IN*finity* 110

IN*finity* 110
Evaluation Kit
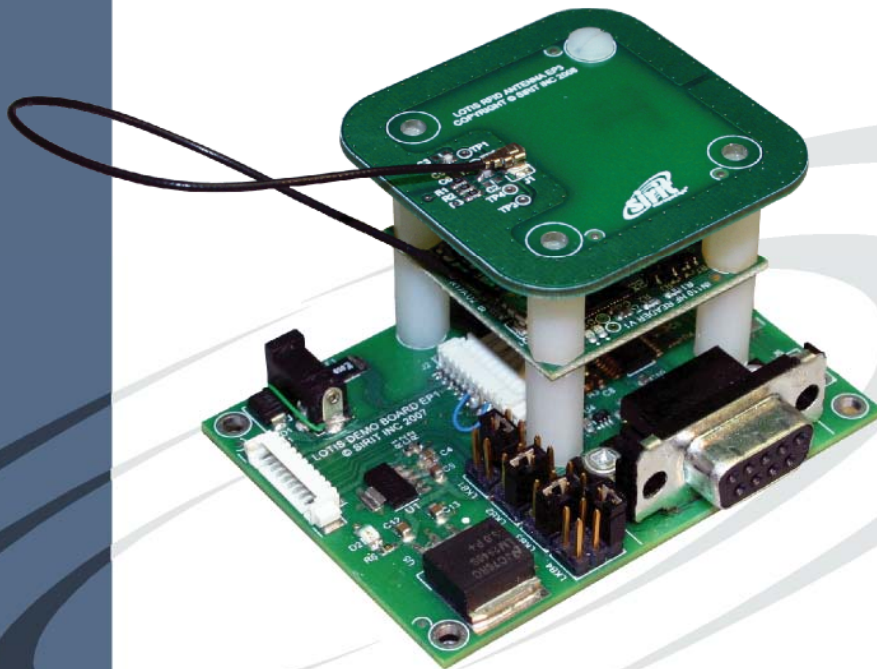
USER's GUIDE

IN*finity* 110 Evaluation Kit
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V1.0
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About Sirit

Sirit Inc. designs, develops, manufactures and sells Radio Frequency Identification (RFID) technology. Targeted at a diverse set of markets RFID technology has become a core technology for applications including: electronic toll collection, access control, cashless payment systems, product identification, and supply chain management systems including logistics, warehousing and manufacturing, and asset management.

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Preface

Intended audience

This document is intended for those who wish to use IN*finity* 110 Evaluation Kit with the integrated IN*finity* 110 Reader. Before attempting to install, configure, and operate this product, you should be familiar with the following:

➤   Windows-based software installation and operation

➤   Device communication parameters and serial communications

➤   RFID reader configuration including antenna placement and RF

➤   Basic digital input/output control

What's in this guide

Evaluation Kit Overview – This chapter provides a brief overview of the IN*finity* 110 Evaluation Kit hardware and software.

Evaluation Kit Connections – This chapter describes how to mechanically and electrically install the Evaluation Kit.

Smart Label Communicator (SLC) Software Installation – This chapter describes how to install the Microsoft Windows SLC application.

Operation – This chapter provides basic instructions for basic operation with the SLC application.

SLC – This chapter describes the SLC Graphical User Interface (GUI) and the various functions you can perform with this Microsoft Windows application.

Configuration and Maintenance – This chapter provides information for configuring the Evaluation Kit. For detailed command information, refer to the IN*finity* 110 *Protocol Reference Guide*.

Troubleshooting – This chapter provides tips for troubleshooting the Evaluation kit.

Specifications – This chapter detailed mechanical, electrical, and environmental specifications for the Evaluation Kit.

Safety Instructions – This chapter provides important safety information about the Evaluation Kit. All users must read this section before installing or operating this Evaluation Kit.

What's New in this Version

Version 1.0 of this User's Guide is the initial release.

Conventions used in this manual

The following conventions are used in this manual:

Bold courier font indicates code entered by the user

(values) within parentheses indicate parameters

(*values*) in italics indicate user defined variables.

<n> indicates a variable number used in a function that can apply to several different devices such as antennas or I/O ports.

NOTES

Important information and other tips are presented in light blue boxes to the left of the applicable section.

! **WARNING:** *Warnings advise the user that a hazardous condition can be created by a particular action that can cause bodily injury or extreme damage to equipment*

! **Caution:** *Cautions advise the user that a condition can be created by a particular action that can cause equipment damage or result in equipment operation that violates regulatory requirements.*

Table of Contents

Evaluation Kit Overview

The IN*finity* 110 Evaluation Kit contains a compact multi-protocol Radio Frequency Identification (RFID) reader operating in 13.56 MHz High Frequency (HF) band along with interface board, antenna, and power supply. The Evaluation Kit supports multiple tag protocols and is compatible with numerous global standards. This product is compliant to FCC Part 15 and ETSI EN300-330 specifications.

Specific features of IN*finity* 110 Evaluation kit include:

➤ Read-from and write-to most leading 13.56 MHz transponders
➤ Secure firmware download capability via the serial interface
➤ Accepts firmware updates to support future tags
➤ Configurable baud rate
➤ Configurable start-up speed
➤ Single 9 VDC power supply operation
➤ Two user input lines and two user output lines

The IN*finity* 110 Evaluation Kit supports the following protocols:

➤ ISO 15693
➤ ISO 14443 A & B
➤ ISO 18000-3 Mode 1
➤ Inside PicoTag™
➤ NXP EPC
➤ NXP UID
➤ NXP I-CODE
➤ NXP Mifare Ultralite
➤ TI-RFID™ Tag-it™

Evaluation Kit

The IN*finity* 110 Evaluation Kit (PN IN110K-001) consists of a IN*finity* 110 Reader, Interface Board, antenna, power supply and cabling.
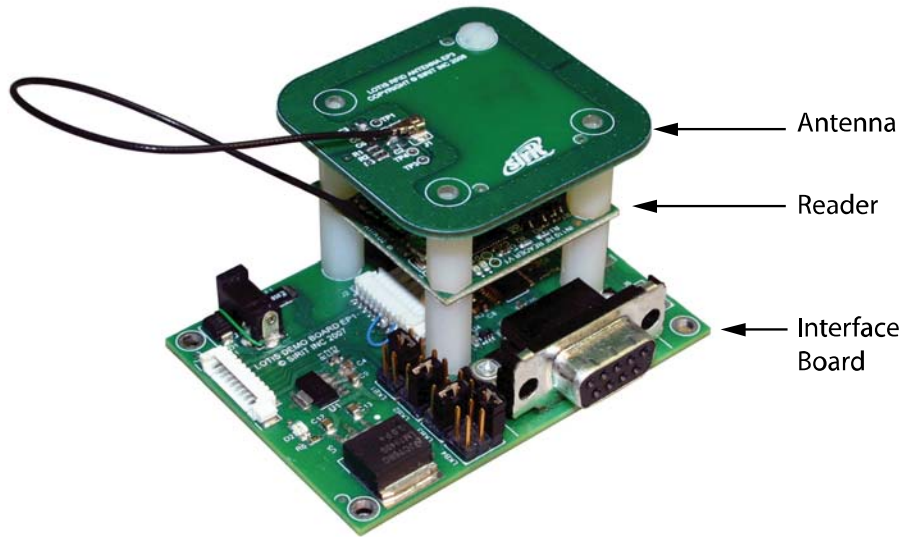
Figure 1   IN*finity* 110 Evaluation Kit (provided AC/DC Power Supply not shown)
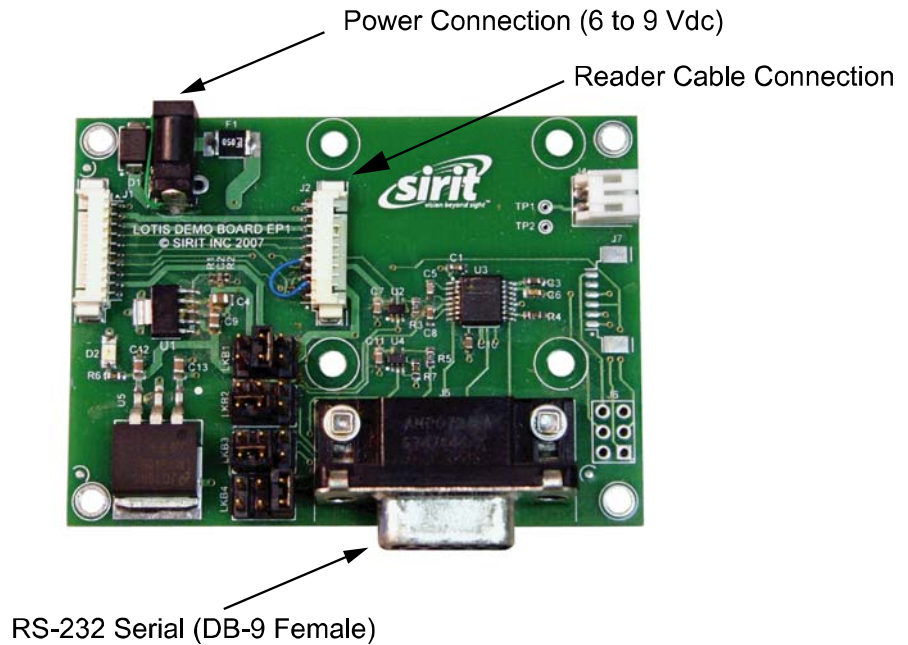
Figure 2   IN*finity* 110 Evaluation Kit Interface Board

Evaluation Kit Software

The Evaluation Kit is shipped with a software program called Smart Label Communicator (SLC) that can be installed on a host computer. With SLC, you can perform the following:

➤ Select a tag protocol
➤ Read and write tags
➤ Perform a tag read test
➤ Read digital inputs
➤ Write digital outputs
➤ Set output attenuation (in dB)
➤ Turn carrier off
➤ Read version and serial number
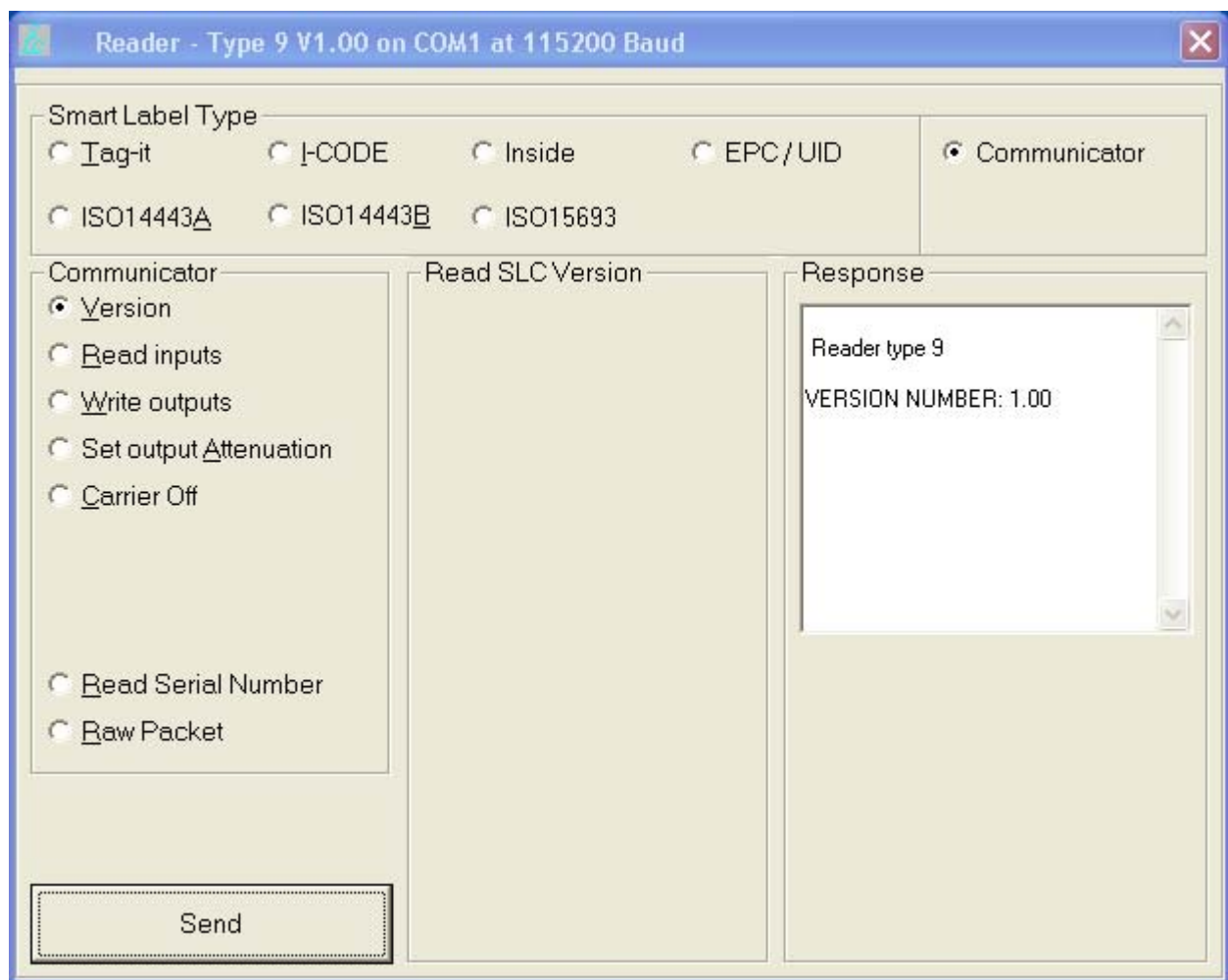
Evaluation Kit Connections

Electrical Installation

Connect the power supply to the 2.1 mm power connector on the interface board. The power supply should provide 6V to 9V at 400 mA.

Connecting Serial Communications

The Evaluation Kit is equipped with one TTL serial port for communication up to 115200 Baud. If TTL-level serial communications is required, connect the Transmit (Tx) line to pin 6 and the Receive (Rx) line to pin 8.

Connecting the Antenna

The Evaluation Kit is equipped with one Hirose U.FL socket (J1) for connecting the provided antenna. This connector (Hirose U.FL) is not commonly available and deters connecting any antenna not designed for this Evaluation kit. Alternatively, a 2-pin 0.1"-pitch header can be installed into the J2 position.

The antenna must be tuned to resonance at 13.56 MHz and should provide a 50 Ohm load (nominal) at this frequency. A return loss of -20dB or greater is preferred for reliable operation. The loaded Q of the antenna should be 10 to 25 for normal operation.

Connecting the Power

When the Evaluation kit powers up, LED D1 will briefly illuminate. After a fraction of a second, LED D1 will extinguish and LED D2 will illuminate. This indicates that power is present, the Evaluation Kit has successfully performed its self-checks, and is ready to accept commands.

If a power supply is capable of monitoring current, a draw of about 45mA should be observed (when operating via the interface board).

Smart Label Communicator (SLC) Software Installation
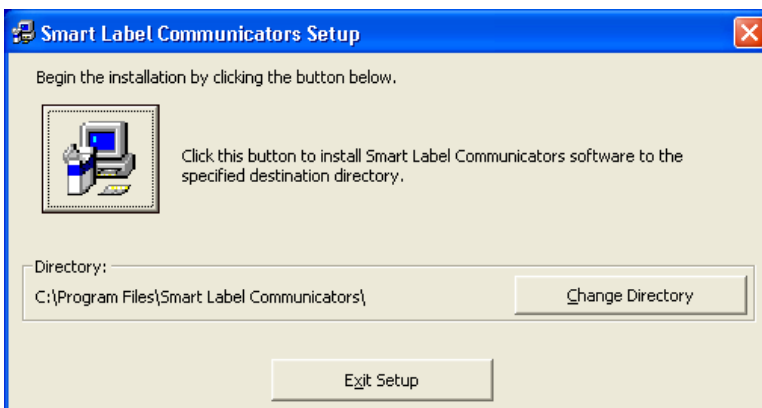
SLC Installation

The Evaluation Kit is delivered with a Microsoft Windows application called Smart Label Communicator (SLC). This application can be used to read tags and perform other functions.
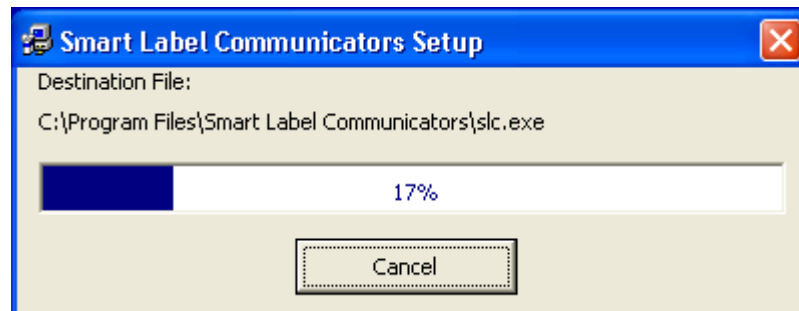
1   To install SLC, load the CD and double-click the **Setup.exe** file:

2   Verify no other applications are running and press **OK**.

3   Press to start the installation.

Smart Label Communicators Setup

Destination File:

C:\Program Files\Smart Label Communicators\slc.exe

17%

Cancel

Smart Label Communicators Setup

Smart Label Communicators Setup was completed successfully.

OK

4   Press **OK** to exit.

Lotis Downloader Installation

Lotis Downloader is used to download firmware updates for the Evaluation Kit. To install Lotis Downloader, perform the following:

1   To install Lotis Downloader, navigate to the Lotis Downloader folder and double-click the **Setup.exe** file:

Lotis Downloader Setup

Welcome to the Lotis Downloader installation program.

Setup cannot install system files or update shared files if they are in use. Before proceeding, we recommend that you close any applications you may be running.

OK   Exit Setup
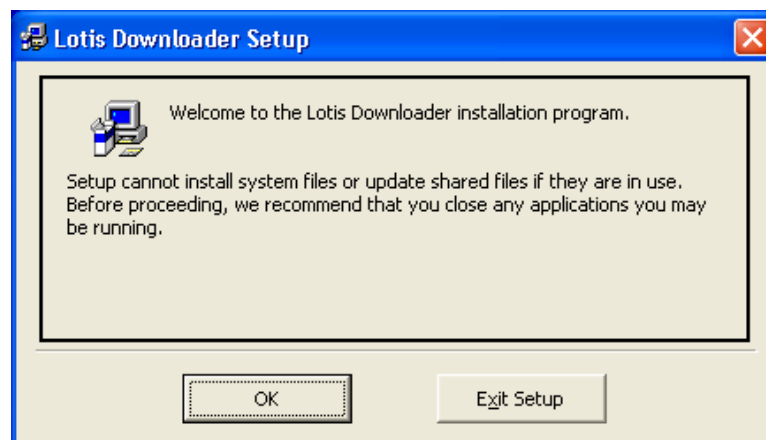
2   Verify no other applications are running and press **OK**.

3   Press to start the installation.

4   Press **Continue.**

Lotis Downloader Setup

Lotis Downloader Setup was completed successfully.

OK
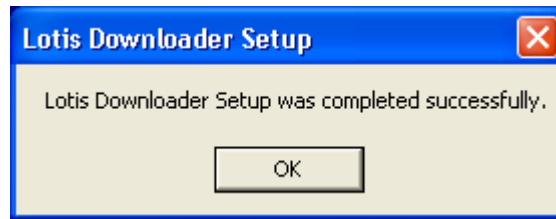
5   Press **OK** to exit.

Operation

Basic Operation

The Evaluation Kit can be operated from the SLC application or by interfacing to a host computer and sending commands. This chapter provides a brief description of how to operate the Evaluation Kit using SLC.

Connect and Power up the Evaluation Kit

1   Connect the serial cable from the Interface Board to the serial port (COM1, etc.) on your computer.

2   Power up the Evaluation kit.

Open SLC

3   From your Windows desktop, select:
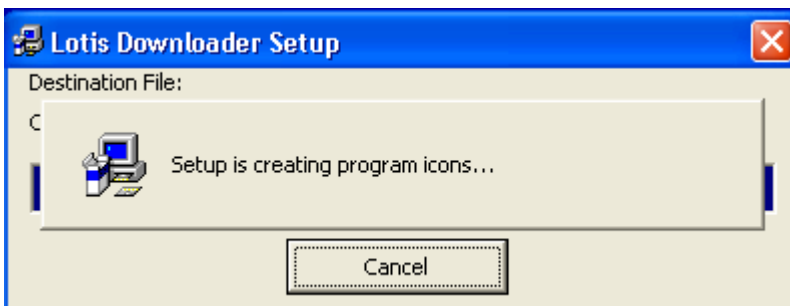
Start→Programs→Smart Label Communicators→ Smart Label Communicators
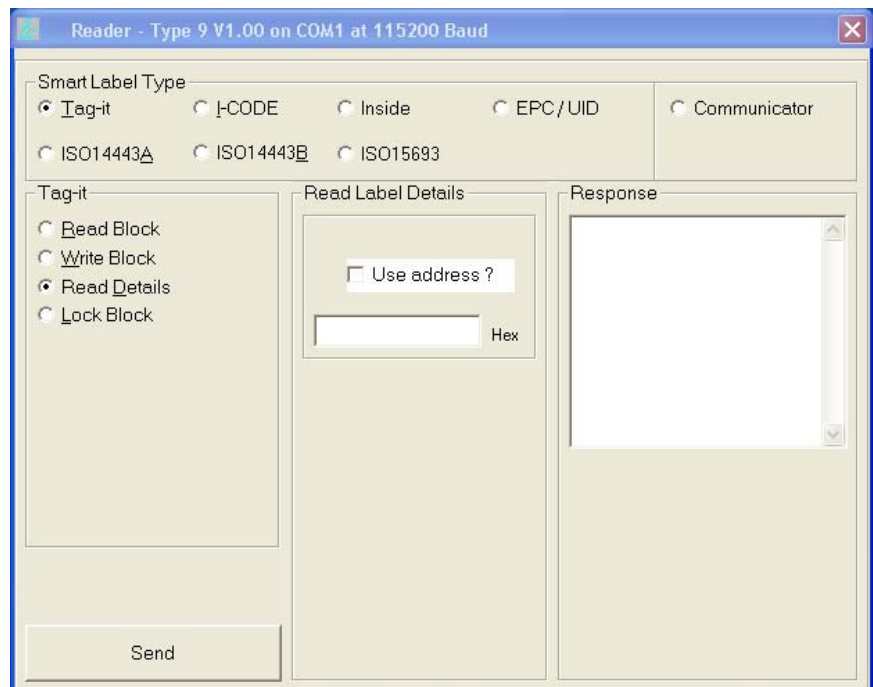
4   If the reader is communicating the following message is displayed across the top of the display.

Reader – Type 9, V1.00 on COM1 at 115200 Baud

Read Tags

5 Select the appropriate protocol (for example, **I-CODE**).

6 Place a tag on top of the antenna.

7 Select **Read Details** and press **Send**.
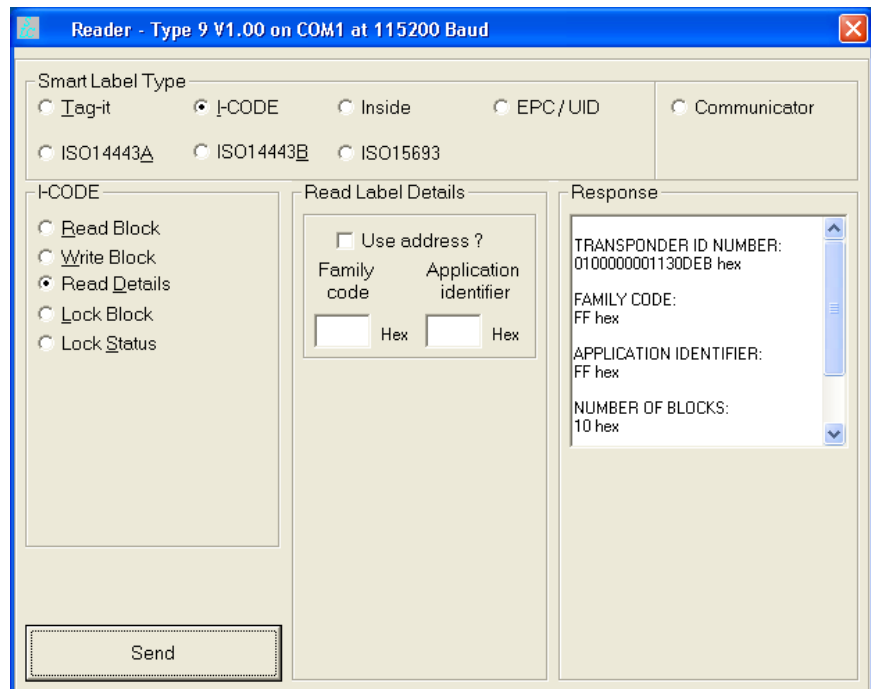
Determine the Read Range

The read range of a specific tag can easily be determined on the Evaluation Kit using the Reader Test function built into the SLC application. To test the read range perform the following:

1   Start SLC.

2   From the menu bar select:

    Options→Reader Test

Read Range

Read range depends on certain factors such as tag protocol, form factor, and antenna geometry.

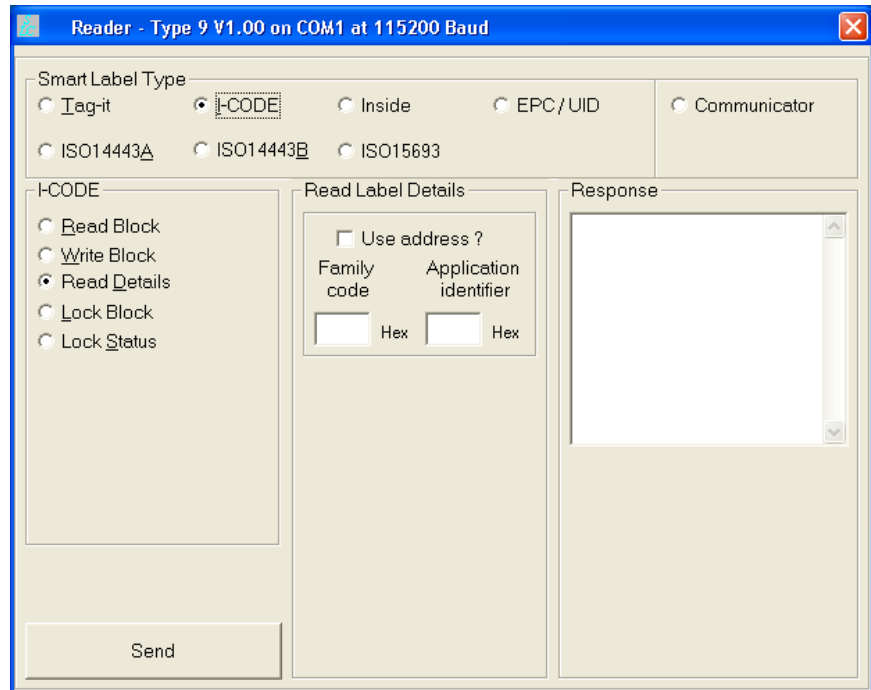3   Select the appropriate protocol. The reader will attempt to the read a tag. If no tag is present the bar graph will turn red and the **Fail** counter will increment.

4   Place a tag over the antenna and slowly move it within range. The bar graph will turn green and the **Pass** counter will increment.

5   Slowly move the tag away from the antenna and note the distance where the bar graph turns back to red.

Read Digital Inputs/Outputs

Digital Inputs and Outputs are provided on the Interface Board via pins 2 to 5. Outputs are open collector and inputs are protected to 30 V.

Table 1   Evaluation Kit Digital Inputs and Outputs

Pin	Signal	Description
2	OP2	Open Collector Output 2
3	OP1	Open Collector Output 1
4	IP2	Input 2 (Max 30V)
5	IP1	Input 1 (Max 30V)

The Read Inputs command (0xF1) reads the logical states of the two digital inputs. The states are returned as the least significant bits of the single data byte of the response packet. Bit 0 indicates the logical state of Input 1, with bit 1 indicating the logical state of Input 2.

The Write Outputs command (0xF2) sets the logical state of two open-collector outputs.

For more information on setting the digital outputs and detecting the state of the digital inputs, please refer to the IN*finity* 110 Protocol Reference Guide.

SLC Application

The SLC software application provides a simple user interface for reading various tags and configuring the Evaluation Kit. Functions provided by SLC include:

➤ Automatically detect a reader
➤ Automatically determine the baud rate
➤ Select a tag protocol
➤ Read and write tags
➤ Perform a tag read test
➤ Read digital inputs
➤ Write digital outputs
➤ Set output attenuation (in dB)
➤ Turn carrier off
➤ Read version and serial number

SLC provides several different screens or pages for reading and writing different tag protocols. These pages include:

➤ Tag-it
➤ I-CODE
➤ Inside
➤ EPC/UID
➤ ISO14443A
➤ ISO14443B
➤ ISO15693

Tag-it

The **Tag-it** page allows you to read and write TI-RFID™ Tag-it™ protocol tags.
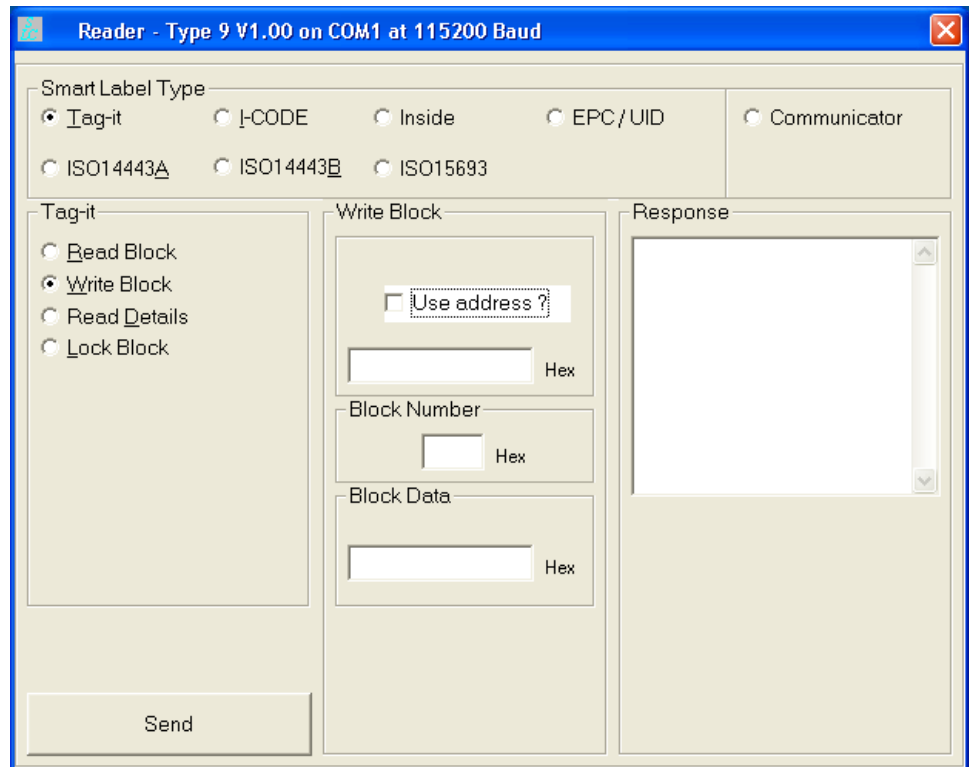
I-CODE

The **I-CODE** page allows you to read and write NXP I-CODE protocol tags.
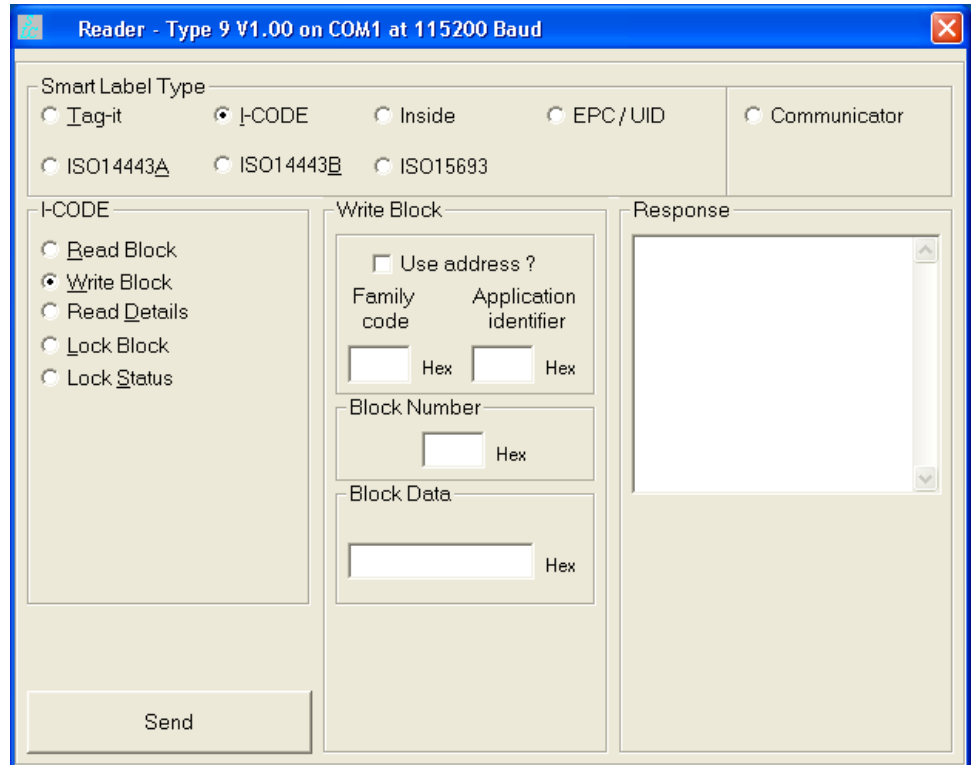
Inside

The **Inside** page allows you to read and write Inside PicoTag™ protocol tags.
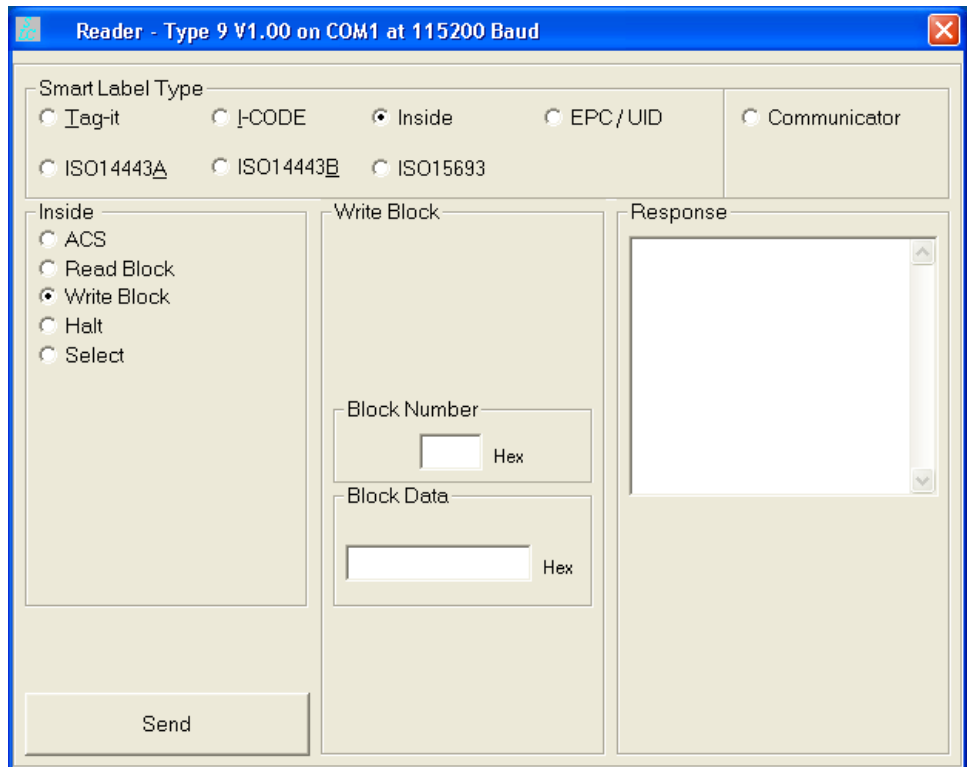
EPC/UID

The **EPC/UID** page allows you to read and write NXP EPC and NXP UID protocol tags.
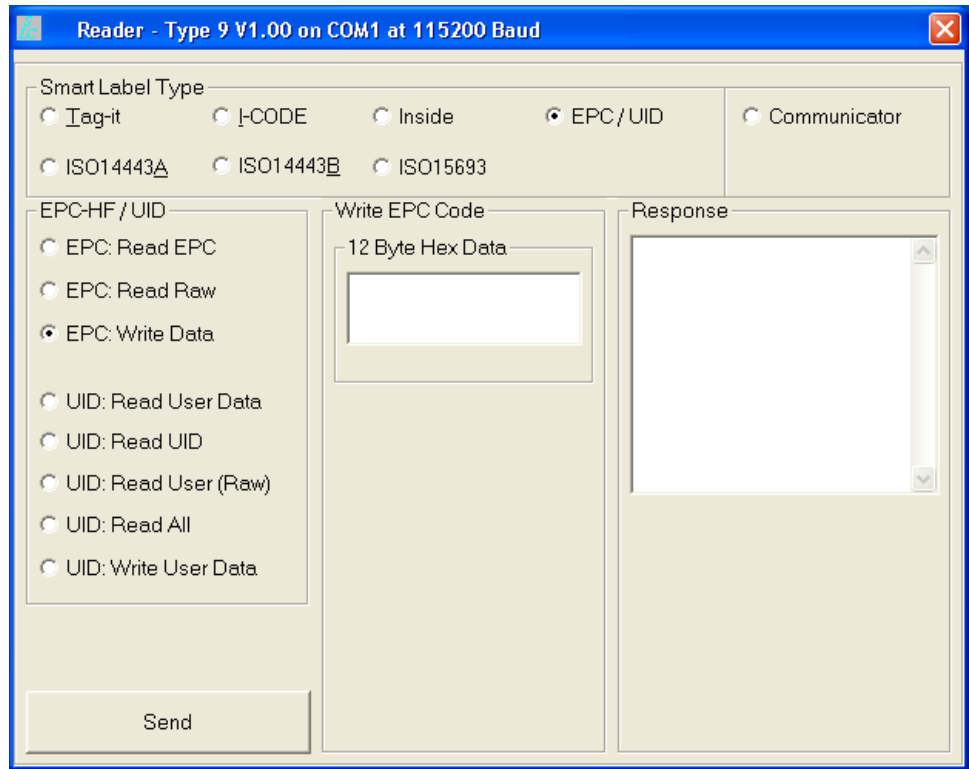
ISO14443<u>A</u>

The **ISO14443<u>A</u>** page allows you to read and write ISO 14443-A and NXP Mifare Ultralite protocol tags.
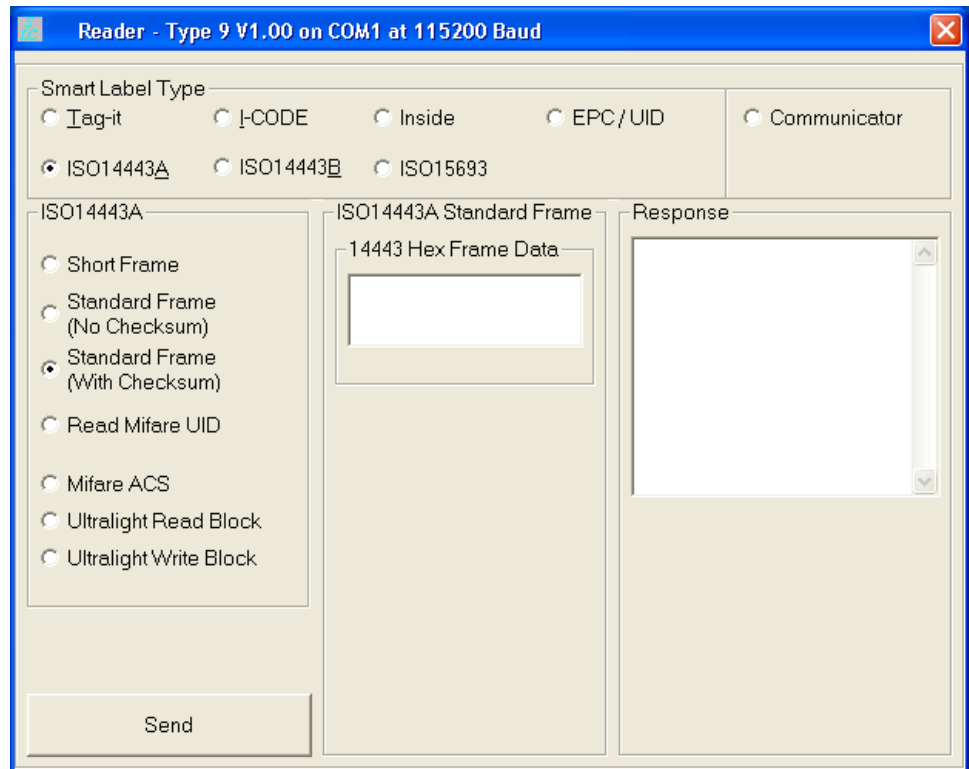
ISO14443B

The **ISO14443B** page allows you to read and write ISO 14443-B protocol tags.
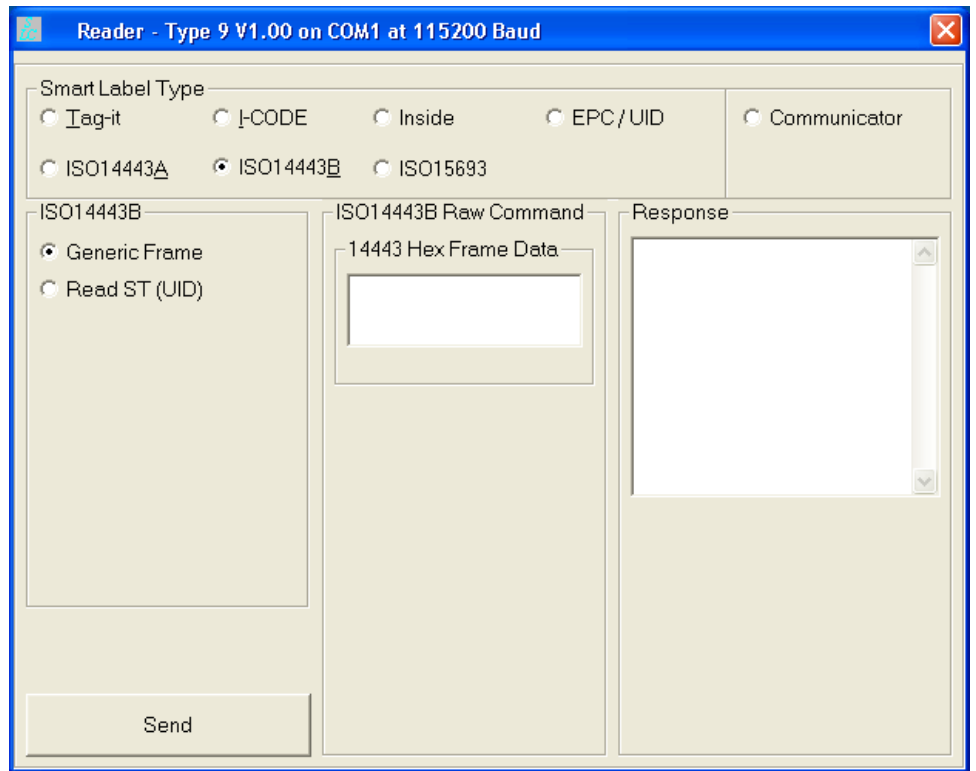
ISO15693

The **ISO15693** page allows you to read and write ISO 15693 protocol tags.

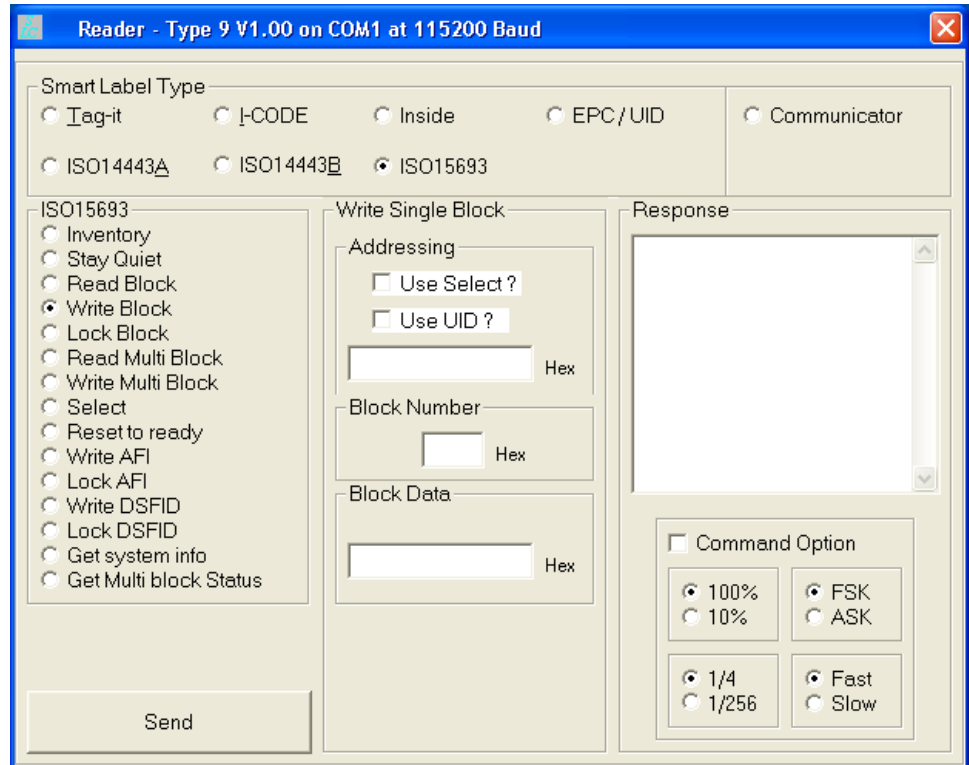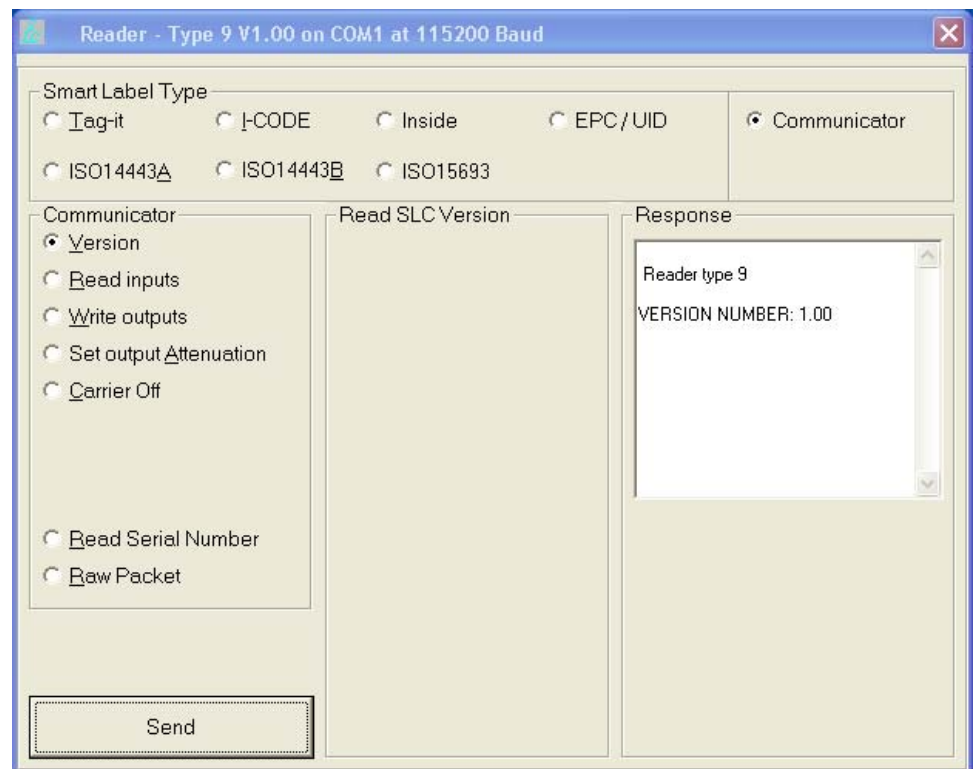# Communicator

The Communicator screen allows you to perform the following functions:

➤ Read firmware version
➤ Read digital inputs
➤ Write digital outputs
➤ Set output attenuation
➤ Turn carrier off
➤ Read serial number
➤ Send a raw packet

Configuration and Maintenance

This chapter provides information for configuring the Evaluation Kit. For detailed information on the IN*finity* 110 command and control protocol, refer to *the INfinity 110 Protocol Reference Guide*.

Setting the Baud Rate

The Evaluation Kit may be configured to operate at one of five Baud rates. These can be configured via the serial command set (refer to the SLC protocol document for more information).

The Evaluation Kit is capable of supporting the following Baud rates:-

➤ 115,200
➤ 57,600
➤ 38,400
➤ 19,200
➤ 9,600

Unless specifically documented, the firmware Baud rate is factory set to 115,200 Baud.

Configuring the Digital I/O

Digital I/O is provided on the Evaluation Kit via pins 2 to 5. Outputs (pins 2 and 3) are open collector and inputs (pins 4 and 5) are protected to 30V. For details of setting the digital outputs and detecting the state of the digital inputs, please refer to the SLC protocol document for more information).

Downloading Firmware

The Evaluation Kit supports the downloading of firmware updates to flash memory via the serial interface. Firmware updates may be provided for this product for regular maintenance, support for new tags and feature enhancements. Note that firmware download files cannot be created and downloaded by the user.

To use the secure download facility, you will need the **Lotis Downloader.exe** program, along with a copy of the latest firmware release.

To install the firmware downloader, execute the setup.exe file located in the firmware downloader bundle. Follow the on-screen prompts, which will guide you through the installation of the software.

Once completed, the **Lotis Downloader** icon will be available in a **Lotis Downloader** folder on the Windows Start Menu. Upon selecting this icon, you will be presented with the following interface.
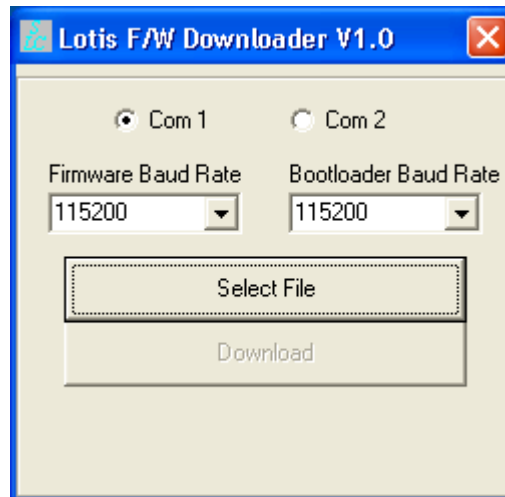
Selecting The Communications Port

Both the *Firmware Baud Rate* and *Bootloader Baud Rate* parameters should be set to the Baud rate of the board. Typically these will both be 115200.

Selecting the Firmware File and Downloading

Pressing the **Select File** button will enable selection of the firmware (.fmw) file. Navigate to the folder containing the firmware file you wish to download, select the filename from the file list and press the **OK** button.

If the load was successful, the **Download** button will now be enabled. Pressing this button will initiate the download process. A blue progress bar will show the status of the download.

During the download process, LED D2 will extinguish and LED D1 will illuminate. This indicates that the reader is in bootloader mode. D2 will blink to indicate each successful transaction between the host and the Evaluation Kit.

Once the download process is complete LED D1 will extinguish and LED D2 will illuminate.

Forcing the Reader into Bootloader Mode

If the reader becomes locked and will not automatically enter bootloader mode (the download software does not work), activating the bootloader link mechanism will force the reader into bootloader mode when powered. To apply the bootloader link mechanism, perform the following:

1   Ensure the Evaluation Kit is powered down.

2   Short the LINK pin (pin 10) to GND (pin 1) on J3.

3   Power-up the Evaluation Kit.

4   Remove the link.

LED D1 should be on and LED D2 should be off to indicate that the Evaluation Kit is running in bootloader mode.

Troubleshooting

Problem	Probable Cause	Corrective Action
No response from module	Incorrect serial communications parameters.	Verify settings of serial communications port (115200bps, 8 data bits, no parity, 1 stop bit)
	Incorrect serial commands construction.	Correct commands to conform to serial protocol as specified in IN*finity* 110 Protocol Reference Guide.
Tags will not read	Incorrect serial command.	Verify command (for example, use ISO 15593 command set for ISO 15693 tags).
	No functional tags in read zone	Verify tags are functional and within the read range of the module.
	Adverse tag environment	HF tags will not function well in some environments, such as areas with high moisture content or in close proximity to metal.
	Antenna not properly connected	Attach antenna. Check the integrity of the antenna connector.
Poor read range / Intermittent tag reads	No functional tags in read zone	Verify tags are functional and within the read range of the module.
	Adverse tag environment	HF tags will not function well in some environments, such as areas with high moisture content or in close proximity to metal.

Specifications

Evaluation Kit Specifications

Frequency	13.56 MHz
RF Output Power	200 mW maximum
Antenna Type	50Ω (ohms)
Input Voltage	3.3 VDC, ±5%, ,50 mV ripple
Active Current	300 mA
Standby Current	60 mA
Idle/Sleep Current	40 mA
Communications	3.3V TTL-level serial

Environmental Specifications

Operating Temperature	-20 ℃ to +60 ℃ (-4 ℉ to 140 ℉)
Storage Temperature	-40 ℃ to +125 ℃ (-40 ℉ to 257 ℉)
Relative Humidity	10 to 80%, non-condensing
Dimensions	70 x 52 x 38 mm (2.75 x 2.03 x 1.50 in.)
Weight	52 g (1.84 oz.)
Mounting	4-corner mounting holes 3.18 mm dia (o.25 in)

Power Supply Specifications

Vendor Part No.	EPS090166UH-P5P-SZ (0.4A) or EMS090200-P5P-SZ (0.6A) with 2.1 mm, center positive plug
Input Voltage	100 to 240 VAC, 0.4A
Input Frequency	50–60 Hz
Output Voltage	9 VDC
Output Current	1.66A maximum

Serial Communications Specifications

Type	3.3V TTL-level
Connector	DB-9 (female on Interface Board)
Baud rate	9600 - 115200 (Default = 115200)
Parity	None
Data bits	8
Stop bits	1
Signals	
Pin 6	Serial TX (Asynchronous, 0 to 3.3 V TTL logic level data output from module)
Pin 8	Serial Rx (Asynchronous, 0 to 3.3 V TTL logic level data input to module)

Regulatory and Safety Instructions

RF Safety

⚠ *Caution:* *The INfinity 110 HF Reader is equipped with one (1) RF port. To prevent reader damage, this RF port must be properly terminated with a 50 ohm load or a functional HF antenna before power up. Never power up the reader unless the appropriate load or antenna is connected. Always power down the reader before removing an antenna or load from an RF port.*

Regulatory Compliance

⚠ *Caution:* *This equipment complies with Part 15 of the FCC rules. Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.*

⚠ *Caution:* *This device complies with Part 15 of the FCC rules subject to the following two conditions:*

1) This device may not cause harmful interference.

2) This device must accept all interference received, including interference that may cause undesired operation.

Sirit's INfinity 110 Evaluation kit (IN110K-001) with 45 mm x 45 mm antenna has passed FCC Part 15 regulatory requirements and was granted FCC certification (FCC Identifier M4ZIN110). Any additional antenna attached to the reader will need to be tested and certified by the user/supplier. It is the responsibility of the user when the system configuration is modified affecting Radio Frequency performance. The following two antenna sizes were supplied for the FCC compliance testing and complied within the radiated limits:

➤ Small Demo Antenna – This is the standard demo kit antenna known as INfinity 11x RFID ANTENNA V1 that is illustrated in Figure 1. This has a nominal resonant frequency of 13.56 MHz and an impedance of 50 Ohms at this frequency. The dimensions of this antenna are 1.77 in x 1.77 in (45 mm x 45 mm).

➤ Compact Disc Antenna – This antenna also has a nominal resonant frequency of 13.56 MHz and an impedance of 50 Ohms at this frequency. The dimensions of this larger antenna are 5.47" x 4.65" (139 mm x 118 mm).

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