequence Number (Not in the Range 0–9, A–F)

If the reader detects an illegal sequence number in a host command message, it will discard the received message, and it will not send a response. If it receives an illegal sequence number in an ACK message, it will respond as if a NAK had been received, and it will retransmit the data.

Wrong Sequence Number

If the reader receives the wrong sequence number in an ACK message, it will respond as if a NAK had been received (it will retransmit the data).

Bad CRC

If the reader detects a bad CRC in a host command message, it will discard the received message (no response is sent). If it receives a bad CRC in an ACK message, it will respond as if a NAK had been received (it will retransmit the data).

Illegal Command

If the reader receives an illegal command, it will return its standard `Error` message.

Transmission Timeout

If the reader transmits an asynchronous message and the host does not send an `ACK` before the ECP timeout occurs, the reader will retransmit the message.

Receive Timeout

If the reader receives a `<som>` but does not receive a matching `<eom>` before the ECP timeout occurs, it will discard the incomplete message and reset its receiver.

Asynchronous Message/Command Message Collision

If the reader transmits asynchronous data at the same time the host sends a command, the reader will give priority to receiving the command. It will process the command and send a message before it retransmits the asynchronous data.

Host Addressed Failure Conditions

The host 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 should retransmit the command with the same sequence number. If the host detects an illegal sequence number in an asynchronous reader transmission, it should send a `NAK` message.

Bad CRC

If the host detects a bad CRC in a reader message, it should retransmit the command with the same sequence number. If the host detects a bad CRC in an asynchronous reader transmission, it should transmit a `NAK` message.

Transmission Timeout

If the reader does not respond to a host command within a specified interval, the host should retransmit 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 should discard the incomplete message and reset its receiver.

Asynchronous Message/Command Message Collision

If the host receives an asynchronous reader transmission at the same time it transmits a command, it should ignore the asynchronous message and wait for the reader's response. The reader will retransmit asynchronous data after it transmits the command message.

Error Correcting Protocol 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 1 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 specification, including the timing specifications discussed in the “Timing and Synchronization” section previously in this chapter.

CRC Calculation

The CRC used by the ECP is based on a 16-bit algorithm. The algorithm, as implemented, operates on 8-bit characters (i.e., 7-bit ASCII character plus 1 optional parity bit). The 16-bit result is converted to 4 ASCII hex characters and is appended to messages transmitted by the reader.

The reader accepts 4 ASCII <`> characters (60 hex) as a wild card CRC in lieu of a valid 4-character CRC to facilitate testing and diagnostic checkout.

The reader implements the algorithm with a 512-byte lookup table to reduce the processing overhead requirements. However, this method requires additional code memory.

To simplify the implementation of the CRC algorithm by host software developers, several examples of the calculation are provided in C source code in Tables 8-1 through 8-4. The calculation may be performed with or without a lookup table, depending upon the tradeoff between code memory and processing overhead.

An example of a function (CALCCRC) that calculates the CRC through a call to a separate function (UPDCRC) is given in Table 8-1. An example of UPDCRC that does not require a lookup table is given in Table 8-2. An example of UPDCRC that does require a lookup table is given in Table 8-3. Finally, a function that creates the lookup table is given in Table 8-4.

Table 8-1 Example of Routine to Calculate CRC

```

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

```

Table 8-2 Example of Routine to Calculate CRC-CCITT without 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);
}

```


Table 8-3 Example of Routine to Calculate CCITT-CRC with 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,
};
```

Table 8-4 Example of Routine to Create 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]);
}
```

Commands

Chapter 9

Commands

Host-transmitted commands can be used to control the operation of the reader. These commands may be transmitted by host software or manually entered using a terminal emulator.

Note: *Tag identification (ID) codes are not transmitted by the reader when in command mode. If the reader is left in the command mode too long, the tag buffer will fill up and any additional tag IDs will be lost. SmartPass must be returned to data mode as soon as possible to ensure proper transmission of acquired tag IDs.*

Sending manual commands to the reader is a three-step process:

Note: *Basic protocol (not error correcting protocol) should be used when manually entering commands.*

1. Put SmartPass into command mode by typing #01 and pressing the enter or return key. # is the start of message character, and 01 is the command number to switch to command mode.
2. Type # and the appropriate command number, and press the enter or return key (no spaces).
3. Return SmartPass to the data mode by typing #00 and pressing the enter or return key.

Command Listings

Table 9-1 lists factory default settings. Table 9-2 lists all of the commands available to users with the commands in order by command number. Table 9-3 lists the same commands in order by command name.

Command numbers consist of 2 to 4 hex digits. The letters *N* or *S* may follow a command number. The letter *N* indicates that part of the command number is variable. The letter *S* indicates the requirement for an alphanumeric data string that is to be included immediately following the command number.

Hex digits (0–9, A–F) must be used for all command number entries. Either uppercase or lowercase characters may be used in data strings and for hex digits A–F.

Table 9-1 Factory Default Settings

Parameter	Setting	Command
Operating mode	Data	00
Baud rate	9600	1005
Stop bits	1	1010
Parity	None	1020
End-of-line delay	0 ms	1030*
Time and date appended	Enabled	302
Auxiliary information appended	Disabled	310
Unique ID code criteria	Separation of 1 ID	4100
Valid ID code criteria	1 acquisition	4200*
Uniqueness timeout	2 minutes	441*
Wiegand mode	Disabled	450
Tag translation mode	Disabled	452
Wiegand transmit mode	1 second	4601
Dual processing mode	Reset on A Transmit on A	48N
Reader ID number	00	6000
Communications protocol	Basic	610
ECP (error correcting protocol) timeout	12.7 sec	612FE
Flow control	Software (XON/XOFF)	6141
Start-of-message character	# (23 hex)	6150*
Buffer control mode	Disabled	6160
Echo mode	Enabled	6171
Output control	Predefined	621
RF-by-input control	Enabled	641
Output pulse duration	228 ms	67C
Presence without tag reports	Disabled	6900
Minimum presence true period	0 ms	6910*
RF-off control	Timeout or no presence	6922
RF timeout	Never true	693F
Input inversion	Disabled	6940
Serial number	000000	695*
Store hardware configuration	Hardware configuration not known	696
Periodic system check tag	Disabled	810
Periodic check tag interval	30 min	8135*
Check tag location	Internal	8160
Input status change reports	Disabled	820

* Fixed parameter, not changeable by user.

Note: In the following list:

- Items in **bold italics** identify factory default settings.
- Only the data portion of the command number is shown.
- Only the command-related data portion of the reader message is shown.
- Refer to Chapter 8, “Communication Protocols,” for the complete syntax of commands and messages.

Table 9-2 SmartPass Command List (Ordered by Command Number)

Number	Command Name	Reader Message
00	Switch to data mode	Done
01	Switch to command mode	Done
05	Switch to download mode	Done
06	Transmit buffer entry	Done, Error, or Tag Data Done = buffer empty Error = not in buffer control mode Tag Data = highest priority tag ID
1000	Set baud rate = 110 baud	Done or Error
1001	Set baud rate = 300 baud	Done or Error
1002	Set baud rate = 1200 baud	Done or Error
1003	Set baud rate = 2400 baud	Done or Error
1004	Set baud rate = 4800 baud	Done or Error
1005	Set baud rate = 9600 baud	Done or Error
1006	Set baud rate = 19.2 K baud	Done or Error
1010	Use one stop bit	Done
1011	Use two stop bits	Done
1020	Disable parity	Done
1021	Select even parity	Done
1022	Select odd parity	Done
20S...S	Set time S...S = HH:MM:SS or HH:MM:SS:hh	Done or Error
21S...S	Set date S...S = MM/DD/YY	Done or Error
22	Display time and date	HH:MM:SS.hh MM/DD/YY
300	Disable time and date append	Done or Error
302	Enable time and date append	Done or Error
310	Disable aux info append	Done or Error
311	Enable aux info append	Done or Error
40	Transmit all IDs	Done
4100	Select one ID separation	Done
4101	Select two ID separation	Done
43	Buffer all IDs	Done
450	Disable Wiegand mode	Done
451	Enable Wiegand mode	Done
452	Disable tag translation mode	Done
453	Enable tag translation mode	Done

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Number	Command Name	Reader Message
46NN	Set Wiegand retransmit interval NN = 01–FF seconds	Done or Error
48N	Select dual-frame processing mode N = 0–3 0 = Reset uniqueness on A, transmit A 1 = Reset uniqueness on B, transmit B 2 = Reset uniqueness on A, transmit both 3 = Reset uniqueness on B, transmit both	Done
505	Display version	Model [model] Ver [Ver no.] SN [serial no.]
506	Display hardware configuration information	S...S S...S = ASCII string (maximum length of 20 characters)
520	Display power fail bit	PWRB Px R0 P0 = no power fail has occurred P1 = power fail has occurred
521	Display reader ID number	RDID xx xx = 00–FF
522	Display comm port parameters	MAIN Bx Sx Px D0 B0 = 110 B1 = 300 B2 = 1200 B3 = 2400 B4 = 4800 B5 = 9600 B6 = 19.2 S0 = one stop bit S1 = two stop bits P0 = no parity P1 = even P2 = odd D0 = EOL delay of 0 ms
524	Display appended info status	IDAP Tx Dx Xx T0 = time not appended T1 = time appended D0 = date not appended D1 = date appended X0 = aux info not appended X1 = aux info appended

Number	Command Name	Reader Message
525	Display comm protocol	ECPS Px Txx Xx S0 P0 = basic P1 = ECP P2 = echo Inquiry Txx = ECP timeout ms = 50 * xx TFF = disabled ECP timeout X0 = no flow control X1 = software flow control X2 = hardware flow control S0 = SOM character is #
526	Display I/O status	IOST Cx Ox lx Dx C0 = host controls outputs C1 = predefined output mode O0 = both outputs off O1 = output0 on O2 = output1 on O3 = both outputs on I0 = both inputs false I1 = input0 true I2 = input1 true I3 = both inputs true D0–DF = output pulse duration (4,8,12,16,20,24,32,40,48,60,76,152 228,300,376,752 ms)
527	Display RF status	RFST Cx Ox T1 C0 = RF controlled by host C1 = RF-by-input control O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min
529	Display presence input status	PRST Px D0 Ax Tx lx P0 = disable presence w/o tag reports P1 = enable presence w/o tag reports D0 = min presence true period of 0 ms A0 = RF off on timeout A1 = RF off on timeout or tag A2 = RF off on timeout or no presence Tx = RF timeout period T0 = always expired T1–TE = (4,8,12,20,24,32,48,60, 92,152,300,452,600,752 ms) TF = infinite I0 = input inversion disabled I1 = input inversion enabled
530	Display RF0 filter status	RF0S Ux V0 U0 = one ID separation U1 = two ID U2 = transmit all U3 = buffer all

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Number	Command Name	Reader Message
532	Display Wiegand mode status	T0F x 0 = disabled 1 = enabled
533	Display Wiegand retransmit interval	WTI xx xx = 01–FF seconds
534	Display tag translation mode	TT x 0 = disabled 1 = enabled
535	Display buffer control status	BCM x 0 = disabled 1 = enabled
536	Display dual-frame processing mode	DUAL x 0 = reset uniqueness on A, transmit A 1 = reset uniqueness on B, transmit B 2 = reset uniqueness on A, transmit both 3 = reset uniqueness on B, transmit both
537	Display echo status	ECHO x 0 = disabled 1 = enabled
540	Display flash checksum	PCKS I0000 Exxxx xxxx = 4-byte ASCII checksum
543	Display boot checksum	BCKS xxxx xxxx = 4-byte ASCII checksum
550	Display periodic checktag status	SCTS Mx T5 M0 = periodic checktag disabled M1 = periodic checktag enabled T5 = periodic interval of 30 min
551	Display selected checktag option	CTAG x 0 = internal 1 = external
560	Display input status change	SSTC Ex Mx E0 = status change reports disabled E1 = status change reports enabled M0 = no reporting M1 = report change on input0 M2 = report change on input1 M3 = report change on either input
60NN	Set reader ID number NN = 00–FF	Done
610	Select basic protocol	Done or Error
611	Select ECP protocol	Done or Error
612NN	Set ECP timeout NN = 01–FE (1–255) timeout = 50 ms * NN (if NN = FF, timeout is disabled)	Done or Error
612FE	Set ECP timeout = 12.7 sec	Done or Error
613	Select data inquiry protocol	Done or Error

Number	Command Name	Reader Message
6140	Disable flow control	Done
6141	Enable software flow control	Done
6142	Enable hardware flow control	Done
6160	Disable buffer control mode	Done
6161	Enable buffer control mode	Done
6170	Disable echo	Done
6171	Enable echo	Done or Error
6200	Turn both outputs off	Done
6201	Turn output0 on	Done
6202	Turn output1 on	Done
6203	Turn both outputs on	Done
621	Select predefined output mode	Done
63	Reset reader	Model [model] Ver [Ver no.] SN [serial no.] Copyright [date] TransCore
6400	Turn RF off	Done
6401	Turn RF on	Done
641	Select RF-by-input control	Done
65	Reset power fail bit	Done
660	Test external RAM	Done or Error
661	Display diagnostic results	DIAG Rx Ex Dx Cx R0 = boot ROM OK R1 = boot failed E0 = flash memory OK E1 = flash failed D0 = external RAM OK D1 = RAM failed C0 = RTC OK C1 = RTC failed
664	Test real-time clock	Done or Error
667	Verify boot ROM checksum	Done or Error
668	Verify flash memory checksum	Done or Error
669	Perform all diagnostics Use 661 to display diagnostic results	Done or Error
66F	Load default operating parameters	Done or Error
67N	Set output pulse duration N = 0–F (4,8,12,16,20,24,32,40,48	Done or Error

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Number	Command Name	Reader Message
	60,76,152,228,300,376,752 ms)	
67C	Set output pulse duration = 228 ms	Done or Error
6900	Disable presence without tag reports	Done
6901	Enable presence without tag reports	Done
6920	Turn RF off on timeout	Done
6921	Turn RF off on timeout/tag	Done
6922	Turn RF off on timeout/no presence	Done
693N	Set RF timeout N = 0–F (always expired, 4,8,12,20,2432,48,60,92,152, 300,452,600,752,infinite)	Done or Error
693F	Set RF timeout = infinite	Done
6940	Disable input inversion	Done
6941	Enable input inversion	Done

Number	Command Name	Reader Message
695S...S	Set serial number S...S = ASCII string (maximum length of 6 characters)	Done
696S...S	Store hardware configuration string S...S = ASCII string (maximum length of 20 characters)	Done
810	Disable periodic check tag	Done
8110	Invoke check tag	Done
8120	Enable periodic check tag	Done
8160	Select internal check tag	Done
8161	Select external check tag	Done
820	Disable status change reports	Done
821	Report change on input0	Done
822	Report change on input1	Done
823	Report changes on both	Done
90	Load program block	Done, Checksum Error, Program Error, or Verify Error
91	Verify flash checksum	Done or Error
96	Erase flash memory	Done
97	Perform destructive flash test	Done or Error
99	Exit download mode	Model [model] Ver [Ver no.] SN [serial no.] Copyright [date] TransCore

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Note: In the following table:

- Items in ***bold italics*** identify factory default settings.
- Only the data portion of the command number is shown.
- Only the command-related data portion of the reader message is shown.
- Refer to Chapter 8, “Communication Protocols,” for the complete syntax of commands and messages.

Table 9-3 SmartPass Command List (Ordered by Command Name)

Command name	Code	Reader Message
All IDs Transmit	40	Done
Appended info status Display	524	IDAP Tx Dx Xx T0 = time not appended T1 = time appended D0 = date not appended D1 = date appended X0 = aux info not appended X1 = aux info appended
<i>Aux info append Disable</i>	<i>310</i>	<i>Done or Error</i>
Aux info append Enable	311	Done or Error
<i>Basic protocol Select</i>	<i>610</i>	<i>Done or Error</i>
Baud rate = 110 baud Set	1000	Done or Error
Baud rate = 1200 baud Set	1002	Done or Error
Baud rate = 19.2 K baud Set	1006	Done or Error
Baud rate = 2400 baud Set	1003	Done or Error
Baud rate = 300 baud Set	1001	Done or Error
Baud rate = 4800 baud Set	1004	Done or Error
<i>Baud rate = 9600 baud Set</i>	<i>1005</i>	<i>Done or Error</i>
Boot checksum Display	543	BCKS xxxx xxxx = 4-byte ASCII checksum
Boot ROM checksum Verify	667	Done or Error
Buffer all IDs	43	Done
<i>Buffer control mode Disable</i>	<i>6160</i>	<i>Done</i>
Buffer control mode Enable	6161	Done
Buffer control status Display	535	BCM x 0 = disabled 1 = enabled
Buffer entry Transmit	06	Done, Error, or Tag Data Done = buffer empty Error = not in buffer control mode Tag Data = highest priority tag ID
Check tag Select External	8161	Done
<i>Check tag Select Internal</i>	<i>8160</i>	<i>Done</i>
Check tag Invoke	8110	Done

Command name	Code	Reader Message
Comm port parameters Display	522	MAIN Bx Sx Px D0 B0 = 110 B1 = 300 B2 = 1200 B3 = 2400 B4 = 4800 B5 = 9600 B6 = 19.2 S0 = one stop bit S1 = two stop bits P0 = no parity P1 = even P2 = odd D0 = EOL delay of 0 ms
Comm protocol Display	525	ECPS Px Txx Xx S0 P0 = basic P1 = ECP P2 = data inquiry Txx = ECP timeout ms = 50 * xx TFF = disabled ECP timeout X0 = no flow control X1 = software flow control X2 = hardware flow control S0 = SOM character is #
Command mode Switch	01	Done
Data inquiry protocol Select	613	Done or Error
Data mode Switch	00	Done
Date Set S...S = MM/DD/YY	21S...S	Done or Error
Default operating parameters Load	66F	Done or Error
Destructive flash test Perform	97	Done or Error
Diagnostic results Display	661	DIAG Rx Ex Dx Cx R0 = boot ROM OK R1 = boot failed E0 = flash memory OK E1 = flash failed D0 = external RAM OK D1 = RAM failed C0 = RTC OK C1 = RTC failed
Diagnostics Perform all Use 661 to display diagnostic results.	669	Done or Error
Download mode Exit	99	Model [model] Ver [Ver no.] SN [serial no.] Copyright [date] TransCore
Download mode Switch	05	Done

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Command name	Code	Reader Message
Dual-frame processing mode Display	536	DUAL x 0 = reset uniqueness on A, transmit A 1 = reset uniqueness on B, transmit B 2 = reset uniqueness on A, transmit both 3 = reset uniqueness on B, transmit both
Dual-frame processing mode Select N = 0–3 0 = Reset uniqueness on A, transmit A 1 = Reset uniqueness on B, transmit B 2 = Reset uniqueness on A, transmit both 3 = Reset uniqueness on B, transmit both	48N	Done
Echo Disable	6170	Done
Echo Enable	6171	Done or Error
Echo status Display	537	ECHO x 0 = disabled 1 = enabled
ECP protocol Select	611	Done or Error
ECP timeout = 12.7 sec Set	612FE	Done or Error
ECP timeout Set NN = 01–FE (1–255) timeout = 50 ms * NN (if NN = FF, timeout is disabled)	612NN	Done or Error
Even parity Select	1021	Done
External RAM Test	660	Done or Error
Flash checksum Display	540	PCKS I0000 Exxxx xxxx = 4-byte ASCII checksum
Flash checksum Verify	91	Done or Error
Flash memory checksum Verify	668	Done or Error
Flash memory Erase	96	Done
Flow control Disable	6140	Done
Flow control Enable	6141	Done
Hardware configuration information Display	506	S...S S...S = ASCII string (maximum length of 20 characters)
Hardware configuration string Store S...S = ASCII string (maximum length of 20 characters)	696S...S	Done
Hardware flow control Enable	6142	Done

Command name	Code	Reader Message
I/O status Display	526	IOST Cx Ox lx Dx C0 = host controls outputs C1 = predefined output mode O0 = both outputs off O1 = output0 on O2 = output1 on O3 = both outputs on I0 = both inputs false I1 = input0 true I2 = input1 true I3 = both inputs true D0–DF = output pulse duration (4,8,12,16,20,24,32,40,48,60,76, 152, 228,300,376,752 ms)
Input inversion Disable	6940	Done
Input inversion Enable	6941	Done
Input status change Display	560	SSTC Ex Mx E0 = status change reports disabled E1 = status change reports enabled M0 = no reporting M1 = report change on input0 M2 = report change on input1 M3 = report change on either input
Input0 change Report	821	Done
Input1 change Report	822	Done
Odd parity Select	1022	Done
Output pulse duration = 228 ms Set	67C	Done or Error
Output pulse duration Set N = 0–F (4,8,12,16,20,24,32,40,48 60,76,152,228,300,376,752 ms)	67N	Done or Error
Output0 Turn on	6201	Done
Output1 Turn on	6202	Done
Outputs Turn off both	6200	Done
Outputs Turn on both	6203	Done
Parity Disable	1020	Done
Periodic check tag Disable	810	Done
Periodic check tag Enable	8120	Done
Periodic check tag status Display	550	SCTS Mx T5 M0 = periodic checktag disabled M1 = periodic checktag enabled T5 = periodic interval of 30 min
Power fail bit Display	520	PWRB Px R0 P0 = no power fail has occurred P1 = power fail has occurred
Power fail bit Reset	65	Done
Select predefined output mode	621	Done

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Command name	Code	Reader Message
Presence input status Display	529	PRST Px D0 Ax Tx lx P0 = disable presence without tag reports P1 = enable presence without tag reports D0 = minimum presence true period of 0 ms A0 = RF off on timeout A1 = RF off on timeout or tag A2 = RF off on timeout or no presence Tx = RF timeout period T0 = always expired T1–TE = (4,8,12,20,24,32,48,60,92,152,300,452,600,752 ms) TF = infinite I0 = input inversion disabled I1 = input inversion enabled
Presence without tag reports Disable	6900	Done
Presence without tag reports Enable	6901	Done
Program block Load	90	Done, Checksum Error, Program Error, or Verify Error
Reader ID number Display	521	RDID xx xx = 00–FF
Reader ID number Set NN = 00–FF	60NN	Done
Reader Reset	63	Model [model] Ver [Ver no.] SN [serial no.] Copyright [date] TransCore
Real-Time clock Test	664	Done or Error
Report changes both	823	Done
RF off	6400	Done
RF off on timeout	6920	Done
RF off on timeout/no presence	6922	Done
RF off on timeout/tag	6921	Done
RF on	6401	Done
RF on by input control	641	Done
RF status Display	527	RFST Cx Ox T1 C0 = RF controlled by host C1 = RF-by-input control O0 = RF off O1 = RF on T1 = uniqueness timeout of 2 min
RF timeout = infinite Set	693F	Done

Command name	Code	Reader Message
RF timeout Set N = 0–F (always expired, 4,8,12,20,2432,48,60,92,152,300,452 ,600,752 ms, infinite)	693N	Done or Error
RF0 filter status Display	530	RF0S Ux V0 U0 = one ID separation U1 = two ID U2 = transmit all U3 = buffer all
Selected checktag option Display	551	CTAG x 0 = internal 1 = external
Serial number Set S...S = ASCII string (maximum length of 6 characters)	695S...S	Done
Status change reports Disable	820	Done
Stop bit Use one	1010	Done
Stop bits Use two	1011	Done
Tag ID separation Select one	4100	Done
Tag ID separation select two	4101	Done
Tag translation mode Disable	452	Done
Tag translation mode Display	534	TT x 0 = disabled 1 = enabled
Tag translation mode Enable	453	Done
Time and date append Disable	300	Done or Error
Time and date append Enable	302	Done or Error
Time and date Display	22	HH:MM:SS.hh MM/DD/YY
Time Set S...S = HH:MM:SS or HH:MM:SS:hh	20S...S	Done or Error
Version Display	505	Model [model] Ver [Ver no.] SN [serial no.]
Wiegand mode Disable	450	Done
Wiegand mode Enable	451	Done
Wiegand mode status Display	532	T0F x 0 = disabled 1 = enabled
Wiegand retransmit interval Display	533	WTI xx xx = 01–FF seconds
Wiegand retransmit interval Set NN = 01–FF seconds	46NN	Done or Error

Command Information

The following sections provide information about each command. Refer to Table 9-3 for a listing of commands ordered by name.

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

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. The reader enters data mode on power up.

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

- Switch to command mode (01)
- Switch to download mode (05)
- Invoke check tag (8110)

Reader message:

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 does not transmit tag IDs to the host as they are acquired. The IDs are stored in the reader's tag buffer for transmission when requested by the host.

While operating in command mode, the reader continuously monitors the level of its tag buffer. If the buffer becomes 75% full, the reader transmits an Error 04 message to the host. If the buffer becomes 100% full, it transmits an Error 02 message. Once the buffer is full, incoming tag IDs cannot be buffered, and they are lost. The reader will not resume asynchronous tag transmission until it is returned to data mode (command 00). Upon return to data mode, the reader begins to empty the tag buffer. Once the buffer is no longer full, the reader will transmit the Error 03 message indicating that the tag buffer has been partially cleared, and new IDs are again being stored. When the buffer has emptied to 50% the reader will transmit the Error 05 message.

Reader message:

Done

05 Switch to Download Mode

Command 05 switches the reader to download mode, which allows an external host computer to download new software into the reader flash memory.

While operating in download mode, the reader accepts a limited set of commands: load program block (90), verify flash checksum (91), erase flash memory (96), perform destructive memory test (97), and exit download mode (99).

Note: *It is important to note that while in download mode, the reader communication port parameters are fixed at the following factory default settings: 9600 baud, 8 data bits, 1 stop bit, no parity, software flow control (XON/XOFF), basic protocol.*

While in download mode, the reader does not echo host commands.

To exit the download mode, the host must transmit exit download mode command 99. The reader will re-execute startup to ensure proper initialization of operating parameters and to verify the boot ROM and flash memory checksum values. The reader will not accept the switch to download mode command 05 if it is operating in data mode; it must first be switched to command mode (command 01).

Reader message:

Done or Error

06 Transmit Buffer Entry

Command 06 allows the host to request data (tag IDs and reports) from the reader. This command is supported if error correcting mode is selected (command 611) and buffer control mode has been enabled (command 6161). If the reader receives command 06 and it has data in its message buffer, it will transmit the buffered message of highest priority. Report data will not be transmitted until all tag IDs have been transmitted.

If the reader's message buffer is empty, it will send the Done message. The reader will return an Error message if it receives this command when error correcting mode and/or the buffer control mode has not been enabled.

Reader message:

Done	buffer empty
Error	buffer control mode not enabled
Message	IDs or reports in buffer

100N Select Baud Rate

Command 100N selects the reader baud rate. The factory default setting is 9600 baud. The *N* variable specifies the baud rate as follows:

Table 9-4 Baud Rate specified by the N Variable

Command	Baud Rate Selected
1000	110
1001	300
1002	1200
1003	2400
1004	4800
1005	9600 (factory default)
1006	19.2 K

The reader will transmit Error if the currently selected error correcting protocol (ECP) timeout is not sufficient for the requested baud rate. The timeout will have to be increased before the select baud rate command can be retransmitted.

Reader message:

Done or Error

101N Select Stop Bits

Command 101N selects the number of stop bits for reader character transmission. The factory default setting is one stop bit. The *N* variable specifies the number of stop bits as follows:

Table 9-5 Stop Bits specified by the N Variable

Command	Stop Bits Selected
1010	1 (factory default)
1011	2

Reader message:

Done

102N Select Parity

Command 102N selects the reader parity setting. The factory default setting is parity disabled. The *N* variable specifies parity as follows:

Table 9-6 Parity specified by the N Variable

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

Reader message:

Done

20 Set Time

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

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

where

HH represents hours (00–23)

MM represents minutes (00–59)

SS represents seconds (00–59)

hh represents hundredths of a second (00–99)

/ is the time delimiter

If hundredths of a second are not specified, the reader will set the hundredths register to 00.

Reader message:

Done or Error

21 Set Date

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

21MM/DD/YY

where

MM represents the month (01–12)

DD represents the day (01–31)

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

/ is the date delimiter

Reader message:

Done or Error

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

30N Append Time and Date Selection

These commands select 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 be lost. If this is unacceptable, allow the buffer to empty before re-issuing append time and date command 30N.

Table 9-7 Commands selecting Options of Appending Time and Date

Command	Append Option
300	No time and date appended
302	Time and date appended (factory default)

Reader message:

Done or Error

The reader will transmit 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

: is the time delimiter

/ is the date delimiter

31N Append Auxiliary Information Selection

These commands select 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.

Table 9-8 Commands Selecting the Option of Appending Auxiliary Information

Command	Append Option
310	No auxiliary information appended (factory default)
311	Auxiliary information appended

Reader message:

Done or Error

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 be lost. If this is unacceptable, allow the buffer to empty before re-issuing append auxiliary information command 31N.

The reader will transmit 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 is the reader ID (value can be set with command 60NN)

y is the antenna number (value fixed at 0)

zz is the number of reads of the previous tag (00–FF)

q is current status of input0 and input1 (0–3). Refer to display I/O status command 526. These values are inverted if input inversion is enabled with command 6941.

- is the auxiliary information delimiter

40 Transmit All ID Codes

Command 40 instructs the reader to transmit all IDs without regard for uniqueness.

Note: Command 40 is for diagnostic purposes only. The tag buffer must be empty before the reader will accept this command.

After diagnostics are complete, reinstate the uniqueness check using select unique ID code criteria (command 410N).

Reader message:

Done or Error

410N Anti-Passback (Select Unique ID Code Criteria)

These commands instruct the reader to buffer and transmit ID codes according to the following test: an ID is buffered if, in the time interval since the new ID was last received, previously decoded IDs have changed value at least $N+1$ times or the uniqueness timeout has occurred. IDs that do not pass the test are not buffered. The factory default setting is command 4100, which selects a separation of one ID.

Table 9-9 Commands for Buffering and Transmitting ID Codes

Command	Uniqueness Criteria
4100	Separation of 1 ID (factory default)
4101	Separation of 2 IDs

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

Comparison register items:

- Item 1 Most recently acquired ID
- Item 2 Second most recent ID (if different from item 1)

When the uniqueness filter is set to a separation of one ID, the newly acquired ID is transmitted only if it is different from item 1. When the uniqueness filter is set to a separation of two IDs, the newly acquired ID is transmitted only if it is different from both items 1 and 2.

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

The uniqueness test has a 2-minute time limit. If an ID is buffered, it will not be accepted again until it arrives at the reader more than 2 minutes from the previous arrival, or until the receipt of one (one ID separation) or two (two ID separations) other IDs resets uniqueness.

Reader message:

Done

43 Buffer All ID Codes

Command 43 buffers and transmits all acquired ID codes. It effectively cancels any uniqueness criteria previously set by select unique ID code criteria command 410N.

Note: *This command is for diagnostic purposes only.*

After diagnostics are complete, reset the select unique ID code criteria using command 410N.

Reader message:

Done

450 Disable Wiegand Mode (Factory Default)

Command 450 disables Wiegand mode. Wiegand mode is disabled by factory default.

Reader message:

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.

If Wiegand mode is enabled, the reader will transmit Wiegand-formatted data through the Wiegand interface and ASCII data through the serial port interface. This feature is only available in SmartPass readers that have been specifically manufactured for Wiegand capability.

In Wiegand mode, the reader outputs data from Wiegand-programmed tags via the Wiegand interface (the red/blue pair for data1/data0; yellow/black pair for logic ground). Tags that are not Wiegand-formatted will not be transmitted through the Wiegand interface.

The reader will return an Error response if the external checktag option is enabled (command 8161). This error occurs because Wiegand mode and the external check tag option are mutually exclusive; they both use output1.

Reader message:

Done or Error

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 Association (ATA) format to ASCII.

Reader message:

Done

453 Enable Tag Translation Mode

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

Reader message:

Done

46NN Set Wiegand Retransmit Interval

Command 46NN sets the time delay before the reader retransmits Wiegand data of a tag remaining in the read zone.

where

NN 01–FF seconds where NN is a hexadecimal code from 01–FF

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

Uppercase or lowercase characters are allowed for NN (i.e., hex digits A–F or a–f).

Reader message:

Done or Error

48N Select Dual-Frame Processing Mode

Command 48N selects the dual-frame tag processing mode. Dual-frame tags consist of an A and a B frame. The dual-frame processing mode selected determines which frame will be used to reset uniqueness (A or B). It also specifies which frame(s) will be transmitted to the host (A, B, or both). The handshake count for a dual-frame tag equals the number of A frame handshakes plus the number of B frame handshakes.

where N = 0–3

- 0 reset uniqueness on A, transmit A; B frames are counted and then discarded (factory default)
- 1 reset uniqueness on B, transmit B; A frames are counted and then discarded
- 2 reset uniqueness on A, transmit both A and B
- 3 reset uniqueness on B, transmit both A and B

Reader message:

Done

If both frames of a dual-frame tag are transmitted to the host, the data will be formatted as follows:

A...A represents A frame data (20 characters)

B...B represents B frame data (20 characters)

A and B frame data strings are separated by one blank character.

Command 302 can be used to append date and time data, and command 311 can be used to append auxiliary information.

Examples:

A...A B...B

A...A B...B&HH:MM:SS.hh MM/DD/YY

A...A B...B%nn-0-hh-q

A...A B...B&HH:MM:SS.hhMM/DD/YY%nn-0-hh-q

505 Display Software Version

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

Reader message:

Model [model] Ver [software version] SNYYYYYY

where

YYYYYY is the serial number expressed in decimal digits (0–9) with the first two digits representing the year

506 Display Hardware Configuration Information

Command 506 displays hardware configuration information stored into the reader memory during system testing.

Reader message:

(An ASCII string from 1 to 20 characters in length)

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 reset reader command 63 or reset power fail bit command 65. On initial power up, the host should transmit one of these two commands to clear the power fail bit.

Reader message:

PWRB P<0–1>R0

where

P0 no power failure has occurred

P1 power failure has occurred

R0 not applicable to SmartPass

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–FF (hex)

522 Display Communication 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<0-6> S<0-1> P<0-2> D0
```

where

B0	110 baud
B1	300 baud
B2	1200 baud
B3	2400 baud
B4	4800 baud
B5	9600 baud (factory default)
B6	19.2 kbps
S0	one stop bit (factory default)
S1	two stop bits
P0	no parity (factory default)
P1	even parity
P2	odd parity
D0	00 ms end-of-line delay (fixed)

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

```
MAIN B5 S0 P0 D0
```

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

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

524 Display Appended Information Status

Command 524 displays the information being appended to the reader transmissions. Appended information is selected using command 30N to append time and date selection and command 31N to append auxiliary information.

Reader message:

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

where

T0	time is not appended
----	----------------------

- T1 time is appended (factory default)
- D0 date is not appended
- D1 date is appended (factory default)
- X0 auxiliary information is not appended (factory default)
- X1 auxiliary information appended

There is one space between each value. For example, if factory default settings are assigned, the reader response is:

```
IDAP T1 D1 X0
```

Time and date are appended and auxiliary information is not appended.

Note: *Time and date may be appended to ID codes, error messages, presence without tag reports, and input status change reports. Auxiliary information may be appended to only ID codes, presence without tag reports, and input change reports.*

525 Display Communication Protocol Status

Command 525 displays selected communications protocol command 61N, selected mode of flow control command 614N, and ECP timeout command 612NN.

Reader message:

```
ECPS P<0-2> T<01-FF> X<0-2>
```

where

- P0 basic protocol enabled (factory default)
- P1 error correcting protocol enabled
- P2 data inquiry protocol enabled
- Txx ECP timeout where xx = 01–FE (hexadecimal)
 timeout (ms) = 50 * xx
 if xx = FF timeout is disabled
- X0 flow control disabled
- X1 software flow control enabled (factory default)
- X2 hardware flow control enabled

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

```
ECPS P0 TFE X1
```

Basic protocol enabled, an error correcting protocol timeout of 254 (12,700 ms, 12.7 sec), and software flow control enabled

526 Display I/O Status

Command 526 displays the current input/output status. The reader message indicates whether outputs are being controlled externally by the host through output control commands (620N) or internally through predefined output mode command 621. It also displays the current status of two outputs, two inputs, and the selected output pulse duration (set by output pulse duration command 67N).

Reader message:

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

where

C0	host controls outputs
C1	predefined output mode
O0	both outputs off
O1	output0 on
O2	output1 on
O3	both outputs on
I0	both inputs false
I1	input0 true
I2	input1 true
I3	both inputs true
D0	4 ms output pulse duration
D1	8 ms output pulse duration
D2	12 ms output pulse duration
D3	16 ms output pulse duration
D4	20 ms output pulse duration
D5	24 ms output pulse duration
D6	32 ms output pulse duration
D7	40 ms output pulse duration
D8	48 ms output pulse duration
D9	60 ms output pulse duration
DA	76 ms output pulse duration
DB	152 ms output pulse duration
DC	228 ms output pulse duration (factory default)
DD	300 ms output pulse duration
DE	376 ms output pulse duration

DF 752 ms output pulse duration

The following table shows the output0 and output1 open/closed conditions for the output status displays.

Table 9-10 Output0 and Output1 Open/Closed Conditions for the Output Status Displays

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

The following table shows the input0 and input1 open/closed conditions for the input status displays.

Table 9-11 Input0 and Input1 Open/Closed Conditions for the Input Status Displays

Input Status	Input0 Wire Pair Green/Red	Input1 Wire Pair 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 (command 640N) or internally by input (command 641). It also displays the current RF status and the uniqueness timeout, which is fixed at 2 minutes.

Reader message:

```
RFST C<0-1> O<0-1> T1
```

where

C0 RF controlled by host

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

O0 RF off

O1 RF on

T1 uniqueness timeout of 2 minutes (fixed)

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

```
RFST C1 O0 T1
```

RF-by-input control, RF signal off, and uniqueness timeout of 2 minutes

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), if input inversion is enabled/disabled (694N), and the minimum presence true period (always true). It also reports the selected RF timeout (693N) and the selected means of RF-off control (692N). If presence without tag reports is enabled (6901), the reader will transmit a report if a presence is detected without the subsequent acquisition of a valid tag.

Reader message:

PRST P<0-1> D0 A<0-2> T<0-F> I<0-1>

where

P0	presence without tag reports disabled (factory default)
P1	presence without tag reports enabled
D0	minimum presence true period of 0 ms (fixed)
A0	RF-off on timeout only
A1	RF-off on timeout or tag
A2	RF-off on timeout or presence condition false (factory default)
T0	RF timeout of 0 ms (always expired)
T1	4 ms
T2	8 ms
T3	12 ms
T4	20 ms
T5	24 ms
T6	32 ms
T7	48 ms
T8	60 ms
T9	92 ms
TA	152 ms
TB	300 ms
TC	452 ms
TD	600 ms
TE	752 ms

TF infinite, never expires (factory default)
 IO input inversion disabled (factory default)
 I1 input inversion enabled

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

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

Presence without tag reports 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 channel input, including the selected unique ID code criteria (command 410N) and the valid ID code criteria, which are fixed at one acquisition.

Reader message:

```
RF0S U<0-3> V0
```

where

U0 one ID separation (factory default)
 U1 two ID separation
 U2 transmit all IDs
 U3 buffer all IDs
 V0 valid ID code criteria of one acquisition (fixed)

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

```
RF0S U0 V0
```

Separation of one ID for uniqueness filtering and a valid ID code criteria of one acquisition

532 Display Wiegand Mode Status

Command 532 displays Wiegand mode status enabled or disabled.

Reader message:

```
TOF <0-1>
```

where

0 Wiegand mode disabled
 1 Wiegand mode enabled

533 Display Wiegand Retransmit Interval

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

Reader message:

WTI <01–FF>

where

01–FF seconds (1–255) in hex

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 will be translated according to ISO standards. Refer to commands 452 and 453 for more information.

Reader message:

TT <0–1>

where

0 tag translation mode disabled

1 tag translation mode enabled

535 Display Buffer Control Status

Command 535 displays buffer control mode status, enabled or disabled. Refer to commands 6160 and 6161 for more information.

Reader message:

BCM <0–1>

where

0 buffer control mode disabled

1 buffer control mode enabled

536 Display Dual-Frame Processing Mode

Command 536 displays the selected dual-frame processing mode. The mode used determines which frame of a dual-frame tag resets uniqueness (A or B) and which frame(s) are transmitted to the host (A, B, or both). Refer to command 48N for more information.

Reader message:

DUAL <0–3>

where

0 reset uniqueness on A, transmit A

1 reset uniqueness on B, transmit B

2 reset uniqueness on A, transmit both A and B

2 reset uniqueness on B, transmit both A and B

537 Display Echo Status

Command 537 displays echo mode status. In basic mode (610) and data inquiry mode (613), the reader may be configured to enable (6171) or disable (6170) the echo of received commands. Refer to commands 6170 and 6171 for more information.

Reader message:

ECHO <0-1>

where

0 echo status disabled

1 echo status enabled

540 Display Flash Checksum

Command 540 displays the flash memory checksum.

Reader message:

PCKS I0000 Exxxx

where

0000 not applicable to SmartPass

xxxx represents the 4-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 4-byte ASCII representation of the boot ROM checksum

550 Display Periodic Check Tag Status

Command 550 displays parameters for the periodic check tag function. The periodic check tag function may be enabled by command 8120 or disabled by command 810. The check tag interval is fixed at 30 minutes. If the check tag function is enabled by command 8110, the periodic function will be disabled.

Reader message:

SCTS M<0-1> T5

where

M0 periodic check tag disabled
(factory default)

- M1 periodic check tag enabled
- T5 periodic check tag interval of 30 minutes (fixed)

551 Display Selected Check Tag Option

Command 551 displays the currently selected check tag option. Refer to commands 8160 and 8161 for more information.

Reader message:

CTAG <0-1>

where

- 0 internal check tag option enabled (factory default)
- 1 external check tag option enabled

560 Display Input Status Change Report Options

Command 560 displays the input status change reporting options. Status change reporting may be disabled by command 82N.

Reader message:

SSTC E<0-1> M<0-3>

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

Input status change reports disabled on both input0 and input1

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 (i.e., hex digits A–F or a–f).

where

NN 00–FF (hex for 0–255)
(factory default = 00)

Reader message:

Done

610 Select Basic Protocol (Factory Default)

Command 610 selects the basic communications protocol. Refer to Chapter 8, “Communication Protocols” in this guide for more information.

Reader message:

Done or Error

611 Select Error Correcting Protocol

Command 611 selects the error correcting communications protocol. Refer to Chapter 8, “Communication Protocols” in this guide for more information.

Reader message:

Done or Error



Caution:

Do not switch to error correcting protocol (command 611) unless the host is prepared to acknowledge each reader transmission.



Vorsicht:

Nicht zum fehlerkorrigierenden Protokoll umschalten (Befehl 611), bevor der Host angewiesen wurde, jede Übertragung des Abtasters zu quittieren.



Precaución:

No pase al protocolo de corrección de errores (comando #611) a menos que el host esté preparado para reconocer cada una de las transmisiones del lector.



Précaution:

Ne pas passer au protocole de correction des erreurs (commande 611) tant que l'ordinateur central n'est pas prêt à accuser réception de chaque transmission du lecteur.



Attenzione:

Non passare al protocollo di correzione dell'errore (comando 611) a meno che l'host non sia pronto a riconoscere ogni trasmissione del lettore.

612NN Select Error Correcting Protocol Timeout

Command 612NN selects the timeout interval for ECP. This timeout applies to the transmission of tag, report, and error messages, and to the receipt of host commands. The transmit timeout is initiated immediately after the end-of-message sequence CR/LF is transmitted. If the host does not acknowledge the message within the specified interval, the reader will timeout and retransmit 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 will discard the partially received message and reset its receiver.

The value for NN specifies the timeout interval as follows:

ms 50 * NN for NN = 01–FE (1–254)

FE factory default (12,700 ms, 12.7 sec)

FF disables the error correcting protocol timeout

Uppercase or lowercase characters are allowed for NN (i.e., hex digits A–F or a–f).

Reader message:

Done or Error

A protection mechanism prevents the assignment of mismatched ECP timeout baud rates values. The reader will transmit Error in response to command 612NN if the specified timeout (NN) is too short for the current baud rate. Refer to the Timing and Synchronization section of Chapter 8, “Communication Protocols,” for more information.

613 Select Data Inquiry Protocol

Command 613 selects the data inquiry communications protocol. Refer to Chapter 8, “Communications Protocols,” for more information.

Reader message:

Done or Error

614N Select Flow Control Option

These commands select 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:

Table 9-12 Select Flow Control Options

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

Reader message:

Done

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

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

6160 Disable Buffer Control Mode (Factory Default)

Command 6160 is used to disable buffer control mode. Buffer control mode is an ECP mode that prevents unsolicited (asynchronous) reader transmissions. If buffer control mode is not active (command 6160), the reader transmits data to the host as soon as the data is acquired. The host must acknowledge the data according to the ECP acknowledgment/negative acknowledgment protocol. Refer to command 6161 for more information.

Reader message:

Done

6161 Enable Buffer Control Mode

Command 6161 is used to enable buffer control mode. Buffer control mode is an ECP option that prevents asynchronous reader transmissions. When buffer control mode is enabled with command 6161, the reader will transmit only in response to command 06. The exception to this rule occurs on start-up when the reader transmits its two-line sign-on message asynchronously.

The host must request data (tag IDs and reports) from the reader using transmit buffer entry command 06. If the reader receives this command and it has data in its message buffer, it will transmit the buffered tag ID of highest priority. If no tag IDs are in the buffer, the next report message will be transmitted. If buffer control mode is enabled, the reader will not support the ECP acknowledgment and negative acknowledgment messages. Since all messages are transmitted in response to a host command, acknowledgment from the host is not required.

Reader message:

Done

6170 Disable Echo Mode

Command 6170 disables the reader's echo of received host commands. If operating in basic mode 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 will transmit its response. If echoing is disabled with command 6170, the reader will not echo the command but will only transmit its response. The reader never echoes with ECP or download mode operation.

Reader message:

Done

6171 Enable Echo Mode (Factory Default)

Command 6171 enables the reader to echo received host commands. Refer to command 6170 for more information.

Reader message:

Done or Error

620N Output Control

These commands provide direct control of two output lines that may be used to operate external hardware such as gates or traffic lights. Receipt of any 620N command automatically disables predefined output mode command 621. The value for *N* specifies the output status as follows:

Table 9-13 Output Control Option Commands

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

Reader message:

Done

The host will not be able to directly control output1 if either Wiegand mode (command 451) or the external check tag option (command 8161) is enabled.

621 Predefined Output Control (Factory Default)

Command 621 configures the reader for predefined output mode. In this mode, both output lines, output0 and output1, are automatically asserted upon receipt of a valid unique tag ID. The output line will remain asserted for the time specified by output pulse duration (command 67N). Any direct control command (620N) will automatically disable predefined output mode.

Reader message:

Done

If predefined output mode is enabled, the reader will not assert output1 upon receipt of a tag ID if Wiegand mode is enabled (command 451) or if the external check tag option is enabled (command 8161).

63 Reset Reader

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

Reader message:

Model [software version] SNYYYYYY

[Copyright notice]

where

YYYYYY is the serial number expressed in decimal digits (0–9), with the first two digits representing the year



Caution:

All buffered data is lost when command 63 is executed.



Vorsicht:

Alle gespeicherten Daten gehen bei der Ausführung von Befehl 63 verloren.



Precaución:

Cuando se ejecuta el comando #63, se pierden todos los datos almacenados en la memoria intermedia.



Précaution:

Toutes les données tamponnées sont perdues à l'exécution de la commande 63.



Attenzione:

Tutti i dati nella memoria buffer vanno perduti con l'esecuzione del comando 63.

640N RF Control

These commands directly control the RF module. The *N* value controls the RF power as follows:

Table 9-14 RF Control Commands

Command	RF Power
6400	RF channel off
6401	RF channel on

Either command disables RF-by-input control command 641.

Reader message:

Done

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

Command 641 configures the reader for RF-by-input control. In this mode, the reader will automatically turn RF on when it detects a presence through input0. The reader will turn RF off according to the selected RF control algorithm command 692N.

Reader message:

Done

65 Reset Power Fail Bit

Command 65 resets the power fail bit to zero. The bit changes from 0 to 1 when power is restored to the reader. Upon reader power up, the host should transmit either this command 65 or the reset reader command 63 to properly initialize this bit. The current state of the power fail bit may be displayed. Refer to display power fail bit command 520 for more information.

Reader message:

Done

660 Test External RAM

Command 660 performs a read/write test of external data memory (32 K). The contents of RAM are not disturbed by this test. Command 660 updates information displayed by the display diagnostic results command (command 661).

Reader message:

Done passed RAM test

Error failed RAM test

661 Display Diagnostic Results

Command 661 displays the results of previously performed diagnostics. The information displayed by this command is updated when the reader receives any diagnostic command. This information is preserved after power down. Executing command 669 updates every field in this message. If diagnostics have never been performed, the information displayed by this command is not predictable.

Reader message:

DIAG R<0-1> E<0-1> D<0-1> C<0-1>

where

R0 boot ROM OK

R1 boot failed

E0 flash memory OK

E1 flash memory failed

D0 external RAM OK

D1 external RAM failed

C0 RTC OK

C1 RTC failed

664 Test Real-Time Clock

Command 664 tests the real-time clock (RTC). The reader will test the RTC by retrieving both the date and time and verifying their validity. This command updates information displayed by the display diagnostic results command (command 661).

Reader message:

```
Done          real-time clock OK
Error         real-time clock failed
```

667 Verify Boot ROM Checksum

Command 667 calculates and verifies the boot ROM checksum. This command updates information displayed by the display diagnostic results command (command 661).

Reader message:

```
Done          boot ROM OK
Error         boot ROM failed
```

668 Verify Flash Memory Checksum

Command 668 calculates and verifies the flash memory checksum. This command updates information displayed by the display diagnostic results command (661).

Reader message:

```
Done          flash memory OK
Error         flash memory failed
```

669 Perform All Diagnostics

Command 669 performs a test on each of the items below:

- External RAM
- Boot ROM
- Flash memory
- Real-time clock

This command also initiates a system check tag operation. This command updates information displayed by the display diagnostic results command (661).

Reader message:

```
Done          all tests OK
Error         one or more failures
```

Use command 661 to display the diagnostic results.

66F Load Default Operating Parameters

Command 66F loads all the factory default operating parameters. Refer to Table 9-1 for a listing of the defaults.

Reader message:

```
Done          all parameters loaded OK
Error         if any parameter load failed
```

67N Set Output Pulse Duration

Command 67N sets the output pulse duration for the predefined output mode command (command 621). This parameter specifies the length of time that output lines(s) will be asserted upon receipt of a valid and unique tag ID. The factory default setting is 228 ms. The variable *N* specifies an output pulse duration of from 4 ms to 752 ms. Actual pulse length output of the reader may vary from the specified value by up to 4 ms.

Uppercase or lowercase characters are allowed for NN (i.e., hex digits A–F or a–f).

Table 9-15 Commands for setting Output Pulse Duration

Command	Delay (ms)
670	4
671	8
672	12
673	16
674	20
675	24
676	32
677	40
678	48
679	60
67A	76
67B	152
67C	228 (factory default)
67D	300
67E	376
67F	752

For example, command 67F specifies an output pulse duration of 752 ms.

Additional IDs may be acquired during the selected output pulse duration; however, the timing will be restarted upon each successive ID acquisition. This command should be used with discretion. For example, when the tag acquisition interval is short compared to the selected pulse duration, distinct pulses may not be generated.

The reader will return an Error message if a valid hexadecimal digit is not substituted for *N* in command 67N.

Reader message:

Done or Error

690N Select Presence Without Tag Report Option

These commands select the presence without tag reporting option. If enabled (command 6901), input reports are transmitted when a presence is detected without the subsequent acquisition of a valid tag. The values for *N* specify reporting as follows:

Table 9-16 Select Presence Without Tag Report Option Commands

Command	Report Option
6900	Disable presence without tag reports (factory default)
6901	Enable presence without tag reports

Reader message:

Done

Refer to Chapter 8, “Communication Protocols,” for message format information.

692N Select RF Control Algorithm

These commands select the algorithm for turning RF power off when RF-by-input control is enabled (command 641). The values for *N* specify the RF control algorithm as follows:

Table 9-17 Select RF Control Algorithm Commands

Command	RF Power Off
6920	On timeout only
6921	Timeout or tag ID acquired
6922	Timeout or presence false (factory default)

Command 6920 turns off RF power based on the timeout established by command 693N.

Command 6921 allows RF power to be turned off either after the timeout period or upon acquisition of a valid tag ID, whichever occurs first.

Command 6922 turns off RF power either after the timeout period or upon the presence false condition, whichever occurs first.

Reader message:

Done

693N Select RF Timeout Period

Command 693N selects the RF timeout period used by RF control algorithm command 692N. Values for *N* range from 0 (always expired) to E (752 ms).

Command 693F disables the RF timeout. The reader will turn RF off immediately following the acquisition of a valid tag, whether or not it is unique. This control algorithm may be used in Wiegand mode to ensure that the tag data is transmitted once and only once per presence on both serial and Wiegand ports.

Uppercase or lowercase characters are allowed for NN (i.e., hex digits A–F or a–f).

Table 9-18 Select RF Timeout Period Commands

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

The reader will return an Error message if a valid hexadecimal digit is not substituted for *N* in command 693N.

Reader message:

Done or Error

694N Select Input Inversion Option

Command 694N enables or disables input inversion. When inversion is enabled, an open circuit input will be interpreted as a closed circuit, and a closed circuit input will be interpreted as an open circuit. This feature allows greater flexibility in the attachment of external equipment to the reader inputs. For example, some proximity sensors indicate presence with an open circuit. In this instance, command 6941 can enable input inversion so an open circuit input will indicate a presence. The values for *N* represent the two inversion options.

Table 9-19 Select Input Inversion Option Commands

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

Reader message:

Done

695 Set Serial Number

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

695SSSSSS

where

SSSSSS is the serial number

The serial number may contain up to 6 ASCII alphanumeric characters. The factory default serial number is 000000. Once assigned, the serial number will be preserved during power down and the loading of default parameters.

Uppercase or lowercase characters are allowed for SSSSSS.

Reader message:

Done

696S...S Store Hardware Configuration String

Command 696S...S stores hardware configuration information into reader memory.

***Note:** Once assigned, this information will be preserved during power down and the loading of default parameters.*

The hardware configuration string is assigned according to the format:

696S...S

where

S...S hardware configuration string that may contain upto 20 ASCII alphanumeric characters

Uppercase or lowercase characters are allowed for S...S.

Reader message:

Done

810 Disable Periodic Check Tag (Factory Default)

Command 810 disables the periodic operation of the system check tag.

Reader message:

Done

8110 Perform System Check Tag Test

Command 8110 performs a single system check tag test. It may be executed either in data or command mode. If the internal check tag option is selected (command 8160), internal check tag circuitry will emit a single ID that will be acquired and stored by the reader in the normal manner. If the external check tag is enabled, the reader will

assert output1. If a real tag is in the field at the time, the check tag operation will be aborted.

Reader message:

Done

Note: *Command 8110 disables the periodic check tag function, which is enabled by command 8120.*

8120 Enable Periodic Check Tag

Command 8120 enables the periodic operation of the system check tag. The reader will perform a system check tag test every 30 minutes. These tests continue until either the disable periodic check tag (command 810) or the perform system check tag test command (command 8110) is received.

Reader message:

Done

8160 Select Internal Check Tag (Factory Default)

Command 8160 selects the internal check tag option. Upon receiving command 8110 or 8120, the reader will commence a check tag operation using internal check tag circuitry. This circuitry emits a single ID (system check tag) that will be acquired and stored in the normal manner.

Reader message:

Done

8161 Select External Check Tag

Command 8161 selects the external check tag operation. Upon receiving command 8110 or 8120, the reader will assert output1. The external check tag used must be an AT5715 tag, field programmed as desired and connected to the output1 green/black wire pair.

If the external check tag option is selected, the host will not be allowed to directly control the state of output1 with command 620N because output1 is used as a dedicated line for the check tag. Also, if predefined output mode is enabled (command 621), the reader will assert output0 only upon receiving a valid tag ID. It will not assert output1.

Reader message:

Done

The reader will return an Error message if Wiegand mode is enabled. This is because Wiegand mode and the external check tag option are mutually exclusive; both the Wiegand mode and the external check tag option require the use of output1.

82N Select Input Status Change Report Option

Command 82N selects the input lines to be monitored to report any change in input status. The enabled input lines are monitored for any changes in their logic states. If

a change is detected, the reader generates an input status change message and treats it as a tag ID. If the auxiliary information option is enabled, the input status field displays the current input values. The values for N specify report options as follows:

Table 9-20 Select Input Status Change Report Option Commands

Command	Report Option
820	Disable status change reports (factory default)
821	Report change on input0
822	Report change on input1
823	Report changes on input0 and input1

Reader message:

Done

90 Load Program Block

Command 90 transfers one Intel hex data record from an external host to the reader flash memory. This command loads an entire program file into reader memory, one block at a time. The flash memory must have been previously erased (command 96).

The reader must be operating in download mode (command 05) before it will accept the load program block command (command 90). Refer to the Program Download section of Chapter 6, “General Software Information” for download information and the download procedure.

Reader message:

Done	Intel hex record received, stored, and verified with no errors detected
Read Error	error occurred during transfer of the record
Program Error	error occurred during programming of the flash memory
Verify Error	error occurred during verification of the programmed data

91 Verify Flash Checksum

Command 91 calculates a checksum on the flash memory and then compares it against the stored checksum.

Reader message:

Done	flash checksum verified
Error	flash checksum failed

96 Erase Flash Memory

Command 96 erases the flash memory. Once this command is executed, exit from download mode will not be possible until a new program is loaded into flash memory.

Reader message:

Done

97 Perform Destructive Flash Test

Command 97 performs a test on the flash memory. Various patterns are programmed into the memory and verified. This test writes over any program previously stored in the flash memory; therefore, a download of software will be required afterwards. . Once this command is executed, exit from download mode will not be possible until a new program is loaded into flash memory.

Reader message:

Done flash memory is OK

Error flash memory failed

99 Exit Download Mode

Command 99 instructs the reader to exit download mode. The reader will re-execute startup to ensure proper initialization of the reader. If the flash memory checksum verifies, the reader will display the sign-on message shown below and will enter data mode.

Reader message:

Model [Model] Ver [software version] SNYYYYYY

[Copyright notice]

where

YYYYYY is the serial number expressed in decimal digits
(0–9) with the first two digits representing the year

If the flash checksum does not verify, the reader will come up in download mode and will transmit the sign-on message shown below:

Model [Model] Ver 0.00

[Copyright notice]

Chapter 10

Troubleshooting

The following table can be used for troubleshooting. Should problems continue after consulting Table 10-1, consult your SmartPass® Dealer's Guide for return and replacement procedures.

Table 10-1 Symptoms and Remedies

Symptom	Remedy
When performing a quick test of SmartPass, the buzz box does not buzz.	Check all your wiring connections and check that your buzz box is working. The wires from SmartPass are grouped in pairs. You will find more than one red wire, more than one black wire, and so on. You must connect the correct wires from the correct pair as specified. Verify that the red/green wire pair you twisted together in Testing with the Audible Circuit Tester is still twisted together.
The baud rate is selected automatically from the DEMO menu on the SmartPass software diskette, but nothing happens.	SmartPass is not communicating with your PC. Check the power supply to your PC and check the connections between the PC and SmartPass. Try reversing the receive and transmit connections. Verify that the red/green wire pair you twisted together in Testing with the Audible Circuit Tester is still twisted together.
When testing SmartPass, all the wires are connected correctly, but the unit does not respond.	SmartPass may not have the software loaded inside the unit. Obtain the SmartPass software diskette from your dealer and, using your personal computer, load the software into the system.
Strange signal responses come from SmartPass when tested with the personal computer.	Check the system defaults using the SmartPass software diskette that is supplied to the dealer or distributor. Your system should be set to 9600 baud, 8 bits, 1 stop bit, and no parity.
When a tag is moved in front of the reader, a clicking sound comes from SmartPass.	SmartPass works! You hear the relay inside SmartPass that is controlled by a lock signal. The relay is actuated when a tag is in the read zone.
Nothing happens when the test tag is passed in front of SmartPass.	Ensure that the red/green pair of wires are twisted together to turn on the RF power continuously. Ensure SmartPass is powered on.
SmartPass came from another site and does not work the way the factory defaults indicate that it should.	Different commands were probably used to support the other site's specific configuration. You can restore the defaults by first disconnecting the power. Next, twist the red/black pair of wires together for 3 or 4 seconds. When you restore power, the program will have the factory defaults restored.

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Symptom	Remedy
When connected to a PC that is running terminal communications software, a just-powered up SmartPass displays one of the following messages: #Model SP-ACC Ver 2.00D SNYYYYYY #[Copyright notice]	SmartPass works! The software is now loaded. YYYYYY is the TransCore assigned serial number for this SmartPass. However, if YYYYYY = 000000, the internal battery has failed or a serial number has never been assigned. If the internal battery has failed, the SmartPass must be returned to the factory for replacement. If a serial number has not been assigned to SmartPass, you can assign a unique serial number by using command 695. Note that each SmartPass unit must have its own unique serial number.
The read zone is too small.	If another SmartPass is in the same area, be sure it operates on another frequency that is at least 3 MHz different. Check for possible interference from another nearby RF source: fluorescent lights, neon signs, high voltage power lines, nearby cellular telephone, or radio stations. Lights will need to be removed or shielded. Point SmartPass in a different direction to see if interference comes from only one direction. You may require a different SmartPass that uses another frequency.
The perimeter of the read zone has been defined, but there is a "hollow" spot in the center of the zone that does not read tags.	The angle of SmartPass may need adjustment. Slightly tilt the angle to change either the length or width of the read zone. If the problem persists, adjust the potentiometer.
How do I download the SmartPass software diskette?	To download SmartPass software, you will need a SmartPass software diskette with READ.ME, DL.EXE, and [new software file]. Insert the demonstration diskette into your PC and print the instructions on the READ.ME file.

Need Help?

TransCore authorized dealers and distributors are responsible to their direct customers for support. Authorized dealers needing support are encouraged to call (214) 461-4031.

TransCore will respond to requests for support from authorized dealers and distributors. Call (214) 461-4031, 8:00 A.M. to 5:00 P.M. U.S. Central time, Monday through Friday, and ask for the SmartPass Product Manager. Send faxes to (214) 461-6478 ATTN: SmartPass Product Manager. Please be prepared to answer a series of questions that are designed to route you to the best TransCore support resource available. These questions will relate to symptoms, configuration, model, and tags used.

End-users and facility operators calling TransCore will be referred to the dealer responsible for the system sale.

Need Marketing Support?

Call SmartPass Marketing at (214) 461-4031 (U.S. only), 9:00 A.M. to 5:00 P.M. Central time, Monday through Friday. Send faxes to (214) 461-6478 ATTN: SmartPass Marketing.

Find Something Wrong with SmartPass or Want to Suggest an Improvement?

Call (214) 461-4031 and ask for the SmartPass Product Manager. Send faxes to (214) 461-6478 ATTN: SmartPass Product Manager.

