DR1000™

Dual Reader

User Manual

Part No. RF-109-0405

TABLE OF CONTENTS

DISCLAIMER

The operations represented in this manual are for guideline purposes only and in no way are to be construed as a warranty or other operation obligation, legal or otherwise. For information on warranty, service and other legal rights and obligations regarding the product covered by this manual, refer to the warranty/service information provided by the seller or reseller of this product.

Safety Precautions & Important Safety Instructions

CAUTION

RISK OF ELECTRIC SHOCK

DO NOT OPEN

CAUTION: TO REDUCE THE RISK
OF ELECTRIC SHOCK
DO NOT REMOVE THE COVER (OR BACK).
NO USER-SERVICEABLE PARTS INSIDE.
REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

The lightening flash with arrowhead symbol within an equilateral triangle is intended to alert the user to the presence of uninsulated dangerous voltage within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the product..

USE OF THIS PRODUCT IN A MANNER OTHER THAN DEFINED IN THIS MANUAL MANY CAUSE DAMAGE TO EQUIPMENT OR INJURY TO PERSONNEL.

FCC WARNING: This equipment has been tested and found to comply with the limits for a device pursuant to Part 15 of the FCC Rules, to wit, operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operations

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that this interference will not occur in a particular installation. If this product does cause harmful interference to radio or television or other wireless reception, which can be determined by turning the product off and on, the user is encouraged to correct the interference by one or more of the following measures:

- Reorient or relocate this product or the unit experiencing interference.
- Increase the separation between this product and the unit experiencing interference.
- Connect this product into an outlet or circuit different from that to which the unit experiencing interference is connected.
- Consult the dealer for technical support.

Changes or modifications to this equipment may cause harmful interference unless the modifications are expressly approved in the instruction manual. The user could lose the authority to operate this equipment if an unauthorized change or modification is made.

Warnings & Safety Precautions

The DR1000™ is designed and manufactured to provide long, trouble-free service. No maintenance other than cleaning is required. Use a soft dry cloth to clean the surface. Never use solvents such as alcohol or thinner to clean the surface.

To ensure your safety when installing this equipment, for operating safety and to avoid damage to the apparatus, read carefully and observe the following precautions and instructions:

1. For performance and safety reasons, only the power supplies listed for use with this equipment should be used.
2. Connect the unit only to a properly rated supply circuit.
3. All wiring external to this product should follow the local wiring codes.
4. This unit is for use in dry locations only. Do not expose the unit to water or moisture.
5. Do not operate in ambient environments with a temperature greater than 104^0F/40^0C or lower than 41^0F/5^0C.
6 Do not open the DR1000. If the unit is damaged in this way, the warranty will be void. Moreover, there is a risk of shock.
10. Do not attempt to service or repair the DR1000 unit. The unit's components are not user serviceable. Only authorized, qualified personnel should service

this system. The Precision Dynamics Corporation is not liable for any bodily harm or damage caused if unqualified persons attempt service or open the cover(s) to any component of the system. Refer all service to authorized DR1000 service technicians.

To avoid damage and prolong operating life:

- Handle the unit carefully when installing and do not drop.
- Set the unit away from heat, excessive dust and direct sunlight..
- Protect the inside of the unit's components from liquids. In case of accident, unplug the console and have the damage serviced by an authorized technician.
- Do not hit or scratch the unit's light-sensor window surface as this causes flaws on the surface of the window and may damage operation.
- Do not connect the PS/2 cable to the host when the 5V power supply is also connected, as it may damage the DR1000 or the host computer

1 Purpose of this Document

The purpose of this document is twofold:

- First, to introduce the user to the capabilities of the DR1000 Dual Reader.
- Second, to enable a user to configure the device to scan RFID tags and barcode data and send data to a host device as if it were entered from a keyboard.

This document describes two critical interfaces of the DR1000:

- the *User Interface*
- the *Host Interface*

The *User Interface* consists of the trigger, two multi-color LEDs, and a beeper. The *Host Interface* is implemented as a keyboard emulation or 'wedge' interface which is available in the USB and PS/2 models: the DR1000 sends data to the host in the form of keystrokes, but the host cannot send any information or commands to the DR1000. In this manner, the DR1000 can be used to input barcode and RFID data directly into any application which accepts keystrokes. This allows a user to quickly incorporate the DR1000 into an existing application without requiring any programming effort.

For users who require functionality beyond what is available with keyboard emulation, a Software Development Kit (SDK) is available. The SDK includes user documentation, sample code and both DLL and ActiveX components to allow a programmer to easily harness the full functionality of the DR1000 Dual Reader.

2 Product Overview

2.1 General Description

The DR1000 Dual Reader is a handheld, tethered barcode/RFID reader for use with most industry standard linear and 2-D barcode symbols, as well as 13.56 MHz RFID tags and labels. The DR1000 is compatible with ISO 15693 transponders and several previous generation proprietary protocols.

The DR1000 Dual Reader is available with three different interface options:

- **USB**
- **RS-232 (serial)**
- **PS/2**

The Dual Reader allows firmware upgrades in the field. This guarantees a forward migration path and sound investment as new features and enhancements become available.

2.2 Features

- Operates from 5V DC
- ISO 15693 compatible
- Flash upgradeable in the field for future product updates
- RFID Read Range: 6.5 inches (16.5 cm) read range with credit card size tags, 5.0 inches (12.5 cm) with wristband-size tags
- Keyboard emulation operation available with PS/2 and USB models
- User feedback via two multi-color LEDs and a beeper
- Trigger operation – point and scan barcodes and RFID tags
- Host control mode – powerful, easy to use software interface (requires SDK)

2.3 DR1000 RFID Tag Compatibility

The DR1000 Dual Reader supports the RFID tag types and features shown in **Table 1** below. By default, the DR1000 will read all compatible tag types (auto-detect), but it may be configured to only read a single tag type to optimize performance.

Table 1 – DR1000 Tag Compatibility

ISO-15693 (-2 and -3 compliant)

Manufacturer	Product	Memory (bits)	Anti-collision	Read	Write
Texas Instruments	Tag-it HF-I	2048	*yes*	*yes*	*yes*
Philips	I·CODE SLI (SL2)	1024	*yes*	*yes*	*yes*
Infineon	my-d SRF55V10P	10k	*yes*	*yes*	*yes*
ST Microelectronics	LR512	512	*yes*	*yes*	*yes*

Proprietary

Manufacturer	Product	Memory (bits)	Anti-collision	Read	Write
Texas Instruments	Tag-it HF	256	*yes*	*yes*	*yes*
Philips	I·CODE (SL1)	512	*yes*	*yes*	*yes*
Inside Contactless	PicoTag 2K	2k	*no*	*id only*	*no*

2.4 DR1000 Barcode Compatibility

The DR1000 Dual Reader decodes the linear and 2-D barcodes listed in **Table 2** below:

Table 2 – DR1000 Barcode Compatibility

Linear:	2-Dimensional:	Postal:
Code 39 Code 128 Codabar UPC EAN I 2of5 RSS Code 93 Codablock	PDF417 MicroPDF417 MaxiCode Data Matrix QR Code Aztec Aztec Mesa Code 49 UCC Composite	Posnet Planet Code BPO 4 State Canadian 4 State Japanese Post Kix

3 Models and Modes of Operation

Table 3 lists the three available models and the corresponding modes of operation. The DR1000 has two (2) operating modes, **Trigger Mode** and **Command Mode**.

Table 3 – DR1000 Models and Modes

	USB (Keyboard Emulation) [1]	**USB** (Serial Emulation) [2] [default setting]	**RS-232 Serial**	**PS/2**
Trigger Mode [3]	Keyboard emulation via USB	ASCII data via virtual COM port	ASCII data via RS-232 connector	Keyboard emulation via PS/2 Connector
Command Mode [4]	N/A	Via virtual COM port	Via RS-232 connector	Via RS-232 Connector
Power Source	Host USB connection	Host USB connection	External Power Supply Adaptor	External Power Supply Adaptor or via the Host PS/2 interface

[1] Keyboard emulation mode is automatically entered at power-on if the HID Mode is set to HID and the trigger is not pulled, or if HID Mode is set to Serial and the trigger is pulled at power-on and then released (USB model only).
[2] Serial Emulation mode is automatically entered at power-on if the HID Mode is set to Serial and the trigger is not pulled, or if HID Mode is set to HID and the trigger is pulled at power-on and then released (USB model only).
[3] Configurable ASCII read-only mode under DR1000 firmware control.
[4] To configure the device for trigger mode operation and/or to perform read and write operations under application control.

3.1 Command Mode

Command Mode is used to configure a device for trigger mode operation, and/or as the primary method to control the device. The BaRS utility software may be used to easily configure the DR1000 for keyboard emulation applications (see Appendix 1 for additional information). Host control of the DR1000 requires programming which is facilitated by the SDK (sold separately).

As long as the DR1000 has power, *Command Mode* is active when the trigger is in the released position. *In Command Mode* the DR1000 is listening for a command from the host. It is not required that a host have the capability to send a command to the DR1000.

NOTE

The DR1000-PS/2 or DR1000 USB in **keyboard emulation can *never* receive a command from a host**. The DR1000 USB can receive commands if it is re-initialized in serial emulation mode. The DR1000-PS/2 can receive commands if its serial connector is plugged in. Writing to a tag can only be done in command mode.

3.2 Trigger Mode

Trigger Mode is designed to read formatted ASCII data from a combination of RFID or barcode data sources, and supply the data to a host device as if it was entered from a keyboard. The user may specify up to three events in a Scan Sequence to capture data from three different RFID or bar code data sources, and quickly populate multiple text fields of a form without the use of a keyboard.

Trigger Mode is activated when a user pulls the trigger (if Trigger Mode is not disabled). While in *Trigger Mode*, the DR1000 begins scanning immediately and continues to scan until a RFID tag or barcode is read, or until the trigger is released. The maximum data string length is 1024 bytes. Data strings that exceed 1024 bytes will be truncated.

The operating characteristics of the DR1000, while in *Trigger Mode*, are defined by the following parameters: **Scan Sequence**, **RFID Data Style**, and **Barcode Data Style**. Each parameter may be configured to match the needs of the application.

3.2.1 Scan Sequence

When Scan Sequence is enabled, a maximum of three events may be defined to capture information from any combination of RFID or barcode data sources. The possible Scan Sequence options are listed in **Table 4**. If Scan Sequence is disabled, Trigger Mode is disabled.

Table 4 – Trigger Mode Setting: Scan Sequence

Disabled
Barcode
RFID
Barcode, RFID (default)
RFID, Barcode
Barcode, Barcode
RFID, RFID
Barcode, Barcode, Barcode
Barcode, Barcode, RFID
Barcode, RFID, Barcode
RFID, Barcode, Barcode
Barcode, RFID, RFID
RFID, RFID, Barcode
RFID, Barcode, RFID
RFID, RFID, RFID

EXAMPLE

In a hospital, a nurse wishes to administer medication to a patient and must record the event in an electronic record. The record consists of nurse's name, medication information, and patient information. The nurse name and medication information will be read from two separate barcodes, and the patient information will be read from a RFID wristband. The Scan Sequence is nurse name (barcode), patient information (RFID tag), and medication information (barcode). Using the DR1000 Dual Reader, this information may be scanned into text fields of an electronic form without using a keyboard. In use, the nurse positions the cursor in the text box for the nurse's name, points the DR1000 at the nurse's badge, and pulls the trigger. The name from the barcode is automatically entered into the text box. The nurse then repeats this operation to capture the patient and medication information.

3.2.2 Barcode Data Style

Barcode Data Style defines how barcode data is transmitted back to the host. The DR1000 has two options as indicated in **Table 5** below.

By default, the **Complete Barcode Data** option causes the DR1000 to read the barcode and send the entire data string to the host.

If the DR1000 is configured for **Use Field Interpretation**, barcode data may be parsed into separate data fields (multiple text boxes), and sent to the host with header and trailer characters, if desired. The header and trailer characters may contain tabs, carriage returns or line-feeds to navigate between different text boxes by reading only one barcode.

The *Barcode Data Style* setting applies to all barcodes defined by the Scan Sequence.

Table 5 – Trigger Mode Setting: Barcode Data Style

Complete Barcode Data (default)
Use Field Interpretation

3.2.3 RFID Data Style

RFID Data Style defines the content and structure of RFID data transmitted back to the host. The *RFID Data Style* options are identified in **Table 6** below. The Tag UID setting allows the DR1000 to read and transmit the RFID tag **U**nique **ID**entification (UID) number. *RFID Data Style* also supports Field Interpretation and operates in the same way as *Barcode Data Style*. The RFID Data Style setting applies to all RFID tags defined by the *Scan Sequence*.

Table 6 – Trigger Mode Setting: RFID Data Style

UID Only
Data Only (default)
UID and Data
Use Field Interpretation

In general, RFID tag ASCII data is read and transmitted to the host until a NUL character is encountered. If multiple tags are present within the read-range of the dual reader, the DR1000 will only read the UID of the first tag it detects.

3.2.4 Keyboard Emulation (Wedge)

In PS/2 or USB *Keyboard Emulation Mode*, the DR1000 will map each byte value of a data string to an equivalent keystroke. Only valid ASCII characters are output to the host. Any other barcode or RFID tag data not part of the ASCII character set is ignored. That is, the following ASCII values are discarded: SOH, STX, ETX, EOT, ENA, ACK, BEL, BS, VT, FF, SO, SI, DLE, DC1, DC2, DC3, DC4, NAK, SYN, ETB, CAN, EM, SUB, FS, GS, RS, US, DEL. Also, any byte value with the MSB set (high bit) is ignored. When a NUL character is encountered, the string is terminated and any additional characters are ignored.

ASCII chart

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0										HT	LF			CR		
1												ESC				
2	SP	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	

3.3 Scanning an RFID Tag

A RFID tag must be oriented parallel to the face of the DR1000 at no more than 5.0 inches for a wristband sized tag and 6.5 inches for a credit card sized tag. Upon a trigger pull, the DR1000 will scan for a RFID tag until a RFID tag is read or the trigger is released. The DR1000 outputs all data to the host as soon as it is read. However, the next scan cannot start until the trigger is released and pulled again.

3.4 Scanning a Barcode

The proper method for scanning a barcode is to hold the face of the DR1000 4-6 inches from the barcode. When the trigger is depressed, a red or green light bar darker than the surrounding red laser appears on or over the barcode. The bar should line up with the barcode horizontally. The DR1000 continuously scans for a barcode until one is read or the trigger is released.

3.5 Field Interpretation

3.5.1 Overview

Field Interpretation is a useful and powerful feature of the DR1000 to automatically parse a data string into multiple segments, or append fixed characters before or after a data string. This capability allows a user to automatically populate and navigate multiple text boxes in a form, simply by scanning a single barcode or RFID tag.

EXAMPLE

A single barcode is scanned which has 10 characters of name, 10 characters of social security number, and 8 characters of date. An example data stream might be First_Name123456789002142005. The data is scanned into a form that has Name, SSN and Date text boxes. A tab character will navigate between the 3 text boxes. It is desired to scan the data into the form as:

Name: First_Name
SSN: 123-456-7890
Date: 02/14/2005

This can be handled readily using Field Interpretation arrays.

In this case, the BaRS program allows the field interpretation parameters to be configured. There are two components to interpretation arrays; how to store interpretation arrays into the DR1000, and how the DR1000 will output data according to the interpretation arrays stored. This section will detail both how to store interpretation array data into the DR1000, how the DR1000 will output data according to the interpretation array stored, and also error conditions that the DR1000 can encounter and its responses.

3.5.2 Field Interpretation Arrays

A raw data string can be parsed into multiple segments by defining field interpretation arrays. A field interpretation array consists of individual records (up to 64), each defined by the following parameters:

Field Address – the starting location of the data string.

Field Length – the maximum length of the data, in number of bytes, to output starting at the field address value. The data is output sequentially from the *Field Address* to the *Field Address* + *Field Length-1*. Field length can be any length from 0x0000 to 0x03FF. A field length value of 0x0000 indicates that field interpretation is terminated, and that the last field sent to the host was the last field to be sent for the current scan.

Header – a 4-character field sent at the beginning of each field. Each field can have a unique header and can be 0 to 4 characters.

Trailer – a 4-character field sent at the end of each field. Each field can have a unique trailer and can be 0 to 4 characters.

All interpretation array data is output in the following format, where H stands for header, T stands for trailer, and FxL is the data of size length L in Field X.

H1 F*1L* T1 H2 F*2L* T2 H3 F*3L* T3 …… HN F(*N < 64)L* TN

Field 1 ---------- > Field N

EXAMPLE

In the previous example, the barcode data stream is broken into seven segments as shown in the following chart.

Field Address	Field Length	Header	Trailer	Comment
0	10		<tab>	Output name followed by a tab character to move to the SSN text box
10	3		-	Insert a '-' between the 3rd & 4th digit
13	3		-	Insert a '-' between the 6th & 7th digit
16	4		<tab>	Output last 4 SSN digits followed by a tab character to move to the Date text box
20	2		/	Insert a '/' between the day and month
22	2		/	Insert a '/' between the month and year
24	4			

This table is entered using the **BaRS software utility** and downloaded to the DR1000. In operation, the user positions the cursor on the *Name* text box and scans the barcode to populate each field in the form.

A field interpretation array is terminated when it encounters a field with a length of 0. The field address does not have to be sequential. That is, the fields in the interpretation array can jump to different addresses in the scanned data. The DR1000 supports up to three separate interpretation arrays, one for each scan that is enabled by the *Scan Sequence* parameter.

NOTE

The field interpretation may be written to the DR1000, but it cannot be read back from the device. For this reason, it is important to use the BaRS software's *Save to File* feature to save the configuration before exiting the program.

3.5.3 Keyboard emulation and serial differences

In the case of a PS/2 unit or a USB unit in keyboard emulation mode, only normal ASCII characters can be transferred to the host. There are no limitations to a RS-232 or USB unit in serial emulation mode. All raw bytes will be sent to a COM port on the host.

3.5.4 Error Conditions and Handling

There are several error conditions that can occur when a DR1000 outputs data according to field interpretation arrays. The DR1000, in most instances, will output a trailer when it encounters an error and indicate to the user an error occurred via the LEDs and beeper. The errors and the DR1000's handling of these errors are described below:

Error: The Field Address attempts to address data outside the scanned data range. For example, an error occurs if the DR1000 scanned 50 bytes of data from an RFID tag or barcode and the field address pointed to location 51.
DR1000 Response: The DR1000 will output the header and the trailer and indicate to the user an error occurred via the LEDs and/or the beeper.

Error: The Field Address attempts to address data inside the scanned data range, but the Field Length exceeds the available scanned data in the DR1000 data buffer. That is, if the DR1000 scanned 50 bytes of data from an RFID tag or barcode and the address pointed to location 49 but had a Field Length of 15.

DR1000 Response: The DR1000 will output data until it gets to the end of available data, and then output the trailer. An error will be indicated to the operator via the LEDs and/or beeper.

4 Power and Host Interface Connections

This section describes the available host interfaces, their specific modes of operation and differences, and power configurations for each model.

4.1 Power

Depending on the interface type, the DR1000 receives power from the PS/2 port, from the USB port, or from a separate 5V power supply. The maximum current required by the DR1000 is 450mA at 5V. The DR1000 operates optimally at 5V, with some read-range degradation at lower supply voltages.

4.2 USB

The USB model supports two modes of operation: **serial communication** and **keyboard emulation**. The current mode of operation may be determined by viewing the *Windows Device Manager*. If the DR1000 is in keyboard emulation mode, the device will register with the operating system as a *Human Interface Device* (HID). Conversely, if the DR1000 is in serial communication mode, the device will register with the operating system as a serial device, with the emulated serial port number identified in the *Device Manager*.

If the DR1000 is in keyboard emulation (HID) mode, it cannot receive commands from the host. Therefore, there is a method to change the DR1000 from keyboard emulation mode to serial communication mode without using a host command:

1. Disconnect the USB cable from the host.
2. Depress and hold the trigger of the DR1000.
3. Connect the USB cable to the host.

If the trigger of the DR1000 is depressed during startup (connection to the host), the DR1000 will toggle modes based on the HID mode previously stored in memory. For example, if the HID mode is set to serial communication and the trigger is depressed during startup, the DR1000 will switch modes and startup in keyboard emulation mode, and vice versa.

The USB model has a Type A male USB connector at the end of a 2-meter cable, tethered and permanently connected at the DR1000 side. The DR1000 is powered from the USB host via the USB cable. The Type A male USB connector mates with any standard host device with a Type A female USB connector.

Table 7 - USB Power and Communications Connection

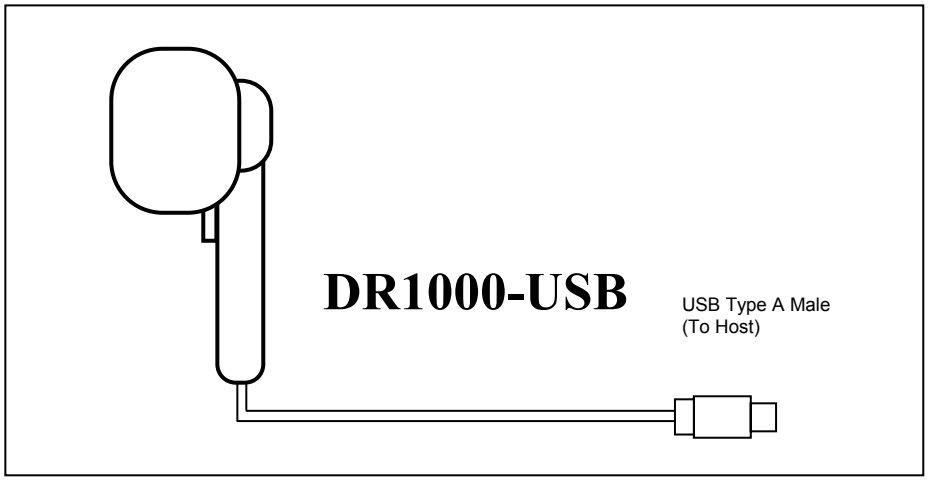


Table 8 - Mating face USB type A female (host)

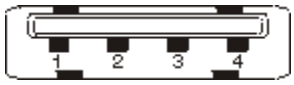


Table 9 USB Connector Pin Assignments

Pin Number	Pin Name	Pin Description
1	+5	Vcc Supply for USB device
2	-D	Negative differential data signal
3	+D	Positive differential data signal
4	GND	Ground for USB device

4.3 RS-232

For the RS-232 model, the power supply must be connected to an active power outlet, and the RS-232 cable must be connected to the host computer.
The RS-232 model has a female DB-9 connector with integrated power dongle input connector at the end of a 2-meter cable, tethered and permanently connected at the DR1000 side. The 2.5mm x 5.5mm center positive power jack option at the end of the power dongle requires power input from an external 5V power supply (wall transformer).

The female DB-9 connector mates with any standard host device with a male DB-9 connector.

Table 10 – RS232 Power and Communications Connections

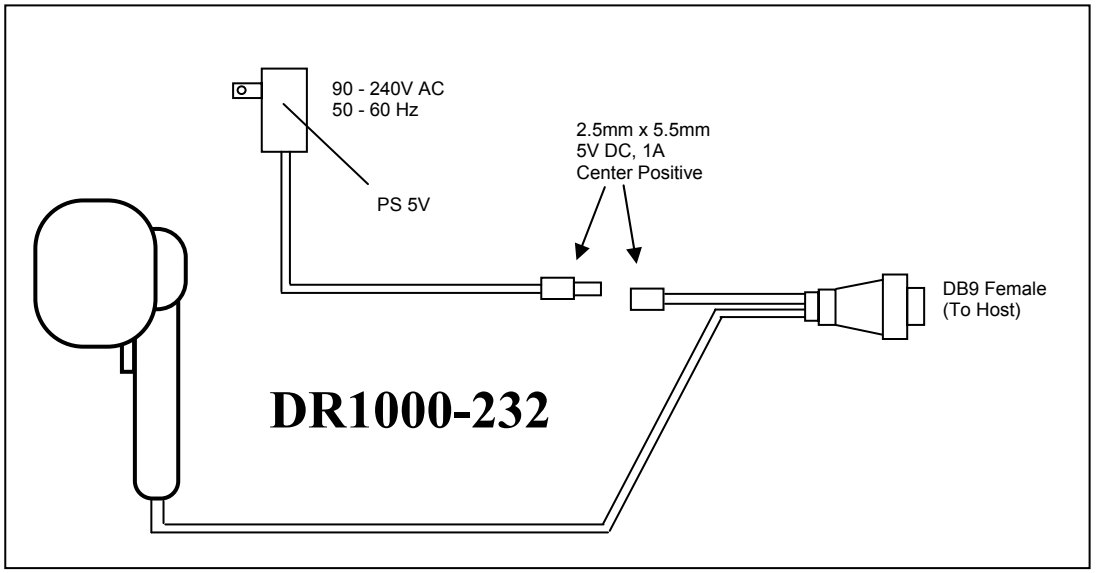


Table 11 - Mating face of DB9 male (host)

Table 12 below identifies the pin assignments for the RS-232 DB9 connector. The DR1000 communication interface supports baud rates of 9600, 19200, 38400, 57600 and 115200 with 8 data bits, 1 stop bit and no parity. Flow control is not supported. The default baud rate is 9600.

Table 12 RS-232 DB9 Pin Assignments

Pin Number	Pin Name	Pin Description
1		
2	Tx_232	RS-232 transmit to host
3	Rx_232	RS-232 receive from host
4		
5	GND	Ground for RS-232 host
6		
7		
8		
9		

4.4 PS/2

The PS/2 model is intended for use with applications that require keyboard emulation only. However, since the DR1000 cannot receive configuration commands while connected to the PS/2 port, the PS/2 model is also equipped with a RS-232 cable. Follow the connection instructions below to configure a PS/2 model:

1. Disconnect the PS/2 cable from the host computer.
2. Connect the RS-232 cable to a host computer.
3. Connect the 5V power supply into a power outlet and connect the power supply to the RS-232 dongle.

WARNING:

Do not connect the PS/2 cable to the host when the 5V power supply is also connected, as it may damage the DR1000 or the host computer.

During normal operation, the PS/2 model is powered from the host computer via the PS/2 port. The 6-pin mini-DIN male connector at the end of the DR1000 PS/2 cable connects to any standard host device with a 6-pin mini-DIN female connector.

Table 13 - PS/2 Operational - Power and Communications Connection

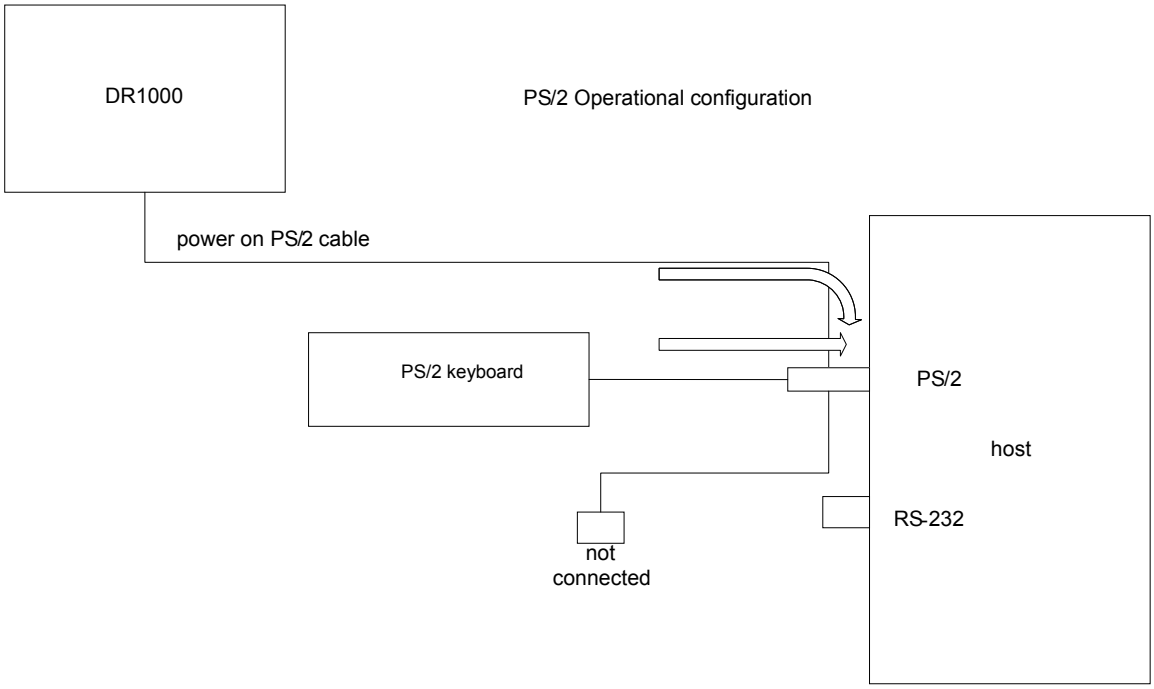
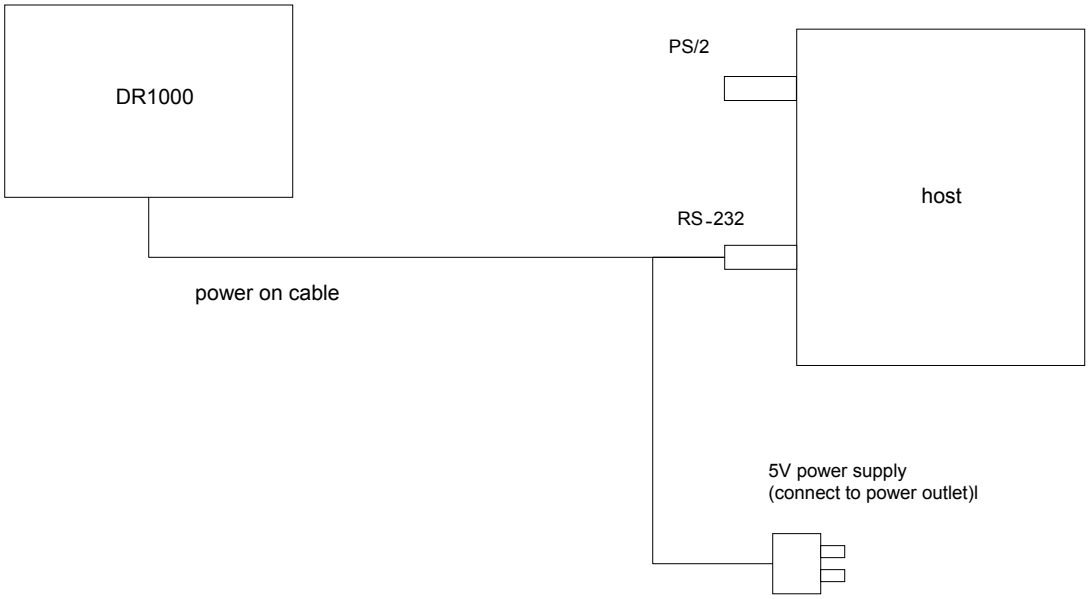


Table 14 - Mating face of 6-pin mini-DIN female

Table 15 PS/2 Connector Pin Assignments

Pin Number	Pin Name	Pin Description
1	Data	Data signal on PS/2 Bus
2	N/C	Not Connected (Can be used for alternate Data Signal)
3	GND	PS/2 Supply Ground
4	+5	Vcc PS/2 Supply
5	CLK	Data Clock on PS/2 Bus
6	N/C	Not connected (Can be used for alternate Clock Signal)

Table 16 - PS/2 Configuration with RS-232 Communication and Power Connections



5 User Interfaces

The DR1000 has a trigger, a beeper and two LEDs for feedback and interaction with the device.

5.1 LEDs

The DR1000 has two multi-colored LEDs (red, green or yellow) controlled by the device firmware or via host control. In Trigger Mode, the LEDs are controlled by the device firmware in the following manner:

1. The top LED (closest to the reader face) indicates "scanning in process".
2. The bottom LED (closest to the handle) indicates the "read" status.
3. When the trigger is not pulled, the "scanning" LED is off.
4. When the trigger is pulled, the "scanning" LED is green and remains green until either a valid read is processed, or the trigger is released. At this point, the LED turns off.
5. When a scan is complete, the color of the "read" LED turns to either green or red depending on whether the read passed or failed, respectively. The LED remains that color until the trigger is pressed again. When the trigger is pressed, the LED turns off and remains off until a valid barcode or RFID tag is read, or the trigger is released.

The color and operation of each LED is fully configurable if the DR1000 is under host control. The configuration instructions are beyond the scope of this document, but are fully explained in the SDK documentation.

5.2 Beeper

At power on, a low-frequency beep indicates an error condition in the RFID or the barcode reader modules. In Trigger Mode, a beep indicates a successful read. This feature may be disabled, but is on by default.

5.3 Trigger

The DR1000 has a single trigger to activate the DR1000 in a typical "point and scan" application. During Trigger Mode, the DR1000 outputs all data immediately after a successful read, and the next scan cannot start until the trigger is released and pulled again.

6 Firmware Upgrades

The DR1000 has a built-in boot loader to allow firmware upgrades in the field through a software interface. Complete instructions will be included to support future firmware upgrades.

Appendix 1 - BaRS Software

The BaRS software application is a powerful tool that allows a user to configure the DR1000 Dual Reader for a specific application, and also demonstrate the advanced capabilities of the device through a hands-on example. The remainder of this manual will fully explain the features and operation of the BaRS software application.

Installing BaRS

The BaRS application software can be installed on any Microsoft Windows XP and 2000 based personal computer. Insert the **BaRS Software CD** into the computer and click on the **INSTALL BaRS** button to begin the installation process. Follow the instructions on the screen.

If a USB version of the DR1000 is to be used with the BaRS application or any host application, the USB serial port emulation drivers must be installed on the host computer to enable serial communication with the DR1000. This driver package is included with the BaRS Software CD.

Installing USB Serial Communication Drivers

Once BaRS has been installed, follow the instructions below to install the USB serial communication drivers. The USB serial emulation drivers are required for USB models only.

1. Insert the DR1000's USB connector into the appropriate slot on the host computer.
2. Open the **Windows Device Manager**. (Right click on *My Computer*, select *Properties*, select the *Hardware* tab, click on the *Device Manager* button)
3. Find the **Human Interface Device** key related to USB to Serial and right click on it. (Select *Human Interface Devices*, right click on *USB Human Interface Device*)
4. Select **update driver**.
5. Select "**Install from list from specific location**" and click *Next*.
6. Select "**Don't search, I will choose the driver to install**". Then click *Next*.
7. Select **Have Disk**. Click *Browse*.

8. Navigate to **C:\Program Files\Precision Dynamics Corporation\BaRS** and select the **hidcom.inf** file. Click *Open* and then click *OK*.

NOTE

If an error message appears at this point, the DR1000 may be set for keyboard emulation mode. In this case, disconnect the USB from the host, pull the trigger on the DR1000, re-connect the USB to the host and release the trigger. Return to step 2.

9. Select "**Cypress USB-HID->COM device**" and click *Next*.
10. If a dialog box appears warning about the driver, click on the **Continue-Anyway** button. When the installation completes, click on *Finish*.
11. The Device Manager window will now reappear with the Ports (COM & LPT) section highlighted (**Cypress USB-HID->COM device (COMn)**. Make note of which COM port has been assigned as this will be needed later.
12. Select **File** and then *Exit* to close the Device Manager window.

Starting the BaRS Application

During the installation of the BaRS software application, two shortcuts are installed on the host computer, one on the Desktop, and one in the Windows Start menu. To run the BaRS application, double-click on the BaRS shortcut on the Desktop, or select the BaRS shortcut from the Start menu. The following opening screen of the application will appear.

To exit the application, select "File | Exit" from the menu bar.

Main Tool Bar

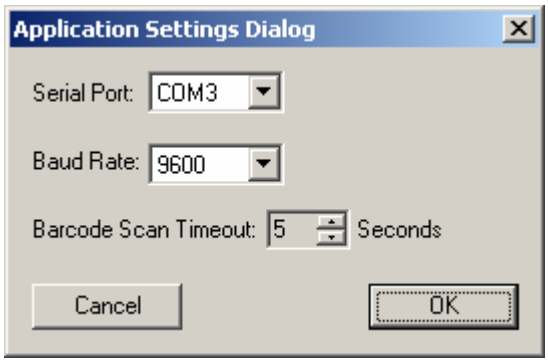
The Main Tool Bar contains the icons to activate each of the functions of the BaRS software. Each button and associated function is described in detail below.

Open RFF File

The **Open RFF File** button allows the user to open an RFF file and apply it to the RFF view of the application. RFF view is an advanced feature of the BaRS application. RFF files are XML-based files that define the format of the displayed form and the RFID data read from a RFID tag. The details of how RFF files are created and used is outside the scope of this document, however, several samples of RFF files are provided for demonstration purposes.

Application Settings

The **Application Settings** button opens the Application Settings dialog box and allows the user to set the desired serial port, baud rate, and barcode scan timeout duration.

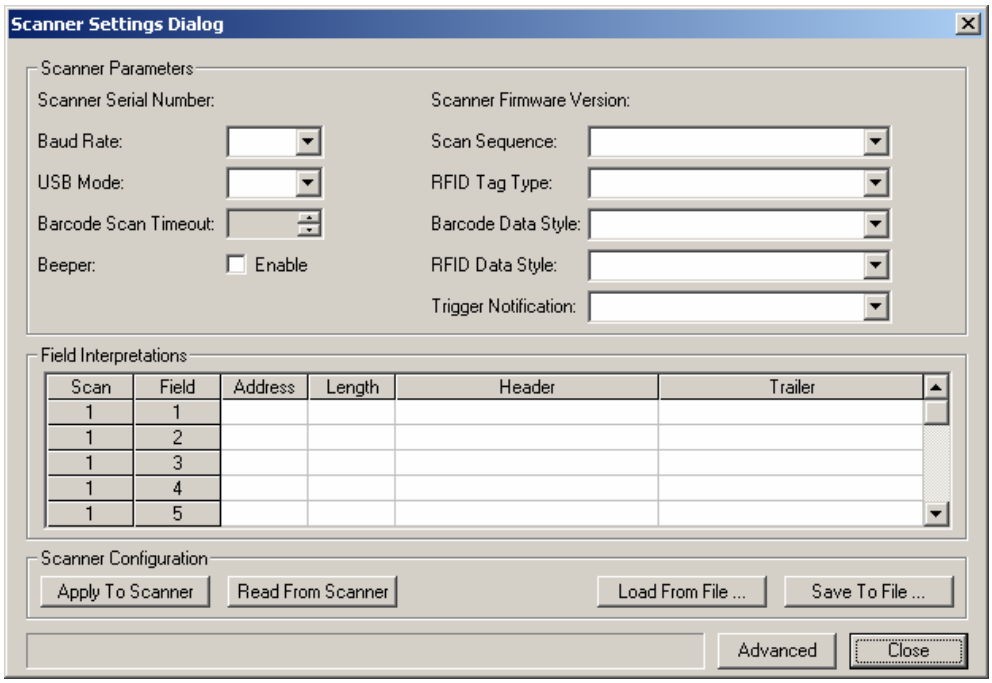


Start Scanner

The **Start Scanner** button initializes serial communication between the DR1000 Dual Reader and the host computer.

Scanner Settings

The **Scanner Settings** button opens the *Scanner Settings* dialog box to allow the user to configure the DR1000 Dual Reader for many of its advanced features. Each configuration parameter of the DR1000 is explained in later sections of this document.

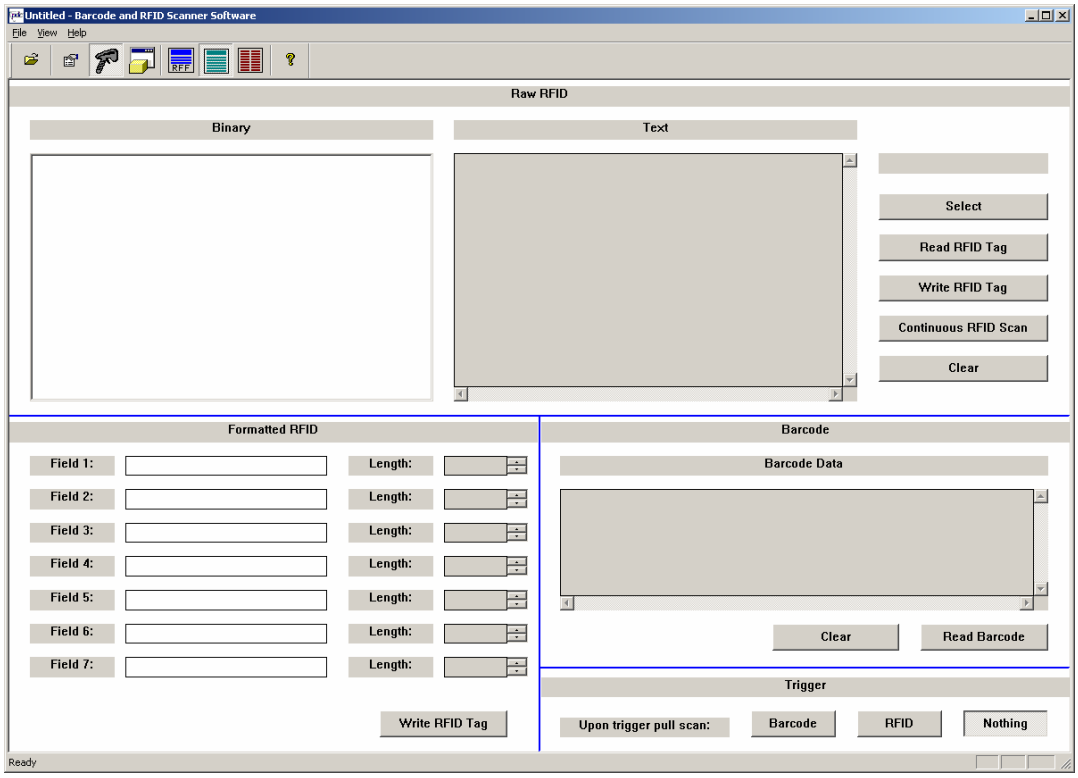


RFF View

The **RFF View** button displays the RFF file that was opened and applied to the application.

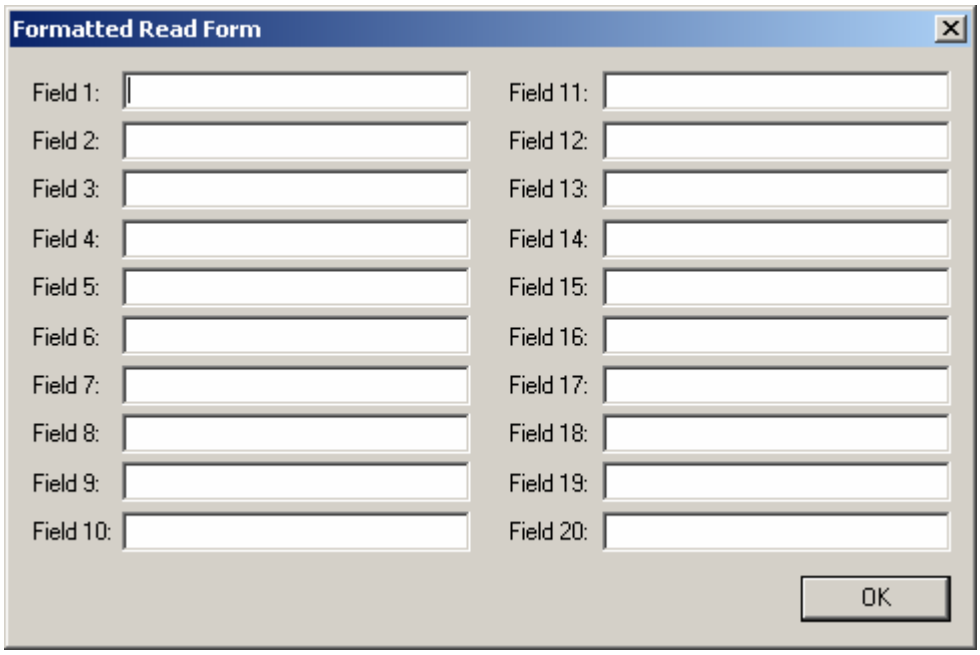
Data View

The **Data View** button displays the data view of the application. This view exercises many of the features of the DR1000 Dual Reader.



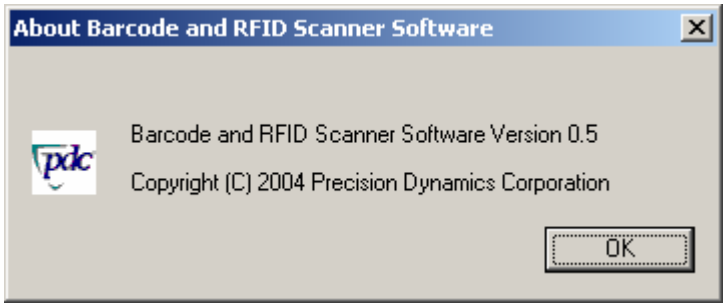
Form Dialog

The **Form Dialog** button opens a Form dialog box used to demonstrate the keyboard emulation feature of the DR1000 Dual Reader.



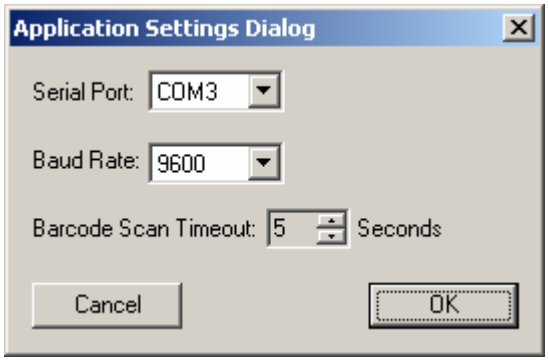
About

The **About** button identifies the application name, version, and copyright statement.



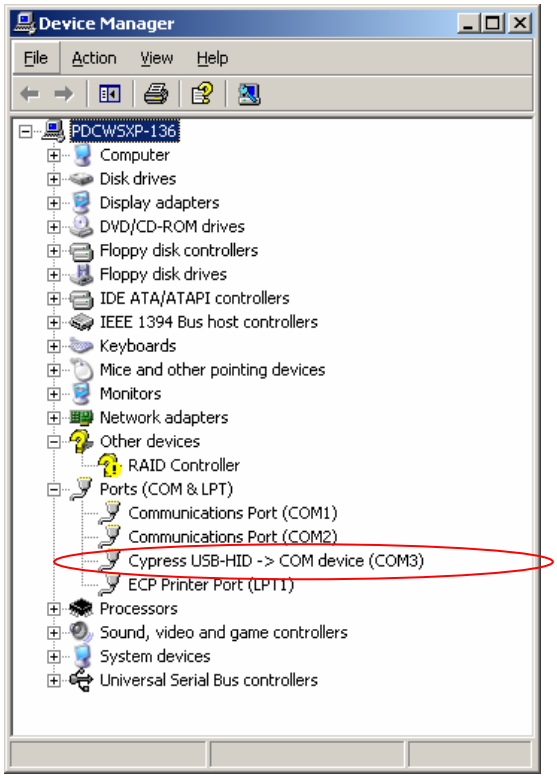
Application Configuration

Click on the  **Application Settings** button to open the dialog box as shown below. The serial port, baud rate, and barcode scan timeout duration may be set as follows:



Serial Port

The **Serial Port** setting must match the COM port assigned by the operating system, either the RS-232 port address, typically COM 1, or the emulated serial port number if the DR1000 is connected via USB. The emulated port number can be found by exploring the Device Manager of the operating system. Use the arrow at the right of the control to select the appropriate serial port.



Baud Rate

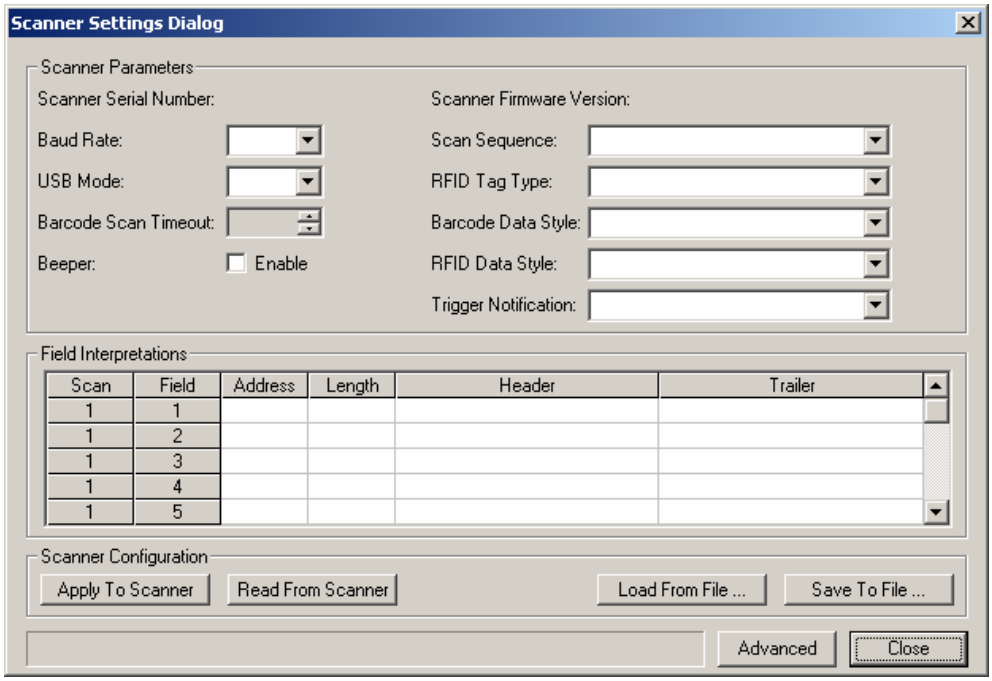
The **Baud Rate** setting controls the communication speed with the DR1000. The baud rate must match the baud rate setting of the DR1000 as explained in later sections. The default setting is 9600 baud.

Barcode Scan Timeout

The **Barcode Scan Timeout** setting defines the maximum length of time (in seconds) the BaRS software waits for the DR1000 to read a barcode. This setting must match the corresponding setting of the DR1000 as described in later sections. The value may be incremented or decremented using the arrows at the right side of the control.

Scanner Settings

Click on the  **Scanner Settings** button to open the Scanner Settings dialog box and configure the DR1000 for a specific application. Note that any number of configurations may be saved to a file for later recall and download to the DR1000. Once a configuration set is applied to the DR1000, it is stored in the device memory and preserved over a power cycle. It is not necessary to reapply the Scanner Settings unless a change is desired.



Baud Rate

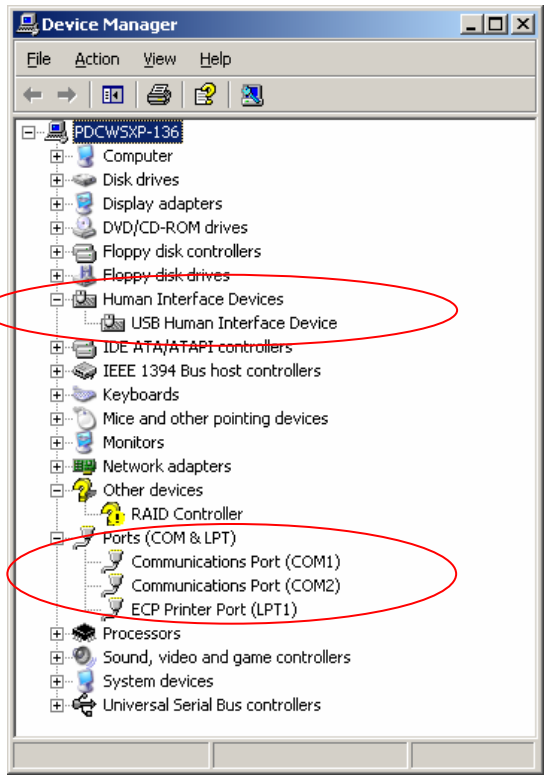
The **Baud Rate** setting defines the serial communication rate of the DR1000 with the host system. This parameter must match the baud rate of the application.

USB Mode

The USB model of the DR1000 can operate in either a keyboard emulation mode, called "HID" (Human Interface Device), or in a serial communication mode. This setting applies to the USB Mode only and does not affect the operation of the RS-232 or PS/2 models.

HID (USB model only)

If the USB mode is set to 'HID' and the DR1000 is connected to the host computer, the dual reader will register as a "Human Interface Device" with the operating system. The DR1000 may be registered with the operating system as a serial device by holding the trigger in the pulled position before connecting the device to the host computer, followed by releasing the trigger after the connection is made.



Conversely, if the USB mode is set to 'Serial' and the DR1000 is connected to the host computer, the dual reader will register as a serial device with the operating system. The DR1000 may be registered with the operating system as a Human Interface Device by holding the trigger in the pulled position before connecting the device to the host computer, followed by releasing the trigger after the connection is made.

Barcode Scan Timeout (COMMAND MODE only)

The **Barcode Scan Timeout** specifies the length of time (in seconds) the DR1000 will attempt to read a barcode before terminating the operation. This parameter must match the Barcode Scan Timeout setting in the Application Settings described above. The value may be incremented or decremented using the arrow to the right of the control.

Beeper

The **Beeper** check box specifies whether the DR1000 beeper is enabled or disabled.

Scan Sequence

This parameter sets the scanning sequence of the dual reader when the trigger is pulled. The **Scan Sequence and the Trigger Notification parameters are interrelated**, and should be set appropriately.

If Trigger Notification is set to anything other than "None", the Scan Sequence parameter should be set to "Disable".

If Trigger Notification is set to "None", then the user can specify the action the dual reader should take when trigger is pulled.

EXAMPLE

Upon the first trigger pull, the dual reader should scan a barcode, and upon the second trigger pull the dual reader should scan an RFID tag, and repeat the sequence again.

RFID Tag Type

The BaRS software application is only capable of reading and writing to RFID tags that meet the ISO 15693 protocol. **If the DR1000 is intended for use with *other* tag types, a Software Development Kit is available**.

Barcode Data Style

Upon reading the barcode data, the DR1000 Dual Reader is capable of sending the complete raw data stream to the host computer, or applying the "Field Interpretations" before sending the data to the host computer. Select the appropriate action to match the application.

RFID Data Style

Upon reading the RFID data, the DR1000 is capable of sending the tag UID to the host computer, sending the RFID data to the host computer, sending the tag UID and data to the host computer, or applying the "Field Interpretations" before sending the data to the host computer. Select the appropriate action to match the application.

Trigger Notification (COMMAND MODE only)

The DR1000 may be configured to send notification to the host computer upon trigger actions by the operator.

NOTE

If Trigger Notification is set to anything other than "None", then the Scan Sequence must be set to "Disable".

Scanner Serial Number

The **Scanner Serial Number** is a read-only parameter from the DR1000. This is a factory-programmed serial number and is displayed in the Scanner Settings dialog box if a DR1000 is properly connected to a host computer.

Scanner Firmware Version

The **Scanner Firmware Version** is displayed in the Scanner Settings dialog box if a DR1000 is properly connected to a host computer.

Field Interpretations

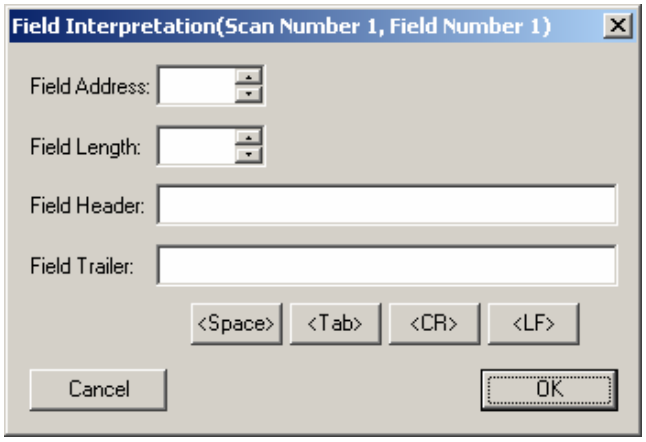
Field Interpretations are a set of user-defined formatting statements applied by the DR1000 Dual Reader to the data stream read from a barcode or RFID tag before it is sent to the host computer. There are three sets of sixty-four field interpretations available. Each set will apply the template to the scanned data based on the Scan Sequence settings.

EXAMPLE

If the Scan Sequence is set to "Barcode RFID", the first sixty-four interpretation fields labeled with "Scan" number "1" are applied to the barcode data, and the next sixty-four interpretation fields labeled with "Scan" number "2" are applied to the RFID tag data. In this case the last sixty-four interpretation fields labeled with "Scan" number "3" are ignored. The same principal applies to other Scan Sequence settings and interpretation fields, accordingly.

When defining interpretation fields for each Scan Sequence, it is important that the interpretation fields are consecutive, and no gap is present within each sequence.

To make an entry in the interpretation field grid or edit an existing entry, double-click in the desired row and the "**Field Interpretation**" editing dialog box opens.



Enter the starting address of the field data from the scanned raw data.

EXAMPLE

If an RFID tag is scanned and the RFID tag contains 256 bytes, and the desired data location is at byte number 10 of the raw data, then enter "10" in the "Field Address".

Enter the maximum length of the data in "Field Length". "Field Header" represents the data that is appended before the raw data prior to transmission to the host. "Field Trailer" represents the data that is appended after the raw data prior to transmission to the host.

To append special characters such as "Space", "Tab", "Carriage Return", and "Line Feed", use the buttons provided.

The maximum length of field headers and field trailers is 4 characters.

Apply To Scanner

The **Apply To Scanner** button downloads the present configuration settings into the dual reader. After downloading the configuration settings into the DR1000, the power must be cycled before the changes take effect.

Read From Scanner

The **Read From Scanner** button reads the current configuration settings of the DR1000. *Baud Rate* and *Field Interpretations* cannot be read back from the device.

Load From File

The **Load From File** button loads a previously saved configuration file into the Scanner Settings dialog box. This feature allows previously saved configuration settings to be easily applied to one or more devices. The user must explicitly apply the configuration settings to each desired DR1000 by clicking the "Apply To Scanner" button.

Save To File

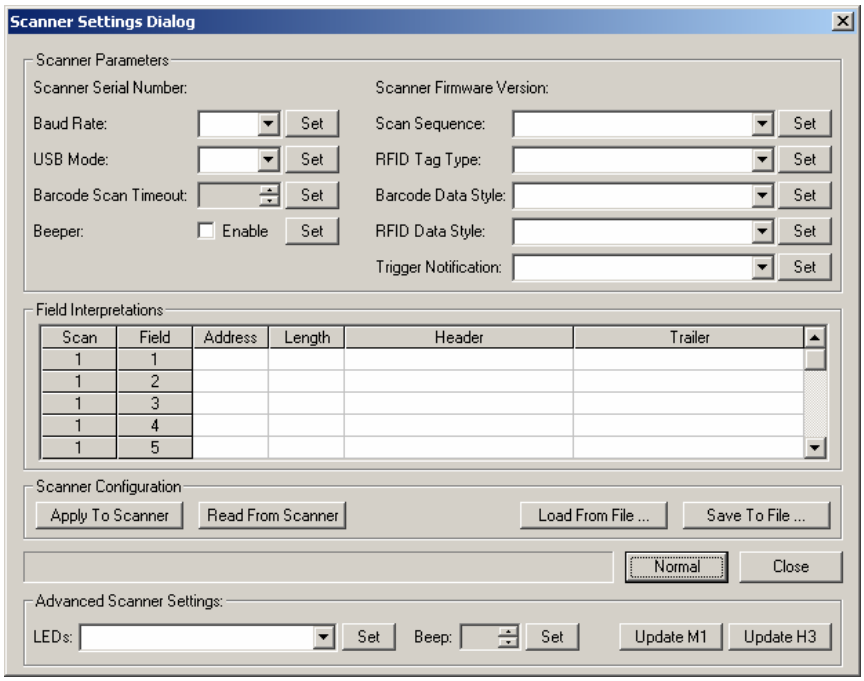
The Save To File button stores the defined Scanner Settings to a file for later retrieval.

Advanced

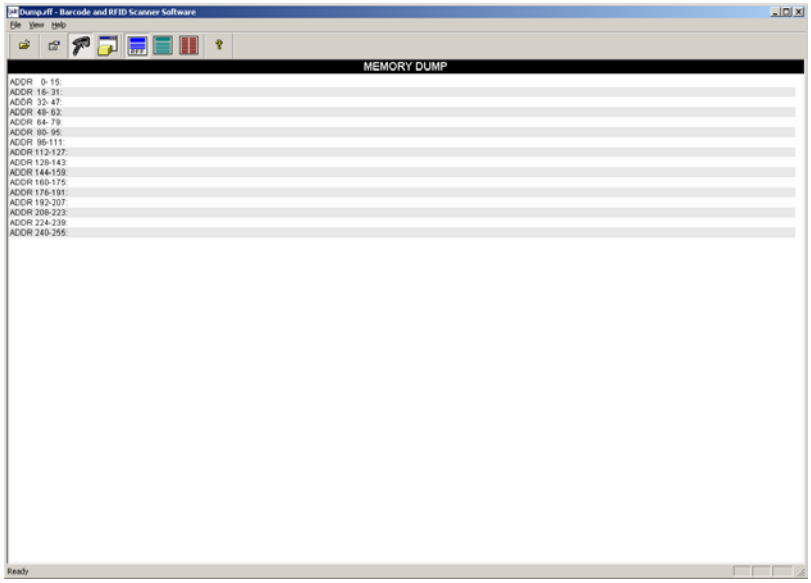
The **Advanced** button enables expanded options available for the DR1000 Dual Reader. Advanced features include: the ability to set each DR1000 configuration individually; update firmware; turn LEDs on or off; and sound the DR1000 beeper.

NOTE

The caption of the "Advanced" button will change to "Normal" when the dialog box is in Advanced mode. Click the "Normal" button to return to Normal mode.

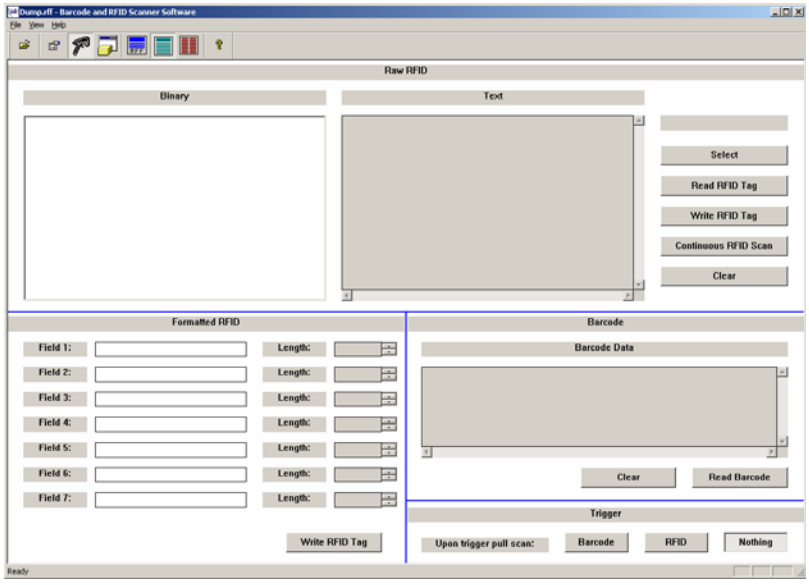


RFF View



RFF View allows the user to load a predefined form to display formatted data. RFF forms are defined and saved in an XML document and loaded into the BaRS application. Creating RFF forms is an advanced function beyond the scope of this document; however, several sample forms are included with the BaRS software.

Data View



The **Data View** is designed to demonstrate the read, write and display capabilities of the DR1000 Dual Reader.

Raw RFID

The **Raw RFID** section displays the data read from a selected RFID tag, both in text mode and in binary mode. Click the Select button to read a RFID tag in the field of the DR1000. After a RFID tag is successfully selected, the UID of the tag is displayed above the Select button. A RFID tag must be selected before attempting to read or write to the tag.

- Click the **Read RFID Tag** button to read and display the data stored to an RFID tag.
- Click the **Write RFID Tag** button to write the data that is in the "Binary" section to a RFID tag.
- Click the **Continuous RFID Scan** button to set the application in a continuous scan mode. In this mode, the application continuously monitors the DR1000 and displays the data of any tag present in the field of the reader.
- Click the **Clear** button to clear the "Binary" and "Text" data sections.

Formatted RFID

The **Formatted RFID** section is designed to write formatted data to a RFID tag. Seven fields are available, each with a corresponding variable length. Enter the desired data into one or more of the available fields and define the appropriate length of each data string. Place a RFID tag within the field of the DR1000 and click the Write RFID Tag button to write the formatted data.

Note that if the length of the data in each field is smaller than the defined field length, null characters are added after the data prior to the write. Similarly, if the length of the data is larger than the corresponding length, the data string is truncated to the defined length prior to the write.

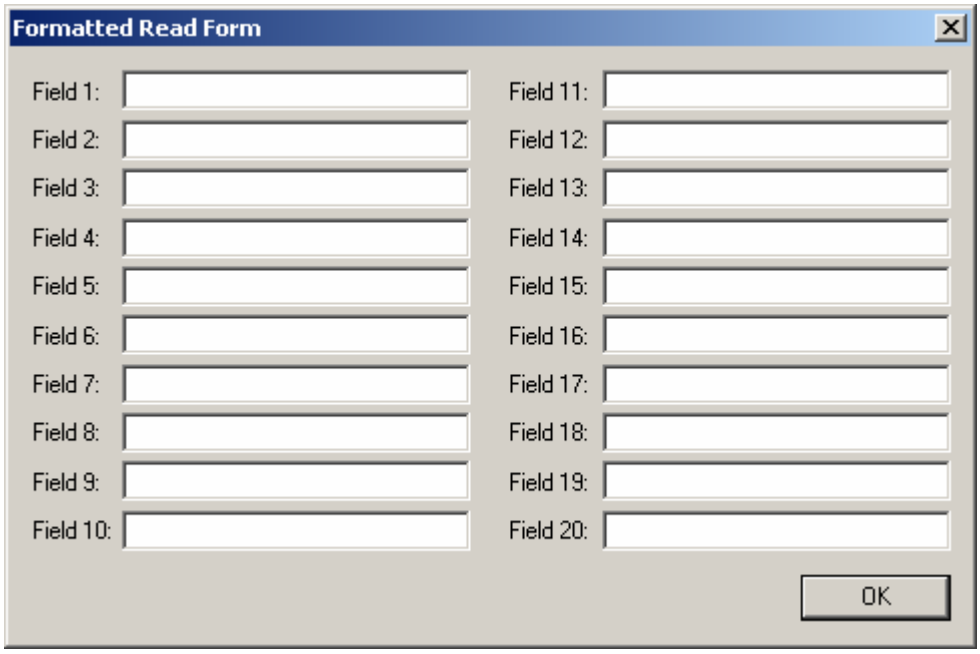
Barcode

The **Barcode** section demonstrates reading and displaying data read from a barcode. Click the Read barcode button to read a barcode. The barcode data is displayed in the "Barcode Data" window. Click the Clear button to delete the contents of the "Barcode Data" window.

Trigger Operation

The DR1000 Dual Reader is capable of sending trigger events to the host computer. These are defined in the "Trigger" section of the Data View window. The DR1000 can read a barcode upon trigger pull, read a RFID tag upon trigger pull, or do nothing, depending on the selected operation. A short beep is heard after the completion of a trigger pull event.

Formatted Read Form



The **Formatted Read Form** demonstrates the ability of the DR1000 to act as a keyboard emulation device. Once proper field interpretations are designed for a particular application, this form may be used to demonstrate how the DR1000 can populate the fields of the form.

Appendix 2 - DR1000 Demonstration

This demonstration assumes that **BaRS** software is installed on the host computer, and that serial emulation drivers, if using the USB model, are also installed and configured properly.

This demonstration is designed to walk a user step-by-step through the process of writing and reading data from an RFID tag, and reading data from a barcode. It demonstrates the field interpretations capability, trigger event detection, and command mode operation of the DR1000.

Start the Application

Double-click the **BaRS icon** placed on the Windows desktop, or select the BaRS option from the Start menu to launch the application.

Preparing the RFID Tag

- Click the  **Application Settings** button to set the desired parameters for communication with the DR1000 Dual Reader. Set the serial port to match the appropriate COM port defined in the Device Manager, and then click OK.
- Click the  **Start Scanner** button to initialize communication with the DR1000.
- Click the  **Data View** button to open the data view of the application.
- Enter the following data into the *Formatted RFID* section of the Data View window:

(Use the **Down arrow buttons** to set the lengths)

Field 1: **First Name**	Length: **15**
Field 2: **Last Name**	Length: **15**
Field 3: **12345 First Street**	Length: **20**
Field 4: **New Town**	Length: **15**
Field 5: **CA**	Length: **5**
Field 6: **91340**	Length: **5**
Field 7: **(987)654-3210**	Length: **15**

- Place a RFID tag within 5 inches of the face of the reader and click on the Write RFID Tag button. The data will be written to the RFID tag as defined in the *Formatted RFID* section.

Applying the Scanner Configurations

- Click the  **Scanner Settings** button to open the Scanner Settings dialog box.

> **NOTE**
>
> If the dual reader settings dialog box does not appear, navigate to the **C:\Program Files\Precision Dynamics Corporation\BaRS** directory and double-click on the **RegisterMSFlsGrd** icon. Then try to open the dialog box again.

- Click the **Load From File** button, and select the "DEMO1.DRC" configuration file from the Configuration Files folder.
- Click the **Apply To Scanner** button to download the configuration settings to the DR1000.
- Click the **Close** button to exit the Scanner Settings dialog box.
- Click the  **Start Scanner** button to stop communication with the reader.
- Exit the BaRS application.
- The power to the DR1000 must be cycled before the new configuration settings may be applied to the device. Disconnect the DR1000 from its power source and reconnect for the new settings to take affect.

Keyboard Emulation Read (USB and PS/2 versions)

- Double-click the **BaRS** icon placed on the Windows desktop, or select the BaRS option from the Start menu to launch the application.
- Click the  **Form Dialog** button to open the formatted read dialog box.
- Point the DR1000 at a barcode, pull the trigger, and the "Field 1" data will be populated.
- Point the DR1000 at the RFID tag programmed previously and pull the trigger. Fields 2 through 8 will be populated.

The above exercise demonstrated how the DR1000 may be used to emulate keyboard entry by applying "Field Interpretations" to the data read from both a barcode and a RFID tag. Close the *Formatted Read* form and exit the BaRS application.

Changing the Scanner Configuration (USB version)

- Disconnect the DR1000 from the host computer.
- Pull and hold the trigger and reconnect the device into the computer's USB port. Once the device is again connected to the host, release the trigger. This action causes the DR1000 to register as a serial device with the computer.
- Start the **BaRS** application.
- Click the  **Start Scanner** button to initialize communication with the DR1000.
- Click the  **Scanner Settings** button to open the Scanner Settings dialog box.
- Click the **Read From Scanner** button to display the current configuration settings of the device.
- Select "**Serial**" from the "USB Mode" drop down list.
- Select "**Disable**" from the "Scan Sequence" drop down list.
- Select "**Pull**" from the "Trigger Notification" drop down list.
- Click the **Apply To Scanner** button.
- Click the **Close** button to exit the Scanner Settings dialog box.
- Click the  **Start Scanner** button to stop communication with the reader.
- Disconnect the DR1000 from the computer, and then reconnect **without pulling the trigger.**

The new settings are now stored in the device memory and preserved over a power cycle. Repeat the procedure above if changes to the configuration settings are desired.

Command Mode Read

The following steps illustrate the various RFID and barcode read events of the DR1000 if operated in Command (host) mode.

- Start the **BaRS** application if it is not already running.
- Click the  **Start Scanner** button to initialize communication with the DR1000.
- Click the  **Data View** button to open the data view of the application.
- Place an RFID tag in front of the dual reader and click the **Read RFID Tag** button. The data from the RFID tag will be read and displayed in the "Binary", and "Text" fields of the "Raw RFID" section.
- Click the **Continuous RFID Scan** button and place an RFID tag in front of the dual reader. The data from the RFID tag will be read and displayed in the "Binary", and "Text" fields of the "Raw RFID" section. Remove the RFID tag from the field of the reader and the data will clear automatically.
- Click the **Continuous RFID Scan** button to end the continuous scan.
- Point the DR1000 at a barcode and click the **Read Barcode** button. The barcode data will be displayed in the Barcode Data section of the Data View window. Click the **Clear** button to clear the data.

Trigger Events

The following steps illustrate the trigger events of the DR1000 if operated in Command (host) mode.

- Click the **Barcode** button in the "Trigger" section.
- Point the DR1000 at a barcode and pull the trigger. The DR1000 will read a barcode and beep at the end of the operation.
- Click the **RFID** button in the "Trigger" section.
- Place an RFID tag in front of the dual reader and pull the trigger. The DR1000 will read the data of the RFID tag and beep at the end of the operation.
- Click the **Nothing** button in the "Trigger" section.
- Pull the trigger and the DR1000 will beep without scanning anything.
- This demonstrates the trigger event and Command (host) mode capabilities of the dual reader.