Texas Instruments

Checking the Total Integrity of an LF System

Application Report

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Checking the Total Integrity of an LF System

Application Report

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Read This First

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This is the first edition of this Technical Application Report, about **Checking the Total Integrity of an LF System**.

It contains a description of how to incorporate an Integrity Checking System for use with the following products:

S2000 and S2510 readers.

About this Manual

This application note is written for the use of TI-RFid™ Customers who are engineers experienced with TI-RFid and Radio Frequency Identification Devices (RFID).

Conventions

Certain conventions are used in order to display important information in this manual, these conventions are:

WARNING

A warning is used where care must be taken or a certain procedure must be followed, in order to prevent injury or harm to your health.

CAUTION

This indicates information on conditions, which must be met, or a procedure, which must be followed, which if not heeded could cause permanent damage to the system.

Note: Indicates conditions, which must be met, or procedures, which must be followed, to ensure proper functioning of any hardware or software.

Note: **Information:**
Information which makes setting up, or procedures, that makes the use of the equipment or software easier, but is not detremental to its operation.

Checking the Total Integrity of an LF System

ABSTRACT

After a Low Frequency RFID system has been installed and commissioned it is often difficult to automatically check that the total system is functioning correctly. This Application Note describes a method whereby the system integrity can be checked at any time, using the I/O capabilities of the Reader. Thus increasing operator confidence and making life easier for the support engineer to fault find.

The fact that no transponder ID numbers are being sent to the controlling process could be due to a number of issues. Firstly that there are no transponders (transponders) present; or secondly there is a malfunction in the RF module in the reader; or thirdly the antenna is damaged, in all these cases transponders could pass through the antenna system unnoticed.

By placing a modified transponder next to the systems antenna and using a spare I/O port on the reader the transponder can be switched on or off. When the transponder is switched ON this effectively creates a faraday cage around it and the systems antenna does not read from it. When the transponder is switched OFF then the transponder acts normally and the system would read it.

1 System Overview

1.1 Background Information

Texas Instruments LF transponders have a property called 'Signal Capture'. That is, if a transponder has a 6dB stronger signal than another, the system will lock-on to that transponder and will ignore all other weaker signals. (This is similar to the way your FM car radio changes to the strongest local radio station as your journey progresses). This property is used for the system integrity check, by having a modified transponder next to the antenna, which can be turned ON and OFF.

When the transponder is turned ON, it becomes the strongest signal and is immediately read and the ID reported to the controlling process but when turned OFF, is not recognized by the system, which continues to operate in the normal way. The reader's own outputs are used to carry out switch the transponder off and on.

1.2 Modifying the Transponder

The transponder has to be modified to enable it to be switched OFF and ON.

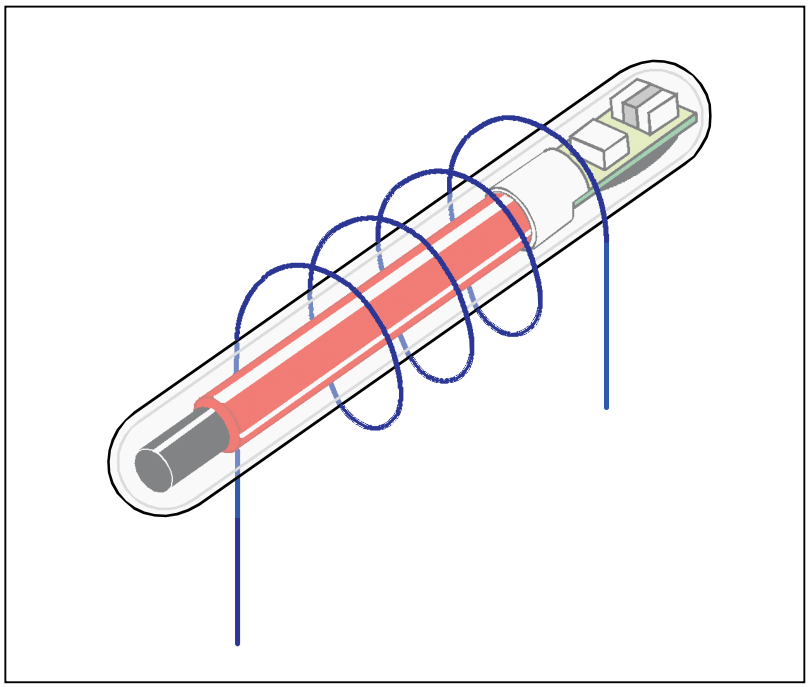

Figure 1. Transponder Windings

It is necessary to make 3 loose windings of light wire (0.5 mm /20 AWG) around the transponder antenna. In practice the transponder would be inserted into a plastic sleeve that gives the necessary 5mm (3/16") spacing around it.

1.3 How it Works

The ends of the wire turns are soldered to screened twisted pair cable, which is connected to a spare I/O port on the Reader. When the cable ends are connected together, the shorted loops create a Faraday cage around the transponder and the transponder will not operate but if the ends are not connected, the transponder will function as normal.

1.4 Testing the Modified Transponder

A hand held reader or the system antenna can be used to test this modification. Place the transponder next to the antenna with the cables ends open circuit and the transponder should be read. Next short circuit the cable ends and the transponder should not be read.

If this does not work then the transponder's antenna could be de-tuned by one of the following:

- If the wire gauge used is heavier than that indicated above.
- If the turns of wire are too close together
- If the wire is wound too tightly.

Check out the modifications to see if one of the above is the cause and correct it in turn and then re-test.

1.5 Positioning the Modified Transponder

The complete transponder, plastic sleeve and winding should be potted in a plastic box for attachment close to the antenna. Inside the potting box, the light wire used for the shorting turns, should be connected to a shielded twisted pair cable long enough to reach the reader I/O connector.

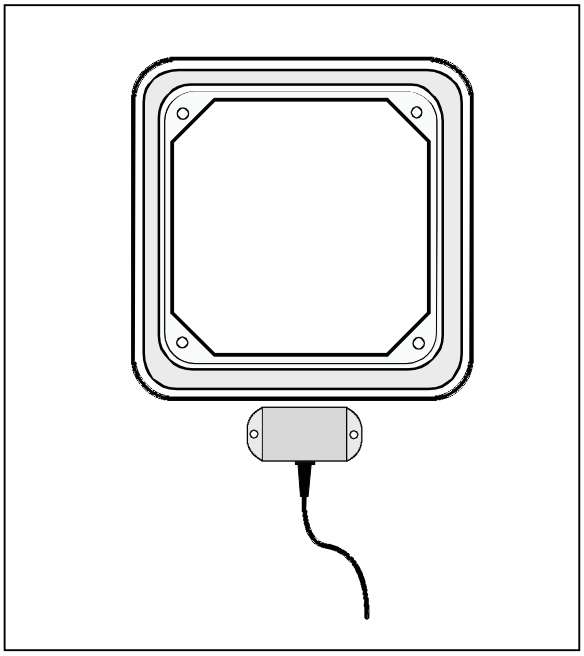

Figure 2. Modified Transponder Potted in Box

1.6 Connecting to the I/O

The reader's open collector outputs are used to make and break the circuit. Appendix A details the Open Collector Outputs for the S2510, whilst Appendix B shows the Open Collector Outputs of the S2000 reader.

The open collector outputs can directly drive a low current 5V relay and the shorting loops around the transponder are connected across the normally closed relay outputs as shown in Figure 3.

Pin 1 of the connector is 5V and OC0 is pin 2. These connect as shown to the relay, which in this case is an OMRON G6N-2-Y and is shown looking at its pins from the bottom.

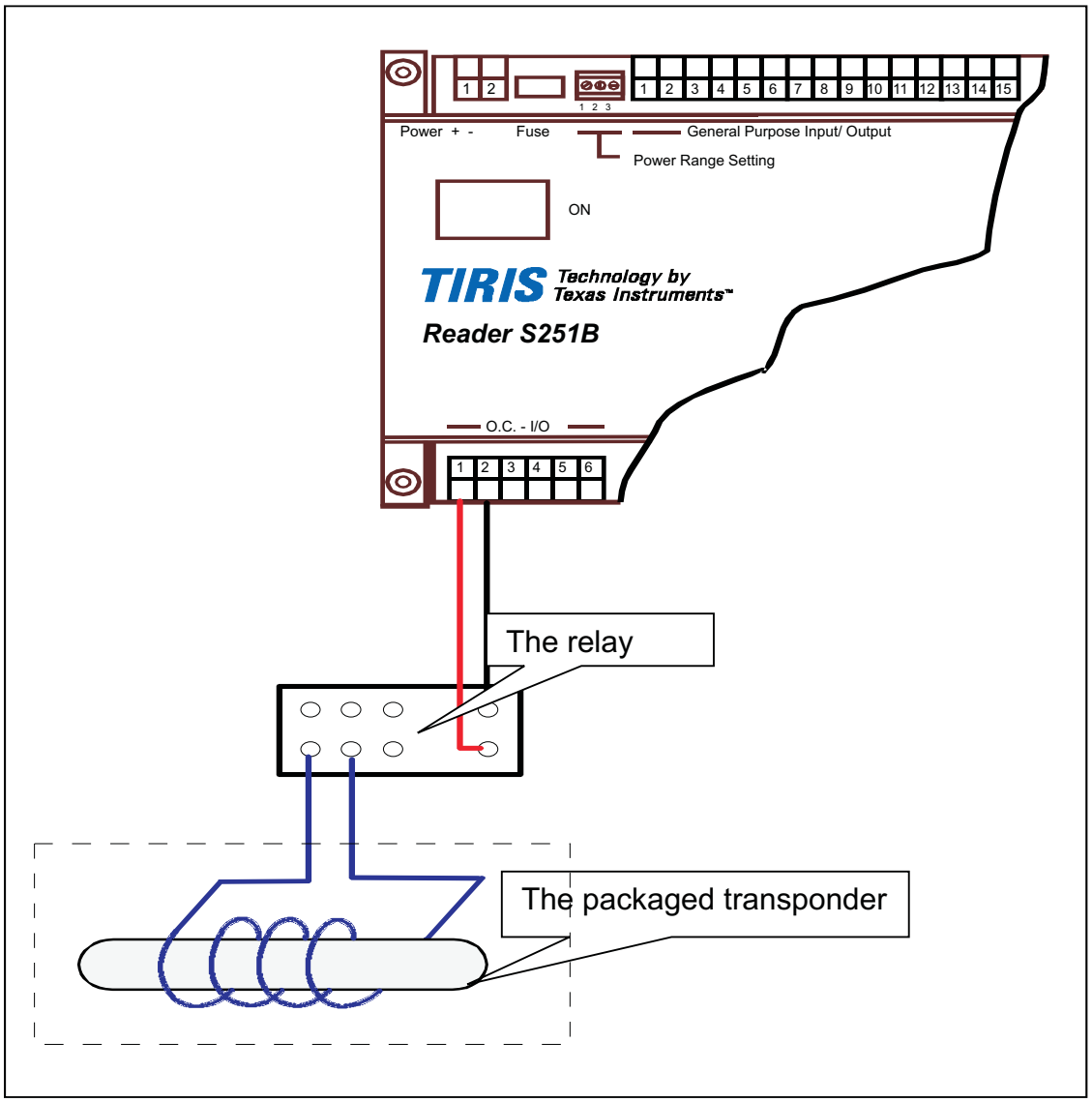

Figure 3. Circuit Illustration

1.7 Software Commands

At power up the Reader's I/O is normally switched OFF (Low). Connecting the transponder to the normally closed contacts (NC) of the relay, at power-up the transponder will be disabled and will not be read. To activate the transponder, the open collector output OC0 needs to be activated (turned ON) using the ASCII Protocol "H" command. While commands are available to check the status of OC0 and turn it OFF or ON, the simplest approach is to invert or toggle both open collector outputs with the command: 'HO0400'. So if both outputs are OFF, they will be ON after the command has been actioned and vice versa.

Table 1. Logic Table for the Test Transponder Connection

READER COMMAND	I/O	RELAY CONTACTS		TEST TRANSPONDER	COMMENT
		NO	NC		
Power Up	Low	Open	Closed	OFF	Test transponder ID not read.
HO0400	High	Closed	Open	ON	Test transponder ID read.

Thus, if at any time the total system integrity needs checking – sending the appropriate command will activate the relay and enable the transponder. If the system is functioning correctly, the controlling process will immediately receive the number of the modified transponder.

Information:

Note: If a Read/Write transponder is used, you can program a special number into the transponder indicating it is the test transponder and not one used in the application.

Appendix A S2510 Reader I/O

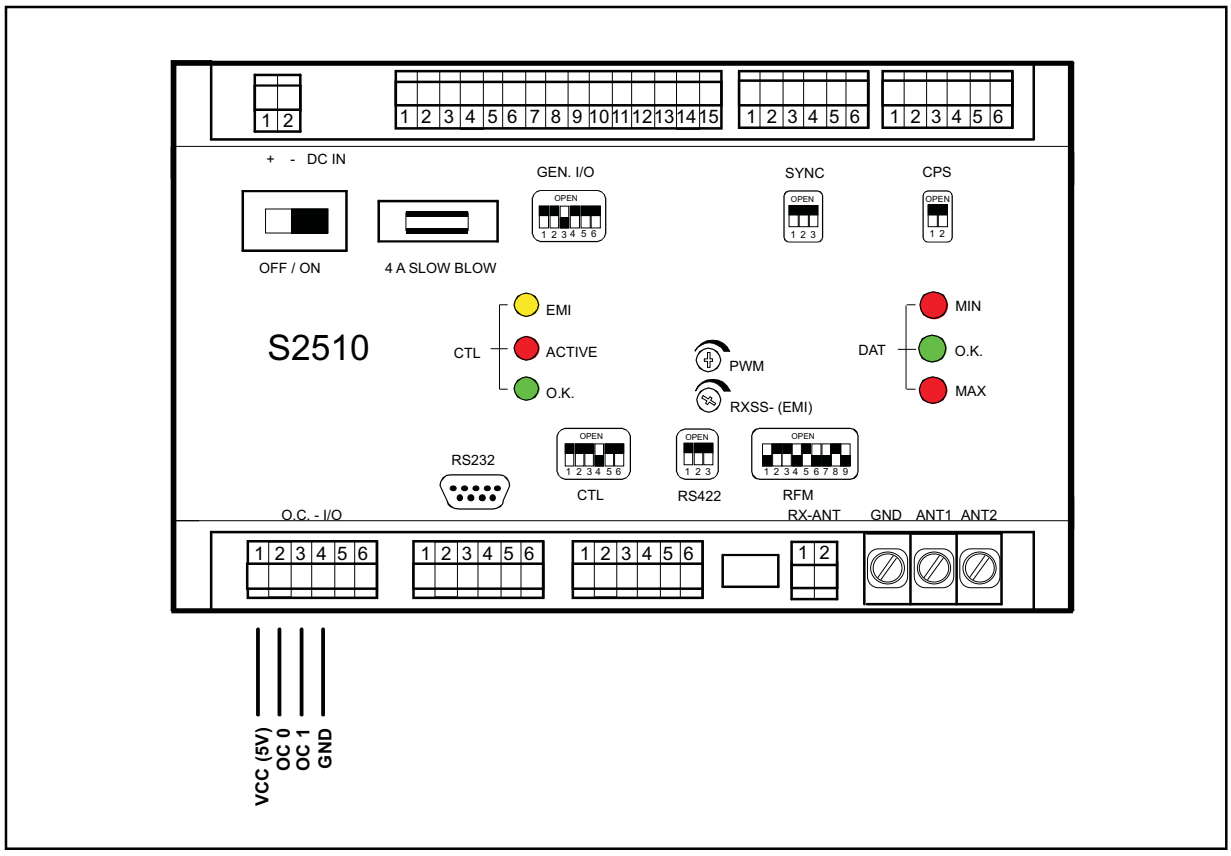

Figure A-1. S2510 Open Collector Outputs

Table A-1. S2510 Open Collector Outputs

		MIN	TYP	MAX
V_{OL}	Low Level Output Voltage (I_{OL} = 500mA)			1.3V
V_{OH}	High Level Output Voltage			80V
I_{OL}	Low Level Output Current			500mA

Appendix B S2000 Reader I/O

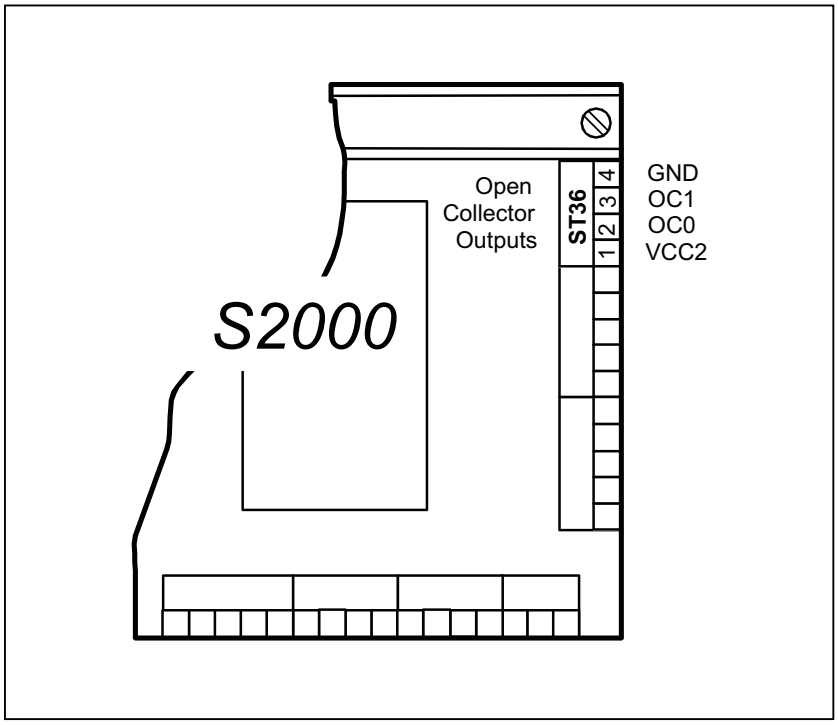

Figure B-1. S2000 Open Collector Outputs

Table B-1. S2000 Open Collector Outputs

		MIN	TYP	MAX
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I_{OL}	Low Level Output Current			500mA

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