MOTOROLA

Integrated Information Systems Group
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Exhibit 8 – Users Manual

BiStatix™ BDR-1000

RFID Tag Reader/Programmer

FCC ID: E9U05866001T1

Model No. BDR-1000

8.0   BDR-1000 Users Manual

MOTOROLA

BiStatix^{TM} Desktop Reader / Writer

BDR-1000
Operation Manual

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BiStatix products are covered under one or more of the following patents: 6,018,299; 6,040,773; 6,091,332; 6,094,138; 6,107,920; 6,107,921; 6,130,613; 6,147,605; 6,157,300; 4,818,855; 5,099,277; 5,221,831; 5,600,683; 6218942. Others are available and pending worldwide.

FCC Compliance: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an installation. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with instruction, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer of an experienced radio/TV technician for help.

Any change or modification to this product voids the user's authority to operate per FCC Part 15 Subpart A Section 15.21 regulations.

CE
This product, when marked with the CE symbol, complies with the European Community Council Directives 89/336/EEC and 99/5/EC R&TTE provided the installer/user adheres to the instructions detailed in this manual. This product, when marked with the CE symbol, is in compliance with EN 300 330, ESTI EN 300 683 with the referenced standards EN 55022 (Class B), EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6, and the Low Voltage Directive EN 60950.

Thank you for purchasing the Motorola BiStatix^{TM} BDR-1000 or BDK-1000. We hope the tools are fruitful in your technology evaluation.

YOUR DEVELOPMENT TOOLS…

The BDR-1000 is the BiStatix Desktop Reader / Writer. The BDK-1000 is the BiStatix Development Kit, which contains a BDR-1000, DLL's, an API and a tag kit.

The BDK-1000 kit enables further evaluation of BiStatix capacitively coupled RFID technology, expanding the capabilities beyond reading tags, enabling you to construct your own tags, experiment with various tag form factors, program custom data utilizing the provided API and DLL's and build upon sample code.

Using the BDR-1000 hardware, the user may experiment with two fundamental versions of the technology – DiPole and MonoPole coupling. The hardware supports either RS-232, RS-422 or RS-485 serial communication interfaces.

Contents:

Item	Description	BDR-1000	BDK-1000
1	BDR-1000 BiStatix Desktop Reader / Writer	√	√
2	Universal Power Supply	√	√
3	Standard U.S. Power Cord	√	√
4	European Power Cord	√	√
5	RS-232 serial communication cable	√	√
6	This introduction / manual	√	√
7	CD with API, DLL's, sample code & soft copy software instruction set		√
8	10-pack letter-sized "Tear-It" tags		√
9	10-pack index card-sized cards		√
10	40-pack letter-sized electrode sheets		√
11	Roll of (100) interposers		√

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Revisions List

rev	date	description of change	author
1	April 26,2001	Initial Draft	Greg Hassman
2	May 4, 2001	Updated per Team input	Greg Hass man

List of Figures

1 PRODUCT SPECIFICATION

Input Voltage:

<u>AC Line (note 1)</u>
100V to 240 VAC
50 Hz to 60 Hz

Notes:
1. The BDR-1000 electronics module requires DC voltages of +/- 12 and +5 volts. A universal power supply (APX SP25970M) is provided with the BDR-1000. This supply has been approved for use with the electronics module in the countries of intended operation of this product. Use of any other power supply is not recommended by Motorola and will void the product's warranty and may affect its performance. Replace the power supply **only** with an APX SP25970M Power Supply.
2. Do not use the equipment's power supply for any other equipment. Doing so will affect the equipment operation.

Typical Read Range:

Monopole	~	10.9 cm (4.3 inches)
Dipole	~	contact

Typical Write Range:

Monopole	~	6.6 cm (2.6 inches)
Dipole	~	contact

Typical Monopole Read and Write Ranges were determined by hand presentations of a 5 cm x 7.6 cm (2" x 3 ") tag with a "bow tie" antenna pattern and a BXI – 5 Interposer in a laboratory environment. Actual performance will vary with any particular installation. You should be able to reach these typical values if care is taken to insure a proper installation and presentation of the tag.

Frequency of Operation:

Excitation Frequency	~	125 kHz
Exciter Modulation	~	On/Off Keyed

Environmental:

Operating Temperature	~	10 °C to 40 °C
Storage Temperature	~	-25 °C to 50 °C
Water Resistance	~	The BDR-1000 is not water resistant.
Chemicals	~	Mild detergent cleaners.

Indicators:

Visual	~	Tri-color LED
Audible	~	Beeper

Enclosure:

Weight	~	0.7 kg (1.5 pounds)
Material	~	ABS
Form Factor	~	see fig. 7

Communication Interfaces:

RS-232, RS-422, RS-485

Standard serial communication protocols are:

- Bits per second   9.6 to 38.4 Kbps (selectable by the host)
- Data bits   8
- Parity   None
- Stop Bits   1

Default condition is RS-232 at 9600 bps.

Certifications:

When appropriately marked the product is certified as follows:

FCC Class B Digital Device (Part 15)
    FCC ID Number E9U05866001T1

CE Compliance per R&TTED
    EN 300 330
    EN 300 683
    EN 60950

CB Compliance

2 INTRODUCTION

The BDR-1000 is a device (aka transceiver) that reads and writes Bistatix Tags. It operates in both DiPole and MonoPole modes and it is intended for indoor use only.

The hardware supports either RS-232, RS-422 or RS-485 serial communication interfaces and has provisions for an external antenna (future option). A standard female DB-9 connector is provided for the RS-232 and two standard RJ-45 connectors are provided for RS-485/422 (one input, one output).

The transceiver includes a power switch, a visual status indicator and an audible indicator. In addition, the package is supplied with an international power supply, a U.S. power cord, a European power cord and a RS-232 serial cable.

The BDR-1000 can read tag data continuously, read tag data on command and program tag data on command.

2.1 Theory of Operation

BiStatix is a non-resonant Capacitive or Electric field RFID technology. Passive RFID tags derive their power and clock signals externally, from the excitation field of a nearby transceiver, such as the BDR-1000. The tags respond with their data. The exciter can be modulated to write data to a tag. BiStatix transceivers operate in DiPole or MonoPole mode.

The DiPole mode is typically used where the tags are positioned in free space, not coupled to a ground reference. It is also used in environments where tag orientation is controlled or where very small tags are required. The BDR-1000 essentially operates in DiPole mode when a tag is placed on the surface of the reader (hands free).

The MonoPole mode is the most common, offering greater flexibility (e.g. orientation independence) and the best overall performance. It is typically used where a ground reference is accessible (e.g. when a tag is coupled to a person, a conveyor, a cart, or any other conductive object, referenced to ground). Here, one of the two tag electrodes is preferentially coupled to the transceiver and the second electrode is preferentially coupled to a ground reference.
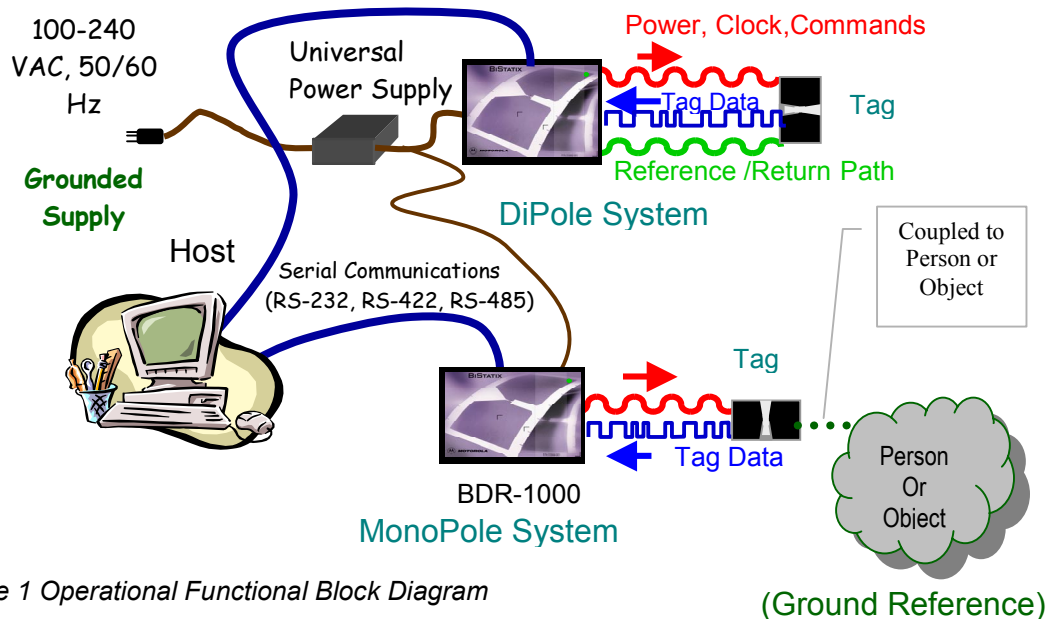

Figure 1 Operational Functional Block Diagram

GROUNDING:

BiStatix technology requires that the power supply ground for proper operation. Efforts must be made to insure that the AC source provides an adequate ground to insure that exciter current has a return path. If a grounded A.C. receptacle is not available, use a 3-to-2 prong adaptor and connect the ground lug to an earth ground. Failure to do so can result in erroneous host communication and poor transceiver performance. This should be the first item of investigation if a unit's performance is suspect.

2.2 Getting Familiar with the BDR-1000 (Tag Orientation)
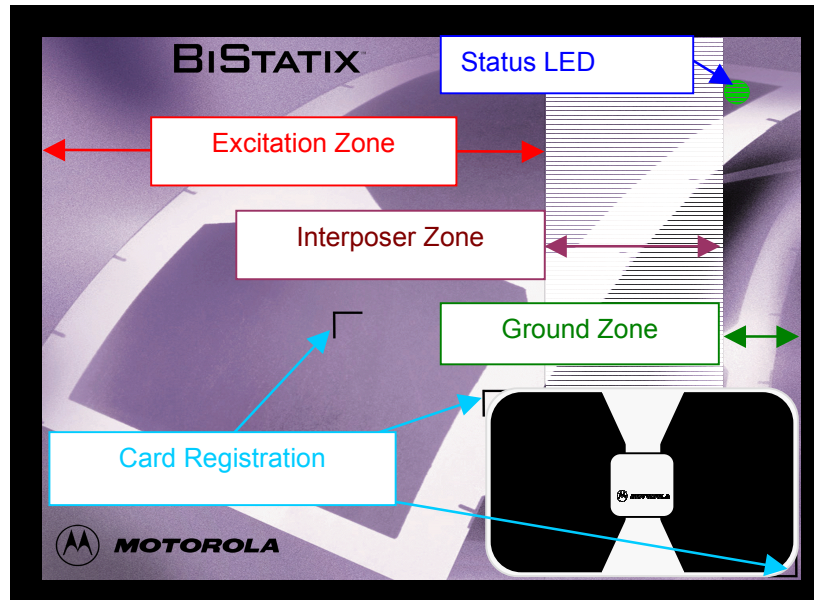

Figure 2   BDR-1000 Label

As depicted above, there are three distinct antenna zones on the BDR-1000. The largest section, to the left, is the *Excitation Zone*. This excitation antenna provides power, clock and command signals to the tag.

The "faded" section to the right of the Excitation Zone is the *Interposer Zone*. It guides proper positioning of tags for the DiPole mode of operation. This zone establishes the position where the interposer must be located when a tag is placed on the transceiver.

On the rightmost side is the *Ground Zone*. In the DiPole mode it provides a ground reference path for the tags, which are placed directly on the transceiver (i.e. hands free).

In DiPole mode the tag's interposer must be positioned in the *Interposer Zone* with one electrode preferentially coupled to the exciter zone and the other to the *Ground Zone*. The tag size illustrated above conveniently positions itself properly when registered to the lower right corner. Larger tags may require that right edge of the tag hang over the edge of the BDR – 1000 to properly position the device over the *Interposer Zone*.

In MonoPole mode one antenna of the tag should be presented to the *Excitation Zone*. The other should be grasped by the presenter.
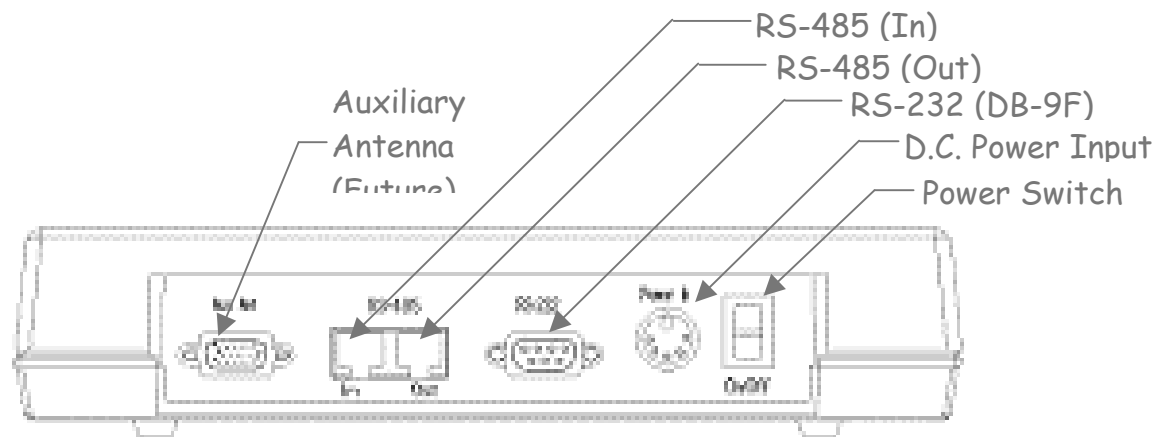
2.3 BDR-1000 Rear Panel

Figure 3 BDR-1000 Rear Panel
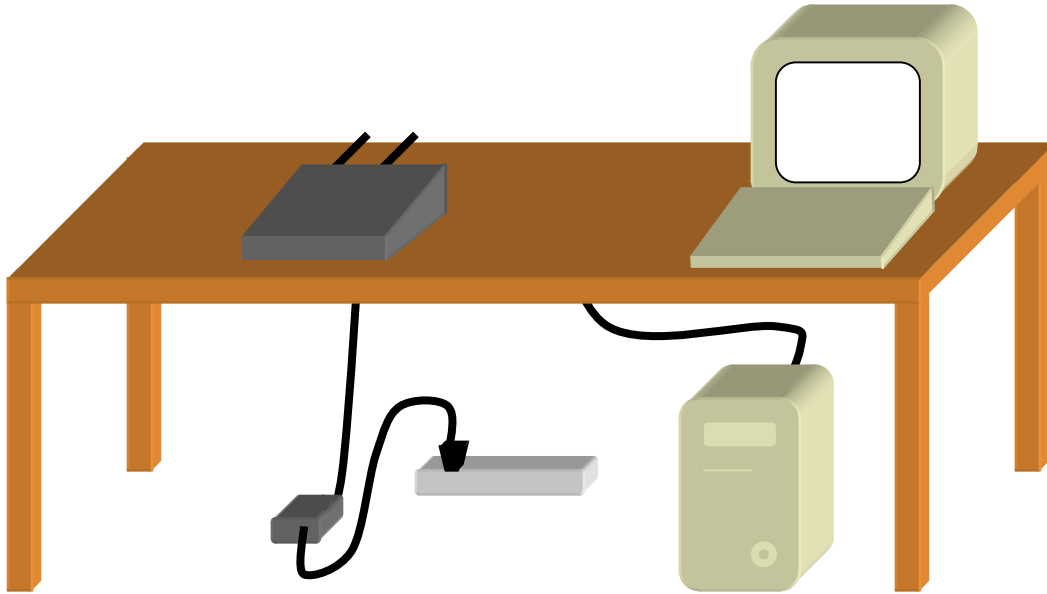
3 INSTALLATION & WIRING

3.1 Setup

Figure 4 Hookup Diagram

- Figure 4 shows a typical installation of the BDR-1000.
- As shown the only connections to the BDR-1000 are the DC input from the power supply and a serial communication cable (either RS-232, RS0422 or RS-485) from the host. These connections are made at the enclosure rear panel. See BDR-1000 Rear Panel, Figure 3 for a view of the rear panel.
- Because this technology is based on radio frequency signals nearby environmental sources of electrical interference may affect the performance of the equipment. Below is a list of precautions that should be considered when installing the equipment.
    1. Keep the computer and monitor at least 1 meter away from the BDR-1000 enclosure.
    2. Insure cable exiting from the rear panel is perpendicular to the rear edge of the enclosure.
    3. Insure that a non-metal table is used.
    4. Metal affects radio signals. Keep any metallic objects clear (at least 1meter away) of the enclosure.
    5. Nearby external sources of electrical interference, such as sources of RF signal transmitters (portable two-way radio, cellular phones, etc.) and/or nearby EMI noise producers may contribute to disturbing the electrical environment of the reader. Depending upon the external noise signal strength of the nearby transmitter, the performance may be reduced or the tag signal may be masked by the external signal, resulting in a non-operation.

6. Maintain all equipment wiring a minimum distance of 30 cm (12 inches) away from other wiring such as AC power, computer data wiring, telephone wiring or wiring to electric locking devices, etc.
7. Do not install the equipment in areas where sources of broad spectrum EMI noise may be present. Examples of EMI broad spectrum noise producers are motors, pumps, generators, AC-DC converters, un-interruptible power supplies, AC switching relays, light dimmers, computer monitors, and CRTs.
8. **WARNING:** Opening the sealed enclosure can expose you to high voltages. No user serviceable parts inside.

3.2 Host Interface Wiring

	Cable Size and Type	*Maximum Length*	**Manufactures P/N**
RS-232	supplied	7.6 m (25 feet)	Assmann xxxxx
RS-422	TBD	Xxx m (xx feet)	TBD
RS-485	TBD	Xxx m (xx feet)	TBD

Drawing Showing construction of a RS-485 cable.

Figure 5   RS-485 Cable Assembly

3.3 Grounding Requirements

BiStatix Technology requires a RF ground when used in the MonoPole Mode to provide a return path for the exciter current. The power supply that is used to operate the BDR-1000 will provide this path as long as the required local ground is connected at the AC source.

This ground can be either an earth ground or a local ground as required for the particular application. In any event the ground connection should be made as shown below.
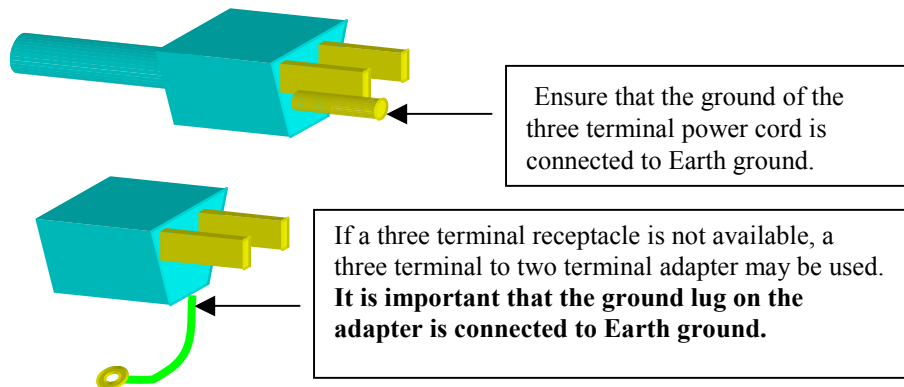

Ensure that the ground of the three terminal power cord is connected to Earth ground.

If a three terminal receptacle is not available, a three terminal to two terminal adapter may be used. **It is important that the ground lug on the adapter is connected to Earth ground.**

Figure 6 AC Supply Grounding

4   OPERATION

4.1 Reader Operation

An on/off switch is provided on the rear panel to apply power to the BDR-1000. At power up the BDR-1000 will perform a "Beepflash^{TM}" and then place the LED in a "Solid Green" state. At this time the BDR-1000 will read a properly programmed tag if it is presented. The power up sequence also configures it to communicate with a host controller via RS232 (see communication interfaces Section1).

Figure 5 below demonstrates a monopole tag presentation (preferred method of reading tags for the BDR-1000). Upon reading the tag an audible (beeper)and visual (LED Flash) feedback is provided to verify that the tag has been read (see section 4.3 for details).

Figure 7 BiStatix Read Mode Monopole Tag Presentation

4.2 Programmer Operation

Commands from the Host Computer can configure the BDR-1000 to act as a Tag Programmer and allow it to program tags or cards. Complete documentation and Application Software for this mode is provided with either the BDK-1000 or the SDK-1000. Refer to the installation manual provided on the CD that accompanies these products for information. Figure 8 below demonstrates a DiPole tag presentation (preferred method for the BDR-1000) to program the contents of a tag. Both audible and visual indicators provide feedback to the user when the tag has been programmed and confirmed (see section 4.3 for details).

This diagram will show a typical Program Mode presentation in the Di-Pole configuration. The tag will be placed upon the BDR-1000 label in the correct position.

Figure 8 BiStatix Program Mode Di-pole Tag Presentation

4.3 Indicators

LED Color	LED State	Description
Green	Solid	Continuous Read Mode (default condition upon power up). Two beeps upon power up.
Green	Flashing	Power on, reader functionality disabled. Will read upon Host command.
Amber	Solid	Tag currently being read or programmed. Single beep upon successful completion. LED returns to green or green flashing.
Red	Solid	Programming failure, LED remains red until overridden by Host command. Beeps three times in succession.
Green / Red	Alternating	Power on self-test failure. Power cycling may clear problem.

5 BDR-1000 CONFIGURATION PARAMETERS

The BDR-1000 Reader is designed for use with the BiStatix Developer Kit (BDK-1000). As such, it comes configured for use with a PC (RS-232) and the software included in the BDK-1000. No additional setup or configuration is required. Refer to the <u>BDK-1000 Reference</u> document on the BiStatix Software Developer Kit CD-ROM for use in the developer configuration.

However, the BDR-1000 can also be used as a desktop reader or tag programmer. To use the BDR-1000 Reader in other configurations its configuration parameters may need to be changed. The **BR***Util* software is provided for purpose as well as verifying basic operation and programming tags. It can be found either separate on the **BR***Util* **CD-ROM** or included in the **BiStatix Software Developer Kit CD-ROM**. Refer to the **BRUtil User's Guide** located on the CD-ROM.

Listed below is a description of the BDR-1000 Configuration Parameters and their default settings as configured at the factory. These parameters are set for use with the BiStatix Developer Kit.

Parameter Name	Description	BDR-1000 Default
Reader Address	Reader address (1…255). 0 is reserved for the Host.	255
BaudRate	Communication baud rate from 9600 bps to 36,400 bps:	9600 bps
IOType	RS-232, RS-422 or RS-485	RS-232
ReadContEnable	Read Continuous mode at startup. This mode continuously searches for tags and notifies the host when one is found. Optionally, it also sends the tag data with the notification. See the **TagDataSend** parameter.	ON
TagDataSend	When both **ReadContEnable** is ON and this option is ON the tag data is returned with notification of a new tag found. If either option is OFF then tag data is not returned.	ON
TagDataStart	This option is applicable only if **TagDataSend** is ON. This value defines the first offset of the tag to read and return to the Host when a tag is found.	0
TagDataLength	This option is applicable only if **TagDataSend** is ON. This value defines the number of bytes on the tag to read and return to the Host when a tag is found. A value of 255 indicates to read all tag bytes.	255
WriteEnable	When this option is ON the Reader is capable of writing tags. When this option is OFF the Reader ignores write commands.	ON
TagExit	When ON, this option instructs the Reader to notify the Host when a tag exits the RF field.	OFF
NotifyAsync	When ON, this option instructs the Reader to automatically send notifications to the Host asynchronously.	ON
HostOpControl	When ON, this option tells the Reader to the Host will control the LED and beeper for all normal operation. When OFF the Reader controls the LED and beeper.	OFF
HostPupControl	When ON, the Host controls the power up operation of the LED and beeper. When OFF the Reader controls the LED and beeper on power up.	OFF
Retries	Number of write retries (0…3).	0

6 BDR1000 to BXR610 Compatibility

WARNING: Two different BiStatix RFID applications exist at this time. One is for Access Control Applications and the other is for Industrial Applications. The BDR1000 is an Industrial BiStatix RFID system. It utilizes a firmware package called Fiji which is different from the one used in Access Control systems. The BXR610 is also BiStatix RFID system but the intent of this application is for Access Control. The BXR610 uses an ACP tag for operation and will not function properly with a Fiji tag. In the same manner the BDR1000 uses a Fiji tag for operation and will not function properly with an ACP tag.

In either case when the incorrect tag is presented to these product the hardware will still perform a Beepflash^{TM} to acknowledge reading but the tag data will be misinterpreted and transmitted incorrectly. The follow is an outline of the compatibility of the two systems.

Reading Tags
1. If presenting a ACP tag to a BDR1000 the output will be the UID field only.
2. If presenting a Fiji tag to a BXR610 the output is undefined at this time.

Programming Tags
1. If writing to an ACP tag with a BDR100 the tag will become a Fiji tag and will no longer function with access control technology.

7 TROUBLESHOOTING

WARNING: Opening the sealed unit can expose you to high voltages. No user serviceable parts inside. If the reader does not function properly when installed according to instructions, please complete this form and fax it to (408) 434-7057 before calling (800) 646-3252 for technical assistance. International customers call (408)383-4000:

FAX

From:_____	**To:** <u>Technical Support</u>
Phone:_____	**Model:** <u>BDR-1000</u>
Fax:_____	**Fax:**___<u>(408) 434-7057</u>
Product S/N _____	**Date:**_____
Product Sales Order Number _____	

Cannot Read Tags
1. Is the setup according to instructions?   o Yes   o No
2. Was read mode checked following a Power Cycle?   o Yes   o No
3. Is an earth ground connected according to instructions?   o Yes   o No
4. Is the supplied power supply being used?   o Yes   o No
5. At reader power up, did reader exhibit SelfTest^{TM}?   o Yes   o No
6. Does both MonoPole and DiPole Read Mode Fail   o Yes   o No
7. Are the card presentations according to instructions   o Yes   o No
8. Upon card presentation, did reader exhibit QuickFlash^{TM}? o Yes   o No

Short Read Range
1. Is the setup according to instructions?   o Yes   o No
2. Is an earth ground connected according to instructions?   o Yes   o No
3. Is the supplied power supply being used?   o Yes   o No
4. Is there a CRT (computer monitor) nearby?   o Yes   o No   _____feet
5. Is the Tag or Card presentation according to instructions?   o Yes   o No

Cannot Program Tags
1. Is BRUtil S/W being used?   o Yes   o No
2. Is an earth ground connected according to instructions?   o Yes   o No
3. Is the supplied power supply being used?   o Yes   o No
4. Does both MonoPole and DiPole Write Mode Fail?   o Yes   o No
4. Does the Read Mode function properly?   o Yes   o No
5. Is the Tag or Card presentation according to instructions?   o Yes   o No

Trouble Using the BRUtil Utility.
1. Has Serial Communication been established?   o Yes   o No
2. Do any Hardware Commands Function Properly?   o Yes   o No
3. Describe the Host Computer being used. _____ .

8 ADDITIONAL INFORMATION

8.1 Mechanical Dimensions
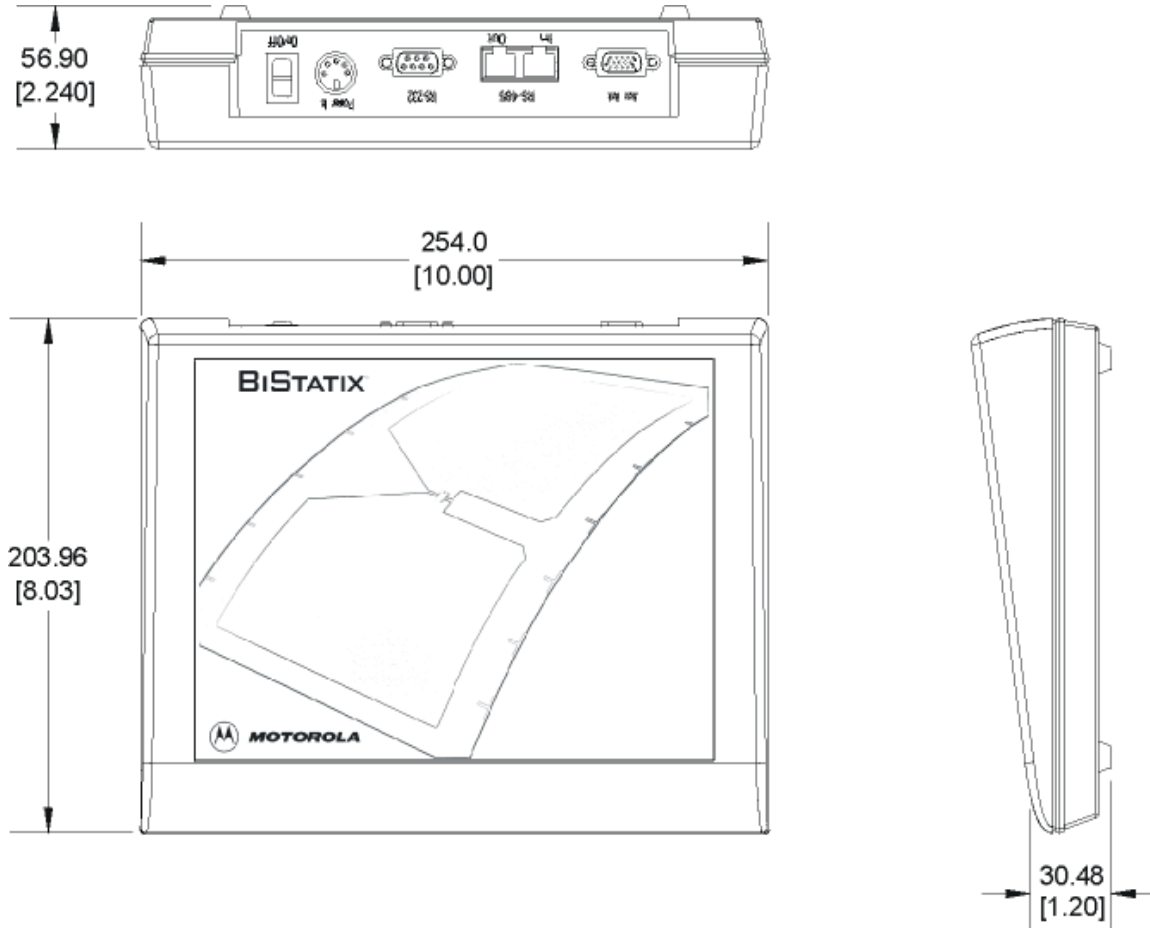
All dimensions are typical.

Figure 9 BDR-1000 Mechanical Dimensions

8.2 Copyrights Patents and Trademark Credits

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Patents pending worldwide.

8.3 Warranty

This product is guaranteed against defects in material and workmanship in accordance with the Terms and Conditions of the Purchase Order acknowledgement. In no event shall the BDR – 1000 warranty exceed one year from the data of purchase.

8.4 RMA (Return Material Authorization)

Goods returned for repair, warranty or non-warranty, must be assigned an RMA (Return Material Authorization) number. The customer is to provide a description of the specific problem.

For readers returned and not covered by the warranty (due to age, misuse, tampering and/or damage), a quote for repairs will be issued, and no work will be performed until a valid purchase order is received.   Readers left over 30 days without a repair authorization and a purchase order will be returned with evaluation charges and shipping costs applied.

8.5 Contacting Customer Support

Please answer all applicable questions in section 7.0 "Troubleshooting" before contacting the Technical support number listed below:

U.S.A. Office:
3041 Orchard Parkway
San Jose, CA 95134-2017
Tel (408) 383-4000, Main
Tel (800) 646-3252, Technical Support
Fax (408) 434-7057

European Office
Jays Close
Viables Industrial Estate
Basingstoke
Hants RG22 4PD
UK
Tel: +44 1256 358211
Fax: +44 1256 488144

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TBD