MOTOROLA

Integrated Information Systems Group
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Exhibit 8 – Users Manual

Motorola BiStatix BXR-610

Access Control Reader

FCC ID: E9UBXR610
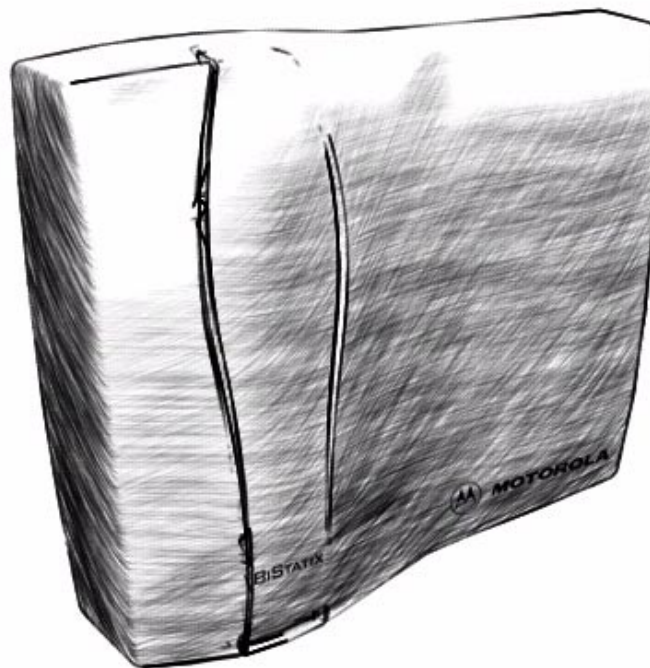
Model No. BXR-610

8.0 BXR-610 Users Manual

Exhibit 8
FCC ID: E9UBXR610
08/21/00

![Motorola logo]

MOTOROLA

Worldwide Smartcard Solutions Division

BXR-610

Installation and

Operation Manual

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 a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with instructions, 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:

- **Reorient 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 or an experienced radio/TV technician for help.**

Notice: Linear, series pass, regulated power supplies are recommended for optimum performance. The use of switching power supplies can result in reduced reader range performance.

*It's imperative that the common (black) power wire is connected to a good earth ground, Performance will be affected dramatically if this is not the case.

Do not use the reader's power supply for other equipment, particularly when operating switched inductive loads such as motor control relays and solenoids (i.e., magnetic locks, latch or strike). Doing so will affect the reader operation. Use a separate dedicated power supply for Motorola proximity readers.

Because this technology is based on radio frequency and because nearby environmental sources of electrical interference may affect the performance of the reader, below is a list of precautions that should be considered when installing or wiring the reader:

- **Metal affects radio signals. Do not cover the face of the reader with metal of any kind.**
- **Reduce or eliminate unwanted signals from external sources.**
- **Do not place the reader wiring bundled in conduit with AC power cables, lock power, or signal wiring.**
- **Maintain all reader wiring a minimum distance of 12" (30 cm) away from other wiring such as AC power, computer data wiring, telephone wiring, or wiring to electric locking devices, etc.**
- **Do not install the reader 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, uninterruptable power supplies, AC switching relays, light dimmers, computer monitors, and CRTs.**
Do not install the reader within 3.5' (1.1 m) of computer CRTs (monitors).

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1.0 Product Specification

- Input Voltage: 5 VDC to 16 VDC (at the reader) 17 VDC absolute Max.
- Read Range and power consumption vs. input voltage.

Input Voltage	Current	Power	Read Range (typical)	
	(Typical)	(Typical)	Off metal	On Metal
5 VDC	90 mA	0.45 W	up to 3.0"	up to 2.0"
12VDC	140 mA	1.68 W	up to 4.5"	up to 3.0"
16VDC	160 mA	2.56 W	up to 5.5"	up to 3.5"

(Read range is a function of proper reader grounding, tag geometry, tag coupling and tag presentation. Above with 2.1" x 3.3" tag, perpendicular presentation.)

- Frequency of Operation:
    - Excitation   125 KHz Typical
    - Data Carrier   62.5 KHz Typical
    - Data Rate   7.8125k bits/second Typical
- Environmental:
    - Operating Temperature   -35°C to +65°C (-31°F to +149°F)
    - Storage Temperature   -40°C to +70°C (-40°F to +158°F)
    - Operating Humidity   5% to 95% non-condensing
- Indicators:
    - Visual   Red, Green, Amber and "Off State" (Host controlled)
    - Audible   Beeper, 85 db typical (Host controlled)
- Electrical Termination: 9.84 feet (3 meters), 24 AWG, 9 conductor shielded
                            cable, pigtail termination.
- Bezel Options:
    Arch
    - Color Options   Onyx, Graphite, Snow, Taupe
    - Dimensions   5.13" (13 cm) H x 6.12" (15.6 cm) W x 1.10" (2.8 cm) T
    Curve
    - Color Options   Onyx, Plum, Forest, Marine
    - Dimensions   5.5" (14 cm) H x 6.53" (16.8 cm) W x 1.48" (3.8 cm) T
    Wave
    - Color Options   Onyx, Plum, Forest, Marine
    - Dimensions   5.6" (14.2 cm) H x 6.5" (16.5 cm) W x 1.5" (3.8 cm) T
- Reader Enclosure Material: ABS/Polycarbonate (UV Resistant Bayblend FR110,
                            UL-94V0 compliant)

Reader Weight:	Reader, mounting bracket, 3 meter cable and appropriate bezel.
- With Arch Bezel	1.34 lbs (608 grams) typical
- With Curve Bezel	1.37 lbs (621 grams) typical
- With Wave Bezel	1.40 lbs (635 grams) typical

- Output Formats: Wiegand, ABA track II, or RS-232. Open collector or Pull-Up Resistor Options for Wiegand and ABA Track II

- Certifications: UL-294 indoor and outdoor compliant. FCC Class A Digital Device (Part 15), ID Number E9UBXR610.

Read range is stated in an undisturbed electrical environment with proper tag coupling, 2.1" x 3.3" tag presented perpendicular to the reader. Reader installed in accordance with Motorola instructions. Power supply reader and controller must be on the same ground, connected too earth reference.

2.0 Introduction

The BXR-610 reader is a modular, miniaturized and rugged low power radio frequency reader designed for applications such as identification systems, security systems, Access Control, and data collection. The BXR-610 mounting bracket accommodates a wide variety of foreign and domestic electrical utility box applicationsand can be easily modified for unique circumstances.

The reader outputs data in Wiegand, ABA Track II, magnetic stripe or RS-232C formats, making it easy to upgrade an existing site to proximity using the wiring already in place.

2.1 Features

- *QuickFlash*™ for immediate user feedback.

- *SelfTest*™ for installer assistance during installation.

- *WatchDog*™ for increased supervisory control.

- Independently controlled audio tone and tri-color status LED.

- Field programmability via the use of option cards.

- Snap-on module construction, enabling configuration at installation site.

- Mounting on standard electrical box.

- Indoor/outdoor operation.

- Attractive, contemporary styling.

- Optional Bezels Available
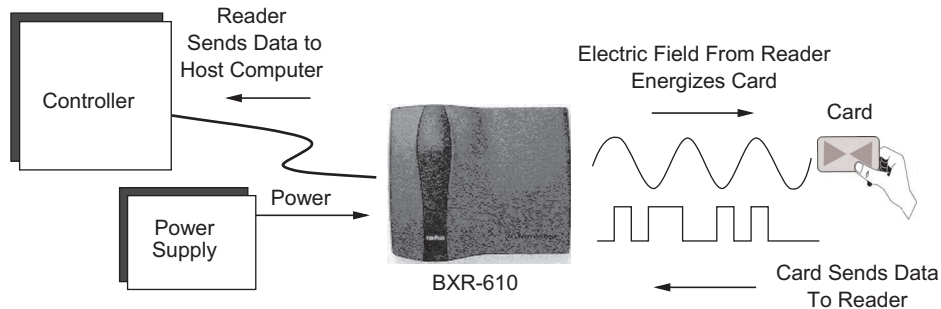
2.2 Theory of Operation

Figure 1 BXR-610 Block Diagram

When powered, the reader transmits a continuous low-power radio frequency (RF) signal
(See Figure 1) which serves as a clock and energy source for RFID cards and tags. Presenting a tag as shown, the hand serves as a required ground reference and activates the tag when in proximity to the reader. The RFID tag responds to the reader with a modulated unique identification number. In turn, the reader demodulates the tag signal, converts it to the pre-determined Wiegand, Magnetic Stripe-compatible, or RS-232 output format and sends the decoded data to an external host controller via the interface cable. In response, the controller takes appropriate action (e.g. open a door). Note: This particular model of reader is not conducive to a hands-free application (e.g.) reading a tag while within a purse, briefcase or wallet is not recommended.

2.3 Unpacking and Identifying Supplied Parts

Unpack the equipment and become familiar with the components. The reader package includes:

- • A Metal Mounting Bracket

- • A Reader Electronics Module

- • A Decorative Bezel

- • An Installation and Operations Manual

Metal Bracket:

Here is a view of the reader with the Arch bezel and bracket:

Here is a view of the reader with the Wave bezel and bracket:

Here is a view of the reader with the Curve Bezel and bracket:

2.4 Identifying the Reader Format

The ID label, located on the back of the reader module, contains the reader format identification, compliance certification reference, reader model number and the reader serial number.

2.5 Separating BXR-610 Bezel from Electronics Module

To remove the BXR-610 reader bezel, insert a small nail or screwdriver into the holes at the bottom of the bezel to release the latches. Lift up the bezel as shown in Figure 2.

New drawing

Figure 2 Separating the Bezel from Electronics Module

3.0 Installation

3.1 Mechanical Installation

3.1.1 Wall Mounting

For installations without an electrical utility box (i.e. drywall), use the mounting bracket as a template to outline the location of the reader cable portrusion and bracket grounding stud. Drill a 1.5" diameter hole to accommodate the cable and ground stud. Mark four mounting hole locations for best support. For best results, insure one screw is attached on each side of the bracket's cable slit. Drill the proper size mounting holes for #6-32 UNC screws at the marked locations. Note: The mounting bracket has been designed with a slight twist to aid in rigidity for single gang box installations.

Using four #6-32 UNC screws with a maximum pan head + washer height of 0.100", attach the mounting plate to the surface of interest. Secure the mounting bracket using four screws, (Insure one screw is on each side of the bracket cable slit for rigidity). See Figure 5 for proper orientation (Cable slot on bracket is top).
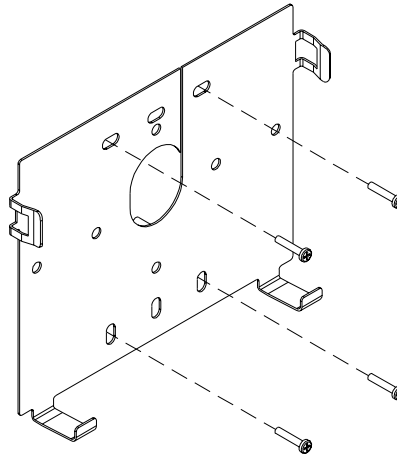

Figure 3 Attaching the Mounting Plate

 Feed the reader cable through the bracket hole, or twist the bracket slightly to slide the cable through the slit in the bracket if the reader cable has already been connected.

Figure 4 Routing the Cable

Connect earth ground to the mounting bracket ground stud using a #6 ring lug, a #6 washer and a #6-32 UNC nut (Supplied).

Once the mounting bracket installation and cable connections are complete, snap the bezel over the reader enclosure as shown in Figure 5. For mechanical dimensions, cable and hole location of the BXR-610 refer to "Mechanical Dimensions" on page 20.
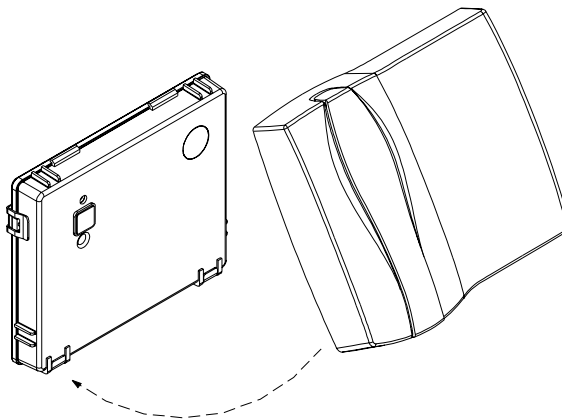
Figure 5 Wall Mounting

K01979-000 Rev. -02

3.1.2   Gang Box Mounting (Preferred Mounting Configuration)

The BXR-610 mounting bracket is designed to accommodate common electrical utility boxes, globally, including single or dual gang boxes. For unique applications, simply drill the appropriate mounting holes, but keep within the recessed profile of the back of the reader enclosure (Insuring that screw heads do not interfere with the enclosure). Note: The mounting bracket has been designed with a slight twist to aid in rigidity for single gang box installations.

For installations without a metal electrical utility box (i.e. plastic utility boxes or drywall installations), connect earth ground to the mounting bracket ground stud using a #6 ring lug, a #6 washer and a #6-32 UNC nut (Supplied). For installations with a grounded metal electrical utility box, the ground connection to the mounting bracket is automatic and the ground stud wiring can be omitted.

Using four #6-32 UNC screws with a maximum pan head + washer height of 0.100", attach the mounting plate to the surface of interest. Secure the mounting bracket using four screws, (Insure one screw is on each side of the bracket cable slit for rigidity). See Figure 5 for proper orientation (Cable slot on bracket is top). Feed the reader cable through the bracket hole, or twist the bracket slightly to slide the cable through the slit in the bracket if the reader cable has already been connected.
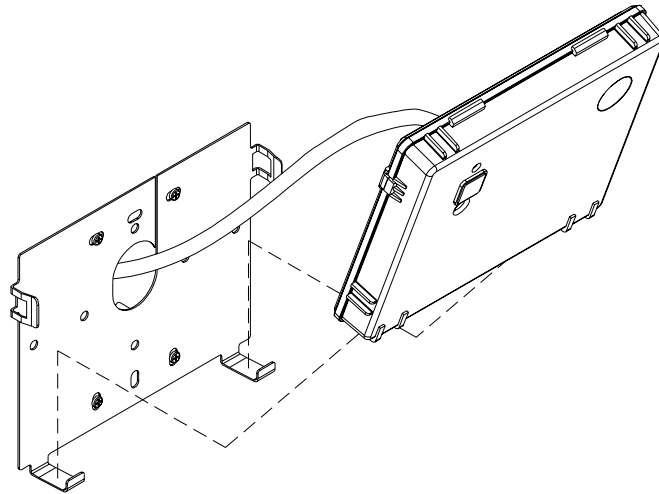
Once the mounting bracket installation and cable connections are complete, snap the bezel over the reader enclosure. For mechanical dimensions, cable and hole location of the BXR-610 refer to "Mechanical Dimensions" on page 20.

New Drawing

Figure 6 Gang Box Mounting

4.0 Power and Cabling

4.1 Power Supply Cable Types and Maximum Lengths

The BXR-610 reader requires a minimum voltage of 5.0 VDC at the reader. Voltage drops, caused by the cable resistance, can be made up by increasing the power supply voltage. **DO NOT SET THE POWER SUPPLY VOLTAGE TO HIGHER THAN 16 VDC!** In noisy environments, use shorter cable runs. Table 1 shows the recommended cable types and maximum cable lengths for connecting the power supply to the reader (**DO NOT USE CABLES WITH GAUGES SMALLER THAN 24 AWG)**
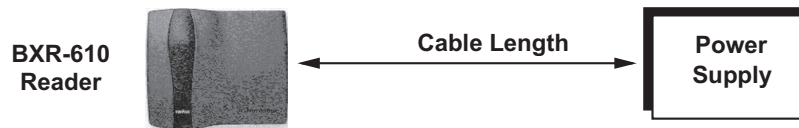
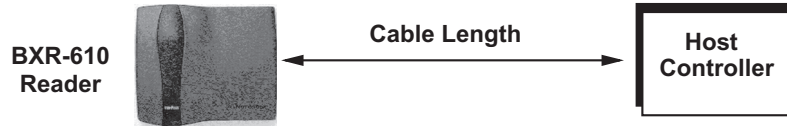| Cable Type	Maximum Cable Length
24 AWG (0.60 mm), three conductor, with an overall foil shield, Belden, 9533 or equivalent.	200' (61 m)
22 AWG (0.80 mm), two conductor, with an overall foil shield, Alpha 5192 or equivalent.	300' (91 m)
18 AWG (1.20 mm), two conductor, with an overall foil shield, Alpha 5386 or equivalent.	500' (152 m)

Table 1 Power Cable Types and Lengths

4.2 Reader to Host Interface Cable Types and Lengths

Refer to Table 2 to determine the recommended wiring type at various maximum distances. Variation in distance requires different wire gauges. Because of system data termination differences, contact your system manufacturer for its exact requirements. Installation should be in accordance with National Electric Code ANSI/NFPA 70.

Cable Type	Maximum Cable Length
22 AWG (0.80 mm), six or eight conductor, with an overall foil shield, Alpha, 5196, 5198 or equivalent.	500' (152 m)
18 AWG (1.20 mm), six or eight conductor, with an overall foil shield, Alpha 5386, 5388 or equivalent.	500' (152 m)

Table 2 Reader Host Interface Cable Types and Lengths

Note: When connecting reader to Host via RS-232 select cable as shown in Table 3

Cable Type	Maximum Cable Length
TBD	TBD

Table 3 RS-232 Cable Type and Length

5.0 Earth Grounding

Connect the Power Supply and Controller directly to an earth ground. An earth ground can be established by driving a copper clad ground rod into the earth. Make certain the DC resistance between your established earth ground and the system ground is 50 Ohms or less. If direct connection to a ground rod is not possible, connect the reader to an earth-grounded cold water metal pipe (do not connect to copper fire sprinkler system because it may have non-conductive couplings), or steel frames (building beams) that connect to earth.

Prevent ground loops by connecting the cable shield, controller ground and the negative line of the power supply to one common earth ground point. Connecting different points to separate earth grounds may result in a ground loop. Ground loops may cause poor read range and communication line interference resulting in no code or improper code being seen by the controller.

In a multiple reader installation, connect all readers to a single earth ground reference point (common ground).
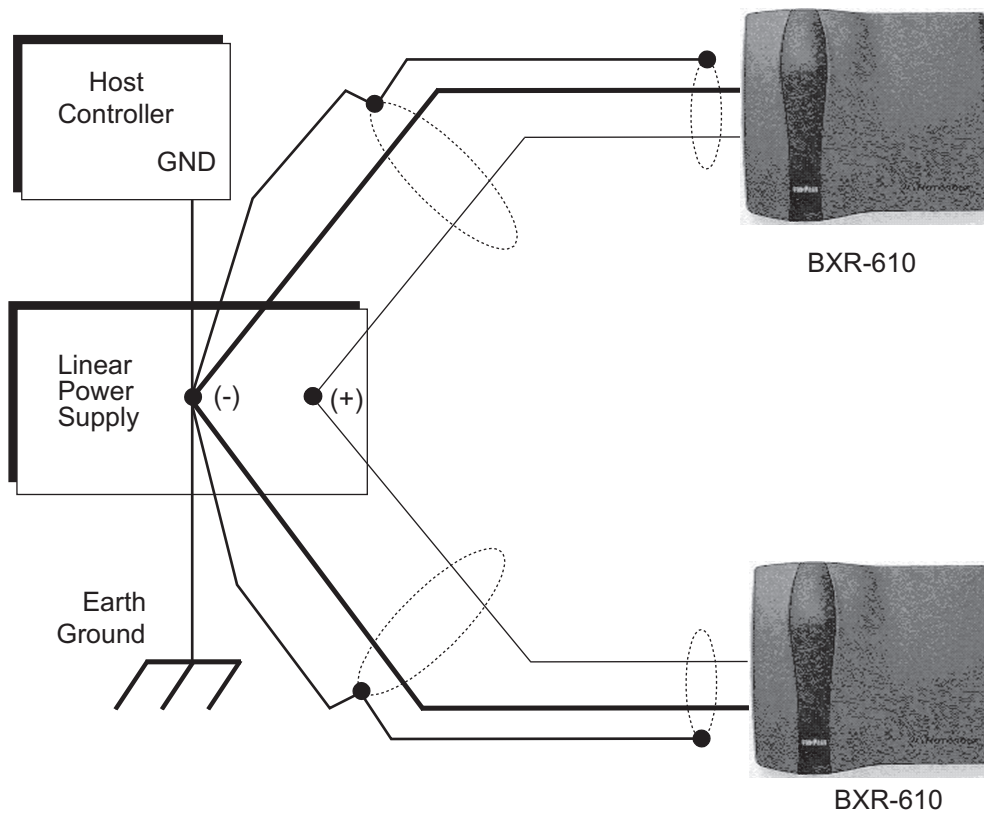
Figure 7 Grounding the Reader

6.0 Reader to Host Interface Wiring

Figure 8 shows all the possible interfaces. Chose the appropriate interface for your installation.

Figure 8 Reader to Host Interface Wiring

Notes:

- The system must have a single earth ground point.

- For open collector (non-terminated output), consult your system manufacturer for correct cable length and type.

- The internal circuit configurations for the reader inputs and outputs are as shown in Figure 9

Figure 9 Reader Internal Circuit Typical Input and Output Configurations

7.0 Operation

When power is first applied to the reader, it performs an internal circuit *Self Test*. If it is functioning properly, the reader will fla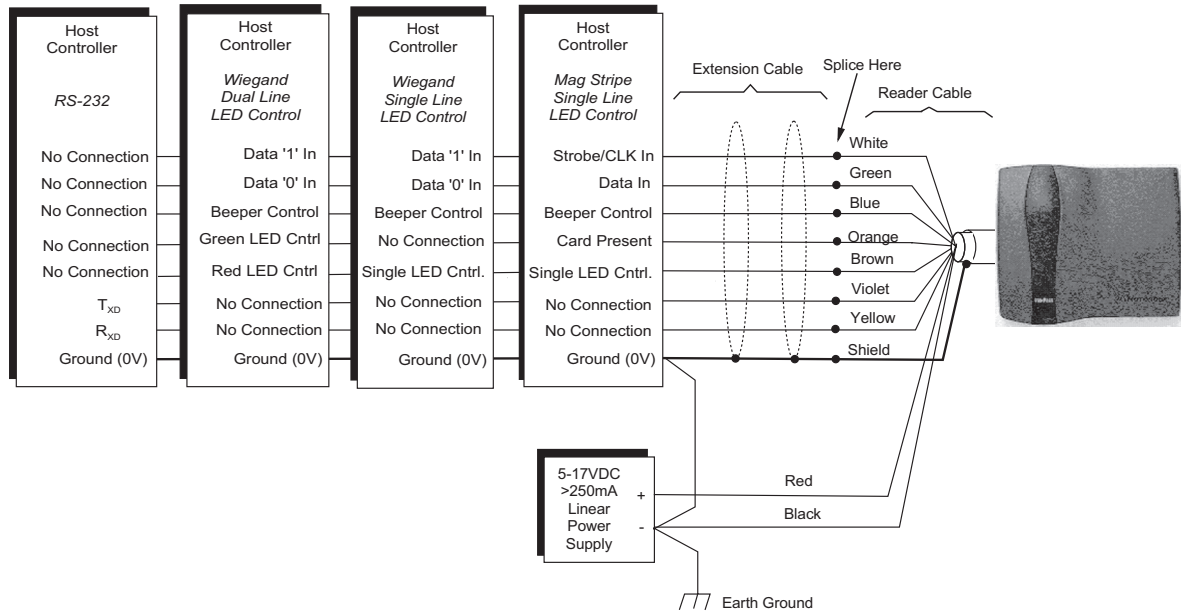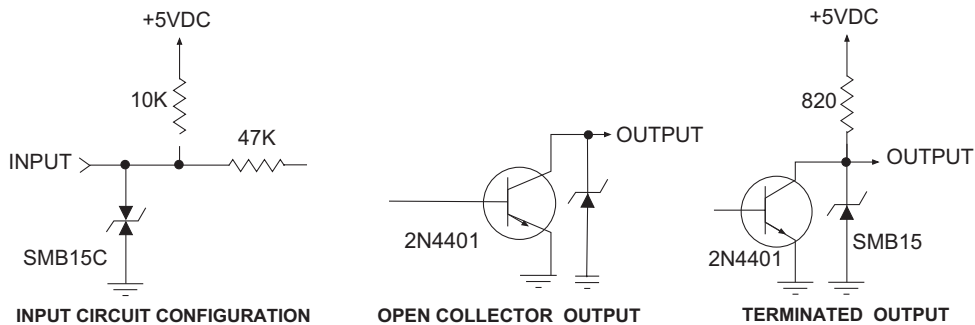sh the amber LED and beep twice. After the *SelfTest* is completed, the reader is in a READY status mode and you may present the card to the reader.

7.1 Presenting the Card

To obtain maximum read range, present the card perpendicular to the reader as shown in Figure 10 Grasp the card on the edge and keeping it perpendicular to the BXR-610 reader, move it slowly toward the face of the reader until a *QuickFlash* (refer to section 7.3) is obtained. This is the point at which the card is read and the data is transmitted to the controller. To read the card again, remove it from the antenna field and present it again. During normal use, the card can be presented to the antenna at any angle, although this will result in a reduced read range.
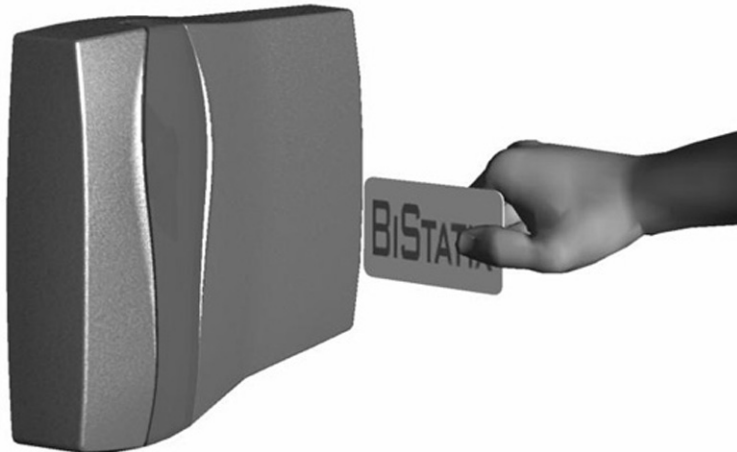
Figure 10 Presenting the Card

7.2 Data Output

The BXR-610 reader is capable of outputting either Wiegand, Magstripe or RS-232C formatted data. For further information please call technical support at (800) 646-3252.

7.3 *QuickFlash*

When a valid card is presented, unless *QuickFlash* is activated, the LED will flash and the audio tone (beeper) will be activated for 70 to 100 milliseconds, regardless of the card's access status. This gives

the user immediate feedback that the card was read and that data was sent to the controller. After the 100 millisecond *QuickFlash* period, the controller takes over the LED and beeper.

7.4 *SelfTest*

The readers have an internal diagnostic routine to assure reader operation at start-up, as well as a means to test the integrity of the data lines. When power is first applied to a reader, it will beep and flash twice to let the installer know that it has performed an internal check and is functioning properly. If the reader start-up routine determines one of the critical memory devices inside the reader has failed, the reader will emit a chirping sound.

7.5 Verifying Data at Host

To verify that the controller can read the data, put the reader into line test mode by holding a *SelfTest* card (Motorola part number 07586-001) in front of the reader. The reader will respond with an alternately flashing LED in all three colors and an audio signal to let you know it is in the line test mode. The reader will remain in the line test mode until power is removed and reapplied or the *SelfTest* card is presented again. While in this mode, the reader will send output pulses down the data lines at a 1 Hz rate, which can be measured at the controller end with a volt meter. If the pulses are not present, then there is probably a break or short in the line. If the pulses are present and the system is still not working, the reader may not be connected to the controller properly, the controller/system may be incorrectly programmed, or the controller may be broken.

8.0 Controls and Indicators

8.1 Wiegand and Magnetic Stripe Single-Line Control LED Wiring

- There is no LED OFF state in this configuration. LED is red when the brown wire is high (above 2.2 VDC or not connected).
- Pull brown wire low to change LED color to green.
- Toggle brown line high-low at a rate of 100 Hz to 1 kHz, 50% duty cycle, to produce amber LED color.
- Pull blue beeper wire low to activate audio beep tone.

8.2 Wiegand Dual-Line Control LED Wiring

- The LED is OFF when both brown and orange wires are high (above 2.2 VDC or not connected).
- Pull brown wire low to activate red LED.
- Pull orange wire low to activate green LED.
- Pull orange and brown wires low simultaneously to activate amber LED.
- Pull blue wire low to activate audio "beeper" tone.

9.0 Option Cards

9.1 Single and Dual-Line LED Control

This option card toggles the state of the LED control lines (Motorola part number 07591-001). If one beep is heard when the card is presented, the reader is set to a single line LED control. If two beeps are heard, the reader is set to a dual line LED control.

9.2 *QuickFlash* Beep Enable/Disable

This option card toggles the state of the *QuickFlash* beep option (Motorola part number 07584-001). If one beep is heard when the card is presented to the reader, the automatic beep is enabled. If two beeps are heard, the automatic beep is disabled.

9.3 *QuickFlash* LED Enable/Disable

This option card toggles the state of the *QuickFlash* LED option (Motorola part number 07585-001). If one beep is heard when the card is presented to the reader, the automatic *QuickFlash* is enabled. If two beeps are heard, the automatic *QuickFlash* is disabled.

9.4 *SelfTest* Card

This option card enables or disables the *SelfTest* mode upon presentation (Motorola part number 07586-001). Present the card once to enable the *SelfTest* mode. Present a second time to revert to normal operation.

9.5 *WatchDog* Enable/Disable Card

This option card toggles the state of the automatic *WatchDog* option (Motorola part number 07587-001). If one beep is heard when the card is presented to the reader, the *WatchDog* output is enabled. If two beeps are heard, the *WatchDog* output is disabled. The *WatchDog* will output an 8-bit "10101010" pattern approximately once every minute over the data lines. This option card is available with either Wiegand or magnetic stripe interfaces.

9.6 *Power Up Delay* On/Off Option Card

(Motorola part number 07588-001)

9.7 Hold Line/Beep Line Control

(Motorola part number 07589-001)

9.8 Option Card Disable

(Motorola part number 07590-001)

10.0 Troubleshooting

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:** Technical Support

Phone:_____   **Model:** BXR-610

Fax:_____   **Fax:**   (408) 434-7057

Product S/N _____   **Date:**_____

Dead Reader

1. Is the reader wired according to instructions?   o Yes   o No
2. Is the recommended power supply being used?   o Yes   o No
3. Is the DC voltage correct?   o Yes, _____volts   o No
4. Is the DC current correct?   o Yes _____ma   o No
5. What is the cable length between the power supply and the reader? ____feet
6. Is the cable type according to specifications?   o Yes   o No

Short Read Range

1. Is the reader wired according to instructions?   o Yes   o No
2. Is earth ground connected according to instructions?   o Yes   o No
3. Is the cable shield connected according to instructions?   o Yes   o No
4. Is the recommended power supply being used?   o Yes   o No
5. Is the DC voltage correct?   o Yes, _____volts   o No
6. Is the DC current correct?   o Yes _____ma   o No
7. Is there a CRT (computer monitor) nearby?   o Yes _____feet   o No
8. Is the card presentation according to instructions?   o Yes   o No
9. What is the card tag number?   Card model number:_____

Data Incorrect or Non-existent

1. At reader power up, did reader exhibit *SelfTest*[TM]?   o Yes   o No
2. Upon card presentation, did reader exhibit *QuickFlash*[TM]?   o Yes   o No
3. If you answered Yes to questions 1 and 2, did you verify the
   data at the host as described in section 7.5.   o Yes   o No
4. Is the reader wired according to instructions?   o Yes   o No
5. Is earth ground connected according to instructions?   o Yes   o No
6. Is the cable shield connected according to instructions?   o Yes   o No
7. Is the card presentation according to instructions   o Yes   o No
8. What is the reader format?   Reader format:_____

11.0 Additional Information

11.1 Mechanical Dimensions

Need new drawing

Figure 11 BXR-610 Mechanical Dimensions

11.2 Copyrights, Patents, and Trademark Credits

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Products are covered by United States patent 4818855, Canadian patent 1253591, and other patents pending worldwide.

11.3 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. The customer is to include serial numbers, formats, card ID numbers, and correct facility codes with the items to be returned. If exact duplicates of returned cards or tags are requested, the customer must provide Motorola with the exact format and ID numbers needed.

For readers returned and not covered by the warranty (due to age, misuse 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.

11.4 Contacting Customer Support

Please answer all questions in section section 10.0 "Troubleshooting" and have your answers ready before you call 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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