



Installation and Operation Instructions

IR-12E RFID Reader

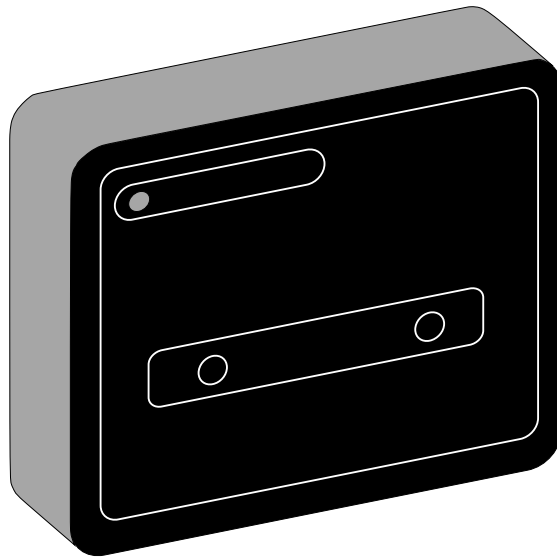


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1.0 Product Specification

The model IR-12E reader is a single piece RFID proximity reader. The reader can be mounted on any surface including metal. It can also be mounted behind any building material except metal.

- Input Voltage:
 - Typical 12 VDC
 - Range 10.5 VDC to 14 VDC (at the reader)
- Input Current:
 - Typical 170 ma at 14 VDC
- Power Consumption:
 - Maximum 16.8 Watts
- Power Supply:
 - Description Regulated linear power supply
 - Recommended Power One, model HA15-0.9-A or approved "Class 2" power supply compliant with UL 1950 and EN60950 requirements, and marked LPS Rated 10.5 to 14 VDC, 170 mA.
- Read Range*:
 - with IT-21E Tag Up to 4.5" (11.43 cm)
 - with IT-34E Tag Up to 5" (12.70 cm)
 - with IT-39E Tag Up to 3.0" (7.62 cm)
 - with IT-52E Tag Up to 1.0" (2.54 cm)
 - with IT-54E Tag Up to 2.0" (5.08 cm)
 - with IT-61E Tag Up to 4.0" (10.16 cm)
- Exciter Frequency 125Khz
- Receiver Frequency 62.5Khz
- Operating Temperature Range -0° to +65° C (32° to 149° F)
- Color: Black
- Dimensions: 4.6"H x 5.6"W x 1.4"T (11.7 x 14.2 x 3.6 cm)
- Material: UV resistant ABS (UL 94V0) plastic
- Weight: 12 Oz. (340g)
- Output Format RS-232, RS-422, and Barcode emulation are Standard

*Expected read range when units are installed in accordance to Motorola instructions, the input voltage at the reader input is 12 VDC minimum, tag is presented centered and parallel to the face of the antenna, and the reader electrical environment is undisturbed by external signal noise such RF and/or EMI.

2.0 Introduction

Motorola RFID systems consist of coded tags, an antenna for reading the codes of the tags, and a remote electronics unit to interface between the antenna and a host computer. The IR-12E is a single piece readers that combine the antenna and the remote electronics circuitry in one package.

In reference to Figure 1. when the reader is powered, a low-frequency, low-level, radio frequency (RF), electromagnetic field is continuously radiated by the reader. When a tag is presented within the field of the reader, the microchip (embedded in the tag) is activated and transmits a unique pre-coded identification (ID) number back to the reader. The reader decodes and converts the identification number to a pre-determined output format (RS-232, RS-422, or Barcode format) and sends this code to an external host computer through data cables. With this information, the host computer determines what action is to be taken as a response to the tag presentation.

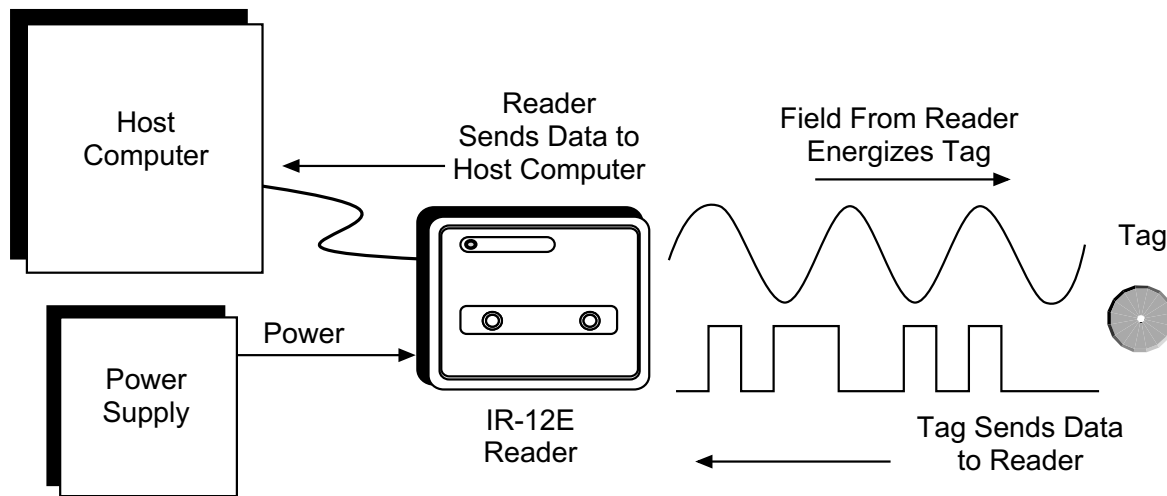


Figure 1. IR-12E RFID Block Diagram

2.1 Guidelines

As this technology is based on radio frequency, one must exercise some extra care installing these products. The following observations apply:

1. Metal affects radio signals.
2. Care must be exercised to reduce or eliminate unwanted signals from external sources. **The external sources, 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 on the external noise signal strength of the nearby transmitter, the read range maybe reduced or the tag signal maybe masked by the external signal, resulting in a no read.**
3. Line-of-sight is not required, as long as the blocking element is nonmetallic.
4. Instructions must be followed carefully; the few special requirements are simple and following them will pay off handsomely.
5. The read range is proportional to the size of the antenna and the type of tag used. Larger tags and antennas read at greater distances than small ones.
6. The rules and regulations of the Federal Communication Commission (FCC) and other regulatory agencies in various countries limit the power level and frequency. Motorola RFID readers are of the type accepted under FCC Part 15 (United States) and by proper regulatory agencies in the European Union EN 300 330.
7. Any changes or modifications not expressively approved by Motorola for compliance could void the user's authority to operate the equipment per FCC Part 15 Subpart A Section 15.21 regulations.

3.0 Installation

3.1 Installation Precautions

The IR-12E reader performance may be reduced if Motorola instructions and proper installation engineering practices are not followed. **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 on the external noise signal strength of the nearby transmitter, the read range maybe reduced or the card signal maybe masked by the external signal, resulting in a no read.** Below is a list of pre-installation precautions that should be considered:

1. *Do not* place the IR-12E reader wiring in conduit with AC power or solenoid and relay control wiring.
2. Silicon Controlled Rectifiers (SCR) for controlling motor speed or for dimming of lighting generate radio frequency signals that can interfere with normal reader performance. When routing reader cables, take care to maintain all reader cabling at 12" (30 cm) minimum distance from those devices and their associated wiring. *Do not place the reader in the immediate vicinity of such controls.*
3. Keep the reader at least 6' (1.8m) from any CRT (computer monitor, CCTV monitor, etc.).

3.2 Mechanical Installation

3.2.1 Metal Mounting

Care must be taken in selecting an appropriate mounting location when installing the IR-12E reader in an environment where metal (including non-ferrous metal, such as aluminum) is present. The following is a list of metal mounting precautions:

1. The IR-12E can be mounted on any type of metal.
2. If the reader must be framed or surrounded by metal, insure that there is at least 1.5" (3.8cm) of separation between each side of the reader and the surrounding metal.
3. Do not cover the face of the reader with metal of any kind.

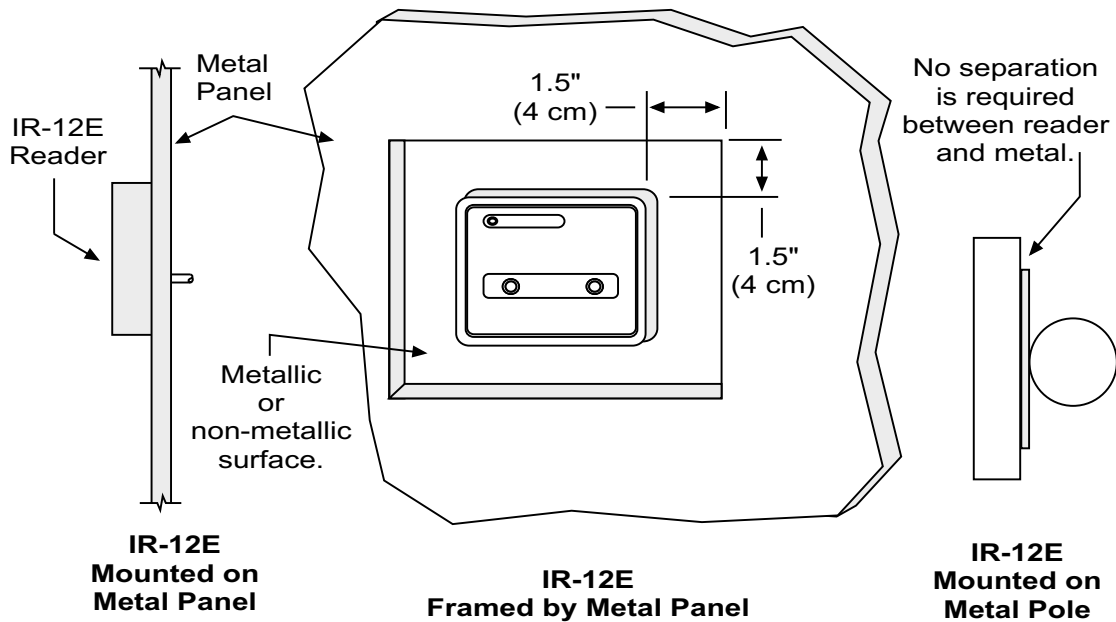


Figure 2. Through Hole Antenna Mounting

3.2.2 Installation on Conveyors with Metal Rollers

Motorola designed the IR-12E reader for use on all types of conveyors. When the reader is being installed under conveyor systems using metal rollers, the metal can have adverse effects since the reader operate by means of radio frequency. Some of the symptoms are short-read range, occasional unknown codes, or other erratic operation. The following are some precautions to follow when installing the IR-12E reader under conveyor systems:

1. The IR-12E reader can be mounted on any surface material, including metal. If the reader must be framed with metal, refer to the Metal Mounting section on page 4.
2. Be aware of the clearance between the metal and the sides of the reader, particularly on narrow conveyors, refer the Metal Mounting section on page 4.
3. Remove the metal rollers immediately over the reader face, refer to figures Figure 3. and Figure 4. Replace the removed rollers with ones of a non-metallic material such as PVC. Center the reader under these plastic rollers for maximum read area.
4. Refer to Figure 5. for guidelines on mounting tags on the item to be identified.

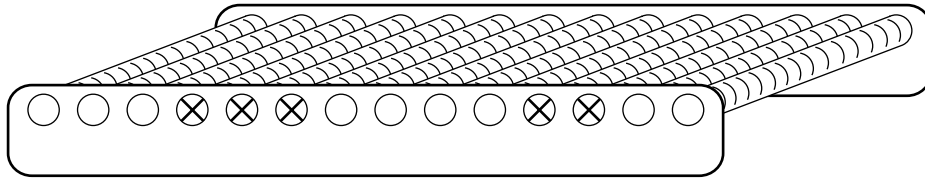


Figure 3. Replacing Conveyors Metallic Rollers with Non-Metallic Ones

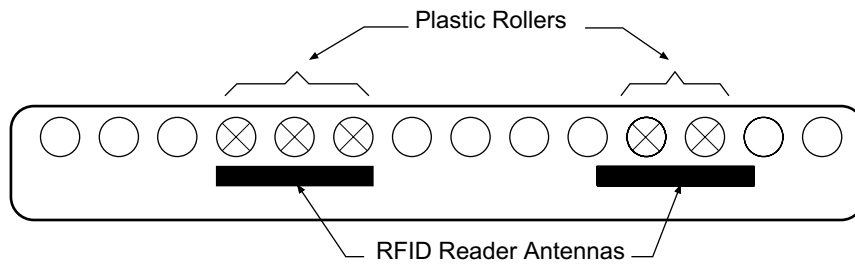


Figure 4. Installing the IR-12E Antenna Beneath Conveyor's Non-Metallic Rollers

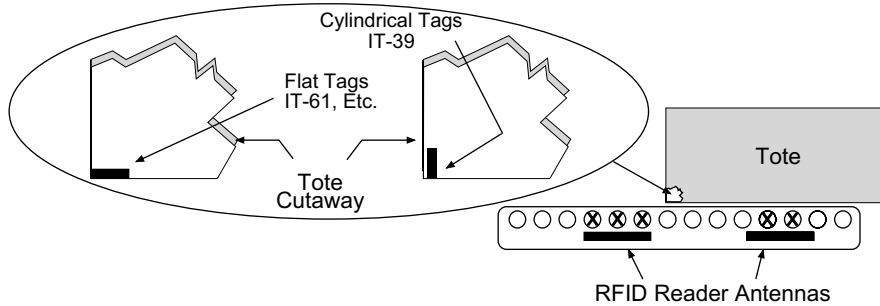


Figure 5. Mounting Tags (For optimum performance) on Items Moving Over Conveyor

3.2.3 Power Supplies, Power Supply Cable Types and Maximum Lengths

3.2.3.1 Power Supply Information

Use of other than the recommended types of power supplies can result in reduced reader reliability and read range. Switching Power Supplies are not recommended.

For the European Market, the recommended power supply for IR-12E should be a linear regulated power supply (not furnished with reader) capable of delivering the reader power with operating parameters as specified in Section 1.0 . The power supply should be CE marked and compliant with the EN 60950 standards and approved for use in the European Union under the low voltage and EMC directive.

For the North American market, the power supply must be a UL approved linear regulated power supply. A recommended (not furnished with reader) power supply is the Power-One International Series Linear power supplies, Model HB-15-0.9A. If using a 12V backup battery, set the output of the power supply to 13.8 volts (the battery required trickle charge voltage level). For optimum read range, maintain a minimum of 12.0 volts DC at the reader input. Refer to section 3.2.3.3 for power cable types and section 3.2.3.4 for power cable maximum length.

Additionally, any power supply used must also meet local building codes and be installed in accordance with the power supply manufacturers instructions.

It is not advisable to use the proximity reader's power supply to power other equipment. This is especially true when operating switched inductive loads such as motor control relays and solenoids. Always use a separate dedicated power supply to power Motorola RFID readers.

3.2.3.2 Wiring IR-12E to Power Supply

During final system installation, refer to the quick wiring procedure detailed on page 9 and the wiring diagram on pages 11 through 13. Use the recommended cable types and the maximum cable length between the power supply and reader (detailed on page 9)

3.2.3.3 Power Cable Type

The recommended cable types to use between the power supply and an IR-12E reader are as follows:

- 0.60mm Dia., three conductor, with an overall foil shield (24 AWG, Belden 9533 or equivalent).
- 0.80mm Dia., two conductor, with an overall foil shield (22 AWG, Alpha 5192 or equivalent).
- 1.20mm Dia., two conductor, with an overall foil shield (18 AWG, Alpha 5382 or equivalent)

3.2.3.4 Power Cable Maximum Length

The IR-12E reader requires a minimum voltage of 10.5 VDC at the reader input (12.0 VDC optimum). 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 14 VDC WITHOUT FIRST CONTACTING THE FACTORY**). In noisy environments, use shorter cable runs. The following are the maximum cable lengths for cables connecting the power supply to the reader (**DO NOT USE CABLES LESS THAN 24 AWG**):

- AWG 24, up to 200 feet.
- AWG 22, up to 300 feet.
- AWG 20, up to 400 feet.
- AWG 18, up to 500 feet

Note: For cable lengths greater than 3.05 meters, cable shall be rated and marked as VW-1 or FT-1.

3.3 Electrical Installation

3.3.1 Wiring Procedure

The following is a simple wiring procedure to assist you in testing the reader before installation (also use this procedure during final installation):

1. Unpack the equipment and become familiar with the components.
2. Read the pre-installation precautions detailed on page 4 and the metal mounting instructions on page 4.
3. Place the reader at least 6.6' (2 m) from any CRT (monitor).
4. Locate and read the appropriate instructions and wiring diagram detailed on pages 11 through 13.
5. According to the appropriate instructions and wiring diagram, connect the reader to the host computer.
6. Read the power supply information on 7. Without applying power to the power supply, connect the reader to the a linear power supply, per the appropriate wiring diagram (on pages 11 through 13).
7. Read the grounding information detailed on 9 and connect to earth ground as described in the instructions for earth grounding and the instructions for avoiding ground loops.
8. Apply power to the power supply.
9. Read the tag presentation information on page 14 then present the RFID tag to the reader parallel to the reader face. Note the read rang at which the *QuickFlash*[™] is obtained.
10. If the read range is reduced, move any nearby monitor further away from the reader.
11. When you are satisfied with the performance of the reader and are familiar with the reader's operation, *remove power to the reader* and proceed with the final installation.
12. Restore power to the power supply.
13. Present the tag to the reader. The tag code should now be displayed on the host computer screen.
14. If there is no code present, there is a communications problem with the computer.
15. If anything does not appear normal, please answer the questions on the Troubleshooting Data Form on page 18 prior to calling for technical support at (800)646-3252.

3.3.2 Earth Grounding

Quite often poor reader performance (such as short range, erratic read, or erroneous codes) is due to improper earth grounding. Connecting RFID readers to a reliable earth ground is very important to their overall operation. An electrical ground is not necessarily a good earth ground. If in doubt, connect the reader to an earth grounded cold water metal pipe (not the copper fire system, as it has non-conductive couplings), or steel frames (building beams) that connect to earth. Earth ground can also 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 less than 50Ω.

3.3.2.1 Avoiding Ground Loops

It is important to connect both the cable shield and the negative line of power supply to one common point earth ground. Exercise care in the overall grounding scheme to insure that no ground loops exist. A ground loop can result when one connects two different points to separate earth grounds. That condition may exhibit problems in many different ways (no operation, poor read range, communications line interference resulting in no code or improper code being sent to the host computer).

When more than one reader share one power supply, it is critical that all readers connect to a single earth ground reference point (common ground). Figure 6. is an example of proper common ground for a multiple reader installation.

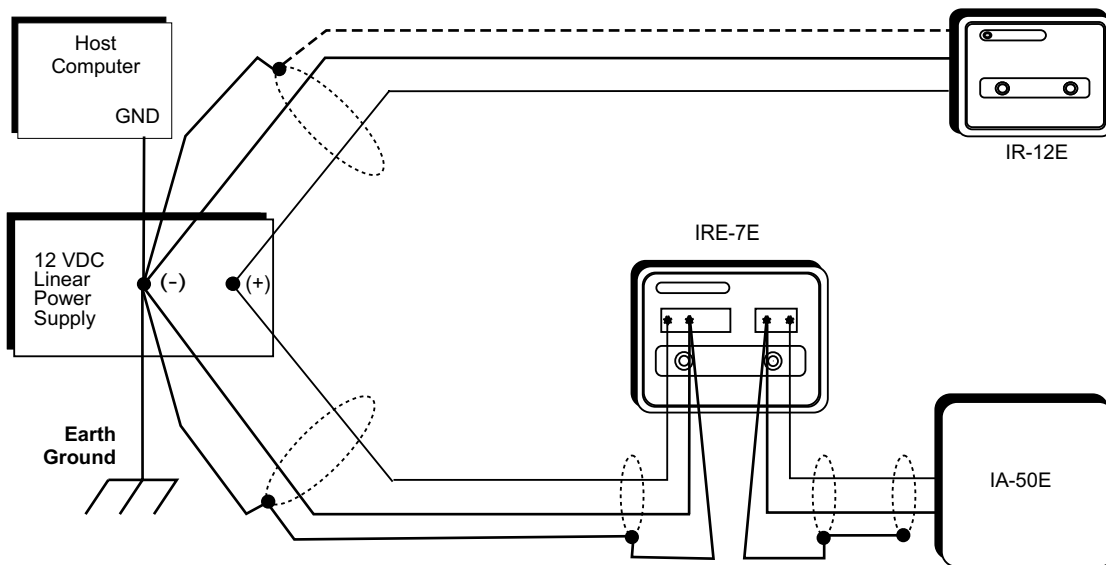


Figure 6. Avoiding Ground Loops

3.3.3 RS-232 Output Wiring

During final system installation, refer to the wiring procedure detailed on page 9 and the wiring diagram shown in Figure 7. Use the recommended cable types and the maximum cable length recommendations as shown in section 3.3.3.1

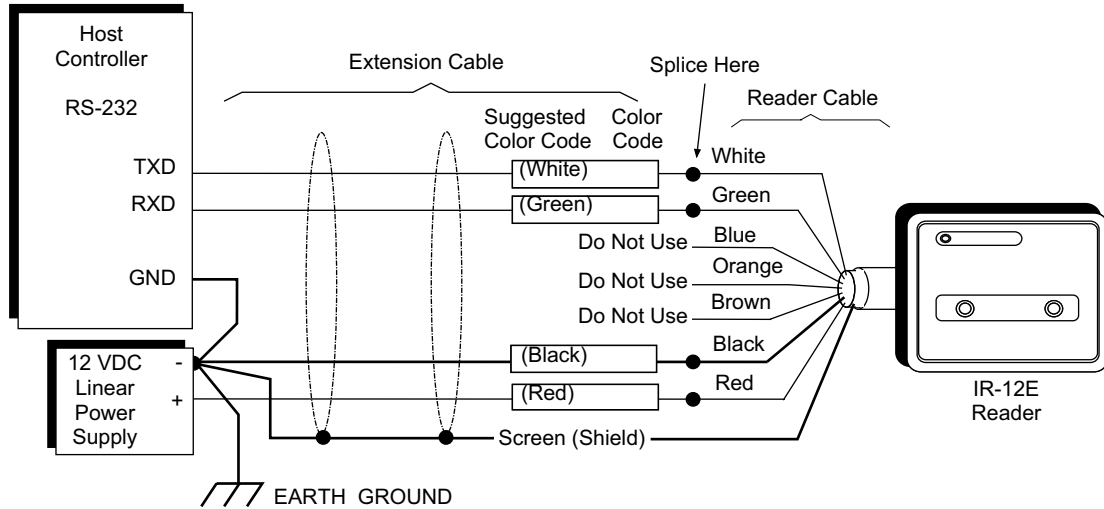


Figure 7. RS-232 Output Wiring Diagram

3.3.3.1 Wire Types and Maximum Cable Lengths (RS-232)

Refer to the table below to determine the recommended wiring type at various maximum cable lengths shown.

Cable Type	Cable Length
24 AWG (0.60 mm Dia.), 6 or 7 conductors with an overall shield (Belden 9536,9537)	100' (31 m)
22 AWG (0.80 mm Dia.), 6 or 7 conductors with an overall shield (Alpha 5196, 5198)	100' (31 m)
18 AWG (1.20 mm Dia.), 6 or 7 conductors with an overall shield (Alpha 5386, 5388)	100' (31 m)

3.3.4 RS-422 Output Wiring

During final system installation, refer to the wiring procedure detailed on page 9 and the wiring diagram on this page. Use the recommended cable types and the maximum cable length recommendations shown in section 3.3.4.1

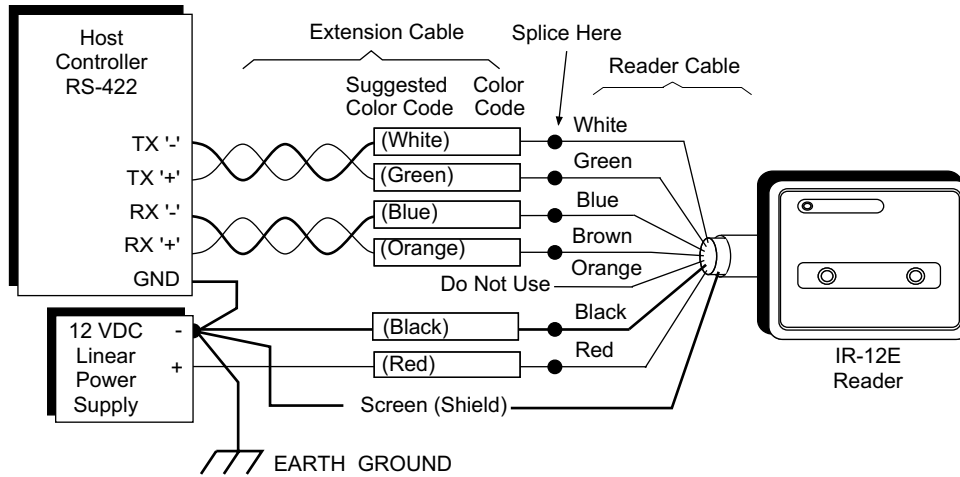


Figure 8. RS-422 Output Wiring Diagram

3.3.4.1 Wire Types and Maximum Cable Lengths (RS-422)

Refer to the table below to determine the recommended wiring type at various maximum distances shown

Cable Type	Cable Length
24 AWG (0.60 mm Dia.), 3 twisted pair, unshielded (Belden 5263 or equivalent)	4000' (1230 m)
22 AWG (0.80 mm Dia.), 3 twisted pair, unshielded (Belden 8742 or equivalent)	4000' (1230 m)
18 AWG (1.20 mm Dia.), 3 twisted pair, unshielded (Belden 8690 or equivalent)	4000' (1230 m)

3.3.5 Barcode Output Wiring

During final system installation, refer to the quick wiring procedure detailed on page 9 and the wiring diagram shown in Figure 9. Use the recommended cable types and the maximum cable length recommendations shown in section 3.3.5.1 .

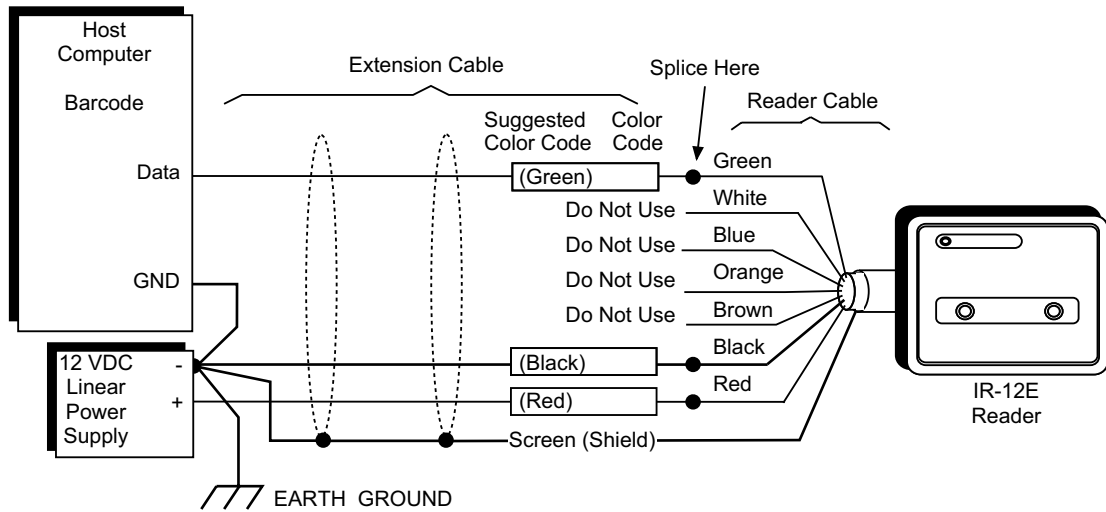
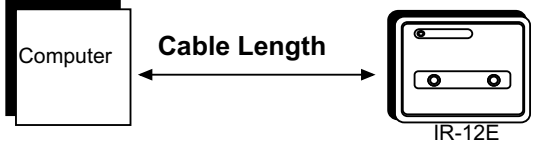


Figure 9. Barcode Output Wiring Diagram

3.3.5.1 Wire Types and Maximum Cable Lengths (Barcode)

Refer to the table below to determine the recommended wiring type at various maximum distances shown.

	
Cable Type	Cable Length
24 AWG (0.60 mm Dia.), 6 or 7 conductors with an overall shield (Belden 9536,9537)	Computer Dependent
22 AWG (0.80 mm Dia.), 6 or 7 conductors with an overall shield (Alpha 5196, 5198)	Computer Dependent
18 AWG (1.20 mm Dia.), 6 or 7 conductors with an overall shield (Alpha 5386, 5388)	Computer Dependent

4.0 Operation

4.1 Tag Presentation

To obtain maximum read range, present the tag to the IR-12E reader as shown in Figure 10. Keeping the tag parallel to the reader, move it slowly toward the face of the reader until a QuickFlash™ is obtained (the LED will flash, and the audio tone "beeper" will be activated for 100 milliseconds. After the 100 millisecond QuickFlash™ period, the computer takes over the LED and beeper control as usual. The QuickFlash™ is an indicator that the tag was read and the data was sent to the computer). Please notice that once the tag is inside the reader field, the reader instantly quickflashes. The time it takes the computer to display the tag code on its screen depends on the speed or the response time of the computer. To read the tag again, remove it from the reader field and present it again. During normal use, the tag can be presented to the reader at any angle, although presenting the tag other than parallel to the face of the reader will result in a slightly reduced read range.

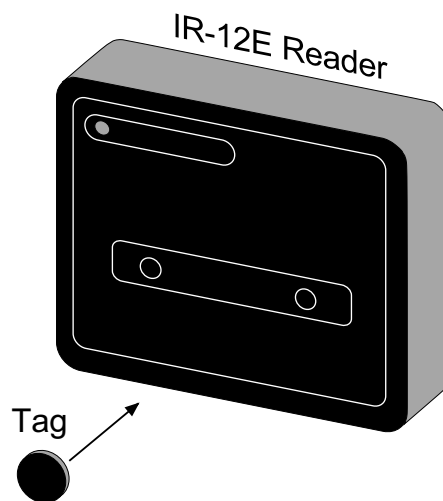


Figure 10. Tag Presentation

5.0 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: <u>Technical Support</u>
Phone: _____	Model: <u>IR-12E RFID</u>
Fax: _____	Fax: <u>(408) 434-7057</u>
Product S/N _____	Date: _____
Dead Reader	
1. Is the reader wired according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
2. Is the recommended power supply being used?	<input type="radio"/> Yes <input type="radio"/> No
3. Is the DC voltage correct? <input type="radio"/> Yes, _____ volts	<input type="radio"/> No
4. Is the DC current correct? <input type="radio"/> Yes _____ ma	<input type="radio"/> No
5. Does the LED and beeper operate with tag presentation?	<input type="radio"/> Yes <input type="radio"/> No
6. What is the cable length ? _____ feet	
7. Is the cable type according to specifications?	<input type="radio"/> Yes <input type="radio"/> No
Short Read Range	
1. Is the reader wired according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
2. Is earth ground connected according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
3. Is the cable shield connected according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
4. Is the recommended power supply being used?	<input type="radio"/> Yes <input type="radio"/> No
5. Is the DC voltage correct? <input type="radio"/> Yes, _____ volts	<input type="radio"/> No
6. Is the DC current correct? <input type="radio"/> Yes _____ ma	<input type="radio"/> No
7. Is there a CRT (computer monitor) nearby? <input type="radio"/> Yes _____ feet	<input type="radio"/> No
8. Is the tag presentation according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
9. Tag being used. Model No. _____	
Data Incorrect or Non-existent	
1. Is the reader wired according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
2. Is earth ground connected according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
3. Is the cable shield connected according to instructions?	<input type="radio"/> Yes <input type="radio"/> No
4. Is there a CRT (computer monitor) nearby? _____ <input type="radio"/> Yes feet _____	<input type="radio"/> No
5. Is the tag presentation according to instructions	<input type="radio"/> Yes <input type="radio"/> No
6. What is the output format? Format _____	

6.0 Additional Information

6.1 Reader Dimensions

The dimensions of the IR-12E are shown in Figure 11.

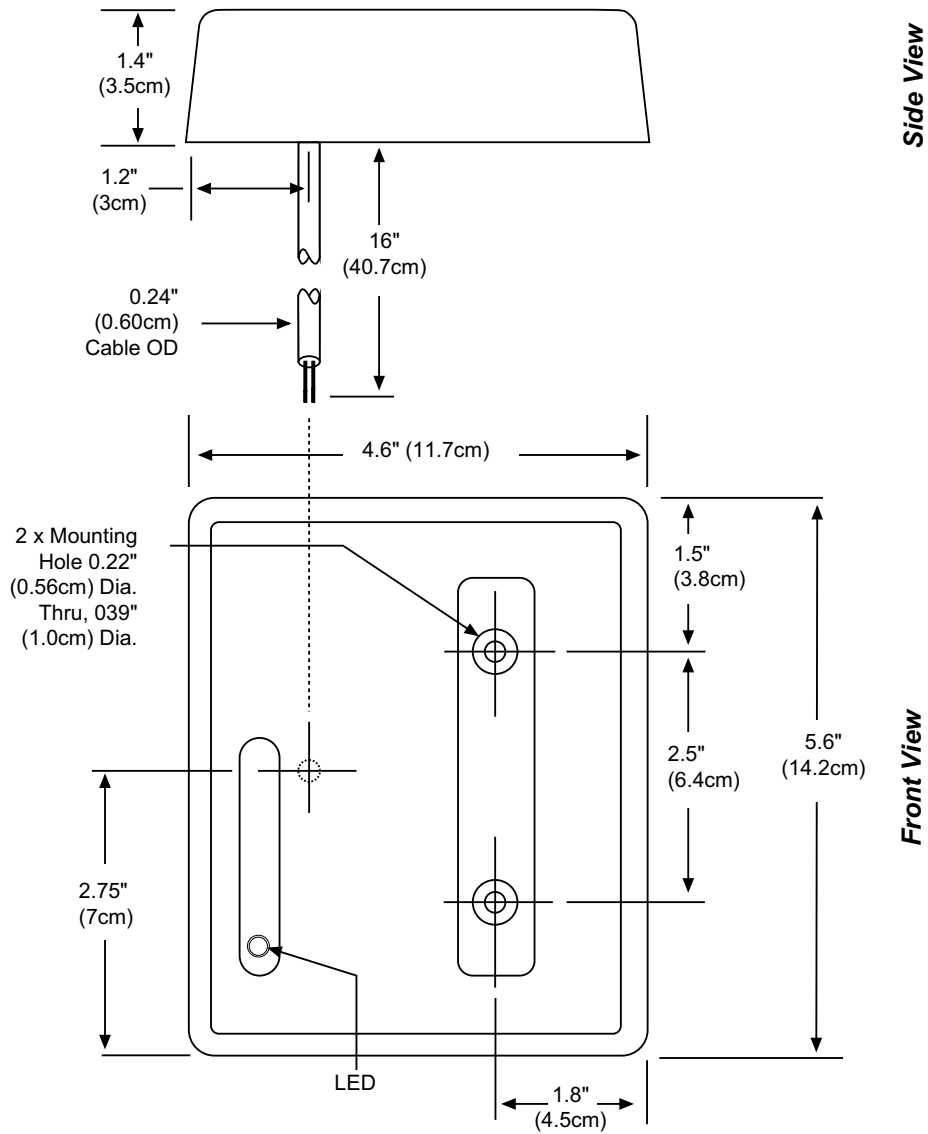


Figure 11. The IR-12E Reader Dimensions

6.2 Patents

Motorola Indala Corporation reserves all Patents, Copyrights, Trademarks, Trade Names, and all other intellectual property rights worldwide. Motorola Indala readers are covered by United States patent 4818855, Canadian patent 1253591, and other patents pending worldwide. © 1995 Motorola Indala Corporation.

6.3 Warranty

I. WHAT THIS WARRANTY COVERS AND FOR HOW LONG:

Motorola Corporation Inc. warrants this Proximity product against defects in material and workmanship under normal use and service. The warranty period commences with the date of shipment to the original purchaser and extends for the time indicated below: Effective date of this warranty policy is August 1, 1994.

This Proximity Reader have a 3 year warranty period. This express warranty is extended by Motorola to the original purchaser and is not assignable or transferable to any other party. This is the complete warranty for Products manufactured by Motorola.

Motorola, at its option, will at no charge either repair, exchange, or replace the Product during the warranty period provided it is returned in accordance with the terms of this warranty. Replaced parts are warranted for the balance of the original applicable warranty period. All replaced parts or product shall become the property of Motorola. In the event no defect is found during evaluation, a USA \$50 minimum charge will be applied to any product, warranty or otherwise, for labor expended. For product 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. The rate for repairs is \$50 per hour, plus materials. Product left over 30 days without a repair authorization and a purchase order will be returned with evaluation charges and shipping costs applied.

Motorola cannot be responsible in any way for the operation or performance of (i) any value added product in which the Product is incorporated, (ii) any ancillary equipment not furnished by Motorola which is attached to or used in connection with the Product, (iii) the Product with any ancillary equipment, and all such equipment is expressly excluded from this warranty. Motorola does not warrant the installation, maintenance or service of the Product.

This warranty applies worldwide.

II. WHAT THIS WARRANTY DOES NOT COVER:

- (a) Defects or damage resulting from use of the product in other than its normal and customary manner.
- (b) Defects or damage from misuse, accident or neglect.
- (c) Defects from improper testing, operation, maintenance, installation, alteration, modification or adjustment.
- (d) Defects or damage due to lightning or other electrical discharge.
- (e) Product disassembled or repaired in such a manner as to adversely affect performance or prevent adequate inspection and testing to verify any warranty claim.
- (f) Modification, tampering with or abuse of the product.
- (g) Freight costs to the repair depot.

III. HOW TO GET WARRANTY SERVICE:

Products returned for repair, warranty or non-warranty, must be assigned by an Motorola tech support representative a RMA (Return Material Authorization) number. The customer is to provide a description of the specific problem. The customer is to include serial numbers, formats and tag ID numbers with the items to be returned. To receive warranty service, deliver or send the Product along with proof of purchase. Call (408)434-7010 for return authorization and shipping address.

IV. GENERAL PROVISIONS:

This warranty sets forth the full extent of Motorola's responsibility regarding the Product. Repair, replacement, or refund of the purchase price, at Motorola's option, is the exclusive remedy. THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER EXPRESS WARRANTIES. ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE SPECIFICALLY EXCLUDED. IN NO EVENT SHALL MOTOROLA BE LIABLE FOR DAMAGES IN EXCESS OF THE PURCHASE PRICE OF THE PRODUCT, FOR ANY LOSS OF USE, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS, LOST PROFITS OR SAVINGS OR OTHER INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE INSTALLATION, USE, OR INABILITY TO USE SUCH PRODUCT, TO THE FULL EXTENT SUCH MAY BE DISCLAIMED BY LAW.

6.4 FCC Compliance Statement

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 the 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.

6.5 CE Mark

This product complies with the European Community Council Directive 89/336/EEC if the installer/user adheres to the instructions detailed in this manual. This product is in compliance with ETS 300 683 with the referenced standards EN 55022 (class B), EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, and EN 61000-4-6.

6.6 Contacting Technical Support

Please answer all of the questions in section 4.0 (Troubleshooting) and have your answers ready before you call the technical support numbers 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
Viabes Industrial Estate
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